

SOUTH HOOK LIQUEFIED NATURAL GAS TERMINAL

APPLICATION FOR A PERMIT UNDER THE POLLUTION PREVENTION AND CONTROL REGULATIONS



Volume 1

Esso Petroleum Company Limited

RPS Planning, Transport
and Environment
NOISE, VIBRATION & AIR QUALITY

NOISE VIBRATION & AIR QUALITY

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SOUTH HOOK LIQUEFIED NATURAL GAS TERMINAL

THE FORMER ESSO REFINERY SITE, MILFORD HAVEN

APPLICATION FOR A PERMIT UNDER THE
POLLUTION PREVENTION CONTROL REGULATIONS

October 2003

	Signature	Date
Written By	<i>[Signature]</i>	29 th October 2003
Checked By	<i>[Signature]</i>	29/10/03
Authorised By	<i>[Signature]</i>	29/10/03

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NON-TECHNICAL SUMMARY AND APPLICATION FORMS

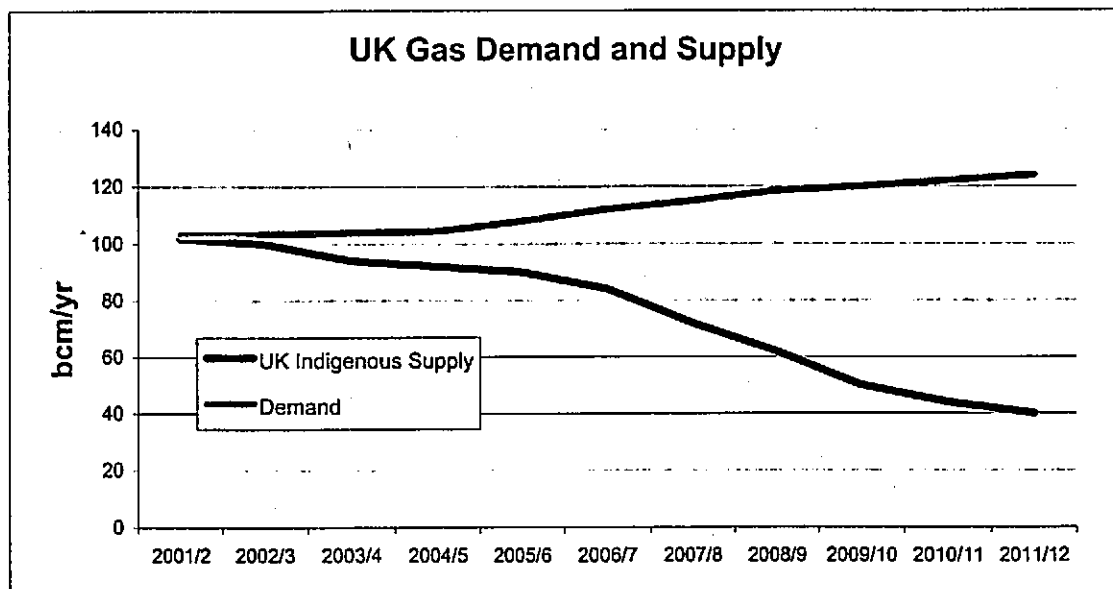
Introduction and Background to the Application

The original need for LNG importation facilities in the UK emerged in the mid-1960s, driven by a desire by the market to move to cleaner natural gas and away from local town gas produced as a by-product of coke ovens. An import facility at Canvey Island was constructed in the 1960s, but subsequently mothballed following the discovery of large natural gas reserves in the North Sea.

With the development of the natural gas market in the UK, a number of small LNG facilities to support peak demand were constructed at the extremities of the pipeline transportation network. Commonly known as "peak shaving" facilities, these units are used to help modulate the overall system supply during periods of high demand. Rather than import LNG, these small facilities take natural gas from the grid in low demand seasons, liquefy it, and then store it ready for use in peak demand periods.

During the 1990s there has been a significant increase in gas utilisation within the UK, whilst the discovery of new UK gas reserves has declined, leading to most industry analysts believing that UK resources have peaked (see Figure 1 below). Current forecasts show that the existing North Sea reserves will be significantly depleted over the next decade with the UK becoming increasingly dependant on imports. Transco's most recent ten year plan and a Cabinet Office Performance Innovation Unit Report show that as much as 10% of the UK's supply will need to be imported by 2005, increasing to 40% by 2010 and 90% by 2020.

Figure 1: UK Gas Supply and Demand



Faced with this scenario, the UK market has the option of either using spare capacity in existing import pipeline connections, constructing new pipelines linking the UK to Continental Europe, or developing LNG facilities. LNG offers a number of advantages, which include greater flexibility and the opportunity to supply the UK with gas from sources that cannot economically be reached by pipeline.

To help meet this shortfall, Esso Petroleum Company Limited (EPCo) are proposing to construct and operate a liquid natural gas (LNG) receiving, storage and regasification

terminal at South Hook, Milford Haven. The terminal will act as a base load facility, that is a facility that will operate throughout the year rather than on a seasonal basis. Consequently, whilst the unloading of LNG will be intermittent, the plant will operate continuously.

It is proposed that the terminal facilities will be developed in two discrete phases. The first phase will involve the installation of equipment, tankage and support facilities to handle 7.78 million tonnes per annum (tpa) of LNG. During the second phase additional equipment, tankage and support facilities will be installed to enable the facility to handle a total of 15.56 million tpa LNG; i.e. the annual throughput of the terminal will be doubled during the second phase.

A planning application supported by a full Environmental Statement for the proposed development was submitted to the Planning Authorities in April 2003. Pembrokeshire Coast National Park Authority and Pembrokeshire County Council have granted planning permission, but the Decision Notice, which sets out the conditions, has not yet been received.

Site History

The proposed LNG facility will occupy the former Esso Refinery site. Refining operations at the site were active from the late 1950's and continued through to the early 1980's. Consequently the site has a history of intensive industrial use and contained a variety of tank structures, process equipment, buildings, drainage ponds, roads and a jetty. The original jetty was upgraded in the 1970's to accommodate larger ships and to increase the number of berths from 2 to 5.

The refinery was fully decommissioned by 1990 and the site has since been unused. Today the only remaining structures from the Refinery are the security building at the entrance to the site, the jetty and the dock office building.

About this Application

This application is being made to permit the operation of a new installation under the Pollution Prevention and Control (PPC) Regulations 2000.

The operator of the installation will be Esso Petroleum Company Limited (EPCo). EPCo is part of the ExxonMobil group of companies, which, in conjunction with its joint venture partner, Qatar Petroleum, has received planning permission for the development of the South Hook LNG Terminal at Milford Haven.

Techniques for Pollution Control

A non-technical summary of the information presented within each section of this application is provided below.

Management Techniques

EPCo will establish and implement a number of management systems including an Environmental Management System (EMS) covering the activities to be undertaken within the South Hook terminal. The principle purpose of the EMS will be to ensure that the process is operated within its design envelope and operating parameters, including all relevant emissions limits. It will also detail the appropriate response procedures should any operating controls be compromised.

Key elements of the Management System will cover:

- Management Structure
- Significant Environmental Impact
- Legal and Regulatory Requirements
- Environmental Policy
- Setting Objectives and Targets
- Environmental Management Program
- Operational Controls
- Maintenance
- Emergency Planning and Accident Policy
- Environmental Key Performance Indicators
- Monitoring and Control Systems
- Training
- Communication and Reporting
- EMS Documentation
- Auditing
- Non-compliance and Corrective Action
- Review and Reporting of Environmental Performance

Materials Input

The primary material present on site will be liquefied natural gas. Other auxiliary materials are required to support the main operations, primarily natural gas, nitrogen, sodium hydroxide, maintenance materials and fuels. Raw material usage will be controlled to ensure optimum usage. The usage rates will be optimised during commissioning.

The LNG facility will not be a major water user. Under normal operation there will be no process requirement for water, with water usage being limited to periodic cleaning water use.

During the lifetime of the plant regular waste minimisation and water usage audits will be undertaken to monitor consumption and identify any areas which may need improvement.

Activities and Abatement

Liquefied natural gas (LNG) will be transported from Qatar to the terminal in specially designed ships. The ships will dock at the jetty head and the LNG will be pumped from the ship cargo tanks to the five LNG storage tanks. The LNG tanks are of the full containment type.

The LNG storage tanks will be heavily insulated to minimise heat ingress. Since 100% efficient insulation is not achievable, a small quantity of heat often referred to as "heat leak" enters the tanks, and causes a small portion of the LNG to "boil-off" or vaporise. The resulting gas constitutes the 'normal' boil off gas flow rate. The proposed design for the South Hook plant incorporates a re-condensation stage, which permits recovery of the boil-off gas to prevent what would otherwise be a loss of material (via flaring).

During the unloading of a ship the LNG discharged from the ship tends to warm up because of the pumping energy supplied to the LNG, and because of heat leak into the unloading lines. These factors contribute to the further generation of boil-off gases. In addition, during ship unloading, vapour space gas will be physically displaced from the LNG tanks by the incoming LNG. These sources comprise the 'high rate' of boil off gas flow.

A Boil-Off Gas (BOG) Handling System comprising of condensers and compressors will be included to collect the boil-off and displacement gases as described above and to redirect them to safe and efficient use.

The LNG will be vaporised within the submerged combustion vaporiser units. Initially 10 SCVs will be installed, a further 10 units being added as part of the expansion phase. Each SCV will comprise a stainless steel tube bundle immersed in a warm water bath. The LNG flows through the tube bundle and is heated and vaporised by heat transferred from the water bath. The warm water temperature is maintained by supplying heat through direct contact with the hot gases resulting from the combustion of a small portion of the natural gas, in the region of 1.5% of the regasification throughput. Direct mixing of the hot gases with the water permits nearly all of the combustion heat to be recovered. The system therefore is capable of high efficiencies in the range of 95 - 100%.

Water is circulated through the SCVs: due to condensation of water vapour from the combustion gases, water accumulates and needs to be discharged. The combustion products warming the water include acidic gases (CO_2 and some NO_x) that dissolve in the water. Therefore to maintain the pH of the water within the design range of 6-9, pH adjustment will be required. This will be achieved by the addition of sodium hydroxide (caustic soda). The excess water will undergo pH adjustment before final release into Milford Haven.

Combustion gases exiting from the SCV will be discharged to atmosphere via an approximately 1.2m diameter, 24m high stack on each SCV unit. These dimensions will be optimised during detailed engineering, whilst ensuring that air quality standards will be met.

The vaporised natural gas is referred to as 'sendout gas'. To ensure that the gas meets the specification for supply to the NTS, nitrogen will be injected into the send out gas. Nitrogen will be generated on-site using a cryogenic air separation process. This plant essentially separates dry air within a high-pressure column into two streams; a nitrogen stream and a crude oxygen stream. The nitrogen is either stored as a liquid or used directly for send-out gas conditioning and the crude oxygen is released to air.

The 'send-out' gas will be metered prior to entry into the NTS.

Groundwater

There will be no direct emissions to groundwater of List I or List II substances from the installation. However, as a result of the past use of the site there may exist List I and List II substances within the soil zone that are mobilised as a result of the excavation and drainage of the proposed development. To prevent mobilisation of any existing contaminants as far as is reasonably practicable, a programme of remedial works will be undertaken prior to operation of the site.

Waste Handling

Process waste generation from the installation is relatively minor. Wastes generated by the installation are:

- Oil contaminated water
- Oily/greasy maintenance wastes
- Redundant/broken equipment
- General wastes
- Spent adsorbent
- General Special Wastes
- Empty chemical and oil containers

All waste generated will be handled according to site procedures, which will be designed to ensure that all regulatory requirements, policies and operational constraints are met.

Waste Recycling, Recovery or Disposal

The waste management policy will be consistent with legal requirements and the company policy on Environment, Health, and Safety. The general management guidelines are to:

1. Minimise the amount of waste generated.
2. Maximise the reuse or recycling of any waste that are generated.
3. Dispose of any residual waste with minimum environmental damage.
4. Pay duty of care for the safety and health of employee, contractors, the public and the environment at all stages of the waste management process.
5. Ensure compliance with all regulations related to waste management.

The following waste disposal/recycling/recovery options are proposed for the wastes generated within the facility:

- | | |
|----------------------------------|-------------------------------------|
| • Oil contaminated water | recovery |
| • Oily/greasy maintenance wastes | recovery |
| • Redundant/broken equipment | re-use/recovery (dependant on item) |

NOISE VIBRATION & AIR QUALITY

- General wastes landfill
- Spent adsorbent landfill
- General Special Wastes landfill
- Empty chemical and oil containers reuse/recycling

Energy

Energy utilised within the installation is sourced from electricity from the grid, natural gas and diesel. Total annual energy consumption has initially been estimated at approximately 2,050,000MWh rising to approximately 4,070,000MWh following the expansion phase.

The site is not subject to the Climate Change Levy and therefore will not be participating in a Climate Change Agreement. It is recognised that the major opportunity for energy efficiency is at the design stage of the project. For this reason the Front End Engineering Design (FEED) contractor will be tasked with optimising energy efficiency during the FEED design stage. A draft energy efficiency plan will be prepared in conjunction with the FEED contractor.

Energy audits will be undertaken regularly to monitor energy efficiency within the installation and to identify any areas for improvement.

Accidents

The proposed installation falls under the Control of Major Accident Hazards (COMAH) Regulations 1999 due to the large volumes of LNG that will be stored. When vaporised, LNG is a flammable gas and the quantity of this material stored at the site exceeds the upper threshold level specified within the COMAH Regulations, consequently the installation is classified as a top tier COMAH site. As a top tier site a detailed Safety Report will be produced and submitted to the Health and Safety Executive and Environment Agency. The safety report must demonstrate how the installation will mitigate and prevent the effects of major accidents associated with LNG, which might damage/harm people and the environment.

An assessment of the potential risks from foreseeable accidents has been undertaken for the installation considering the impacts on the environment for a range of environmental aspects not addressed within the COMAH safety report. Based on the proposed safeguards, the assessment identified no foreseeable accident scenarios requiring priority action or action as a matter of routine.

An accident management plan will be developed and maintained during the operational life of the plant when the design stage is finalised. This plan will consider the findings from both the COMAH Safety Report and the initial accidents assessment presented within this application.

Noise and Vibration

The proposed plant will include items of plant that will generate noise. A noise assessment has been undertaken to predict the impact of noise emissions from the facility. This assessment was also used in support of the Planning Application for the installation.

The assessment demonstrates that there will be no significant noise during the normal

operation of the facility. The noise impact will be rendered acceptable, based on the incorporation of mitigation and distance to noise sensitive receptors.

No significant sources of vibration are likely to be present within the operational site. Furthermore, the nearest sensitive locations are some 500m from the installation boundary, and, at this distance, vibration from the plant or operations onsite are not expected to be perceivable.

Monitoring

A range of emissions, process and environmental monitoring will be undertaken. This will include a combination of continuous and spot monitoring of emissions to air and water, inclusion of a process control system to monitor and control plant operating conditions within design parameters and a programme of environmental monitoring to confirm the predicted impacts from the air quality and noise assessments.

Waste being disposed of will be characterised and described in accordance with the requirements under the Duty of Care Regulations.

Monitoring equipment, sampling and analysis will be carried out in accordance with relevant standards.

Decommissioning

The installation is being designed to ensure it can be operated in such a way that the risk of pollution spillage and contamination is prevented and/or minimised. Process and ancillary items have been designed such that they can be systematically decommissioned to minimise the risk of pollution spillage and contamination during the final phase of activity. It is worth noting that the main raw material handled by the majority of plant is relatively benign in respect of its potential to cause any contamination of equipment and land.

A site closure plan will be developed prior to commissioning of the plant, which will detail how the installation could be decommissioned to avoid any pollution risk and return the site to a satisfactory state. This plan will be kept up to date during the life of the plant.

A baseline site survey has been undertaken to assess the current condition of the site. As part of the project development, it is proposed to undertake a programme of remediation at the site. Following this work an updated baseline assessment of the site will be undertaken.

Installation-wide issues

Esso Petroleum Company Limited will be the sole operator of the site. Consequently issues arising from multiple operators do not arise

Emissions Benchmarks

A comparison of the expected emissions to air and water against available benchmarks has been undertaken. This comparison has concluded that all emission benchmarks will be met and in some cases, the predicted releases are well below the benchmark levels.

Impact

A number of detailed assessments have been undertaken to quantify and assess the potential effect of the proposed LNG facility on the environment. Specifically these are:

- Air Quality Assessment.
- Noise and Vibration Assessment.
- Site Report.
- Environmental Assessment Using H1 Methodology.
- Report in Support of an Appropriate Assessment Under the Conservation (Natural Habitats etc.) Regulations (1994).

These detailed assessments form Appendices A – E to this report.

An assessment of the main plant items, namely the SCVs and LNG storage tanks is also presented and demonstrates that the selected technologies are BAT for this installation.

Overall, the assessments, that have been undertaken having regard for Environment Agency guidance and in consultation with the Regulator and relevant statutory consultees, demonstrate that the facility design is designed in accordance with BAT and can be operated in compliance with environmental obligations.

BW9816

Form IPPC 1 Part A – application for a permit, variation, transfer or surrender

For Environment Agency use only

Date received 17/11/03	Fee received: Yes ☒ No ☐	Amount received £31,350	Name assigned to installation South Hook LNG
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**ENVIRONMENT
AGENCY**

Application for a permit, variation, transfer or surrender

Integrated Pollution Prevention and Control

Pollution Prevention and Control Act 1999

Pollution Prevention and Control (England and Wales) Regulations 2000

For Part A(1) Installations

Introduction to Part A

When to use this form

Use this form if you are sending an application to the Environment Agency under the Pollution Prevention and Control (England and Wales) Regulations 2000 ('the PPC Regulations').

The form is to be used for applications made in respect of both 'installations' and 'mobile plant' (and in the rest of the form, the term 'installation' also covers 'mobile plant' where appropriate).

Before you start to fill in this form

Please read the notes we have produced to help you with your application, called *Part A (1) Installations: Guide for Applicants*. You will also need to read the relevant Technical Guidance to which the Guide refers.

The Guide contains a list of other documents you may need to refer to when you are preparing your application, and explains some of the technical terms we use.

In particular, you should make sure that you refer to the explanation of "installation" in the *Guide*. For example, there may be two or more operators in a single installation. Each operator will need a permit, each obtained by a separate application. Your applications will principally relate to the part of the installation under your control, but will also need to include some information on the rest of the installation. This will help us to assess the operation of the whole installation. The term "installation", when used in this application form (and elsewhere) may refer to either the whole or part of the installation, depending on the nature of the information we are seeking to obtain.

Which parts of the form to fill in

The form is in six parts but we usually only send you the parts you need to fill in. Everyone has to fill in Part A, and complete and sign Part F at the end of their application. The other parts you need to fill in depends on the type of application you are making:

- To apply for a new permit – fill in Parts A and B then Part F,
- To vary an existing permit – fill in Parts A and C then Part F,
- To transfer all or part of an existing permit to someone else – fill in Parts A and D then Part F. This should be a joint application by the transferor and the transferee,
- To surrender all or part of an existing permit – fill in Parts A and E then Part F.

Other documents we need to see

There are a number of other documents you will need to send us with your application. Each time a request for documents is made in the application form you will need to record a document reference number for the document or documents that you are submitting in the box provided on the form for this purpose.

Please also mark the document(s) clearly with this reference number and either the application reference number if you know it or your existing permit number. If you do not have either of these, please use the name of the installation.

If you know your Application Reference Number, please enter it into the box below:

BW9816

Using continuation sheets

In the case of questions required to be answered on the application form itself, please use a continuation sheet if you need extra space; but please indicate clearly on the form that you have done so by stating a document reference number for that continuation sheet. Please also mark the continuation sheet itself clearly with the information referred to above.

If you need help and advice

We have made the application form as straightforward as possible, but please get in touch with us if you need any advice on how to set out the information we need.

Please get in touch with us on 0845 933 3111.

BW9876

A1 About your application

A1.1 What type of application are you making?

- ☒ new permit
☐ variation of an existing permit
☐ transfer of an existing permit
☐ surrender of an existing permit

A1.2 Name of the Installation

SOUTH HOOK LIQUEFIED NATURAL GAS TERMINAL

Please tell us if this name is:

- ☒ already agreed with the Agency; or
☐ one that you are proposing.

A1.3 Please give the address of the site of the Installation.

Street address etc.	DALE ROAD		
Locality	HUBBERSTON		
Post town	MILFORD HAVEN		
County	Pembrokeshire	Post Code	SA73 1DR

Ordnance Survey national grid reference 10 characters, for example SJ 1234 5678

8M 8733 0638

A1.4 Give details of any existing permit(s) for the installation.

Please give details of any applicable IPC authorisations, LAPC authorisations, waste management licences or water discharge consents.

Permit number(s), type(s) and date(s) of issue:

NONE

A1.5 Do you consider that the installation meets the criteria for a "low impact installation" as defined by the Environment Agency?

(Please note that this definition does not apply to installations containing activities that are defined in the PPC Regulations by reference to a numerical threshold.)

- No ☒
Yes ☐

A2 Authorised contacts

It will help us to have someone who we can contact directly with any questions about your application. The person you name should have the authority to act on your behalf.

A2.1 Who can we contact about your application?

This could be an agent rather than the operator.

Name

RAE CRAWFORD

Position

PERMITTING LEAD, UK LNG PROJECT

Address

Street address etc.	ST CATHERINE'S HOUSE		
	2 KINGSWAY		
Locality			
Post town	LONDON		
County		Post Code	WC2B 6NE

Phone number **0207-412-2543**

Fax number **0207-412-2549**

Email address **rae.l.crawford@exxonmobil.com**

A2.2 Operational contact

If different to the above, please identify the person we should contact to discuss operational matters on an ongoing basis.

Name

AS ABOVE

Position

Address

Street address etc.			
Locality			
Post town			
County		Post Code	

Phone number

Fax number

Email address

A3 About the operator

Please provide the information requested below about the 'operator', which means:

- for applications for a new permit – the person who it is proposed will have control over the installation in accordance with the permit (if granted),
- for applications for a variation, transfer or surrender – the person who currently has control over the installation in accordance with the permit.

If you are applying for a transfer, we will ask for more information relating to the proposed new operator (transferee) in Part D.

BW9816

A3 About the operator continued

Legal status of operator

A3.1 Is the operator an individual, a group of individuals, a partnership or a company/corporate body?

- ☐ Individual (sole trader) or group of individuals go to question A3.2.
- ☐ Partnership go to question A3.3.
- ☒ Company or corporate body go to question A3.5.

Individual applicants

A3.2 Please give us the following details. Where more than one person is applying (other than as a partnership) we need details of each person.

Continue on separate sheets if necessary.

Full name

Date of birth

Trading/business name (if any)

Business address

Street address etc.		
Locality		
Post town		
County		Post Code

Contact numbers

Phone number
Fax number
Email address

Now go to question A4, What to do next.

Applications from partnerships

A3.3 Who is applying?

We can only issue permits to named individuals, not to a partnership name. We therefore need details of each person in the partnership.

Continue on separate sheets if necessary.

Person

Full Name

Date of Birth

Principal place of business

Street address etc.		
Locality		
Post town		
County		Post Code

A3 About the operator continued

Contact numbers

Phone number
Fax number
Email address

Person

Full Name

Date of Birth

Principal place of business

Street address etc.		
Locality		
Post town		
County		Post Code

Contact numbers

Phone number
Fax number
Email address

Person

Full Name

Date of Birth

Principal place of business

Street address etc.		
Locality		
Post town		
County		Post Code

Contact numbers

Phone number
Fax number
Email address

A3.4 Please give us the following details about the partnership.

Name of partnership (if there is one)

Principal place of business

Street address etc.		
Locality		
Post town		
County		Post Code

A3 About the operator continued

Contact numbers

Phone number

Fax number

Email address

Now go to question A4, What to do next.

Companies or other corporate applicants

A3.5 Please give us the following details.

Full name of company or corporate body

ESSO PETROLEUM COMPANY LIMITED

Trading/business name (if different)

Registered office address

Street address etc.	EXXONMOBIL HOUSE	
	ERMYN WAY	
Locality		
Post town	LEATHERHEAD	
County	SURREY	Post Code KT22 8UX

Principal office address (if different)

Street address etc.		
Locality		
Post town		
County		Post Code

Company registration number

26538

Date of formation of company

6th APRIL 1951

- For applications from companies, please provide a copy of the certificate of incorporation and any certificates of subsequent name changes.

Document reference number

4 SHEETS ATTACHED

SEE VOLUME 2, APPENDIX E

- For applications from other corporate bodies, please provide evidence of status.

Document reference number

--

A3 About the operator continued

A3.6 Is the operator a subsidiary of a holding company within the meaning of Section 736 of the Companies Act 1985?

No ☐

Yes ☒ name of ultimate holding company

ESSO UK LIMITED

Registered office address

Street address etc.	EXXONMOBIL HOUSE	
	ERMYN WAY	
Locality		
Post town	LEATHERHEAD	
County	SURREY	Post Code KT22 8UX

Principal office address (if different)

Street address etc.		
Locality		
Post town		
County		Post Code

Company registration number

1589650

A4 What to do next

Now you need to fill in the other Parts of this form we sent you.

If you are applying for

- A new permit – fill in Part B then go to Part F,
- A variation – fill in Part C then go to Part F,
- A transfer – fill in Part D then go to Part F,
- A surrender – fill in Part E then go to Part F.



**ENVIRONMENT
AGENCY**

For Environment Agency use only

Application reference

BWS9816

Use this part of the form if you are applying for a new permit

B1 About the installation

Please fill in the Installation table below with details of all the activities and operators at the whole installation, even if you are applying for a permit in respect of only part of the installation.

In column 1 *Activities in "the stationary technical unit"* please identify all activities listed in Schedule 1 to the PPC Regulations that are proposed to be carried out in the "stationary technical unit" of the installation.

For *Directly associated activities* please identify any directly associated activities proposed to be carried out on the same site which:

- have a technical connection with the activities in the stationary technical unit, and
- could have an effect on pollution.

In column 2 *Schedule 1 references* please quote the Section number, Part A(1) or A(2) or B, then paragraph and sub-paragraph number as shown in Part 1 of Schedule 1 to the PPC Regulations for each activity listed in column 1.

In column 3 *Operator* write the name of the operator for each activity (if you are the operator yourself, write "Applicant").

B1.1 Installation table for new permit application

COLUMN 1

Activities in the "stationary technical unit"

20 SUBMERGED COMBUSTION VAPORISER UNITS. WITH AN AGGREGATE RATED THERMAL INPUT GREATER THAN 50MW

COLUMN 2

Schedule 1 refs

CHAPTER 1 - ENERGY INDUSTRIES; SECTION 1.1 COMBUSTION ACTIVITIES; PART A(1)(a)

COLUMN 3

Operator

APPLICANT

Directly associated activities

ALL RAW MATERIALS STORAGE AND HANDLING
ALL WASTE HANDLING AND DISPOSAL
NITROGEN PRODUCTION UNIT
BOILOFF GAS HANDLING AND RECOMPRESSION.

—

APPLICANT

BW9816

B1 About the installation *continued*

B1.2 Why is the application being made?

- ☒ the installation is new,
- ☐ it is an existing installation and you are applying in accordance with the timetable in Schedule 3 of the PPC Regulations,
- ☐ it is an existing installation and you have the agreement of the Environment Agency to make this application now. *Please attach proof of this agreement, such as a letter from the Agency,*

Document reference number for proof

- ☐ it is an existing installation for which a 'substantial change' is proposed,
- ☐ it is for a mobile plant being moved to a new location.

B1.3 Site maps and reports

Please provide:

- a site report describing the condition of the site of that part of the installation in respect of which you are applying for a permit, and, in particular, identifying any substance in, on or under the land which may constitute a pollution risk.

Document reference number for the report

PPC APPLICATION - APPENDIX F

- suitable maps or plans showing the location of the site of the installation, the location and nature of the various activities on that site and the area of the site covered by the site report

Document reference number for the maps or plans

PPC APPLICATION - FIGURE 1

B2 Your proposed techniques

Where the Agency has published a relevant sectoral application template, Section B2 need not be completed where the Application Template is completed instead.

Please provide written information about the aspects of your installation listed below. We need this information, and that which you give in response to B3 and B4, to determine whether you will operate the installation in a way which meets all the environmental requirements of the PPC Regulations.

In each case you should:

- address all of the issues set out in the section of the relevant technical guidance identified in brackets,
- justify your proposals against any indicative requirements contained in the guidance and,
- provide any other information about the installation which you think is relevant to that issue.

B2 Your proposed techniques *cont.*

Information required:

B2.1 Describe the proposed installation activities and the proposed in-process techniques and measures to prevent and reduce waste arisings and emissions of substances and heat (including during periods of start-up or shut-down, momentary stoppage, leak or malfunction) (section 2.1 of the relevant technical guidance).

Document reference number: PPC APPLICATION - SECTION 2.3

B2.2 Describe the other proposed techniques and measures, including end of pipe abatement, to achieve the aims in B2.1.

Identify if there may be a discharge of any List I or List II substance and if any are identified, explain how the requirements of the Groundwater Regulations 1998 have been addressed (section 2.2 of the relevant technical guidance).

Document reference number: PPC APPLICATION - SECTION 2.4

B2.3 Provide details of your proposed management techniques (section 2.3 of the relevant technical guidance).

Document reference number: PPC APPLICATION - SECTION 2.1

B2.4 Identify the raw and auxiliary materials, other substances and water that you propose to use (section 2.4 of the relevant technical guidance).

Document reference number: PPC APPLICATION - SECTION 2.2

B2.5 Characterise and quantify each waste stream from the installation and describe the proposed measures for waste management, storage and handling (section 2.5 of the relevant technical guidance).

Document reference number: PPC APPLICATION - SECTION 2.5

B2.6 Describe how each waste stream is proposed to be recovered or disposed of and, if you propose any disposal, explain why recovery is technically and economically impossible and describe the measures planned to avoid or reduce any impact on the environment (section 2.6 of the relevant technical guidance).

Document reference number: PPC APPLICATION - SECTION 2.6

B2.7.1 Provide a breakdown of any changes to the energy consumption and generation by source and end-use (section 2.7.1 of the relevant technical guidance).

Document reference number: PPC APPLICATION - SECTION 2.7

B2.7.2 Describe the proposed basic measures for improvement of energy efficiency (section 2.7.2 of the relevant technical guidance).

Document reference number: PPC APPLICATION - SECTION 2.7

B2.7.3 Are you, or will you be, subject to a Climate Change Levy Agreement?

No ☒ Describe the proposed sector specific measures for improvement of energy efficiency (section 2.7.3 of the relevant technical guidance).

Document reference number:

PPC APPLICATION - SECTION 2.7

BLW9816

B2 Your proposed techniques cont.

Yes ☐ Please give:

- the (expected) date of entry into the agreement

- documentary evidence to demonstrate participation in the agreement
- Document reference number:

B2.8 Describe the documented system proposed to be used to identify, assess and minimise the environmental risks and hazards of accidents and their consequences (section 2.8 of the relevant technical guidance).

Document reference number: **PPC APPLICATION - SECTION 2.8**

B2.9 Describe the main sources of noise and vibration (including infrequent sources); the nearest noise sensitive locations and relevant environmental noise measurement surveys which have been undertaken; and the proposed techniques and measures for control of noise (section 2.9 of the relevant technical guidance).

Document reference number: **PPC APPLICATION - SECTION 2.9**

B2.10 Describe the proposed measures for monitoring emissions including any environmental monitoring, and the frequency, measurement methodology and evaluation procedure proposed (section 2.10 of the relevant technical guidance).

Document reference number: **PPC APPLICATION - SECTION 2.10**

B2.11 Describe the proposed measures upon definitive cessation of activities, to avoid any pollution risk and return the site of the installation to a satisfactory state (including relevant measures for the design and construction of the installation) (section 2.11 of the relevant technical guidance).

Document reference number: **PPC APPLICATION - SECTION 2.11**

B2.12 Where you are not the only operator of the installation, describe the proposed techniques and measures (including those to be undertaken jointly by yourself and other operators) for ensuring satisfactory operation of the whole installation (section 2.12 of the relevant technical guidance).

Document reference number: **PPC APPLICATION - SECTION 2.12**

B3 Your proposed emissions

Where the Agency has published a relevant sectoral application template, Section B3 need not be completed where the Application Template is completed instead.

Please provide written information about the emissions which will result from the techniques you described in response to the questions in section B2.

You should:

- address all of the issues set out in the section of the relevant technical guidance identified in brackets,
- justify your proposals against any benchmark emission levels contained in the guidance and,
- provide any other information about the installation which you think is relevant to that issue.

B3 Your proposed emissions cont.

Information required:

B3.1 Describe the nature, quantities and sources of foreseeable emissions (section 3.1 of the relevant technical guidance).

Document reference number: **PPC APPLICATION - SECTION 3.2**

B4 Impact on the environment

Where the Agency has published a relevant sectoral application template, Section B4 need not be completed where the Application Template is completed instead.

Please provide written information about the impact your emissions may have on the environment as listed below: In each case you should:

- address all of the issues set out in the section of the relevant technical guidance identified in brackets,
- justify your proposals against any indicative requirements contained in the guidance and,
- provide any other information about the installation which you think is relevant to that issue.

Information required:

B4.1 Provide an assessment of the potential significant environmental effects (including transboundary effects) of the foreseeable emissions (section 4.1 of the relevant technical guidance).

Document reference number: **PPC APPLICATION - SECTION 4.1**

B4.2 Explain how the information provided in other parts of the application also demonstrates that the relevant objectives set out in the Waste Management Licensing Regulations 1994 have been addressed (in applicable cases), or provide additional information (section 4.2 of the relevant technical guidance).

Document reference number: **PPC APPLICATION - SECTION 4.2**

B4.3 Provide an assessment of whether the installation is likely to have a significant effect on a European Site in Great Britain and, if it is, provide an assessment of the implications of the installation for that site, for the purposes of the Conservation (Natural Habitats etc.) Regulations 1994 (section 4.3 of the relevant technical guidance).

Document reference number: **PPC APPLICATION - SECTION 4.3**

B5 Environmental statements

B5.1 Has the development of the installation (or any subsequent change or extension of the development) required an environmental statement under Council Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment?

No ☐

Yes ☒ please supply a copy of the environmental statement submitted and details of any decision made.

Document reference number: **PLANNING ES - ALREADY**

PROVIDED AND SEE

ATTACHED SUMMARY

Form IPPC 1 Part B – Application for a Permit (further information)

The information provided below supplies additional details in response to Questions B5.1, B6.4 and B6.5 of PPC application form B.

Status of planning decisions

An Environmental Statement was prepared by RPS (RPS Ref: JCC2281, April 2003) and included with the supporting documentation for joint planning applications submitted to Pembrokeshire Coast National Park Authority (PCNPA) and Pembrokeshire County Council in April 2003 for works on land. This was accompanied by a hazardous substances application to PCNPA. An application was also submitted in June 2003 to DEFRA's Marine Consents Environment Unit (MCEU) for works associated with refurbishment of the jetty.

Pembrokeshire Coast National Park Authority at its development control committee meeting on 15 October 2003 granted planning permission for the South Hook LNG Terminal (Ref: NP/03/225), subject to appropriate conditions controlling the timescale, materials, landscaping, security fencing, lighting, highway and infrastructure requirements together with a note drawing attention to the need to await the hazardous substances decision. The hazardous substances application will be considered at committee on 19 November 2003.

Pembrokeshire County Council at its planning committee meeting on 21 October 2003 granted planning permission (Ref: 03/0078/PA), subject to conditions relating to landscaping and colour of tanks.

The formal decision notices setting out the conditions are yet to be received.

DEFRA granted a licence on 7 November 2003 to undertake construction works (REF 32167/03/0) associated with the intake, outfall, jetty and ground investigation works, a copy of which is attached.

List of Sites of Special Scientific Interest (SSSIs) within 2 km of the installation

Milford Haven Waterway

List of Sites of Special Scientific Interest (SSSIs) which may be affected by emissions from the installation

The following sites lie within a radius of 10km of the site, beyond this distance it is assumed that the installation will have no potential affects.

Newgale to Little Haven Coast
St Bride's Bay South
Marloes Mere
Dale and South Marloes Coast
Angle Peninsula
Broomhill Burrows
Castle Martin Corse
Castlemartin Cliffs and Dunes
Orielson Stable Block and Cellars

Drawing number JER2580 – AV-121, attached, indicates the approximate locations of the above SSSIs.

Key

- SPA
- SAC
- SSSI
- Application boundary
- 10km site buffer

RPS Planning, Transport and Environment

Contact House
Beaufort Square
Chipsaw
Monmouthshire
NP18 5EP

Tel: 01291 621821
Fax: 01291 627827
email: rps@rps.co.uk

Approved:

Revisions:

Date: 11/08/03

Drawn by: R. Northam

Scale: 1:100,000

Client: Qalargae II

Job: South Hook LNG Terminal

Drawing Title:
CCW Designations Within
10km of Application Boundary

Drawing Number:
JER2580-AV-121


defraDepartment for Environment
Food and Rural Affairs**Department for Environment, Food and Rural Affairs**Ergon House (Area 3A), Horseferry Road,
Westminster, London SW1P 2AL

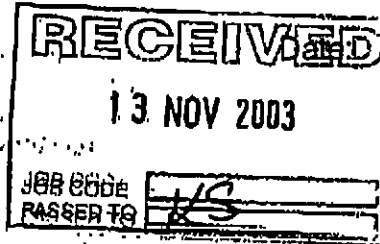
Telephone: 0207 238 5869 Fax: 020 7238 5724

Email: marine.consents@defra.gsi.gov.uk<http://www.mceu.gov.uk>

Qatar Petroleum & ExxonMobil
C/o. RPS Planning, Transport & Environment
Park House
Grey friars Road
Cardiff
CF10 3AF
FAO: Ms K Stephens

Our ref: 32167/03/0 6823

07 November 2003



Dear Ms K Stephens

**Food And Environment Protection Act 1985 (As Amended)
Licence To Undertake Construction Works (Ref 32167/03/0)**

I am pleased to advise you that the Department has now completed its consideration of your application dated 30 June 2003 for a consent under Part II of the Food and Environment Protection Act 1985 to undertake Construction of South Hook Liquid Natural Gas Terminal, Herbrandston, Milford Haven. A licence authorising the deposit of materials associated with these works is enclosed with this letter.

Since this licence constitutes a statutory consent, the terms and conditions set out therein must be complied with in full and are also binding upon any agent or sub-contractor who undertakes any activity to which it refers on your behalf. You are therefore advised to read the document carefully but I would draw your attention in particular to the requirement for the licence holder formally to confirm receipt and understanding of the terms and conditions of the licences, using the enclosed forms, within one month of their receipt.

Under Section 8(12) of the Act, you may request, within 28 days of the issue of a consent, that the Department, as licensing authority, gives you notice in writing of the reasons for the inclusion of any provision within the licence. For its part, the licensing authority is obliged to comply with this request within 28 days of receiving it.

Should you wish to make formal representations you must do so within 28 days of receipt of the aforesaid notice. A copy of notes for the guidance of persons making representations is available on request from the licensing authority

219816

I would further advise you that the issue of this licence does not absolve you from seeking any other consents or approvals which may be required before you embark upon the works to which it refers. For example, Planning Consent is often necessary for works to be undertaken above the low water mark. Approval from the Department of Transport, Local Government and the Regions under the Coast Protection Act 1949, or from the local harbour authority may be required as well as agreement of any land owner having proprietary rights over the seabed and foreshore - commonly the Crown Estate Commissioners. In some cases approval of the Environment Agency may also be necessary (e.g. where the works involve a discharge or have implications for flood defences).

Finally, if you have any queries or require clarification of any of the terms or conditions of the licence, please do not hesitate to contact me.

Yours sincerely



Carol Parliament
Marine Consents and Environment Unit

BWAB

FOOD AND ENVIRONMENT PROTECTION ACT 1985 : PART II (AS AMENDED) -
DEPOSITS IN THE SEA IN CONNECTION WITH MARINE CONSTRUCTION WORKS

Licence 32167/03/0

The Secretary of State for Environment, Food and Rural Affairs (hereinafter referred to as "the Licensing Authority") hereby authorises:

Qatar Petroleum & ExxonMobil
ExxonMobil
Room 26
Administration Building
Fawley
Southampton
SO45 1TX

Company Registration No: N/A

(hereinafter referred to as "the Licence Holder") to deposit in the sea the substances or articles the particulars of which are set out at paragraph 1.1 of the attached Schedule. The Licence is subject to the conditions of use set out, or referred to, in the said Schedule.

This licence shall be valid from the beginning of the day of 01 April 2004, (hereinafter referred to as the start date of this licence) to the end of the day of 31 March 2005, (hereinafter referred to as the end or expiry date of this licence).

For the purposes of this licence and attached schedule and unless indicated otherwise:-

- (i) all times shall be taken to be Greenwich Mean Time (GMT), and,
- (ii) all co-ordinates shall be taken to be latitude and longitude degrees and minutes to two decimal places.

Signed: 

Marine Consents and Environment Unit

for and on behalf of the Licensing Authority

Date of issue: 30 October 2003

The Licence Holder is urged to read carefully all the conditions and requirements of this Licence which are set out in the Schedule. You should acknowledge receipt of this licence and confirm that you have understood its term by signing and returning Form FEP 14 within 28 days of the date of issue of this licence

BWA 816

SCHEDULE TO LICENCE NO 32167/03/0**DATED: 30 October 2003****1. Particulars of the deposit**

- 1.1 The type of works for which the deposit of the substances or articles as specified in paragraph 1.4 of this Schedule are :

Intake
Outfall
Jetty
Ground Investigation Works

- 1.2 Details of the works requiring the deposit of the substances or articles as specified at paragraph 1.1 of this Schedule are:-

Marine works associated with the construction of a Liquefied Natural Gas Facility at South Hook terminal, Milford Haven, Wales as described in Qatar Petroleum & Exxon Mobil's application dated 30 June 2003 to the Department.

- 1.3. such works are as detailed in the drawing(s) and sectional plan(s) detailed below which were submitted in support of your application to the Licensing Authority of 30 June 2003

As shown in drawing nos. Jer2580-1010, 1011, 1012, 1015, 1016 & 1019, JER2580-AV-087B, 089A & 100 dated 9 June 2003, Marine Environmental Statement Addendum dated June 2003 as submitted with this application.

- 1.4 The substances or articles authorised for deposit at sea are:

Timber
Iron / Steel
Silt
Concrete
Plastic / Synthetic

- 1.5. The Licence Holder and any Agent and Contractor acting on their behalf is permitted to deposit the substances or articles specified at paragraph 1.4 of this Schedule, at the following location(s):

SOUTH HOOK (MILFORD HAVEN)

51 42.40 N 05 05.10 W
51 41.85 N 05 03.90 W

HOOK LIQUID, HERBRANDSTON, M HAVEN – TEMPORARY DEPOSIT SITE

51 42.40 N 05 05.10 W
51 41.85 N 05 03.90 W

- 1.6. the works shall be carried out in accordance with the works schedule and method statement as detailed in the following:

Marine works associated with the construction of a Liquefied Natural Gas Facility at South Hook terminal, Milford Haven, Wales. The works comprise of concrete remediation with some removal of deteriorated material of the trestle beams, roadway ad Jetty head. Installation of a temporary structure to catch the debris from sandblasting. The installation of up to 300 new piles adjacent to the existing dolphins and the installation of berthing and mooring dolphins at Berths 1 & 2. New mooring hooks and fenders will be installed at Berth 3. The installation of a new miscellaneous piled structure, such as new pipe

Bwq816

SCHEDULE TO LICENCE NO 32167/03/0**DATED: 30 October 2003**

supports, LNG spill basin and the replacement of some steel structure and applying coatings to the steel piles.

The majority of the works will take place from a Jack-up barge within temporary piled templates, which will be removed on completion of the works.

2. Persons Responsible for the Deposit of the Substances or Articles

- 2.1. The Agents and Contractors permitted to engage in activities subject to the terms and conditions of this licence are:-

Name of Agent or Contractor

Function

RPS Planning, Transport & Environment

Other Agent

3. Distribution of copies of this Licence 32167/03/0

- 3.1 The Licence Holder is required to ensure that a copy of this licence 32167/03/0 and attached Schedule, any special conditions and any subsequent revisions or amendments thereto is given to:

3.1.1. All Agent(s) and Contractor(s) as detailed at paragraph 2.1; and

3.1.2 The Masters of all vessels and transport managers responsible for the vehicles employed in the pursuance of this Licence 32167/03/0 and detailed at paragraph 2.2.

- 3.2 Copies of this Licence 32167/03/0 shall also be available at the following locations:

3.2.1 at the address of the Licence Holder;

3.2.2 at any site office, located at or adjacent to the site of the works, used by the Licence Holder, agent(s) or contractors(s) responsible for the loading transportation or deposit of those substances or articles detailed at paragraph 1.2.1 of this Schedule; and,

3.2.3 on board each vessel or at the office of any transport manager with responsibility for vehicles from which licensed deposits are to be made.

4. Inspection of the Operation

- 4.1 The documents referred to in paragraph 3 shall be available at all reasonable times for inspection by an authorised Enforcement Officer at the locations stated in that paragraph.

- 4.2 The Licence Holder must advise the Licensing Authority and District Inspector of Fisheries 5 working days before the licensed operation, or an individual phase of the operation is expected to commence.

5. Returns to be made to the Licensing Authority

- 5.1 The Licence Holder is required to acknowledge receipt of this licence 32167/03/0 and confirm that you have understood its term by signing and returning Form FEP 14 within 28 days of the date of issue of this Licence. No operations permitted under the terms of this licence 32167/03/0 shall commence until the FEP 14 form has been signed and returned to the Licensing Authority.

- 5.2 All persons referred to at paragraph 2.1 and 2.2 of this Schedule shall provide an acknowledgement, using Form FEP 13, of their receipt of this licence 32167/03/0

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SCHEDULE TO LICENCE NO 32167/03/0**DATED: 30 October 2003**

and their understanding of all the conditions specified therein to the Licensing Authority within 28 working days of the start date of this Licence 32167/03/0 or prior to engaging in any activity to which this Licence relates, whichever is the sooner.

- 5.3 Only those Agent(s) or Contractor(s) whose names appear at paragraph 2.1 and the vessel(s) and operator(s) whose names appear at paragraph 2.2 may operate under the terms of this Licence 32167/03/0. Any changes must be notified to and be approved by the Licensing Authority in writing prior to operating under this Licence 32167/03/0.

6. Contacts

- 6.1 Except where otherwise indicated, the primary point of contact with the Licensing Authority and the address for returns and correspondence shall be:-

Department for Environment, Food and Rural Affairs
Marine Consents and Environment Unit
Area 3/A, Ergon House
Horseferry Road,
London SW1P 2AL

Tel: 020 7238 5873/5869

- 6.2 For the purposes of this Licence 32167/03/0 any references to the Local District Inspector of Fisheries shall mean the relevant District Inspector in the area(s) located at:-

Defra Fisheries Office
4/5 Hamilton Terrace
Milford Haven
Pembrokeshire
SA73 3AL

Tel: 01646 693412

- 6.3 For the purposes of this Licence 32167/03/0 any references to the Centre for Environment, Fisheries, and Aquaculture Science (CEFAS) shall mean:-

Centre for the Environment, Fisheries, and Aquaculture Science
(CEFAS),
The Laboratory
Remembrance Avenue
Burnham-on-Crouch
Essex CM0 8HA

Tel: 01621 787200

7. Force Majeure

- 7.1 If, by reason of "force majeure" the substances or articles specified at sub-paragraph 1.4 of this Schedule, are deposited otherwise than in the area authorised by this licence at paragraph 1.5, full details of the circumstances shall be notified to the Licensing Authority within 48 hours of the incident occurring.

"force majeure" may be deemed to apply when, due to stress of weather or any other cause, the master of a vessel determines that it is necessary to deposit the substances or articles because the safety of human life and/or of the vessel is threatened.

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SCHEDULE TO LICENCE NO 32167/03/0

DATED: 30 October 2003

8. Changes to this licence

- 8.1 In the event of the Licence Holder becoming aware that any of the information on which the granting of this licence 32167/03/0 was based has changed or is likely to change, he/she shall notify the Licensing Authority at the earliest opportunity of the details.
- 8.2 Similarly in the event that the Licence Holder wishes any of the particulars set down in the Schedule to be altered he/she shall inform the Licensing Authority at the earliest opportunity before taking any further action.

9. Supplementary Conditions

- 9.1 The Licence Holder must ensure that any equipment and/or debris associated with the construction project are fully removed from the foreshore/seabed on completion of the works.
- 9.2 The Licence Holder must ensure that measures are in place to minimise contamination of the marine environment by use of wet concrete.
- 9.3 The Licence Holder must ensure that best management practices are employed at all times to minimise disturbance and release of the marine sediments into the water column.
- 9.4 The Licence Holder must ensure that any chemicals, coatings and/or treatments applied to the structures are approved for use in the marine environment.
- 9.5 The Licence Holder must ensure that refuelling of all plant machinery and the storage of any oil/fuels etc associated with the construction work does not take place on the foreshore and/or below the MHWS.
- 9.6 The Licence Holder must agree a full method statement (specifically referring to the piling method to be utilised within the scheme) with the Licensing Authority & the Countryside Council for Wales for approval prior to the commencement of the works.

SCHEDULE TO LICENCE NO 32167/03/0

DATED: 30 October 2003

BWA816

EXPLANATORY NOTES

This page does not form part of this licence 32167/03/0
or its associated schedule but the licence holder is recommended
to read the following guidance notes.

1. The granting of this licence 32167/03/0 does not absolve the Licence Holder from obtaining such other authorisations, consents and approvals which may be required under any other legislation, controls or regulations.
2. Under Section 8 of the Food and Environment Protection Act 1985, the Licensing Authority may vary or revoke this Licence 32167/03/0 if it appears to the Authority that the Licence Holder is in breach of any conditions in it or for any other reason that appears to the Authority to be relevant.
3. A person who makes a deposit, or causes a deposit to be made, at sea in contravention of the conditions specified in this licence 32167/03/0 may be found guilty of an offence under Section 9(1) of the Food and Environment Protection Act. It is a defence under Section 9(3) of the Act for a person charged with such an offence to prove that the operation was carried out for the purpose of securing the safety of the vessel or of saving life ("force majeure") and that he/she took steps within 48 hours following the incident to send full details of the incident including those relating to the operation, the locality and the circumstances in which it took place and the substances or articles concerned, to the Licensing Authority (see paragraph 6 of the schedule).
4. If the works authorised by this Licence 32167/03/0 are unlikely to be completed by the expiry date of this licence, the Licence Holder should apply for a replacement licence at least 10 weeks prior to the expiry date of this Licence

BW9816

B6 Statutory consultees

We will use the information in this section to identify who we must consult about your proposals.

B6.1 In which local authority area is the installation located?

If premises are on a boundary please give names of all relevant authorities.

Borough or district council or unitary authority

PEMBROKESHIRE COUNTY COUNCIL
PEMBROKESHIRE COAST NATIONAL PARK AUTHORITY

Please give the county council unless there is a unitary authority

B6.2 In which health authority area is the installation located?

If premises are on a boundary please give names of all relevant authorities.

PEMBROKESHIRE LOCAL HEALTH BOARD

B6.3 Could the installation involve the release of any substance into a sewer vested in a sewerage undertaker?

No ☒

Yes ☐ please name the sewerage undertaker

B6.4 Are there any sites of special scientific interest (SSSIs) which are within 2 kilometres of the installation?

No ☐

Yes ☒ please give names of the sites

SEE ATTACHED LIST.

B6.5 Are there any other SSSIs which may be affected by emissions from the installation?

No ☐

Yes ☒ please give names of the sites

SEE ATTACHED LIST.

B6.6 Are there any European sites, as defined by regulation 10 of the Conservation (Natural Habitats etc.) Regulations 1994, which may be affected by emissions from the installation?

No ☐

Yes ☒ please give names of the sites

PEMBROKESHIRE MARINE SAC
CASTLE MARTIN COAST SPA
LIMESTONE COAST OF SOUTH WALES SAC

B6 Statutory consultees continued

B6.7 Could the installation involve the release of any substance into a harbour managed by a harbour authority?

No ☐

Yes ☒ please name the harbour authority

MILFORD HAVEN PORT AUTHORITY

B6.8 Could the installation involve the release of any substance directly into relevant territorial waters or coastal waters within the sea fisheries district of a local fisheries committee?

No ☐

Yes ☒ please name the local fisheries committee

SOUTH WALES SEA FISHERIES
COMMITTEE

B6.9 Is the installation on a site for which:

☐ a nuclear site licence is required under section 1 of the Nuclear Installations Act 1965?

☒ a major accident prevention policy document is required under Regulation 5 of the Control of Major Accident Hazards Regulations 1999 or a safety report is required under Regulation 7 of those regulations?

B7 Specified waste management activities

B7.1 Are you applying to operate any 'specified waste management activities'?

No ☒ go to 'B8 What to do next'

Yes ☐ please give details

Planning status

B7.2 Which of the following applies to the specified waste management activities identified in B7.1?

We cannot issue a permit unless one of the following applies. We will need to see a copy of the relevant documents.

☐ You have planning permission.

Document reference number

☐ You have a certificate of lawful existing use or development.

Document reference number

☐ You have an established use certificate.

Document reference number

B7 Specified waste management activities continued

- ☐ The General Permitted Development Order 1995 applies.

please give details

- ☐ Planning permission is not required - *please say why and enclose written confirmation from the planning authority.*

Document reference number

If you have submitted an application for planning permission which has not yet been determined, please provide a copy of the application.

Document reference number

Fit and proper person

We need to make sure that whoever holds the permit is a 'fit and proper person' in relation to any specified waste management activities. This includes consideration of relevant offences, technical competence and financial provision.

Relevant offences

B7.3 Has the operator, or any other 'relevant person', been convicted of any 'relevant offence'?

A 'relevant person' includes each partner, director, manager, company secretary or any similar officer or can be an employee.

- No ☐ *go to question B7.4.*
 Yes ☐ *please give full information*

Document reference number for this information

The details we need are listed below.

- Full name of company or individual convicted
- If an individual has been convicted please state their position at time of offence
- Name of court
- Date of conviction
- Offence and penalty imposed
- Date of any outstanding appeal lodged against conviction
- Any additional information which the operator would like us to take into account in determining whether they are a 'fit and proper person'. *For example, why the offence happened, and what has been done to prevent a similar event occurring.*

Technical competence

B7.4 Are the specified waste management activities covered by the WAMITAB (Waste Management Industry Training Advisory Board) award scheme?

No ☐ *go to question B7.6.*

Yes ☐ *go to question B7.5.*

WAMITAB sites

B7.5 Who will provide the technically competent management of the specified waste management activities?

Please give details for each person and provide a copy of the WAMITAB certificate.

Responsible person

Full Name:

Position:

Level of WAMITAB certificate:

Date:

Document reference number for copy of certificate

Responsible person

Full Name:

Position:

Level of WAMITAB certificate:

Date:

Document reference number for copy of certificate

Responsible person

Full Name:

Position:

Level of WAMITAB certificate:

Date:

Document reference number for copy of certificate

Responsible person

Full Name:

Position:

Level of WAMITAB certificate:

Date:

Document reference number for copy of certificate

Now go to question B7.7.

BW986

B7 Specified waste management activities *continued*

Non-WAMITAB sites

B7.6 Who will be responsible for managing the specified waste management activities?

Please give details for each person.

For each person named below, we:

- need to see a statement of qualifying experience,
- will want to carry out our own assessment.

Responsible person

Full Name:

Position:

Document reference number for statement

Responsible person

Full Name:

Position:

Document reference number for statement

Responsible person

Full Name:

Position:

Document reference number for statement

Management of other installations

B7.7 Are any of these 'Responsible people' already providing the technically competent management at other IPPC installations or at sites licensed under Part II of the Environmental Protection Act 1990?

No ☐ go to question B7.8.

Yes ☐ please use a separate sheet to give details of these people. For each person we need to know the:

- site/installation name and address,
- licence/permit reference number.

Document reference number for this information.

Financial provision

B7.8 If known, how does the operator intend to make financial provision for the specified waste management activities?

- ☐ Renewable bonds
- ☐ Bonds
- ☐ Bank guarantee

Parent company guarantee please include one copy of the parent company's audited trading accounts for the last three years (or for the period of trading if less than three years). These should be no more than 18 months out of date.

Document reference number for accounts

- ☐ Escrow account
- ☐ Trust fund
- ☐ Insurance captive
- ☐ Lump sum
- ☐ Other please specify

Expenditure plan

B7.9 Please provide a plan of the estimated expenditure for each phase of the specified waste management activities:

The plan should include the likely costs of:

- monitoring,
- restoration – landfill only,
- aftercare – landfill only,
- clearing the installation (including drainage systems) of all wastes – non-landfill,
- remedial action in the event of the failure of pollution control systems.

We recognise that this plan may need to be revised before the issue of the final permit.

Document reference number for expenditure plan

B8 What to do next

Now please fill in Part F and sign and date the application.

Form IPPC 1 Part F – application for a permit, variation, transfer or surrender


**ENVIRONMENT
AGENCY**

For Environment Agency use only

Application reference

RA 51816

Please complete this section after you have filled in any other parts of the application form we sent you.

F1 Fees and charges

Please calculate the application fee and provide the other information requested using the template below. In completing this, you should refer to the detailed charging scheme guidance.

F1.1 Type of application

F1.1.1	Permit	(a) Transitional case	☐	(b) Non-transitional case	☒
F1.1.2	Variation	(a) Non-chargeable	☐	(b) Standard	☐
F1.1.3	Transfer	(a) Partial	☐	(b) Full	☐
F1.1.4	Surrender	(a) Partial	☐	(b) Full	☐
F1.1.5	Staged application	☐			

F1.2 Type of installation

F1.2.1	Low impact installation	☐			
F1.2.2	Standard farming	(a) Large	☐	(b) Small	☐
F1.2.3	Non-standard farming	(a) Large	☐	(b) Small	☐
F1.2.4	Mobile plant	(a) First application	☐	(b) Subsequent application	☐
F1.2.5	Other	☒			

F1.3 Invoice address

Contact name RAE CRAWFORD, EXXONMOBIL
 Street address etc. ST CATHERINE'S HOUSE, 2 KINGSWAY
 Locality
 Post town LONDON
 County
 Postcode WC2B 6WE.
 Telephone No. 0207-412-2543 Fax No. 0207-412-2549

F1.4 Components

Scheme Ref. No.	Description	No. of components
NUMBER OF	COMPONENTS IS CALCULATED USING THE	190
NEW OPRA	CHARGING SCHEME	
Total		190

F1.5 Calculation of fee

Amount (£)

F1.5.1	Component charge			
	No. of components	<u>190</u>	Charge per component	<u>£ 165.00</u>
				<u>£ 31,350.00</u>
F1.5.2	Waste (WML) charge			
	WML table ref.	<u> </u>	WML fee	<u>£</u>
			Factor	<u>x</u>
				<u>£ N/A</u>
F1.5.3	LAPC charge			
	LAPC fee	<u>£</u>	Factor	<u>x</u>
				<u>£ N/A</u>
F1.5.4	Low impact installation			<u>£ N/A</u>
F1.5.5	Farming			<u>£ N/A</u>
F1.5.6	Transferred Part A(2) installation			<u>£ N/A</u>
F1.5.7	Subtotal			<u>£</u>
F1.5.8	Less: fee paid for 'Original Operation'			<u>£ N/A</u>
F1.5.9	Total fee enclosed			<u>£ 31,350.00</u>

For Environment Agency use only

 Fee received; Amount £ 31,350.00 Date received 17/10/03 Received by Alfred

BW 9816

F2 Commercial confidentiality and national security

F2.1 Is there any information in the application that you wish to justify being kept from the public register on the grounds of commercial confidentiality?

No ☒

Yes ☐ please give full information

Document reference number for this information

F2.2 If there is any information in the application that you believe should be kept from the public register on the grounds of national security please attach:

- full information on separate sheets,
- a copy of the application to the Secretary of State for a Direction on the issue of national security.

Do not write anything about national security on this form, nor give reference numbers to the relevant information/ documents submitted.

F3 Data protection notice

The information you give will be used by the Environment Agency to process your application. It will be placed on the relevant public register(s), and used to monitor compliance with licence/permit conditions, or to process renewal applications.

We may also use and/or disclose any of the information you give us in order to:

- offer/provide you with our literature/services relating to environmental matters;
- consult with the public, public bodies and other organisations (for example Health and Safety Executive, local authorities, emergency services, MAFF) on environmental issues;
- carry out statistical analysis, research and development on environmental issues;
- provide public register information to enquirers;
- investigate possible breaches of environmental law and take any resulting action;
- prevent breaches of environmental law;
- assess customer service satisfaction and improve our service.

We may pass on the information to agents/representatives who we ask to do any of these things on our behalf.

Individuals have a right to see the information we hold about them. We will correct it if it is inaccurate.

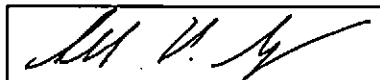
F3 Data protection notice cont.

Data Protection Declaration

This Section must be signed by one of the people signing the declaration in Section F8.

I have read the data protection notice above and confirm that I have brought it to the attention of every individual named on this form.

Signature



Name: ANDREW P. SWIGER

Date: 7 November 2003

F4 Non-technical summary

Please provide a non-technical summary of your responses to all questions in Parts A to E of the application form.

Document reference number for non-technical summary

PPC APPLICATION - NTS

F5 Any other information

Is there any other information that you wish to submit in support of your application?

No ☒

Yes ☐ please give a brief summary here and provide reference numbers for supporting documents

BW9816

F6 Signatures and declaration

It is an offence under Regulation 32 of the PPC Regulations to:

- make a statement which you know to be false or misleading in a material particular,
- recklessly make a statement which is false or misleading in a material particular,

for the purpose of obtaining a permit (for yourself or anyone else) or seeking the variation, transfer or surrender of a permit.

If you make a false statement:

- we may prosecute you, and
- if you are convicted, you are liable to a fine or imprisonment, (or both).

Declaration

I/we certify that the information in this application is correct.

I/we apply:

- ☒ for a permit
- ☐ to vary an existing permit
- ☐ for a transfer of an existing permit
(current operator(s) and proposed transferee(s) must sign below)
- ☐ to surrender an existing permit

in respect of the particulars described in this application (including supporting documentation I/we have supplied).

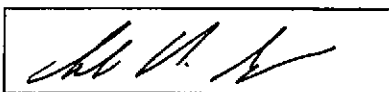
Signature(s) of current operator

Please note that each individual operator must sign the declaration themselves, even if an agent is acting on their behalf.

For applications from:

- more than one person – all persons should sign below,
- a company or other corporate body – an authorised person should sign below.

Signature

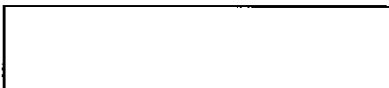


Name: ANDREW P. SWIGER

Position: DIRECTOR

Date: 7 NOVEMBER 2003

Signature



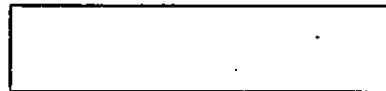
Name:

Position:

Date:

F6 Signatures and declaration cont.

Signature



Name:

Position:

Date:

Signature(s) of proposed transferee

Signature



Name:

Position:

Date:

Signature



Name:

Position:

Date:

Signature

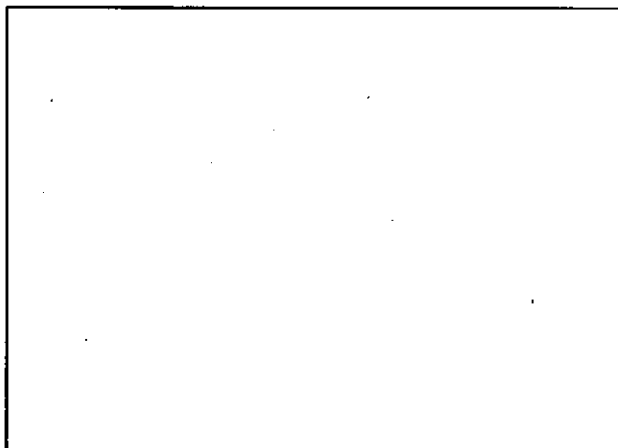


Name:

Position:

Date:

Now please return this form, together with all supporting information and correct payment, to the address below:



Please submit the original application plus the appropriate number of copies. You can use the table on the back of this form to calculate the number of copies needed.

Number of copies

The following table is to help you calculate the number of copies of your application that will normally be needed. You can do this by entering the number of copies required in each blank box in the column appropriate to your application, and then writing the total at the bottom. There are notes in *Part A(1) Installations: Guide for Applicants* to help you use the table.

Reason Required	Application for Permit	Application for Variation with Substantial Change ("yes" to question C1.4)	Application for: (a) Variation with no Substantial Change ("no" to question C1.4) (b) Transfer (c) Surrender
Original for Agency determination	1 ✓	1	1
Copy for Agency public register	1 ✓	1	1
Copy for Food Standards Agency	1 ✓	1	0
Copy for Local Authority public register	2 ✓✓		
Copy for Local Authority as statutory consultee	2 ✓✓		0
Copy for Health Authority	1 ✓		0
Copy for Sewerage Undertaker	—		0
Copy for English Nature	—		0
Copy for Countryside Council for Wales	1 ✓		0
Copy for Scottish Natural Heritage	—		0
Copy for Harbour Authority	1 ✓		0
Copy for Local Fisheries Committee	1 ✓		0
Copy for Health and Safety Executive	1 ✓		0
Copy for Planning Authority	—		0
Copy for Secretary of State for Wales	1 ✓		0
Total submission	1 original plus 14 copies	1 original plus copies	1 original plus copies

ADDITIONAL
AGENCY COPIES

2

Operator and Pollution Risk Appraisal for Integrated Pollution Prevention and Control



ENVIRONMENT
AGENCY

Company **Esso Petroleum Company Ltd**

Permit **not known**

Full instructions for the use of this spreadsheet are contained in the accompanying documentation. It is recommended that the user fills in the spreadsheet following the order of worksheets listed below (click on the appropriate tab at the bottom of the screen). Not all worksheets require input, for those that do, the fields that may require input have no background colour. The sequence of worksheets is divided into two sections. Sheets 1 to 10 are concerned with the input of data. Sheet 11 is the summary for the OPRA Scores and Sheet 12 displays the charges.

1 Complexity

Please refer to the EP OPRA Risk Screening Methodology (Annex 1) for the look-up tables and guidance. Use abbreviated descriptions, select the Schedule 1 references and bands from the pick lists provided.

2 Additional Information

Please enter Part A(2), Part B and aggregated activities onto this sheet.

3 Emissions to Air

4 Emissions to Water

5 Emissions to Land

6 Emissions to Sewer

7 Emissions Summaries

8 Emission - Waste

9 Location

10 Operational Management

11 EP OPRA Summary

No input is required. Output screen only. The emissions are shown separately.

12 Calculation

No input is required. Charges with separate emissions totals. It is possible to clear the scores and recalculate the charges to include any amendments.

For queries about the methodology or the operation of the spreadsheet, please contact the Environment Agency by email: epopra@environment-agency.gov.uk

Version 1 November 2002

Complexity Attribute

Company		Screen 1 of 2	
Permit	Esso Petroleum Company Ltd	not known	
	Description of Activity (or Aggregation Group number see next sheet)	Schedule 1 Reference Section 1.1 Part A (1) a)	Regulatory Complexity (from Look up Table)
1	20 SCV units each with a thermal	D	D
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

Totals before any rules are applied

A	0
B	0
C	0
D	1
E	0

Note:
Complete
Schedule 1 Ref with
A, B, C, D, or E

On completion
please press 'Order
Complexities' and
review output below

Rule 4 A(2) or B Activities Applies (please complete Additional Info Sheet) - select Yes or No

Rule 5 Applies - select Yes or No

Rule 6 Applies - select Yes or No

Note: Rule 7 will be applied automatically if applicable

PPC Charging Scheme Complexity Attribute

Company Permit		This is an output screen only			
Esso Petroleum Company Ltd		not known			
Ordered Complexities		Rule 6 not applied	Rule 6 not applied	Rule 7 Applied	
1	D				
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Band Totals Matrix - Scroll down to view

These totals will be carried forward and used to calculate the EP Summary and Charges

Complexity	First 6 Complexities	Remaining complexities	TOTAL
A	0	0	0
B	0	0	0
C	0	0	0
D	1	0	1
E	0	0	0

List of Schedule 1 Part (A) 2 and Part B Activities included in the Installation		
	Enter description of Activity	Schedule 1 Reference
1	None	
2		
3		
4		
5		
6		
7		
8		
9		
10		

Emissions Attribute - Releases to Air

Company	Petroleum Company Ltd				Please check that the data is entered in the correct units.	
Permit	to be confirmed				The Emission Index will only show if the data entered exceeds the threshold.	
Substance	Units	Emission Threshold	Actual Quantity	Emission Index	Notes	
Oxides of Nitrogen	Tonnes Year	10	395	40		
Oxides of Carbon	Tonnes Year	10000	866745	87		
	kg year	1000		0		
			Total	126		

Note :-

To run macro to remove rows without an actual entry press the button :-

To restore all rows click on down arrow in emission index box and double click on all.

☒ Remove empty rows

Emissions Attribute - Releases to Water

Company: Esso Petroleum Company Ltd
Permit: to be confirmed

Please check that the data is entered in the correct units.
The Emission Index will only show if the data entered exceeds the threshold.

Substance	Units	Emission Threshold	Actual Quantity	Emission Index	Notes
No specified substances released					
			Total	0	

Note :-

To run macro to remove rows without an actual entry press the button:-

To restore all rows click on down arrow in emission index box and double click on all.



Emissions Attribute Releases to Land

Company	Petroleum Company Ltd		Please check that the data is entered in the correct units.		
Permit	to be confirmed		The Emission Index will only show if the data entered exceeds the threshold.		

Substance	Units	Emission Threshold	Actual Quantity	Emission Index	Notes
Inert waste	tonnes year	1000		0.0	
Non hazardous waste (non biodegradable)	tonnes year	350		0.0	
Hazardous waste	tonnes year	100		0.0	
Non hazardous waste (biodegradable)	tonnes year	100		0.0	
			Total	0	

Emissions Attribute - Off-site Disposals to Sewer

Company	Esso Petroleum Company Ltd	Please check that the data is entered in the correct units.
Permit	to be confirmed	The Emission Index will only show if the data entered exceeds the threshold.

Substance	Units	Emission Threshold	Actual Quantity	Emission Index	Notes
No releases to sewer					
Total				0	
Weighting Factor				0.33	
Weighted Total				0	

Note :-

To run macro to remove rows without an actual entry press the button:-

To restore all rows click on down arrow in emission index box and double click on all.



Emissions Attribute - Off-site Disposals of Waste

Company	Esso Petroleum Company Ltd		Please check that the data is entered in the correct units. The Emission Index will only show if the data entered exceeds the threshold.	
Permit	to be confirmed			

Substance	Units	Emission Threshold	Actual Quantity	Emission Index	Notes
Inert waste	tonnes year	1000		0	
Non hazardous waste (non biodegradable)	tonnes year	350	125	0	assumes 5 tonnes of non-recyclable/no re-use redundant equipment
Hazardous waste	tonnes year	100	16	0	
Non hazardous waste (biodegradable)	tonnes year	100		0	
		Total		0	
		Weighting Factor		0.33	
		Weighted Total		0.00	

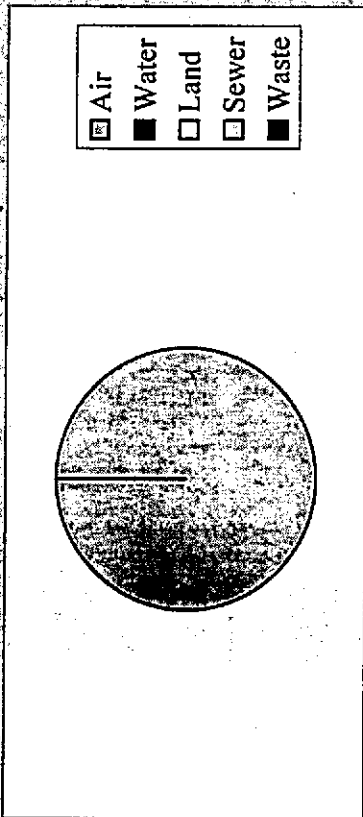
Emissions Attribute - Off-site Recovery, recycling, re-use of Waste

Company		Esso Petroleum Company Ltd		Please check that the data is entered in the correct units.	
Permit		to be confirmed		The Emission Index will only show if the data entered exceeds the threshold.	
Substance	Units	Emission Threshold	Actual Quantity	Emission Index	Notes
Inert waste	tonnes year	1000		0	
Non hazardous waste (non biodegradable)	tonnes year	350		0	
Hazardous waste	tonnes year	100	12	0	
Non hazardous waste (biodegradable)	tonnes year	100	15	0	assumes 5 tonnes of non-recyclable/no re-use redundant equipment
Total				0	
Weighting Factor				0.1	
Weighted Total				0.00	
Overall Total				0	

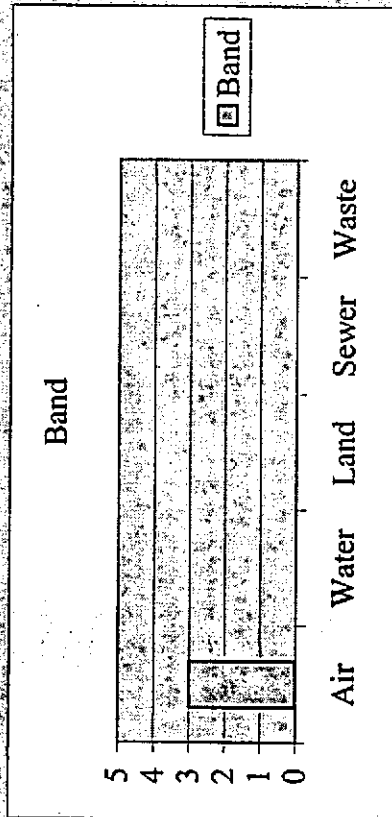
Emissions Attribute Summary Sheet

Company	Esso Petroleum Company Ltd
Permit	to be confirmed

Pathway	Overall Emission Index
Air	126
Water	0
Land	0
Sewer	0
Waste	0



Pathway	Band
Air	3
Water	0
Land	0
Sewer	0
Waste	0



Location Attribute

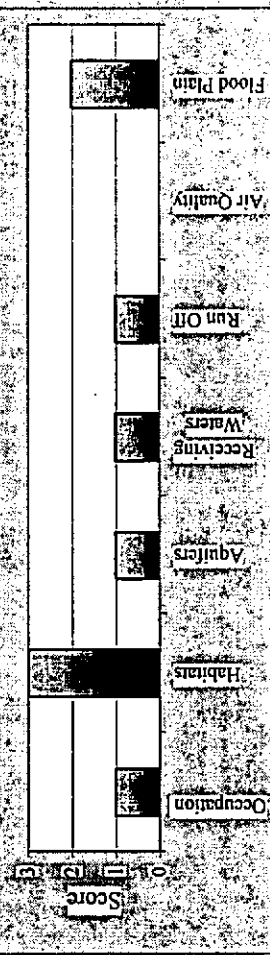
Company	Esso Petroleum Company Ltd		
Permit	to be confirmed		
Parameter	Yes/No	Available	Score
Human Occupation:			
a) if within 50m of the installation boundary	☐	3	1
or:			
b) if greater than 50m but less than 500m of boundary	☐	1	
Statutory sites designated under Wildlife and Countryside, Habitats legislation:			
a) if a Habitats "appropriate assessment" is required	☐	3	3
or			
b) if only CROW assessment required	☐	2	
a) if on an aquifer and within a Groundwater Protection Zone	☐	2	1
or			
b) if on an aquifer and not within a Groundwater Protection Zone	☐	1	
Sensitivity of receiving waters			
a) coastal waters	☐	1	1
b) river category C/D	☐	2	
c) river category A/B or estuarial	☐	3	
a) if there are direct runs off to water without interceptors or other active control measures	☐	2	1
or			
b) if as above but there are interceptors or active control measures	☐	1	
If within an Air Quality Management Zone	☐	3	0
If within a flood plain	☐	2	2
Total			9
Band			C

Maximum Score = 18
Band A = 1 - 3 R = 4 - 7 C = 8 - 12 D = 13 - 17 and E = 18

Maximum Score = 18

Band A = 1 - 3, B = 4 - 7, C = 8 - 12, D = 13 - 17 and E = 18

Location Attribute Profile



Operator Performance

	Y/N	Points available	Points scored	Post or group responsible for each requirement	Document reference (*) or date by which systems will be in place (*see para 4.4.2)
Operations and Maintenance section - 20%					
Effective operational and prev maintenance sys shall be employed on all aspects of the process where any failure could impact on the environment.					
1 Are there any documented operating procedures for operations that may have an adverse impact on the environment?	N	2.0	0.0		
2 Is there a defined procedure for identifying, reviewing and prioritising items of plant for which a preventative maintenance regime is appropriate?	N	2.0	0.0		
3 Are there any documented procedures for monitoring emissions or impacts?	N	2.0	0.0		
4 Is there a preventative maintenance programme for those items of plant whose failure could lead to impact on the environment?	N	1.0	0.0		
5 Does the preventative maintenance programme include regular checks and formal inspections of 'static' items such as tanks, pipework, retaining walls, bunds and ducts?	N	1.0	0.0		
6 Do the operations and maintenance systems include auditing environmental performance?	N	2.0	0.0		
7 Are the reports, results and recommendations arising from audits made available to senior management on a regular basis?	N	2.0	0.0		
8 In the last two years, has there been any notifiable incident or release for which lack of maintenance was a contributory cause ?	N	-2.0	0.0		
9 In the last two years, has there been any notifiable incident or release for which the root cause could not be identified?	N	-3.0	0.0		
Operations and Maintenance Total		12.0	0.0		
Competence and Training - 20%					
The Operator shall ensure that all relevant management and operational staff (including contractors and those responsible for purchasing equipment and materials) receive adequate training with regard to their responsibilities under the Permit. Particular attention should be given to the following:					
☐ minimisation of all potential environmental effects from operation under normal, abnormal, start up and shut down circumstances; ☐ prevention of accidental emissions and action to be taken when accidental emissions occur; and ☐ the need to report deviation from the permit.					
1) Has a training needs assessment been carried out which: ☐ identifies all posts for which specific environmental awareness training is required; and ☐ identifies the scope and level to which such training is to be given?	N	3.0	0.0		
2) Are training systems in place for all relevant staff that cover the following factors: ☐ the regulatory requirements associated with the Permit as they affect their work activities and responsibilities;	N	2.0	0.0		

Operator Performance

		Y/N	Points available	Points scored	Post or group responsible for each requirement	Document reference (*) or date by which systems will be in place (*see para 4.4.2)
	☐ likely potential environmental impacts which may be caused by plant under their control. This should cover both normal and abnormal circumstances;	N	2.0	0.0		
	☐ reporting procedures to inform supervisors or managers of deviations from permit conditions;	N	1.0	0.0		
	☐ procedures to be used by supervisors or managers and for the reporting of deviations from permit conditions to the Agency; and	N	2.0	0.0		
	☐ prevention of accidental emissions and action to be taken when accidental emissions occur?	N	2.0	0.0		
3	Are the skills and competencies necessary for key posts documented and are records of training needs and training received maintained?	N	1.0	0.0		
4	Do the key posts include contractors, those responsible for liaising with contractors and those purchasing equipment and materials?	N	1.0	0.0		
5	Do you assess the potential environmental risks posed by the work of contractors and provide instructions to contractors about protecting the environment while working on site?	N	1.0	0.0		
6	In the last 2 years, have there been any notifiable incidents or releases, which it has been identified that lack of training was a contributory cause?	N	-2.0	0.0		
7	Are there industry standards for training in this sector (e.g. WAMITAB)?	Y	-2.0	0.0		
8	Are individual and organisational training needs reviewed on a regular (e.g. annual) basis?	N	2.0	0.0		
Competence Training Total			17.0	0.0		

Emergency planning - 20%

The Operator shall maintain an accident management plan which identifies potential events or failures which might lead to an environmental impact. The plan shall identify: ☐ the likelihood of, and the actions to be taken to minimise, these potential occurrences; ☐ the environmental consequences and an action plan to deal with such occurrences; The Operator shall have a written procedure for handling, investigating, communicating and reporting of incidents and actual or potential non-compliance with permit conditions including taking action to mitigate any impacts caused and for initiating and completing corrective action. In the case of abnormal emissions the operator shall: ☐ investigate and undertake remedial action immediately; ☐ promptly record the events and actions taken; and ☐ ensure the Regulator is made aware, as soon as practicable.						
1	Is there an accident plan that complies with the guidance covering the following aspects of foreseeable scenarios: likelihood, consequences, actions to prevent, action to take in the event it occurs?	Y	4.0	4.0		PPC Application section 2.8
2	Has the plan identified areas where improvement is needed?	N	1.0	0.0		PPC Application section 2.8
3	Where the need for improvement has been identified, does the plan include an implementation programme with acceptable timescales? If not, 2 points will be deducted.	Y	-2.0	0.0		

Operator Performance

	Y/N	Points available	Points scored	Post or group responsible for each requirement	Document reference (*) or date by which systems will be in place (*see para 4.4.2)
4 Are there written procedures for handling, investigating, communicating and reporting actual or potential non compliance with operating procedures or emission limits?	N	1.0	0.0		
5 Are there written procedures for handling, investigating, communicating and reporting environmental complaints?	N	1.0	0.0		
6 Are there written procedures for investigating incidents, (and near-misses) including identifying suitable corrective action and following up implementation of that action?	N	2.0	0.0		
7 In the last 2 years, have there been any notifiable incidents or releases for which it has been identified that lack of emergency planning was a contributory cause ?	N	-2.0	0.0		
8 Are there audit records of investigations into non compliance, complaints and incidents? Does the audit cover follow up actions? Do the audit reports go to senior managers?	N	3.0	0.0		
Emergency planning Total		12.0	4.0		

Organisation - 40%

The following aspects of site management procedures and controls may not be in the permit conditions but are likely to have an impact on the Agency resources required to apply the PPC Regulations.

1	Do you operate an externally audited environment management system, if so answer one of the following questions. N.B Please enter your Certificate Number, Name of certification body and their UKAS Registration Number in the space for document reference.				
1.1	Is your Environmental Management System EMAS registered? If yes select Y and go to question 4.	N	20	0	
1.2	Is your Environmental Management System certified to ISO 14001? If yes enter Y and go to questions 3 and 4.	N	15	0	
1.3	Is your system an Environmental Management System subject to external audit through a third party audit programme with a published methodology (excludes in-house company audit programme). If yes enter and go to questions 3 and 4.	N	12	0	
Sub Total			Max 20	0.00	
2	If you do not operate an externally audited environmental management system then assess your system against the criteria below:				
2.1	Has your company adopted an environmental policy and programme which :				
	☐ Includes a commitment to continual improvement and prevention of pollution?		1.0	0.0	
	☐ Includes a commitment to comply with relevant legislation, and with other requirements that the organisation subscribes to?		1.0	0.0	
	☐ Identifies, sets, monitors and reviews environmental objectives, independently of the permit?		1.0	0.0	
2.2	Are there procedures that incorporate environmental issues into the following areas (as supported by demonstrable evidence e.g. written procedures):				
	☐ the control of process change on the installation;		1.0	0.0	

Operator Performance

		Y/N	Points available	Points scored	Post or group responsible for each requirement	Document reference (*) or date by which systems will be in place (*see para 4.4.2)
	☐ design and review of new facilities (including provision for their decommissioning), engineering and other capital		1.0	0.0		
	☐ capital approval;		1.0	0.0		
	☐ purchasing policy;		1.0	0.0		
2.3	Are there audits, at least annually, to check that all activities are being carried out in conformity with the above requirements?		1.0	0.0		
2.4	Are they independent? (name the auditing body)		2.0	0.0		
2.5	Are there reports annually on environmental performance, objectives and targets, and future planned improvements?		1.0	0.0		
3	Does your company produce a public environmental statement? You may score in this box for ISO 14001 and Industry systems but not for EMAS as this is a requirement for EMAS.	Y	1.0	1.0		
4	Have you within the past 5 years failed to meet an improvement condition either set by the Agency in a Permit or Variation, or External Audit by the due date, without prior agreement. (-2 will be scored per failure). ADD NUMBER OF FAILURES NOT Y OR N	0	-2.0	0.0		
Organisational Totals			20.0	1.00		

Compliance History (0 to -40% weighting)

For this section only yes/no answers and appropriate scores are required.

1	Enforcement or Works Notices issued in the past year by the Environment Agency under any legislation, or by local authorities under Part I of the Environmental Protection Act 1990 or relevant notice or Abatement Notices issued by local authorities or magistrates courts under Part III of the Environmental Protection Act 1990 (in all cases, other than any overturned on appeal by the Operator).	N	-5.00	0		
2	Formal cautions issued by the Environment Agency in respect of offences under any legislation in the last 3 years.	N	-5.00	0		
3	Prohibition, Suspension or Revocation Notices issued by the Environment Agency under any legislation, or by local authorities under Part I of the Environmental Protection Act 1990, (other than any overturned on appeal by the Operator) in the last 3 years.	N	-10.00	0		
4	Convictions on prosecutions brought by the Environment Agency under any legislation, or by local authorities (in respect of offences under Parts I or III of the Environmental Protection Act 1990) in last 5 years (in last 10 years where a term of imprisonment was imposed on the Operator) (other than any overturned on appeal) [NB each individual offence counts separately].	N	-15.00	0		
5	Failure to submit safety case under COMAH in the last 3 years.	N	-5.00	0		

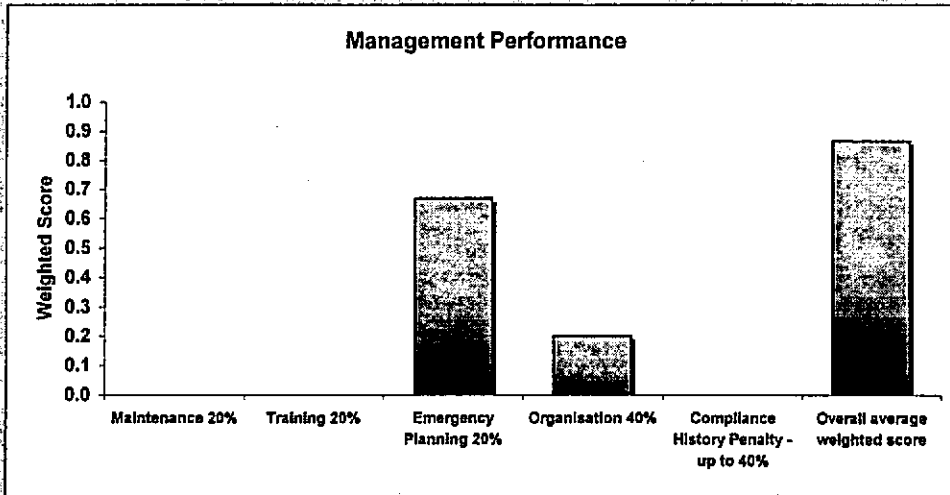
Operator Performance

	Y/N	Points available	Points scored	Post or group responsible for each requirement	Document reference (*) or date by which systems will be in place (*see para 4.4.2)
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Compliance History Total

-40

0



Band E= less than 2, D= 2 to 3.99, C= 4 to 5.99, B= 6 to 7.99, A= 8 to 11

BAND=

E

Company : Esso Petroleum Company Ltd

Permit: to be confirmed

Data calculations generating the above graph

Summary	Max	Score from above	Normalised to scale out of 10	Weighting	Weighted score
Maintenance 20%	12.00	0.00	0.00	20.00	0.0
Training 20%	17.00	0.00	0.00	20.00	0.0
Emergency Planning 20%	12.00	4.00	3.33	20.00	0.7
Organisation 40%	20.00	1.00	0.50	40.00	0.2
Compliance History Penalty -up to 40%	-40.00	0.00	0.00	40.00	0.0
Overall average weighted score					0.9

EP OPRA Banded Profile			
Company		so Petroleum Company	
Permit		to be confirmed	
Attribute		Number	Band
Complexity		0	A
		0	B
		0	C
		1	D
		0	E
Emissions	Air		C
	Water		-
	Land		-
	Sewer		-
	Waste		-
Location			C
Operator Management			
Performance			E

Company: Esso Petroleum Company Ltd Permit: to be confirmed

PPC Charge Calculation



Scoring Summary

Attribute	Band	Score	Total Score
Complexity	A	2	0
	B	15	0
	C	40	0
	D	75	75
	E	100	0
Emissions to Air	C		20
Emissions to Water	C		0
Emissions to Land	C		0
Disposal to Sewer	C		0
Disposal to Waste	C		0
Location	C		20
Operator Management Performance	E		75
Total			190.00

Fees Summary

Application Fee:	£ 31,350.00
Subsistence Fee:	£ 15,200.00

The charge shown will not include any charges associated with Local Authority Part A (2) or Part B activities that form part of the installation.
Please refer to PPC Charging Scheme.

1 INTRODUCTION

1.1 IPPC and BAT, IPC and BATNEEC

Integrated Pollution Prevention and Control (IPPC) and its predecessor, Integrated Pollution Control (IPC) are regulatory systems that employ an integrated approach to control the environmental impacts of certain industrial activities. In England and Wales, IPPC operates under the Pollution Prevention and Control (England and Wales) Regulations, 2000 (now referred to as 'the Regulations'). These Regulations have been made under the Pollution Prevention and Control (PPC) Act 1999 and implement the EC Directive 96/61 on IPPC.

PPC involves the determination of appropriate controls for industry to protect the environment through a single permitting process. To gain a Permit, Operators have to show that they have systematically developed proposals to apply the 'Best Available Techniques' (BAT) and meet certain other requirements, taking account of relevant local factors.

The essence of BAT (and BATNEEC, the IPC equivalent of BAT) is that the selection of techniques to protect the environment should achieve an appropriate balance between realising environmental benefits and costs incurred by Operators. While PPC considerations are wider in some respects than IPC, the cost/benefit balance for any technique will often be the same.

The legal instrument that ultimately defines BAT is the PPC Permit and this can only be issued at the installation level.

The "BAT" (and BATNEEC) approach is different from, but complementary to, regulatory approaches based on Environmental Quality Standards (EQS). Essentially BAT requires measures to be taken to prevent or, where this is not practicable, to reduce emissions. That is, if emissions can be reduced further, or prevented altogether, at reasonable cost, then this should be done irrespective of whether any environmental quality standards are already being met. It requires the environment not to be considered as a recipient of pollutants and waste, which can be filled up to a given level, but to do all that is practicable to minimise the impact of industrial activities. The process considers what can be reasonably achieved within the installation first (this is covered by Sections 2 and 3 of this application) and only then checks to ensure that the local environmental conditions are secure. The BAT (and BATNEEC) approach is, in this respect, a more precautionary one, which may go even beyond the requirements of Environmental Quality Standards.

Permit Reviews

PPC permits can be reviewed or varied at any time. In addition, Regulators are required to review the conditions of Permits "periodically". Permit conditions are normally reviewed on the following basis:

- for individual activities not previously subject to regulation under IPC or Waste Management Licensing, a review will normally be carried out within four years of the issue of the PPC Permit.
- for individual activities previously subject to regulation under IPC or Waste Management Licensing, a review will normally be carried out within six years of the issue of the PPC Permit.

1.2 Structure of this Application

The structure of the application is as follows:

Section 1 sets out the background and provides the application forms.

The remaining sections follow the format set out within the Environment Agency Sector Guidance Note IPPC S0.01 – General Sector Guidance (for use where there is no IPPC sector-specific guidance)

Section 2 describes the proposals and describes the BAT selected for the installation.

Section 3 identifies the emission levels arising from the application of the techniques identified in section 2 and compares these with the emissions benchmarks for the sector.

Section 4 provides an assessment of the environmental impacts associated with the operation of the installation, to ensure that these provide a high level of protection of the environment as a whole.

1.3 About this Application

This application is being made for a new liquid natural gas (LNG) receiving, storage and regasification terminal that will be located within the former Esso Refinery site at Milford Haven. The site address is:

South Hook LNG Terminal
Dale Road
Hubberston
Milford Haven
Pembrokeshire
SA73 3SU

The site is located at OS grid reference SM 8733 0638

For issues relating to this application or any operational matters, please contact

Rae Crawford
ExxonMobil
St Catherine's House
2 Kingsway
London
WC2B 6WE

The operator of the installation will be Esso Petroleum Company Limited (EPCo). EPCo is part of the ExxonMobil group of companies, which, in conjunction with its joint venture partner, Qatar Petroleum, has received planning permission for the development of the South Hook LNG Terminal at Milford Haven.

1.4 About the installation

This application has been prepared to permit the operation of a LNG facility falling under Section 1.1 – Combustion Activities, Part A1 (a) of Schedule 1 to the Regulations. The scope of activities covered within this application is summarised in Table 1.3.1 below.

NOISE VIBRATION & AIR QUALITY

The application is being submitted ahead of the scheduled timescale for Combustions Activities (currently 2006) since the application is for a new installation.

Table 1.3.1: Installation Table

Activities in "Stationary Technical Unit"	Schedule 1 references	Operator
20 Submerged Combustion Vaporiser units with an aggregate rated thermal input greater than 50 MW.	Chapter 1 – Energy Industries; Section 1.1 Combustion Activities; Part A(1) (a)	Applicant
Directly associated activities		
Storage and Handling of Raw Materials	None	Applicant
Storage and Handling of Wastes		
Nitrogen production unit		
Boil off gas handling and recompression		

2 TECHNIQUES FOR POLLUTION CONTROL

The purpose of the proposed LNG terminal is to receive, store and vaporise LNG for ultimate supply to the National Transmission Service (NTS). The terminal will act as a base load facility, that is a facility that will operate throughout the year rather than on a seasonal basis. Consequently, with the exception of unloading activities, the plant will operate continuously.

It is proposed that the terminal facilities will be developed in two discrete phases. The first phase (Train 1) will involve the installation of equipment, tankage and support facilities to handle 7.78 million tonnes per annum (tpa) of LNG. During the second phase (Train 2) additional equipment, tankage and support facilities will be installed to enable the facility to handle a total of 15.56 million tpa LNG. In essence, the annual throughput of the terminal will be doubled during the second phase. Sufficient capacity to enable a peak supply of 125% of the average supply will be included in each phase.

Within this section the BAT selected for the facility is described. The BAT selection adopts the following general principles:

- full consideration has been given to the possibility of preventing the release of harmful substances, e.g. by:
 - substituting materials or processes;
 - preventing waste emissions by reuse or recovery.
- only where prevention is not practicable has the second principle of reducing emissions that may cause harm been adopted.

2.1 Management Techniques

An effective system of management is a key technique for ensuring that all appropriate pollution prevention and control measures are delivered reliably and on an ongoing integrated basis. The subsequent section describes the key features of the Environmental Management System (EMS) to be established and implemented as part of the project. The principal purpose of the EMS will be to ensure that the process is operated within its design envelope and operating parameters, including all relevant emission limits. It will also detail the appropriate response procedures should any operating controls be compromised.

2.1.1 Management Structure

The importance of the management structure is to ensure that the roles and responsibilities for the EMS are defined, documented and communicated in order to facilitate effective environmental management performance. The Managing Director (MD) will have overall responsibility for ensuring that EMS requirements are established and maintained in accordance with the ISO 14001 standards. The MD/Site Manager will have overall responsibility to review the environmental management system and ensure its continuing suitability, adequacy and effectiveness. The Site Manager (SM) will be responsible for the day to day running of the plant, ensuring that the operations on site are undertaken in accordance with the management system and procedures. An Environmental Manager (EM) will be appointed, who will be responsible for the day-to-day environmental management, monitoring and reporting on the environmental performance of the plant, and in ensuring that it complies with the PPC Permit.

2.1.2 Significant Environmental Impact

The environmental management system will be developed having regard to the key environmental effects of the installation. A methodology for the identification and assessment of environmental impacts will be developed and maintained, in order to determine those environmental aspects of the site activities that can have a significant impact on the environment. The basis for the evaluation process in this procedure is the company policy, international and local standards and regulations, and good industry practice. This assessment will have specific regard to the impacts identified within Section 4 to this application. Environmental aspects will be reviewed at least annually throughout the lifetime of the plant.

2.1.3 Legal and Regulatory Requirements

The Operator will establish and maintain a procedure to identify and recognise the environmental laws applicable to the environmental aspects of its activities, products and services. This will include operation in accordance with the conditions of the PPC Permit. It will also update the environmental monitoring and reporting programme to ensure continued compliance with applicable regulations and standards.

2.1.4 Environmental Policy

An Environmental Policy Statement will be developed and will provide a commitment to the prevention of pollution, compliance with legal requirements and continual improvement in environmental performance. The Environmental Policy will be the driver for the whole EMS, which ensures that the environmental performance of the company is improved. Therefore, the policy will be relevant to the nature, scale and environmental

impact of the company activities, product and services and will reflect the key environmental objectives and targets for the site.

2.1.5 Objectives and Targets

The Operator will establish and maintain documented environmental objectives and targets relevant to the company activities, product and services. The environmental objectives and targets will be developed into an environmental programme. The programme will describe how the company will translate its goals into actions to ensure that objectives and targets can be achieved. Progress towards these objectives and targets will be reviewed regularly by management.

2.1.6 Environmental Management Program

Based on the above objectives and targets, an environmental action plan will be implemented throughout the company. The outputs will be a series of action plans that can be tracked for specific progress and completion dates, revised where necessary and finally reviewed to meet the set objectives. Those responsible for development, implementation, execution and maintenance of the programs will be identified through organisational charts, manuals, procedures and instructions.

2.1.7 Operational Controls

Identification of those activities that require control is necessary to maintain the desired level of environmental performance. Relevant operational controls are described in Sections 2.2 to 2.7, 2.11 and 2.12 of this application.

2.1.8 Maintenance

The Operator shall establish and maintain a preventive maintenance programme to ensure that all plant is regularly maintained and serviced. Maintenance records shall include dates of the service, name of person/company undertaking the service, results of the service including activities undertaken and/or equipment replaced and date of next required service.

2.1.9 Emergency planning and accident prevention

A procedure will be developed to identify the potential for (and response to) accident and emergency situations, and for preventing and mitigating any environmental impact that may be associated with them. The emergency incident response requirements and accident prevention plan are addressed in section 2.8.

2.1.10 Environmental key performance indicators

Environmental key performance indicators will be selected to reflect environmental and regulatory requirements, specifically including those defined via the PPC Permit conditions. Periodic performance reports will be produced during the operation of the plant (at least annually). This will include regular review of performance against conditions within the PPC permit.

2.1.11 Monitoring and control systems

The company will establish a procedure to monitor and measure, on a regular basis, the key characteristics of the operations and activities that can have a significant impact on

the environment taken as a whole, incorporating Permit requirements. The proposed monitoring to be undertaken on the site is described in Section 2.10. This section provides details of emission monitoring, process control monitoring and the proposed off-site monitoring programme; and includes details of the proposed reporting and recording of environmental emissions performance.

2.1.12 Training

The operation of the LNG facility will be under the direct management of the Plant Manager who will be assisted and supported by a team of technically competent and professional staff.

The company shall provide training for those personnel assigned specific responsibilities that may result in a significant direct or indirect impact on the environment. The most important training will be in relation to maintaining the operation of the installation within its design envelope and will consequently be site and installation specific. Prior to commissioning, operator training will be carried out for all reasonably foreseeable scenarios of operation. This will ensure that during operation, each operator will fully understand the effect of plant operation on emissions/discharges and is fully aware of the steps to be taken should an abnormal condition arise. As part of this training, personnel will be made aware of the requirements of the PPC Permit and its implications on plant operation.

All management and technical staff will have appropriate professional/technical qualifications, supported by relevant practical experiences in a process environment.

The overall complement of staff is expected to be in the order of fifty people across the broad spectrum of skills and expertise.

A training manager will be appointed prior to the commissioning phase to establish an adequate training programme to meet the expected requirements and to undertake the recruitment and training of staff.

Following the recruitment process, all staff will go through an induction programme to promote awareness of their new surroundings and responsibilities; this will provide an overview of the company business, its objectives, policies, and corporate perspective.

A detailed training programme will be prepared to meet the needs of the staff and to ensure that the desired standards are achieved through a quality driven plan.

The scope of the training will be generally split into specific areas to cover such aspects as Health, Safety and the Environment, in addition to other legislation associated with personnel issues in the workplace, personal protective equipment, display screen regulations, COSHH and RIDDOR, emergency procedures in the event of fire, accident to plant and/or personnel, and major incidents.

Particularly important areas would be pollution control and the legislative framework.

In the context of process training this would be carried out as a series of classroom sessions supported by on site familiarisation with the individual plant components as they are commissioned during construction.

The training programme would commence with the process design philosophy and the authorisation process and other consents to ensure that all matters relating to the process

operation and associated activities within the immediate environs are covered.

Many areas of the training required would be comprehensively provided directly in-house, overseen by a training manager, although external tutors would provide specialist resources. Where necessary, staff would be enrolled at external courses.

Plant and process training would be provided by competent and experienced personnel, and specialist equipment manufacturers.

During the live commissioning period, hands-on training would become effective through working with the commissioning staff, followed by commencement of the rotating shift operation where all the training would translate into full control of the process, under the supervision of the commissioning team.

Throughout this time, a programme of continuous individual review and assessment would be undertaken to ensure that progress is monitored, maintained and recorded.

Upon completion of this period and prior to handover of the plant for client operation, all operational staff would have to meet the prescribed company standard in the form of oral, written and practical exercises to demonstrate their theoretical and technical knowledge, along with its practical application.

This would ensure that each individual would be competent and able to operate the process in a safe and responsible manner.

Where appropriate, training and development plans will be designed and put in place, primarily to ensure the continued safe and efficient operation of the process to meet its legislative and statutory obligations in a timely and cost effective manner. On a technical level, this will be achieved over time with retraining due to the natural progression of equipment design, more stringent standards of environmental compliance, or new working processes.

It will also be required to keep staff up to date with changes in legislation over a wide range of issues such as safety, environment and employment.

All employees shall be provided with Health, Safety and Environmental training on starting with the company, as part of the company induction procedures. New starters will be trained to an acceptable standard through a combination of on the job training and classroom training as appropriate to the individuals experience and qualifications, and the needs of the role.

Training needs will be reviewed on an annual basis as part of the Management Review process. Training records will be maintained by the Site Manager.

Environmental training

In addition to the process specific training, environmental training would be provided at four basic levels, dependent on staff roles and environmental responsibilities, as shown below. Possible additional training may also be undertaken for specific tasks as required, including:

- training for senior managers;

- training courses for staff undertaking environmental audits and managing the environmental management system;
- compulsory environmental awareness and induction talks; and
- pollution response training for relevant staff.

Contractors

The company policy and procedures are applicable to the company employees and contractors alike.

Once operational, all contractors working on site shall be given an environmental induction briefing and supervised in accordance with site procedures.

2.1.13 Communication and reporting

Communications refer to the dissemination of information to an individual or group concerned with or affected by the environmental performance of the company both internally and externally. A procedure will be put in place to ensure that actual or potential non-compliances are reported and acted upon by the appropriate level of management, under the overall responsibility of the MD. This will detail those incidents that require immediate response, controlled system shut down and reporting to the Environment Agency (EA). This will be in addition to the standard, regular and periodic reporting requirements of the EA.

A procedure will be developed and implemented for receiving, documenting and responding to relevant information and requests from interested parties.

2.1.14 EMS Documentation

This document will describe all relevant elements of the EMS. Depending on the subject matter, the documentation will be in the form of procedures, manuals, registers, records, organization charts and action plans.

Documentation will be arranged in such a way that users can locate records, procedures, work instructions and other related information.

2.1.15 Auditing***Purpose***

The purpose of systems audits is to ensure that the management system is reviewed on a regular basis to determine whether the system has been properly implemented and maintained, and to identify areas that require improvement. This will be achieved via internal audits, and surveys carried out by personnel who are external to the facility, to give independence to the audits. The purpose of these audits will be to provide information to management on environmental performance of the EMS, and to ensure that processes are being carried out in accordance with the requirements of the PPC permit (including emission limits) and internal operating systems and procedures.

Audit results

The results of the audit will be summarised in a standard audit report. The completed reports will be distributed to the Site Manager and Environmental Manager, who will be

responsible for overseeing completion of corrective actions. Any environmental issues identified during the audit process that do not constitute system non-compliance, will be also be raised in the audit report.

2.1.16 Non-compliance and corrective action

The auditor shall issue a corrective action request in the event of:

- a non-compliance with a specific requirement;
- an action contravening the environmental procedures or method statements;
- an observation which indicates an environmental impact not previously identified;
- a recorded environmental incident; and
- any other situation that clearly contravenes legislation, policy statement or objectives and targets.

Any non-compliance with the management system highlighted during an audit will be addressed in accordance with a corrective action process and will be the responsibility of the EM. The EM shall maintain a register of corrective action requests to ensure that the appropriate corrective action is taken to rectify or mitigate the situation, and that they are satisfactorily closed out within the prescribed timescales.

Non-compliance with permit emission limits will be reported to the EA in accordance with the requirements and timescales detailed within the permit. Any such incidents will be fully investigated, and appropriate corrective actions implemented.

2.1.17 Review and Reporting of Environmental Performance

Senior management will regularly review the environmental performance of the LNG facility. These reviews will address the overall environmental performance, including the following areas:

- Review of the suitability of the environmental policy to ensure it remains relevant to current operations and business aims;
- Environmental impacts from normal and abnormal operating conditions, including emergencies.
- Periodic review of Environmental Performance;
- The progress towards, and suitability/effectiveness, of the environmental objectives and targets;
- Review of pollution incidents;
- Audit report results;
- Results of any corrective action requests; and
- Where appropriate, review costs for the environmental management of the facility.

The review will be documented and will include observations, conclusions and recommendations for necessary action. Action plans will be drawn up to address those aspects of the environmental system deemed to require attention.

The senior management review will also ensure that environmental issues are incorporated in all other relevant aspects of the business, in particular the following:

- The control of process change on the installation;
- Design and review of new facilities, engineering and other capital projects;
- Capital approval;
- The allocation of resources;
- Planning and scheduling;
- Incorporation of environmental aspects into normal operating procedures.

A report on environmental performance will be produced and will include details of

- Air emissions performance against permit requirements;
- Water discharges performance against permit requirements;
- Progress with objectives and targets, including identification of any further improvement programmes;
- Waste generation inventory; and
- A review of the cost/benefits (or otherwise) from environmental improvements;

The annual report will contain an environmental statement.

2.1.18. Records

Records will be maintained of detailed procedures, works instructions and checklists, covering specific issues identified as significant to the operations within the LNG facility, as appropriate. The EM, or nominated deputy will be responsible for the control of all relevant management system documents and for updating and re-issue in a controlled and timely manner.

Requirements for environmental records will be identified within relevant procedures and the mechanism and format for storing and maintaining the specific records, will be detailed within these procedures.

2.2 Materials Inputs

It is recognised that the use of raw materials has an associated environmental (as well as financial) cost. The principles adopted in respect of the choice of raw materials are:

1. **reduce** the use of chemicals (whilst ensuring appropriate usage, e.g. dosing to achieve emission limits)
2. **substitute** less harmful materials or those which can be more readily abated, in accordance with the BAT assessment
3. **understand** the fate of by-products and contaminants and their environmental impact

2.2.1 Raw materials selection

The activities to be carried out within the installation relate to the receipt, storage and vaporisation of LNG and consequently large volumes of LNG are present on site. The operator will specify the content of raw LNG acceptable for delivery to the installation. A typical composition for the LNG is detailed below.

Table 2.2.1: Typical LNG Composition (as unloaded)

Component	Mole percent
Nitrogen	0.28
Methane	93.49
Ethane	6.21
Propane	0.02
i-Butane	trace
n-Butane	trace
i-Pentane	trace
n-Pentane	trace
Carbon dioxide	trace

Water usage has not been considered here; information on the expected water usage is provided in Section 2.2.3.

Table 2.2.2 below, lists the main raw materials, their potential for environmental impact and their fate/disposal route. The storage locations for these materials are indicated on Figure 2.2.1. This list of raw materials will be maintained up to date and regularly reviewed for completeness and for developments in alternative materials as part of the waste minimisation audit programme described below in Section 2.2.2. A more detailed inventory of all materials used onsite will also be kept and maintained within the COSHH Register in accordance with requirements under this legislation.

The Operator will ensure that quality assurance procedures are in place for controlling the content of raw materials to ensure they meet the required specification for the material concerned. These procedures will lie within the Quality Management System (QMS) and will be regularly reviewed as part of the QMS audit programme.

Table 2.2.2: List of Raw Materials which have Potential for Significant Environmental Impact

RAW MATERIALS (including chemical composition where relevant)	TYPICAL QUANTITY USED	FATE OF THE MATERIAL (approximate % release to each medium and to the product)	ENVIRONMENTAL IMPACT (degradability, bioaccumulation potential, toxicity to relevant species)
Submerged Combustion Vaporisers (SCVs)			
Sodium Hydroxide	7.5kg/hr (initial) 15kg/hr (expansion)	Very soluble in water, 100% reacted in surplus water discharge for pH control	Sodium hydroxide dissociates to sodium and hydroxide ions in water, giving a high pH, depending on the pH buffering capacity of the water. Toxic and corrosive effect on mammals. Under normal operation sodium hydroxide will have reacted with acidic wastewater species to give a neutral discharge containing sodium carbonate and sodium nitrate. Impact on the environment will not be significant.
Natural gas (on site generated from LNG) for combustion in SCVs	14t/hr (initial); 27t/hr (expansion)	100% to air with a small % of combustion gases dissolved and released with wastewater	The primary constituent of natural gas is methane, which has a high global warming potential and very slow photo-oxidation. Under normal operation the natural gas will undergo combustion and will be released as combustion gases to atmosphere, the impact of these releases has been assessed within Appendix A. Some of the soluble combustion gases will be released to water, having first been neutralised to form sodium carbonate and sodium nitrate. Impact on aquatic environment will be negligible.
Nitrogen Plant (Cryogenic air separation) and Air Compression Plant (instrument air)			
Adsorbent in nitrogen plant driers Zeolites	10 tonnes, every 15 years	Material is expected to be non-hazardous unless contaminated in use e.g. with oil vapours, this is considered unlikely. Spent product is disposed of following analysis to determine waste characteristics, (see section 2.6 for details).	Materials Safety Datasheet for Zeolites states no environmental/ecological impacts from the adsorbent material. (only dust hazards)

RAW MATERIALS (including chemical composition where relevant)	TYPICAL QUANTITY USED	FATE OF THE MATERIAL (approximate % release to each medium and to the product)	ENVIRONMENTAL IMPACT (degradability, bioaccumulation potential, toxicity to relevant species)
Adsorbent in air driers Silica gel	None, unless becomes contaminated with oil and dust and requires replacement	Spent product is disposed of following analysis to determine waste characteristics, most likely to landfill (see section 2.6 for details)	Negligible effect, low quantities disposed. Disposal route will be reviewed prior to disposal to establish the feasibility of alternatives.
Maintenance			
Various oils and greases	Estimated at 150 litres per annum Variable usage during maintenance	100% used/collected as waste oil.	Negligible impact from the normal usage during maintenance. Spillages could penetrate soil causing groundwater contamination (low likelihood). Short-term toxicity to aquatic and marine organisms.
Hydraulic oils and silicone based oils	Estimated at 50 litres per annum Variable usage during maintenance	100% used/collected as waste oil.	Negligible impact from the normal usage during maintenance. Spillages could penetrate soil causing groundwater contamination (low likelihood). Short-term toxicity to aquatic and marine organisms.
Liquid fuels			
Heavy fuel oil	No process usage.	100% from and to ship by pipeline / jetty berths	Negligible impact from the normal storage and transfer of the fuel. Spillages could penetrate soil causing groundwater contamination (low likelihood). Short-term toxicity to aquatic and marine organisms.

RAW MATERIALS (including chemical composition where relevant)	TYPICAL QUANTITY USED	FATE OF THE MATERIAL (approximate % release to each medium and to the product)	ENVIRONMENTAL IMPACT (degradability, bioaccumulation potential, toxicity to relevant species)
Low Sulphur fuel oil	No process usage.	100% to ship and transported off-site	Negligible impact from the normal storage and transfer of the fuel. Spillages could penetrate soil causing groundwater contamination (low likelihood). Short-term toxicity to aquatic and marine organisms.
Diesel	None under normal operation. In an emergency maximum usage = 1.2m ³ /hr (for both initial and expansion phases)	100% to ship and transported off-site. (Under abnormal operation diesel combustion products will be released to air from operation of the emergency generator/emergency fire pumps)	Negligible impact from the normal storage and transfer of the fuel. Spillages could penetrate soil causing groundwater contamination (low likelihood). Short-term toxicity to aquatic and marine organisms. Under abnormal operation combustion gases including NO _x , SO ₂ , CO, CO ₂ and particulates will be emitted.
Other			
Expansion foams for fire fighting Containing Ethylene glycol (30-50%)	None - usage only in the event of a fire and dependant on scale	100% to wastewater/removed in impounding basin (see section 2.3.3)	Biodegradable, bioaccumulation unlikely. Low eco-toxicity, virtually non-toxic to aquatic organisms.
Urea based potassium bicarbonate powder for fire fighting	None - usage only in the event of a fire and dependant on scale	100% to wastewater. Small amounts may be released to air during a fire.	Low mammalian and eco-toxicity. Low bioaccumulation. Rapid biodegradation in water to ammonia and carbon dioxide.

Alternatives***Sodium Hydroxide***

Sodium hydroxide is used for pH adjustment of water from the SCVs, which becomes acidic due to dissolved CO₂ and NO_x from the combustion gases. Sodium hydroxide is a standard industrial chemical used for pH adjustment purposes. Whilst there is a range of alternative alkaline materials available, in general they are considered as having similar environmental hazards.

Due to manufacturing methods, sodium hydroxide can be contaminated with traces of mercury. Only low mercury sodium hydroxide will be used within the installation.

Natural Gas

Natural gas is combusted to provide heat within the SCV units. The alternative fuels available for combustion in these units, such as low sulphur oil, light/heavy fuel oil will have higher environmental impacts. Natural gas is also used to supply the flare pilots; again the alternatives will have higher environmental impacts.

Nitrogen Plant Adsorbent

Incoming air to the nitrogen generation units is passed through a molecular sieve to remove moisture. The molecular sieve contains adsorbent comprising zeolites, quartz and a binding material. Periodically the adsorbent will need replacing, the frequency of replacement is expected to be every 15 years. The material has no hazard classification.

Maintenance Materials

The plant will require a variety of materials for maintenance of equipment operated onsite. This will include hydraulic and lubricating oils and greases. In selecting the oils and greases consideration will be given to the biodegradability and bioaccumulation potential. Preference will be given to oils and greases with high biodegradability and low bioaccumulation where appropriate.

Liquid Fuels

Diesel will be used to power the emergency generator and back-up firewater pumps and therefore its use will be low. The diesel would be supplied from diesel day tanks, of approximately 200 litre capacity, which in turn will be filled from the main diesel storage tank. Since gas and electricity are not considered available in an emergency situation, the alternatives to diesel would be other fuel oils, which would have similar or higher potential environmental impacts or to supply power from a battery source. A battery backup system will be used on site to power computer and critical control systems, however these units are not available at a size capable of also meeting the power demand of essential plant and lighting systems. Therefore a diesel powered generator will also be provided as a back-up system for supplying power.

Other

For LNG pool fires, expansion foam is the recommended material for controlling the fire. For ignited safety valve discharges, dry powder (potassium bicarbonate which is urea based) will be used. These are standard fire fighting materials for this type of facility.

2.2.2 Waste minimisation (minimising the use of raw materials)

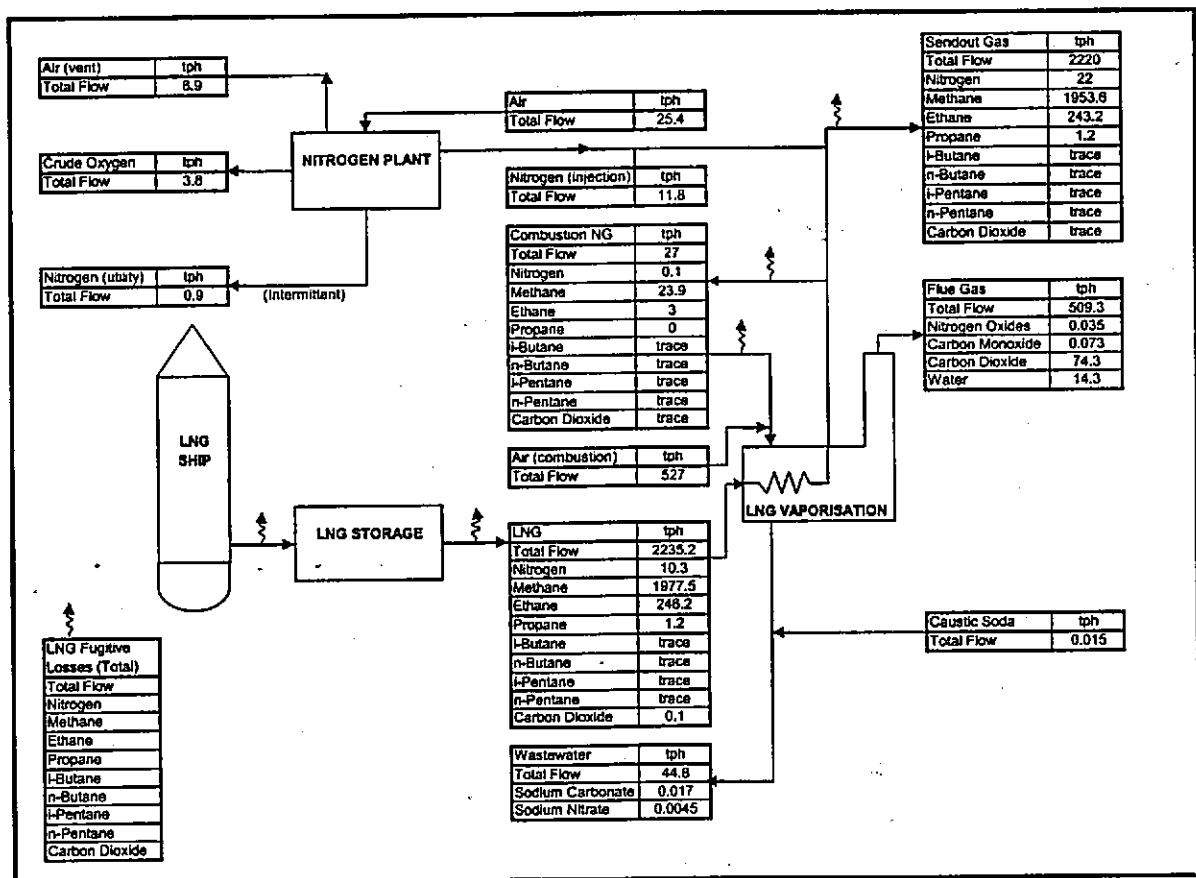
Waste minimisation can be defined as follows: 'a systematic approach to the reduction at source, by understanding and changing processes and activities to prevent and reduce waste'.

The main material processed within the installation is LNG, however to support the processing activities other raw materials are consumed including:

- caustic soda for pH adjustment;
- natural gas combusted within the submerged combustion vaporiser;
- oils and greases, for the maintenance of the plant; and
- fuels, for ship refuelling and emergency power generation.

Raw material usage will be controlled to ensure optimum use. Usage rates will be optimised during plant commissioning. A mass balance is provided as Figure 2.2.2, which indicates the expected typical mass inputs and outputs.

Figure 2.2.2 Typical Mass Balance



The loss of LNG boil-off gas has the most significant potential for wastage and there is an obvious incentive to minimise this. The plant design has achieved this through:

- insulation to minimise heat leak into the system and the generation of boil off gases; and
- recompression and recondensation to permit its recombination with LNG and ultimate release to the NTS.

Waste minimisation audit

A waste minimisation audit shall be undertaken at the start of the process and then on an annual basis. The waste minimisation audit will review the raw materials used within the installation, assess the opportunities for reductions and provide an action plan. Key to this process will be the following:

- a process flow diagram which shows the input and fate of the raw materials and contaminants listed in the raw materials inventory;
- the raw materials mass balance;
- the raw materials/waste minimisation action plan.

The areas covered by the audits shall include the following:

- uses and fate of raw materials and review of alternatives (substitution, e.g. reagents/chemicals/fuels containing fewer contaminants or with lower environmental impacts arising from their use);
- opportunities for reduction in raw materials;
- review of other potential waste minimisation techniques;
- occurrences of abnormal operating conditions;
- rate of use of reagent (within normal (optimal) limits);
- opportunities for waste recovery and reuse; and
- waste handling or storage difficulties.

2.2.3 Water use

The LNG facility will not be a major user of water. Water requirements within the installation will be obtained from the following sources:

- Potable water supply, for amenity use only;
- Service water; and
- Sea water.

Potable and service water will be purchased from the local utility and stored onsite in a potable water tank (approximately 20m³) and two service water tanks of approximately 120m³. Service water will be used for utilities, washing, flushing and for filling the firewater tank and system. Seawater for fire fighting contingency will be abstracted from Milford Haven under an abstraction licence.

Water schematics are attached as Figure 2.2.3a and Figure 2.2.3b; these diagrams indicate the water schemes and flowrates for the minimum flow case and maximum flow case respectively.

Submerged combustion vaporisers (SCVs)

The SCV units will only require water for the initial fill or following any maintenance that requires the units to be drained. This water will be supplied from the service water supply. A total of approximately 180m³ of service water will be used as an initial fill in each of the SCV units. During operation there will be no water requirement within the SCV units. As the hot combustion gases bubble through the water, water vapour from the gases will condense out leading to the accumulation of water and the need to discharge the excess volume.

Cleaning and Wash down waters

In general the activities undertaken within the installation will not require regular cleaning or washing down. Consequently water usage for cleaning/wash down will be low. Should a need for cleaning/wash down arise, then water for cleaning will be supplied from the service water tank. Where possible, dry cleaning techniques will be used in preference to hosing down. Should it be necessary to wash down using hoses then trigger controls or other similar water flow controls will be employed to ensure excessive volumes of water are not used. The maximum usage rate of water for cleaning is estimated to be 20m³/hr, however, the duration of usage at this rate will be short and consequently overall usage will be low.

Firewater

Should a fire occur within the main plant, water for fire fighting will be supplied from the primary fire water system, with a seawater supply available for contingency purposes. The main firewater storage tank will have a capacity of 10,000m³. Since the main fire hazards will arise from the LNG, the fire water system will be supplemented with small quantities of foam powder where required. The jetty will also be provided with a fire-fighting system supplied from the same service water supply.

Water efficiency audit

The use of water will be reviewed regularly; an initial review will be undertaken following the first year of operation, to serve as a baseline and this will then be repeated every three years thereafter. The audit scope will review:

- actual water usage against design usage from comparison with the water mass balance;
- water efficiency objectives through comparison of water usage against relevant benchmarks, including any constraints to further reductions due to installation specific limitations; and
- water efficiency action plan, as agreed with the Regulator.

When setting objectives within the action plan the following principles will be applied in sequence to reduce emissions to water:

- water efficient techniques should be used at source where possible;
- in particular, uncontaminated roof and surface water, which cannot be used, should be discharged separately.

2.3 The Main Activities (including abatement)

2.3.1 Process Overview

Liquefied Natural Gas (LNG) is generated by cooling natural gas to very low temperatures (minus 162°C), at which point it becomes a liquid, commonly referred to as a cryogenic liquid. This process will be undertaken prior to transportation of the LNG from Qatar to the UK. The advantage of liquefying the gas prior to transportation is the reduction in bulk volume, which permits larger quantities of gas to be transferred in a given space. Similarly at terminal facilities, the gas can be economically stored if maintained in a liquid state. A critical design aspect at the terminal is the provision of equipment, pipework and storage tanks that can operate at cryogenic temperatures and minimise vaporisation of the LNG during transfer and storage operations. It is also essential to provide a high degree of insulation to minimise unwanted heat leakage into the process and prevent unwanted boil-off of the liquid.

For ease of understanding, the proposed terminal facilities can be broken down into the following principal activities:

- Receipt of LNG, to unload and transfer the LNG from the ship to the land storage tanks;
- Storage of LNG, to maintain a buffer capacity to ensure supply demands can be met between ship deliveries;
- Boil-off Gas Handling, to recover and re-condense any LNG which evaporates during transfers and storage operations, due to heat ingress;
- Vaporisation of LNG, for supply of natural gas to the network in the gas phase, at which point the gas is referred to as 'sendout' gas;
- Gas Conditioning Plant to produce nitrogen to inject into the vaporised natural gas to achieve the required Calorific Value (CV) or National Transmission System specification in the sendout gas; and
- Utilities and Support Facilities, to support process and other terminal activities.

These are discussed in turn below. The information presented in this section details the expected plant configuration for both phases of the development. During the detailed engineering stage of the project the plant configuration may be optimised, whilst maintaining, or improving upon overall environmental performance. Any changes to the information presented in this application will be agreed with the Agency.

Receipt of Liquefied Natural Gas (LNG)

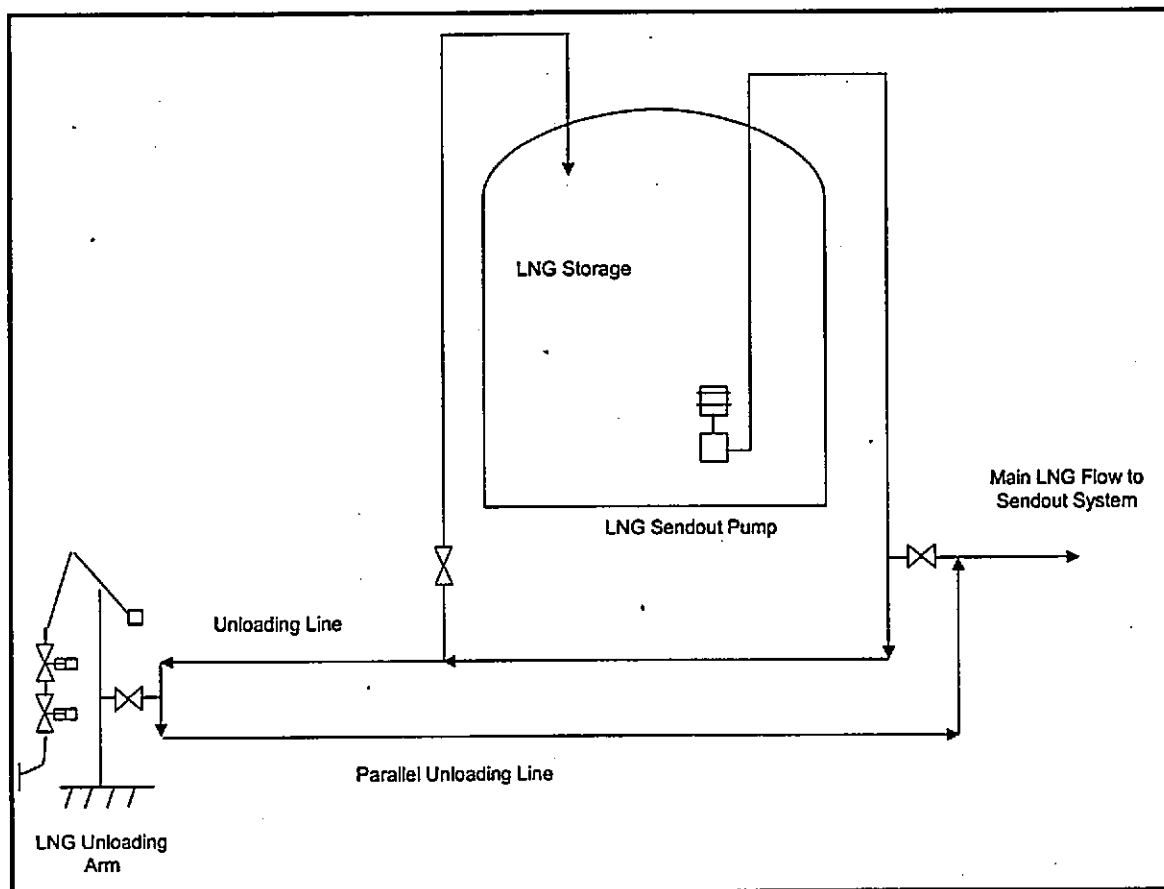
LNG will be transported to the terminal in specialised ships, sized with a cargo capacity of up to 250,000m³. On arrival at the LNG terminal the ships will dock at the jetty. The existing jetty facilities will undergo a refurbishment programme. Initially, one LNG berth will be provided, with a second berth added for the expansion, but the design will allow unloading of only one tanker at a time. It is estimated that initially (Phase 1) around 105 ship deliveries a year will be required, rising to 210 following the expansion (Phase 2).

The LNG unloading system will consist of all the terminal-side facilities, infrastructure and equipment required to safely berth the LNG ship, to establish the necessary ship-to-shore interfaces, and for transferring the LNG from the ship's cargo tanks to the onshore transfer piping.

To unload the LNG, four unloading arms will be available for connection to the ship manifold flanges. These unloading arms will be connected for liquid unloading and a further connection will be available for vapour return to maintain the ship cargo tanks at the required operating pressure. The unloading arms will be configured to enable both horizontal and vertical movements from the docked ship to be absorbed. To ensure a high level of equipment availability, one additional unloading arm will act as a spare, being usable either for LNG or for vapour return service. The liquid unloading arms will connect into the LNG transfer piping, comprising 2 lines to the terminal storage tanks.

Prior to unloading, a communication cable will be connected between ship and shore enabling voice and data communication, and the emergency shutdown functionality of ship and terminal from either side. The emergency shutdown system will be tested prior to commencement of unloading. To minimise boil off of the LNG during transfer it is essential to ensure the unloading arms are cold. The unloading arms are inerted and cooled using nitrogen and then LNG from the onshore transfer line re-circulation, to reduce the temperature to around minus 80°C, discharging vapour into the ship tankage. The vapour return line may also require cooling. A vapour desuperheater located at the jetty will reduce the vapour temperature to below minus 120°C by spraying LNG into the vapour stream. Although the LNG transfer lines will be insulated with cryogenic insulation, a small amount of heat leakage from atmosphere will tend to warm up the lines between deliveries. To offset this heat leak, and thus maintain the lines at minus 160°C, a small "recirculation" flow of LNG will be maintained. LNG from the on-shore storage tanks will be circulated through one unloading line to the jetty head and back through the other unloading line. The boil off gas generated will be handled in the boil off gas system and re-condenser, as discussed in section 2.3.1.3.

Figure 2.3.1: LNG Transfer Line Cooling System



When all pipe work and connections have been cooled, the ship's in-tank unloading pumps will be started and LNG transferred to the on-shore storage tanks. The pumps will be capable of operating at a maximum total unloading rate of 14,000m³.

The LNG transfer lines will allow the LNG to be transferred from the ship's tanks to the onshore storage tanks. Two transfer lines will be installed and both used during normal unloading. A third vapour return line allows natural gas vapour to flow from the boil-off gas handling compressors at the storage tank/process area to the jetty area, and then to the ship's tankage.

The unloading system includes facilities for disconnecting the ship-to-shore interface at the end of the unloading operation, and for unberthing the ship, prior to its departure. Typically, each LNG ship will be berthed at the unloading jetty for less than 24 hours, including preparation for discharge, unloading (approximately 14-16 hours), and preparation for departure.

All pipework, connections and seals will be constructed using proven materials to enable long and reliable service life at cryogenic temperatures. These systems will be insulated.

Storage of Liquefied Natural Gas (LNG)

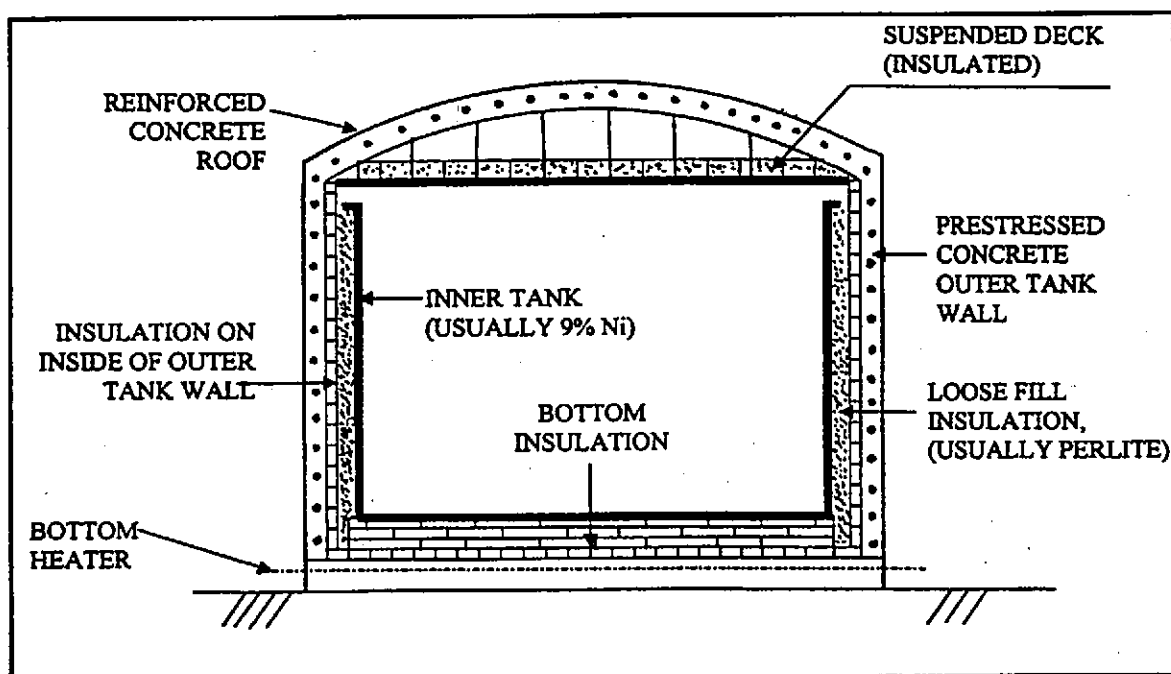
The LNG terminal will operate continuously, whereas LNG ships will arrive at intervals. To facilitate continuous operation the LNG tanks will provide a buffer of storage capacity. The storage tanks will also provide capacity to meet short periods of high gas demand when the rate of sendout gas is higher than the average throughput for the terminal.

The LNG tanks will be installed above ground and will be of the highest available integrity, proven, full-containment design. The normal working capacity of each tank will be 155,000m³. Initially three LNG tanks are proposed with a further two tanks anticipated for the expansion phase.

Each tank will comprise an inner tank and an outer tank. The inner tank, fabricated from 9% nickel steel, will be the primary container for the LNG. The outer tank will be constructed of pre-stressed concrete, with a carbon steel liner, and the roof will be reinforced concrete. The annulus between the inner and outer tanks, approximately 1 metre wide, will be filled with perlite insulation material. This type of tank is known as 'full-containment' since it provides 100% back up in the event of leakage from the internal tank wall. Temperature monitoring will be installed to identify any leak from the internal tank, as well as liquid level monitoring. A typical cross section of this type of tank is shown in Figure 2.3.2. The tanks will have a design pressure of approximately 0.3 barg and a design heat leakage rate of less than 0.07% of the tank contents per day (based on a full tank of liquid methane).

Each tank will be provided with two inlets allowing the LNG entering the tank to be discharged either into the bottom or into the top of the tank, in accordance with recognised and proven practices to ensure adequate mixing and stability of the contents. All the piping connections into and out of the tank will be through the roof, thus avoiding any penetrations through the tank walls or floor, and eliminating the potential for leakage at such locations. The LNG tanks will have pressure monitoring instrumentation, and will operate at slightly above atmospheric pressure at a typical operating pressure of 0.10 to 0.25 barg. The tanks will be protected with vacuum and over-pressure relief devices and interlocks, which will ensure that all vacuum and pressure relief valves are in the correct position to protect the tanks.

Figure 2.3.2: Features of a Typical Full Containment LNG Tank



Each tank will be provided with two in-tank LNG sendout pumps for transferring the LNG from the tank to the BOG re-condenser. The two pumps will transfer LNG at a combined rate of around 1350m³/hr at 6.5 barg. Provision has been made for installing an additional (third) pump in each tank to cater for possible future addition, if maintenance requirements dictate.

Further detail on the selected LNG storage tanks, including BAT justifications, is provided in section 4.1.3.1.

Boil-off Gas Re-Condenser

During transfer and storage of the LNG, some will "boil-off" as a result of heat ingress into the system. The proposed design for the South Hook plant incorporates a re-condensation stage that permits recovery of the boil-off gas to prevent what would otherwise be a loss of material, see section 2.3.1.4.

LNG from the storage tanks will be pumped to the Boil-off Gas (BOG) Re-Condenser, which will operate at about 6.50 barg. In the BOG Re-Condenser boil-off gas will be re-condensed (absorbed) into the LNG stream, which then flows to the suction side of the LNG Booster Pumps. Further details regarding generation and handling of boil-off gases are provided in section 2.3.1.4.

Boil-off Gas Handling

The LNG storage tanks will be heavily insulated to minimise heat ingress. Since 100% efficient insulation is not achievable, a small amount of heat often referred to as "heat leak", enters the tanks and causes a small portion of the LNG to "boil-off" or vaporise. This resulting gas constitutes the 'normal' boil off gas flow rate.

NOISE VIBRATION & AIR QUALITY

During the unloading of a ship the LNG discharged from the ship tends to warm up because of the pumping energy supplied to the LNG, and because of heat leak into the unloading lines. These factors contribute to the further generation of boil-off gases. In addition, during ship unloading, vapour space gas will be physically displaced from the LNG tanks by the incoming LNG. These sources comprise the 'high rate' of boil off gas flow.

The purpose of the Boil-Off Gas (BOG) Handling System is to collect the boil-off and displacement gases as described above and to redirect them to safe and efficient use.

For the normal 'low flow rate', the boil-off gases leaving the LNG tanks will be desuperheated (cooled) with LNG, and sent to the BOG Compressors, via the BOG Compressor Suction Drum. The BOG Compressors will raise the pressure of the boil-off gas to the same pressure as the BOG Condenser. There are 2 x 100% duty BOG compressors for phase 1, and a further 2 for the expansion. In the BOG Condenser the boil-off gas will be re-condensed (or absorbed) into the sendout LNG.

During ship unloading the total quantity of boil-off gas to be handled will be significantly higher than when no unloading is taking place. Under these conditions a larger compressor capacity will be used to provide the additional boil-off gas handling capability. Also, during ship unloading a substantial portion of the boil-off gas will be returned to the ship as "return vapour" to fill the space created by the LNG being pumped out. Any remaining boil-off gas will be recondensed in the BOG Condenser.

For all standard operating conditions all boil-off gas will be captured or reused, by returning it to the ship, recondensing it in the LNG for sendout, or by using it as fuel gas in the SCVs. Consequently, flaring of boil-off gases will not be required under all normally expected operating conditions.

Maintenance will normally be undertaken by removing specific equipment items from service. Warming, purging, and cool down of those items will incur the evolution of natural gas vapour; it is expected that any such vapours will be handled within the BOG system.

Vaporisation of Liquefied Natural Gas (LNG)

LNG from the BOG condenser will pass through a High Pressure LNG Booster Pump designed to raise the LNG pressure sufficiently to match the required 94 barg sendout gas pressure. Initially, there will be ten booster pumps, each with a capacity of 125 tonnes per hour. At the peak initial-phase sendout rate of 1,110 tonnes per hour, nine of these pumps are required and one will be on maintenance standby. The high pressure LNG discharged from the booster pumps is fed to the vaporisation stage.

LNG will be vaporised using Submerged Combustion Vaporisers (SCVs). Initially there will be a total of ten SCVs, each designed to vaporise 125 tonnes per hour of LNG discharging natural gas at between 1 and 15°C. Hence, similar to the LNG pumps, at the peak initial-phase supply rate of 1,110 tonnes per hour, nine SCVs will be in operation, and one will be on maintenance standby.

During the expansion phase an additional 10 SCV units and High Pressure LNG Booster pumps will be installed to handle the additional LNG throughput.

Each SCV will comprise a stainless steel tube bundle immersed in a warm water bath. A schematic arrangement of the SCV is illustrated in Figure 2.3.3. The LNG flows through

the tube bundle and is heated and vaporised by heat transferred from the water bath. The warm water temperature is maintained by supplying heat through direct contact with the hot gases resulting from the combustion of a small portion of the natural gas, in the region of 1.5% of the regasification throughput. Direct mixing of the hot combustion gases with the water permits nearly all of the combustion heat to be recovered. The system therefore has high efficiencies in the region of 95 – 100% based on gross calorific value.

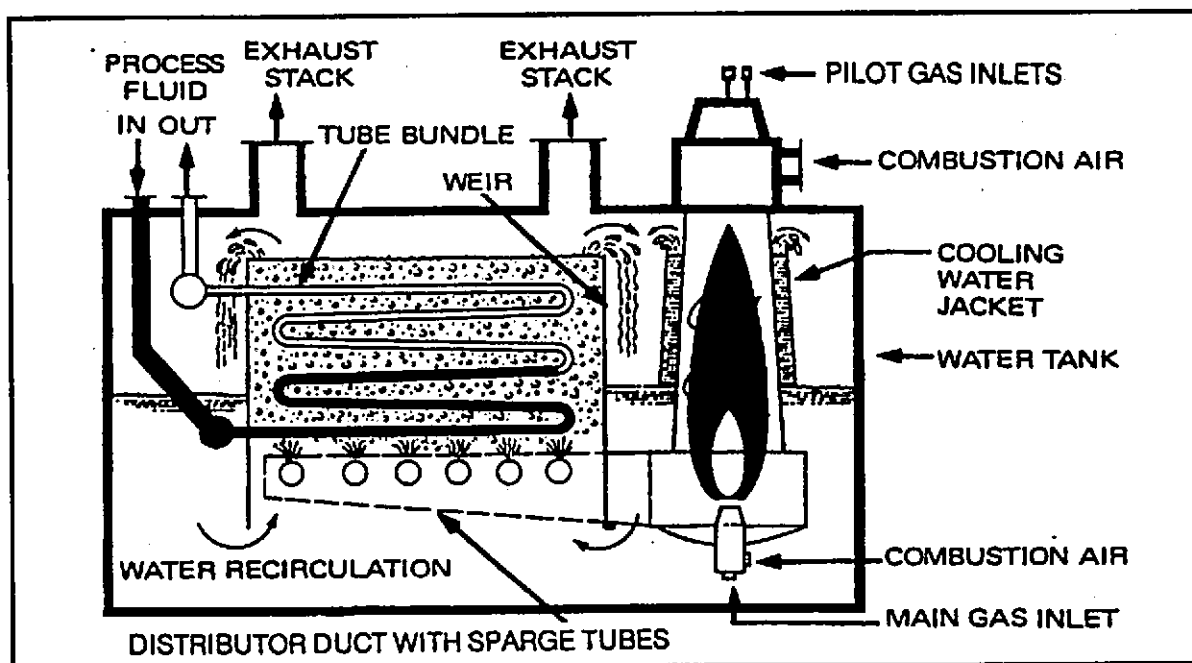
Water is circulated through the SCVs: due to condensation of water vapour from the combustion process, water accumulates and needs to be discharged. Typically around 22m³/hr of wastewater will be discharged from the SCVs during the initial phase, rising to approximately 45m³/hr following the expansion phase. The combustion products warming the water include CO₂ and some NO_x, a small quantity of which dissolves in the water. Therefore to maintain the pH of the water within the neutral design range of 6-9, pH adjustment will be required. This will be achieved by the addition of sodium hydroxide (caustic soda). Following pH adjustment the neutralised excess water will discharge into the skim pond from where it subsequently combines with other site run-off waters prior to discharge into Milford Haven, (see section 2.3.3 for further details).

Combustion gases exiting from the SCV will be discharged to atmosphere via an exhaust stack on each SCV unit. An Air Quality Assessment has evaluated the predicted environmental impact of releases from the stacks, details of which can be found within Appendix A. Dimensions of the stacks will be optimised during detailed engineering, whilst ensuring that air quality standards will be met.

The vaporised natural gas is referred to as sendout gas and will be continuously analysed and metered to appropriate fiscal standards prior to transfer to the National Transmission Service (NTS).

Fuel for the SCVs will be provided by vaporised LNG.

Figure 2.3.3: Schematic Arrangement of a Submerged Combustion Vaporiser (SCV)



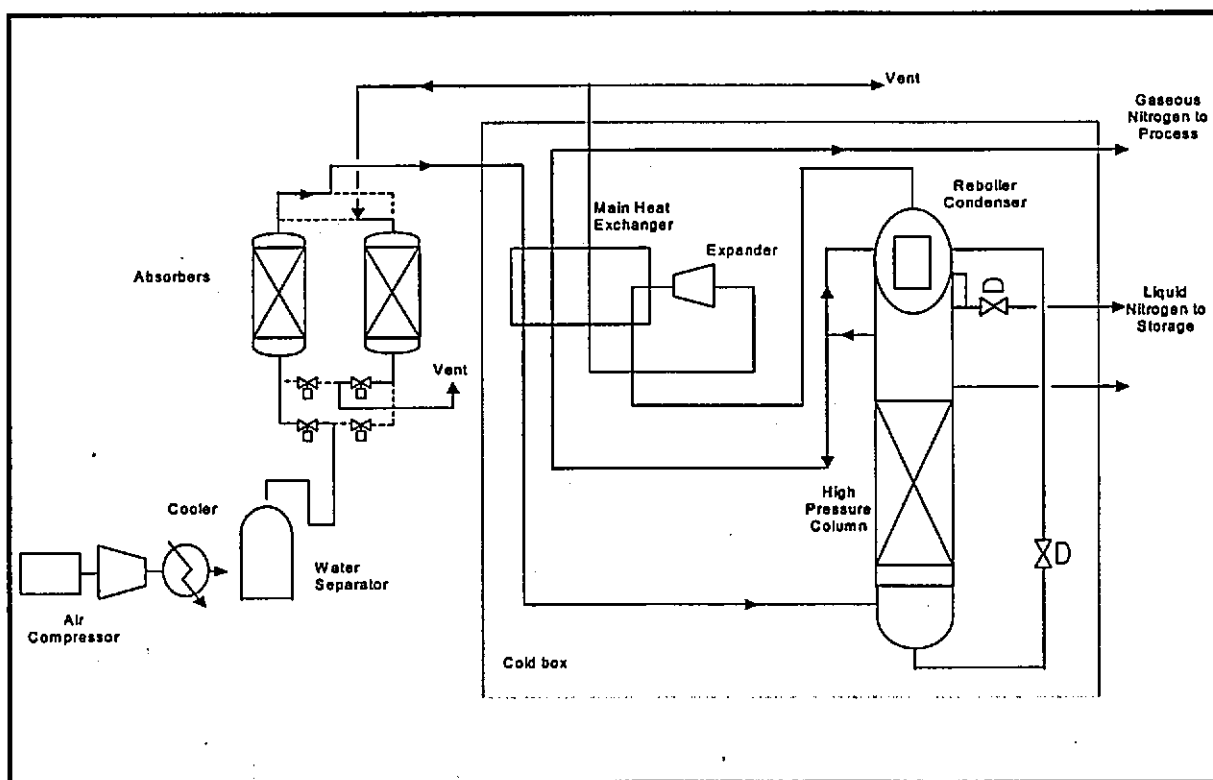
A review of the alternatives available for vaporisation of LNG is provided in section 4.1.3.2, and demonstrates that the use of SCVs within the proposed plant represents BAT.

Gas Conditioning Plant

It is planned that the primary source of the LNG imported to the facility will be from Qatar. The anticipated composition of the LNG to be exported from Qatar does not directly satisfy all of the gas quality requirements specified by the UK National Transmission Service (NTS), notably in respect of the Wobbe number. In order to bring the vaporised LNG quality to within the NTS specifications, a small volume of nitrogen will be added to the sendout gas. The exact amount of nitrogen to be injected will vary depending on the quality of each cargo but typically it is expected to be around 0.5 mole% of nitrogen, or less.

Nitrogen will be generated on site via cryogenic air separation units. To provide adequate operating flexibility and backup, three parallel cryogenic air separation units will be installed such that the total duty is spared. On completion of the expansion phase, three additional units will be operated. A process schematic for the cryogenic air separation unit is illustrated in Figure 2.3.4.

Figure 2.3.4: Schematic Arrangement for a Cryogenic Air Separation Unit



Within each cryogenic air separation unit atmospheric air is compressed and cooled within the compressor aftercooler. The air then passes through a 2-bed adsorption system to remove water vapour. The two adsorber beds will operate alternately, one being regenerated, whilst the other is in service. Regeneration will be achieved by passing dry, waste gas (nitrogen depleted air) from the plant through the adsorber. The adsorber switching sequence will be automatically controlled.

The dry air from the adsorbers enters the cold box where it will be cooled and partially liquefied by heat exchange with the returning product and waste streams in the main exchanger. The cold, partially liquefied air and gas mixture then passes into the bottom of the distillation column where the ascending vapour separates into pure nitrogen at the top and crude liquid oxygen at the base. Nitrogen leaving the top of the column will pass through the reboiler/condenser where it will either return to the high pressure column as reflux or will be sent to storage as liquid product. The crude liquid oxygen from the sump of the distillation column will be flashed into the reboiler section to provide refrigeration for condensing the gaseous nitrogen. A continuous purge of oxygen enriched liquid will be removed from the boiler to prevent the build-up of hydrocarbons and carbon dioxide. Refrigeration of the overall process will be provided when part of the waste gas leaving the reboiler/condenser is warmed in the main heat exchanger and the total mixed stream is expanded to near atmospheric pressure in the expander, with a corresponding drop in temperature. Passing this cold waste back through the main heat exchanger cools the incoming air and a side stream of the waste gas leaving the heat exchanger will be used to regenerate the absorbers. Pure gaseous nitrogen from the top of the distillation column will be heated to near ambient temperatures in the main heat exchanger before leaving the cold box. It then combines with necessary make-up from the storage vaporisers before leaving the plant.

The nitrogen generators can produce liquid nitrogen at a low flow rate. This liquid nitrogen will be used to replenish the liquid nitrogen tank. In addition to the demand for nitrogen injection into the natural gas product, nitrogen from the plant will be used for purging and inerting of various equipment and piping, during both operation and maintenance activities.

General Site Facilities

Fire Protection

Fire and gas detection systems will be installed in all parts of the facility where there is potential for fires involving flammable, and combustible, materials.

A primary fire water main system, supplemented with vaporisation suppressant fire fighting foam where required, will be installed in the terminal. This system will consist of fresh water storage; pumps; ring main distribution; hydrants and monitors. The freshwater will be supplied from a 10,000m³ reservoir tank, filled from the local area service (non-potable) water main. The reservoir tank is considered capable of providing enough capacity to enable the worst credible scenario fire to be brought under control. The firewater main will normally be held at pressure (typically 10barg) with the pressure being maintained by a jockey pump. Auto-starting high capacity pumps will provide the enhanced flowrates necessary for incident control. Two electric firewater pumps will be installed with two backup diesel firewater pumps, should a power failure occur. A secondary seawater supply, from the jetty, will be available for contingency purposes. The jetty fire-fighting system will normally operate from the same freshwater system.

Hose reels, extinguishers and similar portable fire fighting and emergency response equipment will also be provided for rapid manual intervention "first aid" fire fighting, and for support of emergency response personnel.

All hydrocarbon (LNG, fuel oil, diesel) containing areas of the terminal will be monitored with an appropriate combination of thermal, flame, and gas detectors, functioning within the centralised control system.

Figure 2.2.1 indicates the fate of fire waters. Firewater from the bunkering tanks, and other machinery areas which may be contaminated with oil, passes through oil traps before combining with other firewater streams from the process areas. This combined stream drains to the interceptor to remove any remaining contaminants. The cleaned water then discharges to Milford Haven via a settlement pond facility. Firewater from the LNG tank area will be collected in the impounding basin. If this stream is free of LNG it will be continually pumped from the basin and combined with the other clean water stream above. LNG spills can also collect in the impounding basin and if this is the case, the basin outlet is automatically isolated. Foam is then used in the basin to reduce the rate of vaporisation of the LNG and any potential vapour cloud, and control/extinguish any LNG fire in the basin.

The volume of foam used will be small. For example the impounding basins only require 200 litres of 97% dilute foam per application, so may require 500 litres total for one event, allowing for top ups. The foam is biodegradable and typical values are BOD 722g/kg and COD 1320g/kg so that given the small quantities the environmental impact of foams will be minimal. The foam is removed by a fine wire mesh and will break down in the impounding basin to prevent its release. On the jetty any hydrocarbon spills will be similarly impounded and controlled.

Flares

Flaring of gas is not expected under normal operation however, as a safety measure under emergency or upset conditions flaring of gas may be carried out. Two flare systems will be provided: one low pressure and one high pressure. The flare systems will collect and safely burn the gaseous discharges from the plant or equipment, from equipment maintenance, local purge requirements, or operation of over-pressure protection devices. The low-pressure system will handle discharges from the LNG tanks and related low-pressure equipment/piping. The high-pressure system will handle discharges from the vaporisers and other high pressure areas.

Each flare will have three pilots, which continuously burn a small quantity (10Nm³/hr from all three pilots) of natural gas. The flare headers will be purged with nitrogen to keep the oxygen content within the flare at a safe level. Nitrogen purge will be at a rate in the order of 25 Nm³/hr from each flare.

The option of flaring under emergency/upset conditions in preference to venting the natural gas direct to atmosphere has been selected on the basis of the reduced global warming potential of combustion products relative to unburned methane. Although natural gas is non-toxic, it has a high global warming potential: methane (the main constituent) has a global warming potential approximately 22 times higher than that associated with carbon dioxide. Combustion of the natural gas will give rise to releases of CO₂ and water vapour, with some trace contaminants, primarily NO_x and CO.

Fuel Storage

Facilities for storing and loading ships' bunker fuel are available as follows:

- Heavy fuel oil: 45,000 m³;
- Low sulphur fuel oil: 22,000 m³; and
- Diesel: 10,000 m³.

NOISE VIBRATION & AIR QUALITY

All fuel tanks will be of the traditional circular configuration with a cone roof. The tanks will be bunded to provide containment in the event of spill or rupture. Bunds will be sized to contain 110% of the contents of each tank.

Although primarily in place for re-fuelling the ships, diesel will also be supplied to power the emergency back-up generator and the firewater pump. Individual, smaller diesel day tanks of approximately 200 litres capacity each, will be used for this purpose and refilled from the larger main diesel tank.

Compressed Air

There will be 2, 100% instrument and plant air compressors, both electric motor driven. A drier unit will also be installed for the instrument air system. Distribution of these air systems will be by permanent piped systems.

Abnormal Operation

This section addresses foreseeable abnormal operating conditions such as start-up, shutdown and emergency situations.

It is not expected that the plant will require full shutdowns (and hence start-ups) for maintenance activities. Consequently, a full plant start-up and shutdown will be a very rare event.

Commissioning will require cool down of all process equipment and piping, by controlled flow of LNG into the systems. During this period it will be necessary to dispose of the gas evolved by flaring, since it will not be possible to pressure the gas into the export pipeline. Similarly, in the unlikely event of a full shutdown, flaring of boil-off gases evolved will be necessary.

From time to time, individual equipment items or parts of the plant may need to be shutdown for maintenance and/or inspection. Flaring of hydrocarbon contents of the individual items could be required while venting and gas freeing such equipment. Cooling of the repaired/inspected plant parts during recommissioning will again be achieved using a controlled flow of LNG. The gas generated from cooling in this case, will be handled within the BOG system. In the rare instances when the gas generated cannot be accommodated by the BOG system, then flaring will be required.

To ensure plant safety, following any shutdown, the plant in question may initially require a nitrogen purge to ensure it is gas free. When recommissioning nitrogen purge will be necessary to remove oxygen: vaporised gas will then be introduced to reduce nitrogen to an acceptable level (i.e. to avoid discharging a slug of nitrogen into the NTS), and this may require some purge gases to be flared. Depending on the system/methodology/status, the gas may be sourced from either the fuel gas system, or from introducing LNG for cool down.

Procedures will be in place, and followed, to ensure all operations and systems are both shutdown and re-commissioned in a safe and controlled manner. These procedures will cover all shutdown scenarios, including specific plant items, parts of the plant and emergency shutdown systems.

A 'fail safe' emergency shutdown (ESD) system will be incorporated in the design of the terminal to safely shut the plant down and minimise any consequences should a fault condition arise. The ESD system will isolate the process plant and protect the personnel, plant and environment from process fault conditions and leaks.

The shutdown system will instigate various levels of response, comprising: overall plant and utility shutdown, overall process plant shutdown, process train or fire and gas shutdowns, and individual plant equipment or plant areas.

ESD valves capable of remote actuation shall be provided at the boundaries of the fire areas. The fire areas have been established as follows: jetty head and area, each new tank has a separate fire area, recondenser feed pump and recondenser area, and gas compressor area.

The valves initiated by the ESD system shall by preference be pneumatically operated with a designed fail action (close, open or lock, as appropriate). The requirement for ESD valves, electrically operated from a battery back-up system and provided with fire proofed actuator and fire proof power cables, will be determined during FEED. During FEED, the specification for fire proofing of ESD systems shall be reviewed in accordance with the requirements of relevant codes and specifications, and in conjunction with the cause and effect diagrams for the systems.

Provision will be made for ship to shore cable connection across the jetty to link the terminal and ship emergency and shutdown systems, as described earlier. A ship/shore/ship connection scheme, data interfaces and operating procedures will be developed before ship to ship (jetty to jetty) LNG transfer capability is made available.

2.3.2 Abatement of point source emissions to air

Nature of the emissions to air

The main point source emissions to air from the facility will be combustion products from the burning of gas within the SCV units.

The two flare systems, which will only operate on pilot gas under normal operation, will also be minor point source releases. In the event of either system being required, the flare will safely burn the gaseous discharges from the plant releasing combustion products to atmosphere under 'abnormal' and 'emergency' operations.

Table 2.3.3 below summarises the point source emissions to air and their nature. Quantification of the releases is provided in Table 3.1.1. The locations of these release points are indicated on Figure 2.3.5.

Table 2.3.3: Point Source Emissions to Air

Ref	Source	Nature	Conditions
A1-A10	SCV Exhaust Stacks (Initial)	Combustion gases	Normal
A11-A20	SCV Exhaust Stacks (Expansion)	Combustion gases	Normal
A21-A23	Nitrogen Plant Vent (Initial)	Crude oxygen	Normal
A24-A26	Nitrogen Plant Vent (Expansion)	Crude oxygen	Normal
A27	High Pressure Flare	Combustion gases/nitrogen purge	Abnormal/ Emergency
A28	Low Pressure Flare	Combustion gases/nitrogen purge	Abnormal/ Emergency
A29-A32	Tank 1 LNG Relief Valves	Hydrocarbons	Emergency

Ref	Source	Nature	Conditions
A33-A36	Tank 2 LNG Relief Valves	Hydrocarbons	Emergency
A37-A40	Tank 3 LNG Relief Valves	Hydrocarbons	Emergency
A41-A44	Tank 4 LNG Relief Valves	Hydrocarbons	Emergency
A45-A48	Tank 5 LNG Relief Valves	Hydrocarbons	Emergency
A49	High Pressure Flare Pilot (x3)	Combustion gases	Normal
A50	Low Pressure Flare Pilot (x3)	Combustion gases	Normal
A51-A56	Gas Conditioning Plant Adsorption Units (Initial)	Moist air	Normal
A57-A62	Gas Conditioning Plant Adsorption Units (Expansion)	Moist air	Normal
A63-A64	Instrument Air Dryers (Initial)	Moist Air	Normal
A65-A66	Instrument Air Dryers (Expansion)	Moist Air	Normal
A67	Heavy Fuel Oil Storage Tank Vent	Hydrocarbons	Normal
A68	Diesel Storage Tank Vent	Hydrocarbons	Normal
A69	Low Sulphur Fuel Oil Storage Tank Vent	Hydrocarbons	Normal

Control of point source emissions to air

SCV Emissions

The SCVs will release combustion gases generated from burning natural gas. Natural gas is a cleaner alternative to burning other fuels such as fuel oils. The hot gases pass through water where gases such as carbon dioxide and nitrogen oxides (NO_x) will be partially dissolved and most water vapour will condense out. Discharge of exhaust gases from the units will be at a temperature of approximately 40°C and will primarily comprise products of combustion including CO₂, water vapour, and trace contaminants e.g. NO_x and CO. The discharge will be saturated with water vapour. It is therefore expected under certain atmospheric conditions that a visible plume may form.

Plume visibility has been assessed within the Air Quality Assessment (Appendix A). Although the plume visibility beyond the installation boundary exceeds the insignificance criterion (<5% each year), it is not predicted to extend beyond the site boundary. There are no sensitive receptors to plume visibility within the site boundary and therefore the impact on the closest sensitive receptor is not considered to be significant in the context of the scale and nature of the development.

NO_x emissions from the SCVs will be minimised through the selection of combustion equipment with inherently low NO_x emission levels. As part of the FEED process, the performance of SCVs from different manufacturers will be reviewed and incorporated within the plant specification.

Nitrogen Plant Emissions

The nitrogen generation plant basically separates air at cryogenic temperatures to produce nitrogen and crude oxygen fractions. The crude oxygen fraction is released to atmosphere. Since this stream is crude oxygen, the impact on the environment is not considered significant. The adsorber function is to dry the incoming air feed to the nitrogen generation plant. The vents from the adsorbers will release moist air. Similarly the releases from the instrument air dryers will comprise moist air and are consequently trivial.

High Pressure Flare and Low Pressure Flare

The flares, when operated, give rise to emissions of natural gas combustion products. The combustion efficiency in the flares will be high, achieving good combustion of the natural gas. These release points are only used in abnormal operating conditions or emergencies, to ensure that safe conditions are maintained within the plant. The releases are therefore non-routine and short-lived, but would nevertheless be expected to have some short-term minor environmental impact. During the plant commissioning period, when tank cool down, for example, may require flaring, flaring could be more frequent, however, this will be over a limited period of time (approximately 4-6 weeks).

The alternative to flaring under upset conditions would be to vent natural gas direct to atmosphere. Flaring has been selected in preference to venting due to the much higher global warming potential of methane, the main constituent of natural gas when compared to CO₂, (see discussion under 2.3.1.7 earlier). The overall impact of the release of combustion products is therefore considered lower than that from venting of methane (natural gas).

Under normal conditions the flares will have a continuous purge of inert gas. It is expected that approximately 25 Nm³/hr of inert gas will be purged from each flare. The purge gas will be nitrogen supplied from the nitrogen plant.

LNG Relief Valves

Each of the LNG storage tanks is fitted with emergency relief valves with atmospheric vents. These are fitted as an emergency safety measure to prevent over pressurisation of the storage tank. The operation of any of these vents is considered to be a very rare event (estimated at a 1 in 5 to 10 year, or less, frequency). For safety reasons, no abatement or combustion of the natural gas release from these vents will be included.

Flare Pilots

To ensure a ready ignition source in the event of needing to make use of either of the flare systems, a small flow of natural gas (10Nm³/hr from all three pilots on each flare) is continuously burnt in the flare pilots. This gives rise to a trickle release of natural gas combustion products. Each of the two flares will have three pilots.

Fuel Oil Storage Tanks

The three fuel oil tanks containing diesel oil, low sulphur fuel oil and heavy fuel oil respectively will have vents to atmosphere. As a result of tank breathing, small quantities of hydrocarbons will be released to air.

2.3.3 Abatement of point source emissions to surface water and sewer

Wastewaters generated from the installation will include: surface drainage from potentially oil-contaminated areas (for example around machinery), surface drainage from non-contaminated areas and excess water produced in the Submerged Combustion Vaporisers.

There will be no process emissions to sewer from the installation. Aqueous discharges from the installation will be discharged, following treatment into Milford Haven. A single combined discharge point will be used for all releases as detailed in Table 2.3.4. The location of this discharge point is indicated in Figure 2.3.5.

Table 2.3.4: Point source emissions to water

Ref	Source	Expected Nature
W1	Combined SCV, ground water and surface waters	Neutralised pH 6-9 Na ₂ CO ₃ 6.0 mg/l NaNO ₃ 1.58 mg/l

The main water circuits and effluent system are discussed in detail within section 2.2.3. The water schematic for maximum and minimum flows is presented as Figure 2.2.3a and Figure 2.2.3b. When the plant design has been finalised a detailed drainage plan will be developed indicating the location of the various drains and effluent pipework.

Water discharge from the SCV

Within the SCV units most of the water vapour generated from combustion will be condensed within the water bath section of the units. As a result an excess of water within the water baths will be produced which then discharges as a wastewater stream. Due to the presence of dissolved acid gases, this wastewater requires pH adjustment to ensure the discharge waters are in the pH range 6-9. Each SCV unit will have a separate pH adjustment system, using caustic soda as the neutralisation agent. Following neutralisation, the wastewaters will be discharged into the holding area. Under normal operation the water will discharge directly from the holding area and pass into the skim pond. However, should a pH problem be identified, a valve on the exit of the holding area will be closed to prevent off-spec releases. The holding area will have approximately 2 hours holding capacity to enable the problem to be rectified and further neutralisation of the waters to take place.

The wastewater from the SCVs will essentially be clean water containing trace sodium carbonate and sodium nitrate formed from pH dosing with sodium hydroxide. Concentrations of sodium carbonate and sodium nitrate in the neutralised SCV wastewaters, prior to discharge into the skim pond and eventual combination with other site waters, are expected to be in the region of 0.38g/l and 0.1g/l respectively. The local marine environment is sensitive to excess input of nutrients given its biodiversity resulting from very clean waters and minimal nutrient load. Therefore, the discharge from the holding area will pass through the nutrient impoverished skimming pond with an additional benefit of potentially increasing natural attenuation activity within the microbial community within it and increasing the natural degradation of the oily sludge material.

Provided that the volume of effluent discharged into the skimming pond is correctly balanced with the volume of seepage through the basal sediments and natural peat deposits the nitrate compounds within the effluent are likely to provide a welcome source

of nutrients for the indigenous bacteria and help to reduce the time period over which the oily sediments within the skimming pond are naturally bioremediated. The discharge from the skimpond will combine with other site waters prior to discharge into Milford Haven.

A further option has also been assessed as an alternative method for protecting the receiving marine environment. This option involves the construction of an additional discharge line along the jetty trestle and discharging the SCV effluent off the jetty end. The SCV waters are consequently discharged into the main channel and tidal stream to take advantage of maximum tidal flows and dilution away from sensitive marine habitats.

At this stage in the project, the option to use both systems is being included to ensure that should the skim pond prove unable to achieve an acceptable nutrient level for discharge through the combined outfall at any point during the lifetime of the plant, then the SCV effluent will be diverted through the extended outfall.

Clean Surface Water

Surface water from the non-equipment areas will be considered as clean and will be collected within the clean water drains and combined directly with the other site waters.

The combined wastewater and other site drainage will discharge into the settlement pond. The settlement pond will be designed to provide sufficient residence time to permit any solids present in the discharge to settle out. The primary discharge from the settlement pond will combine with the discharge from the skim pond and be released direct into Milford Haven. A small flow will be directed through the skim pond. The purpose of this flow will be to maintain the skim pond in its current condition by restricting the flow to a level similar to the existing flow. A flow restrictor will be included to prevent high flows through the skim pond that could mobilise sediments.

Oily Surface Water

Some plant areas have been identified as having the potential to become contaminated with oil. These areas will all include an oil removal stage to prevent oily waters being discharged. Surface water and rainwater from the bunker storage area and other equipment areas will discharge via an interceptor before being combined with other site wastewaters. Waters from the bunker storage areas will also have a dedicated oil trap upstream of the interceptor. The combined water will discharge into the settlement pond as described above.

Surface water and rainwater from the LNG Tank/Pumps and SCV area will pass through a spill impounding basin before being combined with other site wastewaters. Normally this water will be clean, however should a spill or leak occur then the spill impounding basin will permit such material to be contained and controlled/neutralised prior to release with other site waters via the settlement pond (see above).

Fire Water

In the event of a fire, firewater will be released. This water will eventually discharge into Milford Haven. Treatment of these fire waters will be dependent on the area in which they are generated, see Section 2.3.1 above for discussion.

2.3.4 Control of fugitive emissions to air

Detailed consideration during the design phase has been given to preventing leakage of LNG during transfer, storage and vapourisation activities. Measures incorporated within the plant include:

- Minimising the number of joints and fittings
- Use of welded, not flanged pipework and fittings wherever practicable;
- Selection of hydrocarbon service valves, with appropriate seal design to minimise fugitive leakage;
- Standardised use of spiral wound gaskets to minimise fugitive leakage;
- Controlled tightening of bolting;
- Commissioning and post-maintenance leak testing by procedure;
- Use of centralised fail safe control system which continuously monitors process variables such as temperature, pressure, and flow rates;
- Control system issues audible and visual alarms to operators when process variables are anticipated to vary outside the set parameters;
- Control system will alarm and/or shutdown a system, or the plant, if the monitored parameters exceed the allowable operating envelope.

Sumps and graded drains will be provided to contain and control unforeseen LNG discharges. Sumps will be provided at the following locations:

- Storage tank area;
- Process area;
- Jetty head.

Despite these design measures there remains the potential for leaks to occur giving rise to releases of hydrocarbons to atmosphere. There are significant safety hazards, in addition to the environmental hazards, associated with fugitive emissions of LNG. As a result, a combination of gas detectors and low temperature detectors will be installed at appropriate locations to quickly identify and give warning of a leak so that timely corrective action can be taken.

The design philosophy is for any spillage to be confined and collected by the drainage design and diverted to containment sumps where the spillage can be covered with high expansion foam to reduce the vapour generation and control gas dispersion.

Regular inspection of plant and a preventative maintenance program will also help identify any potential leakage events and enable preventative or corrective action to be instigated. This programme will include periodic checking of the seating of pressure relief valves to all vessels, piping and equipment, sampling connections, connectors (flanges), valves and compressor seals.

Housekeeping

A high standard of housekeeping will be maintained in all areas. However, due to the nature of the operations and materials handled and stored onsite, there is little potential for dust generation giving rise to fugitive emissions.

Materials handling

The main raw materials should not give rise to dust emissions from receipt, handling and storage operations. The main source of fugitive emissions to air is natural gas. The measures to minimise emissions have already been discussed above.

NOISE VIBRATION & AIR QUALITY

Potential emissions to atmosphere associated with ship fuels are primarily associated with deliveries to tankage. Hydrocarbon vapours are released through atmospheric vents when the tanks are being filled, but as the vapour pressure of these oils is very low, these emissions are not considered significant.

2.3.5 Control of fugitive emissions to surface water, sewer and groundwater

The main potential fugitive releases from the installation would result from an accidental spillage or leak. Consideration of accident prevention and control is provided within section 2.8.

Materials that could potentially give rises to a fugitive emission include:

- LNG;
- Natural gas;
- Heavy fuel oil;
- Low sulphur fuel oil;
- Diesel oil;
- Caustic Soda; and
- Maintenance oils.

A schematic of the water/effluent system is provided as Figure 2.2.3a and Figure 2.2.3b and illustrates the fate of all wastewaters and surface waters from the installation. Details of the pollution prevention measures for each stream are described above under section 2.3.4.

The following general provisions will be incorporated within the plant design to minimise the environmental impacts arising should a spillage occur.

Surfacing

During the design process consideration will be given to plant surfacing to ensure the surfacing provided is suitable to the proposed activities in that area. The surfacing of operational areas where liquid materials are handled will be equipped with:

- an impervious surface;
- spill containment kerbs; and
- sealed construction joints.

Hard-standing areas will be constructed with appropriate falls to an adequate drainage system. Any material with the potential to cause pollution will be stored and handled in bunded areas, so that any spillage of these materials will be contained for appropriate segregation, collection and recycle or disposal.

Other areas, where raw materials are not stored will be covered with other suitable surfacing, for example gravel.

Bunds

As previously detailed the LNG storage tanks are the double-integrity full containment type, and therefore do not require separate bunding. The storage locations for other liquid fuels and chemicals on site will be bunded. The capacity and specifications of the bunds will be in accordance with the Control of Pollution (Oil Storage)(England) Regulations 2001.

In particular bunds will:

- be impermeable and resistant to the stored materials;
- have no uncontrolled outlet;
- have pipework routed within bunded areas with no penetration of contained surfaces;
- be designed to catch leaks from tanks or fittings;
- have a capacity which is the greater of 110% of the largest tank or 25% of the total tankage within a single bund;
- be subject to regular visual inspection and have any contents pumped out or otherwise removed under manual control after checking for contamination;
- have fill points within the bund where possible or otherwise provide adequate containment; and
- have a routine programmed inspection of bunds, (normally visual but extending to water testing where structural integrity is in doubt).

Housekeeping

Procedures will be in place, which outline the actions to take in the event of a spillage of liquid materials stored onsite. Any spillage will be cleaned up immediately. Spill kits will be readily available to facilitate quick containment and clean up of any spilt materials.

2.3.6 Odour

The activities undertaken, and materials used within the proposed installation, are not considered odorous.

2.4 Emissions to Groundwater

The Groundwater Regulations came into force on 1 April 1999, and implemented the Groundwater Directive (80/86/EEC), by effecting environmental protection of groundwater. The Regulations place a duty on the Environment Agency to protect groundwater by prohibiting the discharges of List I substances and preventing pollution from any discharges to groundwater of List II substances.

There will be no direct emissions to groundwater of List I or List II substances from the installation.

A significant proportion of the shallow groundwater within the site will be intercepted by the excavation of the proposed LNG tanks, approximately 8m below the current groundwater levels and the drainage of groundwater through a centralised storm water catchment system. The groundwater bearing strata under the site is identified as a minor aquifer by the Environment Agency Wales. The majority of the groundwater is present within the Red Marl (mudstone and sandstone) beds within a small number of fractures; secondary solution features and yields along with storage are low.

As a result of the past use of the site there may exist List I and List II substances within the soil zone that could be mobilised into groundwater as a result of the excavation and drainage of the proposed development footprint. Therefore, an evaluation process will be carried out in two phases. The first phase is to conduct sampling and analysis of groundwater from monitoring wells and a number of boreholes drilled within and in the immediate vicinity of the proposed excavation sites. This part of the program will determine the hydrogeology, types, sources and extent of contaminants migration pathways. The data will be used in selecting and developing appropriate remedial strategy to prevent contaminant mobilisation as far as reasonably practical. The second phase is to collect samples from the sediments, flora and fauna in the watercourses and marine environment downstream of the site discharge points to assess the risk associated with contaminants and their ecological effects.

Evaluation of technologies for treatment of groundwater will be conducted in order to select the most viable solution. Groundwater remediation technologies are applied in situ and/or ex situ.

- Insitu technologies include bioremediation, air sparging, steam flushing, and oxygen enhancement with H_2O_2 .
- Exsitu technologies include pump and treat, air stripping, carbon adsorption, and Ultraviolet/Ozone/ H_2O_2 oxidation.

Factors that will be considered in the final choice of a remedial alternative or alternatives include:

- Protection of human health and the environment;
- Compliance with regulations;
- Long and short-term effectiveness;
- Feasibility;
- Cost; and
- Environmental acceptability.

The outcome from these studies will be reported in two parts:

1. Remedial investigation report.

The reporting will include results of the groundwater quality studies and the nature and extent of contamination. It will also evaluate the human health and ecological risks associated with leaving contaminants in place.

2. Feasibility study – Environmental Impact Review

This report will assess environmental impacts, human health effects, engineering and cost considerations, and ecological and socioeconomic aspects of cleaning up the underground water and surrounding areas.

This will form the basis of the proposed plan, in which the company will recommend to the regulatory authorities the preferred remedial option from the alternatives being developed.

Based on the data gathered on the site and its surrounding it is proposed that contaminated groundwater and hotspots of contamination will be either contained or removed prior to construction to prevent the uncontrolled release of substances to the surface water and marine ecosystems.

At the time of writing (September 2003), the necessary intrusive investigation works have commenced. The outcome of the process will be to design and implement a strategy to remediate the site, prior to construction. The Environment Agency will be fully consulted at all relevant stages of these improvement works.

Given the sites proximity to the marine environment on the South Hook headland, the groundwater is affected by tidal inundation and closer to the coast the quality is affected by saline intrusion. On this basis it is concluded that there are no potable supplies present beneath the site that are at risk from indirect release of List I and List II substances.

2.5 Waste Handling

Process waste generation from the installation is not considered to be significant. Wastes, which will be generated, are identified in Table 2.5.1 below;

Table 2.5.1: Waste emissions

Ref	Source	Nature	Typical Quantity
O1	Oil contaminated water	Oily bund/surface waters interceptor waters etc	10 tonnes per annum.
O2	Maintenance wastes	Oil/grease wastes	2 tonnes per annum.
O3	Maintenance wastes	Redundant/broken equipment	20 tonnes per annum.
O4	General wastes	General controlled wastes including packaging, wood, cardboard, other non-special wastes.	120 tonnes per annum.
O5	Molecular Sieves	Spent adsorbent	10 tonnes every 15 years.
O6	Empty chemical and oil containers	Plastic and metal drums	15-20 drums per annum.
O7	General Wastes Special	Paint cans, lab wastes etc	15 tonnes per annum

All waste generated will be handled according to site procedures, which will be designed to ensure that all regulatory requirements, policies and operational constraints are met.

All waste storage areas and containers will be clearly labelled, identifying the types of waste material(s). When designating waste storage areas, consideration will be given to the compatibility of the waste with other materials and proximity to sensitive receptors. Storage containers will be checked to ensure they are appropriate (compatible) and are not damaged or leaking. In the event that a storage container is identified as defective, appropriate action will be instigated following site procedures to address the problem, including the use of spillage kits to clean-up any leakage. Labels will be placed where they are visible and unlikely to be damaged. Where possible, at least two labels will be used on each container in case one is subsequently damaged or removed.

A dedicated hazardous waste storage area will be provided with impervious hard standing to prevent percolation in the event of spillage. Storage conditions and storage areas will be well ventilated. Secondary containment will be provided for all liquid hazardous wastes and for other wastes that have potential to discharge to surface water/groundwater. Storage areas will be designed with regards to the prevailing weather conditions.

Oil contaminated waters

Areas where potentially oily waters may be generated will be individually banded. Collected oily contaminated water will pass through oil separators (see section 2.2.3 earlier for details). Clean water will be routed to the settlement pond, while skimmed oil will be collected in an oil retention tank for further transfer to an offsite waste oil recycling facility. Removal of the oily waste from the interceptor will be carried out using a vacuum truck or similar facility.

Maintenance Wastes – Oil/Grease Containing

Oily or greasy waste materials, generated from routine and/or change out maintenance activities, will be collected in suitable labelled drums. Filled drums will be further transferred to the waste oil collection area which will be provided with containment facilities for temporary storage, prior to transfer to an offsite waste oil recycling facility.

Oily rags will be generated from many different areas as a result of various maintenance and cleaning activities. They will be separately collected in designated drums, stored in clearly marked areas.

Maintenance Wastes – Redundant/broken equipment

Periodically equipment will need replacement either due to plant modifications or equipment failure. These materials will generally be non-hazardous. Storage and handling of such wastes will be appropriate to the particular waste generated.

General Wastes

General commercial and industrial wastes will arise as a result of operations and maintenance activities. These wastes will be appropriately stored within a dedicated area (transfer station) for proper segregation before final disposal. A waste recycling and reuse programme for paper & cardboard, scrap metals, plastic materials, used oil etc, will be implemented.

Waste Adsorbent Materials

The adsorbent will be a molecular sieve type material, which undergoes alternate duty and regeneration cycles in normal operation. During operational life the efficiency of the adsorbent material reduces to a point when it must be replaced. The frequency will be determined by operational and local meteorological considerations, but will be expected about every 15 years.

A specialist contractor will undertake the removal and disposal of the spent adsorbent. The spent adsorbent will be collected in designated drums or containers for further transfer to the original suppliers, where feasible. Confirmation of the feasibility of returning spent adsorbent will be undertaken as part of the supplier selection process. Otherwise, the material will be analysed for contaminants to allow the waste to be properly classified (normally "inert"). The adsorbent would then be transferred to a suitably licensed landfill site.

Empty Chemical and Oil Containers

Empty chemical containers and oil drums will be collected and temporarily stored within a dedicated banded area. All residues will be decanted into a separate container and reused where possible. If unsuitable for re-use these wastes will be disposed of as special waste.

General Special Wastes

Some special wastes will be generated from general plant activities such as empty paint cans, lab wastes etc. These will be stored in a dedicated secure manner to ensure controlled storage and disposal of wastes. Consideration will be given to ensuring that waste items that are not compatible do not get stored in the same location.

Ship Wastes

Ships waste will not form part of the wastes generated by the installation. Under normal operation, it is planned to remove these wastes by a supply barge. However, on occasions it may be necessary to land waste at the jetty, and remove by road through the site. Such wastes will not be stored or processed on site, and will be subject to Duty of Care.

2.6 Waste Recycling, Recovery or Disposal

PPC requires that an installation be operated in such a way that "waste production is avoided; and where waste is produced it is recovered, or where this is technically or economically impossible it is disposed of, while avoiding or reducing the impact on the environment".

The facility waste management policy will be consistent with legal requirements and the company policy on Environment, Health and Safety. The general management guidelines are to:

1. Minimise the amount of waste generated.
2. Maximise the reuse or recycling of any wastes that are generated.
3. Dispose of any residual waste with minimum environmental damage.
4. Pay duty of care for the safety and health of employees, contractors, the public and the environment at all stages of the waste management process.
5. Ensure compliance with all regulations related to waste management.

Waste minimisation has already been covered in section 2.2.2, and included a commitment to undertaking regular waste minimisation audits. The information provided here describes the fate of wastes generated at the South Hook site and justifies where a waste is disposed of. As already stated in section 2.5, the generation of wastes at the site is not considered significant and therefore the options for recovery of a waste are generally limited by economic viability.

For all waste types, records will be maintained of the quantity, nature, origin and destination of wastes and their disposal route. Records will be kept in accordance with current legal requirements, for example the Duty of Care Regulations.

Oil contaminated waters

Oily wastes will be collected by a specialised vacuum truck. The frequency of collection will be based on regular inspections to determine the need. Waste oil will be transferred off-site for recovery.

Maintenance Wastes – Oil/grease Containing

Oily and greasy wastes result from maintenance of machinery and plant. They will be transferred off-site for recovery at a suitably licensed facility

Maintenance Wastes – Redundant/broken equipment

The fate of redundant/broken equipment is dependant upon the item in question. Where feasible, items will be disposed of for reuse, refurbishment, recycle, or as scrap where parts may be recovered. However, this may not always be possible due to the item not having any re-use/scrap value or where no market can be identified. In the event of the waste not being suitable for either re-use or scrap the item may be disposed off-site to a waste disposal facility authorised for the item(s) in question.

General Wastes

General wastes collected on-site are disposed of to an off-site disposal facility licensed to accept general wastes. The production of general wastes is not expected to be on a scale, which would make re-use or recovery of individual waste fractions economical.

The feasibility and economics for the recovery of materials from the general wastes will be subject to regularly reviews with the objective of identifying feasible alternative options to disposal.

Waste Adsorbent Materials

The feasibility of returning the spent adsorbent material to the supplier for recycling/recovery will be investigated as part of the supplier selection process. Should this not prove feasible then the spent adsorbent will be disposed of to a landfill site licensed to accept the waste. Analysis will be undertaken of the waste adsorbent material prior to disposal to determine whether the waste will be classified as an inert or hazardous waste, and a suitable landfill site selected on this basis.

Empty Chemical and Oil Containers

Used drums will either be returned to suppliers, or sent to a drum laundry. Non re-usable residues will preferentially be returned to suppliers for recycling, or sent for processing or disposal according to Duty of Care.

General Special Wastes

Special wastes will be disposed of to a special waste landfill, which is authorised to accept the wastes being disposed.

Ship Wastes

In the event of any ships' wastes being landed, this material will pass through the site and will be sent to a licensed landfill, unless a recycling outlet can be sourced.

2.7 Energy

The Climate Change Levy (CCL) was enacted to reduce emissions of greenhouse gases by encouraging business and industry to become more energy efficient. The CCL is charged upon industrial and commercial use of energy, including fuel for heating, lighting and power. However, there are some exemptions to the regulations. One such exemption is the energy used in producing fuels. Accordingly, since the energy consumed within the South Hook installation is used in producing natural gas fuel, this usage will be exempt from the levy.

The European Union Emission Trading Scheme (EUETS) is due to come into force in January 2005. This scheme is aimed at reducing greenhouse gases by introducing a cap on emissions. The first phase of the scheme only covers CO₂ emissions but it is open to extension to include other greenhouse gases. Rules and guidelines for the UK Allocation Plan under EU ETS are still under development. At this point in time, it is considered likely that the South Hook facility will need to comply with EUETS and consequently an application has already been submitted to DEFRA for a baseline allocation under this scheme. However, it is not yet clear whether the South Hook facility will be treated as an existing facility in the First Allocation Period (in which case emission credits will likely be grandfathered) or whether it will be treated as a new entrant (in which case it will be subject to the regime being developed for new entrants).

2.7.1 Basic energy requirements (1)

Energy requirements within the installation are supplied from the following sources:

- Electricity

Electricity will be supplied for general site services such as lighting and to power process equipment such as pumps etc. The electrical supply will come from the National Grid. The opportunity to purchase power from renewable sources will be kept under review.

- Natural Gas

Natural gas will be burned within the Submerged Combustion Vaporiser (SCV) units to heat the water used to vaporise the LNG. The natural gas is supplied by withdrawing a small stream from the high-pressure sendout; by using a portion of the compressed boil-off gas; or by a combination of the two.

- Diesel

Diesel fuel will be stored on site for supply to the LNG delivery ships. The energy to power the ships unloading pumps will be supplied from the ships diesel generator. In the event of grid power supply failure, diesel will also be used to power the on-site emergency generator and firewater pumps.

Table 2.7.1 presents the anticipated approximate annual energy consumption rates for the initial (Train 1) and expansion (Train 1 and 2) cases. It may be noted that the conversion efficiencies for the primary fuel sources are different for each supply (being 100% for gas and 38% for electricity). Delivered energy for diesel is based on the total calorific value.

Table 2.7.1: Predicted Annual Energy Consumption by Source

Energy Source		Energy Consumption			
		Delivered MWh	% of Total	Primary ⁽¹⁾ MWh	% of Total
Electricity (from national grid)	Initial	192,800	9.5	501,400	21
	Expansion	359,700	9	935,300	20
Natural Gas	Initial	1,811,300	88.5	1,811,300	77
	Expansion	3,622,600	89	3,622,600	78
Diesel ⁽²⁾	Initial	45,500	2	45,500	2
	Expansion	91,000	2	91,000	2
Other	Initial	0	0	0	0
	Expansion	0	0	0	0

Notes: (1) The primary energy figure is used to provide a common basis for all fuels based upon the thermal input and takes account of the energy conversion efficiency. For example electricity from the public supply is multiplied by a factor of 2.6 to account for energy loss in generation.
 (2) In power outage diesel can be used to power the emergency generator and firewater pumps. The expected usage rate would be 1.2m³/hr. Figure is for the ship unloading pumps only.

Table 2.7.2 provides an estimate of the carbon dioxide (CO₂) emissions associated with energy usage within the facility, by source. The CO₂ emissions have been calculated using emission factors taken from the Environment Agency Horizontal Guidance Note H2¹.

Table 2.7.2: Estimated CO₂ Emissions Associated with Energy Consumption

Source	Primary Consumption MWh		CO ₂ tonnes per year (as CO ₂)	
	Initial	Expansion	Initial	Expansion
Electricity	501,400	935,300	83,225	155,259
Gas	1,811,300	3,622,600	344,145	688,292
Diesel	45,500	91,000	11,375	22,750

Table 2.7.3 provides a breakdown of predicted energy consumption by activity within the installation. For completeness, the energy balance includes the energy utilised for unloading LNG from the ships, although this power is generated onboard the ship and therefore not technically within the installation boundary.

Table 2.7.3: Predicted Annual Energy Consumption by Activity

Equipment		Electricity MWh	Nat. Gas MWh	Diesel MWh	Total MWh
SCVs (water heating, overflow pump and air blower)	Initial	27,300	1,811,300		1,838,600
	Expansion	54,700	3,622,600		3,677,300
BOG Compressor	Initial	22,300			22,300
	Expansion	24,100			24,100

¹ Horizontal Guidance Note IPPC H2, Integrated Pollution Prevention and Control (IPPC) Energy Efficiency, version 3 February 2002.

Equipment		Electricity MWh	Nat. Gas MWh	Diesel MWh	Total MWh
Instrument/Plant	Initial	2,000			2,000
Air Compressor	Expansion	2,000			2,000
Nitrogen Plant (Gas Generator, injection compressor)	Initial	44,700			44,700
	Expansion	89,400			89,400
LNG Sendout Pumps	Initial	7,100			7,100
	Expansion	14,200			14,200
HP Booster Pumps	Initial	85,800			85,800
	Expansion	171,700			171,700
Ship pumps	Initial			45,500	45,500
	Expansion			91,000	91,000
Other pumps	Initial	130			130
	Expansion	130			130
Building Services (lighting, HVAC)	Initial	3,500			3,500
	Expansion	3,500			3,500

2.7.2 Basic energy requirements (2)

The installation will incorporate basic, low cost techniques for ensuring energy efficiency. The techniques included within the installation are described below.

Operating, maintenance and housekeeping measures

Procedures will be in-place to ensure that plant equipment is operated and maintained to ensure efficient use of energy. Techniques for ensuring efficient use of energy will include:

- Monitoring and Maintenance of LNG transfer systems to minimise the generation of BOG and subsequent requirement to recondense;
- Regular maintenance and monitoring of the compressed air system to prevent leaks and ensure early detection should a leak occur;
- Switching off of equipment, e.g. pumps, lighting when not required;
- Regular maintenance and service of motors and drives; and
- Regular cleaning of heat transfer equipment, e.g. within the SCVs to minimise fouling and ensure good heat transfer.

The main sources of energy consumption are the SCVs and the maintenance programme will be designed to ensure that these are maintained to achieve high efficiency (95-100%). Natural gas consumption rates will be monitored to detect any variation in individual SCV performance, which will be rectified as a priority.

Pump and compressor efficiency will be a key consideration in both the selection and maintenance of individual units.

Physical techniques

Basic, low cost, physical techniques will be in place to avoid gross inefficiencies. At the South Hook site the processing activities do not have any requirement for steam and therefore do not require measures to prevent steam heat losses. However, the LNG

facility includes operation and storage at cryogenic temperatures and therefore physical techniques aimed at preventing ingress of heat are a fundamental consideration. Key to the operation is maintaining the stored LNG and associated equipment and piping at low temperatures to minimise boil-off gas (BOG) generation and subsequent need for recondensing (with associated energy consumption). To ensure low heat leakage into the system a high degree of insulation is applied to all LNG containing plant. Downstream of the high pressure sendout pumps, heat ingress is not a critical issue in terms of energy consumption, and is marginally beneficial.

Maintenance and inspection routines will include all plant insulation and will ensure that any defects are quickly identified and repaired as necessary.

Building services

Energy efficient lighting will be fitted as standard. A high proportion of the plant will be located outside of buildings, where natural light is the primary source of lighting. Space heating will not be required for most process areas, and will be limited to control rooms and other areas not specifically falling within the installation, where manned activities are undertaken. Temperature control systems will be installed within these areas integral with HVAC systems as appropriate.

Energy Efficiency Plan

Energy efficiency will be considered as part of the terminal design. The measures to be included have been outlined above, with further design considerations discussed in section 2.7.3. The estimated energy consumption has been presented and the associated emissions of CO₂ calculated. During operation, energy consumption will be monitored and reported to management.

Energy audits will be undertaken on an annual basis to review performance, initially against the energy estimates, provided here and subsequently on a year on year basis. Energy efficiency techniques will be reviewed as part of the audit process to identify any areas for improvements and to review the practicability of any new, more efficient alternatives.

It is recognised that the major opportunity for energy efficiency is at the design stage of the project. For this reason the Front End Engineering Design (FEED) contractor will be tasked with optimising energy efficiency during the FEED design stage. A draft energy efficiency plan will be prepared in conjunction with the FEED contractor. The information provided within this section of the application will form the basis of the Energy Efficiency Plan and will be updated regularly through the energy efficiency audit programme. The Energy Efficiency Plan will:

- identify applicable energy efficiency techniques;
- estimate CO₂ emissions associated with energy efficiency techniques; and
- identify and prioritise areas for improvement.

2.7.3 Further energy efficiency requirements

Energy efficiency techniques

The following energy efficiency techniques will be used at the site:

- high efficiency LNG vaporisers;
- energy efficient technology will generally be used (such as variable speed drives);
- effective insulation will be used to retain heat, and thus minimise the boil-off gas requiring recompression; and
- heat exchangers will be regularly maintained to ensure high heat transfer.

The general sector guidance note identifies a number of further energy efficiency techniques that should be implemented, if applicable and where they are considered BAT for an installation. Each of the proposed techniques is discussed in turn below:

- Heat recovery from different parts of the process.

There is little opportunity for further improvements in this area since waste heat is not an issue at the installation. The design of the SCVs makes use of heat within the combustion gases to heat a water bath and vaporise the LNG (see 2.3.1.4). This system is 95-100% energy efficient.

- High-efficiency dewatering techniques to minimise drying energy.

There are no drying activities undertaken within the installation for which dewatering is appropriate.

- Minimisation of water use and closed water systems.

Water use within the facility is low. The SCVs require only an initial water fill, as they are net generators of water (product of the combustion process). A commitment has been made within section 2.2.3 to undertake regular water audits and to review the potential for improvements in water use efficiency.

- Plant layout to reduce pumping distances.

Where feasible the plant layout has been designed to minimise pumping distances. The main plant area occupies a compact portion of the site and consequently pumping between the various main stages will be minimised, within optimal safety requirements.

The main plant lies some distance from the jetty, taking advantage of a low point of the site combined with excavation to minimise the visual impact of the main plant by lowering its elevation, in particular the storage tanks.

- Process Control and Instrumentation.

The plant will be automatically controlled via the Distributed Control System (DCS); this system is discussed in further detail within section 2.10. All systems will be tested and optimised as part of the commissioning programme. In particular, combustion within the SCV units will be controlled by a burner management system. This system will be used to maintain efficient combustion conditions within these units.

- Continuous processing instead of batch processes.

With the exception of unloading operations, the plant will operate continuously, thus reducing the need for intermittent cooling operations that would give rise to additional volumes of boil-off gas. The unloading lines themselves will be continuously circulated with LNG in order to maintain them at cryogenic temperature, again to avoid any need for intermittent cooling operations.

Energy supply techniques

Guidance suggests that consideration be given to use of the following energy supply techniques:

- Use of Combined Heat and Power Plant (CHP)

During the design process, consideration was given to the installation of a CHP plant and to use the waste heat from this plant to provide the heat for vaporisation of the LNG within the SCVs. The feasibility of the CHP-SCV combination is discussed in detail within section 4.1.3.2, however, in summary this option was rejected on the basis of the overall reduced thermal efficiency and lack of identified market. Changes in these conditions may merit reconsideration of this option at a future date.

- Recovery of energy from waste

The activities undertaken onsite do not give rise to sufficient quantities of waste to make energy recovery from waste a feasible option.

- Use of less polluting fuels.

Under normal operation, natural gas will be used for combustion activities within the installation. Natural gas is accepted as a cleaner alternative to burning other fuels and therefore represents BAT.

2.8 Accidents and their Consequences

It is recognised that during the operation of industrial processes there is the potential for accidents with potentially significant environmental consequences to occur. Through considering potential accidents, measures for preventing, or, mitigating the impact of an accident can be assessed and where necessary improved. This section seeks to identify foreseeable environmental accident scenarios and assess the potential risk through consideration of the potential likelihood and consequences of each scenario. The assessment also takes account of any measures to prevent or mitigate the impact of an accident on the environment.

2.8.1 Accident management planning

Introduction

The purpose of the South Hook facility is to store large volumes of LNG that will subsequently be vaporised and supplied into the National Transmission System (NTS). Flammable liquefied gases including natural gas (whether liquefied or not) are named dangerous substances under the Control of Major Accident Hazards (COMAH) Regulations 1999. The quantity of LNG to be stored within the Milford Haven site exceeds the upper threshold level specified within Schedule 1 to these regulations and consequently the site is classified as a top tier COMAH site.

The main aim of the COMAH regulations is to prevent and mitigate the effects of major accidents involving dangerous substances such as LNG, which can cause damage/harm to people and the environment. The COMAH regulations treat major risks to the environment as being as serious as those to people and therefore are relevant to this application.

As a top-tier site the Operator will be required to submit a safety report that meets the requirements of the regulations. The safety report must include:

- a policy on how to prevent and mitigate major accidents;
- a management system for implementing that policy;
- an effective method for identifying any major accidents that might occur;
- measures such as safe plant and safe operating procedures to prevent and mitigate major accidents;
- information on the safety precautions built into the plant and equipment when it was designed and constructed;
- details of measures (such as fire-fighting, relief systems and filters) to limit the consequences of any major accident that might occur; and
- information about the emergency plan for the site that is also used by the local authority in drawing up an off-site emergency plan.

Information provided in COMAH Safety case reports is publicly available, subject to national security and commercial confidentiality. Safety case reports are living documents and must be updated every 5 years or more frequently following any significant change or new knowledge about safety measures.

At this point in the design of the LNG terminal the COMAH safety report is under development and therefore is not available in its final format. However PPC requires that the documented system which will be used to identify, assess and minimise the

environmental risks and hazards of accidents and their consequences, be described within the application.

As part of the project management system being implemented for the terminal, a series of preliminary hazard identification exercises have been conducted. These studies examined the potential hazards to personnel as well as the environment. As the project continues through the front end engineering design and further into detailed design and construction, more detailed HAZID and HAZOP studies will be conducted. These studies will identify both safety and environmental hazards associated with the plan and set action programmes to minimise any risks identified.

For the purpose of this application an initial assessment of potential accidents and consequences for the proposed installation is presented. It is recognised that this assessment will need to be revisited as the design progresses and also following finalisation and acceptance of the COMAH safety report and HAZOP/HAZID studies.

It should also be recognised that the facility will be designed to company and industry design standards and practices, which inherently recommend infrastructure and equipment that will minimise the impacts to the environment. It is intended that the best available technology as recommended by these standards will be employed to minimise any environmental impact.

Methodology

The purpose of this initial accident assessment is to:

- identify the hazards;
- assess the risks; and
- implement measures to reduce the risks, including contingency plans for any accidents which do occur.

a. Identification of the Hazards

As part of early engineering, preliminary hazard identification studies have identified potential threats to the environment. These exercises are conducted with a team that is knowledgeable of both the proposed facility design as well the surrounding environment. The team systematically brainstorms all foreseeable hazards with a credible cause and investigates the likely consequences (whether environmental or health & safety). For each hazard with a significant consequence, the team investigates relevant safeguards to prevent the hazard or mitigate the consequences.

Table 2.8.5 identifies the hazard scenarios, which could have potential environmental consequences. This is a preliminary list of hazards based upon the current understanding of facility design. It is intended that a more comprehensive set of hazards will be developed once the facility design is further developed.

b. Assessment of Risks

Once the hazards have been identified, the risks can be qualitatively assessed by the team, to better prioritise additional efforts for risk reduction. The method selected is the risk ranking method utilizing a risk matrix. Presented with the hazards and consequences, the team estimates the severity of the consequences and likelihood of occurrence. The severity is judged on one of four levels as presented in Table 2.8.2. The likelihood is judged on one of 5 levels as shown in Table 2.8.1.

The system used to assess the environmental risks from accidents is detailed below. The initial stage involves a screening assessment to provide a focus for any further, more detailed studies. In this assessment, worst case assumptions are adopted and those scenarios shown to present no significant risks are then discarded from further consideration. In the screening assessment the potential accidents from the plants functional units are identified. In order to obtain a level of risk, severity and likelihood levels for each accident scenario are assigned, taking into account the control measures that will be in place.

The frequency or probability of each accident scenario is estimated in broad terms for the purpose of the screening assessment. For the assessment of accidents and consequences the frequency categories applied are set out in Table 2.8.1.

Table 2.8.1 Probability Categories

Probability (P) Level	Description
A – Possibility of repeated incidents	At least once per year
B – Possibility of isolated incidents	Incident occurs between once every year and once every 10 years
C – Possibility of occurring sometime	Incident occurs between once every 10 and once every 100 years
D – Not likely to occur	Incident occurs between once every 100 years and once in 1000 years
E – Practically impossible	Less than once in 1000 years

In order to obtain a level of severity, the behaviour of the release in the environment needs to be determined together with its effect on the receiving targets. The factors considered in the environmental consequence assessment and the severity categories applied are set out in Table 2.8.2.

Table 2.8.2 Consequence Severity Categories

Consequence (C) Level	Description
I	Fatal or permanently disabling effect on humans; extensive and persistent damage to significant area of land preventing the growing of crops or grazing of animals for instance, or total loss of endangered species; major fish kill or long term impact; irreparable damage to a highly valued structure.
II	Temporary disabling effects on humans; significant change in beneficial or protected species; widespread, but not persistent damage to land; significant fish kill, but with no long-term impact and damage to limited number of structures.
III	Irritating effects on humans; some short term change in species population and temporary damage to land; limited fish kill, though no impact on the availability of water resources; repairable damage to everyday buildings.
IV	No significant changes in species numbers and ecosystems; minimal damage to poor value land; no noticeable health effects; slight damage to everyday structures.

The next step in the screening assessment is to make value judgements on the significance of the risks. This is done by means of the risk significance matrix presented

in Table 2.8.3 and used to obtain a level of risk, taking into account the levels of severity and likelihood assigned to each accident scenario identified.

Table 2.8.3 Risk (R) Significance Matrix

Consequence (C)	Probability (P)				
	A	B	C	D	E
I	4	4	3	2	2
II	4	3	2	2	1
III	3	2	2	1	1
IV	2	2	1	1	1

The significance of the risks are interpreted as follows:

Table 2.8.4 Interpretation of Risks

Score	Risk (R)	Techniques to Reduce the Risk
1	Negligible	no further action required
2	Low	no further action normally required
3	Medium	implemented as a matter of routine
4	High	priority action required

Table 2.8.5: Assessment of Risks to the Environment

Hazard	Environmental Consequences	Safeguards	P	C	R	Comments
LNG Tank over-pressurisation leading to operation of LP flare	Release of natural gas combustion products to air (including CO ₂ , NO _x , CO).	- Tank pressure monitoring and early warning system including alarms. - High level alarms and shutdown system. - Flow sensors on tank outlet lines with low flow alarm. - Trained personnel in operating, accident and emergency procedures.	A	IV	2	Whilst process monitoring aims to keep the plant within normal operating conditions, in the event of an abnormal condition the LP flare will be used to ensure safe operation.
Loss of ignition on LP or HP flare	Release of unburnt natural gas (CH ₄ , C ₂ H ₆ , other hydrocarbons) to air i.e. greenhouse gases.	Triplicate pilots; alternative approaches will be evaluated during detailed engineering.	B	IV	2	Both flares are an essential element or the plant safety system.
Loss of ignition on LP/HP flare, coincident with a high pressure flare event	Release of unburnt natural gas (CH ₄ , C ₂ H ₆ , other hydrocarbons) to air i.e. greenhouse gases.	Triplicate pilots; alternative approaches will be evaluated during detailed engineering.	C	IV	1	Considered unlikely that a flare event will coincide with loss of ignition on the flare pilot
Release of LNG from storage tank pressure relief valves	Release of natural gas (CH ₄ , C ₂ H ₆ , other hydrocarbons) to air i.e. greenhouse gases.	- Tank pressure monitoring and early warning system including alarms. - High level alarms and shutdown system. - Flow sensors on tank outlets with low flow alarm. - Trained personnel in operating, accident and emergency procedures.	B	III	2	Gas expected to rise and be dispersed.
Ignition of gas released from pressure relief valves	Release of natural gas combustion products to air (CO ₂ , NO _x , CO).	- As above. - Fire fighting equipment. - Selection of intrinsically safe equipment to remove potential ignition sources.	C	III	2	
Leak from LNG storage tank	Potential release of natural gas (CH ₄ , C ₂ H ₆ , other hydrocarbons) to air i.e. greenhouse gases. Low quantities	- Full containment tanks. - Interstitial tank monitoring and alarms. - Trained personnel in operating, accident and emergency procedures.	D	III	1	

Key

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P = Probability Rating; C = Consequence Rating; R = Overall Risk Rating

Hazard	Environmental Consequences	Safeguards	P	C	R	Comments
Leak from LNG tanker unloading line	Release of LNG to Milford Haven, land and/or hard standing. The LNG will vaporise and be emitted to air, releasing greenhouse gases into the environment. Cooling of the receiving media will occur. Low quantities.	- Leak detection/hydrocarbon detection. - Isolation valves to limit spill size. - Emergency Shutdown System, if required. - Containment area on jetty. - Trained personnel in operating, accident and emergency procedures.	C	III	2	Effect on site personnel could be high, this will be addressed though COMAH/HAZID/HAZOP studies
Minor LNG leaks	Release of LNG to Haven, land and/or hard standing. The LNG will vaporise and be emitted to air, releasing greenhouse gases into the environment. Some local cooling of the receiving media will occur. Very low quantities.	- Leak detection/hydrocarbon detection. - Isolation valves. - Trained personnel in operating, accident and emergency procedures. - Routine inspection, maintenance and repair schedules.	A	IV	2	
Water leak from SCVs	Potential release of low pH water to ground/groundwater.	- Isolation valves to prevent water recirculation to any leaking water bath. - pH measurement and adjustment on each unit. - Trained personnel in operating, accident and emergency procedures. - Routine inspection, maintenance and repair schedules.	C	III	2	

Key

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P = Probability Rating; C = Consequence Rating; R = Overall Risk Rating

Hazard	Environmental Consequences	Safeguards	P	C	R	Comments
Leak from sodium hydroxide storage tank and deliveries	Potential release of high pH liquid to land.	- Sodium hydroxide storage containers will be stored within a bunded area. - Routine inspections of containers on delivery and during operation. - Trained personnel in operating, accident and emergency procedures. - Monitor of SCV water level/flowrate with alarm to warn of low flow or level.	B	III	2	Low likelihood of leakage from tank.
Failure of pH dosing system	Potential high/low pH waters released into the Milford Haven. Potential impact on sensitive aquatic species.	- pH monitors on each SCV unit with high/low pH alarm. - Holding area for off-spec wastewaters with manual dosing and pH test prior to discharge - Routine calibration of pH meter and laboratory spot checks on releases from the neutralisation stage. - Trained personnel in operating, accident and emergency procedures.	C	II	2	
Leak from liquid nitrogen storage tank	Potential release of liquid nitrogen to land and/or hard standing. The liquid nitrogen will vaporise and be emitted to air but is otherwise benign. Some cooling of the receiving media will occur.	- Routine plan inspections, any leaks will be readily visible. - Tank level monitoring. - Trained personnel in operating, accident and emergency procedures.	C	IV	1	

Key

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P = Probability Rating; C = Consequence Rating; R = Overall Risk Rating

Hazard	Environmental Consequences	Safeguards	P	C	R	Comments
Leak of liquid fuel (diesel, low sulphur fuel oil or heavy fuel oil) from storage tanks	Potential contamination of ground and groundwaters.	- Tanks will be banded to 110% of vessel capacity. - Foundation designed to minimise seepage into the water table. - Tank bottom plate corrosion monitoring and inspection equipment installed on tank (including cathodic protection) - Routine plant inspections to enable early identification of leaks. - Spill kits to facilitate quick containment and clean up in the event of a spillage. - Trained personnel in operating, accident and emergency procedures.	D	I	2	
Leak of liquid fuel (diesel, low sulphur fuel oil or heavy fuel oil) from transfer pipework	Potential contamination of ground, groundwaters or Milford Haven. Low quantities	- Check valves and automatic isolation valves to limit spill size. - Containment area on jetty. - Trained personnel in operating, accident and emergency procedures. - Intermittent use.	D	I	2	
Emissions monitoring failure under normal operating conditions	Impact limited to that predicted under normal operation i.e. normal releases to air and water	- Back-up laboratory monitoring system. - Distributed control system to alert Operators of process upsets. - Automatic shutdown system if considered necessary	B	IV	1	

Key

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P = Probability Rating; C = Consequence Rating; R = Overall Risk Rating

Hazard	Environmental Consequences	Safeguards	P	C	R	Comments
Emissions monitoring failure in combination with plant upset.	Potential to exceed emission limits if a plant upset occurs during the failure, e.g. high emissions to air, off-specification releases to the Haven.	- Back-up laboratory monitoring system. - Distributed control system to alert Operators of process upsets. - Automatic shutdown system if considered necessary	C	II	2	
Instrument air failure under normal operating conditions	Impact limited to that predicted under normal operation i.e. normal releases to air and water	- Failsafe plant. - Automatic/emergency shutdown system.	B	IV	1	
Instrument air failure in combination with plant upset	Potential to exceed emission limits if a plant upset occurs during the failure, e.g. high emissions to air, off-spec releases to the Haven.	- Failsafe plant. - Automatic/emergency shutdown system.	C	II	2	
Release of fire water	Potential to release contaminated water into Milford Haven	- Oil separators for run-off from potentially oily areas - Design for 30-year rainwater included - Procedures for effluent water inspection and testing - Spill impounding basin which includes a fine wire mesh to prevent fire fighting foam being released with fire waters - Use of small quantities of fire fighting foam	C	III	2	

Key

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P = Probability Rating; C = Consequence Rating; R = Overall Risk Rating

Hazard	Environmental Consequences	Safeguards	P	C	R	Comments
Excessive noise e.g. from rotating equipment	Potential off-site noise nuisance.	- Selection of low noise generating equipment and location equipment and screening. - Off-site and occupational noise monitoring programmes. - Regular maintenance of potentially noisy plant/equipment.	B	III	2	
Vandalism	Vandalism has the potential to cause any of the above scenarios with corresponding environmental impact.	- Site security office and fencing. - CCTV cameras. - Regular site perimeter inspections. - Controlled entrance and exit to the site.	D	I	2	

Key

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P = Probability Rating; C = Consequence Rating; R = Overall Risk Rating

c. Techniques to Reduce the Risks

No accident scenarios were rated as presenting a high risk (4) or medium risk (3) and consequently there is no requirement for further action. During the life of the plant this assessment will be regularly reviewed and following any process changes a review will be undertaken as a standard part of the project assessment.

2.8.2 General provisions

Roles and responsibilities

The Site Manager (SM) will be informed immediately of any incidents or accidents with a potential to impact on the environment. The SM will be responsible for reporting any such events to the Environmental Manager (EM).

In the event of an accident or incident, which would breach the conditions of the permit, the EA will be notified in accordance with the requirements of the permit. Within normal working hours it will be the EM's responsibility to inform the EA. Outside of normal working hours or in their absence, the SM will be responsible for ensuring the incident is reported to the EA.

In all cases, where environmental damage may occur as a result of activities on the site, measures will be put into place as soon as possible to prevent the pollution. All incidents will be assessed on an individual basis between the EM and EA, where appropriate.

In the event of a significant pollution incident, the EA Pollution Officer will be contacted without delay using the EA emergency hotline. The EM will also be responsible for organising joint Pollution Prevention Inspections of the areas, as required, with the EA.

2.8.3 Key environmental controls

The key controls to prevent or reduce pollution incidents occurring are to ensure that:

- all chemicals and oils are stored in bunded containers. The bunds will be 110% capacity of the containers, or for an area of several containers they will be 25% capacity of all the containers or 110% of the largest container, depending on which is the greatest;
- bunds will be regularly inspected to ensure they remain free of process liquids and/or rain water and to ensure bunds remain in good repair;
- all raw material and waste will be appropriately marked;
- a pollution incident form is filled out when an incident occurs;
- the EM is contacted in the event of a pollution incident;
- all staff are trained in accident procedures;
- spillage response kits are located at appropriate locations on the site;
- in the event of significant pollution incident the appropriate bodies will be contacted as appropriate, including the Environment Agency, Health and Safety Executive, Local Authority and CCW, and relevant;
- barriers will be constructed at appropriate locations to prevent damage to susceptible equipment by the movement of vehicles;
- a register of all substances on the site will be maintained, in accordance with the

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Control of Substances Hazardous to Health (COSHH) Regulations. The main raw materials used within the installation are identified in Section 2.2.1 earlier;

- the likelihood of tank overflows will be minimised through the use of one or more of the following: level measurements; independent high-level alarms; high level cut off and/or batch metering;
- CCTV will be installed on site in order to monitor the operations and prevent unauthorised access;
- the process will be installed with triggers and alarms to give early warning in the event of significant abnormal operations or emissions.
- a register of pollution incidents will be kept;
- environmental policies, procedures and registers will be kept under review and amended as necessary; and
- all staff will be trained in clean up procedures, and spillage kits located at pertinent locations on the site.

Further detail on the proposed mitigation for spillages is provided in section 2.3.5.

2.9 Noise and Vibration

A noise assessment has been undertaken to predict the impact of noise emissions from the LNG facility. The assessment was also undertaken as part of the Environmental Impact Assessment (EIA) for the installation although specific additional information is provided here, as part of the permit application. The assessment has been modelled on the plant layout and facilities identified in Figure 1. Individual source noise level data are based on typical vendor data currently available, supplemented by internal data, where relevant. This information will be used to define the acceptable performance for the purpose of the FEED process and will be confirmed in vendors' contracts and verified during plant acceptance tests.

The assessment takes account of the locally prevailing noise climate, topography and distance to noise sensitive receptors. No significant effects were predicted and hence no "offence to human senses" is anticipated as a consequence of the operation of the facility, using the basis as described.

2.9.1 Main sources of noise

PPC requires that Operators identify the source and its location on a scaled plan, whether the source is continuous / intermittent; the hours of operation; a description of the noise (e.g. clatter, whine, hiss, screech, hum, bang, click, thump or tonal elements) and an indication of its contribution to site overall noise emissions.

The main sources of noise present in the facility are given in Table 2.9.1. The Table also indicates whether the noise is continuous or intermittent, its character, likely usage, and significance of each source (when operating) to overall noise emission from the site. Figure 2.9.1 shows the modelled location of each source.

A noise survey covering all relevant sources is planned as part of the acceptance tests, once the plant is operating in a stable manner at its rated throughput for each train.

In addition to the plant listed below, infrequent noisy activities such as maintenance may occur. In general, these will not significantly add to the noise generated by the site during normal operation.

2.9.2 Main sources of vibration

No significant sources of vibration are likely to be present within the operational site. Furthermore, the nearest sensitive locations are located approximately 500m from the installation boundary, and, at this distance, vibration from the plant or operations on site will not be perceptible.

Table 2.9.1 Significant Sources of Noise

Plant	Mobile/ fixed	Continuous/ Intermittent	Potential operation	Character	Site significance
LNG Submerged Combustion Vaporizers	Fixed	Continuous	24 hr	Roar (low freq broadband)	Medium
Boil-off Gas Compressor	Fixed	Continuous	24 hr	Motor noise (tonal whine)	Low
Ship Unloading Compressor	Fixed	Continuous during unload	24 hr	Motor noise (tonal whine)	Low
Emergency Generator-Diesel Driven	Fixed	Intermittent	24 hr	Diesel Engine (clatter)	Medium
LNG Send-out Pumps	Fixed	Continuous	24 hr	Motor noise (tonal whine)	Low
High Pressure (HP) LNG Booster Pumps	Fixed	Continuous	24 hr	Motor noise (tonal whine)	Medium
Firewater Pumps	Fixed	Intermittent	24 hr	Motor noise (tonal whine)	Medium
Firewater Jockey Pump	Fixed	Continuous	24 hr	Motor noise (tonal whine)	Low
SCV Pumps / blowers	Fixed	Continuous	24 hr	Motor noise, air noise	High
Process Area Sump Pumps	Fixed	Continuous	24 hr	Motor noise (tonal whine)	Low
Bunker Fuel Loading Pump	Fixed	Intermittent during unload	24 hr	Motor noise (tonal whine)	Low
LNG Unloading Arms Hydraulic Pump	Fixed	Continuous during unload	24 hr	Motor noise (tonal whine)	Low
Instrument Air Drier and Package	Fixed	Continuous	24 hr	Motor noise (tonal whine)	Low
Nitrogen Generator Package	Fixed	Continuous	24 hr	Motor noise (tonal whine)	Low
Flare (normal & emergency)	Fixed	Intermittent	24 hr	Roar	High
LNG shipping	Mobile	Intermittent	24 hr	Low freq engine noise	Medium
Vehicles	Mobile	Intermittent	24 hr	Petrol/ diesel engines	Low

2.9.3 Nearest noise sensitive sites

The local environment - sensitive receptors

The area directly surrounding the site is predominantly rural, with the nearest areas of conurbation being Herbrandston, Hakin and Milford Haven. There are a few isolated residential properties closer to the site, the nearest of which is Herbrandston Hall, Gelliswick and the properties on South Hook Road. Locations where members of the public reside are considered to be the most sensitive in terms of noise and vibration. The relevant locations are detailed in Table 2.9.2 and are identified in Figure 1 within Appendix B.

Table 2.9.2: Sensitive Receptor Locations

LOCATION	DISTANCE AND BEARING FROM INSTALLATION
South Hook Road	500 metres E
St Margarets Way	800 metres NNW
Gelliswick	500 metres E
Herbrandston Hall	525 metres NNW
Lodge Farm	1250 metres NE
Hakin School	1450 metres E
Milford Haven	2300 metres E
Herbrandston	800 metres NNW
Haven Drive	1000 metres E
Bay View Drive	1200 metres E
Upper Neeston	1150 metres N

The nearest residential properties are approximately 500 metres from the Installation Boundary. The nearest non-residential sensitive property is Hakin Infant School, Picton Road, at a distance of approximately 1450 metres.

Members of the public may be present in close proximity to the site when using public footpaths and other public accesses; most notably the coastal path, which crosses under the jetty. These exposures will be generally brief, sporadic occurrences. The area surrounding the site is predominantly rural, but contains other industrial development. Existing footpaths will already be affected by noise as they pass in close proximity to existing industrial premises. Given these circumstances and noting that exposure will be transient, appropriate control of the effects of noise on recreational users of footpaths can be achieved by the implementation of BAT for control of noise at source.

Concern is sometimes expressed with regard to the effects of noise on wildlife. Most research on the effects of noise on animals has been carried out for farm animals and has generally been unable to prove any long-term effects to any type of livestock or reproductive activity. The only common effect is that of the startle reflex, which may occur with noise at a high level and with a very short rise time. This type of noise will not occur during the normal operation of the proposed plant, although flaring may occur infrequently, and under emergency conditions. Little work has been carried out on the response of native wild animals, but it has been shown that, in general, animals adapt fairly rapidly to noise. The effects of noise on animals are not therefore considered to be

a determining factor for the implementation of BAT for control of noise at source.

Conditions limits imposed

A planning application was submitted for the development in April 2003, and whilst both Pembrokeshire County Council and Pembrokeshire National Park Authority have granted planning permission, at the time of writing the consent the decision document has not been issued. Should the decision document provide conditions relating to noise, then measures to meet these conditions will be incorporated into the plant design.

Specific noise level

Noise levels at properties in the vicinity of the site have been calculated using the methodology outlined in CONCAWE report no 4/81, "The Propagation of Noise from Petroleum and Petrochemical Complexes to Neighbouring Communities".

The CONCAWE methodology predicts the noise levels in the octave bands from 63 Hz to 4kHz (inclusive). This range usually provides sufficient accuracy for A-weighted noise levels from industrial plant as, although the octave bands outside this range can have significant energy, the A-weighting reduces their importance such that they do not contribute significantly to the overall A-weighted noise level. The noise levels for all sources which have spectral information provided outside the 63 Hz to 4 kHz range have been examined to ensure that this is the case.

The propagation of noise over significant distances is affected by meteorological conditions. The CONCAWE procedure allows the calculation of noise levels for various meteorological categories, which allow variations in wind speed, wind direction, temperature, humidity and atmospheric stability to be taken into account. These variations are addressed within six meteorological categories, which provide a noise impact range from lowest to highest.

Meteorological category six rarely occurs, being a combination of a stable temperature inversion and other extreme effects, and so category five has been considered as a moderately adverse case. Thus in order to provide the typical worst case, only category five has been considered. Where appropriate, a relative humidity of 50% and temperature of 10°C have been assumed in calculations.

The CONCAWE model has been implemented in the computer model "SoundPLAN".

Four operating conditions have been identified and modelled as part of this report. The exact configurations have been chosen to represent worst case. The conditions modelled are:

- Normal operation, exporting gas at 120%;
- LNG unloading, plus normal operation;
- Low Pressure (LP) flare plus normal operation; and
- HP flare, fire pumps, LP flare plus normal operation.

However, in practice, it should be noted that:

- Normal operation is 100%, using a total of 7 to 8 vaporisers, each at less than maximum load; Peak operation is at 125%, accomplished using 9 SCVs
- LP flare and normal operation is possible but for very limited duration; and

- HP flare + fire pumps + LP flare will not be coincident with 'normal operation', and will be an event which is more rare still - the '1 in 5 - 20 years' scenario, or less

Noise levels from all scenarios may, therefore, be lower than those predicted. A list of operational noise assumptions is given in Appendix B.

Figure 1 within Appendix B shows the location of all of the assessment positions, with the full results presented in Appendix B and Figures 32 – 37. A summary of the noise results for each class of receptor is given in Table 2.9.3 below.

Table 2.9.3: Calculated A-Weighted Noise Levels Due to Site Operation

Ref	Name	Floor	Operational Noise, dB L _{Aeq}				Usage
			Normal	+ LNG Unload	+ LP Flare	+ HP Flare	
1	Clay Lane Golf Course	1	33	34	37	48	Leisure
2	Coastal Path	1	16	16	24	36	Leisure
3	Coastal Path	1	23	23	41	53	Leisure
4	Coastal Path	1	29	29	38	49	Leisure
5	Coastal Path	1	28	28	46	57	Leisure
6	Coastal Path / Sandy Haven	1	14	14	21	31	Leisure
7	Conservation Area East of Site	1	45	45	48	56	Ecology
8	Eastern Corner Boundary	1	37	37	39	52	Ecology
9	Far Eastern Corner Boundary	1	23	23	31	43	Ecology
10	Gelliswick	1	22	22	37	48	Residential
		2	26	26	42	52	Residential
11	Gelliswick Bay Caravan Park	1	12	12	23	34	Residential
12	Herbrandston Hall	1	36	36	38	47	Residential
		2	36	36	39	48	Residential
13	LT Survey, South Hook Road	1	24	24	41	51	Residential
		2	28	28	41	51	Residential
14	LT Survey, St Margarets Way	1	34	34	37	46	Residential
		2	34	34	37	46	Residential
15	Lodge Farm	1	30	30	33	43	Residential
		2	30	30	33	43	Residential
16	N Boundary	1	44	44	46	54	Ecology
17	Recreational	1	24	24	39	50	Leisure
18	Res. Haven Drive	1	31	31	37	47	Residential
		2	31	31	37	47	Residential
19	Residential - South Hook Rd	1	19	19	41	51	Residential
20	Residential - Bay View Drive	1	28	28	36	46	Residential
21	SE Boundary Corner	1	19	19	30	39	Ecology

Ref	Name	Floor	Operational Noise, dB L _{Aeq}				Usage
			Normal	+ LNG Unload	+ LP Flare	+ HP Flare	
22	SW Boundary Corner	1	25	25	39	47	Ecology
23	Sensitive Habitat	1	48	48	50	57	Ecology
24	Sensitive Habitat	1	37	37	42	52	Ecology
25	Sensitive Habitat	1	40	40	53	58	Ecology
26	Sensitive Habitat	1	41	41	55	60	Ecology
27	Shoreline - Start of Jetty	1	31	31	51	58	Ecology
28	The Bucket Lodge	1	26	26	30	41	Residential
		2	26	26	31	41	Residential
29	Upper Neeston	1	31	31	34	43	Residential
		2	31	31	34	43	Residential

Residential Property

From examination of the ambient noise measurements given subsequently and the above table, it can be seen that for normal operation and unloading, the measured L_{A90} would not be exceeded. The representative background noise level would only be exceeded at Herbrandston Hall and St Margarets Way, where there would be a marginal impact. No other significant impacts are predicted due to noise from normal operation.

Flaring of gas is expected to be a highly infrequent event, occurring only during emergency or abnormal circumstances, although there will be a requirement to flare gas during initial commissioning of the terminal and cool-down of the tanks, over a period of four to six weeks. The potential for short-term impacts has been considered and it can be seen that noise from the low-pressure flare would marginally exceed the representative background noise level at some receptors, while noise from the high-pressure flare would substantially exceed the representative background noise level. However, this is not considered to be a significant impact due to the infrequent nature of the occurrences. It should also be noted that flaring through the HP flare would be an extremely rare event.

Leisure

Noise levels have been calculated for a number of representative locations on and around the site. Noise levels at these locations are generally lower than the World Health Organisation's (WHO) recommend 16hr daytime level for recreational activities of 55 dB L_{Aeq} for all operations. It is considered, therefore, that there would be no significant impacts on the use of the golf course or for walkers using the coastal path.

Ecology

Noise levels have been calculated for a number of representative locations on and around the site. Noise levels at these locations are generally lower than 55 dB L_{Aeq} for all operations, and it is considered that it is unlikely that there would be any significant long term impacts on the ecological resources in the area. A further discussion of this topic is provided in the Appropriate Assessment.

Vibration

No ambient vibration measurements were taken nor considered necessary, as there are no specific sources in the area likely to produce vibration at magnitudes likely to propagate over any significant distances.

2.9.4 Environmental noise measurement surveys

General

The existing noise climate in the vicinity of the site is influenced by a variety of sources including existing industrial premises, shipping movements, road traffic and wind / sea noise. The closest and potentially greatest affected residential properties to the site are those on South Hook Road, Gelliswick, which is affected by noise from the estuary and is screened from the site, and Herbrandston Hall, located approximately 500 metres from the installation boundary.

Other properties, including the villages of Herbrandston, Milford Haven and Hakin are further from the site. Although, in general, these locations might be expected to experience lower site noise than the properties detailed above, due to the topography of the surrounding area, this need not necessarily be the case. However, built up areas are subject to higher existing background noise levels than more rural locations. Consequently, measurements of existing noise levels were carried out at St Margarets Way, on the edge of Herbrandston, and South Hook Road. These locations combine the highest noise levels from the development with the lowest existing noise levels and therefore provides for a worst case assessment for properties in the vicinity.

Noise measurements

Two unattended noise level surveys were undertaken at two residential properties. The location of these surveys was such as to establish the background and ambient noise levels at the closest residential properties to the site.

For the purposes of the assessment, the nighttime is the most sensitive period of the day, evening and night. This is generally because people are trying to sleep or are asleep and background noise levels are at their lowest. Under a BS 4142 assessment for plant with a relatively fixed noise emission, this is likely to be the period with the highest Rating Level. On this basis, and due to the exposed position of the site and the nearest sensitive receptors, unattended noise measurements were undertaken over a two week period, as summarised in Tables 2.9.3 and 2.9.4 below.

The measurements were undertaken at 2 St. Margarets Way, Herbrandston, and at 'Greenisle', South Hook Road. Both properties have no direct line of sight to the site and are well screened. Figure 1 within Appendix B shows the measurement locations.

Measurements were undertaken for a period of approximately 2 weeks, between 24th October and 7th November 2002. Measurements of L_{Aeq} , L_{Amax} and L_{A90} noise levels were undertaken for every 5 minute period over the survey period.

Noise level measurements were made using RION NL-31 Sound Level Meters. The meters were calibrated before and after use with a RION NC-74 acoustic calibrator. There was no significant drift in calibration.

The weather throughout the survey period was variable, with high winds and precipitation during some of the sample periods and calm dry conditions at other times. As the measurements were undertaken over a two-week period, it is considered that there are

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sufficient data to provide a representative sample of the typical background and ambient noise environments.

Measurement results

Background and ambient noise levels

The average of the measured L_{A90} noise levels from a survey over a period of a few days is often taken to be representative of the background noise. However, in order to provide a conservative figure, the 25th percentile of the sampled background data has been used.

Table 2.9.3: Summary of Noise Survey Results, Receptor 1: 2 St Margarets Way, Herbrandston

	Day (07:00- 23:00 hours)		Night (23:00- 07:00 hours)	
	$L_{Aeq,5min}$ dB	$L_{A90,5min}$ dB	$L_{Aeq,5min}$ dB	$L_{A90,5min}$ dB
Maximum	77	63	70	64
Minimum	28	23	23	23
Average	52	40	50	38
25 th percentile	43	36	38	33

Table 2.9.4: Summary of Noise Survey Results, Receptor 2: Greenisle, South Hook Road, Milford Haven

	Day (07:00- 23:00 hours)		Night (23:00- 07:00 hours)	
	$L_{Aeq, 5min}$ dB	$L_{A90, 5min}$ dB	$L_{Aeq, 5min}$ dB	$L_{A90, 5min}$ dB
Maximum	71	66	72	69
Minimum	33	31	36	34
Average	52	47	51	46
25 th percentile	45	43	44	42

It is the background noise level at night that is of particular relevance, as the impact of noise from the site has the potential to be greatest at night, since it will operate 24 hours per day.

At Receptor 1 (Herbrandston), the arithmetic average of the measured $L_{A90,5min}$ nighttime noise levels was 38 dB for the nighttime period, and the 25th percentile was 33 dB. Thus a level of 33 dB has been taken as a conservative measure of the background noise level at Herbrandston.

At Receptor 2 (South Hook Road), the noise level was noticeably higher. This is thought to be due to noise from the water of Milford Haven. From extrapolation of the data, it can be seen that the arithmetic average of the measured $L_{A90,5min}$ nighttime noise levels was 46 dB and the 25th percentile was 42 dB(A). Thus a level of 42 dB has been taken as a conservative measure of the background noise level in the South Hook Road area.

Vibration

Baseline vibration levels have not been measured. Due to the distance between the closest residences and existing industrial sites, existing vibration levels are considered to be insignificant.

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2.9.5 Identification of any local issues and proposals for improvement

No specific local issues have been identified in addition to those described under the local environment section of this report.

2.9.6 Best Available Techniques**Introduction**

In determining BAT for a facility, Guidance (IPPC H3 Part 1) indicates that there are three main aspects that need to be considered:

Are the **Techniques** appropriate, i.e. are the measures taken and the design features adopted suitable for the control and minimisation of noise from the significant noise sources? The level of risk to the environment also needs to be considered.

Do the **Emission** levels meet the benchmarks, i.e. does the total noise level from the facility exceed any agreed noise limits?

Is the overall **Impact** acceptable, i.e. taking all sources into account, is the noise impact from the operation acceptable?

The above aspects are considered below.

Techniques

Table 2.9.5 lists the main noise sources and operations that are considered potentially significant and also defines the mitigation that has been applied.

Table 2.9.5: Details of Significant Noise Sources and Operations Including Incorporated Controls / Possible Mitigation Measures

Item	Possible Mitigation/Control Measures
LNG Submerged Combustion Vaporizers	Standalone units with self-contained noise mitigation. Site in isolated location. Access hatches to be closed during normal operation. Ensure plant is well maintained
Boil-off Gas Compressor	Specify quiet plant. Screen as appropriate
Process area sump pumps	Specify quiet plant. Screen as appropriate. Low noise drive and gear. Low noise recycle valve.
HP LNG Booster Pump	Specify quiet plant. Screen as appropriate. Low noise drive and gear.
LNG Send-out pumps	Submerged in LNG tank. Isolate tank pipework from vibrations. Low noise drive and gear.
Compressors / Nitrogen generation equipment	Situated in segregated area with sound attenuation and louvers as available. Cladding also applied to associated cold box equipment - attenuation provided by enclosure envelope.
Pressure relief valves / Flares	Emergency use only, situated at high level. Low noise valve.
Compressor house miscellaneous	The compressors may be enclosed in a housing.

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Item	Possible Mitigation/Control Measures
equipment	
Vehicle noise	Vehicles working in the external environment. Minor volume of activity, with movements and reversing to be kept to a minimum through site controls. Daytime work preferred.
Mechanical handling equipment.	Situated inside - building envelope will provide attenuation, no specific attenuation measures required
Fire pumps	Occasional occurrence only - attenuation provided by building envelope
Pipework	Acoustic lagging will be installed on external pipework & vibration isolation mountings used, as appropriate.
Emergency diesel generator	Infrequent use only. Plant well maintained

Plant or equipment whose deterioration may give rise to increased noise will be regularly maintained. The frequency of maintenance routines for these plant items will be reviewed periodically to ensure they remain appropriate.

Emission levels

The noise assessment provides calculated emission levels based upon noise sources provided for similar plant and with noise modelling based upon the CONCAWE methodology. The calculations were carried out for the situations with moderately adverse weather conditions (promoting greatest transmission of noise) and the highest level calculated was 36 dB(A) at Herbrandston Hall. It was assumed that the emission may contain tonal components and hence the 5 dB penalty was applied in accordance with the BS 4142 methodology. This gave a Rating Level of 35 dB(A).

The minimum measured background noise level during the surveys undertaken was 50 dB(A). When compared to the Rating Level of 35 dB(A), this is 15 dB below the background and is a positive indication that complaints would not be expected. On this basis, emission levels are acceptable.

Impact

PPC requires that 'noise from the installation does not give rise to reasonable cause for annoyance, in the view of the regulator and, in particular should justify where either Rating levels ($L_{Aeq,T}$) from the installation exceed the numerical value of the background sound level ($L_{A90,T}$), or the absolute levels of 50 dB $L_{Aeq,T}$ by day or 45 dB $L_{Aeq,T}$ by night are exceeded. (See Assessment and Control of Environmental Noise and Vibration from Industrial Activities for reasons why these levels may be exceeded).

The assessment has considered the potential for noise impacts associated with the developments on noise sensitive receptors, with reference to baseline conditions.

Baseline conditions have been obtained through noise surveys carried out at representative locations near to the facility.

The assessment demonstrates that there will be no significant noise or vibration impacts due to construction or operation of the facility. The noise impact of the operation is

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considered acceptable based upon the incorporated mitigation and the distance to noise sensitive receptors. These aspects will be confirmed during commissioning / plant acceptance testing and operation.

Noise from flaring operations will exceed the representative background noise level at a number of locations. However, due to the very infrequent nature of these activities, it is not considered that this will constitute a significant impact.

No significant noise impacts are predicted on leisure or ecological receptors in the area.

2.9.7 Monitoring

Monitoring will be undertaken to confirm the predicted noise levels. Details of the proposed monitoring scheme are provided in section 2.10.2.

2.10 Monitoring

The monitoring and reporting proposed for the installation is detailed within this section. The Environmental Manager will be responsible for ensuring that all monitoring and reporting is undertaken in accordance with the routines defined within this section.

2.10.1 Emissions monitoring

Monitoring and reporting of emissions to water and sewer

There are no process releases from the installation to sewer. The proposed monitoring of releases to water from the installation is detailed in Table 2.10.1 below:

Table 2.10.1: Monitoring of releases to water

Emission Point	Parameter	Frequency
W1	Flow	Continuous and integrated daily flow rate
	pH	Continuous
	Turbidity	Continuous
	TOC	Continuous
	BOD	Monthly and on start-up and shutdown

Emission performance for releases to water will be forwarded to the EA in accordance with the requirements of the permit. Internally, wastewater discharge performance will be reported to the Site Manager on a weekly basis. Should an abnormal release be identified this will be reported immediately to enable corrective action to be instigated. Records of emissions performance will be kept within the Environmental Department.

In addition to the monitoring above, continuous pH monitoring on each SCV unit will be installed. Should a pH problem occur, the holding area exit valve would be shut and the contents of the holding area neutralised. A manual pH check of the holding area waters will be undertaken to confirm it meets the specified pH range of pH 6-9.

Monitoring and reporting of emissions to air

The following Table sets out the monitoring programme for point source releases to air from the installation.

Table 2.10.2 Monitoring of releases to air

Emission Point	Parameter	Frequency
A1-A20	Nitrogen Oxides	Continuous (two SCV units only) ⁽¹⁾
	Flowrate	Continuous (two SCV units only) ⁽¹⁾
	Nitrogen Oxides	Quarterly (all SCV discharges)
	Flowrate	Quarterly (all SCV discharges)
A49 – A50	Natural gas flowrate	Continuous

Note: (1) One continuous monitor will be installed on each train.

Records will be kept of all release events from the flares (both HP and LP) and LNG storage tank relief valves. The information recorded will include the date and time of the event, and an estimated volume of the release calculated using a mass balance

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methodology and associated cause. Using the estimated released volume from these points, emissions will be derived and recorded. An air emissions inventory procedure will be in place to ensure a standard approach is used for estimating emissions from the flares and flare pilots.

Emission performance for releases to air will be forwarded to the EA in accordance with the requirements of the permit. Internally emission performance from the continuous monitors will be automatically logged within the site computer system. Historical data will be readily available and processing of the data will enable performance trends to be viewed. Records of periodic monitoring results will be stored within the Environmental Department.

Gas detectors will be installed in appropriate areas to monitor for natural gas releases that could indicate of a leak.

Monitoring and reporting of waste emissions

A waste inventory will be maintained showing a list of all wastes generated (other than emissions to air or water), their characteristics (hazardous characteristics, hazard precautions, materials incompatibility, etc) and intended management techniques. A waste storage inventory indicating current inventories in storage will be maintained.

The waste inventory shall be maintained by the Environmental Department using data from applicable waste transfer forms. To permit the inventory to be maintained up to date, copies of all completed waste transfer forms will be provided to the Environmental Department. The Environmental Department shall maintain a file of all completed forms.

Each waste stream will be characterised prior to disposal of the first load. Subsequent to this, the analysis will be reviewed prior to any proposed modifications to the waste stream that could alter its nature (e.g. segregation of certain waste fractions from the main waste) or prior to disposal via an alternative route.

Records of waste disposals from the installation will be kept in accordance with relevant legal requirements e.g. the Duty of Care Regulations. Waste arisings will be reported to the EA in accordance with the requirements of the permit.

2.10.2 Environmental monitoring (beyond the installation)

A programme of environmental monitoring will be undertaken to monitor potential impacts arising from activities within the installation. The aim of this monitoring will be to confirm the findings of the impact assessments undertaken in support of this application. There are basically two strands to the proposed monitoring, a programme of NO_x emission monitoring to confirm the findings of the Air Quality Assessment (see Appendix A) and a programme of noise monitoring to confirm predicted noise levels as detailed in the Noise and Vibration Assessment (see Appendix B).

Table 2.10.3 Environmental Monitoring (beyond the installation)

Location	Monitoring	Frequency	Units
As for baseline monitoring exercise (NO ₂)	Nitrogen oxides	Monthly ⁽¹⁾	µg/m ³
Boundary locations	Noise	Monthly ⁽³⁾	dB ⁽²⁾

Note: (1) Monthly for one year pre-commissioning and one year post commissioning of each phase

(2) Noise Monitoring units will be dB L_{Amax}, dB L_{Aeq}, dB L_{A10}, dB L_{A90}.

(3) Noise monitoring will be undertaken at agreed locations and assessed against criteria defining acceptable community noise levels.

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The basis of the off-site air monitoring programme will be to measure NO_x levels at the predicted locations of maxima, as determined from the air dispersion modelling and selected sensitive receptors. The exact number and location of the monitoring points will be agreed with the EA. Monitoring will be undertaken at these locations for 1 year prior to commissioning and for a year post commissioning of each phase.

Verification of the off-site noise levels predicted within the Noise assessment (Appendix B) will be based on an in-plant measurement program. Several levels will be projected to the community to demonstrate that the project objective has been met.

2.10.3 Monitoring of process variables

The LNG terminal will be controlled and monitored by a Process Control System and protected by a completely independent Emergency Shutdown System. The control systems elements will comprise:

- Distributed control system (DCS);
- Emergency Shutdown System (ESD);
- Fire and Gas system (F&G);
- Field instrumentation;
- Emergency alarm system;
- Closed circuit Television (CCTV).

The DCS will provide normal control and operation of the LNG terminal. The purpose of the ESD/F&G system installation will be to automatically prevent the occurrence of any physical situation that could potentially cause loss, damage or undesirable effects on plant, equipment, product, raw material, property, people and the environment. The ESD equipment will be independent of other plant instruments and instrumentation systems, such that any faults and failures in non ESD/F&G system instruments and systems will not cause a corresponding failure or fault in the integrity or operability of the ESD/F&G system. The ESD/F&G system will be designed to be Fail Safe and will have a Safety Integrity Level of 3. This Safety Integrity Level ensures that the probability of failure of that safety system on demand will be a once in 10⁻³ or 10⁻⁴ occurrence. Further detail on the emergency shutdown system is provided within section 2.3.1.8.

The plant will be equipped with a system of process monitors which feedback information on the plant status into the DCS. Table 2.10.4 details process variables that will be monitored within the facility.

Table 2.10.4 Monitoring of process variables

Process Variable	Frequency	Units	Method
Pressure	Continuous	barg	pressure alarms, pressure control valves (PCVs), relief valves, pressure gauges
Flow	Continuous	Nm ³ /h or m ³ /h	Flow meters
Level	Continuous	% or meter	Level alarms, level gauges
Temperature	Continuous	°C	Temperature alarms, detectors

Pressure Controls

Storage tank, sendout gas and BOG condenser pressures need to be controlled and monitored. This monitoring will be accomplished through pressure gauges, pressure alarms, relief and vent valves.

Due to the large size of the tanks, pressure changes tend to be slow and easily controllable, allowing considerable time for response by the operator.

Flow Controls

Flow meters will monitor the flow of fuel, water, BOG, LNG, and utilities throughout the unit. This monitoring will be designed to maintain the required flow of these materials throughout the plant. Flow readings will be linked to the Process Control System, which will shut down a particular area/system in the event of abnormal flows, to prevent overpressure or accidental release.

Level Controls

Independent "high" and "high high" level alarms and trips will be installed to prevent overfilling of the LNG storage tanks and other vessels.

Temperature Controls

The LNG is stored as a liquid at a temperature just below its boiling point. The operator will monitor the pressure to ensure it remains within operating limits. If the pressure remains steady then the temperature will also remain within the boiling point.

Temperature detectors will be installed on the outer wall of the tank and the tank base to detect any leakage from the inner tank. Other temperature gauges will be installed on the vaporisers and BOG system and will be linked to the emergency shutdown system. When the temperature of the system/unit is beyond the target range, the emergency shutdown system will be activated to close off flow to or from the system/unit to prevent any release or flaring.

2.10.4 Monitoring standards (Standard Reference Methods)

Equipment standards

When selecting monitoring equipment, preference will be given to the use of equipment, where available, which complies with the requirements of MCERTs. Where monitoring arrangements are not in accordance with MCERTs, other validated methods will be used, see list below.

Sampling and analysis standards

Sampling and analysis will be carried out using approved standards. Any monitoring carried out by a third party will be undertaken by a UKAS accredited body.

Standards considered appropriate for selection of equipment or sampling and analysis, where relevant are:

- Comité Européen de Normalisation (CEN);
- British Standards Institution (BSI);
- International Standardisation Organisation (ISO);
- United States Environmental Protection Agency (EPA);
- American Society for Testing and Materials (ASTM);

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- Deutsches Institut für Normung (DIN);
- Verein Deutscher Ingenieure (VDI); and
- Association Française de Normalisation (AFNOR).

2.11 De-Commissioning

The installation has been designed to ensure that it can be operated in such a way that the risk of pollution spillage and contamination is prevented and/or minimised. Process and ancillary items have been designed such that they can be systematically decommissioned to minimise the risk of pollution spillage and contamination during the final phase of activity. It is worth noting that the main raw material handled by the majority of plant is relatively benign in respect of its potential to cause any pollution of equipment and land.

The site report is summarised in Appendix F. This report sets out the current condition of the site. However it should be noted that as part of the site preparations remediation of some areas of the site is proposed. A revised site condition report will be provided post remediation, which will describe the pre-operational site condition.

2.11.1 Operations during the PPC Permit

The operation of the installation has been designed to ensure that there will be no deterioration of the site. Should any pollution incidents occur, or other instances arise which might impact on the state of the site, these will be recorded along with any subsequent investigation or ameliorating work carried out. This will ensure that there is a coherent record of the state of the site throughout the period of the PPC Permit. Any changes to this record will be submitted to the Regulator, as appropriate.

2.11.2 Steps taken at the design and build stage

Care has been taken at the design stage to minimise risks during decommissioning. The design and construction phases of the project will provide a Health and Safety File, in accordance with the Construction Design and Management Regulations (1994), which will record all information essential to the eventual de-commissioning of the plant. The design has ensured that:

- underground tanks and pipework will be avoided where possible (unless protected by secondary containment or a suitable monitoring programme); the only underground pipework is associated with drainage systems and services;
- provision has been included for the draining and clean-out of vessels, equipment and pipework prior to dismantling;
- consideration has been given to the operating regime for the skim pond, with a view to avoiding any deterioration of this facility;
- insulation systems can be dismantled with a minimum of dust or hazard; and
- the materials used in the construction process, notably metals and concrete, are recyclable, where this is practicable, although there will be a surplus of materials that can not be recycled. These have been minimised as far as possible.

2.11.3 The site closure plan

A site closure plan will be developed prior to commissioning of the plant, which will detail how, as designed, the installation could be decommissioned to avoid any pollution risk and return the site to a satisfactory state. This plan will be kept updated as material changes occur. It is recognised that the circumstances at closure will affect the final plans. When developed the closure plan will include:

- plans of all underground pipes, vessels and services;
- results from testing of the skim pond to ascertain the basis for any change in

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quality and the need and basis for any clean-up;

- the removal of potentially harmful materials associated with the project, unless agreed that it is reasonable to leave such liabilities in place;
- methods of dismantling buildings and other structures, to ensure the protection of surface and groundwater during any demolition activities; and
- testing of the soil to ascertain the degree of any pollution caused by the activities and the need for any remediation to return the site to a satisfactory state as defined by the initial site report.

There are no permanent radioactive sources associated with the proposal.

2.12 Installation Wide Issues

Esso Petroleum Company Limited will be the sole operator of the installation. Therefore this section is not applicable to this application.

3 EMISSION BENCHMARKS

3.1 Emissions Inventory and Benchmark Comparison

Emission inventories for releases from the terminal are presented in the following Tables:

- Table 2.3.3 – releases to air
- Table 2.3.4 – releases to water
- Table 2.5.1 – releases to land

3.2 The Emission Benchmarks

IPPC sector guidance notes set out the relevant benchmarks for emissions from a particular activity. Guidance for combustion plant is not yet available and therefore the PPC benchmarks relevant to this sector have not yet been defined. The benchmarks presented in Table 3.2.1 and Table 3.2.2, have been gathered from alternative sources; these are identified in the notes to the Tables.

3.2.1 Emissions to water associated with the use of BAT

A comparison of the expected emissions to water against achievable benchmarks is presented in Table 3.2.1 below.

Table 3.2.1: Benchmark comparison for emissions to water

Ref	Source	Substance	Release Concentration mg/l	Benchmark ⁽¹⁾ mg/l
W1	Combined SCV, compressor blowdown and surface water discharge	pH	pH 6 - 9	No benchmark
		Sodium Nitrate	1.58	No benchmark
		Sodium Carbonate	6.0	No benchmark

Notes: (1) Source IPC Guidance S2 1.09

There are no available benchmarks for the chemicals present within the discharges from the facility.

3.2.2 Emissions to air associated with the use of BAT

Table 3.2.2 provides a comparison of emissions to air from the installation against benchmarks.

Table 3.2.2: Benchmark Comparison of Emissions to Air

Point	Source	Substance	Release Height	Concentration mg/m ³	Benchmark mg/m ³	Frequency
A1-A10	SCV Exhaust Stacks (Initial)	NO _x	24m	85 ⁽³⁾	140 ⁽¹⁾	Continuous
		CO		100 ⁽⁴⁾	100 ⁽¹⁾	
		CO ₂		see section 2.7 ⁽²⁾	none	
A11-A20	SCV Exhaust Stacks (Expansion)	NO _x	24m	85 ⁽³⁾	140 ⁽¹⁾	Continuous
		CO		100 ⁽⁴⁾	100 ⁽¹⁾	
		CO ₂		see section 2.7 ⁽²⁾	none	
A21-A23	Nitrogen Plant Vent (Initial)	Air (crude oxygen)	5-7m	N/A	N/A	Continuous
A24-A26	Nitrogen Plant Vent (Expansion)	Air (crude oxygen)	5-7m	N/A	N/A	Continuous
A27	High Pressure Flare	NO _x	80m	not measured	none	Infrequent
		CO		not measured	none	
		CO ₂		not measured	none	
A28	Low Pressure Flare	NO _x	60m	not measured	none	Intermittent
		CO		not measured	none	
		CO ₂		not measured	none	
A29-A32	Tank 1 LNG Relief Valves	Hydrocarbons	45m	not measured (100% natural gas)	none	Infrequent
A33-A36	Tank 2 LNG Relief Valves	Hydrocarbons	45m	not measured (100% natural gas)	none	Infrequent

Point	Source	Substance	Release Height	Concentration mg/m ³	Benchmark mg/m ³	Frequency
A37-A40	Tank 3 LNG Relief Valves	Hydrocarbons	45m	not measured (100% natural gas)	none	Infrequent
A41-A44	Tank 4 LNG Relief Valves	Hydrocarbons	45m	not measured (100% natural gas)	none	Infrequent
A45-A48	Tank 5 LNG Relief Valves	Hydrocarbons	45m	not measured (100% natural gas)	none	Infrequent
A49	HP Flare Pilot (3 pilots)	NO _x	80m	not measured	none	Continuous
		CO		not measured	none	
		CO ₂		not measured	none	
A50	LP Flare Pilot (3 pilots)	NO _x	60m	not measured	none	Continuous
		CO		not measured	none	
		CO ₂		not measured	none	
A51-A56	Gas Conditioning Adsorption Units (Initial)	Moist air	3.6m minimum	N/A	N/A	Intermittent
A57-A62	Gas Conditioning Adsorption Units (Expansion)	Moist air	3.6m minimum	N/A	N/A	Intermittent
A63-A64	Instrument Air Dryers	Moist Air	3.6m minimum	N/A	N/A	Continuous
A65-A66	Instrument Air Dryers	Moist Air	3.6m minimum	N/A	N/A	Continuous
A67	Heavy Fuel Oil Storage Tank Vent	Hydrocarbons	20m	not measured	none	Tank breathing
A68	Diesel Storage tank Vent	Hydrocarbons	6m	not measured	none	Tank breathing

Point	Source	Substance	Release Height	Concentration mg/m ³	Benchmark mg/m ³	Frequency
A69	Low Sulphur Fuel Oil Storage Tank Vent	Hydrocarbons	25m	not measured	none	Tank breathing

Notes:

- (1) Source IPC Guidance Note S3 1.01
- (2) Annual emissions of CO₂ associated with gas used in the SCVs is estimated in section 2.7
- (3) Figures quoted at 3% O₂ for direct comparisons with benchmark figures
- (4) Manufacturers guaranteed emissions

Nitrogen Oxide (NO_x)

The predicted emission concentrations of NO_x from the SCV units under normal operation will be 85 mg/m³ (at 3% O₂). This is significantly lower than the benchmark figure of 140mg/m³. During abnormal operations, peak NO_x emissions are predicted to increase to approximately 107 mg/m³ (at 3% O₂) again well below the benchmark figure. Emissions at this level would be expected to be short in duration.

Carbon Monoxide (CO)

The guaranteed performance figures for emissions of carbon monoxide from the SCVs meet the benchmark figure of 100mg/m³. Under normal operation it is expected that actual emissions will be below the benchmark concentration.

Carbon Dioxide (CO₂)

No benchmarks are set for emissions of carbon dioxide, nor do regulatory requirements set emission concentration limits. The UK government, however, under the Kyoto Protocol has an obligation to reduce overall CO₂ emissions by agreed targets.

Carbon dioxide emissions are primarily associated with energy usage. The predicted CO₂ emissions associated with energy consumption within the installation are detailed in section 2.7. This section also outlines the energy efficiency techniques which will be employed to minimise energy consumption and hence the associated emissions of CO₂.

Hydrocarbons

Hydrocarbon release from the process will be natural gas or from the storage of fuel oils. Releases of natural gas will be associated with emergency conditions and will arise as a safety mechanism to prevent unsafe plant conditions. These emissions are minimised by flaring in preference to venting. Fugitive emissions of hydrocarbons may also occur; the plant design and control measures to minimise fugitive emissions are detailed in section 2.3.4.

The three fuel storage tanks will have vents to air which will give rise to emissions associated with tank breathing.

Other

Other point source emissions to atmosphere comprise moist air and crude oxygen. These emissions are not environmentally significant.

3.2.3 Emissions to land associated with the use of BAT

There are no relevant benchmarks for releases to land. An inventory of all releases of wastes, including those to landfill is provided in Table 2.5.1. All wastes disposed from the site will be removed to a site authorised to accept the type of waste being disposed. Records will be kept of all waste disposals in accordance with the requirements under the Duty of Care Regulations.

3.2.4 Introduction to standards and obligations

EC based EQ standards

Air quality

The UK Air Quality Strategy (UKAQS) document was first published in March 1997, thereby implementing the EC Framework Directive on Ambient Air Quality Management. The standards and objectives of found in the UKAQS are given legal status in Wales by the Air Quality (Wales) Regulations 2000, the Air Quality (Amended) (Wales) Regulations 2002 and the Air Quality Limit Values (Wales) Regulations 2002, which implement objectives for air quality, to be achieved between 2003 - 2010.

Water quality

Directive 76/464/EEC on Pollution Caused by Dangerous Substances Discharged to Water contains two lists of substances. **List I** relates to the most dangerous, and standards are set out in various daughter Directives. **List II** substances must also be controlled. Annual mean concentration limits for receiving waters for List I substances can be found in **SI 1989/2286** and **SI 1992/337 the Surface Water (Dangerous Substances Classification) Regulations**. Values for List II substances are contained in **SI 1997/2560** and **SI 1998/389**. Daughter Directives cover EQS values for mercury, cadmium, hexachlorocyclohexane, DDT, carbon tetrachloride, pentachlorophenol, aldrin, dieldrin, endrin, isodrin, hexachlorobenzene, hexachlorobutadiene, chloroform, 1,2-dichloroethane, trichloroethane, perchloroethane and trichlorobenzene.

Other waters with specific uses have water quality concentration limits for certain substances. These are covered by the following Regulations:

- SI 1991/1597 Bathing Waters (Classification) Regulations;
- SI 1992/1331 and Direction 1997 Surface Waters (Fishlife) (Classification) Regulations;
- SI 1997/1332 Surface Waters (Shellfish) (Classification) Regulations; and
- SI 1996/3001 The Surface Waters (Abstraction and Drinking Water) (Classification) Regulations.

Future likely changes include:

Some air and water quality standards may be replaced by new standards in the near future.

Other standards and obligations

Those that may be applicable to this sector are:

- Reducing Emissions of VOCs and Levels of Ground Level Ozone: a UK Strategy;
- The UNECE convention on long-range transboundary air pollution;
- The Montreal Protocol; and
- The Habitats Directive.

Revised Large Combustion Plant Directive, 2001/80/EC

The Large Combustion Plant Directive (LCPD) is intended to reduce acidification, ground level ozone and particulates throughout Europe by controlling the emissions of sulphur dioxide (SO₂), nitrogen oxides (NO_x) and dust (particulate matter (PM)) from large combustion plants.

Esso Petroleum Company Limited is of the opinion that the LCPD is not applicable to this installation, according to Article 2 (7) (a) of the Directive. However an assessment has

been undertaken to evaluate the impact on the facilities should the Agency consider that the LCPD does apply to this development.

The Directive applies to combustion plants with a thermal input in excess of 50MW. The SCV units will each be rated at 28.3 MW thermal input and therefore individually are below the 50MW threshold.

However, within the LCPD, where two or more separate new plants are installed in such a way that, taking technical and economic factors into account, their waste gases could, in the judgement of the competent authorities, be discharged through a common stack, the combination formed by such plants shall be regarded as a single unit.

It is not considered technically feasible, nor economically viable, to provide a scheme whereby the waste gases from two or more SCVs could be discharged through a single stack.

On this basis, the LCPD is not considered applicable to the proposed installation.

Those plants, to which the LCPD applies, are required to meet the emission limit values specified within the Directive. For new large combustion plant using gaseous fuels, Annex VI limits NO_x emissions to 150mg/m³. Section 2.3.2 earlier has indicated that the expected emissions from the proposed installation will be well below this value.

3.2.5 Units for benchmarks and setting limits

Releases can be expressed in terms of:

- "concentration" (e.g. mg/l or mg/m³) is a useful day-to-day measure of the effectiveness of any abatement plant;
- "specific mass release" (e.g. kg/t product or input or other appropriate parameter) is a measure of the overall environmental performance of the plant (including the abatement plant) compared with similar plants elsewhere; and
- "absolute mass release" (e.g. kg/hr, t/yr) relates directly to environmental impact.

3.2.6 Statistical basis for benchmarks and limits in Permits

Conditions in Permits can be set with percentile, mean or median values over yearly, monthly or daily periods, which reflect probable variation in performance. In addition absolute maxima can be set.

For Water: UK benchmarks or limits are most frequently 95 percentile concentrations or absolute concentrations, (with flow limited on a daily average or maximum basis).

For Air: benchmarks or limits are most frequently expressed as daily averages or, typically 95% of hourly averages.

3.2.7 Reference conditions for releases to air

The reference conditions of substances in releases to air from combustion point sources are:

temperature 273 K (0°C), pressure 101.3 kPa (1 atmosphere), 3% oxygen, dry.

These reference conditions relate to the benchmark release levels given in this application and care should always be taken to convert benchmark and proposed releases to the same reference conditions for comparison.

4 IMPACT

4.1 Assessment of the Impact of Emissions on the Environment

4.1.1 Introduction

The PPC Application has been run in parallel with the EIA prepared as part of the planning application. The EA, together with a number of other organisations e.g. CCW, is a statutory consultee for EIA developments. A number of detailed assessments have been undertaken to quantify and assess the potential effect of the proposed LNG facility on the environment. Specifically these are:

- Air Quality Assessment (Appendix A)
- Noise and Vibration Assessment (Appendix B)
- H1 Impact Assessment (Appendix C)
- Report in Support of an Appropriate Assessment under the Conservation (Natural Habitats etc.) Regulations (1994) (Appendix D)
- Site Report (Appendix F)

These assessments are fundamentally the same as those prepared for the EIA, whilst taking account of various PPC specific requirements e.g. peak emissions/start-up and shutdown and being primarily focussed on operational (as opposed to construction phase) activities. In addition, PPC requires that Operators prevent pollution at source and where this is not possible to implement controls to minimise and/or mitigate the impacts on the environment. Key to achieving this is the use of techniques, which represent BAT for a particular activity.

This section seeks to demonstrate that the LNG facility employs BAT and also to review the findings of the impact assessments to demonstrate that the plant will not cause significant effects on the environment.

The Environment Agency H1 methodology¹ has been used to provide an assessment of the combined impact (i.e. of emissions to all media) of the proposed South Hook facility.

4.1.2 Objectives of the BAT assessment

The Best Available Technique (BAT) Assessment has been undertaken in accordance with the methodology set out in the Environment Agency's Horizontal Guidance Note IPPC H1¹. The methodology provides a systematic approach for confirming the most appropriate design basis for the process, having regard to both the environmental benefits of the various design options and the cost to implement them.

In order to obtain a Permit to operate an installation covered by PPC it is necessary to demonstrate that BAT is being, or will be, used. Generally, implementing the indicative BAT as given in the Sector Guidance fulfils the requirements of PPC, and providing that the environmental impact from the installation is acceptable there should be no further appraisal of BAT required. Where there is a departure from the indicative BAT provided in the Sector Guidance or where there is more than one BAT option it is necessary to undertake an Options Appraisal of BAT¹.

¹ Environment Agency, *Integrated Pollution Prevention and Control (IPPC) Environmental Assessment and Appraisal of BAT Version 3.1*, July 2002.

Environment Agency IPPC Sector Guidance Notes specify the BAT relevant to that sector. Sector guidance for combustion processes has not yet been produced and therefore sector specific BAT is not defined. However, for the purpose of this application an options appraisal is undertaken for the main plant items and justification for the chosen technique provided.

4.1.3 The proposed development

Section 2.3 describes in detail the techniques selected to prevent and control the impacts of activities at the facility. As part of the design process a review of alternative techniques was undertaken to ensure that the selected techniques were BAT for the installation.

This section summarises the selection process and provides BAT justifications for the main plant items which are:

- LNG Storage Tanks; and
- LNG Vaporisers.

4.1.3.1 LNG Storage

There are three main tank designs available for the storage of LNG, namely single containment, double containment and full containment. As their names suggest, the primary difference in tank designs relates to the degree of containment offered should a leak occur. Table 4.1.1 below summarises the main similarities and differences between the three available options:

Table 4.1.1: Comparison of Typical LNG Tank Designs

Tank design feature	Tank Containment		
	Single	Double	Full
Inner shell	9% Ni or stainless steel	9% Ni or stainless steel	9% Ni or stainless steel
Inner shell designed to contain LNG	Yes	Yes	Yes
Outer shell	Carbon steel	9% Ni or stainless steel or prestressed concrete outer wall	9% Ni or stainless steel or prestressed concrete outer wall and reinforces concrete outer roof
Outer shell designed to contain LNG	No	No	Yes
Other containment	No	No	No
Further containment designed to contain LNG	Contains liquid but not vapour	N/A	N/A
Insulation	Typically perlite	Typically perlite	Typically perlite

For the South Hook Receiving Terminal, the tanks will be of the full containment type, which of the three types available offers the maximum integrity with minimum risk of release of LNG. This type of tank also offers the advantage of being able to be designed to withstand realistic impacts from projectiles. This design is considered BAT for the storage of LNG at the South Hook Terminal.

4.1.3.2 LNG Vaporisation

The following options were considered for vaporisation of the LNG:

- Open Rack Vaporisers (ORV)
- Submerged Combustion Vaporisers (SCV)
- Combined Heat and Power (CHP) – SCV Combination; and
- Geothermal Vaporisers.

LNG terminals commonly employ one of two types of vaporisers, namely the Open Rack Vaporiser (ORV) and the Submerged Combustion Vaporiser (SCV). In general ORVs will obtain the heat for vaporisation from seawater whereas SCVs will require combustion heat input for vaporisation. Typically this heat will be obtained by burning gas, however more recently some installations have installed CHP units, making use of the waste heat for at least part of the vaporisation heat duty in the SCVs. In some locations where subterranean conditions are suitable, vaporisation could be achieved or supported by using geothermal heat from the underlying rock, although this is not known to have been attempted anywhere for this type of application.

It should be noted that other LNG vaporisers are available but are typically used where a heat source is readily available; therefore they are only discussed briefly.

Open Rack Vaporiser (ORV)

The principal of ORVs is to utilise the heat content in seawater to vaporise the LNG. In this system the seawater would be extracted from the Haven, pass through the ORVs and would then be discharged back into the Haven at a lower temperature. An ORV unit typically consists of a panel of vertical, finned heat transfer tubes with LNG flowing upwards through the tubes. A film of seawater flows downwards outside the tubes. Modern designs use tube lengths as high as 6 meters. Even distribution of LNG and seawater among the panels is important to ensure good performance and minimise ice formation outside the tubes. The required peak abstraction rate of seawater following the expansion would be around 70,000 m³/hr, giving around a 1°C temperature drop at 100m from the outfall and a 5°C temperature drop at the point of discharge.

Seawater is corrosive and therefore the tubes of the ORV need to be coated with a protective material, such as an aluminium alloy containing small quantities of zinc. This coating may need re-spraying over the lifetime of the installation, since the expected service life for the alloy is around ten years.

Chlorination of the seawater is also desirable, primarily to protect pumps and pipework associated with the ORV.

Submerged Combustion Vaporisers (SCV)

A description of the SCV option was provided in 2.3.1.4.

Combined Heat and Power (CHP) – SCV Combination

The features of an SCV unit have already been detailed in section 2.3.1.4. In a stand alone SCV, vaporisation is achieved by burning natural gas and utilising the heat from the combustion gases to heat water, which in turn warms the LNG. Using the SCV in combination with a CHP unit enables waste heat from the CHP to be used to meet part of the heat duty requirement for vaporisation. The Distrigaz Zeebrugge Terminal is an example of a LNG facility utilising the CHP-SCV option and consists of a 40MW gas

turbine from which the 'waste heat' in the exhaust gas is recovered in a direct-contact heat recovery unit. The warm water (up to 50°C) generated in the heat exchanger is then used as the heating medium within the SCV, with the balance of the heat duty requirement supplemented by combustion of natural gas.

At the Zeebrugge plant the standard SCV design was modified to enable the unit to operate, firstly as its original design using the SCV natural gas burners to supply heat, secondly using a closed circuit of hot water from the CHP and thirdly using a combination of the two.

Geothermal

This option utilises geothermal heat energy in the underlying rock to vaporise the LNG. At Milford Haven the underlying rock has a temperature of 70°C at a depth of 1400 metres. Whilst it is acknowledged that the overall geothermal resources at Milford Haven and the surrounding area can meet the thermal demand, the challenge is abstracting the required heat reliably throughout the operating life of the plant. Initial investigations estimated that the geothermal heat stored in the depth range of 2-2.5km could provide only 24% to 47% of the required heating energy.

This option would therefore also require back up with SCVs to ensure that the sendout gas rate can be maintained, with obvious financial penalty. 100% SCV back up would be required to cope with unplanned shutdown of the geothermal facilities, or unexpected diminishing of hot water supply.

The use of geothermal heat energy to vaporise LNG, unlike the other options considered, has not yet been used in any similar commercial applications and is therefore not a proven available technology.

Other types of vaporisers

Shell and tube, plate fin, intermediate fluid shell and tube exchangers are all suitable for vaporisation of LNG. They are generally smaller in size, but cost competitive to ORV or SCV systems. In these units heat is applied to the LNG vaporiser in a closed circuit by a suitable heat transfer medium. They are mainly used where a heat source is available. Design of these types of vaporiser systems requires a stable LNG flow at design and turndown condition, and provisions to prevent potential freeze-up within the vaporiser. When the additional costs are taken into consideration where there is no heat source, for base load applications they are not generally competitive with ORV or SCV systems. These types of vaporisers are therefore not recommended for a standalone LNG receiving terminal for producing pipeline gas and will not be discussed further.

A comparison of the environmental impacts from each of the options is summarised in Table 4.1.2.

BAT for Vaporisation

Open Rack Vaporiser (ORV)

The ORV option would require large volumes of seawater to be abstracted from Milford Haven and a corresponding volume of cold seawater to be returned. Based on a continuous send-out gas rate of 7.78 million tonnes per year (initial phase), it is estimated that the seawater intake rate would be approximately 28,000 m³ per hour. At peak (initial phase) send out of 125%, the volume of seawater abstracted and discharged would be about 35,000m³ per hour, rising to 70,000m³ per hour following the expansion phase.

The same quantity of water would be returned to the Haven 5°C colder. It is estimated that the "cold water plume" would extend to a distance of 100 metres before mixing would render the temperature difference to 1°C, compared to the main body of water in the Haven. The potential impact of the cold-water discharge is particularly significant because the site lies within the Milford Haven cSAC and supports a number of species that have a low tolerance to environmental stress and temperature fluctuations.

ORVs were considered for use in this project because they have relatively low global environmental impact, although the energy required for pumping will partly offset this. However, this benefit must be considered against the local impact, namely the peak rate extraction of 70,000m³ of seawater per hour and the discharge of cooled water back to the marine environment. The extraction of up to 70,000m³ per hour of seawater could have a significant impact on the marine environment, with potential removal of around 9,000kg of plankton per annum, as well as fish and other marine organisms and potential disruption to tidal regimes. In addition, the land take for the open rack system would be larger than that required for the SCVs and would result in further terrestrial habitat loss.

Abstraction of the seawater would create a potential for large amounts of underwater fish and plant life to be ingested by the intake system. To minimise this impact would require complex facilities and require significant construction in the fore shore area.

Furthermore, as a minimum, four very large diameter lines, two for inflow, two for outflow, will be required. These lines would be in the order of 7ft (2.13metres) diameter and during their construction would be likely to cause significant impact to the sensitive marine ecology, in particular the red maerl beds. This is over and above the impact on marine ecology due to ongoing operations, which would cause large volumes of cold water to be discharged. Also to avoid restricting access for the pleasure craft channel under the pier, it may be necessary to bury these lines.

Because of the cold water temperature during the winter months, there is also some concern about the viability of the ORVs during the coldest days of the year. To overcome this, a back-up system, most probably SCVs, would need to be installed to permit continuous all year operation.

Due to the environmental concerns (as described above), the use of ORVs for the South Hook facility was rejected.

Submerged Combustion Vaporiser (SCV)

The SCV can be started quickly and can react to sudden load fluctuations. These features combine to make it suitable for use in both base load and peak sendout applications. The system is easily controllable over a wide range of operating throughput, and is therefore ideal for responding rapidly to fluctuations in demand.

To provide the heat requirement the SCVs burn natural gas. Although they require the combustion of fuel, the SCVs inherent design features ensure a thermal efficiency between around 95 - 100%. After passing through the water bath, the combustion gases from the SCVs are discharged to the atmosphere, at a temperature of approximately 40°C. Each SCV will have a small diameter (1.2 m) stack of 24m height (dimensions to be optimised during detailed engineering). The Air Quality Assessment included as Appendix A modelled the emissions from the SCVs and concluded that emissions from the SCVs during typical operation will not result in exceedance of relevant air quality guidelines and objectives at the nearest sensitive receptors. Optimisation of the stack height will take place as part of the detailed engineering design process. The annual

average process contribution (PC) of NO_2 from the SCVs at the nearest sensitive receptors is significantly less than the background concentration of $7.41 \mu\text{g.m}^{-3}$, giving a cumulative total, referred to as the predicted environmental contribution (PEC), less than a third of the criterion value of $40 \mu\text{g.m}^{-3}$ at these receptor locations. The impact of nitrogen deposition from the SCVs would represent an increase of only 2–14% over background levels at the nominated ecological receptor locations.

Combined Heat and Power (CHP)-SCV

Due to the inherent high thermal efficiency of the SCV system (95 - 100%), there is a decrease in overall thermal efficiency using the SCV-CHP compared to the straight SCV option. A simple cycle CHP plant typically has a fuel efficiency of 35%, rising to 54% in a combined cycle power plant. When applied to this application, where the heat from the CHP is utilised within the SCVs for vaporisation, much higher overall efficiencies are possible, typically exceeding 90%. However, because of the small scale of the power plant required, initial studies indicate that the SCV-CHP option would result in unfavourable power costs at the facility. Changes in these conditions may merit reconsideration of this option at a future date.

Geothermal

Initial investigations into the feasibility of the geothermal option identified that only 24% to 47% of the required heating energy could be provided using this heat source. The additional heat energy for vaporisation would then be supplied using SCVs. Whilst the available heat capacity from the geothermal source was considered adequate, there was concern over whether the hydraulic reservoir physical conditions would give rise to unsatisfactory heat supply from the geothermal resource, low groundwater flowrates being the main risk. A lesser risk arises from short circuits between injection and production wells causing a rapid cool down due to insufficient heat exchanging surfaces. As part of the selection processes further investigations were considered and cost projections for the exploratory work obtained. To undertake this work was estimated in excess of £1million for exploratory and appraisal wells. Given that the geothermal option could not meet the full demand and be predicted with certainty to meet any specific demand, it would therefore also require full backup capacity SCVs, this level of investment was not considered justified.

Conclusion

On the basis of these considerations it is proposed to install Submerged Combustion Vaporisers at the facility. For the reasons discussed above, this type of vaporiser is considered to represent BAT for the South Hook terminal.

Table 4.1.2: Comparison of the Environmental Impact of Vaporisation Options

IMPACT	SCV	ORV	CHP-SCV	GEOTHERMAL
Global impacts	Contribution to global warming from burning gas to fire burners.	Contribution to global warming lower – contribution results from fossil fuel combustion associated with pumping demand. Use of renewable resources.	Contribution to global warming from burning gas.	Contribution to global warming resulting from fossil fuel combustion associated with pumping demand is less than ORV. Use of renewable resources.
Local impacts – abstraction	N/A	Abstraction of 70,000m ³ /hr of seawater has a significant impact on the marine environment with potential removal of 9000kg (dry weight) plankton per annum plus fish, etc. and potential disruption to tidal regimes.	N/A	Could have long-term effect on hydrogeology locally with a circulation loop that may affect tidal flow and water quality in the Haven as well.
Local impacts – marine disturbance and habitat removal	N/A (effluent discharges assessed below)	Significant environmental impacts from laying of pipes through sensitive/protected marine habitats (red maerl and zostera). This impact is reduced if pipes are laid on a pipe trestle supported by piles.	N/A (effluent discharges assessed below)	N/A
Local impacts – terrestrial disturbance and habitat removal	Some land take that must be mitigated having regard to sensitive habitats.	Land take area for open rack system – larger area of terrestrial habitat loss on-site. Provided sensitive areas are avoided this impact can be mitigated through relocation. Potential localised cooling, increased fog and dew point conditions on-site may affect terrestrial flora and fauna.	Habitat loss on site from greater land take for construction of power station. However, provided sensitive areas are avoided this impact can be mitigated.	Minimal headwork and process buildings.

IMPACT	SCV	ORV	CHP-SCV	GEOTHERMAL
Local impacts – effluent discharge	Discharge of 44.8m ³ /hr condensed water may have an impact on the marine environment depending on the composition of the discharge; degree of impact would depend on location of outfall point and may also result in minor habitat loss from laying of discharge pipes.	An estimated 1°C temperature drop at 100m from the outfall point would have significant localised impacts (5°C at the point of discharge). Impacts on sensitive marine habitats such as red maerl and other species at their northern limits should be reduced/eliminated where possible by locating the outfall away from these areas.	Discharge of 44.8m ³ /hr condensed water may have an impact on the marine environment depending on the composition of the discharge; degree of impact would depend on location of outfall point and may also result in minor habitat loss from laying of discharge pipes. Additional discharge of boiler blowdown waters (which would probably be more of a problem than SCV water).	Discharge of processed groundwater at near ambient temperature –likely to be highly mineralised water, which potentially could locally alter the marine water quality.
Local impacts – air emissions	Local emissions of NO _x etc.	Localised impact on climate with increased propensity to fog, localised cooling etc.	Local emissions of NO _x etc. from SCV and CHP	May require treatment of radon off-gas from abstracted waters.
Raw material consumption	- Natural Gas for heating. - Water treatment chemicals for pH adjustment of surplus SCV water.	Water treatment chemicals for chlorination of seawater.	- Natural Gas for combustion in CHP and back up fuel for SCV. - Top-up water for CHP boilers. - Water treatment chemicals to minimise fouling of the boiler and heat recovery unit and for pH adjustment of SCV effluent.	Probable water treatment chemicals for reservoir control, nature would need to be determined
Energy consumption /efficiency	High thermal efficiency 95 - 100%.	Energy consumption relates to pumping demand.	Thermal efficiency >90% achievable	Energy consumption relates to pumping demand.

IMPACT	SCV	ORV	CHP-SCV	GEOHERMAL
Noise and Vibration	Noise is emitted from air blowers, but will be controlled to an acceptable level.	Noise levels are higher than from SCVs, but within acceptable industrial limits.	In addition to noise from the SCV, the CHP plant will introduce significant noise generating plant e.g. turbines. Noise levels will be higher than from the SCV units alone, but can be mitigated to acceptable levels.	Noise levels from pumps are comparable with SCVs, but within acceptable industrial limits.

4.1.4 Environmental assessment using the H1 methodology

An environmental assessment of the overall impact of the emissions resulting from the installation as a whole has been undertaken in accordance with the EA H1 Methodology¹. This is in addition to the EIA carried out as part of the planning application for the project. For the purpose of environmental assessment, the H1 methodology comprises the following basic steps:

- Definition of the objective of the assessment;
- Quantification of the emissions to each media; and
- Quantification of the impact.

H1 allows the assessment to focus on those emissions of potential significance and provides a threshold value of 1% of specified Environmental Assessment Levels (EALs) below which emissions are insignificant and do not require further consideration.

The installation gives rise to emissions of NO_x from the SCV units. Predicted emissions were assessed against the significance criteria to determine whether a more detailed assessment was required. The predicted emissions were greater than 1% of the EAL and therefore detailed modelling was required. An Air Quality Assessment, consistent with the assessment carried out for the EIA, has been attached as Appendix A to this application.

Deposition of NO_x was assessed against screening criteria and again was not screened as insignificant. The impact of deposition of NO_x has been considered at sensitive receptors nearby to the proposed facility. This assessment is attached as Appendix D – Report in Support of an Appropriate Assessment under the Conservation (Natural Habitats, etc.) Regulations (1994).

Wastewaters from the process combined with groundwaters and surface water run-off is discharged into Milford Haven. The wastewaters are essentially clean, neutralised waters containing low levels of sodium nitrate and sodium carbonate. There are no EALs available for these substances, therefore the predicted release concentration of nitrates has been compared to EC drinking water standards for this substance, which are highly conservative in the circumstances. The predicted release rate was less than 1% of the 95 percentile limit, but marginally exceeds 1% of the mandatory limit (1.07%). Since the water releases into Milford Haven, which is a nutrient sensitive environment, further assessment of the impact of the nitrate releases has been considered within Appendix D. Sodium carbonate released in these waters is expected to break down to sodium ions and carbonate and consequently due to its chemical nature will not have an impact, consequently this release is not considered further.

Analysis of the predicted noise levels from the proposed facility screened out most sources, exceptions being the SCV units, HP Booster pumps, SCV pumps/blowers and the flares. The flares will be operational only under exceptional circumstances. Further assessment of the noise impacts from the proposed facility have been undertaken and are attached as Appendix B.

The water content of the exhaust gases from the SCV's has the potential under certain atmospheric conditions to cause a visible plume. The Air Quality Assessment (Appendix

¹ Environment Agency, *Integrated Pollution Prevention and Control (IPPC) Environmental Assessment and Appraisal of BAT Version 3.1*, July 2002.

A) considered the impacts of plume and concluded that there will be occasions where a visible plume will extend beyond the installation boundary. However, the plume will remain well within the site boundary and will not therefore affect any off-site locations. Against the H1 criteria the impact would score a rating of medium, considering the impacts beyond the installation. However, since there will be no circumstances under which the plume will extend beyond the site boundary and potentially impact on sensitive receptors, the overall impact is considered as low/insignificant.

Nitrogen dioxide emissions have a photochemical ozone creation potential (POCP) of 2.8 per tonne. Based on the assumption that all NO_x is present as NO₂ the overall POCP of the facility is 1105. This is minimised by NO_x control at source.

The use of energy within the facility gives rise to emissions of CO₂, a greenhouse gas that contributes towards global warming. The CO₂ emissions from this facility arise directly from the use of natural gas and diesel and indirectly from the consumption of electricity from the grid. The global warming potential associated with energy consumption within the facility is 866,290. This is minimised by energy efficiency measures.

The generation of waste from the facility is expected to be low. The figures presented within this application are conservative, it is expected that waste generated during normal operation of the site will be lower. However, based on the conservative numbers, the H1 assessment achieved an overall hazard score of 52.5 and a disposal/treatment score of 152 for waste. As stated in section 2.6, disposal routes will be regularly reviewed in accordance with its waste management policy. Waste minimisation audits will also be undertaken to identify areas where materials can be used more efficiently and consequent wastes generated minimised.

Further discussions of the potential impacts from the proposed installation are presented below.

4.1.5 Site setting and sensitive receptors

The site is located on the northern shore of Milford Haven amid an area of countryside typified by gently undulating hills and valleys. Originally the refinery was developed across two flat-topped hills bisected by a natural valley feature containing the South Hook Pill, aligned approximately north to south running down to Little Wick Bay.

The site elevation changes from the high flat-topped hills at approximately 56 mAOD through the northern and eastern areas of the site, down to 5 mAOD in the valley bottom at its confluence with the sea at Little Wick Bay.

The internal topography of the site has been much altered through the construction and subsequent demolition and restoration of the former Esso oil refinery. As a result a series of terraces and old tank bases remain to form sheltered plateaux and small depressions within the site.

The former oil refinery was finally decommissioned and cleared by 1990. Currently, the only buildings that remain within the site boundary are the security building at the entrance and the dominant structure of South Hook Fort overlooking the Haven.

The National Park boundary splits the site from North to South and the adjacent Milford Haven Waterway abutting the site to the south is the Pembrokeshire Marine candidate Special Area of Conservation (cSAC). An assessment of the impacts of the proposed development on the candidate SAC is presented in section 4.3.

NOISE VIBRATION & AIR QUALITY

To the south and west, the site is bounded by low cliffs of around 20m height facing out onto Milford Haven. The site is bounded to the east by a small valley feature running down to Gelliswick Bay that separates the site from the community of Hubberston. To the northwest a third small valley leading down to Muns Mouth in Sand Haven Bay separates the site from the community of Herbrandston.

The area directly surrounding the site is predominantly rural with isolated, major industrial development. The nearest areas of conurbation are Herbrandston, Hakin and Milford Haven. A few isolated residential properties lie beyond of each of these areas. The nearest of these is Herbrandston Hall, Gelliswick and the properties on South Hook Road. The site is approximately 3 km from the town centre of Milford Haven.

4.1.6 Emissions to atmosphere

An assessment of the potential for the proposed LNG facility at South Hook to cause impacts to air from its operation has been carried out; the full Air Quality Assessment is included as Appendix A. Emissions of combustion gases from the SCVs, i.e. CO₂ and water vapour were identified as the primary source of releases to air under normal operation. The principle contaminant of natural gas combustion emissions under normal operation is NO_x.

Under abnormal operation there may be a need to flare natural gas, the potential impact of these releases has also been considered.

Emissions of NO_x from the LNG facility were modelled using AERMOD Version 4.6.2. This model is recommended by the USEPA as the preferred dispersion model for general industrial modelling scenarios and is widely used in the UK for such applications.

Further assessment was undertaken using the UK model ADMS 3.1 to determine the predicted nitrogen deposition rates. This model allows for the direct comparison with the prevailing nitrogen deposition rate for the subject area.

A more detailed discussion of the models, model scenarios and input data is contained within the Air Quality Assessment.

The potential impacts of NO_x emissions were assessed at sensitive receptors and ecological receptors. The assessment concluded that emissions from the SCVs during typical operation would not result in exceedance of relevant air quality guidelines and objectives at the nearest sensitive receptors. Predicted ground level concentrations of releases from the high pressure or low pressure flares indicate that the contribution of NO₂ at the nearest sensitive receptors will not be significant.

Compliance with the air quality objective for the protection of vegetation and ecosystems would be achieved for all receptor locations with the exception of one, located in the near field and within the site boundary.

Nitrogen deposition from the South Hook facility would represent an increase of only 2-14% over background at the nominated ecological receptor locations.

For the peak-operating scenario where emissions from the SCVs are at the guaranteed level of 46ppm, compliance is predicted for the short-term criterion for NO₂ using the Environment Agency's screening assessment approach of 30% conversion. The Total Oxidant (TOx) Method for NO_x to NO₂ conversion provided a worst case when compared to this approach however, compliance criteria were still achieved.

At normal and peak emissions compliance with the annual NO₂ criterion is achieved.

Different stack heights were considered as part of the assessment. The effect of releases from stack heights of 10m, 17m, 24m and 35m were considered. A stack height of 24m is currently assumed for the SCV units. This height meets emissions criterion, as discussed above, but will be optimised during detailed engineering, whilst still meeting the air quality standards required.

A visible plume beyond the installation boundary is predicted for 10% of the time however, it should not extend beyond the boundary of the site and at no time is there a predicted occurrence of visible plumes grounding.

4.1.7 Emissions to water

The water schematic attached as Figure 2.2.3a and Figure 2.2.3b indicates the proposed water and effluent scheme for the facility. The SCV effluent will be neutralised to between pH 6-9 prior to discharge. This wastewater is basically clean water containing sodium nitrate and sodium carbonate. Prior to discharge the SCV waters are combined with other site drainage and groundwaters.

The final discharge concentration of sodium nitrate and sodium carbonate is dependant on the flow of surface waters and groundwater. A worst case assessment assuming minimum flows of the other site waters would result in a final discharge concentration of sodium nitrate and sodium carbonate of 1.58g/l and 6.0mg/l respectively.

The receiving water for discharges from the site is Milford Haven. This water is sensitive to excess input of nutrients, given its biodiversity resulting from very clean waters and minimal nutrient load. As a result a number of options regarding effluent discharge location and treatment have been considered (see section B2.3.3 for further details). The impact of these emissions has been considered within Appendix D, Report in Support of an Appropriate Assessment under the Conservation (Natural Habitats etc.) Regulations (1994). Given the proposed treatment of these wastewaters, it is considered that the impact of the nitrate discharge on the marine environment will be not significant. The sodium carbonate released in these waters is expected to break down to sodium ions and carbonate and consequently due to its chemical nature will not have an impact.

4.1.8 Emissions to land

The site baseline condition is detailed within the Site Report, which forms Appendix F to this Application.

There will be no direct disposals to land within the installation or site boundary. Waste arisings within the facility are not significant and where practicable, alternative disposal routes to landfill will be used (see section 2.6).

There will be no direct emissions to groundwater of List I or List II substances from the installation.

As a result of the past use of the site there may exist List I and List II substances within the soil zone that could be mobilised into groundwater as a result of the excavation and drainage of the proposed development footprint. A remedial strategy will be developed to prevent this occurring, as far as reasonably practicable. It is proposed that contaminated groundwater and hotspots of contamination will be either contained or removed prior to construction to prevent the uncontrolled release of substances to the surface water and

marine ecosystems.

4.1.9 Noise emissions

A noise assessment was undertaken, which considered the potential for noise impacts associated with the proposed activities, on noise sensitive receptors. The full assessment is included as Appendix B.

The predicted noise impact arising from operation is controlled to acceptable levels at the nearest sensitive receptors, based upon the incorporated mitigation and the distance to noise sensitive receptors (see section 2.9).

There will be no significant noise impacts on leisure or ecological receptors in the area.

A noise monitoring program will be undertaken after construction is complete and the plant is fully operational to confirm the predicted operational impacts at sensitive receptors, as detailed within section 2.10.

4.2 The Waste Management Licensing Regulations

The activities to be carried out within the LNG facility do not involve waste disposal or recovery operations. Therefore the relevant functions under Schedule 4 of the Waste Management Licensing Regulations are not applicable to the proposed activities within this application.

4.3 The Habitats Regulations

The installation is situated within the Pembrokeshire Marine candidate Special Area of Conservation (cSAC) that is subject to nature conservation designations under the European Habitats Directive. In addition within a 10km radius of the proposed installation a further two European sites can be found, namely the Limestone Coast of South West Wales cSAC and Castlemartin Coast Special Protected Area (SPA). An initial assessment of the implications of the installation has been undertaken, as the basis for an appropriate assessment for these European sites. A summary of the assessment is provided below and the complete assessment is presented in Appendix D.

The process of considering the potential impact of the development proposals on the European sites involved identifying those features of the European sites that could be vulnerable to such impact. Interest features found within all three Pembrokeshire marine cSAC include Large shallow inlets and bays, Reefs, Grey Seals, Otter, Allis & Twaite shad, River & Sea lamprey, Coastal lagoons, Mudflats and sandflats not covered by sea water at low tide, Atlantic salt meadows (*Glaucopuccinellietalia maritimae*), Sandbanks which are slightly covered by sea water all the time, Submerged or partially submerged sea caves, all of which are not expected to be effected by the scheme. Interest features of the Limestone Coast of SW Wales cSAC include vegetated sea cliffs of the Atlantic and Baltic coasts & fixed dunes with herbaceous vegetation. Other Annex I habitats also present, but not primary reason for site selection include European dry heaths, semi-natural dry grasslands & scrub & facies: oncalcareous substrates, caves not open to the public and submerged or partially submerged sea caves. Annex II species Greater horseshoe bat and Early gentian and Castlemartin Coast SPA also will not be affected. The Castlemartin Coast SPA is important for breeding chough.

The impacts of the proposed activities including those during the construction phase have been considered against environmental benchmarks. The assessment of impact significance is summarised in Table 7a and 7b within Appendix D.

It was concluded that some impacts from a development of this scale and nature are unavoidable. However, these impacts have been carefully considered and mitigation measures evaluated to ensure that the development of the proposed LNG development will not have a significant impact on the integrity of the Pembrokeshire Marine candidate Special Area of Conservation and other European sites in the wider area.

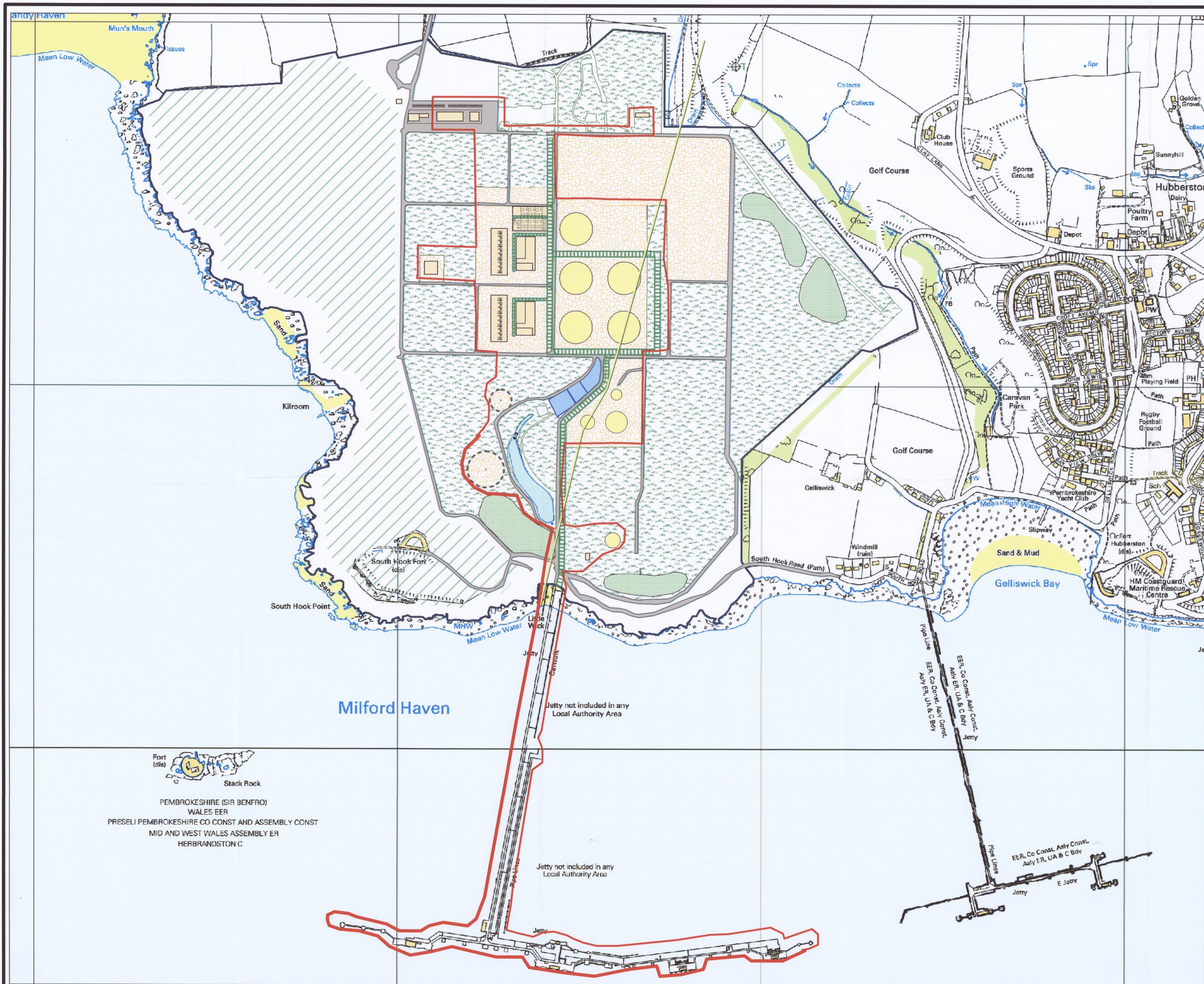
DEFINITIONS

BAP	Biodiversity Action Plan
BAT	Best Available Techniques
BATNEEC	Best Available Techniques Not Entailing Excessive Cost
BOG	Boil Off-Gas
CCA	Climate Change Agreement
CCW	Countryside Council for Wales
CHP	Combined Heat and Power
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
COMAH	Control of Major Accident Hazards
COSHH	Control of Substances Hazardous to Health
CV	Calorific Value
DCS	Distributed Control System
EA	Environment Agency
EEC	European Economic Community
EIA	Environmental Impact Assessment
EM	Environmental Manager
EMS	Environmental Management System
EQS	Environmental Quality Standard
ESD	Emergency Shutdown
F&G	Fire and Gas
FEED	Front End Engineering Design
HAZID	Hazard Identification
HAZOP	Hazard and Operability
HP	High Pressure
HVAC	Heating, Ventilation and Air Conditioning

NOISE VIBRATION & AIR QUALITY

IPC	Integrated Pollution Control
IPPC	Integrated Pollution Prevention and Control
LNG	Liquefied Natural Gas
LP	Low Pressure
MD	Managing Director
NO _x	Nitrogen Oxides
NTS	National Transmission Service
ORV	Open Rack Vaporiser
PPC	Pollution Prevention and Control
QMS	Quality Management System
RIDDOR	Reporting of Injuries, Diseases and Dangerous Occurrences Regulations
SAC (cSAC)	Special Area of Conservation (candidate Special Area of Conservation)
SCV	Submerged Combustion Vaporiser
SM	Site Manager
USEPA	United States Environmental Protection Agency

FIGURES



Key

- Installation Boundary
- Site boundary
- Tanks
- Pipelines
- Building
- Flare areas
- Concrete

SURFACE

- Grass
- Gravel
- Settlement ponds
- Bunds

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Revisions:

Date: 07/08/03

Drawn by: S Kerin

Scale: 1:5,000 @ A1

Client: Qatargas II

Job: South Hook LNG Terminal

Drawing Title: Site Layout Indicating Installation Boundary

Drawing Number: Figure 1



Key

- Site boundary
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- Pipelines
- Building
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SURFACE

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Revisions:

Date: 24/07/03

Drawn by: S Kerin
Scale: 1:5,000 @ A1

Client: Qatargas II

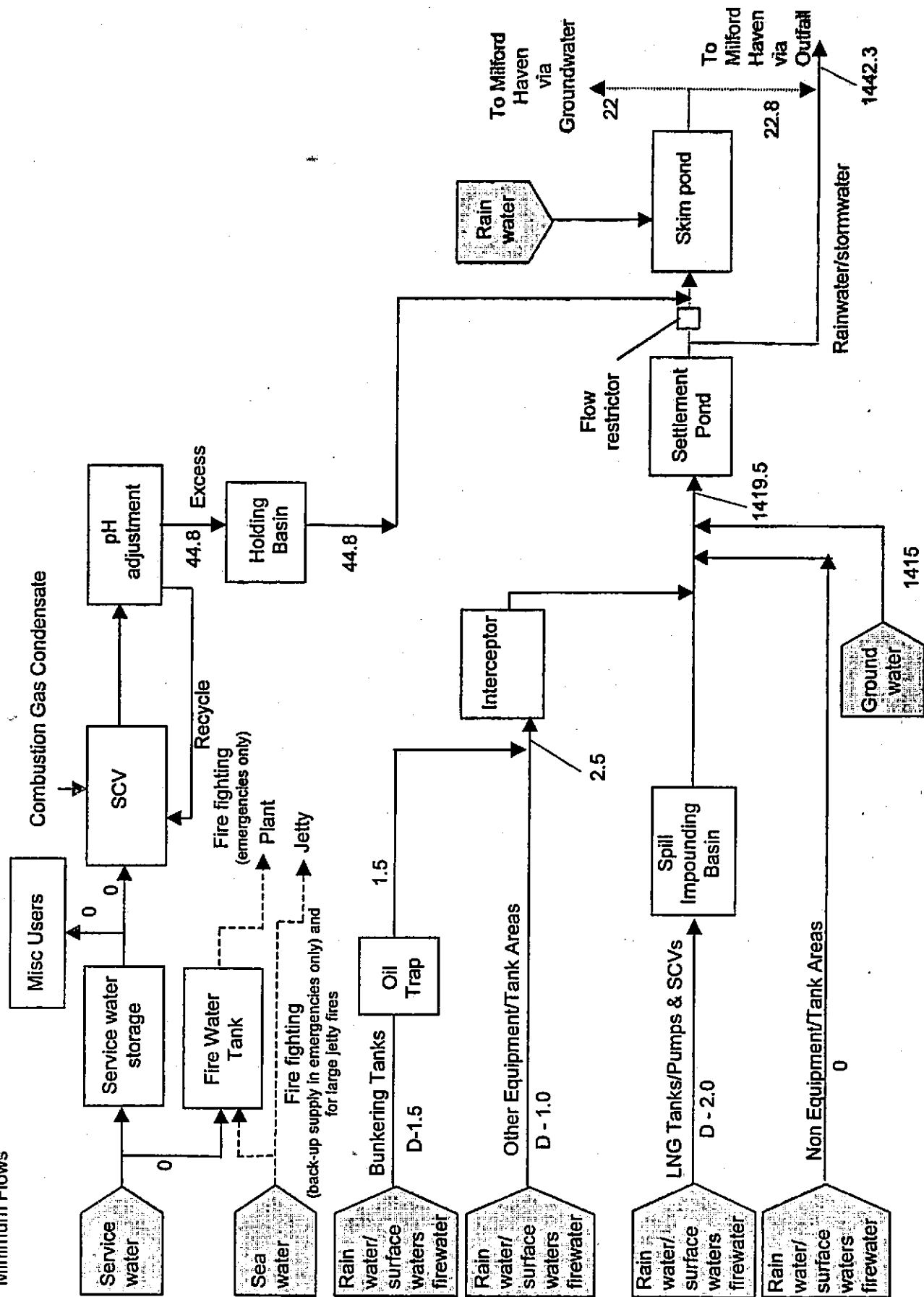
Job: South Hook LNG Terminal

Drawing Title: Layout Diagram Indicating Main Raw Material Storage Materials

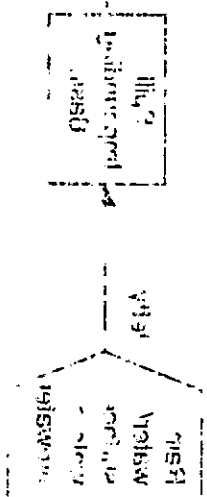
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Figure 2.2.3a Water Schematic (Sheet 1 of 2)

Minimum Flows



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(VHS Yellow, Red, Blue)



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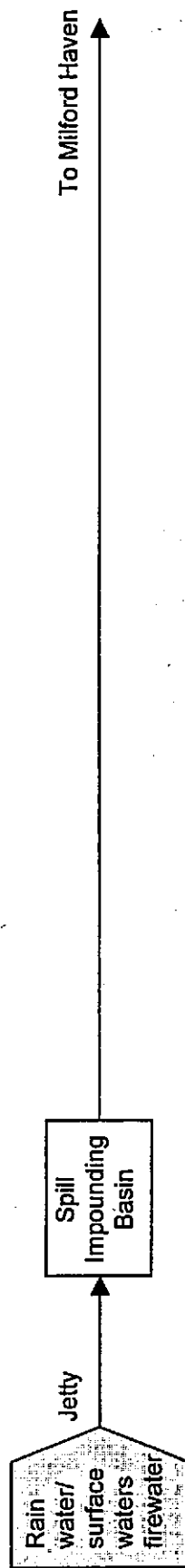
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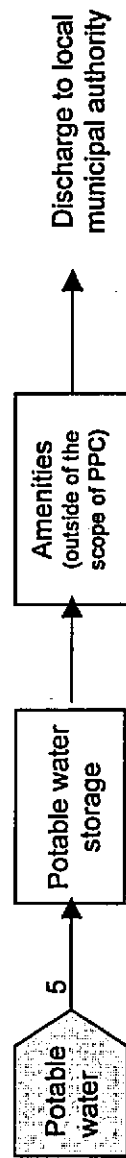
Page 1 of 1

Figure 2.2.3a Water Schematic (Sheet 2 of 2)

Minimum Flows



(non PPC water flow)



Notes

Flows for combined phase plant

All flows in m³/hr

RW - Rainwater

FW - Firewater

D - Equipment Drain

-Maximum rainwater flows used

-Firewater to one zone only with greatest flow used in total

-Service water used for initial fill of SCVs only

-Seawater to Fire water tank as a last resort

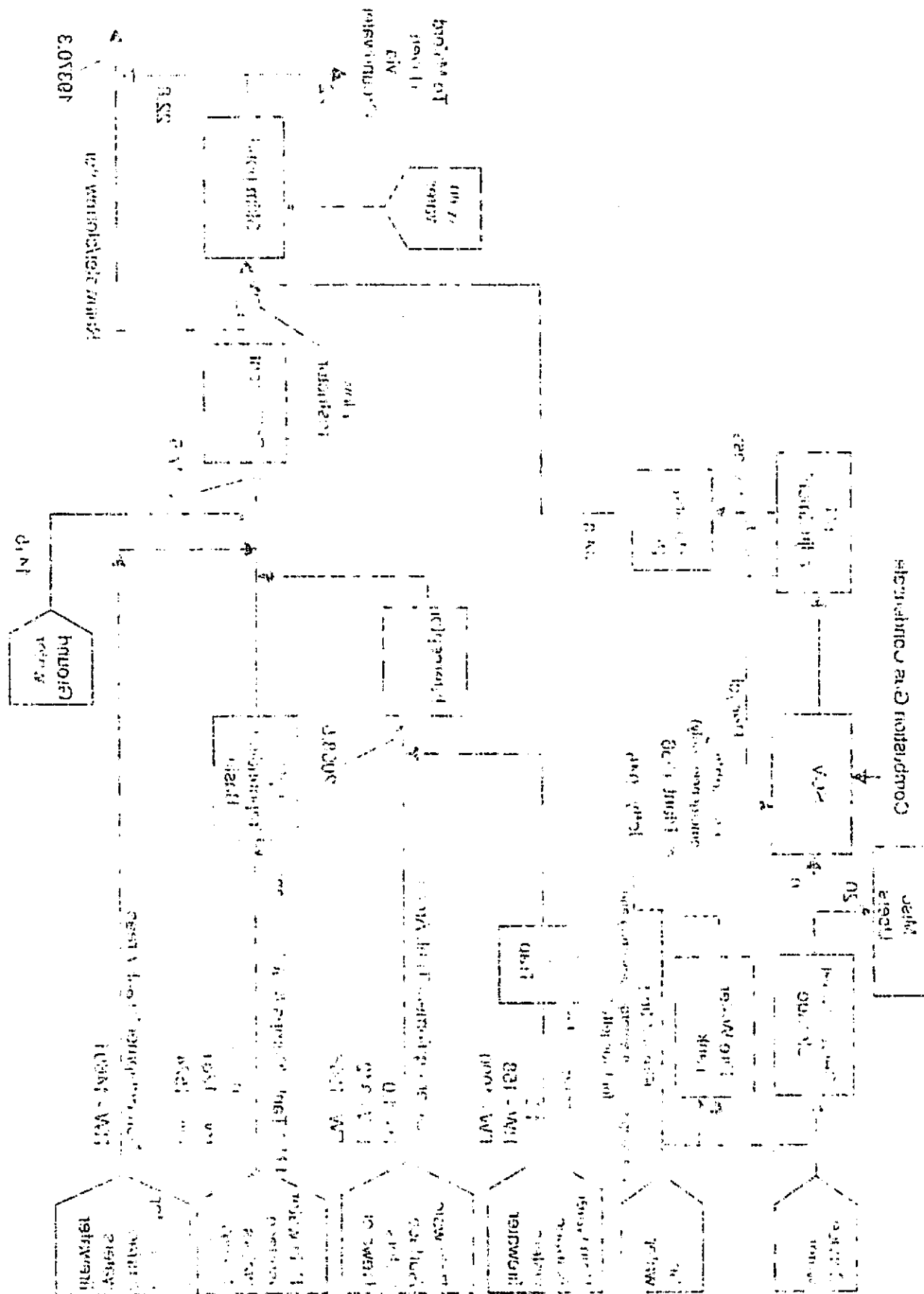
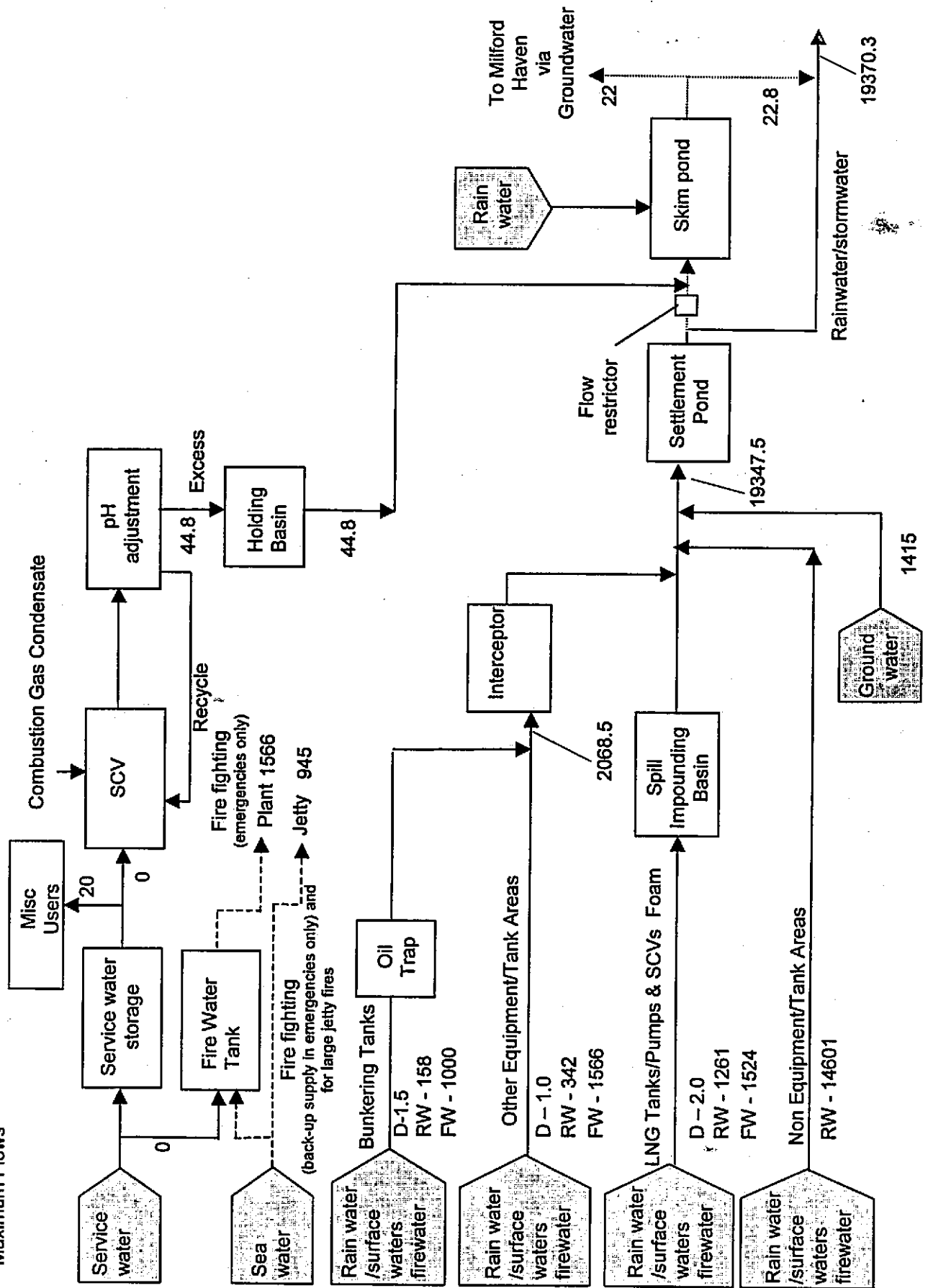


Figure 2.2.3b Water Schematic (Sheet 1 of 2)

Maximum Flows



1. The first step is to identify the problem.

2. The second step is to define the objectives.

3. The third step is to develop a plan of action.

4. The fourth step is to implement the plan.

5. The fifth step is to evaluate the results.

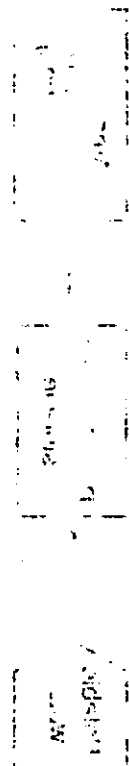
6. The sixth step is to report the findings.

7. The seventh step is to draw conclusions.

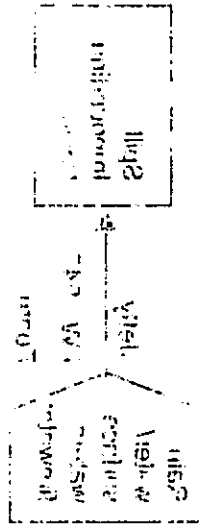
8. The eighth step is to make recommendations.

9. The ninth step is to monitor the progress.

10. The tenth step is to complete the report.



11. The eleventh step is to review the report.

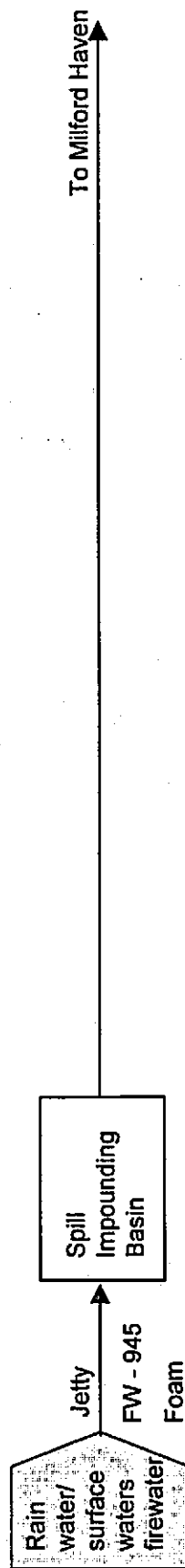


12. The twelfth step is to revise the report.

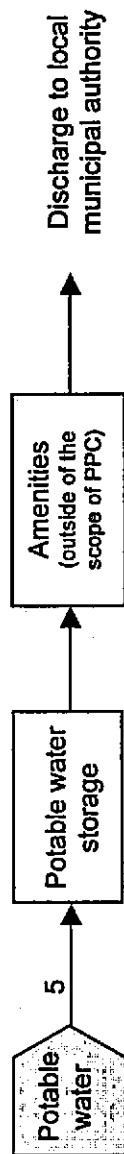
13. The thirteenth step is to submit the report.

Figure 2.2.3b Water Schematic (Sheet 2 of 2)

Maximum Flows



(non PPC water flow)



Notes

Flows for combined phase plant

All flows in m³/hr

RW - Rainwater

FW - Firewater

D - Equipment Drain

-Maximum rainwater flows used

-Firewater to one zone only with greatest flow used in total

-Service water used for initial fill of SCVs only

-Seawater to Fire water tank as a last resort



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S Kerin
Scale:
1:5,000 @ A1

Client:
Qatargas II

Job:
South Hook LNG Terminal

Drawing Title:
Plant Layout Diagram Indicating
Release Point Locations

Drawing Number:
Figure: 2.3.5

Noise Sources

- 1) LNG SCVs x20
- 2) Boil-off Gas Compressor x2
- 3) Ship Unloading Compressor x2
- 4) Emergency Generator
- 5) LNG Send-out Pumps x2
- 6) LNG Booster Pumps x16
- 7) Firewater Pumps
- 8) Firewater Jockey Pump
- 9) SCV Pump / Blowers x20
- 10) Sump Pumps x2
- 11) LNG Unloading Arm Pump
- 12) Air Drier
- 13) Nitrogen Generator
- 14) Flares x2
- 15) LNG Shipping (off Jetty)
- 16) Vehicle (all site)

LNG Facility, Milford Haven
QGI Project
Location of Noise Sources
JAS2787, 15 August 2003
Figure 2.9.1

RPS

Planning, Transport
and Environment

NOISE, VIBRATION & AIR QUALITY

