centrica energy

Hydrocarbon Resources Limited

East Irish Sea Operations
Oil Pollution Emergency Plan

Document Title	**East Irish Sea Operations Oil Pollution Emergency Plan**
Document Number	**DOC-HSE-IMP-034 Part 1**
Revision	**00**
Procedure Owner	**Hydrocarbon Resources Limited**

REVISION	AMENDEMENTS MADE	DATE	APPROVED BY

Rev	Approved by	Date	Prepared by	Date
00	DECC	March 4th 2010	*Oil Spill Response*	February 2010

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List of Abbreviations

API	American Petroleum Institute gravity
BST	Business Support Team
BHP	Broken Hill Petroleum
CCW	Countryside Council for Wales
CEU	Centrica Energy Upstream
CoP	Conoco Phillips
CPC	Central Processing Complex
CPP	Central Production Platform (part of CPC)
CGR	Condensate Gas Ratio
CRO	Control Room Operator
DECC	Department of Energy and Climate Change
DPPA	Drilling and Production Platform (North Morecambe)
EA	Environment Agency
EH	English Heritage
EIS	East Irish Sea Operations
EOM	Emergency Operation Manager
EPC	Emergency Pollution Control Regulations 2002
ERRV	Emergency Response and Rescue Vessel
ESDV	Emergency Shut Down Valve
ESG	Emergency Support Group
HMCG	Her Majesty's Coast Guard
EH	English Heritage
HRL	Hydrocarbon Resources Limited
HSE	Health and Safety Executive
HS&E	Health, Safety and Environment
IoM	Isle of Man
ICC	Incident Control Centre
ITOPF	International Tanker Owners Pollution Federation Limited
JNCC	Joint Nature Conservation Committee
km	Kilometre
m	Metre
mmscf/d	Million Standard Cubic Feet per Day
MFA	Marine Fisheries Agency
MCA	Maritime and Coastguard Agency
MRCC	Maritime Rescue Co-ordination Centre
Nm	Nautical Mile
NE	Natural England
NUI	Normally Unattended Installation

OBM	Oil Based Mud
OCU	Operations Control Unit
Oil Spill Response	Oil Spill Response Limited
OIM	Offshore Installation Manager
OOE	Offshore Operations Engineer
OPEP	Oil Pollution Emergency Plan
OPOL	Offshore Pollution Liability Association
OPRC	Oil Pollution Preparedness, Response and Co-operation, 1990
OSC	On-Scene Commander
OSEO	Operations Safety & Environment Officer
PLEM	Pipeline End Manifold
PON1	Petroleum Operations Notice No1
PSV	Platform Supply Vessel
RSPB	Royal Society for the Protection of Birds
SG	Specific Gravity
SOSREP	Secretary of State Representative
SITREP	Situation Report
SPA	Special Protection Area
SRC	Shoreline Response Centre
UKCS	United Kingdom Continental Shelf
UPDate	Centrica Energy Upstream business management system

Executive Summary

Compilation of this Oil Pollution Emergency Plan (OPEP) for Hydrocarbon Resources Limited (hereafter referred to as HRL) identified the worst case risks involved in the event of identified hydrocarbon releases into the marine environment, during operations within the Morecambe Fields (hereafter referred to as Field). Environmental sensitivities were researched, thereby providing potential environmental impacts in the event of any scenario from Field operations.

Trajectory and stochastic modelling was assessed, taking into account the potential risks involved. For the worst case inventory release of both condensate and diesel, there is a predicted 0% probability of a shoreline impact. Modelling of both oil types identified that a worst case condensate release would migrate closest to the UK coast (12.0 miles), where as a worst case diesel release migrated closer to the Isle of Man 12 nm boundary (12.1 miles) before becoming insignificant.

Taking into account the risk assessment and modelling results, a shoreline impact is highly unlikely. With the non persistent nature of both the condensate and diesel, together with the location of the operations from sensitivities, the preferred oil spill response strategy in the event of a release would be to monitor and evaluate and allow natural dispersion. Decision making aids and Action Cards for key personnel reflect the risk assessment and corresponding preferred strategy.

1 Introduction

1.1 Purpose and Scope

This offshore OPEP compiled specifically for HRL, details the overall coordination of response to an oil spill incident associated with the Morecambe Field operations in the East Irish Sea, United Kingdom Continental Shelf (UKCS). It includes onshore and offshore organisational responsibilities, actions, reporting requirements and resources available to ensure the effective and timely management of an uncontrolled and accidental hydrocarbon spillage from the facilities at the Morecambe Field (Figure 1.1). HRL is a wholly owned subsidiary of Centrica and part of the Centrica Energy Upstream (CEU) business unit.

This OPEP covers all installations and subsea infrastructure within the Morecambe Field operations with the inclusion of HRL operated installations and subsea infrastructure that are part of the Millom, Dalton and Calder developments owned by ConocoPhillips (CoP). Therefore all Normally Unattended Installations (NUI), subsea tie backs, flow lines and Pipeline End Manifolds (PLEM) within Millom, Dalton and Calder developments are covered by this OPEP (Figure 1.2). Export pipelines from the DPPA and CPC up until the UK shore are also within the scope of this OPEP. Specific field details are included in Section 2. Collectively, these developments are known as East Irish Sea Operations (hereafter referred to as EIS).

The requirement to have an OPEP for Offshore Installations located in UK waters has been formalised by the Merchant Shipping (Oil Pollution Preparedness, Response and Co-operation Convention) Regulations 1998, which implements the International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990 (OPRC, 1990). The convention, adopted by the International Maritime Organisation (IMO) is aimed to “mitigate the consequences of major oil pollution incidents involving, in particular, ships, offshore units, sea ports and oil handling facilities”. This plan is also designed to meet the requirements of the Offshore Installation (Emergency Pollution Control) Regulations 2002. The competent national authority designated to oversee all matters pertaining to the OPRC convention under the Merchant Shipping Act 1995 as amended by the Merchant Shipping and Maritime Security Act 1997 is the Maritime and Coastguard Agency (MCA).

Figure 1.1 Morecambe Fields

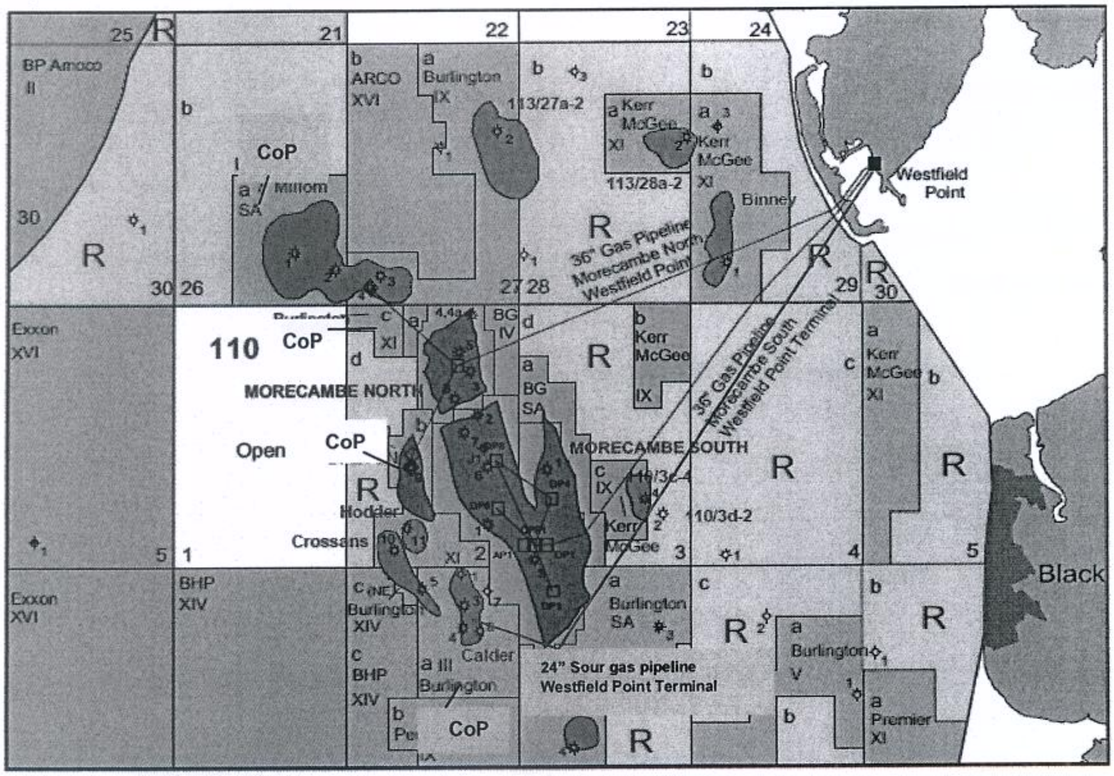
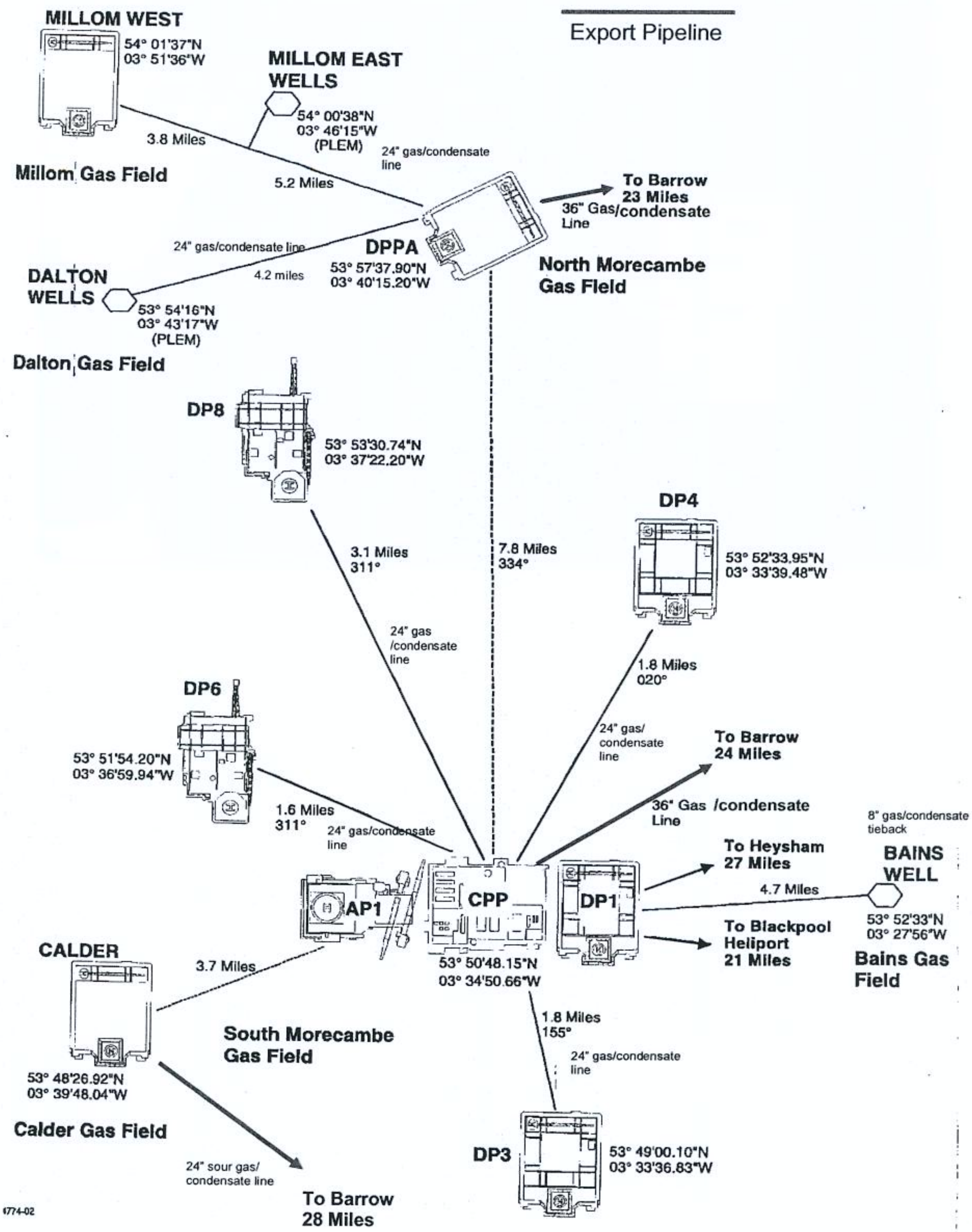


Figure 1.2 EIS Surface and Subsea Infrastructure



1.2 Legal Framework

The OPEP has been prepared with reference to the *Guidance Notes to Operators of UK Offshore Oil and Gas Installations (including pipelines) on Oil Pollution Emergency Plan Requirements* issued by DECC (Department of Energy and Climate Change) (refer to Appendix B.1 for further information). Submission of the plan is aligned with the requirements within the UK National Contingency Plan (NCP) for counter protection measures for offshore installations. The two regulations concerned are:

- The Merchant Shipping (Oil Pollution Preparedness, Response and Co-operation Convention) Regulations 1998
- Offshore Installations (Emergency Pollution Control) Regulations 2002, made under the section 3 of the Pollution Prevention and Control Act 1999

1.2.1 Statutory Roles

In the event of offshore oil spillages, response to the incident may involve a number of national organisations, each of which has a specific role which is defined in the NCP. Involvement of the organisations will be dependent on the magnitude and location of the spill.

The geographical jurisdiction of these organisations varies within the UK Pollution Zone and is given in Figure 1.2. Further information on these regulations is provided in Appendix B.1.

1.2.2 SOSREP and Operations Control Unit

The Offshore Installations (Emergency Pollution Control) Regulations 2002 give the Government (through the SOSREP) powers to intervene in the event of an incident involving an offshore installation that presents or has the potential to present significant pollution. It should be noted that the SOSREP has the authority to intervene even if the Operator is mounting an effective response.

The SOSREP will monitor the actions of HRL (as the operator of an offshore installations) in an emergency and if necessary, will issue directions to HRL to ensure that the actual or potential effects of marine pollution are minimised. Given the SOSREP's role, it is crucial that they are in a position to be able to follow in detail HRL's actions in response to an incident. Therefore the SOSREP may decide to set up the Operations Control Unit (OCU). Further information on the role of SOSREP and structure of OCU is provided in Section 6.6 and Appendix B1.2.

1.2.3 East Irish Sea Operations

As the operator of the Morecambe Field, HRL need to have in place, maintain and implement an OPEP to combat oil pollution of the sea. It is also HRL's responsibility to ensure that these plans are supported by the provision of equipment as required under the Tiered Response defined in Section 7.2 and to ensure that all spills are reported without delay. Centrica Group Environmental Policy Statement which covers Morecambe Area Operations is reproduced in Figure 1.4.

Figure 1.3 Key UK Oil Spill Responsibilities and Jurisdictions

Morecambe Area Operations

Offshore Response Team

- Notification to Onshore Field
- Initial notification of relevant Authorities via PON1 Form
- Mobilise infield response resources

Onshore Incident Management Team

- Coordinating response in a Tier 2/3 incident
- Provide appropriate response strategy
- Mobilise response resources
- Liaise with relevant authorities

200 nm

DfT (Department of Transport)

Responsibility of HM Coastguard to inform the Maritime Coastguard Agency (MCA) of an incident.

<u>HM Coastguard (HMCG)</u>
- Coordinates maritime search and rescue
- Primary contact in event of oil spill
- Reports all spills to MCA
- Support MCA response

<u>Maritime and Coastguard Agency (MCA)</u>
- UK Government response
- Advice on oil spill response
- Authority to co-ordinate response in accordance with the National Contingency Plan
- Responsible for mobilising Governments equipment for offshore and onshore clean up
- Establish Shoreline Response Centre (SRC) with Local Authority

Depending on the scale of the incident the MCA may advise and co-ordinate clean up operations utilising MCA, industry and contractors resources.

Authority to liaise with Republic of Ireland (ROI) National Competent Authorities for spills moving towards the median line with ROI.

DECC (Department of Energy and Climate Change)

- Offshore oil and gas regulatory authority
- Responsible for monitoring and reporting the illegal discharges of oil at sea from offshore installations to the relevant prosecuting authorities
- Ensure that operators comply with OPEP and are equipped and prepared to respond to a spill
- Authorise mobilisation of SOSREP if needed

JNCC (Joint Nature Conservation Committee)

- Advisors to Government on environmental matters
- Concerned with the conversation of offshore and coastal seabirds and mammals
- Provide environmental data for scientific assessment
- Form part of Environmental Group (EG) if set up

MFA (Marine Fisheries Agency)

- Responsible for the protection of English and Welsh fisheries interests and the marine environment
- Authority for the approval of dispersant use in water depths < 20 m or within 1 nm of any such area
- Consult authority for the use of dispersant around shallow water areas
- Form part of EG if set up

12 nm

NE (Natural England)

- Advisors to Government on environmental matters in England
- Concerned with the conservation of coastal, intertidal and subtidal habitats and communities, coastal seabirds and mammals
- Provide environmental data for scientific assessment
- Liaise closely with JNCC
- Form part of EG if set up

6 nm

EA (Environment Agency)

- Consultation on waste disposal
- Responsible for water quality in river and estuary areas
- Form part of EG if set up

Low Water Mark

LA (Local Authority)

- Co-ordinates local response for shoreline clean up operations
- Co-ordinates with MCA concerning establishment of SRC

Figure 1.4 Centrica Group Environmental Policy

In line with our Business Principles we are committed to understanding, managing and reducing the environmental impact of our activities and to implement internationally recognised environmental management systems to achieve this aim.

We recognise that Centrica has an important role to play in environmental management specifically in relation to climate change. Centrica is taking steps to reduce our overall impact on climate change both directly through our own business activities and also indirectly through supply chain management and by helping our customers to use energy more efficiently.

We are committed to the development of renewable and low-carbon energy sources that will facilitate the reduction of our carbon footprint. When we acquire carbon intensive assets we will work to reduce their impact on the environment. We will enable our customers to participate in the move towards a low carbon future by helping them make informed decisions about the use of our products and services. We will also encourage our employees to make responsible use of resources and engage in activities that reduce the company's operational impact.

We aim to achieve this by:

- *Adopting exemplary environmental governance and stewardship*
- *Implementing environmental management systems certified to ISO14001 or an equivalent for all our business activities*
- *Targeting resource efficiency in our operations and supply chains*
- *Working with stakeholders; listening and responding to their views*
- *Setting objectives and targets reviewing our performance against them and publishing regular performance reports*
- *Implementing processes to have data relating to our environmental performance validated by independent third parties*

Specifically we will:

- *We will develop a coordinated and innovative approach to combating climate change in the upstream and downstream business activities and we will lead by example in the management of our internal carbon footprint*
- *Ensure the efficient use of energy, water and other resources, focussing particularly on the reduction of greenhouse gas emissions*
- *Communicate this policy to our employees and help them understand their role in reducing the environmental impact of our operations and the part they play in encouraging our customers to be more energy efficient.*
- *Undertake environmental assessments as a core element of our decision-making on major operational issues including new projects and acquisitions.*
- *Quantify and seek to reduce the environmental impact of our activities on an ongoing basis through continual improvement.*
- *Comply with relevant environmental legislation, regulations and other codes of practice.*
- *Encourage our suppliers, contractors and business partners to pursue responsible environmental practices.*
- *Prevent or limit the impact of environmental incidents through proactive management systems and effective contingency planning.*
- *Review and improve our policies and practices in response to performance measures, changes to our business strategy and improvements in our understanding and knowledge.*
- *Minimise operational waste through reduction, reuse and recycling.*
- *Understand our impacts on biodiversity and put in place management processes and action plans that seek to minimise them.*
- *Encourage dialogue on the Company's environmental performance and with stakeholders including employees, shareholders, customers, suppliers, regulators, local communities and other groups; listen and respond to feedback from these discussions to develop and take appropriate actions.*
- *Work closely with relevant agencies to promote environmental good practice and contribute to thinking on the environmental aspects of sustainable development*

2 Field Details

This OPEP covers the North Morecambe, South Morecambe, Millom, Calder, Dalton and Bains installations and subsea infrastructure. HRL own and operate the North Morecambe and South Morecambe reservoirs. The Millom, Dalton and Calder reservoirs are owned by Conoco Philips (CoP) and are operated on their behalf by HRL. The Bains reservoir is owned in conjunction with Edinburgh Oil & Gas with HRL having the majority share and operating this facility on behalf of the partners. This OPEP also covers the three export pipelines from the CPC, DPPA and Calder until the UK shore.

The Morecambe and Satellite Field's are located in Blocks 110/2, 110/3, 110/7, 110/8, 113/26b and 113/27a in the eastern Irish Sea, approximately 21 miles west of Blackpool. All reservoirs are gas / condensate. Water depths within the Fields range between 17 and 35m.

Products are recovered within the South Morecambe reservoir (which is located in Blocks 110/2, 110/3 and 110/8) via a Central Processing Complex (CPC) which is a 3 bridge linked fixed installation in Block 110/3. Products are recovered within the North Morecambe reservoir via a fixed Remote Drilling and Production Platform (DPPA) in Block 110/2a and the Calder installation in Block 110/7a. CPC, DPPA and Calder facilities act as strategic points for receiving production import from other installations or fields, each then export to separate terminals at Barrow via separate dedicated subsea export pipelines.

2.1 South Morecambe Field

The South Morecambe Central Processing Complex (CPC) incorporates a main Central Processing Platform (CPP), an Accommodation Platform (AP1) and a Drilling Platform (DP1). There are a further four remote drilling platforms (DP3, DP4, DP6, and DP8) and they are connected to the CPP via gas / condensate pipelines. These platforms are all NUI's and are controlled from AP1. Although termed "Drilling Platforms" there is now no further drilling activity. These are normally visited on an "intervention" basis, with a small crew flying each day to conduct planned maintenance and production activities. An emergency overnight shelter is available with limited bedding and cooking facilities and frozen food in the event that an intervention team is forced to stay overnight on each of the NUIs. All reservoir fluids (gas, condensate and produced water) are exported directly from the DPs to the CPC via 24" pipelines. Further subsea infrastructure data is illustrated in Figure 1.2.

On the CPP, the gas and liquid from each DP are collected in the slug catcher which separates the bulk of the liquids from the gas. Further liquid separation is utilised to split the condensate and water; the condensate is then coalesced. The gas is compressed and finally the coalesced condensate is re-injected into the gas stream and the mixture is transported from CPP to a dedicated terminal at Barrow in Furness via a 24 miles, 36" subsea pipeline.

2.1.1 Calder

The Calder reservoir is located some 6.3 miles south of the Dalton Reservoir and approximately 3.7 miles south west of the CPC and is within Block 110/7a. The reservoir is produced through a single NUI with minimal processing facilities onboard the Calder Platform, all gas / condensate and produced water is exported to a reception / H_2S stripping terminal adjacent to the HRL North Morecambe terminal via a dedicated 24" subsea pipeline.

The Calder Reservoir is owned by CoP and operated on their behalf by HRL. The major difference with Calder gas / condensate streams is that it is sour, having levels of toxic H_2S gas between 3,500 and 4,500 ppm. The Calder facilities have been designed with scope for future tie-back of production from subsea developments on the Darwen and Crossans reservoirs, although these are not yet programmed and development would normally be under CoP control and their own development oil spill plan.

2.1.2 Bains

The Bains Reservoir is owned by HRL, Edinburgh Oil and Gas, and Gaz de France. Centrica having the majority share (approximately 53% equity), are the designated duty holder for Bains and operate the facilities on behalf of the other equity holders. The Bains reservoir is produced from a single subsea well tied back via a single 8" flexible pipeline and riser that is tied in to the existing production and test manifold on DP1. The Bains reservoir is located 4.7 miles east of the DP1 platform and is within Block 110/3c.

2.2 North Morecambe Field

The North Morecambe Remote Drilling and Production Platform (DPPA) is a NUI controlled from Barrow NMT unless temporarily manned. There are no process facilities on the DPPA, the reservoir products being exported via a 23 miles, 36" pipeline to an onshore terminal at Barrow. There is a separate pipeline for return of methanol and corrosion inhibitor for injection into the gas / condensate stream prior to export from the platform. DPPA has an NUI linked to it via subsea pipeline at Millom West and also a subsea tieback at Millom East, both located in block 113/26a. There is another subsea tieback located in block 110/2b, serving the Dalton wells. Further subsea infrastructure data is illustrated in Figure 1.2.

2.2.1 Millom

The Millom reservoir is located approximately 6.2 miles north-west of DPPA. The Field is divided into two accumulations known as Millom West and Millom East, separated by a thin gas leg in the saddle area. The reservoir spans Blocks 113/26a, 113/27a and 110/2c.

Millom West has a NUI and is produced from four subsea wells (P1-P4). Millom East is produced from the three subsea wells (Q1-Q3) tied back via flow lines to a PLEM. Q1 and Q2 are currently in long term isolation. The combined gas / condensate streams mix at the PLEM with the gas / condensate produced from the Millom West NUI, with the combined output going to DPPA via a 24" subsea pipeline. The Millom (and Dalton) gas / condensate is metered on DPPA before being mixed with North Morecambe gas / condensate.

2.2.2 Dalton

The Dalton reservoir is produced from two subsea wells tied back via flow lines to a PLEM. The combined gas / condensate streams flow from the PLEM to the DPPA via a 24" subsea pipeline. Dalton facilities are limited to subsea structures consisting of the two wellheads and a PLEM. The Dalton reservoir is located 4.2 miles south-west of DPPA platform and is within Block 110/2b.

2.3 Vessels

The Emergency Response & Rescue Vessel (ERRV) the *VOS Pathfinder* spends 28 days in the field doing "standby" duties and is relieved for roughly 24 hours by a similar ERRV for each monthly crew change.

The Platform Supply Vessel (PSV) *Highland Pioneer* sails from Heysham Port on a Friday night and spends approximately 12 hours Saturday daytime servicing all HRL platforms, it returns for around 6 hours on Monday daytime and again for 12 hours during the day on Thursday before heading back to Heysham Port. Therefore on average the vessel spends 30 hours in-field during a week.

Table 2.1 Field Description

Site	Location	Block	Installation Type	Function	Owner
CPC	53° 50'48.15"N 003° 34'50.66"W	110/3	3 steel jacked linked platforms	Import pipelines from the four satellite platforms and Bains well terminate. Condensate is coalesced, gas is compressed. AP1 is dedicated to accommodation, DP1 is a periodically manned bridge. 36" seabed export pipeline to Barrow.	HRL
DPPA	53° 57'37.90"N 003° 40'15.20"W	110/2b	4 steel jacked wellhead platforms	Import pipelines from Millom and Dalton wells terminate. NUI controlled from Barrow NMT unless temporarily manned. There are no process facilities. 36" seabed export pipeline to Barrow.	HRL
DP3	53° 49'00.10"N 003° 33'36.83"W	110/8		Wellhead platforms with 24" seabed transport pipelines to the CPC/DPPA	HRL
DP4	53° 52'33.95"N 003° 33'39.48"W	110/3			HRL
DP6	53° 51'54.20"N 003° 36'59.94"W	110/2			HRL
DP8	53° 53'30.74"N 003° 37'22.20"W	110/2			HRL
Calder	53° 48'26.92"N 003° 39'48.04"W	110/7a		Wellhead platform with 24" seabed export pipeline to Barrow	CoP
Bains	53°52'33"N 003° 27'56"W	110/3c	Well	Single well tied back via a single 8" flexible pipeline and riser that is tied in to the existing production and test manifold on DP1	HRL, Edinburgh Oil and Gas, and Gaz de France
Dalton	53°54'16"N 003° 43'17"W	110/2b		2 wells tied back via flow lines to PLEM	CoP
Millom West	54'01'37"N 003° 51'36"W	113/26a	4 steel jacked wellhead platforms	NUI and 4 wells (P1-P4) with 24" seabed transport pipelines to the DPPA	CoP
Millom East	54°00'38"N 003° 46'15"W	113/26a	Well	3 wells (Q1-Q3) tied back via flow lines to PLEM. Q1 and Q2 currently in long term isolation.	CoP

Table 2.2 Pipelines

From	To	Export Method	Hydrocarbon Type	Export Rate	System Isolation	Approx Water Depth
CPP	Barrow	36" for 24 miles	Gas/ Condensate	9.77 mscm/d	ESDV at each end of the pipeline. Isolation achieved under 60 secs post leak detection. Pipelines have low pilot alarms to indicate loss of containment.	26.5
DPPA	Barrow	36" for 23 miles		1.50 mscm/d		30.5
DP3	CPP	24" for 1.8 miles		1.34 mscm/d		26.5
DP4	CPP	24" for 1.8 miles		1.34 mscm/d		26.5
DP6	CPP	24" for 1.6 miles		2.49 mscm/d		26.5
DP8	CPP	24" for 3.1 miles		2.68 mscm/d		26.5
Calder	Barrow	24" for 28 miles		3.00 mscm/d		29
Millom West	DPPA	24" for 9.0 miles		1.00 mscm/d combined (no separate flowmeter for MW/ME)		35
Millom East	DPPA	Q3 24" for 0.15 miles mix with MW at PLEM				35
Bains	DP1	8" tieback for 4.7 miles		0.25 mscm/d		26.5
Dalton	DPPA	24" for 4.2 miles		0.60 mscm/d		30.5

Table 2.3 Installation and Subsea Infrastructure Distances

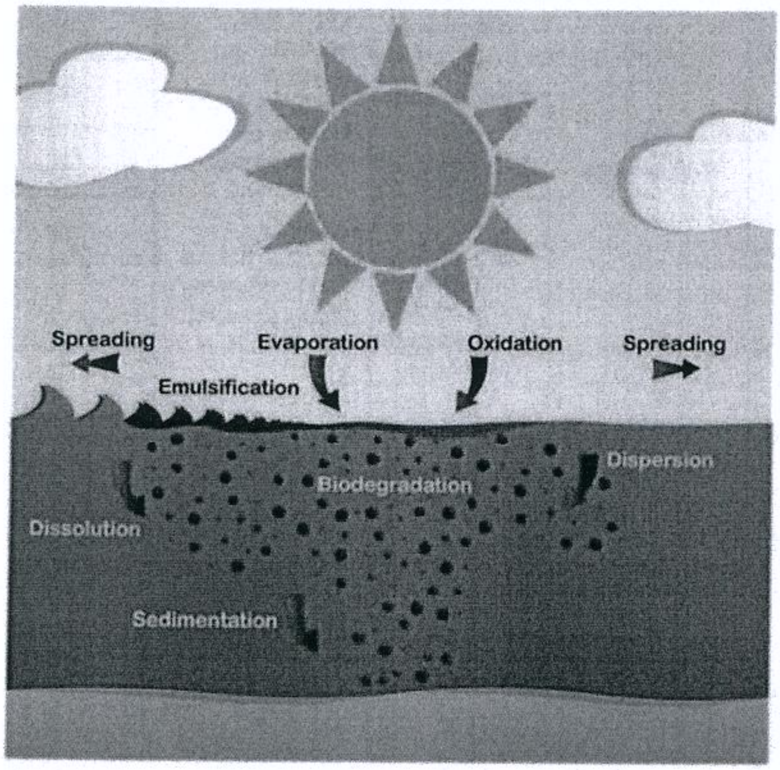
Site	Distance to closest UK coastline (miles)	Distance to closest IoM 12 nm boundary (miles)
CPC	21.2	26.2
DPPA	18.4	19.4
DP3	26.3	28.8
DP4	18.3	26.5
DP6	22.0	24.4
DP8	22.4	24.0
Calder	23.6	26.1
Millom West	24.2	10.3
Millom East	21.2	13.8
Bains	15.3	29.3
Dalton	22.4	25.6

3 Risk Assessment

3.1 Weathering Processes

The physical and chemical changes that oil undergoes when spilled on the water are collectively known as "weathering" (Figure 3.1). Knowledge of these processes and how they interact to alter the nature and composition of the oil with time is essential in identifying the best oil spill response strategies. How an oil weathers will depend upon the meteorological and oceanographic conditions and the individual characteristics of the hydrocarbon. A short description of each fate process is presented in Table 3.1.

Figure 3.1 Overview of Oil Weathering Processes



(Source: ITOPF)

http://www.itopf.com/marine-spills/fate/weathering-process/

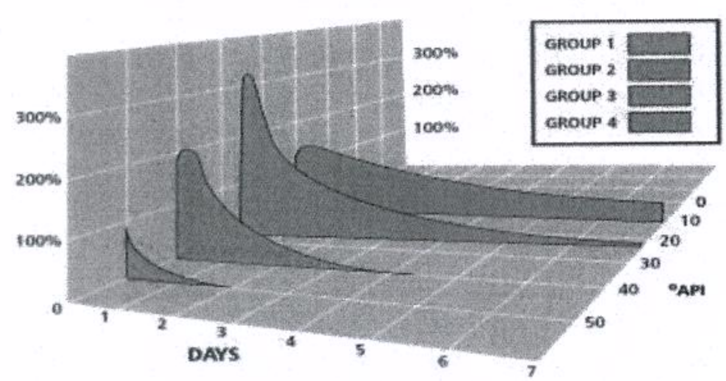
Table 3.1 Weathering Processes

Weathering Process	Description
Drifting / Advection	Physical movement of surface oil from one location to another due to the combined effects of water current, tides, waves and wind.
Spreading	Increase in the length and breadth of the oil slick as it spreads and thins on the sea surface.
Evaporation	Evaporation of lighter hydrocarbons from the oil to the atmosphere.
Emulsification / Mousse Formation	Formation of water-in-oil emulsions, resulting in an increase in oil viscosity. Oils with a high asphaltene content (>0.5%) are more likely to form stable emulsions.
Dispersion	The formation of oil droplets due to breaking waves, resulting in transport of oil from the sea surface into the water column.
Dissolution	Physical-chemical process resulting in oil from the oil slick or from suspended oil droplets dissolving into the water column.
Submergence / Sinking / Sedimentation	Increase in density of oil due to weathering and interaction with suspended sediments or material of biological origin. Deposition of material to the sea floor. Tar balls may be formed, which could be deposited on the seabed.
Shoreline Interaction / Stranding	Impact of oil on the shoreline where it may strand on the surface, or become buried in layers, or may re-float and move elsewhere. The rate of weathering of stranded oil depends on several factors, in particular the amount of exposure to waves.
Biodegradation	Biological-chemical process altering or transforming hydrocarbons through the action of microbes and/or the ingestion by plankton and other organisms.

3.2 Fate of Spilt Oil

In considering the fate of spilled oil, a distinction is frequently made between non–persistent (light) oils, which tend to disappear rapidly from the water surface and persistent (heavy) oils, which dissipate more slowly (ITOPF Classification Figure 3.2).

Figure 3.2 ITOPF Oil Persistency Classification



Source: ITOPF

3.3 Hydrocarbon Characteristics and Inventory

The main physical properties that affect the behaviour of the hydrocarbons in the Morecambe Field are presented in Table 3.2. The Specific Gravity (SG) of hydrocarbon is a measure of its density relative to water. The asphaltene content indicates whether an oil will form a stable water-in-oil emulsion.

Table 3.2 Hydrocarbon Characteristics

Type	Physical/chemical Properties	ITOPF Group	Spill Characteristics
Diesel	Pour Point (°C): -5 to -31 Flash Point (°C): 81 Viscosity @ 15°C (cST): 4 Asphaltene (%): Low	I	• Low viscosity distillate fuel which spreads very rapidly to form a thin sheen • High proportion of light ends which evaporate quickly • Probably formation of an unstable emulsion in very rough weather • Rapidly disperse / evaporate if released in to the marine environment.
Condensate	Density @ 15°C (SG): 0.6991 Flash Point (°C): 56 min Viscosity @ 15°C (mm^2/s): 3–5 Wax content (%): Low Sulphur content (% m/m): 0.5	I	• Comprised of low molecular weight (C2-C15) • Highly volatile hydrocarbon that evaporates within two hours • Condensate vapour plume carries with it the hazard of possible fire and explosion as well as the danger of oxygen deficiency • Do not form emulsions

Table 3.3 Hydrocarbon Inventory

Operations	Scenarios	Product Type	Maximum Volume (m^3)	Comments
CPC Topside	Storage Tank Failure	Condensate	70 m^3	Maximum inventory on the CPC. Smaller inventories exist on the Drilling Platforms.
		Diesel	200 m^3	Maximum inventory on the CPC. Largest single tank is 100m^3. Worst case would be loss of the inventories from all installations (346 m^3 capacity), which is extremely unlikely.
		Lube oil	37.3 m^3	Maximum inventory on the CPC. Largest tank is 15m^3.
		Hydraulic Oil	13.4 m^3	Maximum inventory on the CPC. Worst case would be loss of the inventories from all installations (19.8 m^3 capacity), which is extremely unlikely.
PSV	Loss of entire inventory	Diesel	381 m^3	Maximum likely inventory aboard the *Highland Pioneer*
ERRV	Loss of entire inventory	Diesel	340 m^3	Maximum likely inventory aboard the *VOS Pathfinder*. Vessel spends 28 days in the Field, relieved by a similar ERRV for 24 hrs.
CPP/DPPA Export Pipelines	Loss of entire static volume	Gas/ condensate	24,285m^3	Volume (24,285m^3) @ 10^{-5} CGR ≈ 0.24m^3 condensate
Drilling Platform Export Pipelines	Loss of entire static volume	Gas/ condensate	Static internal volume of largest Drilling Platform pipeline (Millom West-DPPA) is 4,667m^3	Volume for 24" diameter for 9.0 nm export line would be ~ 4,667 m^3. Loss of entire volume would result in the release of approximately 50 litres of condensate. Condensate releases of all remaining DP export lines are considered insignificant.

3.4 Hazard Identification and Oil Spill Scenarios

In order to indentify the risks related to the Field operations, an assessment was conducted by taking into consideration the operational system and events that may result in an oil spill. The risk assessment process combines the consequential maximum volume of hydrocarbon that may be spilled and its impact, along with the likelihood of occurrence of the incident scenario (i.e. the 'probability'). The likelihood of occurrence (1-5) is shown in Table 3.4. The corresponding environmental consequences have also been taken into account; the results are illustrated in Table 3.5.

Table 3.4 Probability Assessment

Category	Probability
1	Rare
2	Unlikely
3	Moderate
4	Likely
5	Almost Certain

Table 3.5 Environmental Consequences

Consequence		Definition
Minor	1	Local contained spill or emissions within permit limits.
Important	2	Contained spill or emissions within boundary fence. No significant impact on or offsite.
Significant	3	Uncontrolled spill or emissions with minor offsite environmental impact.
Major	4	Uncontained spill or emissions with serious medium-term offsite impact. Liquid spills with 5-10 miles impact offsite. Airborne: offsite public evacuation.
Catastrophic	5	Uncontained spill or emissions with severe long-term offsite impact. Extensive loss of aquatic life.

The potential sources, types and volumes of hydrocarbons, including the likelihood of an oil spill from operations within the Field are presented in Table 3.6. It summarises a range of spill scenarios that has been identified to reflect spills that could occur from operations at the Field (fixed platforms, flow lines and vessels). Scenarios are subdivided on the basis of the operational functions.

Table 3.6 Oil Spill Incident Scenarios

Operations	Number	Scenarios	Possible Causes	Product Type	Maximum Volume (m^3)	Probability	Consequence	Comments
Production	1	Topside leak rate of CPC	• Sabotage • Equipment malfunction • Unexpected reservoir conditions	Gas/ Condensate	Worst case Field free flowing rate: 7.5 mscm/day (@ 10^{-5} CGR)	2	3	Greater chance of a blowout during drilling as opposed to normal production operations. The field is in the production phase. This takes into account 35 production wells in the south field. Identified as worst case scenario.
Export From CPP	2	Export pipeline rupture, loss of static volume, loss of export flow rate for 60 seconds	• Over-pressure • Corrosion • Sea movement • Civil engineering earthworks • Human error • Anchor dragging	Gas/ Condensate	0.24 m^3 condensate	2	1	Volume for 36" diameter for 24 miles export line would be ~ 24,285 m^3. Isolation of export line would initiate <60 secs. Loss of entire condensate volume (0.24m^3) plus a minimal free flowing quantity extremely unlikely due to pressure of seawater.
Export From Drilling Platforms	3	Export Pipeline Rupture	• Human error • Anchor dragging • Over-pressure • Corrosion • Sea movement • Civil engineering earthworks	Gas/ Condensate	Static internal volume of largest Drilling Platform pipeline (Millom West-DPA) is 4,667m^3.	2	1	Volume for 24" diameter for 9.0 miles export line would be ~ 4,667 m^3. Isolation of export line would initiate <60 secs. Loss of entire volume would be insignificant.
Rig Supply	4	Bunkering Hose Rupture	• Human error • Corrosion • Lack of maintenance	Diesel	3 m^3	3	1	Bunkering the CPP by the *Highland Pioneer* PSV.

Operations	Number	Scenarios	Possible Causes	Product Type	Maximum Volume (m^3)	Probability	Consequence	Comments
CPC Topside	5	Storage Tank Failure	• Human error • Corrosion • Lack of maintenance	Condensate	70 m^3	3	1	Maximum inventory on the CPC. Smaller inventories exist on the Drilling Platforms.
	6			Diesel	200 m^3	3	2	Maximum inventory on the CPC. Largest single tank is 100m^3. Worst case would be loss of the inventories from all installations (346 m^3 capacity), which is extremely unlikely.
	7			Lube oil	37.3 m^3	2	1	Maximum inventory on the CPC. Largest tank is 15m^3.
	8			Hydraulic Oil	13.4 m^3	2	1	Maximum inventory on the CPC. Worst case would be loss of the inventories from all installations (19.8 m^3 capacity), which is extremely unlikely.
PSV	9	Loss of entire inventory	• Human error • Collision • Sinking • Lack of maintenance	Diesel	381 m^3	3	2	Maximum likely inventory aboard the *Highland Pioneer*. Although the *VOS Pathfinder* is on station in the field longer, it has lesser diesel capacity.