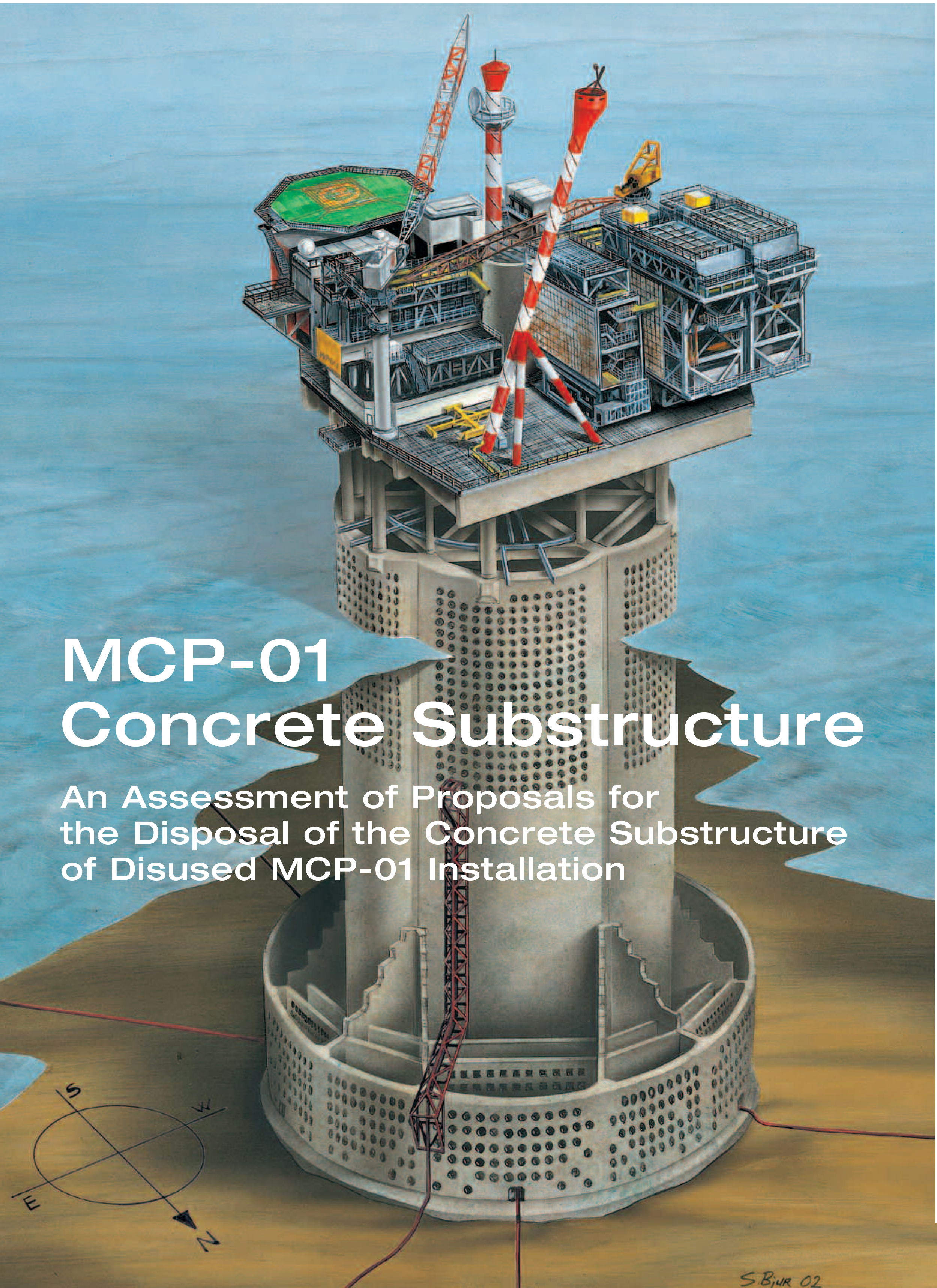
E&P

TOTAL E&P UK PLC

MCP-01



MCP-01 Concrete Substructure

An Assessment of Proposals for the Disposal of the Concrete Substructure of Disused MCP-01 Installation

TOTAL

MCP-01
Concrete Substructure

An Assessment of Proposals for the Disposal of the Concrete Substructure of Disused MCP-01 Installation

10 February 2006

UK Ownership

TOTAL

Norwegian Ownership

petoro

STATOIL

HYDRO

TOTAL

ExxonMobil

Shell

Norsea Gas A/S

ConocoPhillips

Eni Norge

Preface

The Manifold and Compression Platform MCP-01 is situated in the UK sector of the North Sea. However, the installation forms part of the Frigg Transport System and, as such, comes under the Frigg Treaty which was set up to manage the exploitation and transportation of the Anglo-Norwegian gas reservoir at Frigg. Consequently the UK and Norwegian Authorities have agreed to have a joint approach to the decommissioning of MCP-01. This means that this document is presented by both the UK Government and the Government of Norway.

TOTAL E&P UK PLC as operator of MCP-01, recommends to the UK and Norwegian competent authorities on behalf of the owners of MCP-01, that the concrete substructure (a concrete gravity base structure) remains in place, suitably marked with navigation aids and monitored. The property and responsibility of the concrete substructure remains with the owners of MCP-01, unless other arrangements are agreed with the Governments of the UK and Norway. The topsides and steelwork attached to the external concrete wall will be removed to shore for recycling or disposal.

The recommendation to leave in place the concrete substructure has been reached following a thorough comparative assessment of all the disposal options. The assessment was undertaken strictly in accordance with national UK and Norwegian legislation and OSPAR Decision 98/3.

This document presents a summary of the studies and assessments carried out by TOTAL E&P UK PLC into the technical, safety, economic, environmental and social aspects of the decommissioning of MCP-01. A complete copy of the MCP-01 Decommissioning Programme document (which includes a detailed Environmental Impact Assessment) can be viewed at:
www.uk.total.com/activities/ep_sf_mcp01_03.htm

Michel Contie
Managing Director
TOTAL E&P UK PLC

Contents

1. Introduction

MCP-01 is an offshore installation originally installed in 1976 to facilitate the gas transport through two 32” pipelines from the Frigg Field to the onshore St Fergus Gas Terminal in Scotland, (see Figure 1.1). Later, other fields have used MCP-01 as an entry point for their gas transportation to St Fergus.

Under the Frigg Treaty the MCP-01 platform forms part of the “UK Pipeline” and the “Norwegian Pipeline” as an “associated installation(s) serving [the] pipeline on an intermediate platform…”. The UK Department of Trade and Industry (DTI) and the Norwegian Ministry of Petroleum and Energy (MPE) have therefore agreed to a joint approach by the UK and Norway to the decommissioning of MCP-01 under the provision of the Frigg Treaty.

In accordance with the provisions of OSPAR Decision 98/3, this report provides information about the process and the studies performed which led to the conclusion that there are significant reasons why leaving the concrete substructure of the MCP-01 installation in place is preferable to reuse or recycling or final disposal on-land.

This assessment is based upon the information contained in the MCP-01 Decommissioning Programme submitted by TOTAL E&P UK PLC as operator, on behalf of the owners, to the governments of the UK and Norway.

The MCP-01 Decommissioning Programme has been based upon studies carried out in the period from 2002 to 2004. Independent experts from many European countries have provided input to the studies, and have verified the results and conclusions. The studies undertaken have been based upon scientific principles and have been carried out by particularly experienced personnel, using the latest knowledge and techniques. Advantages have been taken of the studies and experience gained in the Frigg decommissioning being managed by TOTAL E&P NORGE AS.

An integral part of the studies and assessments has been a process of public consultation and dialogue, which TOTAL E&P UK PLC has conducted, principally in the UK and with some stakeholders in Norway. This process has allowed an open exchange of ideas and concerns between the MCP-01 owners and interested parties.

Except where specifically noted in the text, the name “TOTAL E&P UK” has been used in this document to mean TOTAL E&P UK PLC. In accordance with common practice, the abbreviation UK has been used throughout this document to refer to the United Kingdom of Great Britain and Northern Ireland.

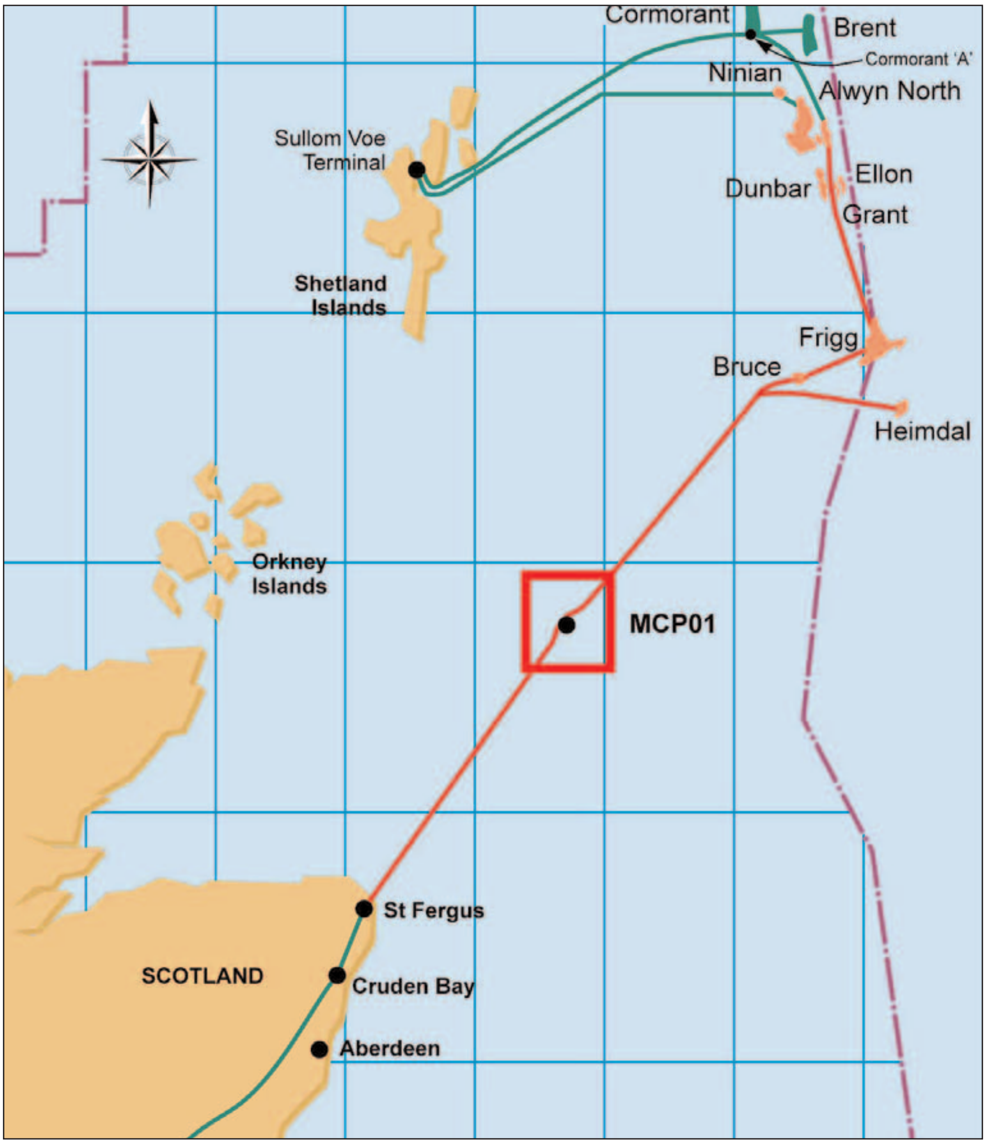


Figure 1.1 Location of MCP-01

2. Summary

2.1 Manifold and Compression Platform - MCP-01

The Manifold Compression Platform (commonly known as MCP-01) is a concrete gravity base structure located in Block 14/9 (see Figure 2.1), 173km north east of Aberdeen, in the UK sector of the North Sea Continental Shelf. The operator of the platform is TOTAL E&P UK. The water depth at the location is 94m.

Under the terms of the Frigg Treaty two 32” pipelines were installed between 1974 and 1977 to transport the gas from the Frigg Field to the St Fergus Gas Terminal in Scotland. One pipeline is owned by UK interests (named Frigg UK pipeline), while the other is owned by Norwegian interests (named Vesterled pipeline). Later, other fields have used MCP-01 as an entry point for their gas transportation to the St Fergus Gas Terminal.

As the pipeline systems will continue to be in use, the two pipelines which used to run through the bottom part of MCP-01, have been bypassed to allow the decommissioning work to commence. The 32" Frigg UK pipeline was rerouted during summer 2004. The bypass for the Vesterled pipeline took place during summer 2005.

Under the Frigg Treaty the MCP-01 platform forms part of the “UK Pipeline” and the “Norwegian Pipeline” as an “associated installation(s) serving [the] pipeline on an intermediate platform…”. **The DTI and the MPE have therefore agreed to a joint approach by the UK and Norway to the decommissioning of MCP-01 under the provision of the Frigg Treaty.**

2.2 MCP-01 Decommissioning Programme

TOTAL E&P UK, on behalf of the owners of MCP-01, (see Section 3.1), has prepared a decommissioning programme for the MCP-01 facilities as a whole, which has been submitted to both the UK and Norwegian governments for consideration. This Decommissioning Programme includes an environmental impact assessment of the various disposal alternatives. This document is entitled **“MCP-01 Decommissioning Programme”** (see reference in Section 10).

Both the UK and Norwegian Authorities have given agreement for an early removal of the topside facilities to enable the MCP-01 work to be integrated into a cross-border project with the Frigg Cessation Project (see Section 6.3). The topsides of MCP-01 are planned to be removed and transported to shore for deconstruction. As much as practicable of the materials and equipment brought to shore will be reused or recycled.

Figure 2.1 The Installation MCP-01 to be Decommissioned

The following disposal alternatives have been considered for the concrete substructure:

- **On-land disposal**, (see Section 5.4):
  - Refloat, tow to shore, deconstruct and dispose on-shore
- **At-sea Disposal**, (see Section 5.5):
  - Refloat and disposal in deep water
  - Cutting down to provide a clear shipping draft of 55m
  - Leave in place after removal of external steelwork

It is proposed that, after the necessary preparation (see Section 6), the concrete substructure of MCP-01 should be left in place.

This document contains an assessment of the proposal that the concrete substructure should be left in place. The assessment has been prepared in accordance with the framework set out in OSPAR Decision 98/3.

The requirements of the 1992 OSPAR Convention and OSPAR Decision 98/3 on the Disposal of Disused Offshore Installations have been fully complied with during the assessment of disposal alternatives and will continue to receive the highest priority throughout the decommissioning work. The studies, which form the basis of this assessment, have been undertaken by independent specialists and have been the subject of peer review by experts from a number of European countries (see references in Section 10).

2.3 Public Consultation and Dialogue

TOTAL E&P UK began planning for the decommissioning of MCP-01 in 2002 and had the first contact with the main stakeholder groups in the UK and Norway during Spring 2003 (see also Section 5.2).

The consultation process has been similar in both countries whilst respecting the particular national regulations. In addition to the statutory consultations required by both the UK and Norwegian Governments, efforts have been made by TOTAL E&P UK to identify, and involve, a wide range of stakeholders who might have an interest in the decommissioning of MCP-01.

Efforts have been made to ensure that the consultation and dialogue process is open and transparent. Feedback received from stakeholders has been greatly appreciated and has influenced the studies and assessments undertaken and has given valuable input to the drafting of the MCP-01 Decommissioning Programme.

2.4 Comparative Assessment Findings

Overall Conclusion

Based upon an assessment conducted in accordance with the provisions of OSPAR Decision 98/3 (see Section 5), it is concluded that there are significant reasons why leaving the concrete substructure of MCP-01 in place is preferable to reuse or recycling, or final disposal on-land. The main reasons for reaching this conclusion for the concrete substructure are detailed below.

Technical Feasibility of on-land disposal

It has been estimated that the chance of a major accident or incident during the refloat, towing and deconstruction operations is in the order of 60% which is six hundred times higher than the acceptance criterion.

This very high probability of not being able to refloat the substructure as planned is due to the likelihood that it will not be possible to undertake all the required tasks in one season and that consequently the structure will be damaged during the winter that follows.

The design of MCP-01 is such that the concrete substructure cannot be left over a winter period with less than half the solid ballast in place without risk of serious damage occurring. Indeed even with half the ballast left in place the substructure will be overloaded when exposed to common winter storms. Once a few steel cofferdams have been installed, the wave forces on the substructure will increase significantly and similarly it is not possible to leave the substructure over a winter period without the risk of serious damage to the structure.

It is therefore necessary to remove at least half the solid ballast (if not more), install the six cofferdams, commission all the necessary deballasting and control systems, test the water tightness, refloat the substructure and tow to an inshore location within one summer season.

The feasibility of refloating the MCP-01 concrete substructure is dependent upon the water-tightness of the walls, the base slab and the cofferdam which would be used to close the holes in the external wall. Reports produced during the construction phase suggest that the condition of the concrete substructure, when installed, was good. There is also no evidence to indicate that there were any major leaks whilst the platform was lowered into position and placed onto the sea bed. The platform has, however, been in location since 1976 and during approximately 30 years of operation it has been subject to severe storm loading. The overall integrity of the concrete substructure is not in doubt, as this is checked by periodic subsea inspections. However, there is a possibility that cracking of the concrete may have occurred, particularly in the area of the base slab, as a result of the loads incurred during the platform's operational life. The probability of severe cracking in the base slab is not considered high, but it is not possible to verify that there is no significant cracking in the base slab until the majority of the ballast has been removed and the steel cofferdams have been installed to seal the holes in the external wall.

Risk to Personnel

The probability of a fatality occurring during operations to refloat the concrete substructure, tow it to shore and then deconstruct it has been estimated as 47% (see Section 5.6.1). This is a very high probability and indicates that there are many hazardous operations associated with the on-land disposal alternative. The statistically predicted chance of a fatality occurring during preparation work for leaving the concrete substructure in place is less than 1%.

Based upon the estimated fatalities, the average Fatal Accident Rate (FAR value) for the complete removal and onshore disposal work is estimated to be in the order of 19. This is approximately 1.5 times the estimated average risk to workers on MCP-01 when it was fully operational.

Environmental Impacts

The EIA conducted by Det Norske Veritas (DNV) concludes that from a total environmental perspective, the leave in place alternative is considered to be the best option. The environmental impacts are generally “insignificant” and “small negative” with a potential for “moderate negative” impacts due to physical changes in local substrata. On this latter issue, the impact potential is most limited for the leave in place alternative, as it will impact the smallest area.

It is important to note that cleaning of the MCP-01 concrete substructure is not required, as it has **never been used for the storage of crude oil.**

Leaving the concrete substructure in place, and removing as much external steelwork as reasonably practicable has by far the best performance in terms of energy consumption and CO_2 emissions. Disposal on-land will give poor performance in terms of energy consumption (2 million GJ), will result in large emissions of CO_2 (137,000 tonnes), and will also result in negative physical and aesthetic impacts.

It is judged that there will be no, or “insignificant”, discharges to sea for both on-land and leave in place disposal alternatives.

The on-land and leave in place disposal alternatives will result in a predicted “moderate negative” impact for physical impacts to the environment, as a result of the placement of inert ballast material onto the seabed or the deposition of the substructure as it degrades over time. The “moderate negative” impact is not necessarily associated with the area of impact, but rather the sensitivity of receiving environment (i.e. potential *Nephrops* habitat that exists beyond the sandy mound where MCP-01 is situated).

The onshore deconstruction of the concrete substructure is judged to have a “small to moderate negative” aesthetic impact due to the visual impact, noise, smell and dust associated with breaking up the concrete. The aesthetic impact of leaving the substructure in place is considered to be “insignificant”.

Disposal on-land has the best performance in terms of material management, due to large percentages of high value (i.e. steel) material recycling and re-use.

A “small negative” littering impact has been identified if the substructure is left in place. Although considered small, it will be a long-term impact.

The removal of the substructure is judged to have a “small positive“ impact in respect to fisheries at sea. If the concrete substructure is left in place the effect is judged to be “small negative” due to the substructure causing a potential obstruction to fishing vessels and passing marine traffic. Removal of the substructure is judged to have an “insignificant” impact on free passage.

The environmental impacts detailed above assume that the operations are carried out essentially as planned and that there is no need to undertake extensive remedial works resulting from a major accident during the disposal operations. If a major unplanned event occurred during the operations, the impact on the environment would be considerably greater. A major leak occurring during the refloat operation would result in the substructure falling back onto the seabed. This would have a significant physical impact on the local environment, as would the extensive marine and diving operations necessary to try and clear up the area.

Cost

The total cost of the work necessary for removal and on-land disposal of the concrete substructure is estimated to be £446.6m/5,359 MNOK (€651m). A significantly greater cost would be incurred if there were a major accident or incident during the refloating and towing operations. The estimated cost of work to prepare the concrete substructure to be left in place is £11.7m/140 MNOK (€17m). In addition the cost of removing the topsides of the platform and deconstructing it on shore is estimated to be £70m / 840 MNOK (€102m). The costs are expressed in year 2004 money terms and represent a 50/50 estimate reflecting the high uncertainties identified in the risk assessment.

2.5 Preparation of Concrete Substructure before leaving the place

The steel topsides of MCP-01 and the steelwork attached to concrete walls on the substructure, such as riser with steel support, stairways, landings etc, will be removed (see Sections 6.3 and 6.4).

The steelwork and cables within the central shaft of MCP-01 will be left in place together with the protective aluminium and zinc anodes. These items are not considered to adversely affect the natural environment but will degrade gradually over time. Working in the central shaft is particularly hazardous and leaving the steelwork in place will reduce the risk to personnel during the decommissioning operations.

The concrete substructure has never been used for the storage of crude oil. Cleaning operations to remove hydrocarbon deposits are therefore not required.

All materials and substances removed from the substructure will be transported and disposed of on shore in accordance with relevant national and international regulations.

Navigation aids will be installed on the concrete substructure and regularly maintained. They will also be designed to ensure a high level of reliability. Back-up systems will be incorporated and parts of the navigational aids system will be changed at regular intervals. The navigational aids themselves, and their maintenance programme, will satisfy the requirements of UK regulations and other applicable international conventions.

The UK Hydrographic Office will be notified of the position and status of the concrete substructure to enable the relevant Admiralty charts to be updated.

To assist fishermen, it is planned to introduce the position of the concrete substructure into the UK “FishSAFE” programme which is a computerised system providing fishermen with information about obstructions or hazards in the fishing grounds. When they come within 6 nautical miles of an identified obstacle the bridge will be warned by a visual and audible alarm.

All debris on the seabed forming a hazard to other users of the sea will be removed within a 500-meter zone around MCP-01. A sonar sweep and trawling tests will be undertaken after the area has been cleared.

2.6 Impacts of leaving the Concrete Substructure in place

After the substructure is decommissioned the energy requirement will be very limited. The maintenance of the navigation aids will require a supply vessel for transport to MCP-01 where a helicopter will be used for the actual change-out.

The materials that would be left in place are:

Material	Substructure tonnages
Concrete	137,000
Reinforcement steel	10,800
Concrete ballast	2,200
Ballast sand placed inside concrete substructure during construction	47,000
Ballast sand placed offshore	173,000
Marine growth (estimated)	2,600
Steel works inside concrete substructure	1,000
Sum	**373,600**

Table 2.1 MCP-01 Concrete Substructure - Inventory of Materials.

Discharges from the concrete substructure if left in place at its current location, are considered to have "insignificant" impacts on the environment (see Section 7). The effects of leaching from the structure as it degrades are expected to be "none or insignificant". This is due to the slow release-rate coupled with the low concentration of the leached materials, from both concrete and steel materials.

Likewise, degradation of anode and electrical materials and associated paint inside the central shaft will also result in the release of diluted metals over long periods of time. As with the structured materials, the impact of this discharge is considered to be "insignificant".

The stone, sand and concrete ballast will be retained with the concrete substructure and thus it is unlikely that this will be released into the marine environment for hundreds of years. The stone/sand is a naturally occurring inert material that will not pollute the marine environment.

After about 100 years the main reinforcement with limited cover in the splash zone may be subject to significant corrosion and become ineffective. Impacts from waves would cause risk of local structural damage to the central shaft and the breakwater wall in the splash zone. Serious damage to all parts above sea level with a possible breakdown to the sea level is estimated to take place in roughly 200 years. Breakdown of the breakwater wall and the central shaft down to about 27m below sea level is predicted to take place in 400 to 800 years. A breakdown below 55m could take more than 1000 years.

As the structure slowly degrades, but remains standing, the physical impact is considered to be "none or insignificant". However, when the installation is fully deteriorated it will form heaps of concrete fragments and solid ballast. This constitutes a change in the natural environment of an undisturbed seafloor. Although this is a localised effect, nearby *Nephrops* habitat may also be impacted (i.e. beyond the sandy mound). The sensitivity of the recurring environment means that the physical impact would then be considered as "small to moderate negative".

There are considered to be no aesthetic impacts such as noise, smell or dust as a result of leaving the concrete substructure in-place. Visual impacts are considered negligible due to the remote offshore location.

By leaving the substructure in place, there will be some long-term littering effects, as the substructure degrades and eventually collapses onto the seabed. However, this littering impact is considered to be "small negative".

Leaving the concrete substructure in place is considered to result in "small negative" impacts on fisheries. The main issues of concern identified are the physical presence of the substructure creating an avoidance area for trawling fisheries, and the physical presence of the substructure resulting in the creation of an artificial reef.

The long term consequences for the fisheries in the MCP-01 area are difficult to predict, due to the uncertainties on how the fisheries in this area will develop in the future. Based on fisheries statistics, the immediate area around MCP-01 is most important for cod and haddock fisheries and less important for *Nephrops*. Assuming that in the future, the fishery will be present to a comparable extent as it is today, leaving the concrete substructure in place is regarded to have “small negative” impacts on the fisheries.

The statistical probability of a collision by a fishing vessel or a passing vessel has been evaluated by experts to be low. The annual number of seafarer fatalities estimated from vessel collision if the concrete substructure is left in place, is estimated to 1 fatality in 3,600 years. It has been estimated that the planned measures and industry developments would reduce the collision frequency by approximately 50% (see Section 7.).

The risk of pollution occurring as a consequence of such collision is even smaller. In the worst-case scenario of a serious collision involving a laden crude tanker, large outflow of oil could potentially occur (in excess of 10,000 tonnes). However data indicates that such incidents are extremely rare. The vast majority of the spills which occur are small. Therefore the total risk is considered low.

2.7 Monitoring

At the end of the decommissioning work programme, an environmental survey, including seabed sampling, will be undertaken to document the environmental conditions. A survey of the condition of the concrete substructure and the adjacent seabed will also be undertaken.

Regular surveillance will be carried out to check that the navigation aids are operational. The navigation aids will be designed in such a way as to allow them to be changed from a helicopter, thus obviating the need to man the platform for this purpose.

A visual check on the above water condition of the concrete substructure will be undertaken and recorded when the aids to navigation are being checked by helicopter. The implications of any observed deterioration of the substructure, in relation to the safety of users of the sea, will be assessed and any required action determined in consultation with UK and Norwegian authorities.

The concrete substructure, which is proposed to be left in place, will remain the property and responsibility of the owners of MCP-01, unless other arrangements are agreed with the Governments of UK and Norway.

2.8 Further Information

References to the many supporting studies undertaken and the peer review reports are to be found in Section 10 of this report.

The MCP-01 Decommissioning Programme, which includes the report on the Environmental Impact Assessment undertaken by Det Norske Veritas (DNV), may be found on the dedicated website for MCP-01 decommissioning: www.uk.total.com/activities/ep_sf_mcp01_03.htm

A complete copy of this OSPAR assessment document may also be accessed through the same website.

3. Description of MCP-01 and Surrounding Area

3.1 MCP-01

The Manifold Compression Platform (commonly known as MCP-01) is a concrete gravity base structure located in Block 14/9, 173km north east of Aberdeen, in the UK sector of the North Sea Continental Shelf, shown on Figure 3.1. The operator of the platform is TOTAL E&P UK.

Following the discovery of the Frigg Field in 1971, an agreement between the UK and the Norwegian governments was deemed necessary to regulate the exploitation of the Frigg Field reservoir and transmission of gas from the Frigg reservoir, straddling the UK and Norwegian continental shelves. Accordingly an agreement was prepared entitled ***"Agreement between the Government of the United Kingdom of Great Britain and Northern Ireland and the Government of the Kingdom of Norway relating to the Exploitation of the Frigg Field Reservoir and the Transmission of Gas therefrom to the United Kingdom".*** This agreement, known as the Frigg Treaty, signed 10th May 1976, came into force later that year. It was revised in 1998.

Under the terms of the Frigg Treaty two 32" pipelines were installed between 1974 and 1977 to transport the gas from the Frigg Field to the St Fergus Gas Terminal in Scotland, as illustrated on Figure 3.2. The pipeline leaving the UK platform TP1 on Frigg was named the UK Frigg pipeline and is owned by UK interests.

The other pipeline leaving the Norwegian platform TCP2 on Frigg was named the Norwegian pipeline - known today as the Vesterled pipeline. It is owned by Norwegian interests and is under Norwegian jurisdiction until it enters the UK territorial waters.

MCP-01 was installed in 1976 mid-way between Frigg and the St Fergus Gas Terminal to facilitate the operations of these two pipelines. Later other fields have used MCP-01 as an entry point for their gas transportation to the St Fergus Gas Terminal.

Under the Frigg Treaty the MCP-01 platform forms part of the "UK Pipeline" and the "Norwegian Pipeline" as an "associated installation(s) serving [the] pipeline on an intermediate platform…". **The DTI and the MPE have therefore agreed to a joint approach by the UK and Norway to the decommissioning of MCP-01 under the provision of the Frigg Treaty.**

As the pipeline systems will continue to be in use, the two pipelines which used to run through the bottom part of MCP-01, have been bypassed to allow the decommissioning work to commence. The 32" Frigg UK pipeline was rerouted during summer 2004. The bypass for the Vesterled pipeline was completed during summer 2005.

Figure 3.1 Manifold and Compression Platform MCP-01

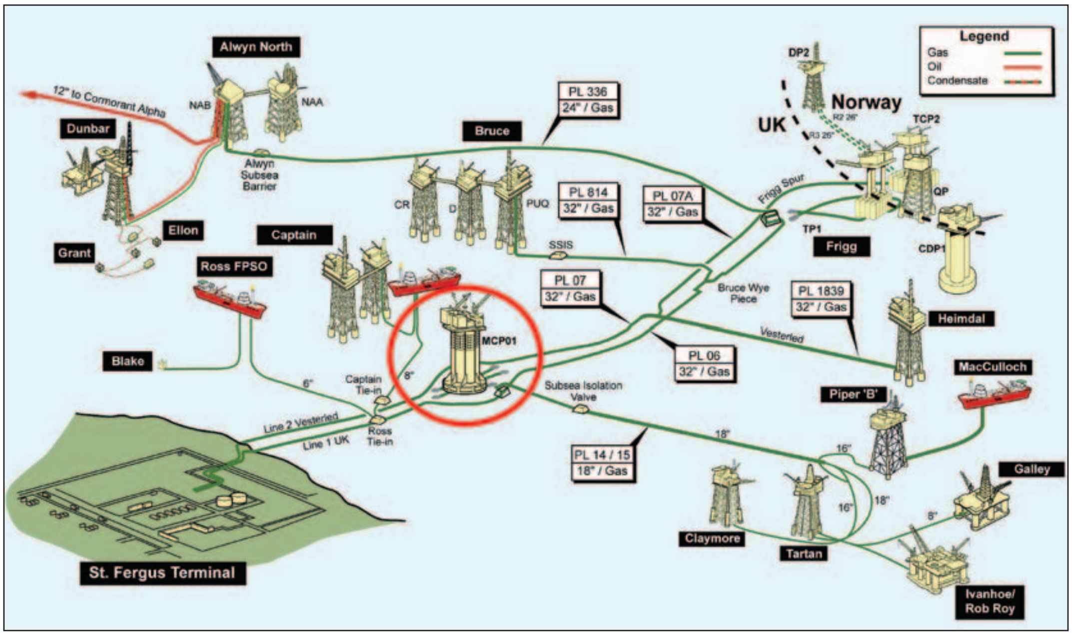


Figure 3.2 The original Frigg Transportation System between Frigg, MCP-01 and the St Fergus Gas Terminal in Scotland, illustrating the required bypass of the pipelines at MCP01 (in red circle)

The owners of the concrete substructure with its integrated concrete support frame are as follows:

• Total E&P UK PLC and Elf Exploration UK PLC (together "UK interest")	50%
• Gassled* ("Norwegian interest")	50%

Gassled consists of the following Norwegian companies:

1.	Petoro** AS (100% owned by the Norwegian State)	38.627%
2.	Statoil ASA	20.557%
3.	Norsk Hydro produksjon a.s	11.186%
4.	TOTAL E&P NORGE AS	8.672%
5.	ExxonMobil Exploration and Production Norway AS	5.179%
6.	Mobil Development Norway A/S	4.576%
7.	Norske Shell Pipelines AS	4.440%
8.	Norsea Gas A/S	3.045%
9.	Norske ConocoPhillips AS	2.030%
10.	Eni Norge AS	1.688%

* Operated by Gassco on behalf of Gassled

** Petoro AS is the licensee for the Norwegian State's direct participation share (State's Direct Financial Interest – SDFI)

3.2 MCP-01 Environment - Current Situation

3.2.1 Seabed

MCP-01 is situated on a sandy elevated mound/bank in 94m of water that covers an area of 1.2 x 2.0 km with surrounding muddy/clay areas commencing at 100m depth contour. The area of the seabed consists of 2-3 metres upper layer of brown medium sand with shell fragments. Underneath this upper layer (to about 30 metres) is a layer of fine grey sand interspersed with thin centrimetric levels of clayey silt and layers of organic matter. A few inter-bedded levels of gravel are also present.

MCP-01 is located at the edge of the Witch Ground Basin pockmarks area as shown in Figure 3.3. As the platform is situated on a sandy elevated mound/bank there is little or no evidence that would suggest that this would provide suitable conditions for the development of any significant pockmarks in the immediate vicinity of the MCP-01 platform. Site video survey conducted in 2000 also confirms that there are no visible pockmarks at the MCP-01 site and within 100m of the site. Figure 3.4 shows typical sandy seabed features 100m from the MCP-01 platform. Hence, from an EU Habitats Directive perspective, the apparent absence of Methane-derived Authigenic Carbonate (MDAC) and pockmarks in the vicinity of MCP-01 means that this is not an area of high sensitivity.

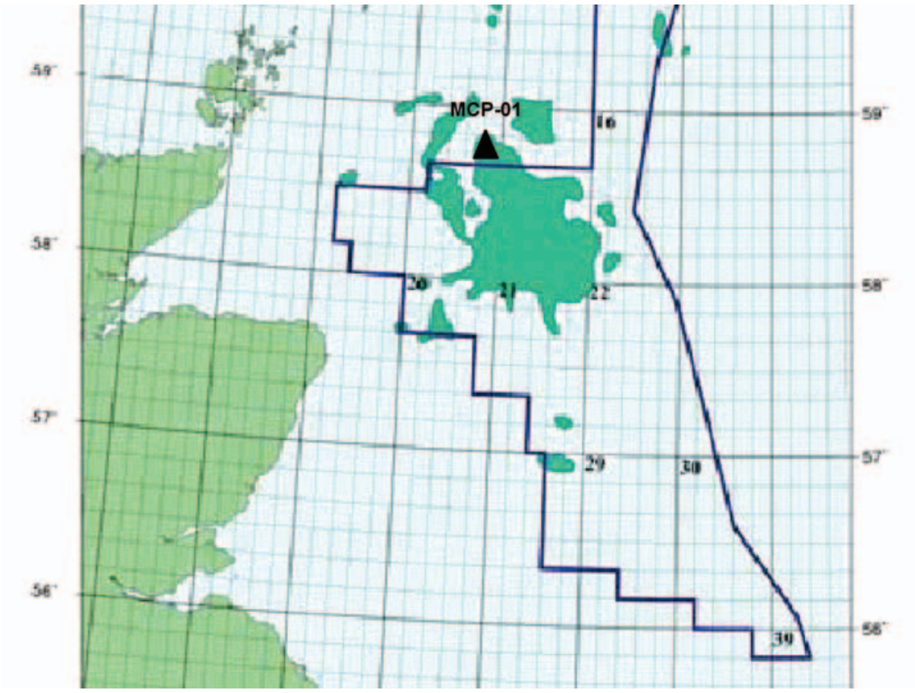


Figure 3.3 The distribution of pockmarks in the UK North Sea and the location of MCP-01

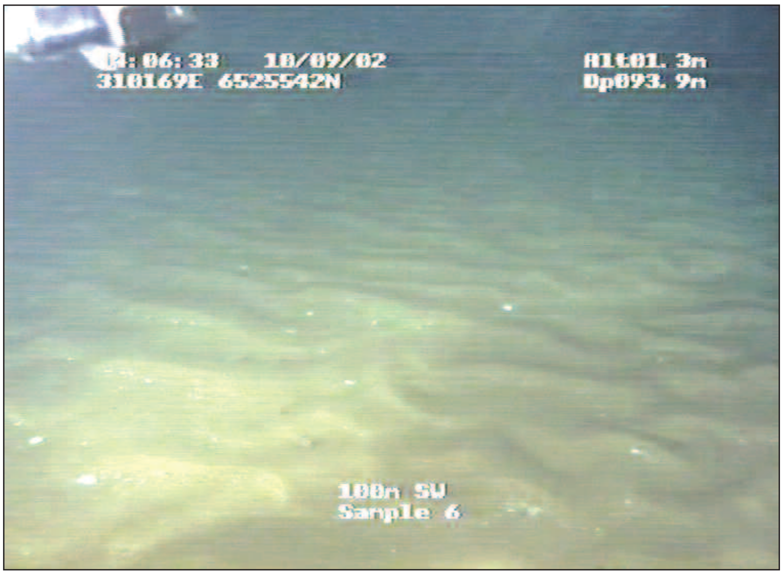


Figure 3.4 Sandy seabed from 93.9m depth 100 m SW of the MCP-01 platform.

Grab sediment and biota samples have been taken from a total of eight locations: 50 and 100m approximately to the northeast, northwest, southeast, and southwest of MCP-01. The samples were analysed for metals and hydrocarbon contents.

Many of the elements studied (barium (Ba), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), and nickel (Ni)) for the sediments around MCP-01 indicate comparable (or lower) levels than the mean Northern North Sea (NNS) reported background concentrations (1975-1995) and lower than EAC (Ecotoxicological Assessment Criteria)/BRC (Background Reference Concentrations) and mean levels of these elements reported for the OSPAR North Sea Quality Status Report 1993.

The total hydrocarbon concentrations for sediments around the platform at the 50m stations can be considered background in relation to the Northern North Sea and background levels quoted for the OSPAR Quality Status Report in 1993. A similar conclusion can be drawn when comparing the MCP-01 sediment aromatic concentrations against the OSPAR background/reference concentrations and the EAC.

Based on the monitoring results it can be concluded that the area around MCP-01, as a whole, can be classified as relatively undisturbed (i.e. Group A[1]).

3.2.2 Water Quality

The International Council for the Exploration of the Sea (ICES) and the Joint Monitoring Programme (JMP) Laboratories reviewed data on trace metals in the North Sea during 1985-1987. The conclusion from that programme was that there are low levels of cadmium (Cd), copper (Cu), lead (Pb) and mercury (Hg) in the central areas of the North Sea as compared to the southern areas.

Water column monitoring related to offshore activities has been undertaken in the region during the last few years. No signs of contamination have been reported, and no discharge of produced water or drill cuttings have taken place from MCP-01. As there are no significant point sources of organic material, nitrogen or phosphorous in the MCP-01 area, the level of nutrients in the water masses is at normal background level for this part of the North Sea.

In conclusion, the water quality in the MCP-01 area is considered to be good in relation to heavy metals, organic contaminants and nutrients level.

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[1] Relatively undisturbed communities, with low dominance (no species present in very high numbers) and a wide range of species from a variety of taxonomic groups, including molluscs, echinoderms and crustacea. Moderate species numbers and total abundance, high biomass.

3.2.3 Marine Fauna

This report contains a short summary description of the most relevant aspects.

Plankton

The majority of the plankton occurs in the top 20m of the sea, known as the photic zone (i.e the layer where light penetrates to allow photosynthesis). In the North Sea and in the water masses surrounding MCP-01, plankton blooms start during March/April. The phytoplankton cells utilise the light and suspended nutritious matter from the water, producing oxygen and food for zooplankton and fish stocks. During the summer months in the NNS the activity is low due to the stratification of water masses. This stratification of the water masses causes denser concentrations of plankton to accumulate in upper layers. The vertical position of the boundary between these layers in the water column can vary throughout the year and a second plankton bloom occurs when the water masses mix during the autumn (September-October).

Benthos

Benthic organisms would be vulnerable to mechanical and chemical disruption in the seabed environment, such as covering with sand/mud. The overall benthos concentrations at the MCP-01 site is considered to be low-medium when compared to the Northern North Sea values.

Marine Fouling

Marine growth samples were collected in September 2002 from eight locations on the concrete substructure: in the splash zone (5-10m), and at various depths (15-30 & 50m and below) on the east and west side of the structure. The findings show that marine growth on MCP-01 is abundant and the main species present are typical of fouling communities in clean inshore Scottish waters. In addition, the depth-related zonation pattern is similar to that expected on most vertical rock faces in open water at comparable depths.

Fish and Shellfish

The MCP-01 area provides habitat for haddock, saithe, whiting, sprat, Norway pout and *Nephrops*. This is supported by accounts from the Scottish Fishermen’s Federation (SFF) members, who have stated that the area in the immediate vicinity of MCP-01 provides habitat for commercial fish species such as cod and haddock, which are fished from the end of August to February.

Marine growth samples taken from MCP-01 have also been analysed for a suite of contaminants. Total hydrocarbon concentrations found in the tissue of the blue mussel (*Mytilus edulis*) samples indicate no marked difference between the zones sampled (i.e. splash zone to the deepest station at 50m). Measured levels of mercury and lead in the tissue samples are comparable to the background ranges.

MCP-01 platform is located on the edge of the Fladen Ground *Nephrops* habitat area which is the only major offshore *Nephrops* ground in Scottish waters. However, there is no evidence of *Nephrops* burrows during survey investigation so the sandy raised slope area of MCP-01 is not suitable as *Nephrops* habitat. The muddy clay areas surrounding the sandy mound may provide suitable habitat for *Nephrops*. However, it is noted that there are no reported *Nephrops* catches within the MCP-01 vicinity in the fisheries statistics.

Seabirds
The main species of seabirds that are present in the MCP-01 area include fulmar, guillemot, little auk and kittiwake. The density of different species varies throughout the year, as in other parts of the North Sea.

Marine Mammals
A wide range of cetaceans has been sighted in the North Sea, the most common being the harbour porpoise and white beaked dolphin. Minke whales have also been sighted in the vicinity of MCP-01 during the summer months.

Extensive information on the distribution of British grey seals at sea shows that although they do sporadically occur in the vicinity of the MCP-01, neither the grey seal nor the harbour seal populations as a whole spend significant time in the MCP-01 site-specific area.

3.2.4 Marine Activity around MCP-01

The shipping traffic within the Northern North Sea and the Central North Sea is relatively moderate with an average of between 1 and 2 vessels per day (568 vessels per annum) on one of 14 shipping routes passing through waters within 10nm of the MCP-01 site. Figure 3.5 shows the shipping activity in the immediate vicinity of the MCP-01 site. The North America - Rogaland route (#1 in Figure 3.5) passes within 2.2nm due south of MCP-01. There are no routes passing within 2nm of the site.

The majority of shipping traffic comprises merchant ships, supply vessels and tankers. Within the Central North Sea merchant vessels represent over 61% of the total number of vessels and 45% fall within the weight class 0-1499 dwt. The majority (60%) of the vessels entering the area within 10 nm of MCP-01 are in the 1500-5000 dwt categories. Most supply vessels originate in the Ports of Aberdeen or Peterhead and transect the region along the shipping lanes. Table 3.1 gives a summary of present shipping activities within 10nm of the MCP-01 area.

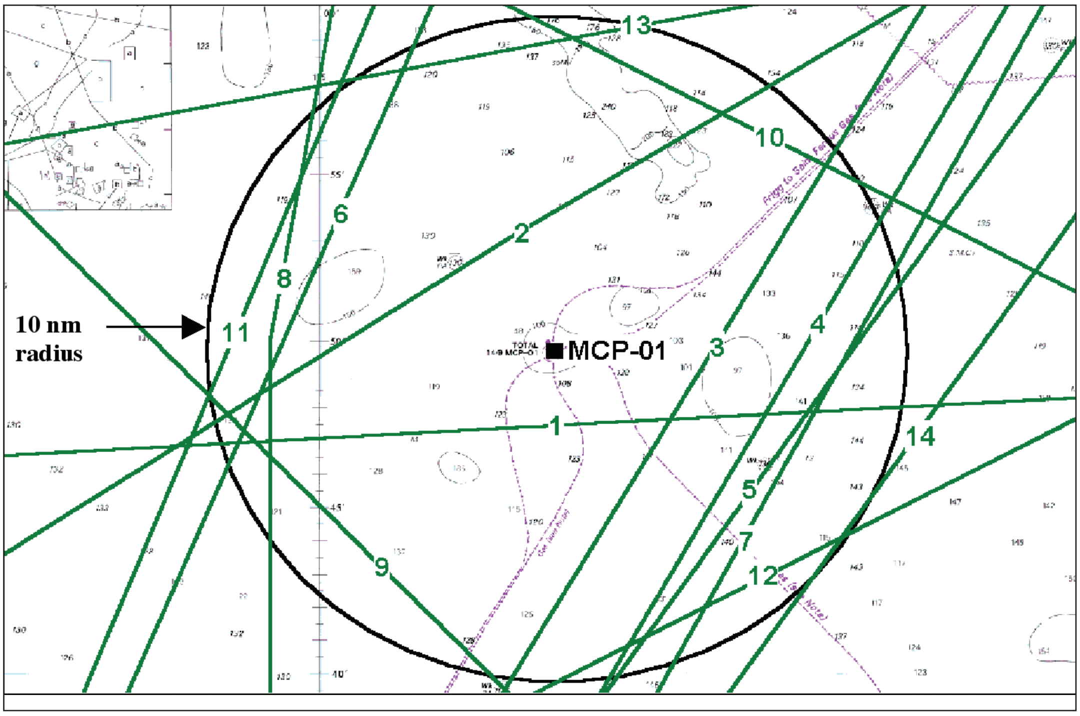


Figure 3.5 Shipping activities around the MCP-01 area

Route No.	Description	CPA (nm)	Bearing (°)	Ships per year	% of total
1	America North-Rogaland (W Norway)*	2.2	177	12	2%
2	Leadon-Moray Firth Shuttle*	3.6	327	16	3%
3	Aberdeen-N Norway/Russia*	3.8	121	68	12%
4	Tay-N Norway/Russia*	6.1	119	56	10%
5	Storfjorden-Peterhead	7.0	124	8	1%
6	NW Hutton-Aberdeen ASCo EoS	7.3	293	87	15%
7	N Norway/Russia-Forth*	7.5	118	40	7%
8	Dover Strait-Sullom Voe*	8.0	277	60	11%
9	Hamburg-Iceland	8.3	226	20	4%
10	Limfjorden (DK)-Iceland	8.4	28	8	1%
11	Thistle-Aberdeen ASCo EoS	8.7	292	85	15%
12	Moray Firth-Marstein (W Norway) *	8.9	152	48	8%
13	America North-Bømlafjorden (W Norway)*	9.1	349	48	8%
14	Aberdeen-Froysjøen*	9.9	125	12	2%
	TOTAL			**568**	**100%**

* *Where two or more routes have identical Closest Point of Approach (CPA) and bearing they have been grouped together. In this case, the description lists the sub-route with the most ships per year.*

Table 3.1 Shipping activities within 10nm of the MCP-01 area

3.2.5 Fisheries Activity

The North Sea is of international importance as a spawning, growth, and feeding area for many different fish species. The fishing activity in this area is high and total catches from the North Sea represent about 5% of the total world catch from fisheries.

Fisheries in the NNS can be split into three main groups:

- **Demersal trawling**: for bottom living species for direct consumption (mainly cod, haddock, whiting, crustacean and different species of flat fish);
- **Industrial trawling**: for Norway pout, sand eel, blue whiting and sprat;
- **Pelagic trawl with net gear**: which exploit species living in the water column (herring, horse mackerel and mackerel)

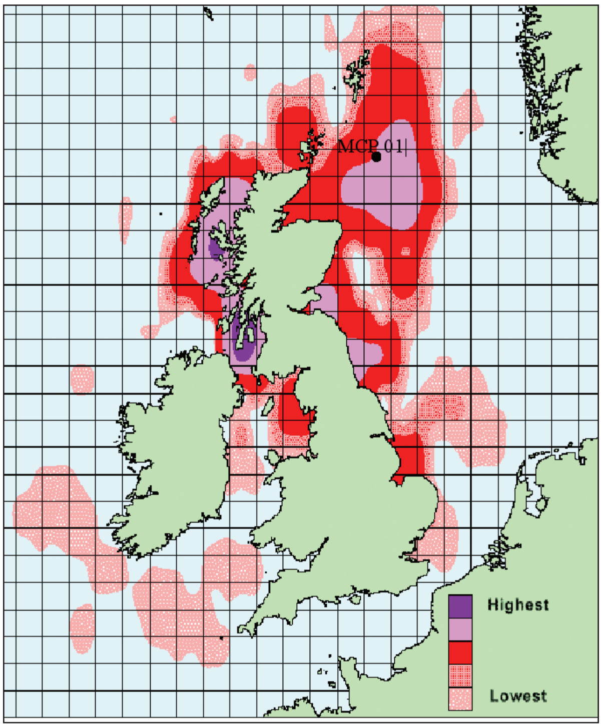
The northern part of the North Sea is an important living area for adult stages of many common fish species, especially cod, saith and herring. Because of high concentrations of commercially exploitable fish and crustacean species in these areas, both trawl and net fisheries are present in the ocean around MCP-01.

Otter and pair trawl accounts for most of the fishing effort in the northern North Sea. Beam trawls are rarely used. MCP-01 is located in one of the key areas of otter trawl effort. Scottish and Danish fishing vessels have the greatest fishing effort in this area, with some Norwegian fishing vessels.

The area in the vicinity of MCP-01 has a high relative value, as illustrated in Figure 3.6 with *Nephrops*, shrimps, and demersal species of the greatest importance. Landing volume tonnages indicates that the industrial fisheries by Danish trawlers dominate this area, targeting mainly Norway pout, but also blue whiting and sprat.

Demersal fishery operations are considerably mixed, but are dominated by Scottish vessels, which targets cod, haddock and whiting (see Figure 3.6). There are also herring and mackerel fishery operations in the area, targeted by Danish and Scottish vessels which are landed in Denmark and Scotland. Crustaceans fisheries are dominated by Scottish and Danish landings.

The Scottish vessels mostly target *Nephrops* (i.e. Norway lobster), while the Danish vessels target pink prawns. The size of the *Nephrops* catches compared to total landings for the Fladen Ground also indicates that the *Nephrops* fisheries in this area is of high importance.



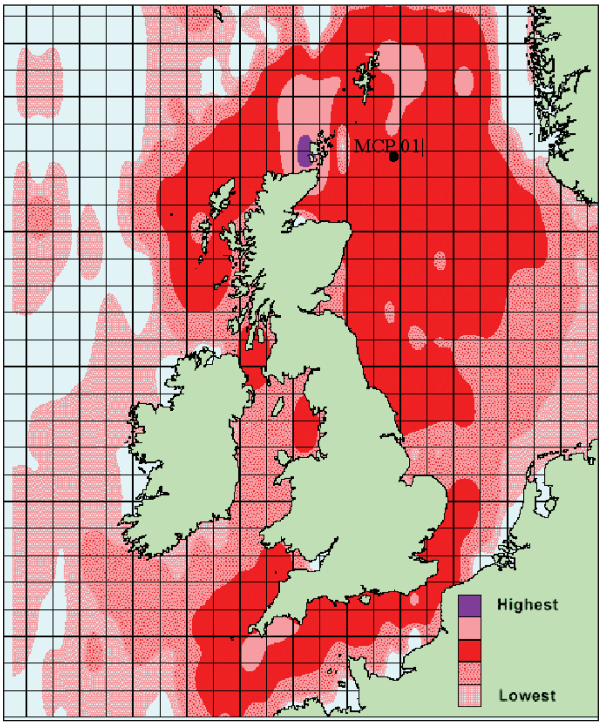


Figure 3.6 Fishery sensitivity maps in British Waters.
Top: Relative Value for (1996) for *Nephrops* and shrimps.
Bottom: Relative Value (1996) for demersal species

4. Description of Concrete Substructure

This section contains a brief description of the MCP-01 concrete substructure together with key data about its size and weight in Table 4.1. The concrete substructure was not designed for removal. The water depth at the location is 94m.

After the platform was installed in 1976, the compartments inside the external walls were filled with 173,000 tonnes of sand ballast to keep the platform stable on the seabed. The total weight of the concrete substructure including the ballast is 373,700 tonnes (see Table 4.1).

The substructure consists of a series of concentric cylindrical concrete walls of different heights connected together by the base slab and radial concrete walls. The main external walls extend from the base slab to about 11m above the water level. The upper 37m section of the external wall is perforated with about 1282 holes to reduce the wave forces on the substructure. Inside the external wall a central concrete shaft runs from the base slab to about 24m above the concrete deck beams.

The deck consist of a series of 4m deep reinforced concrete beams that are supported on the central concrete shaft and a series of concrete filled steel columns mounted on top of the main external wall. These concrete beams support the topside modules and equipment.

Scour mats were initially placed around the circumference of the base and overlay the soil adjacent to the base. These have been replaced by a band of rock dumped around the entire circumference to prevent scouring.

There are no drill cutting accumulations either inside the substructure or on the seabed near the platform. The concrete substructure has never been used for the storage of crude oil nor drilling operations.

The substructure has currently been in-place for approximately 30 years and no major structural damage has been reported on the substructure. However, it is likely that some deterioration of its condition has occurred during these years.

Table 4.1 gives the key data on the concrete substructure while Figure 4.1 illustrates both the substructure and the topside facilities on MCP-01. The topside facilities, weighing about 13,500 tonnes, will be removed for onshore disposal.

MCP-01	Dry Weight (tonnes)		Overall Dimensions		Comments
Concrete Substructure	Concrete	137,000	Height (top of central shaft)	146m	The concrete weight includes the weight of the integrated concrete support beams.
	Reinforcement steel	10,800	Diameter of base slab	101m	
	Concrete ballast	2,200	External wall diameter	62m	
	Ballast sand placed inside concrete substructure during construction	47,000			
	Ballast sand placed offshore	173,000			
	Marine growth (estimated)	2,600			
	Steelwork inside the external walls	1,000			
	Steelwork attached to the external walls	100			

Table 4.1 Key Platform Data for MCP-01 Concrete Substructure.

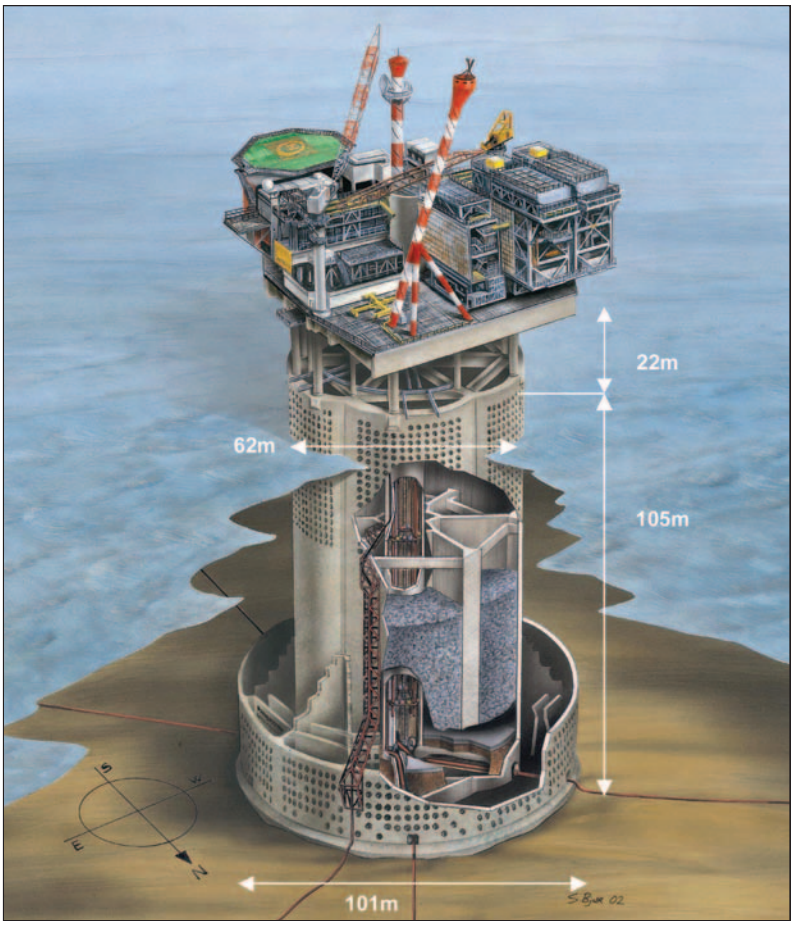


Figure 4.1 Manifold and Compression Platform No. 1 (MCP-01)

5. Assessment of Disposal Alternatives

5.1 The Assessment Process

5.1.1 Principles and Approach

A sequential assessment process has been followed in determining the disposal arrangements to be adopted for the MCP-01 concrete installation, when it reached the end of its operational life. The assessment process is based upon the “waste hierarchy” detailed below, which values reuse above recycling, and disposal onshore above disposal at sea.

- Evaluation of the possibility of reusing all or parts of the offshore facility either at the current location or at another site
- Evaluation of the possibility of recycling all, or parts, of the offshore facility
- Evaluation of the possibility of disposal onshore
- Evaluation of the possibility of disposal at sea

In accordance with the principle of the waste hierarchy the possible reuse potential of the concrete installation has been assessed as described in Section 5.3. In assessing the reuse potential of the facility, the technical feasibility has been assessed in the light of existing proven technology and financial viability, evaluated based upon current economics.

The general principle has been adopted that if reuse is not possible, either at the current location, or at another site, then as much of the equipment and materials as practicable will be recycled. This principle has been extensively applied throughout the Environmental Impact Assessment where account has been taken of the energy requirements and discharges during the recycling processes.

As the reuse of the MCP-01 facility at its current location has been shown not to be viable, the technical feasibility of refloating the concrete substructure has been studied. The implications in terms of feasibility, safety, impact on the environment and other users of the sea and cost have therefore been assessed. The general principle adopted has been that, if possible, within currently used acceptance criteria, all facilities shall be returned to shore where they may be reused, recycled or disposed of in the most effective manner. These studies and assessments for on-land disposal are described in Section 5.4.

The possibility of disposing of the concrete substructure at-sea has also been considered. The alternatives considered have included refloating and sinking at a deep water disposal site, cutting the substructure down to provide a clear shipping draft of 55m, or leaving the substructure in place on location. Consideration of these disposal alternatives is provided in Section 5.5.

The assessments provided have been undertaken in accordance with the requirements set out in “OSPAR Decision 98/3 on the Disposal of Disused Offshore Installations”. In particular the content and structure of the assessment has been based upon Annex 2 of OSPAR Decision 98/3 entitled “Framework for the Assessment of Proposals for the Disposal At Sea of Disused Offshore Installations”.

The alternative disposal arrangements for the concrete substructure have been fully studied but, in the following subsections, the main emphasis has been given to an assessment of the on-land disposal alternative and the leave in place alternative.

5.1.2 Methodology

Development of Method Statements

Doris Engineering, the company involved in the original design and construction of MCP-01 in the 1970s, was engaged to conduct the initial engineering and feasibility studies for the disposal of the concrete substructure in 2003.

The main objective of the studies was to assess the feasibility of refloating the substructure. Different methods were considered and a recommended methodology was proposed by Doris Engineering based upon a number of engineering evaluations. The recommended methodology was described in the form of a general procedure or “method statement”, which was reviewed to identify risks to personnel engaged in the disposal activities. The method statement was then modified as necessary, to reduce or eliminate unacceptable risks. Scandpower, working together with Doris Engineering, undertook the qualitative safety assessments using “SAFOP” (Safe Operation) techniques.

Whilst developing the method statements, new or innovative activities or operations that were beyond current experience were identified. The feasibility of these activities was assessed and the need for programmes to develop the necessary technology was highlighted.

In parallel, Doris Engineering assessed the feasibility of other disposal options and prepared method statements for each, which described the proposed method of undertaking the work.

Studies undertaken for its sister platform CDP1 in the Frigg Field, operated by another affiliate in the TOTAL Group (TOTAL E&P NORGE AS), have to some extent been used as a reference point. However, as these two concrete substructures have different functions and histories, it has been important to address the specific challenges arising in the removal of MCP-01 on its own merits. Doris Engineering was at the very beginning instructed to consider MCP-01 concrete substructure as a new platform, but take on board the past experience from the previous extensive studies performed on the concrete substructure on the Frigg Field.

The method statements and engineering studies were reviewed and validated by a group of independent experts including representatives from SINTEF, Norwegian Geotechnical Institute, Noble Denton, Munich University and Det Norske Veritas.

Assessment Parameters

In assessing alternative disposal arrangements for the MCP-01 concrete substructure the following aspects have been evaluated and considered:

- Technical Feasibility
- Risk to Personnel
- Environmental Impact
- Cost
- Public Consultation

In this context "Environmental Impact" includes impacts for users of sea and society as well as impacts on the natural environment.

Figure 5.1 gives an overview of the various studies that form part of the overall assessment for the concrete substructure.

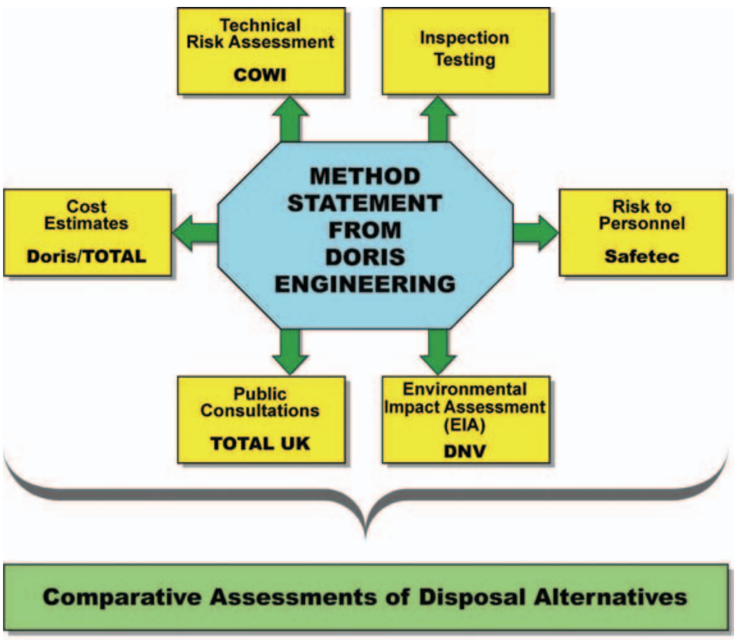


Figure 5.1 Assessment Process for Refloat and On-Land Disposal Alternative

Technical Feasibility

The technical feasibility of a disposal arrangement has been judged based upon knowledge of existing equipment and practices, although in some instances the possible extension of existing technology has been included, where this is reasonably foreseeable. In such situations the implication of being unable to develop and test the necessary technology prior to use, has been assessed. Leading independent experts in many different fields have been consulted to provide input to the studies and verify the conclusions. A major factor in assessing technical feasibility has been the level of uncertainty associated with the activities to be undertaken. This uncertainty particularly arises due to insufficient knowledge as to the exact structural condition of the installation and the behaviour of the structure under the load conditions arising during decommissioning activities. Again, specialist input has been obtained from independent experts in the relevant fields to allow verification of the results produced and the conclusions reached.

Using the method statements developed by Doris Engineering, the technical feasibility of the disposal alternatives has been analysed by the Danish consulting engineers COWI. The risk of being unable to complete the disposal work as planned due to major accidents or incidents was estimated in quantitative terms using state of the art methods. Independent experts from Norway, UK, Germany, Switzerland and France were used to provide specialist input to this technical risk analysis.

Both the probability and the consequences of major accidents or incidents during the planned disposal activities were estimated. The implication of these “worst case” scenarios has been an important factor in the decision making process.

For a number of years the TOTAL Group has used criteria to limit the risk of asset loss arising from differing levels of damage to offshore platforms. These risk acceptance criteria have been adopted as the basis for determining the acceptability of technical risk during the decommissioning of the MCP-01 facility.

Based upon these criteria, the maximum acceptable probability of a major accident during the decommissioning operations has been set as 1 x 10^{-3} (1 in 1000).

This figure is in-line with the guidance contained in Part 1 of the “Rules for Planning and Execution of Marine Operations” published by Det Norske Veritas in January 1996. In these rules DNV state that it was not possible to set a definitive acceptable risk level for marine operations at that time, due to the scarcity of data. DNV further state that they will seek further data and that **“A probability of total loss equal to or better than 1/1000 per operation will then be aimed at.”** These same rules indicate that during marine operations a probability of structural failure ten times less than this (that is 1 in 10,000) should be aimed at. These risk acceptance criteria would be used if TOTAL E&P UK were to install a new platform at the present time. In fact, risk levels considerably lower would be sought in accordance with the general risk acceptance principles defined in TOTAL Group standards.

When MCP-01 was installed in 1976 quantitative risk analysis was not in general use and the necessary computational methods and tools were not available to allow a full quantitative assessment of the risks during the installation process. It is therefore not possible to directly compare the risks during the decommissioning phase with those experienced during installation.

Risk to Personnel

Both qualitative and quantitative assessments of the risks to personnel engaged in the removal and disposal operations have been carried out. Current practice has been a major factor in the qualitative assessments together with the expert judgement and experience of many of the personnel who were engaged in the initial design, fabrication and installation of offshore concrete installations. Practicable risk reducing measures, identified during the qualitative risk assessment, have been included into the planned activity arrangements.

Quantitative estimates of the risks to personnel have been made based upon the number of man-hours involved for the various tasks and the risk for each task, estimated from both offshore and onshore construction or deconstruction experience. This method is regarded as the best available at the present time but has a tendency to **underestimate the risk to personnel** due to the fact that hazards which are specific to the actual work are not fully included. The degree of underestimation of risk is not possible to quantify, but experts in this field judge that in some situations the actual risk may be up to double the risk estimated solely on the basis of generic historical data.

In common with risk analysis practice, the risk to personnel has been expressed in terms of the statistically predicted number of fatalities (Potential Loss of Life or PLL[2]) or major injuries (Potential Major Injuries or PMI[3]) have been estimated. Both values are determined based upon the anticipated decommissioning work and historical accident statistics.

The physical significance of PLL and PMI is somewhat difficult to appreciate, particularly when expressing a fatality or injury level less than 1. Accordingly, **the probability** or “likelihood” of a fatality occurring during the work scope in question has also been calculated, and is presented in percentage terms (such as a 13% chance of a fatality).

The risk of fatality for any individual shall not be greater than **1×10^{-3} per year** (1 in 1000) and **shall be as low as reasonably practicable**. This criterion is in accordance with generally accepted principles applied throughout industry, supported by the UK Health and Safety Executive, and is the individual risk limit stated in the TOTAL E&P UK’s management procedure. The risk of 1 in 1000 is the highest risk that is permissible for an individual and, in practice, a personnel risk level considerably lower than this is sought for all operations in accordance with the principle that risks should be as low as reasonably practical.

The Fatal Accident Rate (FAR[4]) for a particular activity or set of activities is also presented. FAR values are commonly used to express the risk associated with particular activities such as construction work, scaffolding, helicopter flying etc. Fatal Accident Rates are also widely used as a way of comparing the risk of different types of activity. They are also sometimes used to express the “average“ risk for an operation which includes many different activities, of differing durations, each having different numbers of participants. When used in this way FAR values only give a general indication of the “average” risk. This can be helpful in making relative comparisons between different options, but is not appropriate to use as an absolute decision making criterion.

2 Potential Loss of Life (PLL) is the number of fatalities that are “likely” to occur whilst undertaking a defined amount of work.
3 Potential Major Injuries (PMI) is the number of major injuries that are “likely” to occur whilst undertaking a defined amount of work.
4 Fatal Accident Rate (FAR) is the number of fatalities that are “likely” to occur whilst undertaking 100 million hours of a particul ar activity.

The average yearly risk of fatality for any person may be expressed in an alternative form as a Fatal Accident Rate (FAR). The FAR is calculated from the average yearly risk based upon the number of manhours worked by an individual in a year. For a "normal" offshore worker on the UK Continental Shelf who spends approximately 4300 hours a year offshore, an average yearly risk of fatality of 1 in 1000 is equivalent to a yearly average FAR value of 22.9. This is **the highest risk to an individual that can be tolerated and a risk considerably less than this must be sought.**

Environmental Impact

The impact of the disposal operations on the environment and society has been estimated using generally accepted methods and principles. The Environmental Impact Assessment has been carried out by Det Norske Veritas (DNV). The Environmental Impact Assessment Report has been peer reviewed by an independent expert.

The purpose of the Environmental Impact Assessment is to:

- Present information about possible impacts in a manner that can assist in the evaluation of the disposal alternatives.
- Clarify the consequences of the relevant disposal alternatives for the MCP-01 facility that may have a significant impact on the environment, natural resources and society.
- Present proposals for mitigating any damage and nuisance caused by the chosen disposal alternatives.

The parameters studied in the environmental impact assessment fall generally into two main categories as listed below.

Environmental Impacts

- Energy consumption
- Releases (emissions) to atmosphere
- Releases (discharges) to sea, water, or ground
- Physical impact on the environment (includes marine noise)
- Aesthetic impact: noise, odour, visual effects
- Waste/resources management
- Littering
- Risk to the environment from unplanned events

Social / Community Impacts

- Fisheries
- Free passage at sea
- Costs and national supplies
- Employment effects

Some environmental impacts can be quantified, but where this has not been possible, qualitative assessments have been used, based on principles set out in the Norwegian Oil Industry Association's (OLF) Handbook for Decommissioning Environmental Impact Assessments, as illustrated in Figure 5.2. These assessments are documented in "Impact Assessment Forms" as shown on Table 5.1 per aspect assessed to allow for transparency in evaluations made and priorities given.

The assessment distinguishes the important impacts from those that are less important. This is done by considering the effect of an impact in the area in which it is occurring ("value" or "sensitivity"), combined with the scope of the effect, to arrive at the total impact. By using this method the same magnitude of effect may then give different impacts depending on the value or sensitivity of the impacted environmental component. Additionally, the same type of effect will give a different impact depending on the sensitivity of the recipient/environment. The assessment of the non-quantifiable impacts is marked with quotation marks in this report, e.g. “small negative”.

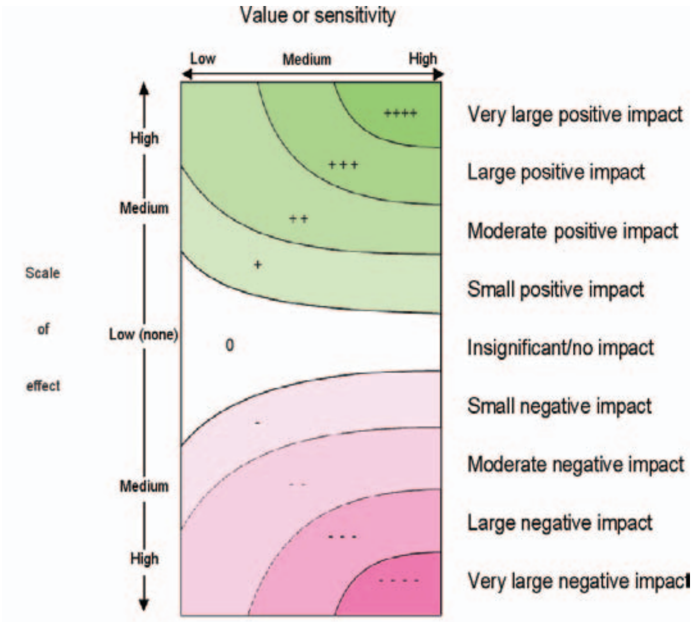


Figure 5.2 Methodology for Assessment of Non-Quantifiable Impacts.

Category: (e.g. Environmental, Fisheries, or Society issue) **Consequence evaluation for: (aspect)**	
1. General description of the area (situation and characteristics)	
Describe the basis for evaluating value or sensitivity of an area. What are the facts, literature sources or statements this is based upon. Indicate further factors considered more important than other arriving at this conclusion. Small Medium Large Evaluation of the value: |----------|----------| X	
2. Description of the extent of effect	**3. Total (environmental) impact**
Describe the scientific information and data the assessment is based on. Describe further how it is interpreted in this context, etc. What has been given highest priority, and why? This also includes an assessment of spatial and temporal effects. Document the reasons for effect rating Evaluation of extent: Very neg. Medium neg. Little/no Medium pos. Very pos. |--------------|----------------|---------------|------------------| X	Combine 1) and 2) in the impact matrix (see Figure 5.2) The total impact can then be identified, and stated here.

Table 5.1 Example of Impact Assessment Form

Cost

The cost estimate is based upon studies performed by several different contractors both in Norway and UK, using appropriate North Sea rates and the principles used for the Frigg Field concrete substructures verified by personnel within the TOTAL Group. The costs are expressed in year 2004 money terms and represents a 50/50 estimate reflecting the high uncertainties identified in the risk assessment.

Possible increases in the cost of the works have also been estimated based upon the technical uncertainties associated with the disposal alternatives.

5.2 Public Consultation

The public consultation process for MCP-01 decommissioning has ensured that interested parties are consulted on how the consultation process itself is conducted as well as issues relating to MCP-01. Dialogue is tailored to each of the stakeholders who have committed to participating in the process and includes e-mails and letters, fact sheets, face-to-face meetings, and when appropriate round-table discussions at key milestones. General information and consultation documents are published on the TOTAL Corporate web site for the UK: www.uk.total.com/activities/ep_sf_mcp01_03.htm

TOTAL E&P UK began planning for the early decommissioning of MCP-01 in 2002 and had the first contact during Spring 2003 involving the main stakeholders in the UK and Norway.

The consultation process has been similar in both countries whilst respecting the particular national regulations. In addition to the statutory consultations required by both the UK and Norwegian Governments, efforts have been made by TOTAL E&P UK to identify, and involve, a wide range of stakeholders who have an interest in the decommissioning of MCP01.

Efforts have been made to ensure that the consultation and dialogue process is open and transparent. Feedback received from stakeholders has been greatly appreciated and has influenced the studies and assessments undertaken and the drafting of the MCP-01 Decommissioning Programme.

To date, the main stakeholder consultation activities have been:

- Informed the main stakeholder groups in March/April 2003 that TOTAL E&P UK was considering the decommissioning of the MCP-01 facility.
- A public announcement was placed in UK national, regional and specific interest publications in January 2004 to ensure that a wide group of stakeholders were made aware that the consultation around MCP-01 had begun and inviting them to participate in the process.
- Letters with an information pack were sent out in January 2004 to the UK statutory stakeholders and interested parties inviting them to participate in the decommissioning of MCP-01. A reply form was included to ascertain the stake holders' level of interest so that contact could be made at a latter date.
- Interested Stakeholders were invited to comment on the MCP-01 proposed scope of work for the Environmental Impact Assessment in January 2004.
- Key stakeholders groups were invited to an informal round table discussion of MCP-01 decommissioning issues in May 2004.
- Statutory public consultation of the MCP-01 Decommissioning Programme from 9 March 2005 to 25 April 2005.

A video animation has been prepared to illustrate the uncertainties associated with attempting to refloat, or cut down the concrete substructure. This video is being used during discussions with stakeholders to explain and show the problems involved.

A copy of the MCP-01 Decommissioning Programme was sent to each statutory consultee and to a wider group of interested parties. Other stakeholders were notified that the Decommissioning Programme had been issued and that it was available either on the web site or from the offices of TOTAL E&P UK, and Public Notices advertising this fact were placed in the UK national press.

During the 45 days statutory consultation period the main groups of stakeholders were contacted and meetings held when requested to discuss and explain the reasoning in the Decommissioning Programme. The written responses received from both the statutory consultees and other interested parties have been summarised and, together with the comments from TOTAL E&P UK, are included in the Third Draft of the MCP-01 Decommissioning Programme.

5.3 Reuse Potential

Throughout its operating life MCP-01 has functioned as a pipeline export centre for the Frigg Transportation system and the gas arriving from the Piper/Tartan area. Extensive studies during the past years addressing technical and safety aspects of the present use of MCP-01 concluded that the overall best option was to initiate plans for decommissioning the platform. Its function as a pipeline export centre therefore ceased when the pipelines were rerouted in 2004 and 2005 as described in Section 3.1.

Some of the possible reuse alternatives considered are summarised in this section.

5.3.1 Reuse as a Treatment Centre for Adjacent Fields

At present there are no known reservoirs in the vicinity that can be economically developed from MCP-01. In addition, the prospect for new developments in the area is limited.

Possible reuse as a treatment centre for adjacent fields would require completely new topside facilities. The fact that MCP-01 has never been used as a drilling or treatment platform also limits the reuse options. Its sole function during its entire operational life has been to facilitate gas transport through the two 32” pipelines to the St Fergus Gas Terminal.

It is therefore concluded that reuse of MCP-01 for oil and gas activities at its current location is neither likely nor economically viable.

5.3.2 Possible Non Oil and Gas Reuse in Place

No specific studies have been initiated as part of the decommissioning studies for MCP-01 as they would duplicate the extensive studies carried out for the three Frigg Field concrete substructures. In this section the main conclusion from these studies are summarised since they are also valid for MCP-01.

The following non oil and gas reuse alternatives were specifically evaluated:

- Artificial Reefs
- Wind-generators
- Emission-Free Gas Fired Power Plants

Artificial Reef

The establishment of an artificial reef utilising a concrete substructure is not considered to be a favourable option. This is mainly due to the fact that large concrete surfaces do not generate a reef effect in the same way as a steel substructure would. It is concluded that the use of the MCP-01 substructure as an artificial reef is not a desirable reuse alternative.

Wind-generators

Studies performed for the Frigg Field using the concrete substructures as a foundation for wind-generators, have shown that it is technically feasible to supply power from wind-generators to a nearby platform via subsea cables. However, the economic viability of offshore electricity generation based on wind-power systems depends upon its cost relative to electricity generation based on the combustion of hydrocarbons. The price of electricity generated by offshore wind power systems so far from shore has been estimated to be considerably higher than the cost of electricity generated from hydrocarbons.

It is therefore judged that electricity generated offshore from only one wind-generator placed on MCP-01 would not be competitive in the energy market, even if the cost of production could be significantly reduced. The cost uncertainties associated with the conversion and maintenance of the aging MCP-01 facilities and its logistical support, also mitigate strongly against using MCP-01 as support for one wind-generator.

It should also be noted that any potential consumer of wind generated electrical power would need to install and maintain a back-up source of power for times when there is insufficient wind to meet the required power demand.

The reuse of MCP-01 as a foundation for an offshore wind-generator is therefore judged not to be viable at the present time.

Emission-Free Gas-Power Plant

The installation of an emission-free gas-fired power plant on MCP-01 has been assessed based upon the studies performed for the Frigg Field Cessation Plan. Here it is assumed that the electricity generated would be exported to other platforms in the area by subsea cable. The gas (CO_2/Nitrogen) from the power generation process would be exported, via pipelines, to fields in the area for use in reservoir pressure support and enhanced oil recovery.

Although the reuse of a concrete platform as an electric power plant is considered technically feasible in principle, it was concluded that such an option should not be pursued further. There are a number of technical uncertainties surrounding the concept as it is still only at the pilot-scheme stage. Although the cost figures are still somewhat uncertain it seems likely that there would not be a market for the electricity and gas at the price necessary to ensure commercial viability. This conclusion is valid even ignoring the cost of additional back-up power supplies that may be required by the electricity consumer. There will also be a significant financial risk associated with the continuing maintenance and logistical support of the aging structure. Although the concept is emission-free, large quantities of high-temperature cooling water would be discharged into the sea. There is no practical possibility of recovering and using this energy and thus the energy balance for such a scheme is not environmentally attractive.

The reuse of MCP-01 as an emission free gas power plant is therefore judged not viable at present.

5.3.3 Possible Reuse at Another Location

A general assessment of the potential reuse opportunities has been carried out and possible scenarios established. One option, that could provide added value to society, is to use the concrete substructure as bridge foundations for fjord crossings. Such a use has the potential to provide cost savings on the bridge construction cost. The concrete substructure could also be incorporated into some form of quay foundation or be used as landfill for industrial purposes.

The feasibility of such schemes does, however, depend entirely upon the ability to safely re-float the substructure, which was not designed specifically for removal at a future date. The studies indicate that the risk of a major accident or incident occurring during an attempted refloating operation is high. There would also be risks associated with towing to a new location and installation which are not possible to quantify at present.

5.4 On-land Disposal

In the absence of any viable reuse for the MCP-01 concrete substructure, studies have been carried out to consider the feasibility of refloating the installation to shore for deconstruction and recycling the materials.

When assessing the on-land disposal alternative, the technical feasibility, risk to personnel, environmental impact and cost aspects have been carefully assessed and the results are summarised in this section. The views expressed by the stakeholders during the consultation process have also been assessed.

5.4.1 Proposed Method

The sequence of operations for refloating the MCP-01 substructure would be:

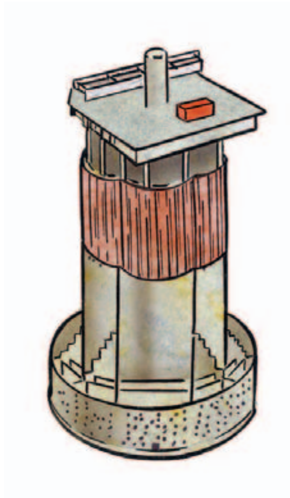
Offshore Preparations

- Remove the topside facilities.
- Plug and disconnect the pipelines
- Install water de-ballasting system.

Summer period one year before planned removal

- Remove up to half of the solid ballast (non-contaminated sand and gravel) between the central shaft and the outer wall using a suction dredging system working from the concrete deck beams. The sand and gravel ballast would be removed and deposited on the seabed a short distance from the platform.

Summer period for planned removal



- Remove the remaining ballast which is also deposited on the seabed.
- Remove debris inside the foundation raft.
- Seal the wave-breaking holes in the outer wall by installing a prefabricated steel cofferdam, made up of six separate sections, around the external face of the wall.
- Reinstate towing points on the substructure.
- Pump water out of the substructure until structure lifts off the seabed. Studies indicate that there is likely to be limited "suction" between the substructure and the soil, although it is possible that the buoyancy forces may not be sufficient to free the substructure from the seabed.
- Continue pumping water out of the substructure until it is floating at its towing draft.
- Tow to inshore location and remove any remaining topside steelwork and the concrete deck beams.
- Remove steel cofferdam and deconstruct the concrete substructure.
- Install a temporary cofferdam around the lower section of the substructure and then tow it into a dry dock and complete the deconstruction.
- All the sections of reinforced/prestressed concrete cut from the substructure would be crushed onshore to allow recovery of the steel and concrete. The steel would then be sent for re-smelting whilst it is anticipated that the crushed concrete would be reused or disposed of in landfill.

5.4.2 Technical Feasibility

During the design of the MCP-01 concrete substructure, no consideration was given to its removal at a later date. Accordingly the ability of the structure to resist the loads during a refloat operation was not checked and no specific features were incorporated into the design to facilitate removal.

It has been estimated that the chance of a major accident or incident during the refloat, towing and deconstruction operations is six hundred times higher than the acceptance criterion for marine operations.

In assessing the technical feasibility of refloating the MCP-01 concrete substructure, a number of aspects have been identified that would be critical to the success of the operation. The most important aspects, which have the potential to cause the refloat operation to be aborted, are shown in diagrammatic form in Figure 5.3 and are explained further in the following text.

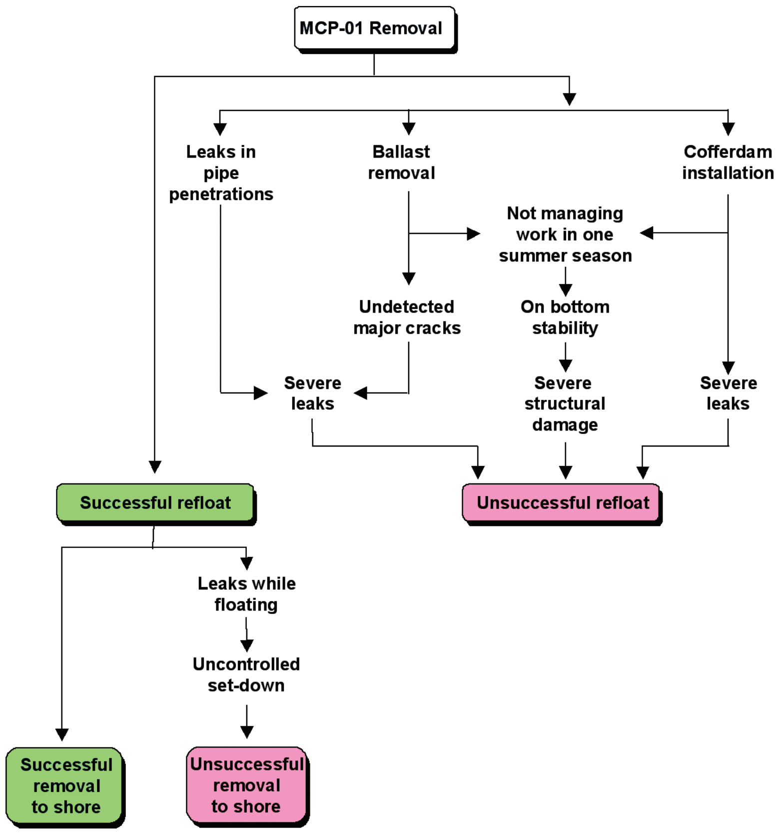


Figure 5.3 Areas of Uncertainty Affecting the Success of the Refloat and Towing of MCP-01

Not Managing Work in one Summer Season

The main reason for the very high probability of not being able to refloat the substructure as planned is the likelihood that it will not be possible to undertake all the required tasks in one season and that consequently the structure will be damaged during the winter that follows.

The design of the structure is such that the concrete substructure cannot be left over a winter period with less than half the solid ballast in place without risk of serious damage occurring. Indeed even with half the ballast left in place the substructure will be overloaded when exposed to common winter storms. Once a few steel cofferdams have been installed, the wave forces on the substructure will increase significantly and similarly it is not possible to leave the substructure over a winter period without the risk of serious damage to the structure. Installing the cofferdams before removing the sand ballast would introduce additional technical uncertainties and an increased risk of not being able to complete the work as planned.

It is therefore necessary to remove at least half the solid ballast (if not more), install the six cofferdams, commission all the necessary deballasting and control systems, test the water tightness, refloat the substructure and tow to an inshore location within one summer season.

No major concerns as to the technical feasibility of the sand ballast removal have been identified, although there is a possibility that compression of the material over the last 30 years will result in the task taking longer than planned.

Each of the six cofferdams is a very large steel panel (cofferdams) which will be prefabricated onshore and transported to the offshore site by a barge. Each cofferdam will then be lifted off the barge using a floating crane and positioned over the holes in one of the lobes of the external wall. The offshore installation of such large panels can only be undertaken in extremely calm weather conditions and the platform designer Doris Engineering have determined that a 72 hour weather window with a significant wave height of 1m or less is necessary for the installation of each of the cofferdams. In addition to these critical operations there will be extensive diving and other subsea operations with similar severe weather limitations.

The possibility of delays in removing the sand ballast, installing the steel cofferdams, and testing the water tightness of the substructure has been estimated based upon detailed analysis of the tasks to be performed and the likely weather conditions at MCP-01. The probability of having the requisite periods of very good weather during the summer working season has been evaluated based upon predictions of a specialist environmental consultant. Based upon these analyses it is has been determined that there is a very high probability of not being able to carry out all the operations necessary to complete the refloat operation within one summer season.

Thus, it is highly likely that the substructure would have to remain in place throughout the winter period in a deballasted condition with the cofferdams installed. In that condition it is virtually certain to sustain significant damage during the winter storms due to a combination of sliding and rotational instability. The redistribution of stresses arising from this movement of the substructure would lead to extensive cracking of the base slab and the radial and external walls. If the platform stands through a winter period in an un-ballasted condition with the cofferdams in place it is highly likely that the water tightness of the structure will be impaired and it will therefore be impossible to refloat the substructure in the following season.

The time necessary to locate, investigate, design and execute the repair, possibly carry out grouting, injection etc., which needs to set, virtually ensures that any leakage will cause severe delays.

Analysis undertaken has identified that the weather limitations for the installation of the steel cofferdams are responsible for the greatest delay. In order to assess the sensitivity of the analysis results to the weather limitations on the installation of the cofferdams, the analysis was re-run using the assumption that it would perhaps be possible to install each of the cofferdams in a 72 hour weather window with seas having a significant wave height (Hs) up to 2m rather than the requirement for waves less than 1m Hs as specified by Doris Engineering. It must be stressed that it is by no way certain that an installation procedure for the cofferdams can be developed to allow their deployment in seas with a significant wave height of 2m. Notwithstanding this consideration, the analysis indicated that the probability of being unable to complete the removal work as planned is reduced to 7% if the cofferdams could be installed in sea states up to a significant wave height of 2m, which is seventy times greater than the acceptance criterion.

A further sensitivity analysis was undertaken in which the effect of delays due to weather constraints was ignored, in effect, assuming that the significant wave height was less than 1m throughout the year. It is appreciated that this is unrealistic but, by eliminating the weather constraints, an indication of the inherent probability of mission failure is obtained although this is only of theoretical interest. When the weather constraints were removed from the analysis, the probability of being unable to complete the removal work as planned was estimated to be in the order of 3%, which is thirty times greater than the acceptance criterion.

Figure 5.4 shows the estimated probability of being unable to refloat MCP-01 depending upon the limiting sea states for critical marine operations (orange area).

The corresponding values for Frigg CDP1 (sister platform to MCP-01) are shown in the blue line in Figure 5.4. The higher probabilities of mission failure for CDP1 are mainly due to structural and leak uncertainties arising from the fact that 24 conductor holes were drilled through the base slab, and due to structural damage to the external diaphragm walls which occurred due to insufficient sand ballast in the early years of operation.

In the Frigg Field Cessation Plan the probability of mission failure for CDP1 was estimated to be in the order of 30%. The higher probability of mission failure for MCP-01 (60%), as presented in the MCP-01 Decommissioning Programme, is due to the fact that the effect of delays due to weather constraints was not fully accounted for in the CDP1 evaluations. This is illustrated on Figure 5.4, where the probabilities of being unable to refloat the two concrete substructures (referred to as mission failure) are shown, depending on the sea states that limit certain critical marine operations. This shows that the higher the permissible wave height the lower the risk as there is a potentially greater period of time when decommissioning activities can be carried out. The probability of mission failure when sea state limitations are ignored is also shown.

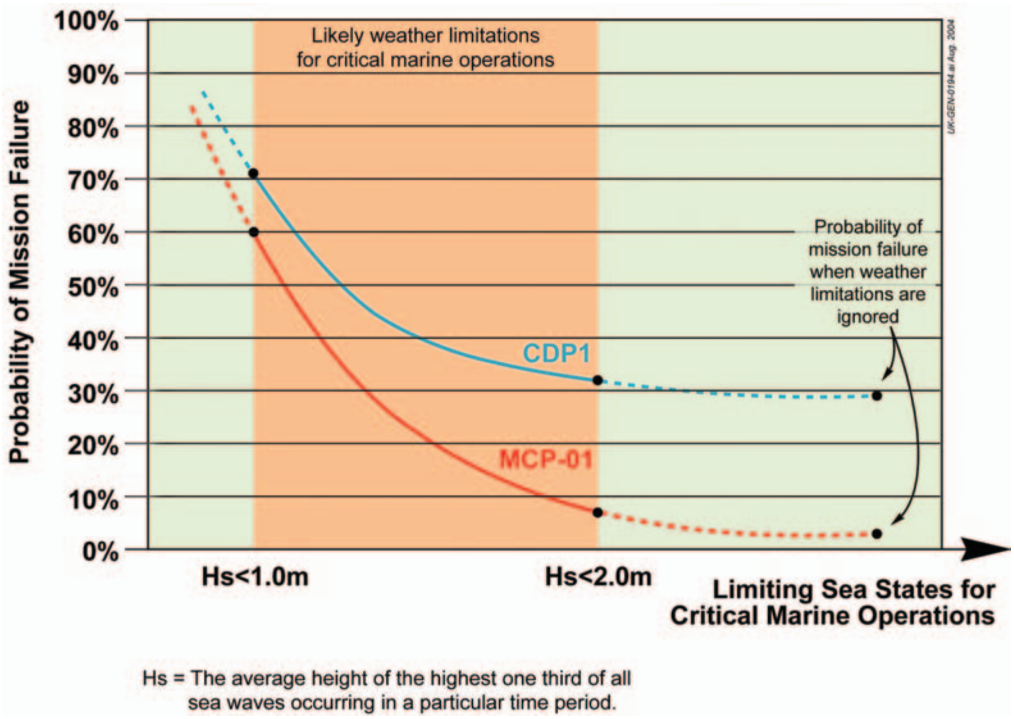


Figure 5.4 Probability of Failure of the Refloat and Onshore Disposal Alternative as a function of Limiting Sea States for Critical Marine Operations

Severe Leaks

The feasibility of refloating the MCP-01 concrete substructure is dependent upon the water-tightness of the walls, the base slab and the cofferdam used to close the holes in the external wall. Reports produced during the construction phase suggest that the condition of the concrete substructure, when installed, was good. There is also no evidence to indicate that there were any major leaks whilst the platform was floated into position and lowered down into position onto the sea bed. The platform has, however, been in location since 1976 and during approximately 30 years of operation it has been subject to severe storm loading. The overall integrity of the concrete substructure is not in doubt, as this is checked by periodic subsea inspections. However, there is a possibility that cracking of the concrete may have occurred, particularly in the area of the base slab, as a result of the loads incurred during the platform's operational life. The probability of severe cracking in the base slab is not considered high, but it is not possible to verify that there is no significant cracking in the base slab until the majority of the ballast has been removed and the steel cofferdams have been installed to seal the holes in the external wall.

There are 1282 large holes in the external wall of the concrete substructure which were provided to reduce the wave forces on the platform. Approximately 1000 of these holes are below mean sea level and would need to be effectively sealed before it is possible to attempt to refloat the substructure. Alternative methods of sealing the holes to allow refloat have been evaluated by Doris Engineering and it has been determined that providing individual seals for each hole would not be practicable. The most effective arrangement for sealing the holes is considered to be **six steel cofferdams**, one of which would be installed on the outer face of each of the six lobes of the external wall; as illustrated in Figure 5.5.

These large steel cofferdams would each weigh in the order of 250 tonnes and measure approximately 30m by 30m. Although using a cofferdam is considered better than trying to seal the holes individually, it will still be extremely difficult to ensure the water-tightness of the cofferdam. The installation work would involve extensive, complex and demanding operations. There will be inevitable geometric deviations between the concrete wall and the cofferdams. Extensive measures can be taken to prevent leakage, including the provision of rubber sealing strips and grouting, however the size of the cofferdam and the fact that it will need to be installed on an old concrete structure, in the open sea, means that **there is a very high probability of significant leakage occurring**. These leaks will not be apparent until the water tightness test is performed after all the cofferdams are in place.

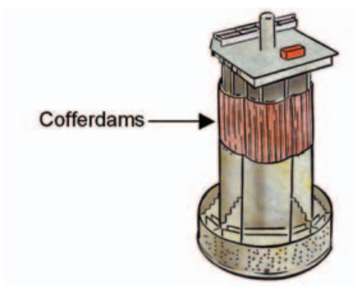


Figure 5.5 Location of the Steel Cofferdam Installed to seal the holes in the external wall of MCP-01

A further cause of uncertainty is the possibility of leakage through the seals around the four connections for the two 32" pipelines. Although both the 32" diameter Frigg UK pipeline and the Norwegian Vesterled pipeline, have been diverted around MCP-01, the redundant sections of pipeline will still be connected to the concrete substructure routed through tunnels in the base of the concrete substructure, as illustrated in Figure 5.6.

The seals, which prevent flooding of the tunnels and central shaft, are known to be in poor condition. As a result of this TOTAL E&P UK has, in recent years, severely restricted work in these areas. In order to attempt a refloat operation it will be necessary to cut the redundant sections of pipeline just before they enter the tunnels. It is believed that cutting the pipelines near to the seals could degrade the performance of the seals still further. There is therefore considered to be a significant probability that **failure of the seals around the pipelines** could result in flooding of the central shaft during deballasting and refloat operations. It should also be noted that the pipeline seals on the Frigg Field TP1 and TCP2 platforms have experienced failures.

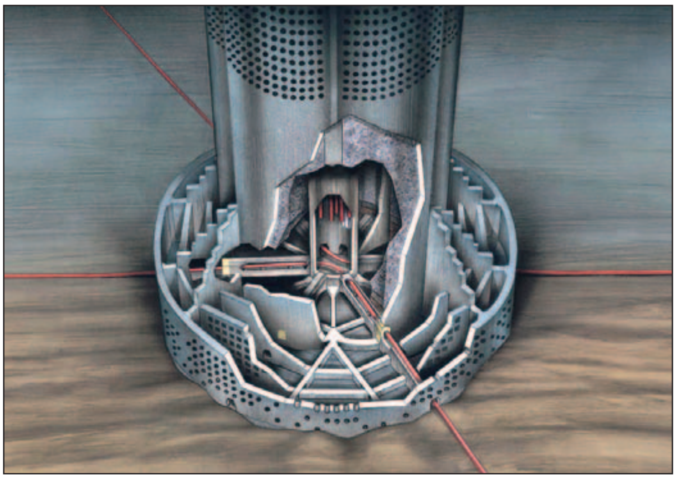


Figure 5.6 The 32" pipelines passing through the tunnels of MCP-01.

Due to the design of the substructure, it is not possible to test or demonstrate the water-tightness of the structure until the solid ballast has been removed as planned, the cofferdam has been installed around the external wall, as illustrated in Figure 5.5, and the water level inside the external wall has been adequately lowered. In view of all this and, in the absence of information to the contrary, it must be assumed that there is a significant probability of leakage during any refloat operation.

5.5 At-Sea Disposal

Three different at-sea disposal alternatives have been considered for the concrete substructure:

- Remove external and internal steelwork, refloat and dispose at a deep water location.
- Remove internal and external steelwork and cut down concrete to provide a clear shipping draft of 55m.
- Leave in place, removing as much external steelwork as reasonably practicable to avoid hazards to users of the sea.

5.5.1 Refloat and Disposal in Deep Water

This method of disposal would entail refloating the concrete substructure in essentially the same way as described previously for on-land disposal. When the concrete substructure was floating at a suitable draft it would be towed to a pre-agreed deep-water location where it would be sunk. The uncertainties and risks associated with refloating the substructure for on-land disposal (as described in Section 5.4) also relate to the alternative involving disposal in the deep water.

The refloat and disposal in the deep water alternative has been fully studied and the technical risk and the risks to personnel are similar to the removal and onshore disposal alternative. Thus, although full assessments of technical, safety, environmental and cost aspects have been made, only limited information about the deep-water disposal alternative is presented in this document. Full details of the studies and assessments made for the disposal in deep water alternative may however be found in the MCP-01 Decommissioning Programme.

5.5.2 Cutting Down to Provide a Clear Shipping Draft of 55m

The procedure for cutting the MCP-01 concrete substructure would be rather complex involving cutting and toppling both the external walls and the radial walls to give the requisite shipping draft. Figure 5.7 illustrates the concrete substructure cut down to -55m.

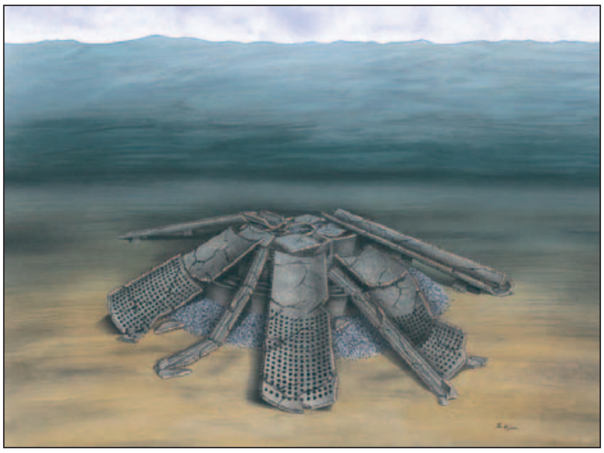


Figure 5.7 Cutting down the Concrete Substructure to –55m

Several methods of cutting the concrete columns were evaluated, including various combinations of drilling, diamond wire sawing and explosives. The cutting methods were considered feasible in principle but considerable development work would be required to achieve commercial applicability. It is also likely that a large amount of diving work would be necessary to support the cutting operations, much of which would be in particularly hazardous conditions.

The possible methods for cutting down the substructure have been carefully studied and specialist companies retained to assess the practicalities of such operations. The technical risks associated with cutting down the substructure are generally similar to those occurring if the substructure were removed and deconstructed onshore. The risks to personnel involved in cutting down the substructure are higher than the removal and onshore disposal alternative. The fishing industries were particularly opposed to this disposal alternative. Although full assessments of technical, safety, environmental and cost aspects have been made, only limited information about the cutting down disposal alternative is presented in this document. Full details of the studies and assessments made for the cutting down disposal alternative may however be found in the MCP-01 Decommissioning Programme.

5.5.3 Leave In Place after Removal of External Steelwork

This alternative involves leaving the concrete substructure in place after removing the topside modules, the steel deck components, and the steel items on the outside of the concrete substructure, principally the 18” diameter riser and the supporting steel truss. The steelworks inside the concrete central shaft would be left in place.

No significant technical problems associated with the work have been identified. The work is not considered to involve any unusual technical risk and the risk of not being able to complete the planned work tasks is considered to be very low.

A fuller description of the decommissioning works to be undertaken as part of this disposal alternative is given in Section 6.

The necessary navigation aids would then be installed on the concrete substructure and debris on the seabed around the substructure would be recovered. These activities would be planned and undertaken working closely with the various users of the sea and the relevant authorities.

The impact of leaving the concrete substructure in place is described in Section 7.

5.6 Risk to Personnel, Environmental Impact and Cost

This section details the risks to personnel, impact on the environment and cost of disposing the concrete substructure on-land as compared to leaving it in place.

5.6.1 Risk to Personnel

The probability of a fatality or a major injury whilst refloating the concrete substructure, towing it to shore and deconstructing it compared to the leave in place alternative is shown in Table 5.2. The risk to personnel has been estimated based upon a quantitative risk analysis of all the tasks required to refloat the concrete substructure, tow it to shore and deconstruct it. The analysis uses the manhour estimates for the disposal works prepared by the platform designers together with historical data for operations such as offshore and onshore construction, scaffolding, diving, marine operations, helicopter flying etc.

	On-land Disposal	At-sea Disposal - Leave in Place
Probability of a Fatality	47%	< 1%
Fatal Accident Rate (averaged across all workers)	19	7
Probability of a Major Injury	More than 90%	26%

Table 5.2 Estimated Probability of a Fatality or Major Injury during Refloat, Towing and Deconstruction Operations for full Removal and Leave in place alternatives

It can be seen from Table 5.2 that the removal alternative has a significant higher probability of a fatal accident occurring compared with the leave in place alternatives. The probability of a fatality is more than 47 times higher for full removal. It should also be noted that the analytical method used to estimate the likely fatalities and major injuries tends to underestimate, rather than overestimate, the risk to personnel.

For the removal alternative the main contributors to fatality risk are inshore/onshore demolition (48%), offshore marine operations (23%), and offshore diving operations (12%). The main contributor to the diving risk is surface diving in the area around the wave-breaking holes in the external wall. From previous experience in the North Sea this is known to be a particularly hazardous area, due to the strong currents and turbulence caused by the sea flowing through the holes.

Based upon the estimated fatalities, the average Fatal Accident Rate (FAR value) for the complete removal and onshore disposal activities is estimated to be in the order of 19. This is approximately 1.5 times the estimated average risk to workers on MCP-01 when it was fully operational.

The average FAR value for all personnel engaged if the substructure was left in place has been estimated as 7 on the basis that the subsea steelwork removal work can be undertaken using ROVs. There is however a possibility that a small amount of diving work may be needed and in that event there would be some increase in the average FAR for the project.

The probability of a fatality as reported in Table 5.2 assumes that it is possible to complete the work as planned. If a major accident occurred, the probability of a fatality during the initial work together with the necessary rectification work would be even higher, as indicated in Figure 5.8.

5.6.2 Environmental Impact

The environmental impacts of refloating the concrete substructure, towing it to shore and deconstructing and disposing of the constituent parts are described in detail in Section 8 of the Environmental Impact Assessment Report which forms Part 2 of the MCP-01 Decommissioning Programme.

The qualitative impacts, as assessed by DNV, are given in Table 5.3 for the Disposal-on-Land and the Leave-in-Place alternatives.

Parameter	On-land Disposal	At-sea Disposal - Leave in Place
Energy Consumption (Million GJ)	1.98 – "Moderate negative"	0.05 - "Insignificant"
Total Energy Impact (Million GJ)	1.98 – "Moderate negative	0.41 – "Small negative"
Total CO_2 Emissions (1000 tonnes)	137	3.7
Discharges to sea	"Insignificant"	"Insignificant"
Physical / habitat effects	"Moderate negative"	"Moderate negative"
Aesthetic	"Small - Moderate negative"	"Insignificant"
Material Management	"Moderate positive"	"Insignificant"
Littering	"Insignificant"	"Small negative"
Impacts on fisheries	"Small positive"	"Small negative"
Impacts on free passage	"Insignificant"	"Small negative"

Table 5.3 Comparison of Quality Impacts for Disposal On-land and At-sea Disposal as detailed in the MCP-01 Decommissioning Programme (See Figure 5.2 for explanation on use of colours).

The EIA Report concludes that from a total environmental perspective, the leave in place alternative is considered to be the best option. The environmental impacts are generally "insignificant" or "small negative" with a potential for "moderate negative" impacts due to physical changes in local substrata. On this latter issue, the impact potential is most limited for the leave in place alternative, as it will impact the smallest area.

It is important to note that cleaning of the MCP-01 concrete substructure is not required, as **it has never been used for the storage of crude oil.**

Leaving the concrete substructure in place, and removing as much external steelwork as reasonably practicable has by far the best performance in terms of energy consumption and CO_2 emissions. Disposal on-land will give poor performance in terms of energy consumption (2 million GJ), will result in large emissions of CO_2 (137,000 tonnes), and will also result in negative physical and aesthetic impacts.

It is judged that there will be no, or "insignificant", discharges to sea for both disposal alternatives.

Both disposal alternatives will result in a predicted “moderate negative” impact for physical impacts to the environment, as a result of the placement of inert ballast material onto the seabed or the deposition of the substructure as it degrades over time. The “moderate negative” impact is not necessarily associated with the area of impact, but rather the sensitivity of receiving environment (i.e. potential *Nephrops* habitat that exists beyond the sandy mound where MCP-01 is situated).

The onshore deconstruction of the concrete substructure is judged to have a “small to moderate negative” aesthetic impact due to the visual impact, noise, smell and dust associated with breaking up the concrete. The aesthetic impact of leaving the substructure in place is considered to be “insignificant”.

Disposal on-land has the best performance in terms of material management, due to large percentages of high value (i.e. steel) material recycling and re-use.

A “small negative” littering impact has been identified if the substructure is left in place. Although considered small, it will be a long-term impact.

The removal of the substructure is judged to have a “small positive“ impact in respect to fisheries at sea. If the concrete substructure is left in place the effect is judged to be “small negative” due to the substructure causing a potential obstruction to fishing vessels and passing marine traffic.

The environmental impacts detailed above assume that the operations are carried out essentially as planned and that there is no need to undertake extensive remedial works resulting from a major accident during the disposal operations. If a major unplanned event occurred during the operations, the impact on the environment would be considerably greater. A major leak occurring during the refloat operation would result in the substructure falling back onto the seabed. This would have a significant physical impact on the local environment, as would the extensive marine and diving operations necessary to try and clear up the area.

5.6.3 Cost

The estimated costs of the on-land disposal and leave in place alternatives for the concrete substructure and concrete deck beams of MCP-01 are given in Table 5.4.

On-land Disposal	At-sea Disposal - Leave in Place
£446.6m/5,359 MNOK/€651m	£11.7m/140 MNOK/€17m

Table 5.4 Estimated Cost of On-Land Disposal and Leave in Place alternatives for the MCP-01 Concrete Substructure

The total cost of the work necessary for removal and on-land disposal of the concrete substructure is estimated to be £446.6m/5,359 MNOK (€651m). A significantly greater cost would be incurred if there were a major accident or incident during the refloating and towing operations as shown in Figure 5.8. The estimated cost of work to prepare the concrete substructure to be left in place is £11.7m/140 MNOK (€17m). In addition the cost of removing the topsides of the platform and deconstructing it on shore is estimated to be £70m / 840 MNOK (€102m).

5.7 Summary of Assessment

The predicted consequences, in terms of safety, environmental impact and cost, of attempting to refloat the concrete substructure of MCP-01 as compared to leaving it in place are summarised in Figure 5.8.

	Remove and Dispose Onshore – As Planned	Remove and Dispose Onshore – Major Unplanned Event	Leave in Place – As Planned	Leave in Place – Major Unplanned Event
Technical Feasibility Probability of a major unplanned event		Probability In the order of **60%** i.e. 600 times greater than acceptance criterion		No potential for major unplanned event
CONSEQUENCES				
Safety Probability of a Fatality	**47%**	**50-70%**	**< 1%**	**-**
Impact on Environment Total Energy Impact (1,000GJ)	**1,980**	**2,300-3,700**	**410**	**-**
CO_2 Release (1,000 tonnes)	**137**	**157-260**	**4**	**-**
Physical Impact on Environment	**“Moderate Negative”**	**“Moderate Negative” plus “Small Negative”**	**“Moderate Negative”**	**-**
Cost £m MNOK €m	**446** **5,359** **651**	**500 - 820** **6,000 - 9,840** **729 - 1,195**	**11.7** **140** **17**	**-**

Figure 5.8 Predicted Consequences of On-land Disposal of the MCP-01 Concrete Substructure as Compared to Leaving In-Place

The main uncertainty relating to the possible refloat and onshore disposal of MCP-01 is the need to undertake a large amount of weather sensitive offshore work in one season. If delays occur, it may not be possible to refloat the substructure in the same season as the majority of ballast is removed and the cofferdams are installed to seal the wave breaking holes in the external wall. With the ballast removed and cofferdams in place, the substructure is very susceptible to damage by winter storms. If the substructure has to stand through a winter period in this condition, it has been determined that both sliding and rotational failure of the foundations will occur and severe damage to the base slab and external walls of the substructure is virtually certain.

Such extensive damage would make it virtually impossible to refloat the substructure in the following season due to the lack of water tightness of the substructure. The probability of a major accident or incident during the refloating operations has been estimated to be six hundred times higher than the acceptance criterion for marine operations.

The consequences of a major accident during the refloat operations have been shown to be particularly severe, especially in respect to the safety of personnel and cost. During the anticipated activities involved in offshore removal and onshore disposal operations, the probability of a fatality has been estimated to be in the order of 47% (approximately 1 in 2). This is a very high risk compared to the leave in place option with an estimated probability of a fatality less that 1%.

After preparing the concrete substructure, as described in Section 6, the impact of discharges to the environment from leaving the substructure in place is assessed to be “insignificant”.

5.8 Proposed Disposal Arrangements for MCP-01

Due to the significant reasons set out in Section 5.7, it is considered preferable to leave the concrete substructure of MCP-01 in place, rather than dispose of it on land or at another location at sea.

The activities to be undertaken as part of the decommissioning process for the concrete substructure are detailed in Section 6 and the impacts of leaving it in place are described in Section 7.

Figure 5.9 Proposed Decommissioned Condition of the MCP-01 Concrete Substructure

6. Planned Activities for MCP-01 Concrete Substructure

6.1 Approach

Preparing the concrete substructure to be left in place is part of the overall process of decommissioning of the MCP-01 facilities.

The requirements of the 1992 OSPAR Convention and OSPAR Decision 98/3 on the Disposal of Disused Offshore Installations have been fully complied with during the assessment of disposal alternatives and will continue to receive the highest priority throughout the implementation phase.

No facilities will be removed, transported, or disposed of without the necessary approvals being obtained from the relevant national and international regulatory authorities.

6.2 Overall Schedule

The overall schedule for the MCP-01 decommissioning is shown in Figure 6.1.

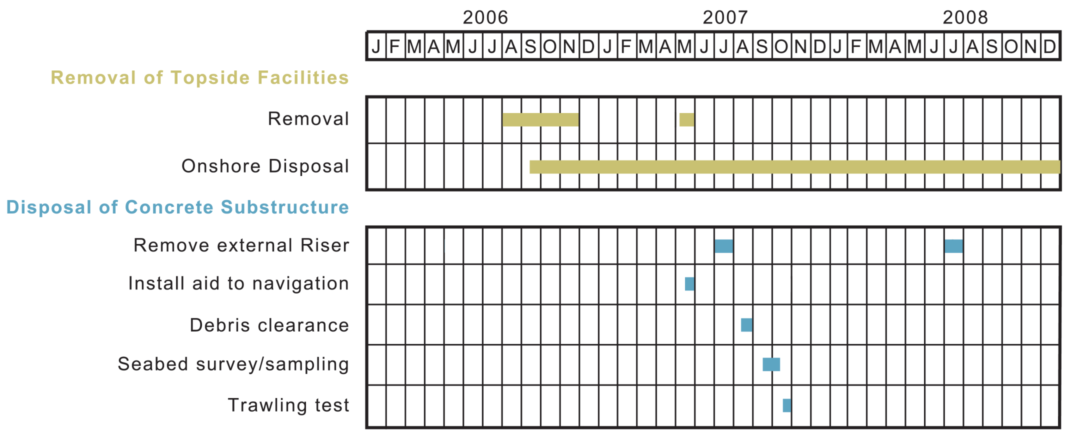


Figure 6.1 Proposed Schedule for the MCP-01 Decommissioning

The offshore campaign for the removal of MCP-01 topside facilities is due to commence at the beginning of August 2006 and will last for four months. It is planned to complete the offshore removal of the topside facilities in a campaign during May 2007. During this period the aid to navigation is planned to be installed.

It is planned to remove the external riser, umbilical caisson and supporting steel structure attached to the external concrete wall of the substructure in either 2007 or 2008.

It is planned to complete the onshore disposal of modules and equipment by the end of 2008.

It is therefore assumed that the recommended programme of disposal activities will be completed by the end of 2008.

6.3 Early Removal of Topside facilities

The offshore removal and onshore disposal of the topside facilities on MCP-01 will be integrated into the Frigg Cessation Project, operated by TOTAL E&P NORGE. Significant synergy effects are expected from such collaboration. The technical and safety challenges are very much the same as for the sister platform CDP1 on Frigg. This collaboration is also meeting the expectations from the OSPAR Ministerial meeting at Sintra in July 1998 where the Contracting Parties agreed to: “promote collaboration between operators of offshore installations in joint operations to decommission such installations”.

Figure 6.2 MCP-01 Topside facilities

Both the UK and Norwegian Authorities have given agreement for an early removal of the topside facilities to enable the MCP-01 work to be integrated into a cross-border project with the Frigg Cessation Project.

The removal of the topside facilities before obtaining approval of the full MCP-01 Decommissioning Programme will not prejudice the assessment of decommissioning alternatives applicable to the concrete substructure. Before attempting a possible refloat of the substructure all the topsides and most of the ballast inside the external wall would have to be removed in any case. Figure 6.3 shows the tow-out of MCP-01 in 1976 illustrating that present topside facilities (see Figure 6.2) were installed offshore after the platform was positioned on the seabed.

Figure 6.3 Tow-out of MCP-01 in 1976

6.4 Removal of Steelwork on Outside of Concrete Substructure

The only steel item attached to the external wall of the concrete substructure (see Figure 6.4) is a supporting steel structure for an 18” riser and umbilical. If this steel item was left in place, over time it would corrode and fall on to the seabed next to the substructure where it would become a hazard to fishing operations. It is therefore proposed to remove this steel item from the outside of the concrete substructure as part of the decommissioning work for the platforms.

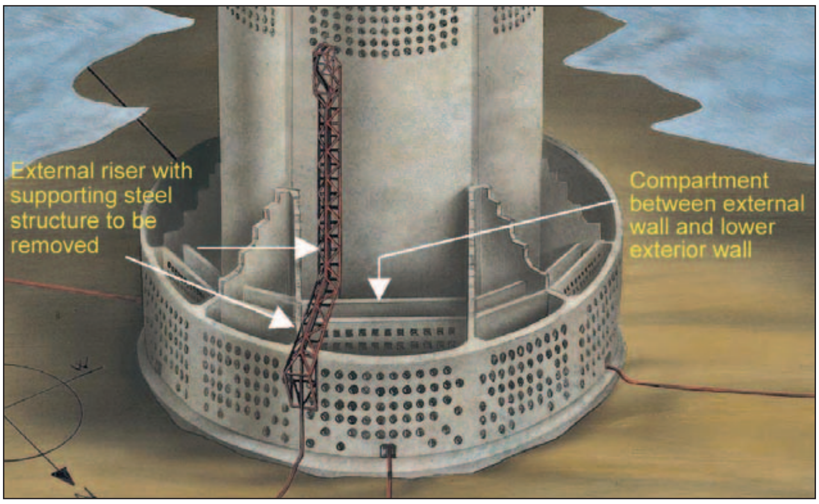


Figure 6.4 Position of riser with supporting steel structure attached to the external wall of the Concrete Substructure

6.5 Items Inside Concrete Substructure

There are no tanks or pipes containing diesel oil, hydraulic oil or methanol used for operational purposes within the concrete shaft.

The steelwork and cables within the central concrete shaft of MCP01 will be left in place together with the protective aluminium and zinc anodes. These items are not considered to adversely affect the natural environment but will degrade gradually over time.

The concrete substructure has never been used for the storage of crude oil. Cleaning operations to remove hydrocarbon deposits on the platform are therefore not required.

6.6 Installation of Navigation Aids

Navigation aids will be installed on the concrete substructure and regularly maintained. They will be designed to ensure a high level of reliability. Back-up systems will be incorporated and parts of the navigational aids system will be changed at regular intervals. The navigational aids themselves, and their maintenance programme, will satisfy the requirements of UK regulations and international conventions.

In addition measures will be taken to ensure that the MCP-01 substructure remains marked on navigation charts and relevant information will be circulated to mariners. Although it is rather difficult to quantitatively assess the effect of these measures, it has been conservatively estimated by specialists that the likelihood of collision could be reduced by as much as 50%.

To assist fishermen, it is planned to introduce the position of the concrete substructure into the UK “FishSAFE” programme which is a computerised system providing fishermen with information about obstructions or hazards in the fishing grounds. Fishing vessels fitted with the “FishSAFE” equipment receive a visual and audible alarm when they come within 6 nautical miles of an identified obstacle.

Regular surveillance will be carried out to check that the navigation aids are operational. The surveillance schedule will initially be determined based upon the predicted performance of the navigation aid system. Operational experience will then be used to assess the surveillance interval. The navigation aids will be designed in such a way as to allow them to be changed from a helicopter, thus obviating the need to man the platform for this purpose. The responsibility for the maintenance of the navigation aids remains with the owners of MCP-01, unless otherwise agreed with the authorities.

6.7 Debris Removal

All debris on the seabed forming a hazard to other users of the sea will be removed within a 500-meter zone around MCP-01.

A pre-debris removal survey will be carried out first to identify the location of the debris. It is planned to recover the majority of the debris using remotely operated vehicles, although diver assistance may be required in certain instances. If larger items are encountered it may be necessary to use divers to sling the load for recovery to the surface. Debris recovered from the seabed will be transported to shore for recycling or disposal.

At the end of the debris clearance operation, a post clean up survey will be undertaken by sonar sweep, to confirm and document that the seabed is free of debris. The results from the survey will be submitted to the appropriate UK authorities.

Independent trawling tests carried out by the fishermen's organisations will then be performed as part of the effort to open up the area around MCP-01 for fishing activity. Such tests will verify that no obstructions remain in the area that would impede fishing operations. The test programme will be established in co-operation with the fishermen's federations in the UK to ensure that representative equipment is used in the test. The results from the trawling test will be submitted to the appropriate UK authorities.

7. Impacts of Leaving Concrete Substructure in Place

This section describes the impacts of leaving the MCP-01 concrete substructure in place after decommissioning. The impacts described for each category are taken from the comprehensive Environmental Impact Assessment Report (EIA Report) prepared by independent consultants DNV, the full text of which is included in the MCP-01 Decommissioning Programme.

Energy

After the substructure has been decommissioned very little further energy will be consumed. The energy used will consist of small amounts of electricity to power the navigation aids and the helicopter fuel used to visit the platform for periodic inspection and maintenance of the navigation aids.

The power for the navigation aids will be provided by arrays of solar cells suitably mounted on the top of the concrete substructure.

Emissions to Atmosphere

Following the decommissioning process there will be no emissions to the atmosphere apart from the emissions from helicopters used to inspect and maintain the navigation aids on the substructure.

Releases to Sea, Water or Ground

The inventory of materials that would be left in place in the concrete substructure is shown in Table 7.1.

Material	Substructure tonnages
Concrete	137,000
Reinforcement steel	10,800
Concrete ballast	2,200
Ballast sand placed inside concrete substructure during construction	47,000
Ballast sand placed offshore	173,000
Marine growth (estimated)	2,600
Steel works inside concrete substructure	1,000
Sum	**373,600 ***

*After removal of steel work attached to the external concrete wall (100 tonnes)

Table 7.1 MCP-01 Concrete Substructure - Inventory of Materials if left in place

Discharges from the substructure if left in place at its current location, are considered to have “insignificant” impacts on the environment. Potential areas of concern, which have been identified and assessed, include:

- Degradation of structural materials (i.e. concrete and steel); and
- Degradation of electrical and anode material

As the structure degrades over time, materials from the decomposition of concrete, steel, and electrical and anode material will leach from the substructure. Leachate from the structure decomposition will be discharged to the marine environment in very dilute concentrations over long periods of time. The MCP-01 platform was built with high quality concrete specially designed to withstand the corrosive physical and chemical actions of sea water for a period larger than 25 to 30 years. The actual life span of the concrete is expected to be much longer. Deterioration of concrete marine structures such as MCP-01 is caused by physical and chemical interaction with seawater. The greatest rate of deterioration will occur in the splash zone caused by:

- Mechanical action of the waves;
- Swelling and shrinkage caused by alternate saturation and drying;
- Atmospheric conditions (wind, exposure to sun, freezing); and
- Electrochemical corrosion of steel reinforcement.

The degradation of the submerged structure will occur at considerably slower rates because of reduced levels of oxygen availability on the seabed.

However, the effects of this leaching are expected to be “none or insignificant” because of the duration of the release-rate coupled with the low concentration of the leached materials, from both concrete and steel materials.

Likewise, degradation of anode and electrical materials will also result in the release of diluted metals over long periods of time. As with the structured materials, the impact of this discharge is considered to be “insignificant”.

Stone, Sand and Concrete Ballast

The stone, sand and concrete ballast will be retained with the concrete substructure and thus it is unlikely that this will be released into the marine environment for hundreds of years. The stone/sand is a naturally occurring inert material that will not pollute the marine environment.

Paint

The paint included in the inventory is associated with the steelwork inside the central shaft. This will degrade very slowly over time but the rate of release will be so slow that there will be no impact on the environment.

Cabling

The electrical and instrument cables inside the concrete central shaft will degrade slowly over time but the rate of release will be so slow that there will be no impact on the environment.

Physical Impact on the Environment

After about 100 years the main reinforcement with limited cover in the splash zone and above will become ineffective. Impacts from waves would cause risk of local structural damage to the central shaft and the breakwater wall in the splash zone. Serious damage to all parts above sea level with a possible breakdown to the sea level is estimated to take place in roughly 200 years.

Breakdown of the breakwater wall and the central shaft down to about 27m below sea level is predicted to take place in 400 to 800 years. A breakdown below 55m could take more than 1000 years.

The above-water deterioration of the concrete structure will, however, take place relatively slowly and the navigation aids with suitable maintenance may be expected to remain in place for several hundred years.

As the structure slowly degrades, but remains standing, the physical impact is considered to be “none or insignificant”. However, when the installation is fully deteriorated it will form heaps of concrete fragments and solid ballast. This constitutes a change in the natural environment of an undisturbed seafloor. Although this is a localised effect, nearby Nephrops habitat may also be impacted (i.e. beyond the sandy mound). The sensitivity of the recurring environment means that the physical impact would then be considered as “moderate negative”.

Aesthetic Impacts including Noise, Smell and Visual Effects

There are considered to be no aesthetic impacts such as noise, smell or dust as a result of leaving the concrete substructure in-place.

Material Management

Although recovering about 100 tonnes of recyclable steel this impact is “insignificant” from a material management perspective.

Littering

By leaving the substructure in place, there will be some long-term littering effects, as the substructure degrades and eventually collapses onto the seabed. Reinforcement and concrete fragments may spread on the seabed in the vicinity of MCP-01’s current location. In addition, fishing gear interaction may spread the collapsed structural material. However, this littering impact is considered to be “small negative”.

Impacts on Fisheries

Leaving the concrete substructure in place is considered to result in “small negative” impacts on fisheries. The main issues of concern identified as part of the fisheries impact evaluation included:

- The physical presence of the substructure, creating an avoidance area for trawling fisheries; and
- The physical presence of the substructure resulting in the creation of an artificial reef.

The existence of a 500m exclusion zone around MCP-01 would have adverse effects on the area for fisheries. In particular, trawling vessels have to begin deflection manoeuvres very early to avoid moving into the exclusion area; this implies that an area larger than the actual exclusion zone is unavailable for trawling fisheries.

The long term consequences for the fisheries in the MCP-01 area are difficult to predict, due to the uncertainties on how the fisheries in this area will develop in the future. Based on fisheries statistics, the immediate area around MCP-01 is most important for cod and haddock fisheries and less important for Nephrops. The reason for this is that MCP-01 is located on a sandy mound representing an area of 1.0 x 2.5 km.

There may be changes in the future, but no predictions are possible. However, assuming that in the future, the fishery will be present to a comparable extent as it is today, leaving the concrete substructure in place is regarded to have “small negative” impacts on the fisheries.

Free Passage at Sea

The annual number of seafarer fatalities from vessel collision if the concrete substructure is left in place, is estimated to be 2.8×10^{-4}, or 1 fatality in 3,600 years.

The annual risk of fishing vessels colliding with the MCP-01 concrete substructure, if left in place, has been estimated to be in the order of 5.5×10^{-3}, corresponding to a collision return period of 183 years based upon current fishing activity in the area. Because the concrete substructure is visible, the probability of fishing vessels snagging their gear on the substructure is considerably less than if the base were left on the seabed after the substructure is cut down. For passing vessels the annual risk of collision is estimated to be 7.9×10^{-5}, an average of one collision in 12,600 years.

The risk of pollution occurring as a consequence of such collision is even smaller. In the worst-case scenario of a serious collision involving a laden crude tanker, a large outflow of oil could potentially occur (in excess of 10,000 tonnes). However data indicates that such incidents are extremely rare. The vast majority of the spills which occur are small. Therefore the total risk is considered low.

It has been estimated by specialists that the TOTAL E&P UK measures and industry developments would reduce the collision frequency by approximately 50%. Section 8 gives brief details of the measures that will minimise the collision frequence. Leaving the substructure in place is therefore considered to have a “small negative” impact on free passage at sea.

The 500m safety zone around the concrete substructure will remain in place during the approved decommissioning work, after which consideration will be given to removing it.

8. Monitoring

During the summer of 2002 sediment and biota samples were taken from eight locations around MCP-01. The samples were analysed to determine their metal and hydrocarbon contents. Marine growth samples were also collected from eight locations at various depths on the concrete substructure. The analysis of the samples taken is given in Section 6 in the Environmental Impact Assessment forming part 2 of the MCP-01 Decommissioning Programme.

At the end of the decommissioning work programme, an environmental survey, including seabed sampling, will be undertaken to document the environmental conditions at the end of the removal and disposal operations. A survey of the condition of the concrete substructure and the adjacent seabed will also be undertaken at the end of the decommissioning work programme. The scope for these environmental and condition surveys will be discussed with the DTI. The results will be submitted to the appropriate UK and Norwegian authorities.

The need for further monitoring activities will then be determined based upon the findings of the surveys and discussions with the relevant parties.

Regular surveillance will be carried out to check that the navigation aids are operational. It is envisaged that the navigation aids will be designed in such a way as to allow them to be changed from a helicopter, thus obviating the need to man the platform for this purpose. Unless and until otherwise agreed with the authorities, the responsibility for the maintenance of the navigation aids remains with the owners of MCP-01.

A visual check on the above water condition of the concrete substructure will be undertaken and recorded when the aid to navigation is being checked by helicopter. The implications of any observed deterioration of the substructure, in relation to the safety of users of the sea, will be assessed and any required action determined in consultation with UK and Norwegian authorities. The UK Hydrographic Office will be informed of any deterioration which may result in falling debris causing an obstruction.

Measures will be taken to ensure that the position of the concrete substructure left in place is correctly identified and marked on relevant charts. To assist fishermen, it is planned to introduce the position of the concrete substructure into the UK "FishSAFE" programme.

9. Future Liability

The MCP-01 concrete substructure, which it is proposed to leave in-place, remains the property and responsibility of the owners of MCP-01, unless other arrangements are agreed with the Governments of the UK and Norway.

10. Supporting Studies and Peer Reviews

General

- “MCP-01 Decommissioning Programme”, Third Draft, dated 10 February 2006, rev. 2a, which includes the Environmental Impact Assessment Report available on the website: www.uk.total.com/activities/ep_sf_mcp01_03.htm

Studies Related to Safety

- “MCP-01 Operational Safety Case”, TOTAL E&P UK PLC, rev. 03, dated November 2003.
- “Asbestos Survey of MCP-01”, RPS Consultants Ltd, ref. AM5512/4720/AF/HR, dated 10.07.2003.
- “Rules for Planning and Execution of Marine Operations”, Det Norske Veritas, January 1996.
- “The Tolerability of Risk from Nuclear Power Stations”, UK Health and Safety Executive Report, ISBN 0 11 886368 1, dated 1988, Revised 1992.
- “Reducing Risks, Protecting People”, UK Health and Safety Executive Report, ISBN 0 7176 21510, Dated 2001.
- “MCP01 – Platform disposal options safety evaluation”, SAFETEC, Doc. No. ST-20367-RA-1-Rev 01, dated September 2003.
- “MCP-01 Ship Collision Risk Assessment”, Anatec UK Limited Report, Ref. A1212-TOT-CR-1, dated 31 March 2004.
- Specification to TOTAL E&P Norge AS :”Aid to Navigation Engineering for Frigg Field Decommissioning”, issued by the UK Northern Lighthouse Board and the Norwegian Coastal Administration, dated 27.05.2003.

Studies Related to Concrete Substructure

- “MCP-01 Disposal Study – Executive summary report”, Doris Engineering, Report no. 65-1733-MC-01, rev. 1, dated 15.04.03.
- “MCP01 Disposal Study – Final report”, Doris Engineering, Report no. 65-1733-MCP01-Final Report, rev. 2, dated 15.04.03.
- “MCP-01 Disposal Study – Design criteria – Design premises”, Doris Engineering, Report no. 65-1733-MCP01-GL-E-0001, rev. 2, dated 26.03.03.
- “MCP-01 Disposal Study – Option No. 1 – Leave in place”, Doris Engineering, Report no. 65-1733-MCP01-GL-E-0002, rev. 2, dated 26.03.03.

- “MCP-01 Disposal Study – Option No. 2 – Outline method statement”, Doris Engineering, Report no. 65-1733-MCP01-GL-E-0003, rev. 2, dated 26.03.03.
- “MCP-01 Disposal Study – Option 2 – List of steel items to be removed”, Doris Engineering, Report no. 65-1733-MCP01-SS-F-0001, rev. 2, dated 26.03.03.
- “MCP-01 Disposal Study – Option 3 – Partial platform demolition – outline method statement”, Doris Engineering, Report no. 65-1733-MCP01-GL-E-0004, rev. 2, dated 26.03.03.
- “MCP-01 Disposal Study – Option No. 3 & 4 – Removal of solid ballast”, Doris Engineering, Report no. 65-1733-MCP01-DI-E-0002, rev. 1, dated 26.03.03.
- “MCP-01 Disposal Study – Option 4 – Assessment of mechanical systems”, Doris Engineering, Report no. 65-1733-MCP01-PI-E-001, rev. 2, dated 26.03.03.
- “MCP-01 Disposal Study – Option 4 – Assessment of mechanical systems”, Doris Engineering, Report no. 65-1733-MCP01-PI-E-001, rev. 2, dated 26.03.03.
- “MCP-01 Disposal Study – Option 4 – Structural strength assessment”, Doris Engineering, Report no. 65-1733-MCP01-SC-D-0001, rev. 1, dated 26.03.03.
- “MCP-01 Disposal Study – Option 4 – Hydrodynamic behaviour at pop-up”, Doris Engineering, Report no. 65-1733-MCP01-WT-D-0002, rev. 2, dated 15.04.03.
- “MCP-01 Disposal Study – Option 2, 3 & 4 – methods for disconnection of flowlines”, Doris Engineering, Report no. 65-1733-MCP01-DI-E-006, rev. 2, dated 26.03.03.
- “MCP-01 Disposal Study – Safety studies report”, Doris Engineering, Report no. 65-1733-MCP01-SF-E-0001, rev. 1, dated 26.03.03.
- “MCP-01 Disposal Study – Disposal options - Scheduling”, Doris Engineering, Report no. 65-1733-MCP01-DI-I-0001, rev. 2, dated 25.03.03.
- “MCP-01 Disposal Study – Option 3 – Methods of cutting the upper part of the GBS”, Doris Engineering, Report no. 65-1733-GEN-DI-E-0001, rev. 1, dated 26.03.03.
- “MCP-01 Disposal Study – Identification of offshore disposal site”, Doris Engineering, Report no. 65-1733-DI-E-0002, rev. 1, dated 26.03.03.
- “MCP-01 Disposal Study – Identification of onshore disposal site”, Doris Engineering, Report no. 65-1733-GEN-DI-E-0003, rev. 1, dated 26.03.03.
- “MCP-01 Disposal Study – Option 4 – Recycling & reuses of equipment & materials”, Doris Engineering, Report no. 65-1733-GEN-DI-E-0004, rev. 1, dated 26.03.03.
- “MCP-01 Disposal Study – Option 4 – Methods for cutting and recycling concrete and steel materials”, Doris Engineering, Report no. 65-1733-GEN-DI-E-0005, rev. 1, dated 26.03.03.
- “MCP-01 Disposal Study – Use of explosives – Environmental assessment”, Doris Engineering, Report no. 65-1733-GEN-EN-E-0001, rev. 1, dated 26.03.03.

- "MCP-01 Disposal Study – Concrete demolition – Environmental Assessment", Doris Engineering, Report no. 65-1733-GEN-EN-E-0002, rev. 1, dated 26.03.03.
- "MCP-01 Disposal Study – Major waste streams – Environmental assessment", Doris Engineering, Report no. 65-1733-GEN EN-E-0003, rev. 1, dated 26.03.03.
- "MCP-01 Disposal Study – End uses/disposal options for concrete – Environmental Assessment", Doris Engineering, Report no. 65-1733-GEN-EN-E-0004, rev. 1, dated 26.03.03.
- "MCP-01 Disposal Study – Vessels operation – Environmental Assessment", Doris Engineering, Report no. 65-1733-GEN-EN-E-0005, rev. 1, dated 26.03.03.
- "MCP-01 Disposal Study – Assessment of disintegration rate of the GBS", Doris Engineering, Report no. 65-1733-GEN-DI-E-0004, rev. 1, dated 26.03.03.
- "MCP-01 Disposal Study – Maintenance and inspection activities – Post-abandonment", Doris Engineering, Report no. 65-1733-GEN-IN-E-0001, rev. 1, dated 26.03.03.
- "MCP-01 Disposal Study – Limiting conditions for marine spread", Doris Engineering, Report no. 65-1733-GEN-MO-E-0001, rev. 1, dated 26.03.03.
- "MCP-01 Disposal Study –Marine operations – Marine spread documentation", Doris Engineering, Report no. 65-1733-GEN-MO-E-0002, rev. 1, dated 26.03.03.
- "MCP-01 Disposal Study – Option No. 4 – On-bottom stability during removal steps", Doris Engineering, Report no. 65-1733-MCP01-WT-D-0004, rev. 1, dated 26.03.03.
- "MCP-01 Disposal Study – Option No. 4 – Structural assessment during removal steps", Doris Engineering, Report no. 65-1733-MCP01-SC-D-0002, rev. 1, dated 26.03.03.
- "MCP-01 Disposal Study – Option No. 3 – Structural assessment", Doris Engineering, Report no. 65-1733-MCP01-SC-D-0003, rev. 1, dated 26.03.03.
- "Evaluation of Residual Lifetime for the MCP-01 Gas Booster Platform in the North Sea", SINTEF Report, STF22 F03604, dated 29 April 2003.
- "Disposal of MCP-01 concrete substructure – Technical risk assessment" COWI Report, Ref. no. P 57124-A-001, dated November2003.
- "MCP01 Disposal study – Review of –55m option", Stolt Offshore, Report No. RE-613017-019, rev. 3.0, dated 28 02.2003.
- "MCP-01 Decommissioning Study", Fugro GEOS, Ref. No. C50256/2845/R2, dated April 2003.
- "Disposal of MCP-01 concrete substructure – Comparison of the results from the technical risk assessment for CDP1 and MCP-01", COWI Report, Ref. No. 57124A-201, dated 05.03.2004.
- "Assessment of future technologies for safe removal of MCP-01 concrete substructure", Dr. Tech. Olav Olsen a.s, Doc. No. 2698/001, rev. B, dated 30.07.04.

- “Frigg Field Cessation Plan”, TOTAL E&P NORGE AS, dated 9 May 2003.

Studies Relating to the Environmental Impact Assessment

- “MCP-01 Decommissioning - Environmental Impact Assessment (EIA) Report”, DNV report no. 2004-4046, Rev 7, dated 20 January 2005, (also included in the MCP-01 Decommissioning Programme).
- “Consequence Evaluation of Disposal Alternatives”, Appendix to report DNV report no.: 2004 - 4046, Rev. 2, dated 20 January 2005

Peer Review Verification Studies

- “Review of the disposal study of the MCP-01 platform”, Norwegian Geotechnical Institute (NGI), dated 27.04.2003.
- “MCP01 Disposal study”, Noble Denton, Report No.L19924/NDE/JR, rev. B, dated 12.06.04.
- “Confirmation of review of reports concerning disposal of MCP-01 concrete substructure”, Professor Dr.-ing. Peter Schiessl, dated 10.07.2003.
- “MCP01 – Comments on Disposal Study prepared by Doris Engineering” K. Hove, Det Norske Veritas, dated 13.06.03.
- “Cessation Project – Platform MCP-01 – Review of structural strength assessment”, SINTEF report 227133.00, dated 15.07.2003.
- “MCP-01 Decommissioning Programme – Environmental Impact Assessment”, Peer review dated 4 June 2004, by Professor Cliff Johnston, Johnston Environment Ltd.
- “Minutes of Meeting, MCP01, 2nd Workshop, MCP-01 Technical Risk Assessment”, 12 and 13 May 2003, at COWI in Copenhagen.

Appendix A – Abbreviations and Glossary

ASCo EoS	Onshore supply base in Aberdeen
Ba	Barium
BRC	Background Reference Concentrations
CDP1	Frigg Field Concrete Drilling Platform 1
Cd	Cadmium
CPA	Closest Point of Approach
CO_2	Carbon dioxide
Cr	Chromium
Cu	Copper
DNV	Det Norske Veritas
DTI	UK Department of Trade and Industry
EAC	Ecotoxicological Assessment Criteria
EIA	Environmental Impact Assessment
EU	European Union
FAR	Fatal Accident Rate (fatalities per 100million manhours of exposure)
Gassco	Operator of the Vesterled pipeline
Gassled	Group of Norwegian oil and gas companies having interest in MCP-01
GJ	Giga Joules (1,000 million joules)
Hg	Mercury
Hs	The average height of the highest one third of all sea waves occurring in a particular time period
ICES	International Council of the Exploration of the Seas
JMP	Joint Monitoring Programme
km	Kilometre
MCP-01	Manifold and Compression Platform No. 1
MPE	Norwegian Ministry of Petroleum and Energy

Ni	Nickel
NNS	Northern North Sea
MDAC	Methane-derived Authigenic Carbonate
Nephrops	Nephrops Norvegicus – Scientific nomenclature for Norway lobster or langoustine
nm	Nautical miles
OLF	Norwegian Offshore Operators Association (Oljeindustriens Landsforening)
OSPAR	The Convention for the Protection of the Marine Environment of the North East Atlantic 1992.
Pb	Lead
PLL	Potential Loss of Life (predicted number of fatalities)
PMI	Potential Major Injuries (predicted number of major injuries)
Riser	The part of a subsea pipeline running from the seabed up to the topside
ROV	Remotely Operated Vehicle
SAFOP	Safe Operations Technique
SF	St Fergus Gas Terminal
SFF	Scottish Fishermen’s Federation
SINTEF	The Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology
TOTAL E&P NORGE	TOTAL E&P NORGE AS
TOTAL E&P UK	TOTAL E&P UK PLC
UK	The United Kingdom of Great Britain and Northern Ireland
Zn	Zinc

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