OIL & GAS UK
THE DECOMMISSIONING
OF STEEL PILED JACKETS
IN THE NORTH SEA REGION
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1 Foreword

In 1967, BP began production from the West Sole ‘A’ platform, which was the first fixed steel piled jacket (SPJ) to be installed in the North Sea region. Since then, a total of 556 steel piled structures have been installed across the region. Fifty-two of those structures have been decommissioned.

This report aims to provide an overview of the decommissioning of SPJs in the North Sea region in accordance with the regulatory regime. It covers all areas of the North Sea, including the Irish Sea and west of Shetland, under the jurisdiction of the UK, Norway, Denmark, the Netherlands and Germany. The document consolidates the findings of recent joint industry research and highlights advances that have been made in health and safety, environment, and technology, as well as the technological challenges that still remain. The publication is designed for use by operators as a reference document.

The OSPAR Convention governs the decommissioning of offshore structures in the North Sea region. OSPAR Decision 98/3 (Ref 1), which came into force in February 1999, requires all redundant man-made structures in the OSPAR region to be removed for disposal on land. The only exceptions to this rule are concrete gravity structures and the footings of SPJs that were installed before 1999 and where the jacket installed exceeds 10,000 tonnes in weight. For these structures, or parts of structures, the owner can apply to the relevant national Government, including consultation with the other OSPAR Contracting Parties, for derogation to leave them in place based on safety, environmental or technical grounds.

Within Decision 98/3, the OSPAR Commission is committed to formally reviewing the decision every five years and to consider any amendments proposed by the OSPAR Contracting Parties. Such amendments would be determined by actual experience in decommissioning and the development and application of new technology.

The last review was in 2008 and since then the industry has successfully completed two of the largest decommissioning projects to date, namely BP’s North West Hutton and Total’s Frigg Cessation Projects. The execution of these and other recent decommissioning programmes illustrate the sector’s ability to complete major projects within the OSPAR regulations to high safety and environmental standards. They also demonstrate the capability of current decommissioning technology.

Technology for decommissioning is continually being developed but challenges remain in a number of areas. For SPJs that weigh more than 10,000 tonnes, limitations exist in the capability to lift complete structures, or large sections of structures, in a single piece. There is also currently no technology available within acceptable safety and technical risk criteria to cut the largest sections of these structures, such as footings and grout-filled pile clusters.

Experience has shown that the 10,000 tonnes derogation criterion for SPJs is consistent with current technology.

Any feedback on this report will be welcomed and should be directed to Oil & Gas UK’s operations directorate, on operations@oilandgasuk.co.uk.
2 Key Findings

This document highlights a number of aspects of the inventory of steel piled jackets (SPJs) in the North Sea region and the progress made in decommissioning these structures to date. The key findings can be summarised as follows:

- Since 1967, a total of 556 SPJs have been installed in the North Sea region, including west of Shetland and the Irish Sea. Of those, 52 facilities have been decommissioned after reaching the end of their useful life.

- Consistent with OSPAR Decision 98/3, all decommissioned SPJs to date have been fully removed, with the exception of those jackets whose installed weight exceeds 10,000 tonnes and have been granted derogation to leave the footings in place. At the time of publication, BP’s North West Hutton jacket is the only facility where such derogation has been implemented.

- Decommissioning of offshore structures represents a unique health and safety challenge to the oil and gas industry. Issues such as the management of hazardous materials and working within a constantly changing workplace have required bespoke work practices to be developed. The efforts made by the operators and contractors who execute the decommissioning projects have ensured that the high standards applied to health and safety performance are consistent with other offshore and onshore operations within the sector.

- An environmental impact assessment is prepared to support all decommissioning plans. Potential environmental impacts are well understood and mitigation measures have been established to minimise the effects during decommissioning.

- The removal, or partial removal, of a disused steel piled structure presents significant technical challenges, which vary considerably according to the structure size and the water depth in which it is installed. The key technological areas that determine the methods used for decommissioning are lifting, subsea cutting, and onshore dismantling.

- Lifting capacity represents a key criterion for decommissioning structures. To date, the heaviest lift achieved using a vessel-based crane in a decommissioning project is 8,500 tonnes. A steel jacket of similar weight was also successfully removed, along with its module support frame, using purpose built temporary buoyancy tanks. However, all available lifting technologies are subject to limitations in capacity and cannot be applied to all jacket configurations and larger structures in the North Sea region inventory.

- Subsea cutting equipment is available and proven for steel members up to three metres in diameter where circumferential clearance from other members allows access. Technology is not currently available to cut underwater clusters of grout (cement)-filled piles and pile-guides several metres below the seabed, the overall dimensions of which would significantly exceed current section diameter limits. This prevents the cutting of footings of the largest structures.

- Once a structure, or section of a structure, has been recovered to shore, the dismantling and recycling or disposal processes are well established. Challenges, however, still remain in physically recovering large structures and in finding a suitable quayside to allow dismantling to take place. To date, the largest structures have all been dismantled offshore and lifted ashore in smaller sections.
• The industry is achieving high levels of recycling and reuse of materials recovered during decommissioning. Typically greater than 97 per cent of material from jackets and topsides are recycled or components reused. Steel from the jackets alone can be 100 per cent recycled, while parts of decommissioned structures have been reused in construction projects. There has also been success in reusing components such as cranes, booms, compressors, turbines and large ball valves after refurbishment in other applications.

• Complete jacket structures, however, are limited in their reuse potential. In the North Sea region only a small number of redundant gas processing topsides have been reused for further production of hydrocarbons. The major challenge in reusing a redundant facility in a new oil and gas development is aligning the decommissioning and development schedules without introducing risks in either. This has prevented the reuse of complete SPJs.

• Reuse of complete jacket structures has also been limited outside of the oil and gas industry because of uncertainties surrounding structural integrity and long-term liability.

• From the experience the industry has gained since OSPAR Decision 98/3 came into force, it can be demonstrated that major decommissioning projects can be completed to high safety and environmental standards. It has also been shown that the 10,000 tonnes derogation criterion remains consistent with the current limitations of commercially available decommissioning technology.
3 Introduction

Oil & Gas UK has compiled this document to consolidate and share knowledge and experience of decommissioning steel platforms, known as steel piled jackets (SPJs), in the North Sea region.

It draws on direct industry practice from decommissioning projects carried out since 2008, as well as the results of the Decommissioning Baseline Study, a joint industry project carried out by Oil & Gas UK between October 2010 and June 2012 on behalf of industry sponsors.

In 1998, the Contracting Parties to the OSPAR Convention (for the protection of the marine environment of the North-East Atlantic) agreed a new and binding regime for the disposal of redundant offshore installations. OSPAR Decision 98/3, which came into force in February 1999, prohibits the leaving in place of any disused offshore structure, or part of a structure. The exceptions to this rule are concrete gravity structures and the footings of SPJs that were installed before 1999 and where the jacket installed exceeds 10,000 tonnes in weight.

Since 1999, the oil and gas industry has been decommissioning disused offshore structures in accordance with these regulations. The document gives an inventory of SPJs that have been installed in the North Sea region, the methods that have been adopted to decommission these platforms and the lessons learnt from this work. It also describes how existing cutting, lifting and disposal technologies are being applied in decommissioning steel platforms and the influence technology has on the methods selected.

It should be noted that throughout the document it is assumed that topsides will be removed from all SPJs at decommissioning. The focus of this report is therefore solely on the jacket structure, including footings where relevant.

Oil & Gas UK would like to acknowledge the valuable contribution made by the following groups and organisations in the preparation of this document: The Decommissioning Baseline Study JIP Sponsors¹, Perenco UK, Genesis Oil and Gas Consultants Limited and The International Association of Oil and Gas Producers (OGP). The authors would particularly like to thank the members of Oil and Gas UK’s Decommissioning Steering Group Task Group 2 for their significant contribution. This report complements a similar document from OGP on concrete gravity structures [Ref 2].

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## 4 Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTA</td>
<td>Buoyancy Tank Assembly</td>
</tr>
<tr>
<td>COP</td>
<td>Cessation Of Production</td>
</tr>
<tr>
<td>CRINE</td>
<td>Cost Reduction In the New Era</td>
</tr>
<tr>
<td>DAFWC</td>
<td>Days Away From Work Case</td>
</tr>
<tr>
<td>DECC</td>
<td>Department of Energy and Climate Change (UK)</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>HLV</td>
<td>Heavy Lift Vessel</td>
</tr>
<tr>
<td>HSE</td>
<td>Health and Safety Executive (UK)</td>
</tr>
<tr>
<td>IMO</td>
<td>International Maritime Organization</td>
</tr>
<tr>
<td>KLIF</td>
<td>Norwegian Climate and Pollution Agency</td>
</tr>
<tr>
<td>LAT</td>
<td>Lowest Astronomical Tide</td>
</tr>
<tr>
<td>LTI</td>
<td>Lost Time Injury</td>
</tr>
<tr>
<td>MPA</td>
<td>Marine Protected Areas</td>
</tr>
<tr>
<td>MPE</td>
<td>The Norwegian Ministry of Petroleum and Energy</td>
</tr>
<tr>
<td>MSF</td>
<td>Module Support Frame</td>
</tr>
<tr>
<td>NUlI</td>
<td>Normally Unmanned Installation</td>
</tr>
<tr>
<td>OGP</td>
<td>The International Association of Oil and Gas Producers</td>
</tr>
<tr>
<td>OIC</td>
<td>Offshore Industry Committee</td>
</tr>
<tr>
<td>OSPAR</td>
<td>Oslo Paris Convention</td>
</tr>
<tr>
<td>SPI</td>
<td>Steel Piled Jackets</td>
</tr>
<tr>
<td>UKCS</td>
<td>United Kingdom Continental Shelf</td>
</tr>
<tr>
<td>UNCLOS</td>
<td>The United Nations Convention On The Law Of The Sea</td>
</tr>
</tbody>
</table>
5 Definitions

**Derogation**
Deviation from a rule. In the context of this document it refers to deviation from Paragraph 2 of the OSPAR Decision 98/3 on the Disposal of Disused Offshore Installations. This prohibits the dumping at sea or leaving wholly, or partly in place, a disused offshore installation.

**Footings**
As per Reference 1:
“Those parts of a steel installation which:
(i) are below the highest point of the piles which connect the installation to the seabed
(ii) in the case of an installation built without piling, form the foundation of the installation and contain amounts of cement grouting similar to those found in footings as defined in Annex 1 of Reference 1
(iii) are so closely connected to the parts mentioned in (i) and (ii) above as to present major engineering problems in severing them from those parts.”

**Topsides**
Those parts of an entire offshore installation which are not part of the substructure. It includes modular support frames and decks where their removal would not endanger the structural stability of the substructure [Ref. 1].

**Steel Piled Jacket**
The substructure of a steel offshore platform that supports the topsides. It includes the steelwork associated with the footings.
6 Steel Piled Jackets in the North Sea Region

A total of 556 fixed steel piled jackets (SPJs) have been installed in the North Sea region, including the Irish Sea and west of Shetland, since BP installed the first fixed steel platform in 1967 in the West Sole gas field. The variation in regional conditions, such as water depth and environmental loadings, along with the different production and processing needs of individual fields, has led to a wide variety of steel jackets being installed.

Figure 1: Examples of Steel Piled Jacket Categories in the North Sea Region

6.1 Self-Floaters

This steel jacket structure weighs in excess of 12,000 tonnes and is designed with two large diameter legs (up to 10 metres in diameter) for buoyancy during installation. The jacket is fabricated in a construction yard, floated horizontally to the field using the structure’s inherent buoyancy, and then upended through controlled flooding of the jacket members. Final positioning may require crane assistance.

As shown in figure 3 (see page 13), these jackets were all installed in the 1970s and early 1980s and include the Magnus platform, the largest steel jacket in the North Sea region at over 34,000 tonnes. To date, no self-floater SPJ has been decommissioned in the North Sea region.
6.2 Barge-Launched Jackets
Barge-launched jackets weigh between 5,000 and 25,000 tonnes. They are yard-fabricated and transported horizontally to the field on a transportation barge, then launched from the barge over rocker beams and upended through controlled flooding. Final positioning may require crane assistance.

Figure 3 (see page 13) shows the significant inventory of barge-launched jackets remaining in the North Sea region. Notably, only one such jacket has been installed using this method following the OSPAR Decision 98/3 in 1999, which requires all jackets to be removed after decommissioning. This was the Grane A platform installed by Hydro in 2003.

6.3 Lift-Installed Jackets
Lift-installed structures weigh less than 10,000 tonnes. These are again yard-fabricated and transported horizontally or vertically on a barge to the field. Once at the field, the jacket is lifted from the barge into position using a suitable crane vessel.

Aside from the range of shallow water jackets (described below), this is the most frequently installed jacket type in the North Sea region, with 85 remaining structures (see figure 3 on page 13). Lift-installed jackets have been adopted throughout the history of the North Sea region, but became the primary installation method of choice for larger structures after 1990. This was when the industry was seeking to cut its costs in response to the Cost Reduction in the New Era (CRINE) initiative\(^2\), leading to the design of smaller and lighter platforms.

Notably, the largest single lift-installed jackets are Veslefrikk A platform at 9,700 tonnes (1989), Bruce PUQ at 9,400 tonnes and Brae East at 9,300 tonnes (1993).

6.4 Shallow Water Jackets
These structures usually weigh less than 2,000 tonnes and are typically deployed in water depths of 55 metres or less. They include smaller launched and lift-installed jackets, as well as minimum facilities platforms such as monotowers, Vierendeel towers (such as the Seaharvester) and braced caissons, etc. As can be seen in figure 3 (see page 13), these types of platforms have been regularly installed in the North Sea region, mostly in the southern sector.

6.5 Inventory
Three hundred and ninety-two of the 556 installations identified in the North Sea region were installed in water depths of less than 55 metres (shallow water jackets) and a further eight are known to have been designed as self-floaters [Ref 3]. Where detailed installation information is not publicly available, it is assumed that the jackets installed in water depths greater than 55 metres and weighing less than 6,500 tonnes were lift-installed, with the remainder barge-launched.

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\(^2\) CRINE or Cost Reduction in the New Era was the UK industry’s response to the low oil prices in the late 1980s. By increasing collaboration between operators and contractors, the industry sought to reduce development costs by 30 per cent and increase the UK’s competitiveness in the global oil and gas market.
Figure 2 gives the following estimated numbers for each jacket design category in the North Sea region.

**Figure 2: Inventory of Steel Piled Jackets in the North Sea Region**

<table>
<thead>
<tr>
<th>Type</th>
<th>UK</th>
<th>Norway</th>
<th>Netherlands</th>
<th>Denmark</th>
<th>Other</th>
<th>Total</th>
<th>Decommissioned To Date (2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-floater</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Barge-launched</td>
<td>26</td>
<td>39</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>68</td>
<td>20</td>
</tr>
<tr>
<td>Lift-installed</td>
<td>45</td>
<td>36</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>88</td>
<td>3</td>
</tr>
<tr>
<td>Shallow water</td>
<td>202</td>
<td>2</td>
<td>139</td>
<td>46</td>
<td>3</td>
<td>392</td>
<td>29</td>
</tr>
<tr>
<td>Totals</td>
<td>281</td>
<td>77</td>
<td>139</td>
<td>53</td>
<td>6</td>
<td>556</td>
<td>52</td>
</tr>
</tbody>
</table>

Figure 3 below shows the differences between the SPJs that remain in the North Sea region by structure category and weight. This illustrates the size range of the facilities that will eventually require decommissioning.

Of the barge-launched and self-floater SPJs, 40 of the remaining facilities have a substructure installed weight of 10,000 tonnes or more, and hence they may be subject to a derogation application within the OSPAR regulations.

**Figure 3: Remaining Steel Piled Jacket Inventory in the North Sea Region (2012), Categorised by Jacket Type, Weight and Installation Year**
7 Decommissioning Regulations Applicable to the North Sea Region

The first international conference on national rights and obligations relating to the marine environment took place in Geneva in 1958. It resulted in the Geneva Convention, which came into force in 1964, and initiated requirements to regulate offshore installations and remove disused structures.

This agreement was superseded in most countries in 1982 by The United Nations Convention On The Law Of The Sea (UNCLOS). This extensive agreement covers many aspects of the national stewardship of the marine environment, including environmental and pollution control responsibilities. It contains particular reference to the permitting requirements for leaving man-made structures in the marine environment.

In 1989, the International Maritime Organization (IMO) published *Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone*. These were adopted by the North Sea region countries. Developed from Article 60 of UNCLOS, the guidelines specifically cover disused offshore installations and the factors that need to be considered when permission is granted for a structure, or part of a structure, to be left in place.

Regarding SPJs, the IMO guidelines state that any structure protruding the sea should be maintained to prevent structural failure. If a structure is partially removed, an unobstructed water column of not less than 55 metres should be maintained.

These guidelines also advise that all structures in 75 metres water depth and weighing less than 4,000 tonnes, excluding topsides and decks, should be removed. For structures installed after 1 January 1998, the guidance water depth for complete removal was increased to 100 metres.

The London Convention 1972 and, notably, the 1996 Protocol effectively banned all dumping at sea except for a list of wastes for which a permit may be sought from the host state. Man-made structures are included on this list in Annex 1 of the 1996 agreement. This requires that reuse or recycling be considered ahead of dumping, with the emphasis on minimising the impact on the environment.

Regulations on the decommissioning of offshore structures were consolidated and reinforced in 1998 when the OSPAR Contracting Partners agreed what was to become the OSPAR Decision 98/3 on the Disposal of Disused Offshore Installations.

OSPAR began in 1972 with the Oslo Convention and operates under the UNCLOS. It focuses on environmental policy to prevent marine pollution and achieve sustainable management of the North-East Atlantic marine ecosystem.

Decision 98/3 was an outcome of the OSPAR Environment Ministers Conference held in Sintra, Portugal, in July 1998. It forbids dumping whole, or part, of a disused offshore structure in the marine environment [Ref. 1]. It does, however, allow the host state, under certain circumstances, to consider granting a derogation to leave all, or part, of a structure in place.
This applies to:

1. Steel structures weighing more than 10,000 tonnes in air and which were installed before February 1999. Derogations may be granted for all, or part, of the footings
2. Gravity-based concrete installations
3. Any other disused offshore structure, which has suffered unforeseen structural damage or deterioration to an extent that its removal represents equivalent difficulties

Prior to granting derogation, and as part of its consultation process, the host state must submit notification to the OSPAR Executive and Contracting Parties who may provide comment [Ref 1, Annex 3].

Decision 98/3 came into force in February 1999 and is implemented via separate statute in each of the North Sea region countries, such as the Petroleum Act and Energy Act 1998 in the UK (administered by the Department of Energy and Climate Change [DECC]) and the 1996 Petroleum Act in Norway. Decision 98/3 effectively governs the options available to the owner of a disused offshore structure in the North Sea region.
8 Decommissioning Options for Steel Piled Jackets

8.1 North Sea Decommissioning Options
As noted in Section 7, the OSPAR Decision 98/3 governs decommissioning of offshore oil and gas installations in the North Sea region. This prohibits the dumping or leaving in place of disused offshore installations, effectively requiring that they are completely removed to be reused, recycled or disposed of on land. The only exceptions to this requirement are those platforms, or parts of platforms, that were installed before 1999 and may be granted derogation from the regulations as noted in Section 7.

The options available for decommissioning disused SPJs in the North Sea region under OSPAR Decision 98/3 are described below, along with examples of alternative methods which have been used in other regions around the world.

8.1.1 Jacket Removed to Seabed and Transported to Shore
This is the base case for all SPJs weighing less than 10,000 tonnes. It involves cutting the piles that attach the jacket to the seabed and taking the complete structure to shore. This can be achieved in a number of ways depending on the size and complexity of the jacket.

For smaller shallow water jackets (described in Section 6.4), this involves cutting the piles below the seabed and removing the structure in a single lift, typically using a crane vessel. It is then transported to shore either on the crane hook, or using a transport barge.

For larger structures, such as the barge-launched or lift-installed jackets (described in sections 6.2 and 6.3), it may be necessary to use other removal methods. These include cutting the jacket up in situ and removing smaller sections that can be lifted with the available vessels. This is the so-called “piece-small” method. It may also be feasible in some circumstances to use a more novel lifting system such as Aker Solution’s buoyancy tank assemblies (see section 14.3.3).

There have been numerous shallow water jackets removed in their entirety using heavy lift vessels, for example Welland, Esmond, Gordon, four of the Viking ‘A’ platform jackets and, most recently, six jackets from Shell’s Inde Field. Larger steel structures that have been removed completely include the Frigg QP, DP1 and DP2 jacket structures.

8.1.2 Remove to Footings
This scenario is permitted under OSPAR Decision 98/3 if derogation is granted by the host state. It is only considered for SPJ structures weighing in excess of 10,000 tonnes at installation.

Under this scenario, the jacket is removed down to the top of the footings. The sizes of the sections removed are determined by the overall structure configuration, the offshore lift capability, and the size and accessibility of the members to be cut underwater. The removal options are the same as those for full jacket removal and are driven by cutting and lifting capability. The jacket section(s) is transferred to shore by barge or on the deck of the lift vessel.

The jacket for the North West Hutton development was barge-launched and weighed 17,500 tonnes at installation in 1983. As part of its decommissioning plan, BP was granted derogation to leave the footings in place. In 2009, the jacket was decommissioned using the piece-small approach; the 8,500-tonne jacket section above the footings was removed in 58 offshore lifts, facilitated by 248 cuts to jacket members [Ref. 4].
8.2 Selection of Decommissioning Option

For structures that do not fit the criteria for derogation, the only option available under the regulations is full removal and hence no justification needs to be made by the operator for selecting that option.

The method for removing the structure or the necessary sections of the structure is confirmed using a comparative assessment. This is submitted to the regulator in the host state in which the subject installation lies (for example DECC in the UK, The Ministry of Petroleum and Energy (MPE) in Norway) as part of the decommissioning plan.

Under OSPAR Decision 98/3, any request for derogation to leave footings in place must also be made to the regulatory department. It must be supported by a comprehensive comparative assessment which considers the safety, environmental impact and economic aspects of all options for disposal, such as reuse, recycling, disposal onshore and any other offshore disposal options [Ref. 5]. The regulator must in turn consult with statutory consultees and all other OSPAR Contracting Parties prior to granting derogation within Decision 98/3.

8.3 Other Decommissioning Scenarios

Although the methods described below are not permitted under OSPAR regulations, they are outlined for information and completeness and, in some cases, have been used for decommissioning SPJs in other regions.

8.3.1 Leave in Place

Leaving an installation in place means leaving it in situ anchored to the seabed, without any significant deconstruction. In such a scenario it is likely that the topsides would be removed, and installation and maintenance of navigational aids would be required for as long as the structure remains a potential hazard to other users of the sea. Although limited information is available, examples have been presented of SPJs in Indonesia being left in situ after decommissioning [Ref. 6].

8.3.2 Topple In Situ as Artificial Reef

This scenario involves removing the topsides and cutting the legs of the jacket, and either pulling the structure over onto the seabed, or lifting and placing it next to any remaining jacket sections. In any scenario, IMO guidelines (see section 7) require 55 metres clearance below the sea surface.

In 2009, Offshore Iwaki Company adopted this method to decommission the Iwaki Platform offshore in Japan [Ref 7]. It was also used for the damaged Baram 8 platform in Malaysia in 2004 [Ref. 6].

Following the tragic Piper Alpha disaster of 6th July 1988 on the UK continental shelf, in which 167 people lost their lives, the unstable remains of the structure were authorised to be toppled as the safest and most respectful way of removing the damaged structure. This is the only example of “toppling in situ” in the North Sea region.

8.3.3 Remove to Seabed and Transport to Artificial Reef Site

This scenario is the same as that described above, except that the structure is taken to a designated reef site where it is deposited with similar structures. Such arrangements have been adopted to dispose of disused offshore platforms in the USA (for example in the Gulf of Mexico and California) and South East Asia (Brunei, see Ref 6). No such option exists in the North Sea region.
8.3.4 Remove to Elevation – 55 metres
For this scenario, the jacket legs and bracing members are removed to a depth of 55 metres below the lowest astronomical tide (to comply with current IMO guidelines). The removed portion is then disposed of in an appropriate way. Options for section removal are the same as for removing the jacket structure (see section 8.1.1).
9 Safety

9.1 Overview
Safety is paramount and an integral part of the planning and management of all phases of a decommissioning project, be it to remove jackets weighing less than 10,000 tonnes or to make a derogation application for jackets that exceed the 10,000-tonne weight criteria. Safety forms a key part of the comparative assessments for both these scenarios.

On the UK continental shelf (UKCS), before any decommissioning work can begin on a jacket, the Safety Case for the installation must be updated. This is because decommissioning involves different activities from the day-to-day operation of a platform and so new hazards may emerge. The updated Safety Case is submitted to the Health and Safety Executive (HSE) for assessment.

9.2 Health and Safety Challenges
The main health and safety challenges that may pose a risk to personnel are common to all decommissioning options and jacket removal methods. The areas of concern are as follows:

- **Lifting** – the large number of lifts and the uncertainties surrounding load paths and structural integrity
- **Diving** – significant diver intervention may be required to support extensive subsea cutting and lifting operations
- **Hazardous substances** – legacy materials of construction and operations, as well as products released during decommissioning activity, such as from hot work during dismantling
- **Integrity** – hidden flaws and structural degradation in aged facilities
- **Changing work environment** – worksite and safety procedures constantly change as work progresses
- **High levels of activity** – there are many workers at all stages of the project, onshore and offshore
- **Working at height** – for offshore and onshore personnel, including the risk of dropped objects
- **Poor weather** – this extends the duration of offshore tasks by prohibiting work and increases the number of hours personnel spend offshore
- **Marine growth** – management of waste and odour

A number of techniques are employed to reduce and, or, mitigate the risk to personnel. Those methods which have proven successful include regular updating of job cards and work and emergency plans throughout the project; permit-to-work systems; safety initiatives such as good quality “toolbox talks”, sharing of experience and learnings; technology improvements and training.

9.3 Safety Performance To Date
The decommissioning of the Frigg Field and North West Hutton jacket were the most extensive and complex decommissioning projects completed in the North Sea region to date.

9.3.1 Frigg field
Decommissioning of the Frigg field from 2005 to 2010 required seven million manhours in total, 2.4 million offshore for hook down and preparation for removal. There were 100 lifts of over 100 tonnes, and a further 30,000 smaller lifts by platform cranes during the decommissioning works. This required 5,300 vessel days and 1,600 helicopter flights. During all this activity three Lost Time Injuries (LTI) were recorded [Ref 8]. Workshops on safety issues were subsequently held and a safety DVD was produced [Ref 10]. As part of the Frigg project, several technologies were also introduced to improve safety for personnel and enhance efficiency [Ref 9]. This includes a novel seafastening system to reduce personnel intervention on deck of the transport barge [Ref 10].
9.3.2 North West Hutton
The removal of the North West Hutton jacket in 2009 used 330,000 offshore manhours, 100 heavy lift vessel days offshore (using the vessels available to the main contractor and including weather down-time) and 58 lifts. During the project, one Days Away From Work Case (DAFWC) was recorded which occurred at the onshore dismantling site [Ref 4].

Overall, although four DAFWCs/LTIs were reported across both these projects, these decommissioning operations have demonstrated the industry’s success in developing health and safety systems that meet the unique requirements of these activities. They have yielded performance which is equal to that achieved during production activities.

9.4 Key Lessons Learnt
Health and safety experience from the North West Hutton and Frigg decommissioning projects has highlighted a number of lessons learnt [Ref 8, 11, 12, 13, 14]:

- Contractors, including management and operatives, should be involved at an early stage. Good communication between operators, contractors and sub-contractors is vital
- Health and safety of personnel should be made the first priority of every person working on the decommissioning project
- Preparation for decommissioning should begin whilst the platform is still in operation to properly map and document the state of facilities. Otherwise knowledge of the platform condition may not be complete
- Due to the nature, age and environment of the SPJs in the North Sea region, there will be issues surrounding structural integrity and hazardous waste during decommissioning which are unknown beforehand. These must be dealt with without compromising health and safety. This will entail method changes, mobilisation of additional resources and rescheduling of operations
- A cutting plan should be developed and a variety of cutting tools should be made available
- The interface risks of using tools from different vendors must be considered when using remotely operated vehicles (ROVs), alongside the training of sufficient pilots and technicians
10 Environmental Impact Assessment

10.1 Overview
The regulations of the Norwegian Petroleum Act of 1996 require that an environmental impact assessment (EIA) is carried out as part of the preparation for decommissioning infrastructure assets including SPJs [Ref 15].

In the UK, the decommissioning programme must also be supported by an EIA. The conclusions of the EIA should identify the likely environmental and societal impacts of decommissioning activities and propose mitigation measures to avoid, or reduce to acceptable levels, any significant effects. The EIA should also assess cumulative impacts as well as those that have the potential to affect marine protected areas (MPA). It considers the impacts of jacket removal, as well as the different methods to achieve removal.

In the case of an OSPAR derogation application, the environmental impacts of the different disposal options must be outlined through a comparative assessment. At present, the options available are full jacket removal or removal to the footings (see section 8.1). Occasionally, the leave-in-place option may be considered to provide a base case scenario for comparison purposes.

The potential environmental impacts and areas for mitigation that are considered as part of the EIA are highlighted below.

10.2 Environmental Impacts

10.2.1 Gaseous Emissions/Energy Usage
Emissions of primarily CO₂, but also smaller quantities of CO, NOx, SOx and VOC, occur during fuel combustion in the vessels used for cutting, lifting and transportation. These may cause local deterioration in air quality and contribute to wider climate change processes. In 2011, CO₂ emissions from the UK offshore oil and gas industry represented 3.7 per cent of the total UK CO₂ emissions [EEMS data]. Emissions estimates are included on a project by project basis for decommissioning within the EIA.

The EIA would also include an estimate of the amount of energy required to recycle materials and to replace materials left in place under a derogation.

10.2.2 Discharges to the Sea
Discharge of sewage and food waste, ballast water and treated bilge water may occur during vessel operations. These would cause localised and transient deterioration in water quality, but pose no real long-term hazards to birds, fish, benthos and plankton. Any chemicals that may be used to clean and flush pipework, or to remove jackets and topsides, would be strictly controlled through the Offshore Chemical Regulations. All discharges to sea during decommissioning operations are permitted activities that are regulated by DECC.

10.2.3 Underwater Noise
Underwater noise is generated from vessel operations, particularly from the use of dynamic positioning systems, as well as from cutting and seabed excavation works. Noise generated during decommissioning activities is likely to be localised, of lower intensity and shorter duration than that generated during installation operations. However, the potential for noise to cause disturbance to marine mammals should be assessed in the EIA process and appropriate mitigation proposed.
10.2.4 Physical Disturbance to the Seabed
Some disturbance to the seabed around jacket legs may be required to gain access for cutting piles and legs prior to lifting. This will impact on the organisms that live in and on the seabed. The likely magnitude and duration of this impact depends on the extent of the excavations and would be assessed in the EIA.

10.2.5 Dismantling, Recycling and Disposal
Dismantling decommissioned jackets onshore may result in a variety of aesthetic issues such as visual impacts and generation of odour and noise. There will be consequential increases in road traffic to remove dismantled materials with resulting emissions. Whilst it is likely that most of a jacket would be recycled, there may be some materials that would be consigned for disposal (such as concrete grouting).

The extent to which these issues are significant depends on the location of the onshore facility in relation to surrounding communities. This would be assessed within the EIA.

10.2.6 Drill Cuttings Disturbance
Where present, drill cutting piles may be disturbed during excavation around the jacket base to enable cutting and lifting. Such excavations can result in resuspension of cuttings, which will resettle onto the seabed. The significance of this depends on the composition of the drill cuttings pile and the scale of any clearance operation. The options and likely impacts would be assessed through the EIA process, although this may also benefit from discussion with the regulators.

10.2.7 Debris/Dropped Objects
During cutting and lifting operations some larger objects may be accidentally dropped into the sea. Such objects, plus any infrastructure that is not removed, could interact with fishing gear. Side scan sonar and ROV surveys are used to help identify objects for recovery following decommissioning, prior to conducting a trawl-sweep to confirm the seabed is free of obstructions.

10.3 Rare and Protected Species
Cold water coral *Lophelia Pertusa* and reef-forming worm *Sabellaria Spinulosa* have previously been recorded on or around some offshore installations in the North Sea region. Both species are protected by the EU Habitats Directive.

Pre-decommissioning survey work would determine whether these organisms are present. The potential impact of jacket removal on such species should then be covered in the EIA, with mitigation measures proposed to minimise disturbance.

The presence of any such species would also result in a habitats regulation assessment by DECC during its review of the decommissioning programme. This would be followed by an agreement between DECC and the operator on the most appropriate mitigation measures. The regulations do not apply to artificial habitats created by the subsea infrastructure itself [Ref 5].
11 Monitoring and Liability

Under OSPAR Decision 98/3, Annex 4, any permit issued for the derogation of all, or part, of a disused offshore structure should contain details of the monitoring required post-decommissioning.

For SPJs, this will involve the inspection and clearance of any debris from the seabed. Typically, the seabed is then dragged using a chain trawl to confirm that no obstructions remain. For longer term monitoring of derogated footings, a bespoke plan is agreed between the operator and the regulator based on pre- and immediately post-decommissioning survey findings.

To meet the requirements of Annex 4 of Decision 98/3 and to be consistent with UK regulatory guidance [Ref 5], operators on the UKCS must inspect the facility prior to decommissioning to provide a reference point for subsequent inspections. The type and frequency of such activities will be agreed between the operator and the regulator and may change between inspections depending on the findings.

In Norway, guidelines from KLIF (the Norwegian Climate and Pollution Agency) require that two environmental surveys are performed after cessation of production at three-year intervals. As with the UK authorities, exact survey requirements are agreed between the operator and regulator [Ref. 16].

In all decommissioning cases across the North Sea region, the facility operator must also advise mariners and the responsible hydrographer’s office of the change in the facility’s status, that is, whether it is to be wholly or partially removed, so that navigational charts can be updated.

Residual liability in respect of a decommissioned facility is determined at national level by the applicable legislation. In the UK, liability for a partially removed structure remains with the facility owners in perpetuity and is covered by the provisions in sections 29 and 34 of the Petroleum Act 1998. DECC [Ref 5] has confirmed that significant advances in technology could require further remedial action on derogated footings. This is described in section 34 (1) of the Petroleum Act 1998. No such requirement exists within Norwegian legislation. In Norway, future liability after decommissioning is agreed between the facility owners and the State, and liability may be assumed by the State based on an agreed financial compensation [Ref 15].
12 Decommissioning Cost Estimates

Experience gained from decommissioning projects executed to date illustrates that all such activities are unique and, by their nature, include unknowns that can significantly affect cost.

The overall cost of decommissioning is, however, of interest to owners of existing offshore facilities and Governments who ultimately share the cost burden. Each year Oil & Gas UK publishes an estimate of decommissioning costs as provided by its members [Ref 17]. This only covers infrastructure on the UKCS.

To understand the cost of decommissioning SPJs specifically, cost estimates have been developed for the different platform types in the whole of the North Sea region (see figure 4 below). To prepare these, a facility that is considered typical of each category was selected and a cost estimate produced based on the current regulatory requirements. It was assumed that derogation would be granted where applicable for the largest structures, and, where possible and appropriate, lessons learnt from completed projects are included in these estimates.

Each of these “typical costs” were then multiplied by the number of SPJs in that category to produce an overall estimate of the cost of decommissioning these structures in the North Sea region (see figure 4 below).

**Figure 4: Remaining Steel Piled Jackets in the North Sea Region — Estimated Decommissioning Costs (2012 based on Current Regulations)**

<table>
<thead>
<tr>
<th>Type</th>
<th>Number of Jackets Remaining</th>
<th>Estimated Cost, £ Millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-floaters</td>
<td>8</td>
<td>260</td>
</tr>
<tr>
<td>Barge-launched</td>
<td>48</td>
<td>1,230</td>
</tr>
<tr>
<td>Lift-installed</td>
<td>85</td>
<td>1,800</td>
</tr>
<tr>
<td>Shallow water</td>
<td>363</td>
<td>2,100</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>504</strong></td>
<td><strong>5,390</strong></td>
</tr>
</tbody>
</table>

Due to the simplifications made in the estimates, these costs are considered to have an accuracy of ±40 per cent and potentially even lower for some individual platforms. They do, however, provide a total estimate of the decommissioning cost which is broadly consistent with the estimates made in the 2011 Oil & Gas UK operator survey for SPJs on the UKCS.
13 Steel Piled Jacket Decommissioning Experience To Date

A summary of the SPJs that have been decommissioned in the North Sea region to date, along with the decommissioning option adopted, is presented in Appendix A. The total numbers of decommissioned platforms in each category are summarised in figure 5 below.

*Figure 5: Summary of SPJ Decommissioning in the North Sea Region To Date (2012)*

<table>
<thead>
<tr>
<th>Type</th>
<th>Number Decommissioned To Date (2012)</th>
<th>Remaining Platforms to be Decommissioned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-floaters</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Barge-launched</td>
<td>20</td>
<td>48</td>
</tr>
<tr>
<td>Lift-installed</td>
<td>3</td>
<td>85</td>
</tr>
<tr>
<td>Shallow water</td>
<td>29</td>
<td>363</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>52</strong></td>
<td><strong>504</strong></td>
</tr>
</tbody>
</table>

Case studies of four decommissioning projects, which represent the range of experience gained in the North Sea region to date, are included in Appendix B for North West Hutton, Frigg DP2, Indefatigable and Welland.

The industry has successfully executed projects in all but the very largest SPJ category. Valuable lessons are learnt with each completed project, along with a clear demonstration of what the industry can achieve with the currently available technology.
14 Technology

14.1 Overview
Along with the safety and environmental criteria, the availability and capability of technology continue to be major determining factors when evaluating and selecting decommissioning options for SPJs. The most important technological areas are:

- Cutting offshore and subsea
- Offshore lifting
- Onshore recovery and disposal

The successful application and limitations of current technology in these disciplines are illustrated through the major projects completed in recent years (see section 13). How technology influenced these activities is described below.

14.2 Cutting

14.2.1 Introduction
The ability to cut large and often complex steel sections in an offshore environment, and often subsea, is fundamental to the first phase of the decommissioning process. Sections to be cut vary from several centimetres to several metres in diameter.

14.2.2 Available Cutting Techniques and their Application
The three main types of cutting equipment used to remove SPJs are:

- Diamond wire
- Abrasive water jet
- Hydraulic shears

The highest standards for safety have dictated the equipment design and its procedures for use. The cutting tool selected depends on the size of the section, access constraints, the desire to execute the cutting phase as quickly as possible and the need to minimise risk exposure to offshore personnel.

Currently diamond wire tooling is available and proven for subsea cuts up to a maximum diameter of three metres (120 inches), but this does require significant access around the site for the cutting package itself. Smaller tooling for cuts up to 0.45 metres (18 inches) in diameter is also available. Diamond wire cutting allows complex cuts to be made, incorporating features such as castellations in the shape of the cut, but the process can be time consuming.

Like diamond wire, abrasive water jet tools can make quite sophisticated cuts and are capable of cutting sections up to 1.8 metres (72 inches) externally. Tooling is also available to perform internal cuts in tubular sections, such as piles and pile cans, up to an internal diameter of 2.3 metres (90 inches).

The fastest technology for severing steel sections are hydraulic shears. These have been used extensively in decommissioning projects to cut sections with diameters of up to 1.2 metres (48 inches).
While it is evident that the contracting community continues to develop its capability, it is noted that the current proven maximum size limit for subsea cutting of tubular sections is three metres external diameter.

All three of these cutting methods were employed to decommission BP’s North West Hutton jacket in 2009. As noted in Appendix B, the platform was dismantled offshore by cutting and removing jacket sections. In total, 248 cuts were made above and below sea-level, of which 105 involved the use of hydraulic shears, 85 abrasive water jet and 58 diamond wire.

The North West Hutton project is believed to represent the upper limits of current cutting technology in the offshore and subsea environment given the complexity of dismantling this platform in situ and the range of tools used by BP to complete the project.

14.2.3 Technologies under Development
The decommissioning sector continues to innovate in developing existing and new cutting technology. This is consistent with the constant need to improve the efficiency and safety of these offshore operations. Two emerging products of note are the underwater laser cutter and the sub-bottom cutter.

The underwater laser cutter is the subject of an industry-sponsored programme at Aberdeen University, the next phase of which, subject to funding, is to develop a prototype in 2013. The sub-bottom cutter combines a diamond wire tool with an excavation device to cut piles up to 4.5 metres below the mudline, up to a diameter of 1.4 metres (54 inches). In 2011, the sub-bottom cutter was trialled in dry and submerged conditions, but it has not yet been made available on the open market [Ref 18].

14.2.4 Remaining Challenges
Challenges remain in finding a way to perform subsea cutting of steel and grout-filled piles that are larger than three metres in diameter, as well as large pile cluster structures on the largest steel jackets such as North West Hutton. The problem is characterised by the need to cut multiple steel and grout (cement)-filled piles with diameters of 1.5 metres (60 inches) within a pile cluster assembly in excess of five metres in diameter.

Such an operation would also face the significant challenge of excavating the seabed around the pile cluster, potentially to a depth of several metres below the mudline to gain access around the structure for cutting equipment.

14.3 Offshore Lifting

14.3.1 Introduction
The ability to lift large sections of steel structures offshore remains the major criteria for selecting decommissioning options under the current regulatory regime.

The primary lifting solution is a heavy lift vessel (HLV) for complete or large sections of steel platforms. A novel method providing added buoyancy was also used successfully on Total’s Frigg project. The application and capabilities of the available methods are described below.
14.3.2 Heavy Lift Vessels

HLVs have been used extensively to decommission oil and gas facilities in the North Sea region. Often equipped with tandem cranes, the largest semi-submersible vessels have a total crane capacity in excess of 14,000 tonnes. In practice, however, the actual lifting capacity depends on the geometry of the lift and the outreach of the crane hook from the base of the crane pedestal. When a structure is in its offshore location, such control and flexibility of lift geometry is not available and lifting capacity will be less than during installation. The largest single lift achieved during decommissioning using a HLV is thought to be for the removal of the Frigg TCP2 module support frame (MSF) at 8,500 tonnes.

Nonetheless, HLVs have enabled complete topsides or jackets to be lifted and taken ashore for disposal. For North West Hutton, the Heerema HLV Hermod performed 58 lifts, with a maximum lift weight of 2,250 tonnes. The HLV removed a total of 8,500 tonnes of an 17,500-tonne SPJ [Ref 4]. Total’s 5,200-tonne QP jacket on Frigg was removed from the field and transported near shore in a single lift with Saipem’s HLV S7000.

14.3.3 Buoyancy Tank Assembly

Aker Solution’s Buoyancy Tank Assembly (BTA) is a notable development in lifting methods. It was successfully applied on Total’s Frigg Cessation Project during the decommissioning of the DP2 steel jacket and its MSF (weighing 8,200 and 3,400 tonnes respectively) in 2008 [Ref. 13].

The BTA technology involves attaching large, partially flooded buoyancy tanks to the four corner legs of a steel structure. When the four BTAs are de-ballasted, the buoyancy force is applied to the jacket and lifts it in a controlled manner to a vertical floating position. The jacket and BTAs are then towed to the onshore disposal facility for dismantling, with the tanks removed at the yard for reuse.

DP2 is the only project to date where these BTAs have been used and they are the only such tanks in existence. Their installation relies on removing any obstructions or appurtenances along the platform legs to enable attachment along the length of the BTA, as well as the installation of lift points at the top of each leg.

As with any lift, the feasibility of using the BTAs is subject to confirming the steel platform’s structural integrity, including of newly fabricated lift points as the lifting loads are applied.

14.3.4 Technology under Development

The ability to lift larger jackets, parts of jackets, or even complete steel platforms including topsides, is being investigated by the contractor community.

An example of the so-called “single lifter” is Allseas’ Pieter Schelte. The vessel’s conceptual design commenced in 1987, the detailed design in 2007 and, in 2010, Allseas announced that it had awarded the contract for its construction. The vessel is scheduled for operation initially as the world’s largest pipelay and topsides removal vessel in 2014, with jacket removal capability to be added by 2015. The vessel will have a reported jacket lift capacity of 25,000 tonnes and topsides lifting capacity of 48,000 tonnes.

Other single lifter concepts such as Versatruss and the Twin Marine Lifter have been publicised.
14.3.5 Remaining Challenges

Experience has shown that the oil and gas industry has at its disposal the necessary lifting technology options to meet current regulatory requirements in the North Sea region. The areas where challenges remain and which therefore define the current state of the art are:

- **Offshore lift capability** – the maximum vessel-based single lift performed during decommissioning of a disused oil and gas facility is 8,500 tonnes. Challenges also remain in securing lifting points on older structures and back lifting onto barges in open water.
- **Jacket modifications** – the successful lifting of disused SPJs often involves creating new lifting points and loading the structure in a way that it was not designed for, whether by HLV, BTA or a single lifter concept such as Pieter Schelte. In many cases this will involve significant jacket strengthening, retrofitting structural lift points, or providing additional strength to the entire structure such that it does not collapse during the lifting process. Such works can represent a significant challenge given the additional risk to offshore personnel.

14.4 Onshore Recovery and Disposal

14.4.1 Overview

A key part of the decommissioning process is to transport, via barges or HLV, the decommissioned structure to shore for dismantling. The technology applied is well proven, but there are limits in the recovery and dismantling capability. Smaller structures have been landed complete, but challenges remain to recover onshore the largest jackets or jacket sections and in finding a suitable sized and equipped shore-based facility.

To date, none of the largest jacket structures have been recovered as a single section to a quayside for dismantling, achieving a complete reversal of the installation process.

During the decommissioning of DP2 on Frigg, the complete jacket was lifted from the seabed but could not be recovered to shore as a single section. Instead the structure was dismantled in a 92-metre deep fjord six kilometres from the Stord decommissioning yard, before being transported to the yard in smaller pieces.

Typically, sections of the larger steel jackets, such as North West Hutton and Frigg DP1 and QP, have been recovered using shore-based, or in some instances vessel-based craneage, and then cut into the required size sections offshore before being transported onshore to be recycled.

Once onshore, the techniques and processes applied to dismantle a structure are well proven with the industry demonstrating the highest levels of recycling and reuse of decommissioned steel jackets (see section 15).

14.4.2 Remaining Challenges

In the same way that it is not technically possible to fully reverse the installation for barge-launched and self-floater jackets, it has similarly not been demonstrated that such platforms, and those lifted in place, can be recovered to the quayside in one piece. This remains a technical challenge for the decommissioning of these jackets.
15 Recycling and Reuse

15.1 Overview
A fundamental element of OSPAR Decision 98/3 is that reuse, recycling or onshore disposal are the preferred options to dispose of disused offshore structures. Consistent with that agreement, the oil and gas industry has demonstrated its commitment to this premise when decommissioning redundant facilities and, in particular, with respect to SPJs.

The steel jacket represents one of the simplest waste items to manage. The topsides, in comparison, usually include a processing plant and often drilling and accommodation modules and, therefore, it represents a greater challenge to safely dismantle the topside structure and process the waste streams.

Nonetheless, the industry is regularly exceeding targets of 97 per cent for reuse and recycling of all materials and components recovered from jackets and topsides [Ref 10, 19].

15.2 Recycling
For the SPJ structure, the logical aim is to recycle the steel in its entirety. Once the structure is recovered and cut into suitably sized sections, the steel is usually free of significant contamination and can be sent for melting and ultimately recycling into “new” steel.

Total confirmed in the Frigg Decommissioning Close-out Report [Ref 12] that almost 100 per cent of the DP1, DP2 and QP steel jackets were recycled. This confirms an established market for steel recovered from offshore structures.

Interestingly, in terms of comparative environmental impact, Total has demonstrated on the Frigg Project that the CO₂ emissions generated from recovering and recycling redundant steel platforms are equivalent to those from smelting steel from raw materials [Ref 8].

15.3 Reuse
Reuse, however, is the preferred option for disused offshore structures, but finding alternative uses has proved difficult either in situ or elsewhere. There has been some success in reusing small, gas processing topside facilities from southern North Sea platforms [Ref 20], but this has not been extensive and has never included the jacket structure.

The reuse of major parts of a facility, such as complete topsides or jackets, on another oil and gas project is only possible if the schedules for the decommissioning and development projects are aligned and, most importantly, the risk to the development project is no greater than a new-build option. Such synergies have proven difficult to make and this has been a limiting factor in reusing a facility on another oil and gas development.

There has, however, been success in reusing components such as cranes, booms, compressors, turbines and large ball valves after refurbishment in other applications [Ref 11].

Recent projects have also seen large parts of a decommissioned platform, such as a complete module or a helideck, being reused in a different application. For example, the accommodation module from the North West Hutton platform is now an office facility at the decommissioning yard that dismantled the topsides.
Large sections of decommissioned steel structures have also been used in construction projects. In 1999, Brent Spar was cut into sections and used to construct the foundations of a new deep water quay at Mekjarvik next to Stavanger in Norway. Similarly, a pile cluster from the DP2 jacket and sections of the QP jacket from the Frigg project were used as part the foundations for a new quay, [Ref 11].

Reusing a complete facility in place by changing its use has never been identified as a preferred or economically viable solution from a comparative assessment of decommissioning options. Each facility is considered on its own merits, but a number of common factors have driven these conclusions, such as high maintenance, difficult access and obsolete technology, as well as the question of long-term liability for the structure.
16 Public Consultation

16.1 Requirements for Consultation
In the UK there is a statutory requirement for operators to consult with stakeholders to gather their views on the proposed decommissioning option. Two key pieces of guidance are taken into account when planning a consultation with interested parties:

1. *Guidance Notes: Decommissioning of Offshore Oil and Gas Installations and Pipelines under the Petroleum Act 1998* [Ref S]
2. OSPAR Decision 98/3 on the Disposal of Disused Offshore Installations [Ref. 1]

In Norway, the Regulation to the Petroleum Act requires a separate impact assessment programme to be prepared and subject to a public consultation (12 weeks). This ensures the public are properly informed and provides various stakeholders with the opportunity to express opinions and inputs into the scope and execution of the project. The final impact assessment report is also subject to a public consultation (12 weeks).

16.2 Statutory Consultees (United Kingdom Continental Shelf)
Annex H of the DECC Guidance Notes [Ref S] specifies those organisations that should be contacted as part of statutory stakeholder consultation. These are Global Marine Systems, Northern Ireland Fishermen’s Federation, Scottish Fishermen’s Federation and The National Federation of Fishermen’s Organisations.

Annex E and section 6.14 of the Guidance Notes also identify Government departments with a relevant role and to whom copies of a draft decommissioning programme must be sent.

16.3 Consultation Process (United Kingdom Continental Shelf)
Statutory consultation starts at the point at which a draft decommissioning programme is submitted to DECC. A period of 30 days for the consultation is stated in the DECC guidelines.

Decommissioning proposals are announced by placing a public notice in appropriate national and local newspapers and journals, and by placing details on the Internet. This notice indicates where copies of the draft decommissioning programme can be viewed and to whom representations should be submitted.

Typically the programme is available to download from the Internet with hard copies available for inspection at the operator’s offices. The results of consultations are reported in the decommissioning programme when it is submitted for final approval.

Further guidance can be found in the *Guidelines on Stakeholder Engagement for Decommissioning Activities* on the Oil & Gas UK website at [www.oilandgasuk.co.uk](http://www.oilandgasuk.co.uk).
17 References


2. Disposal of Disused Offshore Concrete Gravity Platforms in the OSPAR Maritime Area, OGP Report revised in 2012

3. North Sea Platform Database, Oil & Gas UK publication

4. North West Hutton, Project Summary presentation at GOM 3rd Annual Decommissioning & Abandonment Summit by Eamon Sheehan, 15 to 16 March 2011


6. Decommissioning in South-East Asia Past, Present & Future, presented to The 10th North Sea Decommissioning Conference, by Brian Twomey, Bergen, 15 to 17 February 2010


14. North West Hutton, Project Summary presentation by Eamon Sheehan, Bergen, 16 February 2010

15. Guidelines for Offshore Monitoring, KLIF, TA 2849, 2011

16. Section 5-3 and 5-4, Act 29, November 1996, No 72, relating to Petroleum Activities

17. 2011 Decommissioning Insight, Oil & Gas UK publication, 2011, http://www.oilandgasuk.co.uk/knowledgecentre/marketinsight.cfm


19. Waste Management for Offshore Decommissioning, Dunblane conference presentation, by Caroline White, BP, October 2011

20. Reuse of Decommissioned Offshore Facilities, Platform Brokers, August 2011
## Appendix A: Table of Decommissioned Steel Structures in the North Sea Region 2012

<table>
<thead>
<tr>
<th>Platform Name</th>
<th>Type of SPJ</th>
<th>Decommissioning Option</th>
<th>Year Installed</th>
<th>Jacket Weight (T)</th>
<th>Water Depth (m)</th>
<th>Year Removed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany Emshorn Z1A</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1981</td>
<td>420</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Netherlands K10-C</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1983</td>
<td>740</td>
<td>29</td>
<td>1997</td>
</tr>
<tr>
<td>Netherlands K11-FA-1</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1977</td>
<td>510</td>
<td>30</td>
<td>1997</td>
</tr>
<tr>
<td>Netherlands K13-B</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1989</td>
<td>970</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Netherlands K13-C</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1988</td>
<td>440</td>
<td>26</td>
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<tr>
<td>Netherlands P12-C</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1990</td>
<td>480</td>
<td>27</td>
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<tr>
<td>Netherlands P2-NE</td>
<td>Shallow Water</td>
<td>Reused as Q4-B</td>
<td>1997</td>
<td>1200</td>
<td>30</td>
<td>2002</td>
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<tr>
<td>Netherlands P2-SE</td>
<td>Shallow Water</td>
<td>Reused as P6-D</td>
<td>1998</td>
<td>1200</td>
<td>29</td>
<td></td>
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<tr>
<td>Netherlands Q1-Helder-B</td>
<td>Shallow Water</td>
<td>Removed to shore, reused as Q1 Halfweg</td>
<td>1989</td>
<td>596</td>
<td>25</td>
<td>1989</td>
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<tr>
<td>Norway 36/22-A</td>
<td>Barge-Launched</td>
<td>Removed to shore</td>
<td>1975</td>
<td>4833</td>
<td>73</td>
<td>2010</td>
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<tr>
<td>Norway 37/4-A</td>
<td>Barge-Launched</td>
<td>Removed to shore</td>
<td>1975</td>
<td>4600</td>
<td>74</td>
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<tr>
<td>Norway Albuskjell 1/6-A</td>
<td>Barge-Launched</td>
<td>Removed to shore</td>
<td>1979</td>
<td>7320</td>
<td>71</td>
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<tr>
<td>Norway Albuskjell 1/6-A-FL</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1979</td>
<td>800</td>
<td>70</td>
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<tr>
<td>Norway Albuskjell 2/4-F</td>
<td>Barge-Launched</td>
<td>Removed to shore</td>
<td>1979</td>
<td>7320</td>
<td>71</td>
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<tr>
<td>Norway Albuskjell 2/4-F-FL</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1979</td>
<td>800</td>
<td>70</td>
<td></td>
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<tr>
<td>Norway Cod 7/11-A</td>
<td>Barge-Launched</td>
<td>Removed to shore</td>
<td>1979</td>
<td>4400</td>
<td>72</td>
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<tr>
<td>Norway Cod 7/11-A-FL</td>
<td>Barge-Launched</td>
<td>Removed to shore</td>
<td>1979</td>
<td>1103</td>
<td>78</td>
<td></td>
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<tr>
<td>Norway Edda 2/7-C</td>
<td>Barge-Launched</td>
<td>Removed to shore, reused as Q4-B</td>
<td>1979</td>
<td>7357</td>
<td>71</td>
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<tr>
<td>Norway Edda 2/7-C-FL</td>
<td>Barge-Launched</td>
<td>Removed to shore, reused as P6-D</td>
<td>1979</td>
<td>779</td>
<td>70</td>
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<tr>
<td>Norway Ekofisk 2/4-F1</td>
<td>Barge-Launched</td>
<td>Removed to shore</td>
<td>1977</td>
<td>765</td>
<td>72</td>
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<td>Norway Ekofisk 2/4-G</td>
<td>Barge-Launched</td>
<td>Removed to shore</td>
<td>1981</td>
<td>1950</td>
<td>78</td>
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<td>Norway Ekofisk 2/4 – P</td>
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<td>Removed to shore</td>
<td>1975</td>
<td>1420</td>
<td>77</td>
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<tr>
<td>Norway Ekofisk 2/4- S</td>
<td>Barge-Launched</td>
<td>Removed to shore</td>
<td>1984</td>
<td>7639</td>
<td>77</td>
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<tr>
<td>Norway Froy</td>
<td>Lift-Installed</td>
<td>Removed to shore</td>
<td>1995</td>
<td>6000</td>
<td>119</td>
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<td>Norway Odin</td>
<td>Barge-Launched</td>
<td>Removed to shore</td>
<td>1984</td>
<td>6200</td>
<td>103</td>
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<tr>
<td>Norway Vest Ekofisk</td>
<td>Barge-Launched</td>
<td>Removed to shore</td>
<td>1977</td>
<td>2720</td>
<td>76</td>
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<tr>
<td>Norway Frigg CP</td>
<td>Barge-Launched</td>
<td>Removed to shore</td>
<td>1975</td>
<td>4,210</td>
<td>104</td>
<td>2009</td>
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<tr>
<td>Norway Frigg DP1</td>
<td>Barge-Launched</td>
<td>Removed to shore</td>
<td>1974</td>
<td>7,300</td>
<td>104</td>
<td>2009</td>
</tr>
<tr>
<td>Norway Frigg DP2</td>
<td>Barge-Launched</td>
<td>Removed to shore</td>
<td>1976</td>
<td>8,446</td>
<td>104</td>
<td>2008</td>
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<tr>
<td>UK Camelot CB</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1992</td>
<td>644</td>
<td>43</td>
<td>2002</td>
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<tr>
<td>UK Esmond CP</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1985</td>
<td>1,912</td>
<td>35</td>
<td>1996</td>
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<tr>
<td>UK Esmond CW</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1985</td>
<td>1,049</td>
<td>35</td>
<td>1996</td>
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<tr>
<td>UK Forbes AW</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1985</td>
<td>991</td>
<td>27</td>
<td>1993+</td>
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<tr>
<td>UK Gordon BW</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1985</td>
<td>857</td>
<td>21</td>
<td>1996</td>
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<tr>
<td>UK Inde, Juliet-D</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1971 - 77</td>
<td>910</td>
<td>31</td>
<td>2009-10</td>
</tr>
<tr>
<td>UK Inde, Juliet-P</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1971 - 77</td>
<td>363</td>
<td>31</td>
<td>2009-10</td>
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<tr>
<td>UK Inde, Kilo</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1971 - 77</td>
<td>816</td>
<td>31</td>
<td>2009-10</td>
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<td>UK Inde, Lima</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1971 - 77</td>
<td>836</td>
<td>31</td>
<td>2009-10</td>
</tr>
<tr>
<td>UK Inde, Mike</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1985</td>
<td>637</td>
<td>31</td>
<td>2009-10</td>
</tr>
<tr>
<td>UK Inde, November</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1987</td>
<td>703</td>
<td>31</td>
<td>2009-10</td>
</tr>
<tr>
<td>UK Leman BK</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1968</td>
<td>609</td>
<td>37</td>
<td>1987</td>
</tr>
<tr>
<td>UK North West Hutton</td>
<td>Barge-Launched</td>
<td>Removed to shore, footings to remain in place</td>
<td>1983</td>
<td>17,500</td>
<td>144</td>
<td>2009</td>
</tr>
<tr>
<td>UK Piper A</td>
<td>Barge-Launched</td>
<td>Toppled in situ</td>
<td>1976</td>
<td>14,300</td>
<td>144</td>
<td>1989</td>
</tr>
<tr>
<td>UK Viking AC</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1972</td>
<td>650</td>
<td>26</td>
<td>1996</td>
</tr>
<tr>
<td>UK Viking AD</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1972</td>
<td>714</td>
<td>26</td>
<td>1996</td>
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<tr>
<td>UK Viking AP</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1972</td>
<td>625</td>
<td>26</td>
<td>1996</td>
</tr>
<tr>
<td>UK Viking FD</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1972</td>
<td>214</td>
<td>26</td>
<td>1996</td>
</tr>
<tr>
<td>UK Welland South</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1990</td>
<td>570</td>
<td>39</td>
<td>2010</td>
</tr>
<tr>
<td>UK West Sole WE</td>
<td>Shallow Water</td>
<td>Removed to shore</td>
<td>1967</td>
<td>600</td>
<td>28</td>
<td>1978</td>
</tr>
</tbody>
</table>
## Appendix B: Case Studies of Decommissioning Projects

### North West Hutton

<table>
<thead>
<tr>
<th>Operator</th>
<th>BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water depth</td>
<td>144 metres</td>
</tr>
<tr>
<td>Topsides weight</td>
<td>20,000 tonnes</td>
</tr>
<tr>
<td>Jacket weight</td>
<td>17,500 tonnes, 8,500 tonnes removed (derogation for footings)</td>
</tr>
</tbody>
</table>

### Timeline

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975</td>
<td>Reserves discovered</td>
</tr>
<tr>
<td>1981 to 1983</td>
<td>Installed with accommodation for 210 personnel</td>
</tr>
<tr>
<td>January 2003</td>
<td>Cessation of Production</td>
</tr>
<tr>
<td>2002 to 2004</td>
<td>Well plugging and abandonment and topsides cleaned and freed from hydrocarbons</td>
</tr>
<tr>
<td>April to July 2003</td>
<td>100-day maintenance programme</td>
</tr>
<tr>
<td>July 2004 to April 2008</td>
<td>Operated as normally unmanned installation</td>
</tr>
<tr>
<td>December 2005</td>
<td>OSPAR consultation process completed</td>
</tr>
<tr>
<td>2006</td>
<td>Contract awarded for removal and disposal of topsides, caissons and jacket</td>
</tr>
<tr>
<td>2007</td>
<td>Platform attendance increased for inspection and survey work</td>
</tr>
<tr>
<td>May to August 2008</td>
<td>Topsides modules and caissons removed to Teesside yard</td>
</tr>
<tr>
<td>November 2008</td>
<td>Onshore demolition commences</td>
</tr>
<tr>
<td>Summer 2009</td>
<td>Jacket removal</td>
</tr>
<tr>
<td>2011 to 2012</td>
<td>Pipeline and subsea decommissioning scope carried out</td>
</tr>
</tbody>
</table>

### Decommissioning Execution

The topsides and caissons of the North West Hutton platform were removed by adopting a reverse installation method. Modules were lifted using the heavy lift vessel Hermod and transported in five barge loads to Teesside for dismantling.

The North West Hutton jacket was barge-launched in early 1983. The decommissioning option selected for the jacket was removal to the footings. Derogation was agreed and 8,500 tonnes of the jacket were removed in 54 pieces using cutting and lifting techniques. This required 224 subsea cuts using prime shear, diamond wire and abrasive water cutting tools, two remotely operated vehicles and 4,500 subsea hours. The largest lift was 2,250 tonnes.

The jacket was transported to Teesside for dismantling. Over 98 per cent of material was reused and recycled. Both the accommodation module and helideck were reused.
Appendix B: Case Studies of Decommissioning Projects (continued)

**Indefatigable**

- **Operator**: Shell
- **Location**: SNS gas field, 75 kilometres off the coast of East Anglia
- **Water depth**: 31 metres
- **Six platforms**: Juliet P, Juliet D, Kilo, Lima, Mike and November
- **Total topsides weight**: 8,283 tonnes
- **Total jacket weight**: 4,265 tonnes

**Timeline**

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966</td>
<td>Reserves discovered</td>
</tr>
<tr>
<td>1971 to 1987</td>
<td>Inde Field brought on stream</td>
</tr>
<tr>
<td>1990s</td>
<td>Demanning of several platforms and compressor reconfiguration,</td>
</tr>
<tr>
<td></td>
<td>wells drilled with jack-up rigs</td>
</tr>
<tr>
<td>March 2005</td>
<td>Stakeholder consultation begins</td>
</tr>
<tr>
<td>July 2005</td>
<td>Cessation of Production</td>
</tr>
<tr>
<td>April 2006</td>
<td>First well plugging and abandonment begins on Mike platform</td>
</tr>
<tr>
<td>April 2007</td>
<td>Cleaning and disconnection of platforms complete</td>
</tr>
<tr>
<td>August 2007</td>
<td>Decommissioning programme approved</td>
</tr>
<tr>
<td>January 2009</td>
<td>Contract awarded for decommissioning six platforms</td>
</tr>
<tr>
<td>February 2009 to March 2010</td>
<td>Rigless well plugging and abandonment of wells, Lift preparations, including installation of padeyes and pipeline cleaning campaign</td>
</tr>
<tr>
<td>March to May 2010</td>
<td>Piece-small removal of the Inde Juliet and Inde Kilo topsides</td>
</tr>
<tr>
<td>March to July 2011</td>
<td>Six platforms removed by heavy lifting vessel, Stanislav Yudin, and transported to the Wallsend dismantling yard</td>
</tr>
<tr>
<td>January to July 2012</td>
<td>Diving support vessel is used to cut pipelines and clear debris. The NFFO/MARR Management Farnella Trawler used to clear debris and verify the seabed</td>
</tr>
</tbody>
</table>

**Decommissioning Execution**

The Indefatigable field consisted of six platforms: Juliet P, Juliet D, Kilo, Lima, Mike and November. These were four to six legged shallow water SPJs and ranged in weight from 363 to 2,818 tonnes. The decommissioning option selected for all the jackets was full removal to shore.

The method of removal used for topsides and jackets was reverse installation and single lift of the topsides and jackets. Some piece-small removal was used during decommissioning of the Inde Kilo, Juliet D, Juliet P platforms. The topsides and jackets were transported to the Wallsend yard on Tyneside for dismantling and disposal.
Frigg, DP2

Operator: Total E&P Norge
Water depth: 104 metres
Jacket DP2 weight: 8,446 tonnes

Timeline

1977 to 1978
Production begins at Frigg field

2002 and 2004
24 wells plugged and abandoned on DP2, carried out in two phases

2003 and 2004
Frigg Field Cessation Plan approved by Norwegian and UK authorities

October 2004
Cessation of Production

October 2004 to January 2005
Frigg field topside cleaning

2004 to 2009
Onshore disposal

2005 to 2009
Frigg field topside removal

2007 to 2008
Pipelines and cables removed

2007 to 2009
Jacket preparation and removal

2010
Post-removal activities such as debris clearance, seabed surveys, visual inspection of concrete structures and trawl sweeps

November 2010
Last steel delivered to Amsterdam for smelting

Decommissioning Execution

The DP2 drilling and production platform formed part of Frigg field and was located on the Norwegian Continental Shelf. The DP2 topsides were removed by reverse installation using a heavy lift vessel and some piece-small removal.

The eight legged DP2 steel piled jacket was barge-launched and weighed 8,446 tonnes. The decommissioning option selected for the DP2 jacket was full removal to shore. The jacket was cut one metre below the seabed and removed using Aker Solutions’ buoyancy tank assemblies. The four buoyancy tanks were attached to the jacket subsea and lifted the jacket by 11 metres. It was then towed to a fjord near the Stord yard in Norway and grounded in 92 metres of water, two kilometres off the coast.

The module support frame was transported with the jacket. The DP2 jacket was cut into 12 pieces lifted and transported on barges from the fjord to the Stord yard for dismantling. Over 95 per cent of material was reused and recycled.
Appendix B: Case Studies of Decommissioning Projects (continued)

### Welland

<table>
<thead>
<tr>
<th>Operator</th>
<th>Perenco UK</th>
</tr>
</thead>
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<tr>
<td>Location</td>
<td>SNS gas field, 72 kilometres off the Norfolk Coast</td>
</tr>
<tr>
<td>Water depth</td>
<td>37 metres</td>
</tr>
<tr>
<td>Structure</td>
<td>Single tripod platform weighing 2,000 tonnes</td>
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</table>

#### Timeline

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1983 to 1986</td>
<td>Fields cluster discovered</td>
</tr>
<tr>
<td>1990</td>
<td>Welland jacket and topsides installed and production commenced</td>
</tr>
<tr>
<td>2003</td>
<td>Last of the five wells ceases production</td>
</tr>
<tr>
<td>2004</td>
<td>Formal cessation of production submitted</td>
</tr>
<tr>
<td>2007</td>
<td>Transfer of operatorship from ExxonMobil to Perenco UK</td>
</tr>
<tr>
<td>2009</td>
<td>Review of ExxonMobil’s decommissioning plans</td>
</tr>
<tr>
<td>2010</td>
<td>Perenco UK’s decommissioning plan initiated along with pre works. Well, pipeline and ancillary jacket to topsides connections are removed, leaving just the leg-pile connection</td>
</tr>
<tr>
<td>2011</td>
<td>Mobilise lift barge, cut top of piles, lift topsides, land on transit barge, tow to flushing for refurbishment and reuse. Dredge leg piles internally, cut below seabed, lift jacket and carry to the Netherlands for recycling</td>
</tr>
<tr>
<td>2012</td>
<td>Topsides refurbishment complete, docked on self installing barge, towed to West Africa and installed offshore for commissioning</td>
</tr>
</tbody>
</table>

#### Decommissioning Execution

The topside of the Welland platform was cut from the substructure using a high-pressure water jet and lifted onto a barge for transportation to shore.

The Welland platform was a single tripod platform weighing 2,000 tonnes and classified as a shallow water jacket.

The decommissioning option selected for the topsides was complete removal to shore for use internally within Perenco at a new location in West Africa.

The jacket piles were cut at the seabed and the jacket was lifted, sea fastened on the lift barge and secured in the lift position for transportation to a yard in the Netherlands for cleaning, dismantlement and steel reprocessing.
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