CONTROLLED DOCUMENT

Title:

Cavendish Decommissioning Project
Comparative Assessment Report

Notes:

CONSULTATION VERSION

This is a report of the Comparative Assessment (CA) undertaken as part of the Cavendish Decommissioning Project. The CA evaluates and compares potential decommissioning options for the 10.75” Gas Export Pipeline, 2.37” piggybacked methanol line and 1.25” fibre optic cable that lie between the Cavendish and the Murdoch MD platforms, and will be the subject of decommissioning activities (along with the Cavendish platform), as part of the Cavendish decommissioning project.

Revision Record:

<table>
<thead>
<tr>
<th>Rev.</th>
<th>Date Prepared</th>
<th>Author</th>
<th>Chk’d</th>
<th>Name</th>
<th>Title</th>
<th>Signed</th>
<th>Date App’d</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>28/10/19</td>
<td>P Jones</td>
<td>-</td>
<td>D Scott</td>
<td>Operations Director</td>
<td>D Scott</td>
<td>28/10/19</td>
</tr>
<tr>
<td>2</td>
<td>01/10/19</td>
<td>P Jones</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1</td>
<td>19/03/19</td>
<td>P Jones</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>0</td>
<td>06/11/18</td>
<td>P Jones</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

The master original of this document is held by: QHSE

Document Origination Check Document Approval for use by INEOS Oil & Gas UK
EXECUTIVE SUMMARY

The Cavendish Field is located approximately 125km east of the UK coastline at Flamborough Head and 65km west of the UK-Netherlands median line, in a water depth of 18 metres. The Cavendish platform is tied back to the Murdoch MD platform, 44km to the south-east.

Produced gas and condensate, from three wells, at Cavendish was exported via a 47.35km long 10.75” export pipeline, to Murdoch MD. A 2.37” methanol line is piggybacked onto the 10.75” export pipeline which, during production operations, supplied methanol from the Murdoch MD platform back to Cavendish. A 1.25” fibre optic cable is also laid in the same trench as the pipeline bundle.

A Comparative Assessment of potential decommissioning options has been completed for the 10.75” export pipeline and piggybacked 2.37” methanol line between the Cavendish and Murdoch MD platforms and associated fibre optic cable.

A Comparative Assessment study is required to support the final decision for the decommissioning of the Cavendish pipelines and fibre optic cable. This report presents a description of the potential decommissioning options considered, the method used to complete the Comparative Assessment and the findings of the work undertaken.

Following a screening exercise, the Comparative Assessment considered the following two main options for both the Cavendish pipelines and fibre optic cable:

- Complete Removal; and
- Partial Removal.

The options were assessed using the OPRED Decommissioning Guidance Notes [Ref 1] and evaluations made on the basis of a qualitative evaluation for each of the main areas of assessment, namely:

- Safety
- Environmental
- Technical
- Societal

The study concluded that the best option would be to undertake partial removal of the pipelines and fibre optic cable, whereby the surface laid sections at either end of the line (i.e. the Cavendish platform end and the Murdoch MD tie-in manifold end) would be recovered and removed to shore for recycling/disposal, leaving only the buried sections in situ.

Acknowledging that the pipeline route is some 47.35km long, it was identified that complete removal would present a greater technical challenge which would result in a notably higher degree of environmental impact when compared to the partial removal option.

Mattress removal at the platform ends was not considered within this comparative assessment as it forms part of the base case plan for the Cavendish decommissioning programme whereby all surface laid mattresses will be removed where possible.

It has been assumed that gravel used at crossing points (Rita-Hunter crossing) would remain in situ. However, mattresses used over the Trent-Tyne would be lifted under the base case option in co-operation with the operator of the Trent-Tyne pipeline.
Table of Contents

1 Introduction .................................................................................................................. 6
  1.1 Overview .................................................................................................................. 6
  1.2 Purpose and Scope .................................................................................................... 6
  1.3 Environmental Setting ............................................................................................. 6
  1.4 Pipeline Burial Status .............................................................................................. 7
  1.5 Deposited Rock/Mattresses ...................................................................................... 8
  1.6 Assumptions, Limitations and Gaps in Knowledge ................................................... 9

2 The Comparative Assessment Process ......................................................................... 10
  2.1 Comparative Assessment Process .......................................................................... 10
  2.2 Screening Assessment ........................................................................................... 10
  2.3 Comparative Assessment Criteria ........................................................................... 10
    2.3.1 Safety ................................................................................................................ 10
    2.3.2 Environmental ................................................................................................... 10
    2.3.3 Technical ............................................................................................................ 11
    2.3.4 Societal .............................................................................................................. 11
    2.3.5 Commercial ....................................................................................................... 11

3 Results of the Comparative Assessment ..................................................................... 12
  3.1 Option Screening ..................................................................................................... 12
  3.2 Results of the Comparative Assessment .................................................................. 12
    3.2.1 Safety – Comparative Assessment ...................................................................... 12
    3.2.2 Environmental – Comparative Assessment ....................................................... 13
    3.2.3 Technical ............................................................................................................ 14
    3.2.4 Societal .............................................................................................................. 14
    3.2.5 Commercial ....................................................................................................... 15

4 Conclusions ................................................................................................................ 16

5 References .................................................................................................................. 17

Appendix A – Pipeline Burial Charts (2015 Pipeline Inspection Surveys) ......................... 18

Tables
  Table 3-1 Summary of Options Screening Assessment .................................................. 12
  Table 3-2 Summary of Comparative Assessment - Safety ............................................ 13
  Table 3-3 Summary of Comparative Assessment – Environmental ............................. 14
  Table 3-4 Summary of Comparative Assessment – Technical ..................................... 14
  Table 3-5 Summary of Comparative Assessment – Societal ........................................ 15
Figures

Figure 1-1 - Depth of Cover (2015) ........................................................................................................................................ 7
Figure 1-2 – Multibeam Image of the Tyne-Trent Pipeline Crossing at KP27.654 (2015) ..... 8
Figure 1-3 – Multibeam Image of the Rita-Hunter Pipeline Crossing (Gravel Dumps) at
KP44.034 and KP44.060 (2015) ........................................................................................................................................ 9
1 **Introduction**

1.1 **Overview**

The Cavendish Field is located approximately 125km east of the UK coastline at Flamborough Head and 65km west of the UK-Netherlands median line, in a water depth of 18 metres. The Cavendish platform is tied back to the Murdoch MD platform, 44km to the south-east.

Produced gas and condensate, from three wells, at Cavendish was exported via a 47.35km long 10.75” export pipeline, to Murdoch MD. A 2.37” methanol line is piggybacked onto the 10.75” export pipeline which supplied methanol from the Murdoch MD platform back to Cavendish. In addition, a fibre optic cable is laid in the same trench as the pipeline bundle.

Cavendish production ceased in August 2018.

The Cavendish pipeline bundle crosses the following:

- Trent to Tyne 20” & 3” bundle (KP27.654)
- Norsea Com Fibre Optic Cable (KP47.158)

In addition, the Cavendish pipeline bundle is crossed at KP14.178 by the Cygnus 24” export pipeline and at KP44.034 by the Rita to Hunter 8” pipeline and control/injection umbilical (KP44.060). There is also a Tee-piece (the ‘Keplar Tee-piece’) which is installed and buried on the pipeline route at KP19.72.

1.2 **Purpose and Scope**

As per the OPRED Guidance notes [Ref 1], pipeline decommissioning options require to be comparatively assessed.

The purpose of this Comparative Assessment is to provide an assessment of potential decommissioning options available for the Cavendish 10.75” gas export pipeline and 2.37” methanol line against a set of assessment criteria derived from OPRED guidance documents. The output of this Comparative Assessment will assist in identifying the preferred decommissioning options and methods, and supports the submission of the decommissioning programme to OPRED.

1.3 **Environmental Setting**

Cavendish is located within an area of fine sand, which due to the shallow depth of the water, undergoes high energy wave action. This physical environment impacts the species that are dominant in the area. Benthic species are dominated by polychaetes and amphipods and are used to natural seabed disturbance. There is a lack of diversity and low individual abundance (i.e. small numbers of individuals from each species) which indicates absence of notable contamination.

The area is used as a nursing ground for eleven fish species and a spawning ground for six species. Species present include cod, whiting, sandeel, ling and hake. Seabird species common in this part of the Southern North Sea include Common guillemot, Northern fulmars and Black-legged kittiwake. Seabirds are particularly sensitive to oil on the surface of the water.
between June and September (with July rated extremely high and August considered very high sensitivity) and in December.

There is the potential that up to six marine mammal species (white-beaked dolphin, harbour porpoise, minke whale, bottlenose dolphin, common dolphin and white-sided dolphin) may be present in the area of Cavendish, with April, May and October to December seeing the highest densities. Cavendish is situated within the outermost reach of the most common excursions of grey seals which are heading towards the Dogger Bank feeding grounds.

Cavendish is located within the Dogger Bank Special Area of Conservation (SAC) and the Southern North Sea SAC for harbour porpoise as well as within the East Offshore Marine Plan area.

1.4 Pipeline Burial Status

Pipeline inspection surveys have been undertaken on the Cavendish pipelines in 2007 (following construction in 2006), 2009, 2012 and 2015.

Following pipelay works in 2006, there were reported to be some locations with pipeline exposures. However, these exposures were not observed in the backfill survey undertaken in 2007. Various cable exposures were identified in the 2007 surveys, but none that were considered a snag risk.

By 2009 the average depth of cover of the pipeline bundle was calculated to be 1.07m. The fibre optic cable was observed at surface at a number of locations throughout the route. A high degree of trawl scars were observed along the route. The Keplar Tee piece was not observed in the 2009 surveys. Of note, however, it was reported that the depth of cover was notably increased following construction in 2007 and it was interpreted to be as a function of the trench backfilling over time.

In the surveys undertaken in 2012, the pipeline had buried further with an average depth of cover reported at 1.20m over the complete route. There continued to be no evidence of the Keplar Tee-piece at KP19.72, indicating it remained well buried.

The most recent survey of the pipeline undertaken in 2015 reported the pipeline to be buried for the entire route (with the exception of the two transition ends, i.e. at the Cavendish platform and Murdoch MD manifold). The depth of cover was reported to be 1.2m over the entire route.

Figure 1-1 - Depth of Cover (2015)

Of note, the 2.37" methanol line was noted to be exposed and partly in freespan for a 12m section between KP14.64 and KP14.652 in 2015. The Keplar Tee-piece was not observed in 2015 surveys and was estimated to be 0.6m buried below seabed.
1.5 Deposited Rock/Mattresses

The use of mattresses at platform/manifold tie-in locations is widespread and forms the base case for removal in the case of the Cavendish Decommissioning Programme.

Other than at the two tie-ins, mattresses have been used at the Tyne-Trent Pipeline Crossing. These have been noted to be mostly sand covered in pipeline surveys with intermittent blocks appearing through the cover of sand.

*Figure 1-2 – Multibeam Image of the Tyne-Trent Pipeline Crossing at KP27.654 (2015)*

An area of gravel dump exists over the Rita-Hunter crossings which is laid over the Cavendish pipeline bundle.
The Cygnus pipeline crosses over the Cavendish bundle and is covered with rock between KP14.164 and KP14.189.

1.6 Assumptions, Limitations and Gaps in Knowledge

The comparative assessment has been undertaken on the following basis.

- There is no assessment of mattress removal options as it is base case for all surface laid mattresses and grout bags to be removed where possible. If difficulties are experienced during offshore works INEOS will approach OPRED for advice in such circumstances.
- Gravel/rock dumped areas will not be removed and will remain in situ.
- The assessment approach was qualitative. As such, judgement has been required throughout parts of the assessment relating to the relative differences between options considered.
- It was assumed that complete removal of the pipeline would be undertaken by reverse reeling. It is recognised, however, that there is limited experience of reverse reeling of trenched and buried lines [Ref 2], so estimates of the safety risk, technical challenge and cost implications carry some uncertainty.
- The complete removal option assumes that pipelines underneath any pipeline crossing would not be disturbed.
- There are no known reportable freespans on the route. It was noted in the most recent survey in 2015 that there was a 12m section of exposure of the 2.37” methanol line. It has been assumed this small section of exposed line will be covered with rock for ongoing marine safety. Furthermore, there are no known reports to Kingfisher Information Services in FishSAFE of any exposures.
- Sections of pipeline left in situ would be the subject of a survey frequency as agreed with OPRED.
# 2 The Comparative Assessment Process

## 2.1 Comparative Assessment Process

The Comparative Assessment process has been accomplished by internal review by the decommissioning experts within INEOS.

## 2.2 Screening Assessment

As per OPRED guidelines, a screening assessment was undertaken in order to identify the feasible decommissioning options for the Cavendish lines. Following this, the selected options were taken forward for the Comparative Assessment.

## 2.3 Comparative Assessment Criteria

In order to evaluate each potential decommissioning option identified following the screening assessment, a series of criteria were defined in line with the OPRED guidance notes. The criteria were grouped into four main sections to include Safety, Environment, Technical, and Societal. Commercial criteria would only be considered in the event that a preferred strategy could not be identified using the main four evaluation criteria. In the case of the Cavendish Comparative Assessment, a commercial evaluation was not necessary.

A description of each of the criteria assessed is presented within the sections below.

### 2.3.1 Safety

- **Risk to personnel** - Assesses the risk that each decommissioning option poses to those personnel working offshore during the operations, including vessel personnel, but excludes subsea divers;
- **Risk to other users of the sea** - Assesses the risk that each decommissioning option poses to 3rd party assets and vessels both during operations and after operations.
- **Risk to those on land** – for people involved in the handling, recycling and/or disposal of the recovered items when returned onshore.

### 2.3.2 Environmental

- **Marine Impacts** – this includes chemical discharges, hydrocarbon discharges, seabed disturbance.
- **Energy Use and Atmospheric Emissions** – comparison of energy and emissions for each option.
- **Resource Consumption** – resource use for the options.
- **Other environmental consequences** – including noise and vibration, accidental spills and cumulative effects.
2.3.3 Technical

- **Risk of Major Project Failure** - Assesses the risk of major project failure for each decommissioning option.

2.3.4 Societal

- **Fisheries and Shipping Access (post ops)** - Assesses the risk that each decommissioning option poses to access for fisheries and shipping (exclusion zone or non-trawling areas);
- **Community (onshore) disturbance** - Assesses the risk that each decommissioning option poses to onshore communities, when materials are brought ashore for disposal or processing (i.e. communities situated near the sites);
- **Local Employment** - Assesses the risk or the opportunity that each decommissioning option poses/offers to local employment, such as those working in local shipping yards.

2.3.5 Commercial

- **Economic** - Assesses the magnitude of the cost of each decommissioning option – only to be undertaken in the event that a clear strategy cannot be determined by evaluation of the above four categories.
3 Results of the Comparative Assessment

3.1 Option Screening

The initial option screening assessment considered a range of decommissioning approaches for the Cavendish pipelines. Table 3-1 below provides a summary of the options considered and those taken forward for the full Comparative Assessment. A number of options were considered for the Cavendish pipelines, summarised in below.

**Table 3-1 Summary of Options Screening Assessment**

<table>
<thead>
<tr>
<th>Option</th>
<th>Status</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leave the pipeline as is</td>
<td>Discounted</td>
<td>Whilst the majority of the pipeline is well buried and could potentially be left, it was identified that to leave the shallow and unburied sections of line at the two ends of the line to be an unrealistic scenario.</td>
</tr>
<tr>
<td>Trench the unburied sections at the two platform ends</td>
<td>Discounted</td>
<td>Considered easier to remove the unburied sections rather than try to bury them considering the effort and time required to achieve sufficient burial depth.</td>
</tr>
<tr>
<td>Rock Dump to bury the existing shallow/unburied sections of line</td>
<td>Discounted</td>
<td>Base case is to achieve decommissioning without rock dumping where possible and to only use rock dumping where absolutely necessary.</td>
</tr>
<tr>
<td>Complete Removal</td>
<td>Taken forward for Comparative Assessment</td>
<td>Whilst the specific method of removal was not considered in detail, the concept of complete removal was taken forward into the comparative assessment and the advantages/disadvantages considered.</td>
</tr>
<tr>
<td>Partial Removal</td>
<td>Taken forward for Comparative Assessment</td>
<td>Partial removal would result in a clean seabed but with the majority of the pipeline buried below 600mm, would enable the decommissioning to be efficient.</td>
</tr>
</tbody>
</table>

On the basis of the above, the full Comparative Assessment was undertaken on two options: Partial Removal and Complete Removal.

3.2 Results of the Comparative Assessment

A summary of the findings of the Comparative Assessment are provided within the sections below and are presented within the four categories of assessment in the OPRED guidance – Safety, Environmental, Technical and Societal.

3.2.1 Safety – Comparative Assessment

Some of the key highlights of the safety assessment are as follows:

- The complete removal of the pipeline eliminates any snagging hazards.
- Main risks are due to the potential for dropped objects during onshore and offshore operations.
- Due to the large quantity of subsea operations, it is possible that diving intervention will be required which poses a higher risk.
- There is also a risk to 3rd party assets and vessels during operations due to the potential for breakdown of trenches which could damage the trenching equipment, but this is considered to be low.
Although the assessment undertaken was qualitative, not quantitative, it was readily apparent that complete removal would potentially involve a greater degree of diver and offshore working risk due to the significantly larger workscope. With this in mind, mitigations can be put in place and therefore, although complete removal represents a higher risk option it was not considered unacceptable on the basis that various mitigations can be put in place.

Under a partial removal option, there is a residual potential snagging hazard that exists by leaving the pipeline, however, this is mitigated by the burial of exposed areas and ends.

A summary of the safety assessment is provided below.

### Table 3-2 Summary of Comparative Assessment - Safety

<table>
<thead>
<tr>
<th></th>
<th>Option 1 - Complete Removal</th>
<th>Option 2 – Partial Removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk to personnel</td>
<td>Significantly more offshore work due to the length of pipeline. Limited experience of reverse reeling. Large quantity of recovered pipeline to be handled offshore introducing a greater risk to personnel. Due to the length of pipeline involved there is a greater risk of vessel collision during complete removal.</td>
<td>Lower degree of offshore works compared to full removal which lowers the risk to those offshore. Workscape can be completed without the use of divers. As the works would be within the 500m zones for the most part, the risk to 3rd parties would be limited.</td>
</tr>
<tr>
<td>Risk to other users of the sea (post ops)</td>
<td>Marginally lower risk as potential snag risks would have been completely removed, noting that the pipeline is buried for the vast majority of the route. Seabed disturbance in the form of mounds, etc. could be created when excavating the buried sections of line and present a snagging hazard.</td>
<td>The buried pipelines will degrade over time within the surrounding sediments and are not expected to present a hazard to other users of the sea. The pipelines will not be preserved, which will assist in expediting the degradation.</td>
</tr>
<tr>
<td>Risk to those onshore (during Ops)</td>
<td>Significantly more onshore activity (lifting, cutting, handling, etc.) prior to recycling/disposal of the recovered sections of pipelines.</td>
<td>Limited onshore handling as only the unburied sections of pipeline would need to be recovered to shore.</td>
</tr>
</tbody>
</table>

### 3.2.2 Environmental – Comparative Assessment

Some of the key highlights of the assessment are as follows:

- The environmental appraisal of the two options determined there to be a low risk for chemical and hydrocarbon discharges in both cases due to the pipeline being cleaned prior to decommissioning works.
- Removal of the complete 47.35km length of line would create a significantly greater disturbance to the seabed compared to the partial removal option. Although such impacts would likely be relatively short-lived, there is nonetheless a significant difference between the two options.
- Energy usage and atmospheric emissions were also estimated to be high in the complete removal option, due to the large amount of equipment required for multiple activities of long durations.
- There is risk of accidental spills from operation vessels. Longer duration campaigns therefore carry a higher potential risk of spills.
- A complete removal option would require much higher energy use onshore for handling and processing of the recovered pipeline sections.

A summary of the environmental assessment is provided below.
### Table 3-3 Summary of Comparative Assessment – Environmental

<table>
<thead>
<tr>
<th>Category</th>
<th>Option 1- Complete Removal</th>
<th>Option 2 – Partial Removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marine Impacts</td>
<td>Discharges to sea will be limited as the pipeline will be cleaned and flushed prior to cut and removal. However, complete removal will place a far higher degree of seabed disturbance due to the length of the pipeline corridor.</td>
<td>Discharges to sea will be limited as the pipeline will be cleaned and flushed prior to cutting. Relatively short duration vessel use. Seabed disturbance will be limited to the areas where pipeline sections are unburied, which will mainly be restricted to the 500m zones.</td>
</tr>
<tr>
<td>Energy Use and Atmospheric Emissions</td>
<td>Significantly longer duration offshore works will result in much higher energy use and emissions to air. Further, there will be greater energy and emissions requirement to process the recovered pipeline once onshore.</td>
<td>Relatively short lived offshore works resulting in lower energy use and emissions to air. With less material recovered to shore, there will be lower energy and emissions associated with processing the recovered materials.</td>
</tr>
<tr>
<td>Resource Consumption</td>
<td>Higher resource consumption will be necessary to recover from the seabed and return to shore the 47.35km long pipeline.</td>
<td>Relatively low resource consumption based on short lived nature of offshore works.</td>
</tr>
<tr>
<td>Other consequences - Accidental Spills</td>
<td>Longer offshore campaign would increase the risk of accidental spills, however, robust mitigation measures should make this a relatively unlikely event.</td>
<td>Always a potential for accidental spills, however, the relatively short duration works will limit the risk and the mitigation measures should make this a relatively unlikely event.</td>
</tr>
</tbody>
</table>

#### 3.2.3 Technical

Some of the key highlights of the assessment are as follows:

- There are a large number of activities required for the complete removal option, which increases the likelihood of technical challenges. Furthermore, although there is an increasing level of experience in the UKCS, the full removal of a 47.35km long section of pipeline would represent a substantial challenge.
- The requirement of a crane for lifting means activities have both wind and wave restrictions, making both options weather sensitive. In the case of partial removal, however, a shorter workscope reduces the weather risk.
- A partial removal options represents a relatively low risk technical option.

### Table 3-4 Summary of Comparative Assessment – Technical

<table>
<thead>
<tr>
<th>Category</th>
<th>Option 1- Complete Removal</th>
<th>Option 2 – Partial Removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Feasibility</td>
<td>Limited experience of reverse reeling of trenched and buried pipelines and of cutting/handling of 47.35km of pipeline.</td>
<td>Cut and lift is well established method for retrieval of short sections of line.</td>
</tr>
</tbody>
</table>

#### 3.2.4 Societal

Some of the key highlights of the assessment are as follows:

- In both options, risks to stakeholders were considered low for fisheries and shipping access due to the pipeline being completely removed or buried.
- In the complete removal case there is the potential for short-term benefits to local employment at ship and disposal yards.
• However, there will be an increase of activity around the local ports and yards which could disrupt the onshore community. Additionally, the positive benefits of such work would only be relatively short-lived.

**Table 3-5 Summary of Comparative Assessment – Societal**

<table>
<thead>
<tr>
<th>Category</th>
<th>Option 1 – Complete Removal</th>
<th>Option 2 – Partial Removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fisheries and Shipping Access</td>
<td>There would be a short-term effect on fisheries whilst the offshore works are being undertaken, but there would be no legacy surveys over the pipeline required.</td>
<td>No impact during the offshore works as everything would be within the respective 500m zones of platforms. Limited potential future impact associated with pipelines surveys.</td>
</tr>
<tr>
<td>Community (Onshore) Disturbance &amp; Employment</td>
<td>Much more handling of pipeline sections onshore which would improve short term employment prospects. However, long term prospects cannot be guaranteed.</td>
<td>Limited onshore disturbance. Lower requirement for short term employment due to less material being brought to shore.</td>
</tr>
</tbody>
</table>

**3.2.5 Commercial**

No commercial evaluation was undertaken for this comparative assessment on the basis that there are some notable differences between the two considered options, rendering a commercial assessment unnecessary.
4 Conclusions

The decommissioning options for the Cavendish pipelines and fibre optic cable were subjected to a Comparative Assessment in line with OPRED guidance. The Comparative Assessment comprised a screening level appraisal following by a full Comparative Assessment of viable options in which consideration was given to Safety, Environmental, Technical and Societal aspects.

It was determined in the screening level assessment that the most viable options were complete removal of the pipelines or partial removal whereby the shallow and unburied sections of the lines (i.e. at the Cavendish platform and Murdoch MD pigging skid ends) would be recovered to shore for recycling/disposal. As such, these two options were considered in greater detail within the qualitative Comparative Assessment.

Following completion of the assessment, the preferred option was Partial Removal, based on the following key factors.

- The pipelines and fibre optic cable are, on the main route section, well buried and stable, as evidenced by pipeline inspections surveys. Both lines have substantially more cover than the minimum 600mm.
- Given the relatively well buried nature of the lines, it was evident that a complete removal option would require substantially greater input in terms of offshore scope and would result in a much greater degree of seabed disturbance compared to the partial removal option, for only incremental benefit.
- The Partial Removal option was considered technically achievable and relatively efficient to complete with the increasing sphere of experience in the UKCS of decommissioning projects. With the removal of the unburied/shallow buried sections of line at the Cavendish platform end and the Murdoch MD Pigging Skid end, the majority of the line would remain well buried and stable and would be very unlikely to result in any long term snagging risk.
- Under a partial removal option, the reduced duration and scope of offshore works reduces the safety risk, environmental impact and technical risk to the project.
5 References

4. OGUK (2013) Decommissioning of Pipelines in the North Sea Region 2013, Oil & Gas UK.
Appendix A – Pipeline Burial Charts (2015 Pipeline Inspection Surveys)