APPENDIX D – Oil Loading Pipeline - Options

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D.1 Summary of Decommissioning Options Considered

Four main options were considered for decommissioning the Oil Loading Pipeline: -

Option 1 – Float the pipeline and tow it to shore for disposal;

Option 2 – Recover to surface intact, cut into sections and bring sections to shore for disposal;

Option 3 – Cut in sections on seabed, retrieve sections and bring to shore for disposal

Option 4 – Clean and leave buried

D.1.1 Option 1 - Float the Pipeline and Tow it to Shore for Disposal

This method considers recovery of the pipeline to the shore in a single length and requires buoyancy to be attached so that it can be towed to shore intact.

Towing is required since the diameter of the pipeline (24") is too large to permit its recovery by reeling.

The outline procedure for recovery of the intact pipeline is:

(1) Pipeline Cleaning

See Section 9.

(2) Expose Pipeline

The pipeline must be exposed before recovery can commence. Overburden removal could be carried out using a plough or a jetting unit.

(3) Attach buoyancy to the pipeline

Buoyancy units could be attached to the pipeline either by rigid clamps or by straps. The preferred option would be to use attachment straps as these would be easier to install. Steel buoyancy tanks of 5 te net buoyancy at 20 m centres are proposed. Each tank would be provided with valves to control buoyancy. The buoyancy tanks would be lowered to the seabed flooded (ballasted) for diver attachment to the pipeline. The tanks would then be partially de-ballasted and floated using compressed air pumped from the surface and they would be ‘hooked-up’ to a surface buoyancy control system.

(4) Float pipeline

The pipeline would be floated by operation of the surface de-ballasting control system situated on the lead towing vessel (tug). The tug would also provide an initial lift to ensure that the pipe rises progressively from the forward end.

(5) Tow to disposal site

The lead tug and stern tug would then tow the pipeline to the land based disposal site.

(6) Winch to shore and dispose

The tow wire from the lead tug would be attached to a winch on shore and the pipeline would be dragged up a slipway. The other end of the pipe would be kept under control by the stern tug whilst the pipeline was cut into manageable sized sections for disposal purposes.

Table D-1 Cost Breakdown for Option 1

Activity	Resource	Duration	Rate (£)	Cost (£)
Mobilise DSV & Equip.	DSV	1½ days	Lump Sum	400,000
Complete pigging programme	DSV & Pigging Spread	5 days	Lump Sum	1,000 000
Expose pipeline.	DSV Jetting.	4 days	100,000	400,000
Attach buoyancy tanks and hook-up deballasting SCS.	DSV	15 days	100,000	1,500,000
Fit tow and trail heads to pipeline.	DSV	1 day	100,000	100,000
Mobilise tugs.	Tugs x 2	1 day	20,000	40,000
Connect tugs to pipeline and float pipeline.	DSV Tugs x 2	1 day	100,000 20,000	100,000 40,000
Tow pipeline to shore and land on slipway.	Tugs x 2	4 days	20,000	160,000
Towing wires.			Lump sum	50,000
Floatation tanks.			Lump sum	800,000
Tow/trail heads.			Lump sum	50,000
Weather downtime.	DSV Tugs x 2	3 days 1 day	100,000 20,000	300,000 40,000
Demobilise tugs.	Tugs	1 day	20,000	40,000
Demobilise DSV & Equip	DSV	1 day	Lump Sum	250,000
Debris sweep.	Trawler	1 day	10,000	10,000
Pull and cut pipeline and dispose. LSA cleaning & disposal	Onshore facility	10 days	Lump sum Lump Sum	100,000 500,000
			Total	**5,880,000**

Note: Weather downtime is calculated approximately as 1 day in 7.

D.1.2 Option 2 – Recover to Surface Intact, Cut into Sections and Bring Sections to Shore for Disposal

This option considers recovering the pipeline onto a surface vessel where it would be cut into manageable sections which would then be transported to a suitable disposal site onshore. This is essentially a reverse lay operation.

The outline procedure for lifting the pipeline to the surface and cutting it into sections is presented below.

(1) Pipeline Cleaning

As per Option 1.

(2) Expose pipeline

As per Option 1

(3) Attach lifting gear, dewater and pull pipeline end onto the vessel

The pipeline end would be lifted to the barge deck using a winch wire attached by divers. The pipeline would be dewatered to minimise stress in pipeline and recovery loads. The far end would be secured to a temporary anchor to provide a reaction to the pipe tension.

(4) Pull pipeline onto lay barge and cut

The pipeline would be secured within the barge tensioners and would be pulled onboard and cut and recovered in manageable lengths. The barge would heave itself back along the pipeline lay-route using its anchors.

(5) Transfer cut pipe sections to pipe carrier vessel for transport

Using barge craneage the pipe sections would be lifted onto an adjacent pipe carrier vessel or barge for transport to the onshore disposal site.

Table D-2 Cost Breakdown for Option 2

Activity	Resource	Duration	Rate (£)	Cost (£)
Mobilise DSV & Equip	DSV	1½ days	Lump Sum	400,000
Complete pigging programme	DSV & Pigging Spread	5 days	Lump Sum	1,000,000
Expose pipeline	DSV Jetting or jet prop	4 days	100,000	400,000
Fit pulling head to pipeline and connect barge recovery wire.	DSV	1 day	100,000	100,000
Weather downtime.	DSV	1 day	100,000	100,000
Demobilise DSV.	DSV	1 day	Lump Sum	250,000
Mobilise Barge and attendant tugs.	Lay Barge Spread	6 days	200,000	1,200,000
Pick up recovery wire and pull pipeline onto barge. Secure in pipe handling system.	Lay Barge Spread	1 day	200,000	200,000
Recover and cut pipeline.	Lay Barge Spread	7 days	200,000	1,400,000
Mobilise supply vessels.	Supply vessels x 2	1 day	20,000	40,000
Back load pipe sections and debris to supply vessels.	Lay Barge Spread Supply vessels x 2	2 days	200,000	400,000
		2 days	20,000	80,000
Weather downtime	Lay Barge Spread	2 days	200,000	400,000
Demobilise Barge	Lay Barge Spread	2 days	100,000	200,000
Transport pipe sections to onshore disposal site.	Supply vessels x 2	2 days	20,000	80,000
Debris sweep	Trawler	1 day	10,000	10,000
Onshore disposal	Onshore facilities	3 days	Lump Sum	50,000
LSA cleaning & disposal*			Lump Sum	500,000
			Total	**6,810,000**

Note: Weather downtime is calculated approximately as 1 day in 7.

D.1.3 Option 3 - Cut in Sections on Seabed, Retrieve Sections and Bring to Shore for Disposal

This option considers cutting the pipeline into sections on the seabed and recovering the sections onto a surface vessel and then transporting the sections to an onshore disposal site.

The activities for cutting the pipeline on the seabed and lifting the sections onto the surface vessel are discussed below:

(1) Expose pipeline

As per Option 1

(2) Cut Pipeline

The pipeline would have to be cut around 80 times. Therefore an efficient cutting system, which is safe and requires minimal set up time, would be required.

(3) Lift the pipe sections

The pipeline would be cut into sections of not more than 30 m to avoid handling problems. The weight of a 30 m section would be approximately 6 te in air. Rigging would be performed by divers.

(4) Transport to shore

The cut pipeline sections would be backloaded onto supply vessels for transport to the onshore disposal site where the pipe sections would be cut into more manageable sized lengths before being disposed.

Table D-3 Cost Breakdown for Option 3

Activity	Resource	Duration	Rate (£)	Cost (£)
Mobilise DSV.	DSV	1½ days	Lump Sum	400,000
Complete pigging programme	DSV & Pigging Spread	5 days	Lump Sum	1,000,000
Cut pipeline and recover pipe sections.	DSV Cutting system	20 days	100,000	2,000,000
Rigging /seafastening.			Lump sum	50,000
Weather downtime.	DSV	4 days	100,000	400,000
Mobilise supply vessels.	Supply vessels x 3	1 day	20,000	60,000
Back loading supply vessels and standby.	Supply vessels x 3	15 days	20,000	900,000
Transport pipe sections to onshore disposal site and offload.	Supply vessels x 3 Onshore facility	2 days	20,000	120,000
Demobilise DSV	DSV	1 day	Lump Sum	250,000
Debris sweep	Trawler	1 day	10,000	10,000
Demobilise Supply Vessels	Supply vessels x 3	1 day	20,000	60,000
Cut pipe sections and dispose.	Onshore facility	5 days	Lump Sum	75,000
LSA cleaning & disposal*				500,000
			Total	**5,825,000,**

Note: Weather downtime is calculated approximately as 1 day in 7.

D.1.4 Option 4 – Clean and Leave Buried

This option would result in the pipeline being cleaned and left open ended in its trench on the seabed. Since this is the selected option it is fully described in Section 10.

Pipeline inspections have shown that the seabed is relatively stable and that exposure of the pipe has not been significant for the 16 years that it has been operating. Hence, decommissioning of the pipeline *in situ* is the preferred option.

In accordance with current regulatory guidance, the Oil Loading Pipeline will be cleaned and allowed to back fill with sea water.

The activities required for the decommissioning of the pipeline are discussed below:

(1) Pipeline Cleaning

As per Option 1

(2) Cut sections at either end

There is currently one short section of pipeline (approx 20 m) where the crown of the pipe is exposed. It is proposed that a layer of rock material will be placed over the pipe to provide sufficient cover in an overtrawlable profile.

(3) Pipeline route debris and snag survey

The pipeline route will be overtrawled to ensure that the pipeline does not present any snagging features to users of the sea and that all debris has been recovered.

(4) Pipeline inspection

Periodic inspection of the pipeline route will be carried in conjunction with other pipeline inspection activities.

Table D-4 Cost Breakdown for Option 4

Activity	Resource	Duration	Rate (£)	Cost (£)
Mobilise DSV	DSV	1½ days	Lump Sum	400,000
Complete pigging programme	DSV & Pigging Spread	5 days	Lump Sum	1,000,000
Cut and recover sections at either end of pipeline.	DSV	3 days	100,000	300,000
Known remedial rock material placement.	Rock Dumper	1½ days	Lump Sum	75,000
Debris sweep.	Trawler	1 day	10,000	10,000
Weather downtime	DSV	1 day	100,000	100,000
Demobilise DSV	DSV	1 day	Lump Sum	250,000
Pipeline route inspection.	Survey vessel	Periodic Inspection	20,000 per visit. Assuming 1 x visit every 3 years for the next 60 years and no remedial work required.	400,000
Onshore disposal of pipeline end sections.	Onshore facility	1 day	Lump Sum	15,000
LSA cleaning and disposal				50,000
			Total	**2,600,000**

D.2 Comparative Assessment Options

This subsection describes the findings of the qualitative assessment of the four options available for decommissioning of the Oil Loading Pipeline. It also documents the qualitative assessment conducted to rank each option with respect to safety, environmental, technical challenges and costs. The results are summarised in Table D-5, Table D-6, Table D-7 and Table D-8.

The evaluation methodology applied, was to compare each option relative to each other and rank them in order of 1 to 4 on each of the relevant selection criteria (1 being most and 4 being least desirable).

The overall scores and rankings are considered in subsection D.3.

D.2.1 Option 1 – Float the Pipeline and Tow it to Shore for Disposal

Complexity and associated technical risks

The option of exposing, lifting and transporting the oil export pipeline to shore, as a single unit, has the greatest degree of complexity of all retrieval methods considered. Exposing the pipeline before refloat would be relatively straightforward. This involves a jetting unit from the Dive Support Vessel (DSV) to move the seabed material from above the pipeline. The attachment of buoyancy units onto the pipeline to raise the pipeline to the surface would involve divers at around 96 m depth and would take approximately 15 days. The refloat operation to bring the pipeline to the surface would involve filling the attached buoyancy units with compressed air and providing the initial lift by using a tug. This operation is expected to involve divers operating at around 96 m depth, a dive support vessel and equipment to pump compressed air to the pipeline and buoyancy units. Once on the surface, the towing operation would require 2 tugs to manoeuvre the pipeline to the land-based disposal site. The tow operation could take up to 4 days, depending on the location of the disposal site, and could be severely hampered by bad weather. There is a risk of the pipeline breaking into sections during the tow operation if bad weather is encountered. This could lead to sections of the pipeline sinking to the seabed, requiring further efforts to recover them. This pipeline would not be allowed to be towed over third party pipelines or telecommunications lines.

Risks to personnel

The requirement for divers operating at 96 m depth during refloat operations presents a risk to their safety. There could also be increased risk to personnel during towing operations and onshore work, particularly if bad weather is encountered during the tow. If the pipeline were to break into sections then there could be added risk to other vessels and/or subsea facilities.

Although the pipeline will have been pigged prior to any decommissioning work, there is still the potential for it to be LSA contaminated. There could therefore be potential handling issues and disposal complications if the pipeline is found to contain LSA material.

Environmental impacts

The main environmental impact from this option would be from the jetting operation to uncover the pipeline. This would result in disturbance to and re-suspension of seabed material along the length of the oil export pipeline, a distance of about 2.3 km. The physical disturbance would be confined to the route of the pipeline itself but the resulting displacement and re-suspension of material could affect a wider area, depending on the local currents. The re-suspension of material would be temporary but might cause smothering of areas where the suspended material lands. Depending on the time of year that the jetting operation takes place, spawning fish could be subject to disturbance from re-suspended material. Fish spawning activity is discussed in Section 3.

As well as the potential LSA issue, other environmental impacts would be emissions to air from the combustion of diesel from vessels used during the refloat operation and subsequent tow away and from equipment used in winching the pipeline to shore. Figures for these emissions are likely to be higher than those associated with leaving the pipeline *in situ* (Option 4) or lifting the pipeline and cutting it on the surface (Option 2). This is owing to the number of vessels involved and the duration of operations (see Table D-7).

Once the pipeline has been cut into sections onshore, they can be sent to a landfill, recycled or reused. However, reuse is unlikely to be practical because the pipe is weight coated and considerable care would be required when cutting and handling the pipe to ensure that it remained in a satisfactory condition. Burial would require a suitable landfill site but does not present any apparent technical difficulties. Disposal would require removal of the cathodic protection anodes and crushing of the pipeline to break off the concrete coating. The steel and the anodes have scrap value and could be recycled via the existing scrap metal market.

Effect on safety of navigation and other sea users

During refloat operations other vessels would be required to stay away from the immediate vicinity. Similarly, during the tow to the onshore disposal location, there would be a requirement for navigation warnings to be issued to other shipping in the area. If severe weather is encountered during the tow, and problems controlling the pipeline on the surface occur, then there could be further risks to other sea users in the area. If the pipeline did break up on tow in bad weather and sections sank to the seabed, then these sections would form a hazard to vessels fishing and/or subsea facilities in the area and would need to be removed.

Costs

Costs for the recovery of the pipeline intact and its disposal onshore are given in Table D-2. This method of decommissioning the oil export pipeline is the second most cost-effective of the four options considered.

D.2.2 Option 2 – Recover the Surface Intact, Cut into Sections and Bring Sections to Shore for Disposal

Complexity and associated technical risk

This option would involve the use of a laybarge and lifting gear in order to pick-up (winch) one end of the pipeline to the surface and onboard the laybarge, prior to cutting the pipeline into sections. The process of attaching the lifting gear to the cut end of the pipe would require divers operating at around 96 m depth. The use of jetting equipment to loosen the pipeline from the seabed would also be required prior to any lifting operations.

A significant technical and safety risk exists when gripping the concrete coated pipeline. The grip could be suddenly released if the concrete coat spalls off. This could result in severe damage to the vessel and poses a significant safety risk.

Risks to personnel

The requirement for divers operating at 96 m depth during pipeline pick-up operations presents a risk to their safety. Divers would only be required for the attachment of the lifting gear. As mentioned above, there could be risk to personnel onboard the laybarge if there are problems gripping the pipeline concrete coating during cutting operations.

There would be a requirement for craneage on the pipe handling vessel to transfer the cut sections of pipe to the supply vessel, prior to shipment to land. The pipeline would require to be cut into approximately 80 sections. Each section would be a maximum of 6 te in weight and a maximum of 30 m long. There would be added risk to personnel associated with this lifting operation, owing to the weight and length of the sections and the number of lifts required.

Although the pipeline will have been pigged prior to any decommissioning work, there is still the slight potential for it to be LSA contaminated. There could, therefore, be a potential handling issue and disposal complications if the pipeline is found to contain LSA material.

Environmental impacts

As the jetting equipment is required to loosen the seabed material along the pipeline route then there would be localised disturbance and re-suspension of material, as described for Option 1. The removal of the oil export pipeline from its present position would also disturb the seabed in the immediate area. The physical disturbance would be confined to the route of the pipeline itself but the resulting displacement and re-suspension of material could affect a wider area, depending on the local currents. The re-suspension of material would be temporary but might cause smothering of areas where the suspended material lands.

A qualitative comparative assessment for emissions to air from vessel movements during the proposed operations indicates that these emissions are likely to be higher than those associated with leaving the pipeline *in situ* but lower than the other two options, owing to the number of vessels involved and the duration of operations (see Table D-7).

Once the pipeline sections are onshore, they would need to be further cut into more manageable lengths and sent to landfill, recycled or reused with potential LSA issues. This is similar to Option 1 and is discussed in more detail above.

Effect on safety of navigation and other sea users

Other vessels would be required to stay away from the immediate vicinity during pipeline lifting and cutting operations. These restrictions would only be required until the pipeline has been cut up and transferred to the transport vessel.

Costs

Estimated costs for lifting the pipeline from the seabed and cutting it into sections on the surface, prior to transporting the sections onshore are given in Table D-8. This method of decommissioning the oil export pipeline is the most expensive of the four options considered.

D.2.3 Option 3 – Cut in Sections on Seabed, Retrieve Sections and Bring to Shore for Disposal

Complexity and associated technical risk

As discussed for earlier options, the use of jetting equipment to uncover the pipeline from the seabed would be required prior to cutting operations. The actual method to be used for cutting the pipeline into sections is optional. Explosive cutting could be used but this requires considerable preparation. External abrasive cutting requires good access all around the pipeline. Internal abrasive cutting is suitable but would require a long umbilical to thread along the pipeline. Since the pipeline would need to be cut into approximately 80 sections, the cutting method used would need to be highly efficient and require minimal pipe preparation and set-up time.

Risks to personnel

The requirement for divers operating at 96 m depth during cutting operations presents a risk to their safety. Although an efficient cutting method would be used, this option would still require the greatest use of divers out of the four options considered (see Table D-6).

There would be a requirement for craneage on the pipe handling vessel to lift the sections of pipeline from the seabed to the vessel, prior to shipment onshore. There would be approximately 80 sections of pipeline to be lifted in this way. Each section would be a maximum of 6 te in weight and a maximum of 30 m long. There would be added risk to personnel associated with this lifting operation, owing to the weight and length of the sections, the number of lifts required and the possibility of dropped objects.

Furthermore, although the pipeline will have been pigged prior to any decommissioning work, there is still the potential for it to be LSA contaminated. There could therefore be a potential handling hazard and disposal complications if the pipeline is found to contain LSA material.

Environmental impacts

The environmental impact from this method is similar to that from Option 1 and Option 2.

Once the pipeline sections are onshore, they would need to be further cut into more manageable lengths and sent to landfill, recycled or reused with potential LSA issues. This has been discussed in more detail for Option 1.

Effect on safety of navigation and other sea users

Other vessels would be required to stay away from the immediate vicinity during pipeline cutting and lifting operations. The restrictions would only be required during these operations.

Costs

Estimated costs for cutting the pipeline into sections on the seabed and lifting the sections to the surface, prior to transportation to land are given in Table D-8. This method of decommissioning the oil export pipeline is the second most expensive of the four options considered. (The removal of the pipeline in one whole section was estimated to be more expensive).

D.2.4 Option 4 – Clean and Leave Buried

Complexity and associated technical risk

The most complex activity connected with this option would be removal of the two exposed end sections.

Risks to personnel

The requirement for divers operating at 96 m depth during cutting of the pipeline ends presents a risk to their safety. This option would require the least use of divers out of all four options considered (see Table D-6).

Environmental impacts

The environmental impact from this option is relatively minor compared with the other options. It involves small excavation at the pipeline ends, to cut and bury them.

Figures for emissions to air from vessel movements during the proposed operations are unavailable. However, a qualitative assessment indicates that these emissions are likely to be the lowest of all four options considered, owing to the duration of the operations and the number of vessels involved (see Table D-7).

Pipeline degradation would occur through time. Data from several studies indicate that large diameter (> 16") pipelines would not be likely to break-up in the first 50 years after decommissioning. As the pipeline will be at ambient temperature after decommissioning it is likely that the corrosion rate will be lower than during the operational phase, perhaps in the order of 2 μm/year/^{o}C. Corrosion is likely to be limited for the first few years owing to the cathodic protection system providing some degree of protection.

It has been estimated that the concrete coating around a pipe could last in excess of 100 years if it is not damaged by anchors or fishing gear (Reference Cordah[1]). The 24" oil export pipeline is concrete coated and is trenched to a minimum of 0.5 m and backfilled to protect it from damage in this way.

In conclusion it is likely that if left in-situ, the pipeline would take a very long time to degrade. As the pipeline is trenched and naturally backfilled it is likely that over a period of time it would collapse in on itself posing little or no threat to other users of the sea from steel debris.

Regular monitoring would continue to be carried out to ensure that the pipeline remains buried. See Section 10.

There would be minimal impact on land-based disposal sites in this option since the pipeline would be remaining in situ with minimal waste returned to shore.

Effect on Safety of Navigation and Other Sea Users

Once the pipeline ends have been buried there would be a debris sweep along the length of the pipeline carried out by a fishing trawler, prior to the pipeline route being declared overtrawlable. There will be minimal impact on the safety of navigation and other sea users resulting from leaving the oil export pipeline *in situ*.

Costs

Estimated costs for leaving the pipeline in situ are given in Table D-8. This method of decommissioning the pipeline is the most cost-effective of the four considered options.

Table D-5 Oil Loading Pipeline Option Selection Summary Table – Technical Considerations

Rankings as well as comments on particular issues considered

Option	Technical				
	Lifting	**Cutting**	**Transporting**	**Exposure / Burial**	**Disposal**
1 Float to surface and tow to shore intact for disposal	Deballast pipeline and float	Onshore – limited technical risk except for handling	Towing: 4 days x 2 tugs Risk of Tow failure Risk of Buoyancy failure Risk of Pipe failure	Expose entire length of pipeline	480 te pipeline (steel/mastic/ concrete) Pigging waste Possible LSA
Ranking	**4**	**2**	**4**	**4**	**4**
2 Recover to surface intact, cut into sections and bring sections to shore for disposal	Handling pipeline intact Possible concrete coating failure	200 cuts topsides – (offshore)	Supply Vessels 5 x trips	Expose entire length of pipeline	480 te pipeline (steel/mastic/concrete) Pigging waste Possible LSA
Ranking	**3**	**3**	**1**	**4**	**4**
3 Cut in sections on seabed, retrieve sections and bring to shore for disposal	Mechanical grab – lifting 80 sections @ 6 te from seabed	80 subsea cuts (Hot cut – automated)	Supply Vessels 5 x trips	Expose entire length of pipeline	480 te pipeline (steel/mastic/concrete) Pigging waste Possible LSA
Ranking	**2**	**4**	**1**	**4**	**2**
4 Clean and leave buried	2 x end sections (short sections)	2 x subsea cuts (Hot cut)	DSV 2 x End sections of Pipeline only	Expose locally to enable cut for section and retrieval	2 x end sections Pigging waste Possible LSA
Ranking	**1**	**1**	**1**	**1**	**1**

Table D-6 Oil Loading Pipeline Option Selection Summary Table – Safety Considerations

(Rankings as well as comments on particular issues considered)

Option	Safety				
	Divers	**Surface work**	**Marine**	**Onshore**	**Materials on the Seabed**
1 Float to surface and tow to shore intact for disposal	12 @ 21 days 2 x cuts Attach buoyancy Expose pipe	Control float Attach tow	DSV - 1 @ 26 days + Tugs - 2 @ 1day Tugs - 2 @ 6 days Trawler - 1 @ 1day = 41 vessel days Possible Tow failure Navigation Hazard	Winching to Slipway Handling pipe intact 200 x cuts Handling 200 x sections @ 2 te Road transport Pigging Waste Possible LSA	Nothing remaining
Ranking	**3**	**1**	**3**	**4**	**1**
2 Recover to surface intact, cut into sections and bring sections to shore for disposal	12 @ 5 days 2 x cuts Attach winch Pigging Ops Expose pipe	Handling pipe to barge Possible concrete coating failure 200 x cuts possible LSA Handling 200 x sections @ 2 te	DSV – 1@ 8 days Laybarge – 1 @ 20days + Supply vessel – 2 @ 2 days Supply vessel – 2 @ 3 days Trawler – 1 @ 1 day = 39 vessel .days	Handling 200 x sections @ 2 te Road transport Pigging Waste Possible LSA	Nothing remaining
Ranking	**2**	**4**	**2**	**2**	**1**
3 Cut in sections on seabed, retrieve sections and bring to shore for disposal	12 @ 24 days 80 x cuts Expose pipe	Handling 80 x sections @ 6 te	DSV – 1@ 30days + Supply vessel – 3 @ 15 days Supply vessel – 3 @ 4 days Trawler – 1 @ 1 day = 88 vessel days	Handling 80 x sections @ 6 te 120 x cuts Handling 200 x sections @ 2 te Road transport Pigging Waste Possible LSA	Nothing remaining
Ranking	**4**	**3**	**4**	**3**	**1**
4 Clean and leave buried	12 @ 3 days 2 x cuts 2 x lifts to surface Expose pipe locally to enable cut for removal of pipeline end sections	Recovery of pipe ends	DSV – 1@ 6days Survey vessel – 1 @ 20 days (over 60 years) Trawler – 1 @ 1 day = 27 vessel days	Handling of pipe ends Pigging Waste Possible LSA	Monitoring and users of the sea
Ranking	**1**	**2**	**1**	**1**	**4**

Table D-7 Oil Loading Pipeline Option Selection Summary Table – Environmental Considerations

(Rankings as well as comments on particular issues considered)

Option	Environmental		
	Marine	**Atmospheric**	**Onshore**
1 Float to surface and tow to shore intact for disposal	As per Option 2 except: Vessel effluent x 41 vessel days	Exhaust emissions x 41 vessel days. Road transport	480 te pipelines (steel/mastic/concrete) Pigging waste
Ranking	**2**	**3**	**4**
2 Recover to surface intact, cut into sections and bring sections to shore for disposal	Disturbance to 2.3 km x 10 m area of seabed to 1 m depth Vessel effluent x vessel 39 days Some pipe cut waste	Exhaust emissions x 39 vessel days. Road transport	480 te pipelines (steel/mastic/concrete) Pipe cut waste x 200 cuts (some overboard) Pigging waste
Ranking	**3**	**2**	**3**
3 Cut in sections on seabed, retrieve sections and bring to shore for disposal	Disturbance to 2.3 km x 10 m area of seabed to 1 m depth Vessel effluent x 88 vessel days Pipe cut waste x 80	Exhaust emissions x 88 vessel days. Road transport	480 te pipelines (steel/mastic/concrete) Pipe cut waste x 120 subsea cuts Pigging waste Pipe material – potential LSA
Ranking	**4**	**4**	**2**
4 Clean and leave buried	Limited disturbance to seabed Vessel effluent x 27 vessel days.	Exhaust emissions x 27 vessel days.	Onshore disposal of pipeline ends Pigging waste Pipe material – potential LSA
Ranking	**1**	**1**	**1**

Table D-8 Oil Loading Pipeline Option Selection Summary Table – Cost Considerations

Option	Costs (£)
1 Float to surface and tow to shore intact for disposal	5.9 million
Ranking	**2**
2 Recover to surface intact, cut into sections and bring sections to shore for disposal	6.8 million
Ranking	**4**
3 Cut in sections on seabed, retrieve sections and bring to shore for disposal	5.8 million
Ranking	**3**
4 Clean and leave buried	2.6 million
Ranking	**1**

D.3 Selection of Preferred Option

On the basis of the comparative assessment presented in subsection D.2 and the cost evaluations presented in subsections D.1.1, D.1.2, D.1.3 and D.1.4, Option 4 – clean and leave buried, has been selected as the preferred option.

A qualitative assessment of the safety and environmental hazards, technical challenges and costs for all options and methods is contained in subsections D.2.1 and D.1.4.

The evaluation methodology applied, was to compare each option relative to each other and rank them in order of 1 to 4 on each of the relevant selection criteria (1 being most and 4 being least desirable).

The overall score and ranking was generated by summation – applying a general weighting of 2 to the safety and environmental rankings to account for their greater importance. These rankings are presented Table D-9 and they lead to the preferred option being Option 4.

Table D-9 Oil Loading Pipeline Option Selection Rankings Table

Option/Method	Safety					Environmental			Technical					Cost	Overall	
	Divers	Surface work	Marine	Onshore	Materials on the Seabed	Marine	Atmospheric	Onshore	Lifting	Cutting	Towing	Exposure/ Burial	Disposal		Score	Ranking
1 Float to surface and tow to shore intact for disposal	3	1	3	4	1	2	3	4	4	2	4	4	4	2	62	3
2 Recover to surface intact, cut into sections and bring sections to shore for disposal	2	4	2	2	1	3	2	3	3	3	1	4	4	4	57	2
3 Cut in sections on seabed, retrieve sections and bring to shore for disposal	4	3	4	3	1	4	4	2	2	4	1	4	4	3	66	4
4 Clean and leave buried	1	2	1	1	4	1	1	1	1	1	1	1	1	1	30	1

D.4 Notes and References

The notes below, provide additional reference information relevant to this section. A Glossary of terms and abbreviations is also included before Appendix A, and a complete list of supporting studies and procedures is contained within Section 17.

[1] Assessment of the Environmental Impacts of the Operations to Refloat the Maureen A Platform, 0572-33-492, October 1998, Cordah Environmental Management Consultants, Aberdeen