Respooling Versus Offshore Cutting

"Why chop it up when we can reuse it?"

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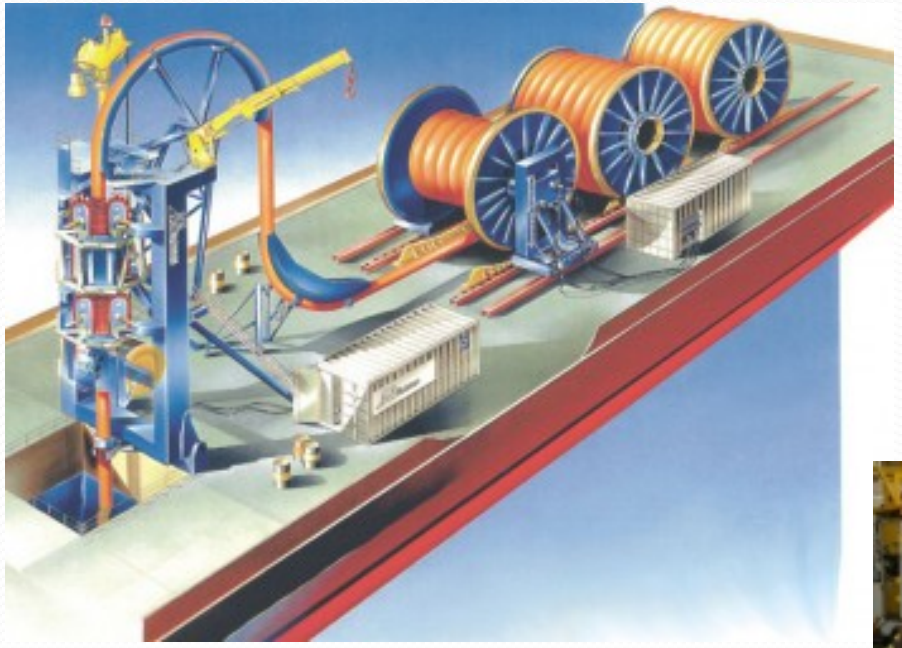
Introduction - Why chop it up when we can reuse it?

- Explore decommissioning alternatives available to operators and compare costs, and discuss some problems with each method.
- Currently almost all surplus flexible pipe flowlines recovered in the North Sea are hauled up and cut into short lengths for onwards delivery by road to recycling plants.
- Is there a viable cost effective alternative to offshore cutting of flowlines?
- This talk will explore what is necessary to make respooling a cost effective alternative and discuss the pro and cons of each method.

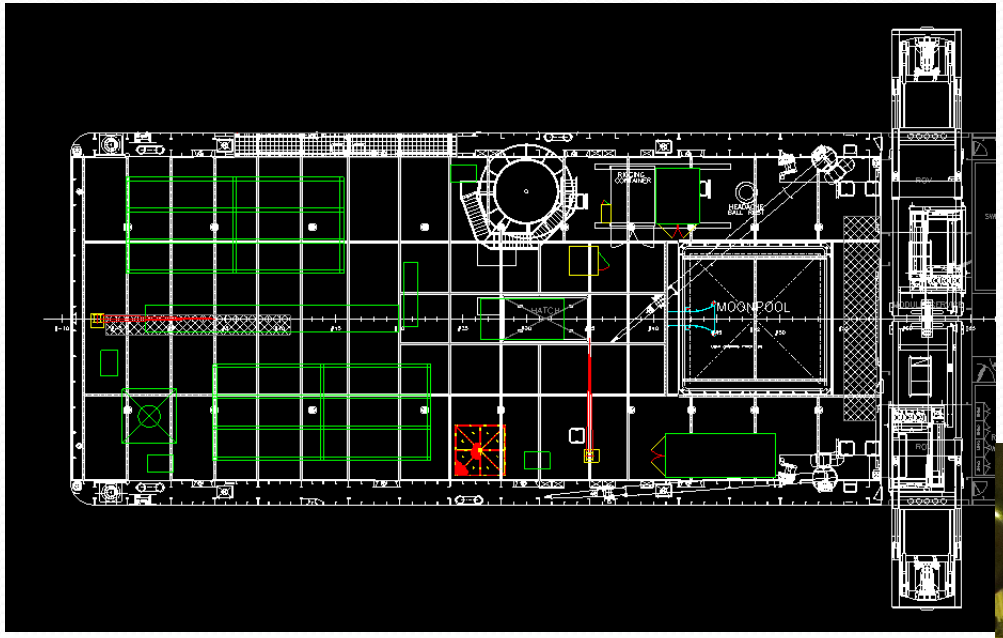
Examples of Cutting & Re-Spooling



Typical re-spooling operation using VLS and multiple reels with rail centre drive system

Pipe recovery using linear tensioner feeding a shear to cut pipe into 14m lengths

Cutting Pipe Offshore



Typically a DP2 vessel with work class ROV spread and deck crane is required. These light OCV's are currently only £35K per day.

Pipe is recovered either over a chute using a linear tensioner through the moon pool or over the stern

Recovery and Re-Spooling

For respooling typically a vessel like the Normand Vision is required either using under-deck carousels or multi-reel RDS as shown in the above picture. This vessel commands a day rate in excess of £100k/day.

Pros and Cons

Reel Up	
Pro	Con
Re use of the recovered pipe is possible	Cost of reel hire
Closed system	Cost of reel handling
Control of fluids	Cost of flange disconnections
Small number of controlled heavy lifts for offloading	Cost of heavy lifts. Reels up to 300Te. Sometimes possible with vessel crane

Lift & Chop	
Pro	Con
Short scrap lengths	Possible release of polluting hydrocarbons
Cheap to transport	Possible gas release
Low cost cutting of pipe or tie in spool	Offshore handling, weather sensitive
Relatively cheap to offload with approx. 100Te crane in 25Te bundles	Health and Safety issues with unpredictable lifting of curved pipe sections

Cost comparison study

1. Case Study Summary

This cost analysis is based on the following scenario:

- **Field Location:** Central / Northern North Sea, approx. 100 nm from North East UK Port facilities (Peterhead, Aberdeen, Dundee, Fife, Invergordon, Montrose)
- **Water Depth at Field:** 115m
- Field Development Type / Configuration:
  - **Two (2)** drill centres tied back to an FPSO disconnectable riser buoy system;
  - Each drill centre is located approx. 1.4km from the FPSO and comprises one manifold comingling production from multiple wells;
  - Each manifold is tied-back to the FPSO riser buoy with **four (4)** flexible combined flowline / risers pipes and **one (1)** Control Umbilical with the following characteristics:

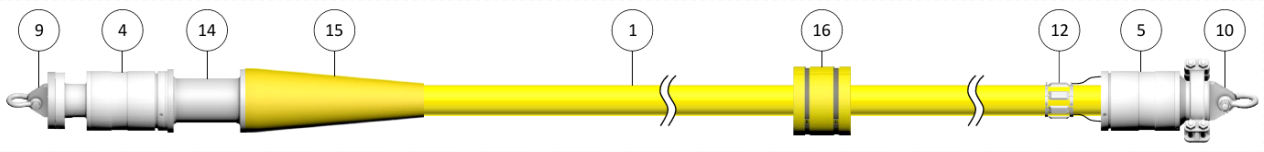
Description	Q.ty per DC	Length	ID	OD	Weight air		Weight submerged	
					empty	waterfilled	empty	waterfilled
		[m]	[inch]	[inch]	[kg/m]	[kg/m]	[kg/m]	[kg/m]
Gas Lift Flowline / Riser	1	1,400	6	9.03	94.01	114.36	50.12	70.47
Water Injection Flowline / Riser	1	1,400	8	10.50	81.30	114.50	23.80	57.00
Production Flowline / Riser	2	1,400	8	14.10	154.60	182.20	51.00	78.80
Control Umbilical	1	1,400	-	4.5	-	21.70	-	12.40

NOTE: decommissioning of Control Umbilical is excluded from this study

Cost comparison study

Unfortunately due to time constraints we can only give a very brief overview of the cost comparison study

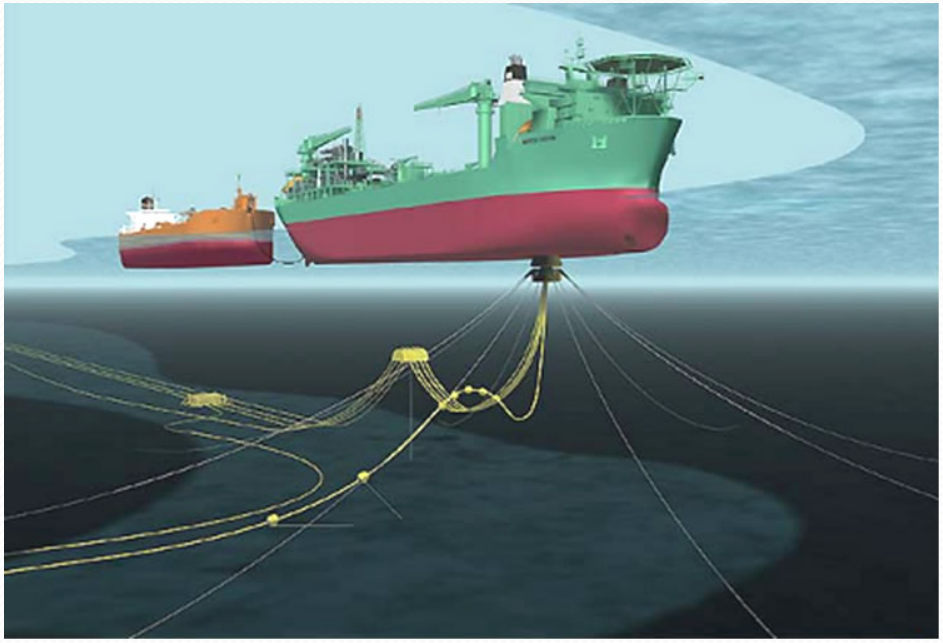
- Each riser section has a “Lazy Wave” configuration, with eight (8) distributed buoyancy modules and hold-down / hold-back clamps near the Touch Down Point (TDP) tethered to suction piles;



Typical flexible pipe arrangement

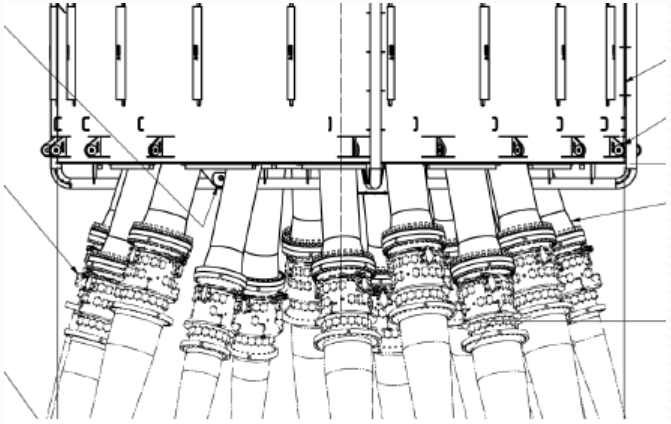
- The flowline ends have bolted connections to rigid spool pieces at the drill centre manifold, and the spools are accessible for cutting without damaging the pipe termination;

Costs of Offshore Re-Spooling



To make a comparison we have considered a small FPSO based field development like shown with subsea wells controlled via umbilcals from the floater.

Risers would typically be connected to a disconnectable buoy, often with ROV-operated bend-stiffener disconnections under the buoy but sometimes air diving is required.



Costs of Cutting Pipe Offshore

In this example the deck is laid out with 2 shears to cut 2x14m lengths for each recovery cycle

Pipe is recovered in 28m lengths and cut twice with storage pens alongside for faster handling

Innovations to Reduce Costs of Re-Spooling

Modular reel carrier to reduce costs of onshore handling shifting reels from quay edge. Use vessel crane to load and unload reels.

Onshore reel supply and handling centre

Controlled onshore cutting and continuous splitting for material separation

Using vessel crane for offloading reels

Re use of Flexible Pipe

Engineering, fatigue life and material assessments

Pigging and flushing to remove hydrocarbon in a closed system.

Skin repair, plastic welding.

Annulus Testing

Hydrostatic testing

Safety & Environmental Considerations

Operation	Offshore Cutting Option LCSV Normand Mermaid	Re-spooling Option CSV Normand Vision
Mobilisation	12-17Te of steel fabrication required for seafastening deck equipment. Considerable number of man hrs with the usual associated personnel risks	All equipment permanently installed on vessel. Reduced Fuel Consumption Lower Emissions to Environment Reduced risk of injury to personnel, no lifting operations / manual handling
Transit	9 offshore trips required = 180hrs vessel transit Considerable Co2 emissions	1 offshore trip required = 20hrs vessel transit Reduced Fuel Consumption Lower Emissions to Environment
Offshore Operations	Labour-intensive deck operations, including cutting & lifting, with project-specific equipment / techniques	Reverse-installation technique using equipment permanently installed on vessel. Reduced risk of injury to personnel.
Onshore Recycling / Disposal	Product can only be recycled with manual techniques. Almost total recycling but no re-use of metal / plastic components.	Product can be assessed for re-use or disposed with dedicated system maximising recycling of steel & plastic material. Splitting process can be automated Reduced risk of injury to personnel. Higher amount of reused material No energy consumption for recycling of scrap metal

Overall Comparison Cutting vs Spooling

Based on current market rates and estimated project durations of 38 days for cheaper cutting vessel or 26 days for the more expensive VLS vessel, the projected cost are:

Offshore Cutting Option:

GBP 2.4m, equalling to 211 £/m or 1.7 £/kg of pipe for disposal

Offshore Re-Spooling Option:

GBP 3.6m, equalling to 318 £/m or 2.6 £/kg of pipe recovered for re-use

This reduced to 18 days (or by 1/3) if the RDS is already mobilised making the overall cost the same as for the offshore cutting option.

This estimate is purely for offshore workscope and does not account for the onshore operations involved with pipe disposal or preparation for reuse.

How can we make respooling competitive?

- Organise campaigns of VLS vessel with reel drive system
- Realise the value from the recovered pipes
- Incentivise the recovery contractor by giving them profit from the sale of the recovered pipe
- Incentivise the asset owner by also giving them profit from the sale of the recovered pipe
- Remove barriers such as owners ongoing liability issues
- Expanding market acceptance of pre owned pipe
- Make sure the environmental benefits of reuse over recycling are pointed out financially or in PR benefits to the Operators
  - This may be a job for the OGA

Questions & Answers

- Thank you for your attention, please let me try to answer any questions