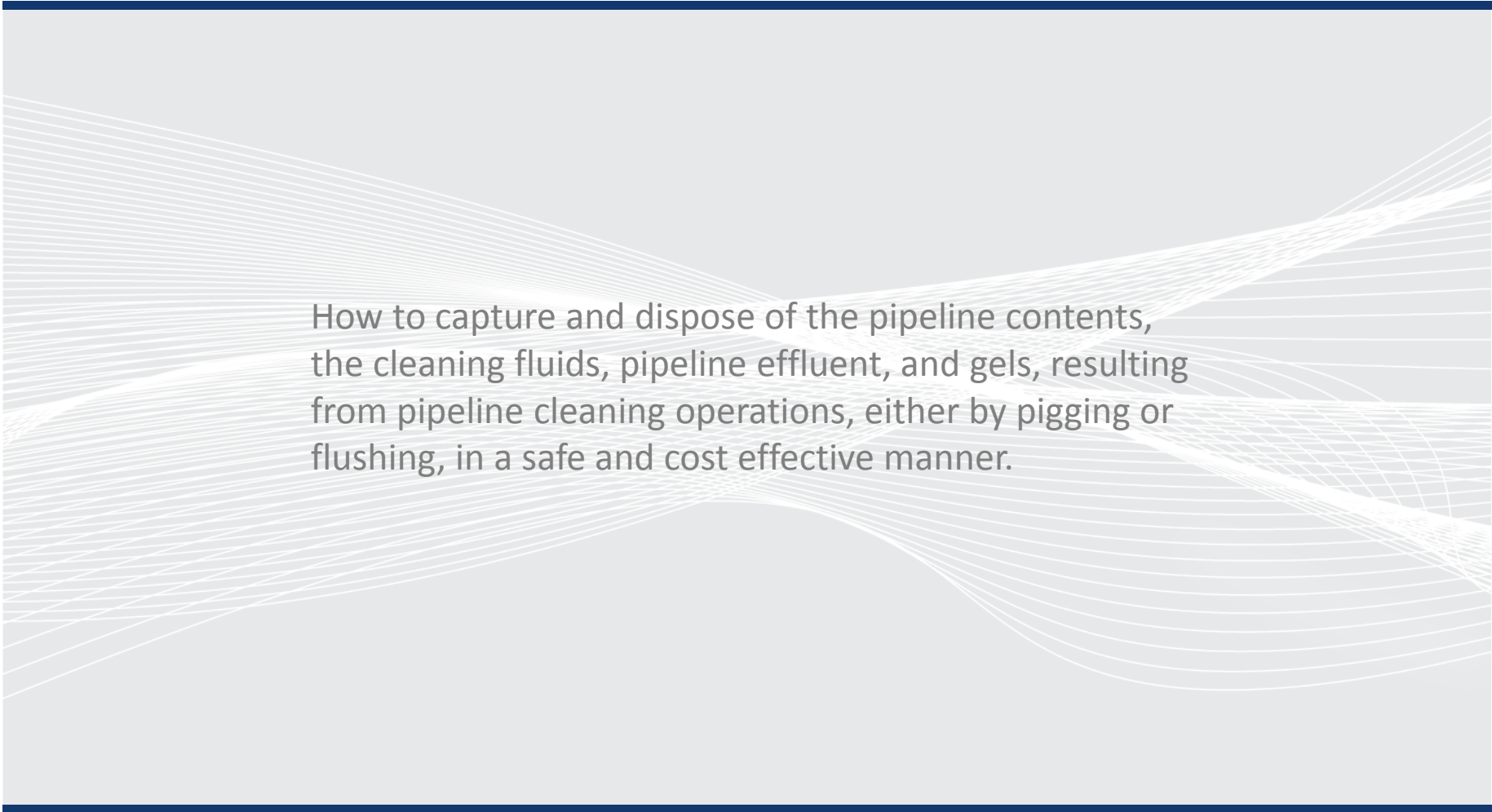


Axis Energy Projects

Pipeline Decommissioning –
The Cost Effective Capture and Disposal of Pipeline Cleaning Fluids

21st June 2017

Challenge

A decorative background graphic consisting of numerous thin, white, wavy lines that create a sense of motion and depth, resembling a stylized wave or a network of connections. The lines are set against a light gray background.

How to capture and dispose of the pipeline contents, the cleaning fluids, pipeline effluent, and gels, resulting from pipeline cleaning operations, either by pigging or flushing, in a safe and cost effective manner.

Transfer to Storage Vessel via flexible Hose

Axis Energy Projects can provide fluid transfer systems to evacuate the contents of trunk or in-field pipelines into tanker or other vessels via flexible hose systems.

Our track record includes extended well test export systems - where stabilised crude is transferred via a flexible hose, in many different possible configurations, from a drilling rig or EWT vessel to a tanker and this technology has been adapted for the capture and disposal of fluids produced in cleaning pipelines as part of their decommissioning process.

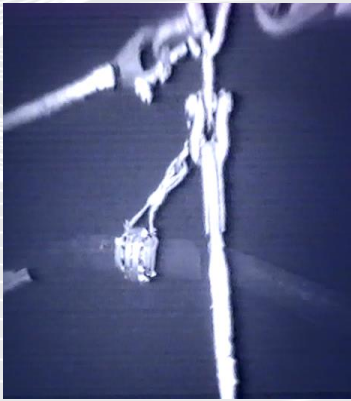
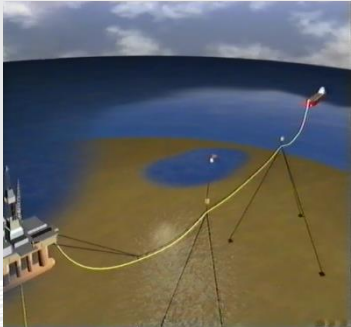
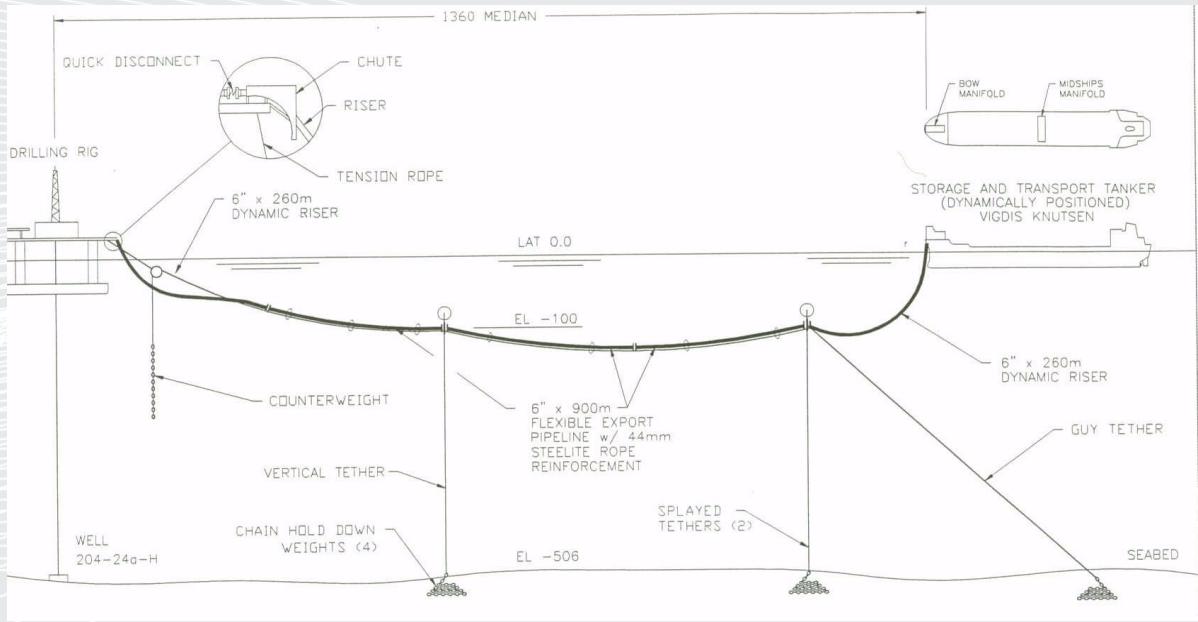
A connection can be made at any suitable location on a platform, PLEM or production manifold allowing the fluid to be transferred to a tanker or other suitable vessel.

The systems are provided with both passive breakaway connectors and actuated release connectors .

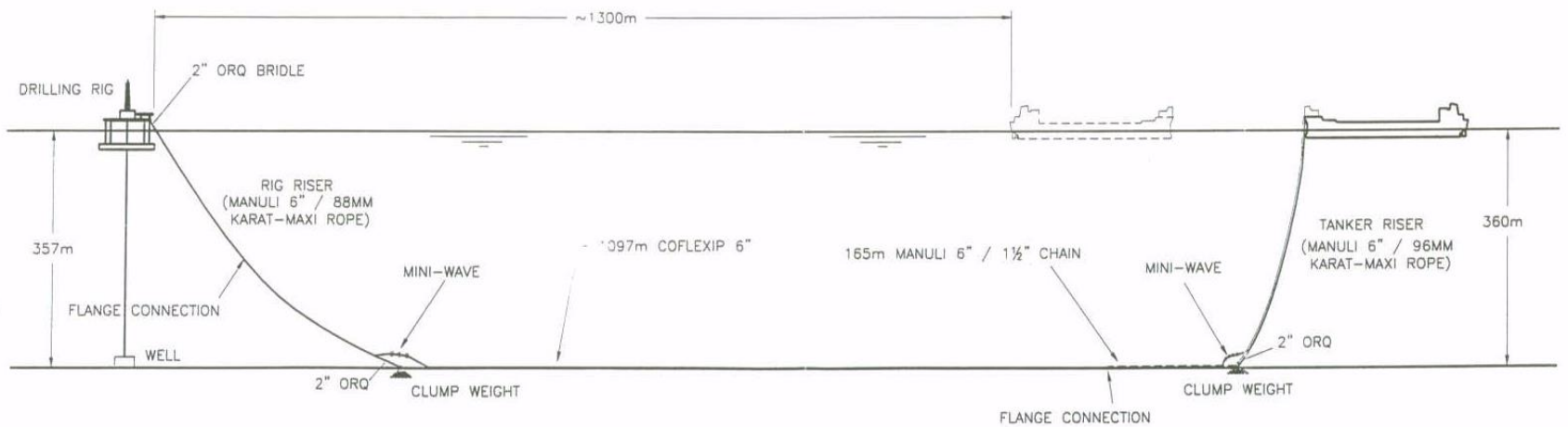
Hose Configuration Examples

The systems can be configured in a variety of ways to suit the requirements of specific projects.

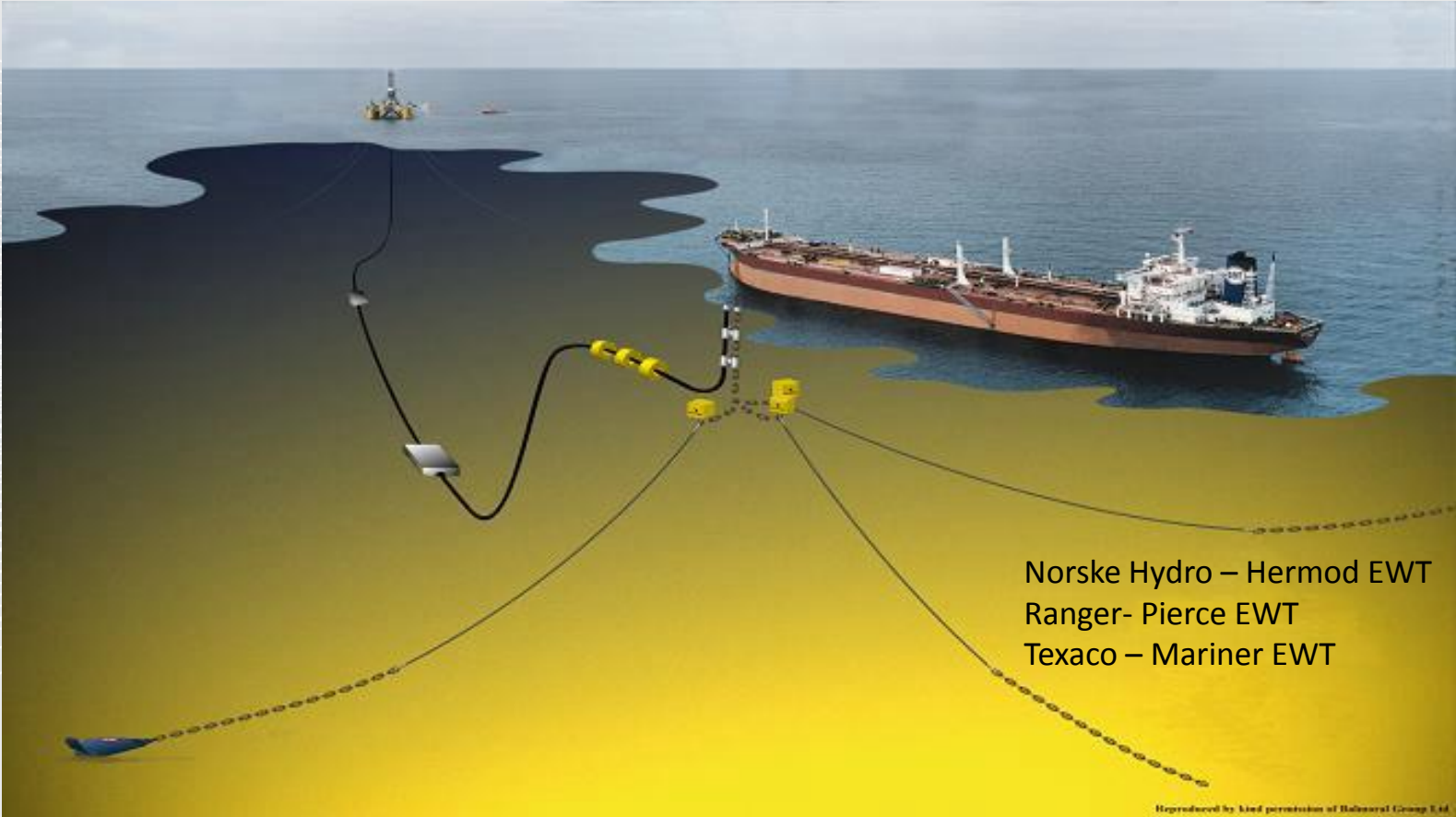
BP Foinaven EWT Export System. Midwater Hose to DP Tanker



BP Schiehallion EWT Export System. Seabed Laid Hose to DP Tanker



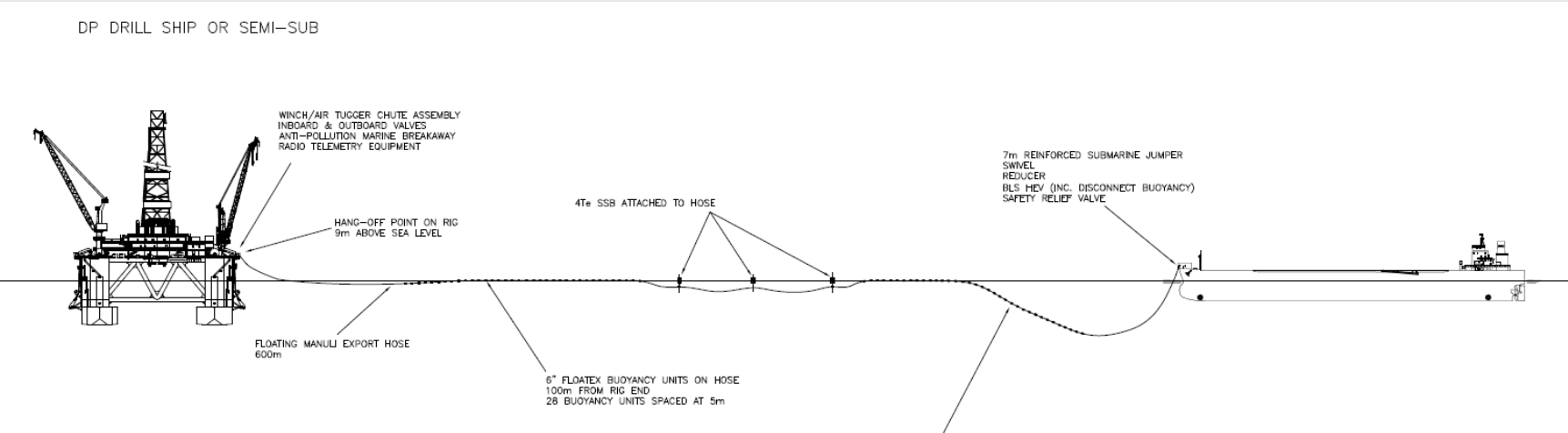
Seabed Laid Hose to Moored Conventional Tanker



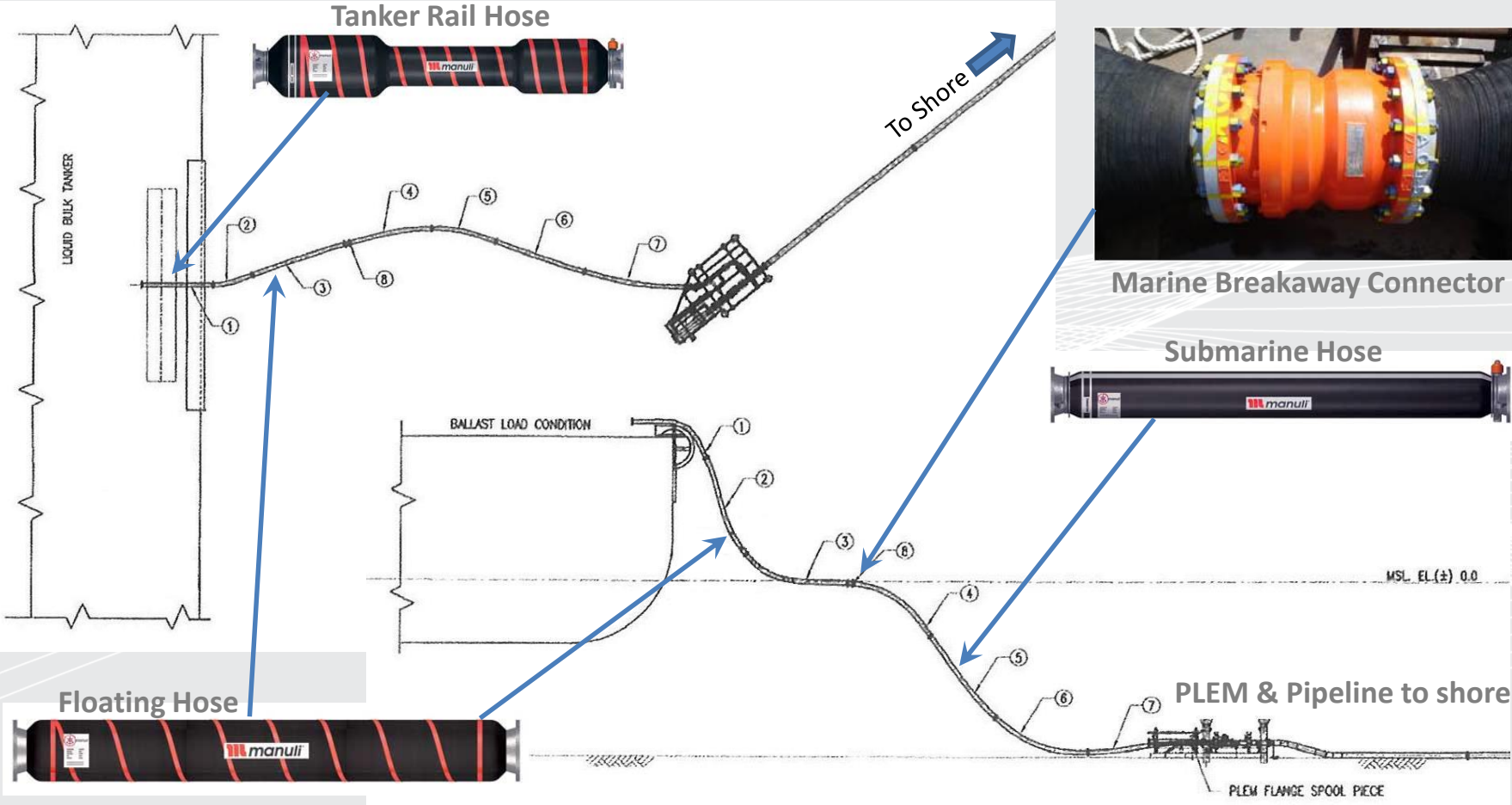
Norske Hydro – Hermod EWT
Ranger- Pierce EWT
Texaco – Mariner EWT

Reproduced by kind permission of Balmoral Group Ltd.

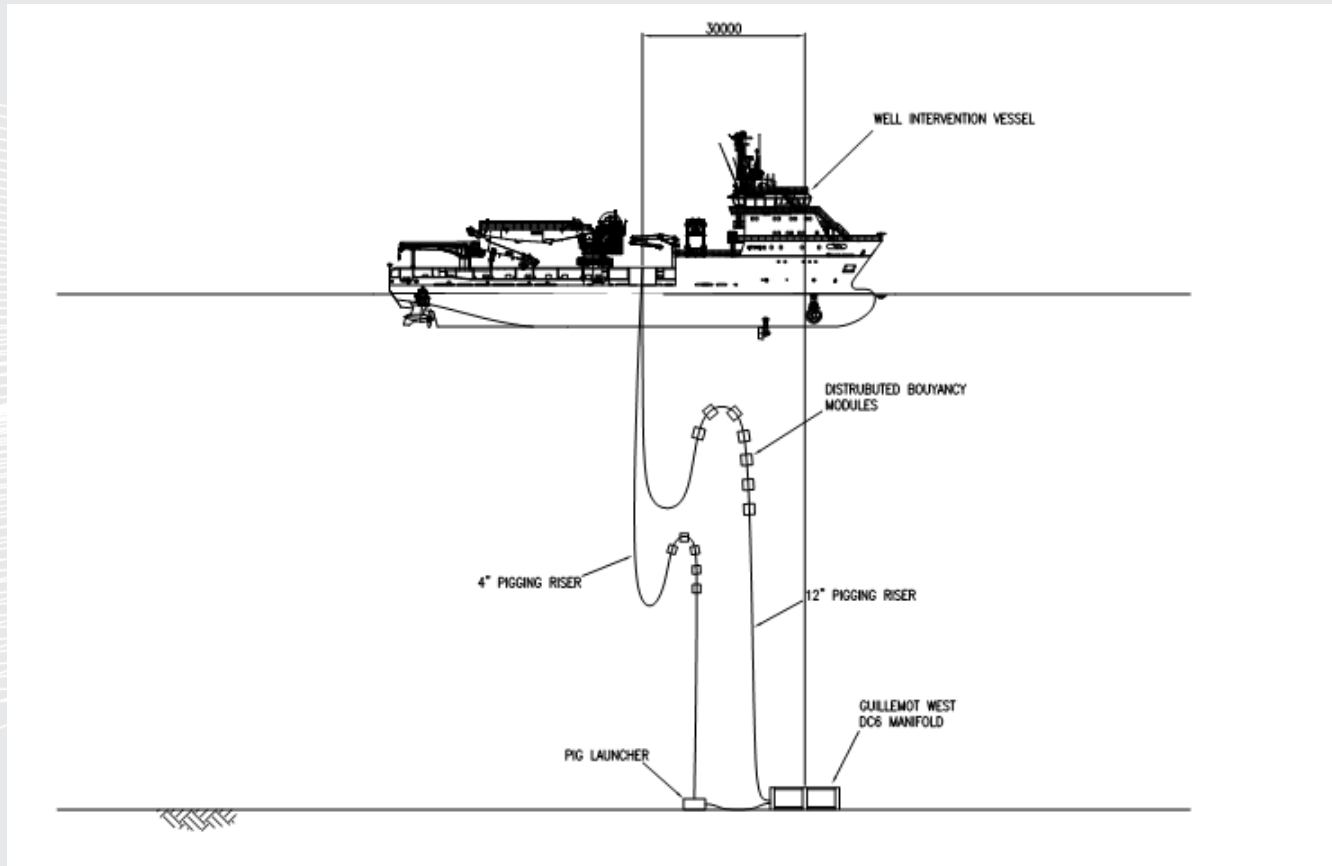
Diega Equatorial Guinea EWT Floating Hose



Fluid Transfer Loading / Offloading



Pigging to LWIV from Subsea Launcher



System Configurations

A wide variety of hoses and auxiliary equipment is available.

Great flexibility in system configuration is available.

Project specific solutions are achievable.



Vessel Selection

Fluid Transfer Systems – Tankers & Barges

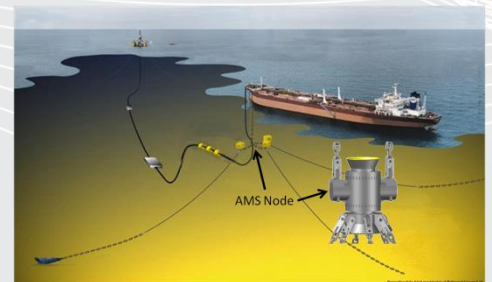
Tanker Options:

Spot market Aframax tanker capacity c. 100 – 110,000 m³

- DP Tanker
- HiLoad System with Conventional tanker
- Conventional tanker with Bow Mooring System

Barge Options:

- Moored storage barge – up to c. 7000m³
- barge HiLoad System with Conventional tanker
- Conventional tanker with Bow Mooring System



The HiLoad DP concept

A cost effective solution to simplify Shuttle Tanker offtakes

The HiLoad DP attach to any flat bottom tanker in open sea ($H_s < 4.5$ m), takes control over the tanker and station keep the tanker within 2-3 m accuracy in harsh environment.

The HiLoad DP has a high degree of redundancy including a class 2 DP system.

More info available at www.remora.no



Fluid Disposal Costs/ Economics Offshore Water Knock Out

The potential to knock much of the water put offshore
to reduce onshore fluid disposal costs.



EXPRO

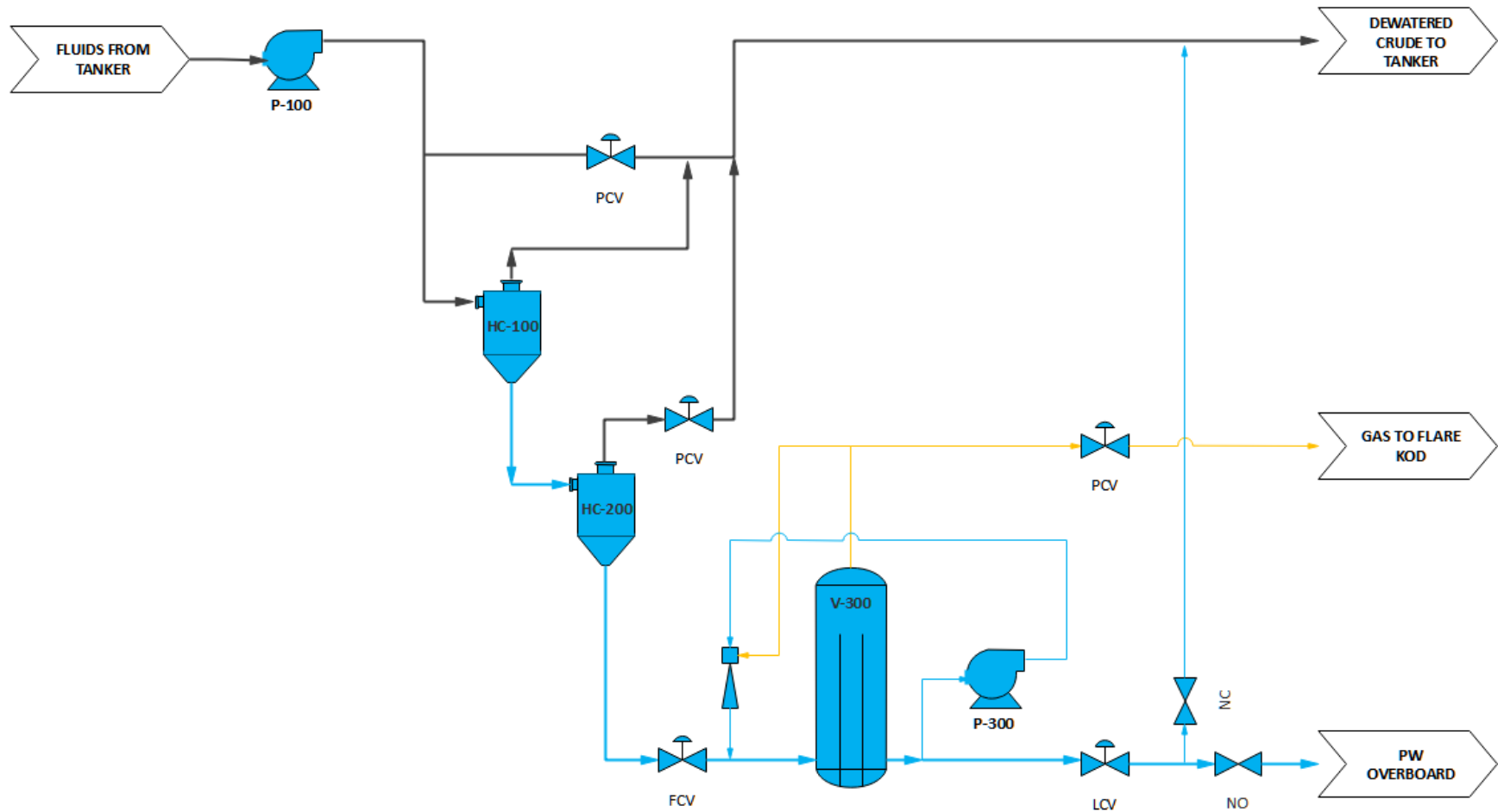
Pipeline Decommissioning – The Cost Effective
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De-watering Package – Challenges

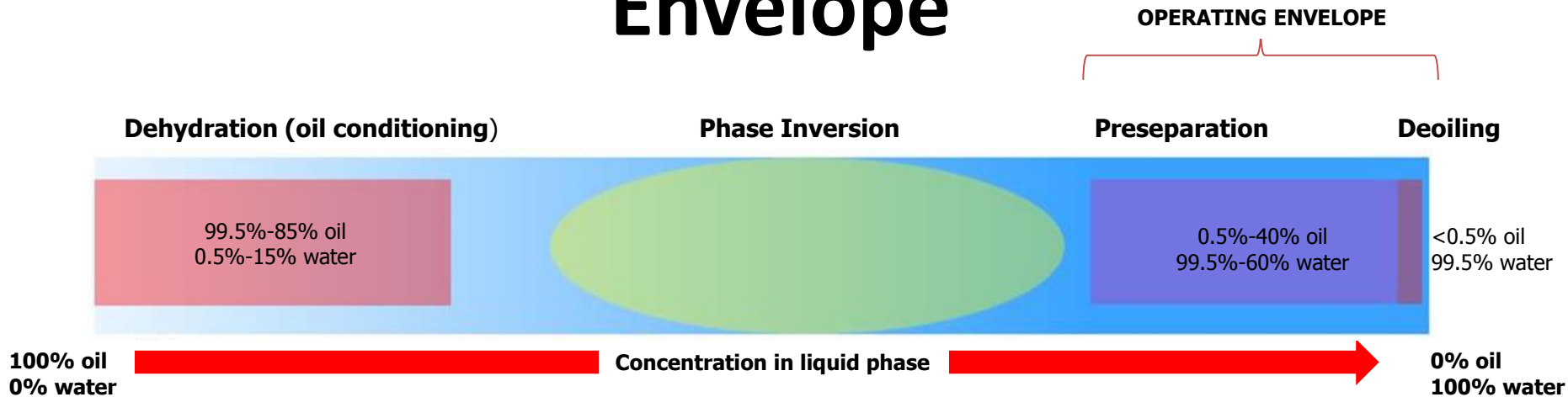
- The package shall process pipeline cleaning fluids
- The package shall be:
 - Installed on the tanker
 - Compact
 - Simple with minimal facilities
 - Low cost
 - Low maintenance
- The package shall be suitable for separating at least 80% of the water, for varying water cuts ranging from 60% to 100%, and cleaning it to meet an overboard disposal spec. of 20 ppmv.

De-watering Package – Processing Scheme

| | | | | |
|---------------|----------------------------|-----------------------|------------------------|-------------------|
| P-100 | HC-100 | HC-200 | V-300 | P-300 |
| BOOSTER PUMPS | PRESEPARATION HYDROCYCLONE | DEOILING HYDROCYCLONE | COMPACT FLOTATION UNIT | CFU RECYCLE PUMPS |

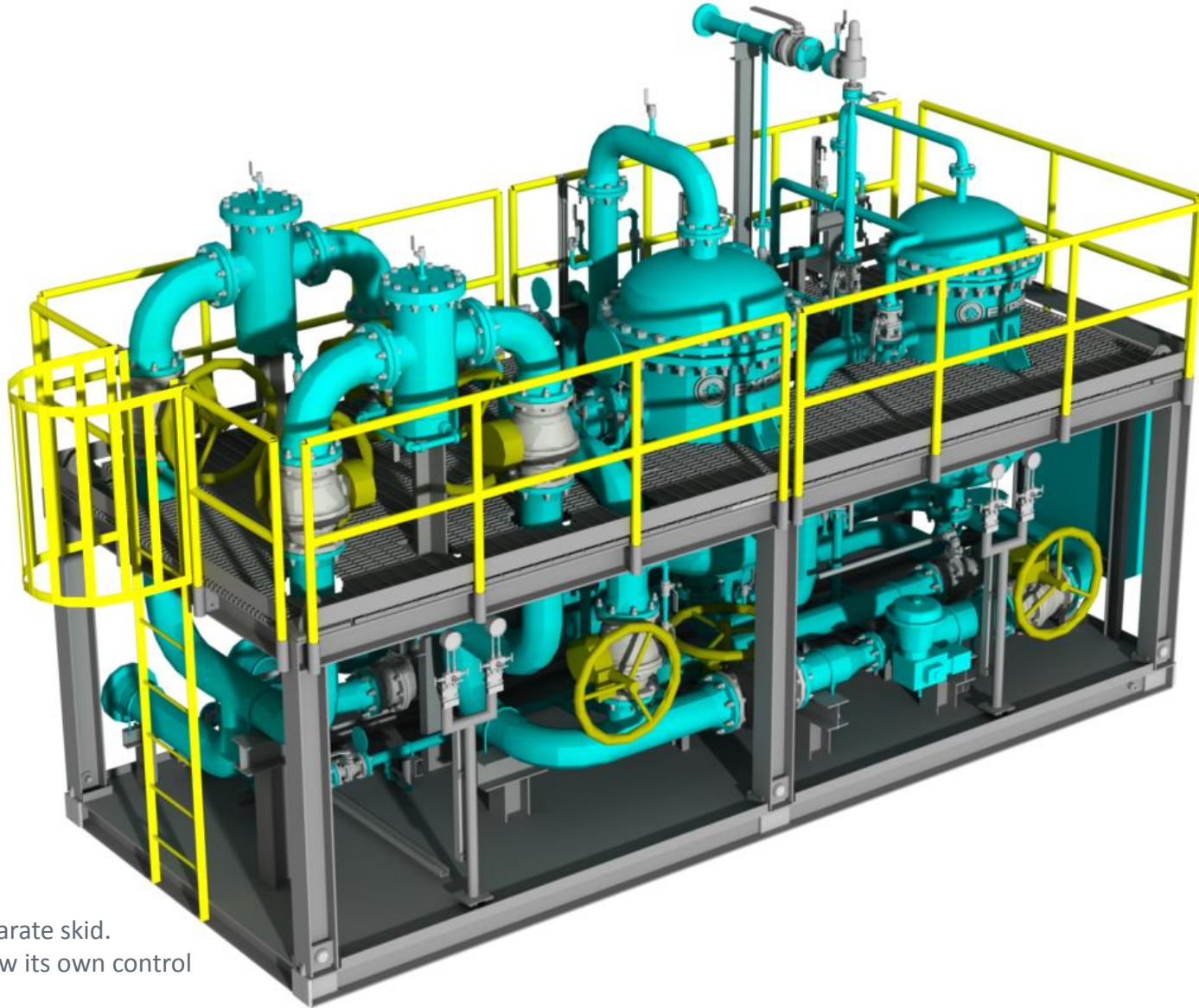


De-watering Package – Operating Envelope



- Preseparation Hydrocyclones can only successfully process **water continuous streams** Water cut must be typically > 60%
- Pipeline cleaning fluids will be fully degassed – no requirement for upstream InLine Degasser
- Processing flowrate can be fixed – simple control logic
- Demulsifier chemicals may be required depending on the presence of emulsions

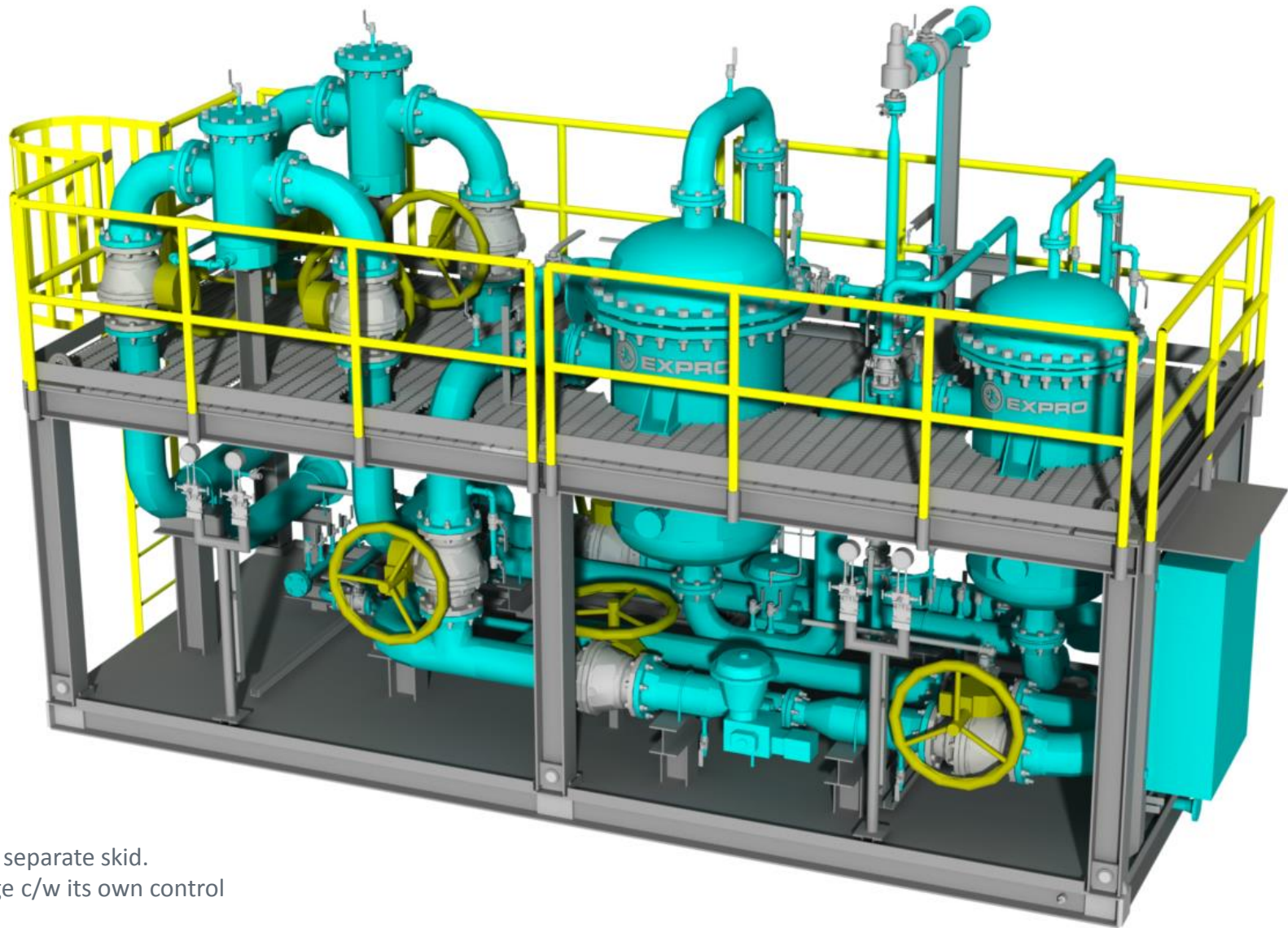
De-watering Package – ExH2O™



Notes:

- 1.CFU in separate skid.
- 2.Package c/w its own control panel

De-watering Package – ExH2O™



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- 1.CFU in separate skid.
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Mechanical Separation

80% of oily water/slops handled at source with no NPT or LTI

Fuel, production, oily water, slops (mud, water), hydraulic oil, BOP, shutdown turnaround, vessel cleaning

- Max Process Rate: 5 to 15m³/hr
- Max Solids Content processed: 18%
- Max Oil Content Processed: 58,000 ppm
- Oil in Water Content at Discharge 2 -15 ppm





Equipment

Stabilised Crude Fluid Transfer System Equipment



Axis can provide a complete fluid transfer system from stock based on 1,800m of the highest spec riser EC grade Manuli 6" long length hose (300m per reel).

Fluid Transfer Equipment

