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Managing Pressure, Minimising Risk

Unconventional Applications of Isolation Plugs Throughout the Pipeline Life Cycle

Dale Millward - Director EPRS & Subsea Services

Conventional Applications of Pipeline Isolation Plugs

Overview of Double Block Isolation Plugs – Piggable and Non-Piggable

Case Studies: Unconventional Applications of Isolation Plugs Through the Pipeline's Life-Cycle

- Subsea Pipeline Construction – Flood Mitigation
- Repair and Maintenance – Pipeline Sectional Replacement
- Repair and Maintenance – Dead Leg Removal
- Decommissioning and Abandonment

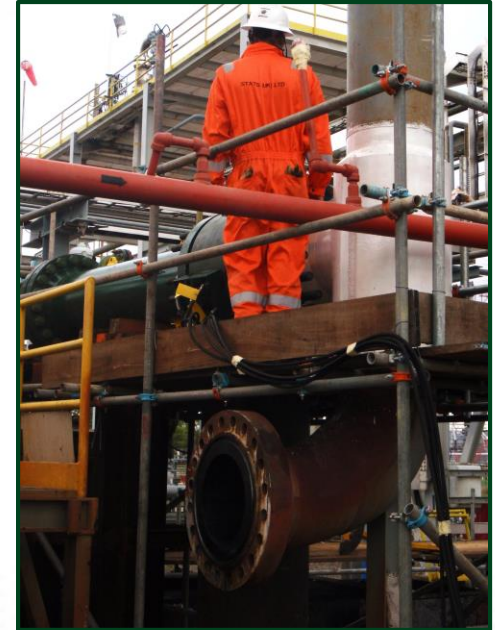
Above cases include short descriptive animations

Questions and Answers



Conventional Applications of Pipeline Isolation Plugs

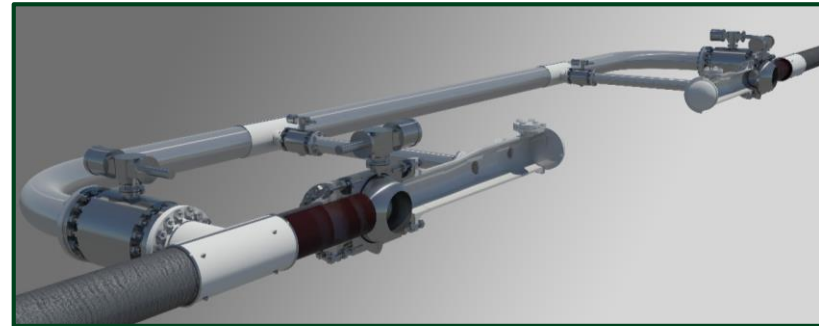
Remote controlled, Tethered and Hot tap installed Isolation plugs are routinely used to provide fully proved Double Block and Bleed / Monitor isolations to enable safe breaking containment operations on pressurised pipelines - for repair or modification



Typical Applications: Valve Repair, Replacement or Pipeline Tie-In Modifications

Conventional Applications of Pipeline Isolation Plugs

Isolation plugs are routinely used to enable safe breaking containment operations on pressurised pipelines - for repair or modification



Typical Applications: Retrofitting Pigging Facilities

Double Block Isolation Plugs (Type Approved)

Piggable Isolation Tools



Remote controlled Tecno Plug: Through-wall communication

Isolation Category: Proved Double Block and Monitor (DBM)
 > With a managed bleed capability

If full bore access such as pig launchers or blinded flanges exists then a piggable isolation tool can be used



Tethered Tecno Plug: Controlled via hydraulic umbilical
 Isolation Category: Proved Double Block and Bleed (DBB)

Tecno Plug - Remote Controlled Isolation Plug

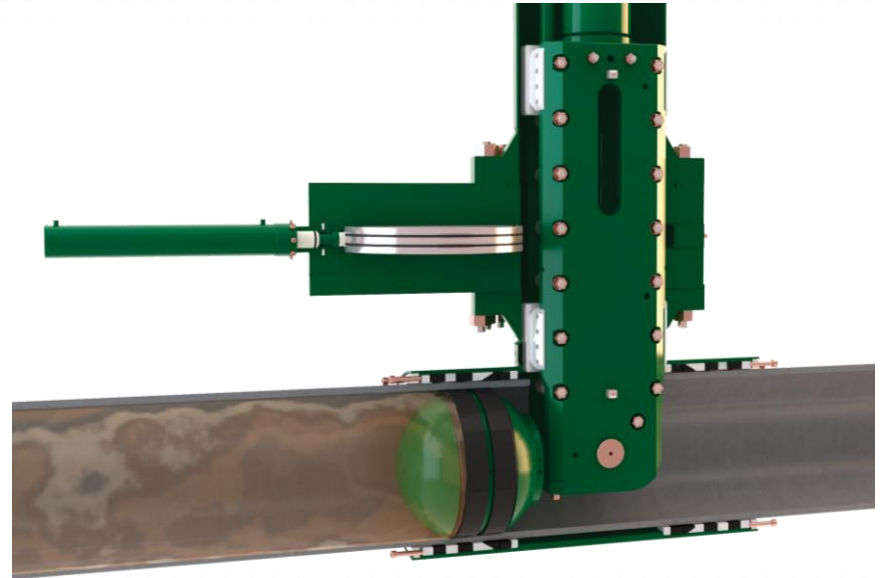


Double Block Isolation Plugs (Type Approved)

Hot Tap Fitting, Branch Installed – Isolation Tools

If full bore access is not available then an isolation tool can be installed into the pipeline via a hot tap intervention

Some line stop isolation tools such as the BISEP provide an isolation that complies with isolation category: Proved Double Block and Bleed (DBB)



BISEP: Hot tap installed

BISEP - Branch Installed Isolation Plug



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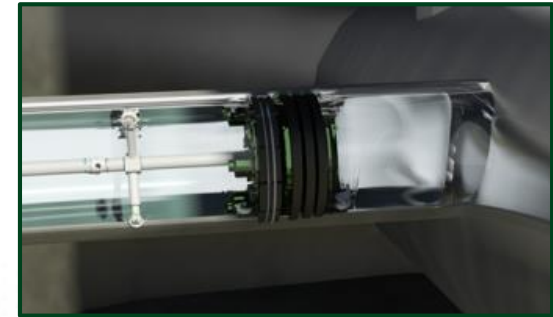
Unconventional Applications of Isolation Plugs – Through Pipeline's Life-Cycle



Construction - Wet Buckle Contingency



Operational Phase – Sectional Replacement



Decommissioning - Abandonment



Pipeline Construction – Wet Buckle

Wet Buckle

- Undesired loss of integrity in a pipeline
- Raw seawater and seabed floods into air-filled pipeline

Wet Buckle Location

- Usually where pipeline is most stressed, near the sag bend, before touch down point
- Occasionally at the overbend on the installation vessel

Emergency Abandonment

- If a wet buckle occurs - especially during deep water large diameter pipeline installation
- Increased weight of the flooded pipeline will overload the pipeline handling system
- Pipeline released to the seabed

Dewater and Recover

- Following wet buckle and emergency abandonment of the pipeline - usually need to
- Dewater the pipeline
- Connect A&R line to recover back onto pipe lay vessel

Wet Buckle Contingency

Wet buckle contingency is a method of mitigating against the effects of a wet buckle:

- Remediates the situation
- Allows pipeline recovery for installation to continue, so the pipeline can be completed
- Sometimes a project insurance requirement



36" Wet Buckle Recovery



42" Wet Buckle Recovery

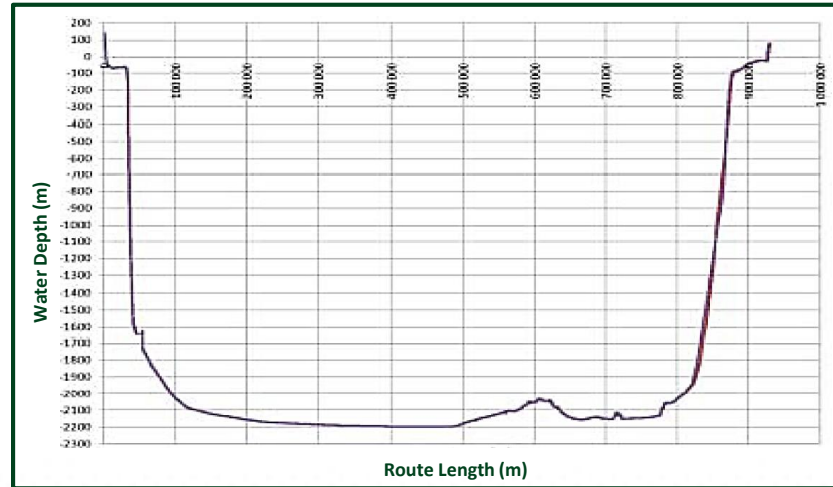
Wet Buckle Contingency - Scenarios

Example Wet Buckle Contingency System for two Scenarios

Shallow Water / Above Water Tie-Ins - Wet Buckle Flood Prevention



Deep Water 2200m, ~900 Km Pipelines



Deep Water Section - Wet Buckle Recovery

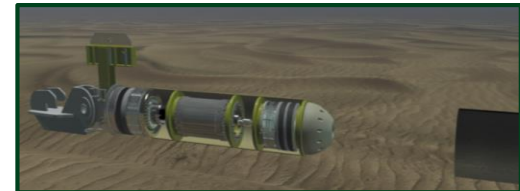
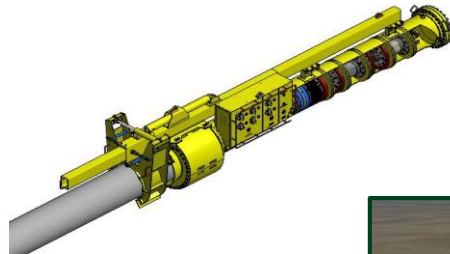
Deep Water – Wet Buckle Recovery

Following deep water wet buckle

- Abandoned pipeline end prepared by cutting upstream of wet buckle and removing damaged section
- Debris removal, raw seawater displacement 3-pig train pigged through the pipeline with treated seawater - pigs pre-installed in subsea initiation head
- First two pigs ejected from pipe end
- Final pig remains in line - preventing raw seawater contaminating treated seawater
- A Tecno plug installed onto the cut end of the pipeline subsea - using diverless flangeless subsea launcher or PRT with cassette
- Dewater catenary section (5km) with Tecno Plug - pigged back at 220 bar air via coiled tubing
- Plug set to hold back treated seawater



Flangeless Diverless Subsea Launcher

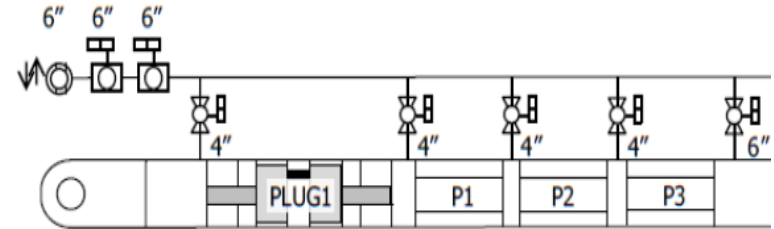


PRT with Cassette containing Tecno Plug



Shallow Water - Wet Buckle Flood Prevention

Strategic use of isolation plugs prevents seawater flooding into deep water section of pipeline, if wet buckle occurs while doing above water tie-ins



Start-up / AWTI-head #10
kp 1.85 @ 30m WD

Preinstalled plugs pigged out of Initiation and Laydown heads and set in the pipeline – before pipeline is lifted up to do above water tie-ins

Preventing deep water section of pipeline flooding if wet buckle occurs

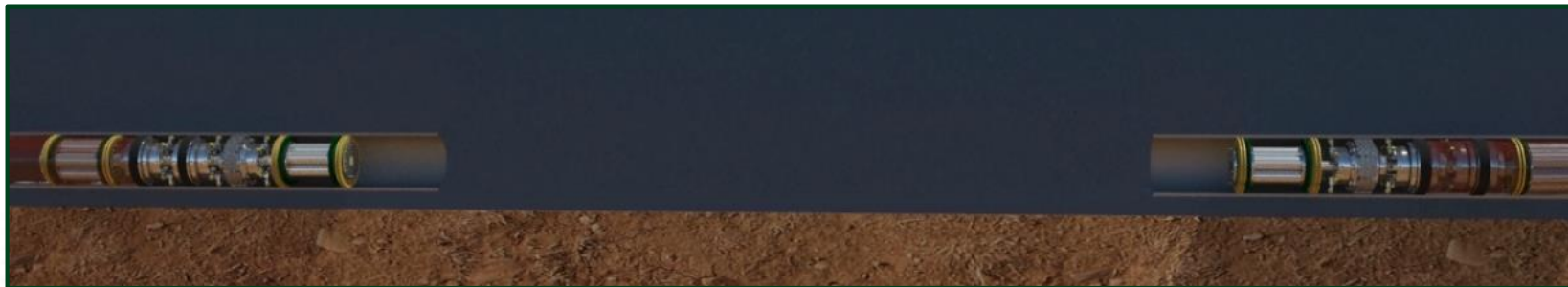
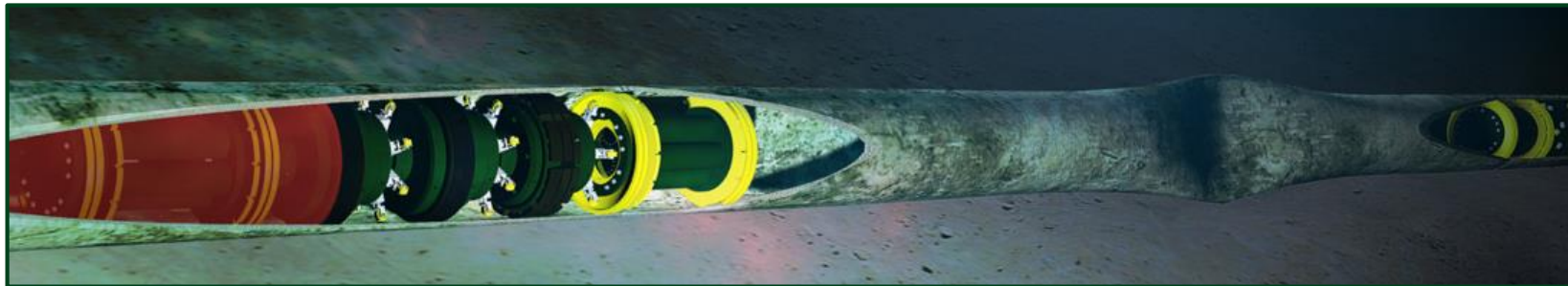
Wet Buckle - Flood Mitigation



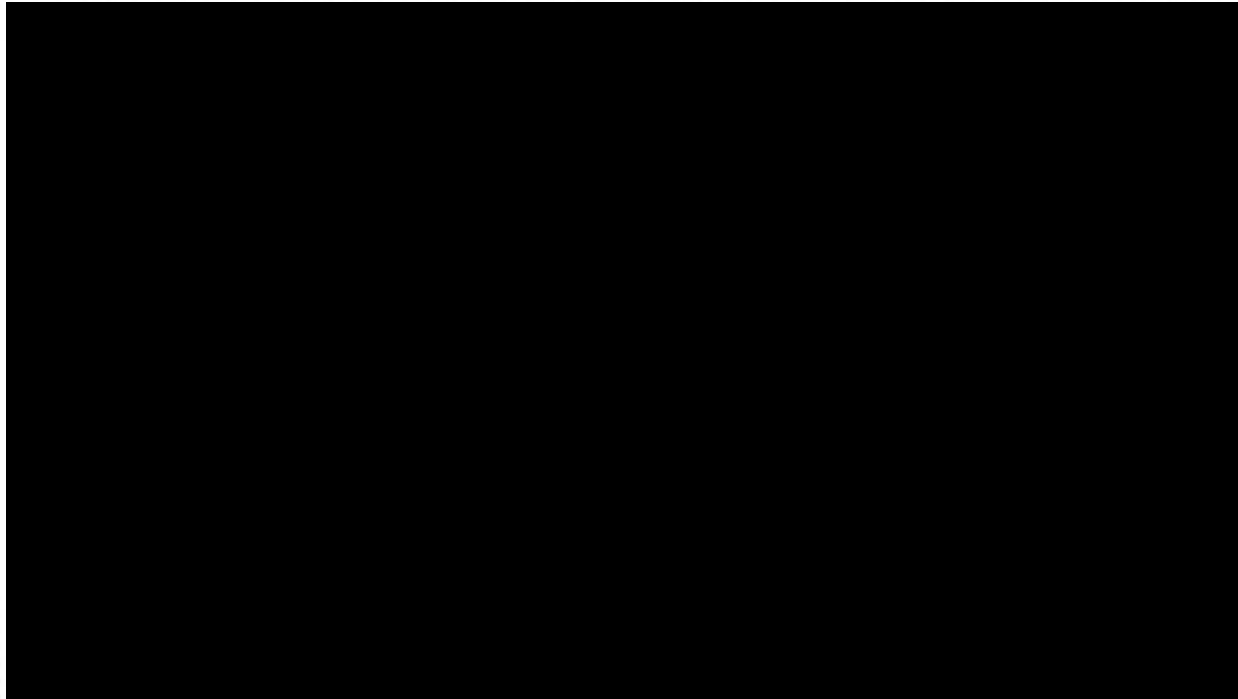
Repair - Sectional Replacement



Counter Opposed Pigging



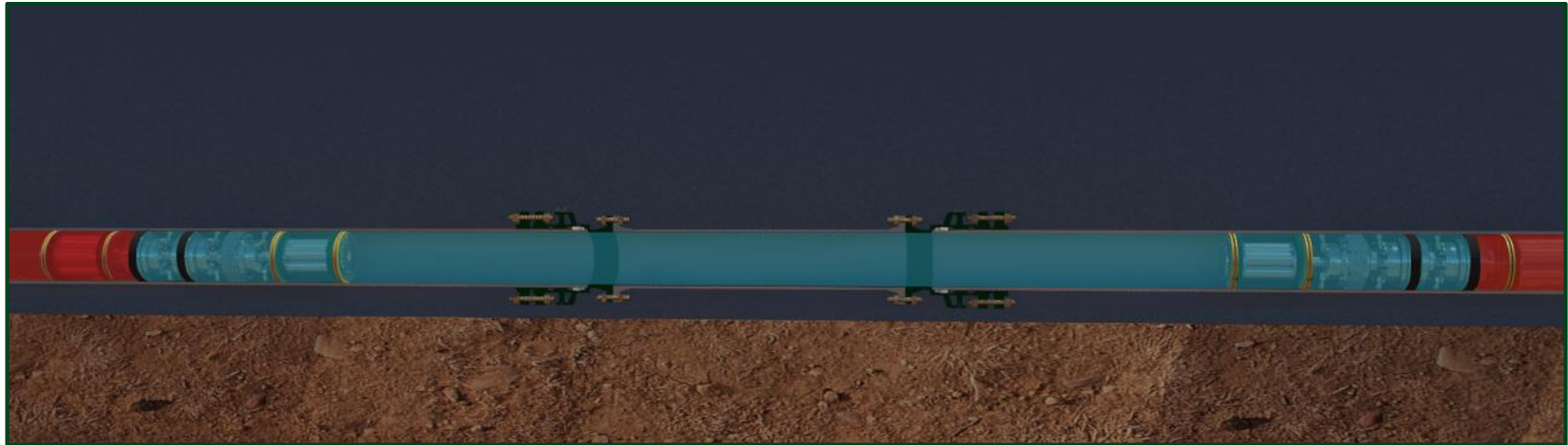
Repair - Sectional Replacement



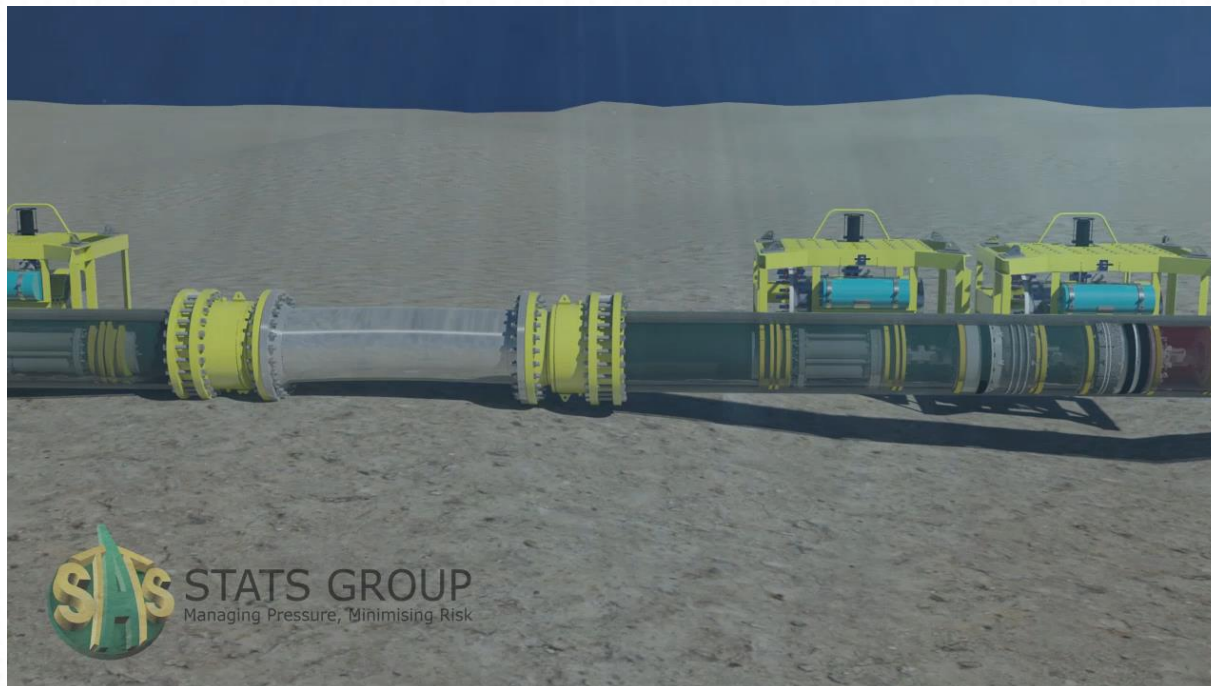
Repair - Sectional Replacement



Pressure Equalisation for Testing and Unsetting



Repair - Sectional Replacement



Repair – Dead Leg Removal

Tethered Tecno Plug – Stem Bar Deployed around a Bend



Pipeline Configuration Before



Pipeline Configuration After

Dead Leg Threat Removed at 14 locations – Without Interrupting Production

Repair – Dead Leg Removal

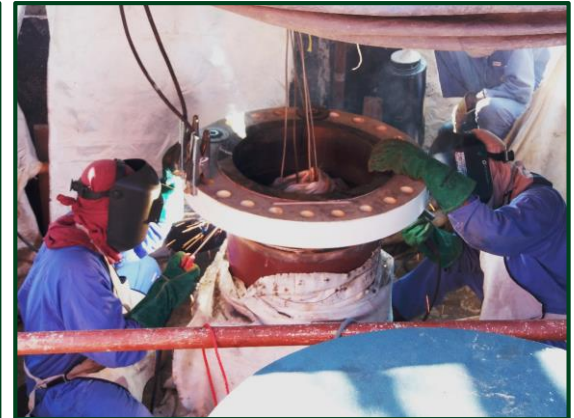
Tethered Tecno Plug – Stem Bar Deployed around a Bend



Tethered Tecno Plug Deployment



Isolation Location



Flange Welded Behind Tecno Plug

Repair – Dead Leg Removal



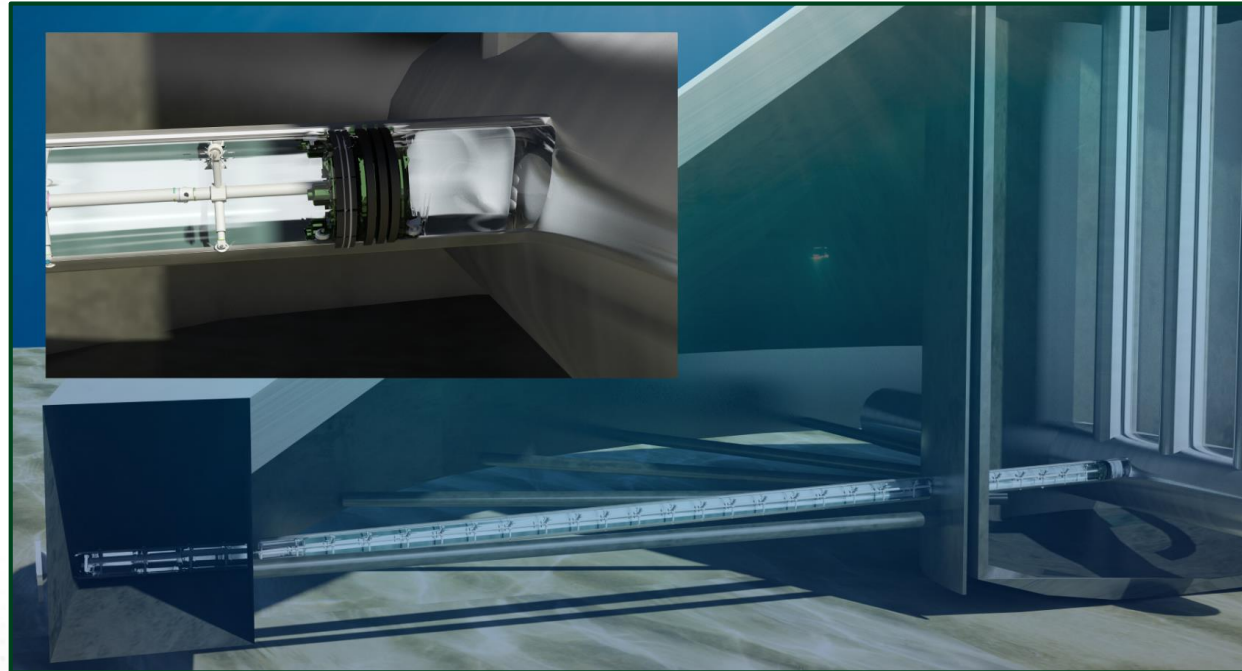
Decommissioning / Abandonment / Dead Leg Removal

Permanently plugging a 42" subsea dead leg connected to 96" pump header

Tethered Tecno Plug deployed subsea

- 38m into dead leg
- Up 5 degree incline - with rams
- Plug mechanically locked-in

Loss of Containment Threat Removed





**Thank You For Your Attention
Questions?**



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