NORTH SEA CASE STUDY: PLATFORM DEPLOYED 8” TETHERED ISOLATION PLUG CUTS DECOMMISSIONING COSTS

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Abstract

At the end of a platform’s productive life, it is essential that the asset be safely disconnected from neighbouring infrastructure so that decommissioning can proceed. Where a platform remains tied to another Operator’s field via live or potentially pressurised pipelines, this dependency can delay decommissioning and lead to unnecessary maintenance and management of non-operational assets.

In 2022, a southern North Sea platform faced this challenge. The associated well, owned by another Operator, had no near-term plug and abandonment plans, preventing the platform Operator from progressing. A STATS 8” Tethered Isolation Plug was therefore deployed from the platform to a subsea isolation point, marking the first known application of its kind and the longest tethered plug deployment to date at approximately 80 metres. Once set and a leak-tight isolation had been verified, the control umbilical and riser were cut, permanently abandoning the line and enabling topside and jacket removal activities to proceed.

By applying proven technology in a novel way and leveraging a large existing fleet, this solution provided a cost-effective method for platform-to-pipeline abandonment isolation during decommissioning, with zero vessel involvement otherwise required for remotely controlled isolation plugs.

Isolation Plugs - Background

Isolation plugs are used throughout the lifecycle of a pipeline, from pre-commissioning applications such as anti-flooding tools in the event of a wet buckle, to standard operational isolations for valve changeouts and sectional replacements, and finally for pipeline isolation and abandonment during decommissioning. Isolation plugs are deployed by two means, pushed or pigged on a tethered or free-swimming and remotely operated.

The Tethered Tecno Plug® (TTP) was developed first and established a significant track record, being successfully deployed in hundreds of projects before the introduction of the Remote Tecno Plug® (RTP), which was developed some years later and has since become the more commonly used option. Each system has advantages that make it suitable for specific scopes of work. Both tools cover pipeline diameters from 10” to 56”, but the TTP® additionally covers the range from 2” to 8”.

RTPs are loaded and launched like a standard pig, are 200 bar rated, 3D bend compliant as standard and can be pigged up to 2000km.

Figure 1: Remote Tecno Plug

TTP's® are somewhat more nuanced. They can be deployed using rigid stem bars, allowing straight deployment typically 15 metres from the launcher and for isolation pressures up to 230 bar, or via an umbilical, allowing deployment in the tens of metres from the launcher with some bend compliance, but limited by capstan friction and the umbilical rating, typically around 60 bar.

Figure 2: Tethered Plugs, Stem Bar (left) and Umbilical (right)

For decommissioning projects, abandonment plugs are used to achieve permanent pipeline isolation and incorporate a mechanical locking mechanism in their design. Abandonment plugs can be either remotely controlled or tethered, and for this project a tethered abandonment plug was selected to meet the specific parameters of the scope and the client's requirements summarised below.

- Pipeline pressure ~10 bar (below umbilical limitation of 60 bar)
- Only two 45° bends (1 x 3D, 1 x 5D), limited and acceptable capstan friction
- Vertical launcher and suitable access for the necessary tethered abandonment plug equipment.
- Most cost-effective option

Introduction and Scope of Work

A southern North Sea platform, located approximately 40 km east of the Humber Terminal in a water depth of around 22 m, was one of four assets scheduled for decommissioning. The installation was tied back to a single subsea wellhead structure via a 15.5 km, 8" wet gas import pipeline piggybacked by a 2" umbilical.

Figure 3: The Platform, 8" Riser (centre, yellow)

The subsea well, owned by a different Operator, had become uneconomical and was no longer in service. However, the well Operator had no immediate plans to decommission the asset through a plug and abandonment (P&A) campaign for several years. This presented a challenge for the platform Operator, who wished to progress their decommissioning programme without being delayed by the inter-field dependency. Postponing the platform decommissioning would have resulted in ongoing maintenance, inspection, and management costs for a non-operational asset.

Ordinarily, the decommissioning sequence would follow the P&A of the well, with the subsea pipelines subsequently flushed and decommissioned. In this case, however, an alternative approach was required to enable the platform decommissioning to proceed independently of the well P&A schedule. The pipeline was flushed, and a STATS 8” Tethered Abandonment Plug was deployed in 2022 to provide a safe, verified dual seal isolation barrier. This allowed the pipeline to be cut while maintaining containment and preventing fugitive emissions or discharges, as the wellhead valves were known to be passing.

The overall decommissioning plan was as follows:

- Flush and clean the pipeline with 2–3× line volume into the well
- Deploy the STATS Tethered Abandonment Plug (2022)
- Cut #1, Cut the riser below the cellar deck for topsides removal (2023)
- Cut #2, Cut the subsea pipeline at the riser base for jacket removal (2025)

The deployment of the tethered plug proved instrumental in enabling the platform decommissioning scope to proceed safely and efficiently ahead of the well P&A campaign. The approach reduced the number of non-operational assets under management, avoided dependency delays between Operators, and delivered tangible time and cost savings across the wider decommissioning programme.

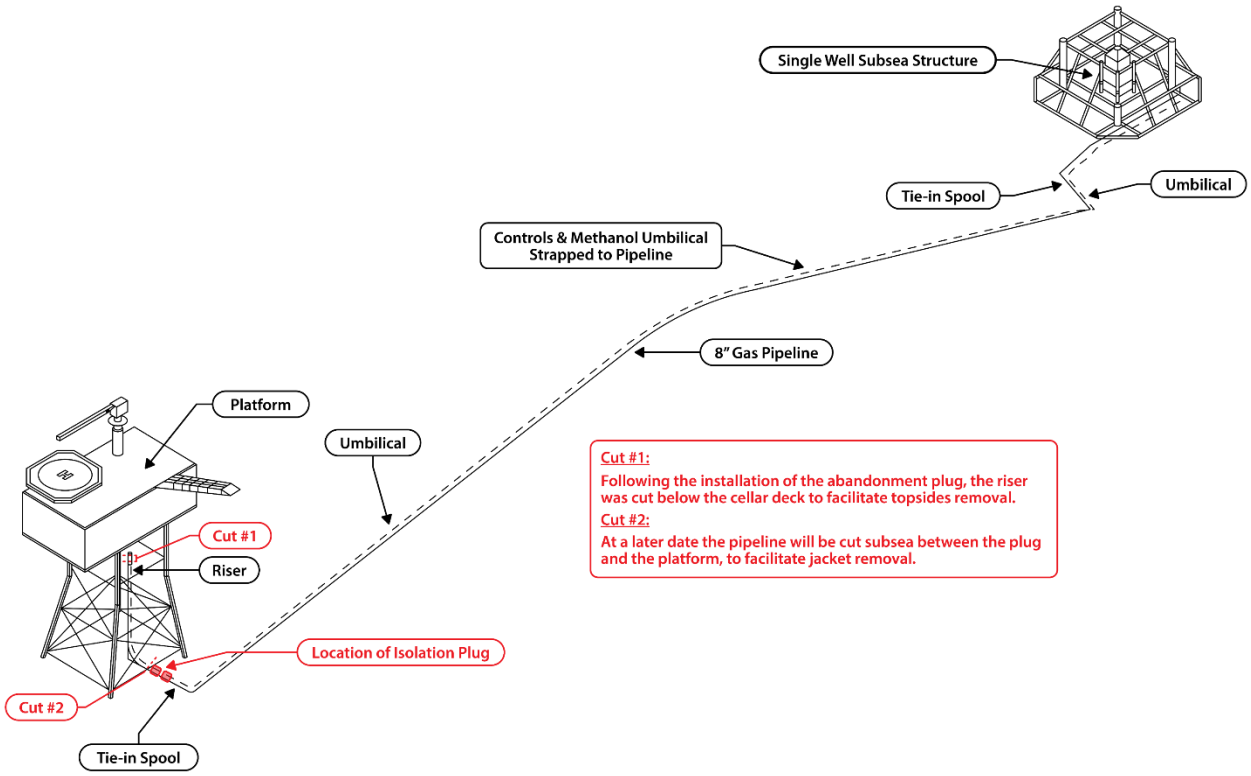

Figure 4: Platform, 8” Pipeline and Cut Locations 1 and 2

The Tethered Abandonment Plug

The Tethered Abandonment Plug supplied for this scope of work was designed with a ten-year service life, as specified by the Operator, and comprised three modules:

1. Front Pigging Module, which accommodates pigging drive to assist in traversing pipeline features and houses magnets for tracking purposes
2. Abandonment Plug Module, which incorporates twin elastomeric seals, tapered lock segments, and an internal hydraulic actuation system
3. Reverse Pigging Module, which houses pilot-operated check valves and control lines
4. Umbilical, 2” and sacrificial for this scope of work, the hydraulic oil was changed out for aqualink oil (safe to discharge to sea)

The tool was initially set by applying hydraulic pressure from a topside control console through the umbilical into the plug cylinder. This causes the piston to stroke and compress the plug module. As the module compressed, the locks were guided up the lock bowl until they engaged with the pipe wall, mechanically securing the plug in place. Simultaneously, compression caused the seals to radially expand to the internal diameter of the pipeline, and together with the annulus vent between the seals, this provides a tested double block and monitor isolation.

The abandonment design employs an internal ratchet mechanical lock system to maintain the plug and isolation independently of hydraulics once the 8” pipeline is permanently abandoned. This differentiates the design from standard plugs, which are intended to be repeatedly set and unset hydraulically without recovery, a useful feature when pipeline condition is uncertain and achieving a seal on the first attempt is not guaranteed.

Although the mechanical lock secures the plug permanently, abandonment plugs can be unset if required. The abandonment plug is fitted with a shear ring on the unset circuit, and by applying two to three times the standard unset pressure, the plug can be mechanically released. If a release occurs, the plug must be recovered to the launcher before it can be reset.

For this scope of work, it was technically feasible to disconnect and recover the umbilical once the plug had been set; however, doing so would have increased the overall length and complexity of the plug assembly. Following discussion, the decision was made to replace the standard oil-based hydraulic fluid with a project-specific water-based alternative carrying a CEFAS D rating. This allowed the umbilical to be treated as sacrificial, with fluid safely discharged subsea following the cut, thereby reducing operational duration, cost, and system complexity.

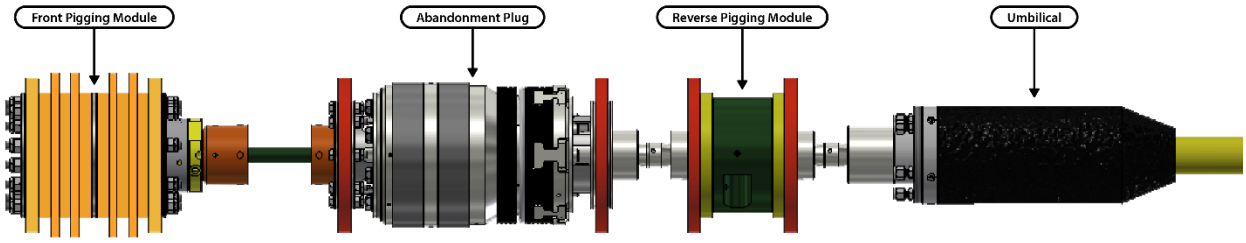

Figure 5: 8” Tethered Abandonment Plug

Figure 6: 8” Tethered Abandonment Plug, Post Factory Acceptance Testing

Factory Acceptance Test (FAT)

Factory Acceptance Testing (FAT) was carried out by STATS prior to mobilisation in accordance with the project parameters. The FAT was conducted in a test fixture designed to replicate key pipeline features and minimum bores, confirming piggability and pigging differential pressure (dP).

In isolation plug projects, it is sometimes necessary to reverse pig to another isolation location, for example if a 100% leak-tight seal cannot be achieved due to pipeline condition or debris. For this scope of work, the abandonment plug would need to be recovered to the launcher for refurbishment of the shear ring in the event of a first time unsuccessful seal test. Consequently, it was essential to ensure reverse pigging capability. The Operator expressed concern that insufficient pressure in the pipeline may prevent the plug from being pigged back to the launcher following the initial pipeline flush towards the well. As a contingency measure, the Operator requested a 'pull test' on the umbilical to ensure it was strong enough to pull the plug back to the launcher if required.

During the FAT, a reverse pigging attempt was made using the standard umbilical reel to determine feasibility. As expected, the 'pull test' was unable to overcome the flip disc pressure and capstan friction in the FAT's horizontal orientation, and conditions in the field would have been even more challenging. On the project, the Operator confirmed that sufficient reverse pigging pressure could be provided via their subsea control umbilical, eliminating the need for mechanical recovery of the plug.

Figure 7: Pigging FAT

Pigging and Tracking

The pigging operation was carried out by a third-party contractor at a controlled speed of 1 m/s (30 l/min) to ensure a slow and steady run, avoiding excessive vibration. Differential pressure during pigging was measured at 4–5 bar. The operation was limited by the umbilical rating of approximately 60 bar and achieved deployment of around 80 m into the riser base spool subsea.

Tracking of the tethered abandonment plug was achieved using both direct mechanical measurements and auxiliary equipment. Simple project-specific markings on the outside of the umbilical, including the set location and contingency set location, allowed the plug position to be monitored mechanically. In addition,

two magsigs were installed, one outboard of the EDSV and another on the cellar deck. Although magsigs are typically used on Remote Tecno Plug projects for precision tracking, in this scope they were not strictly necessary but provided a contingency in case the umbilical became disconnected, offering a reliable reference for plug location.

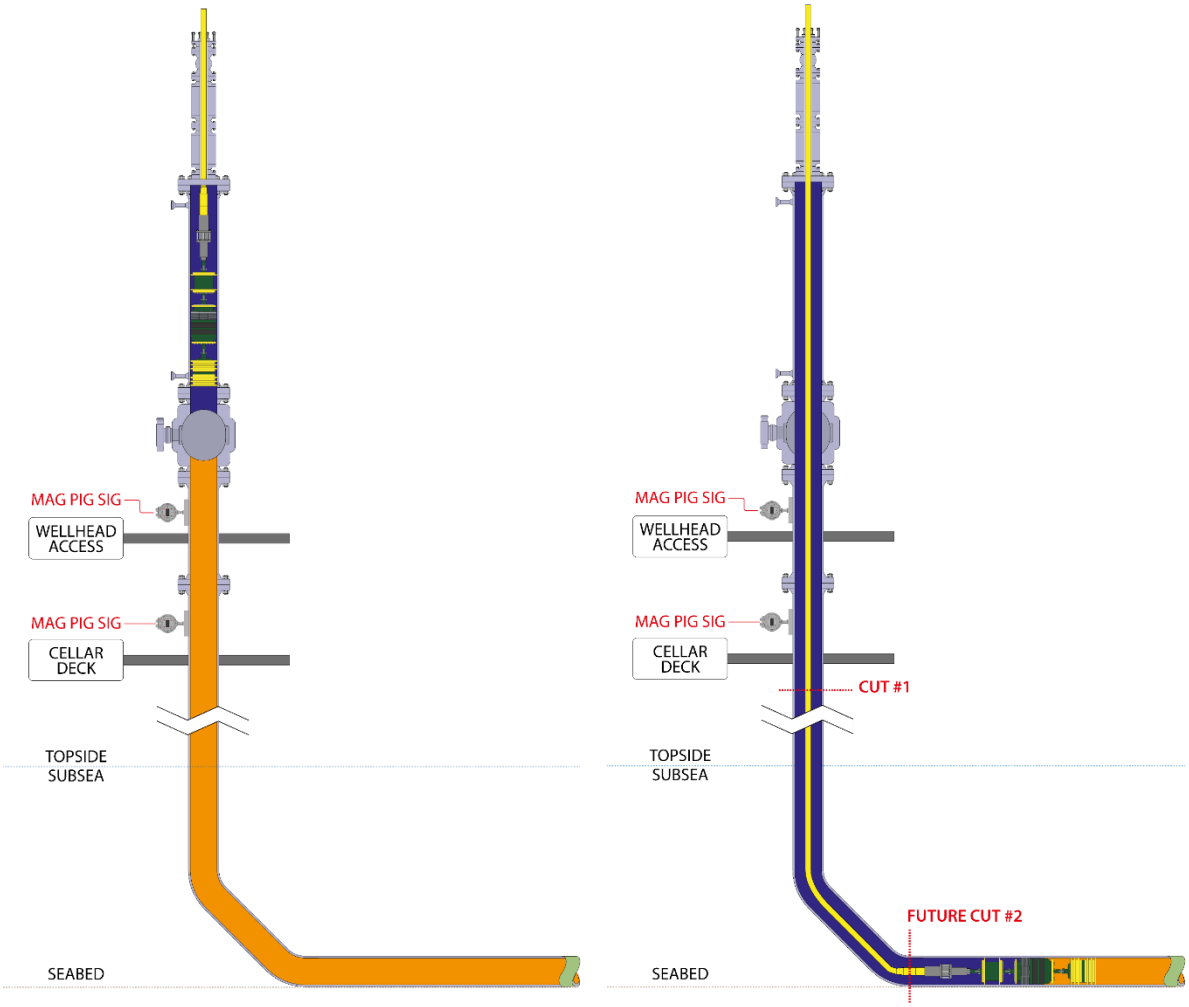

Figure 8: Launching of the 8” abandonment plug

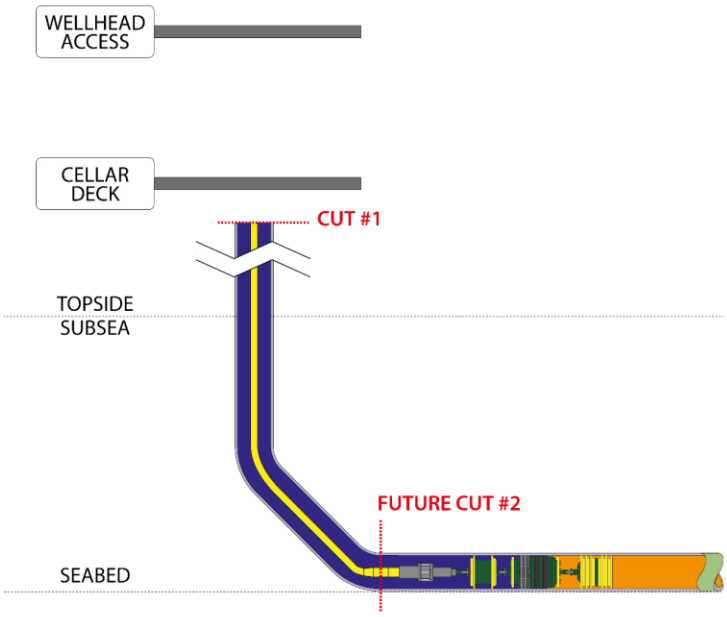

Figure 9: Abandonment Plug Set Subsea, Riser and plug umbilical cut

Isolation plugs are likely the most intrusive type of tool pigged into a pipeline, the hard outside diameter (OD) of the plug is often ~95% of the smallest feature to be traversed. A piggability assessment is required on each project to ensure features such as valves, tee's, bends and even dents can be safely traversed whilst ensuring the seals on the plug can radially expand, against the pipeline internal diameter for a sufficient, proven, leak-tight seal. The smaller the internal diameter (ID) of the features that must be pigged through, the smaller the hard (steel components) OD of the plug and thus generally speaking the greater the seals radial expansion must be at the isolation location.

The hard OD of the abandonment plug was 173mm and the minimum bore to be traversed was around the single 3D, 45° bend, resulting in a worse case clearance of 4.6mm, which allows a little 'wiggle room' for pipe tolerances. The plug was successfully pigged around both bends with no stalling issues.

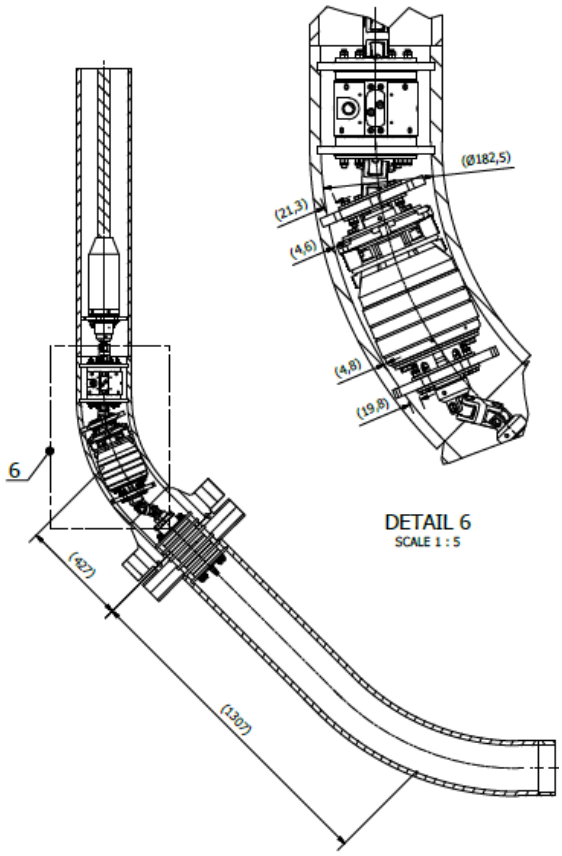

Figure 10: 8" Abandonment Plug, piggability model in 3D, 45° Bend

Isolation and Cut

The isolation was successfully achieved on the first attempt, so no reverse pigging was required. The plug provided a leak-tight double block isolation in September 2022, and the cut and topsides removal were completed in May 2023

Summary

The deployment of the 8-inch Tethered Abandonment Isolation Plug represented a first-of-its-kind application, enabling the safe and verified disconnection of a southern North Sea platform from a live subsea tie-in. By extending proven isolation plug technology to an unprecedented subsea distance of approximately 80m, the project delivered a robust dual-seal barrier that allowed platform decommissioning to proceed independently of the well P&A schedule.

The solution eliminated inter-Operator dependencies, significantly reducing ongoing maintenance and integrity management costs for the idle platform. Using a water-based hydraulic fluid rated safe for subsea discharge, the operation maintained full environmental compliance while avoiding the need for vessel intervention, an efficiency gain over traditional remotely controlled plug deployments.

Through innovative adaptation of established technology and careful project integration, this approach provided a cost-effective, low-risk method for platform-to-pipeline abandonment isolation. It accelerated the removal of non-operational infrastructure, optimised the decommissioning sequence, and established a valuable precedent for future late-life asset management challenges in the North Sea and beyond.