PLATFORM DECOMMISSIONING:
CASE STUDIES IN PIPELINE NETWORK RECONFIGURATION

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Abstract

Inline isolation tools have been safely used over many years as an alternative to inert purging (depressurising and water filling) and intrusive isolation techniques. During pipeline and platform decommissioning, inline isolation avoids large pumping spreads, push-back management, inert gas or glycol filling with long pig trains, and the flaring of many cubic metres of gas or disposal of other product. In addition, it minimizes the personnel requirements compared to intrusive isolations.

Inline isolations can also be used for line replacement, tie-ins, valve change-outs, pipeline reconnections and other operations where assets are connected and the pipelines must remain pressurized during intervention. By avoiding shutdown and allowing production to continue, inline isolation presents significant benefits in terms of schedule and cost compared to conventional methods. As assets age and decommissioning becomes more frequent, this type of intervention will play a key role.

Introduction

As onshore and offshore pipeline assets age, challenges often arise that can alter the operating requirements and parameters of the entire network. For example:

- Because of exposure to the operating environment, equipment and facilities may degrade. As a result, the entire system or any of its components may require maintenance, repair, or replacement.
- If requirements or engineering standards change, equipment and installations may be rendered obsolete.
- Advances in technology can significantly increase asset efficiency.
- As individual wells and entire fields mature and production conditions change, production management can be affected.
- When major offshore export pipelines are re-used and new fields are tied in, it complicates the topology and may cause knock-on effects within in asset configurations.

In order to optimize production and minimize costs, operators may eventually need to replace and decommission aging assets. Entire platforms may be shut down and the original pipelines that were tied into them re-used or repurposed in new infrastructure. Conversely, pipelines can be removed from platforms and rerouted or decommissioned. In either case, isolating the platform from the pipeline is essential. Isolation enables risers to be cut and the open pipeline ends reconnected via bypass loops, or allows tie-in of the pipeline to a new platform.

This paper discusses three case studies where non-intrusive inline isolation tools facilitated offshore decommissioning activities. Two of the case studies concern asset decommissioning in the North Sea, where some of the oldest offshore infrastructure is located. The third case study is related to decommissioning a subsea pipeline in the Gulf of Mexico.

Case 1: Platform Decommissioning in the North Sea

Pumping platforms once served to maintain pressure in a pipeline delivery system. However, as technology has advanced, the need for gas compression has declined and pipeline operators can often remove these platforms.

Case in point: two pumping platforms along the Norpipe natural gas pipeline, which runs 440 km (270 mi) from the Ekofisk field in the North Sea to a receiving terminal at Emden, Germany. The B-11 and H-7 pumping platforms (see figure 2), which were in service more than 35 years, provided pressure boosts at approximately 150 km (93 mi) intervals. The H-7 was removed in 2007 and the B-11 in 2013. Although the case study relates to the B-11 removal, the H-7 decommissioning process was similar.

Figure 1: B-11 platform (Source: GASSCO)

Located in the German sector of the North Sea, the B-11 platform became operational in 1977 as part of the gas transport system from Ekofisk to Emden. At the same time as the need for gas compression in Norpipe was declining, substantial upgrading costs were faced on B-11. Gassco accordingly recommended that a bypass be incorporated in the pipeline so that the platform could be removed, and this was accepted by the Gassco-led joint venture in 2010. (Source: Gassco, June 27, 2013)

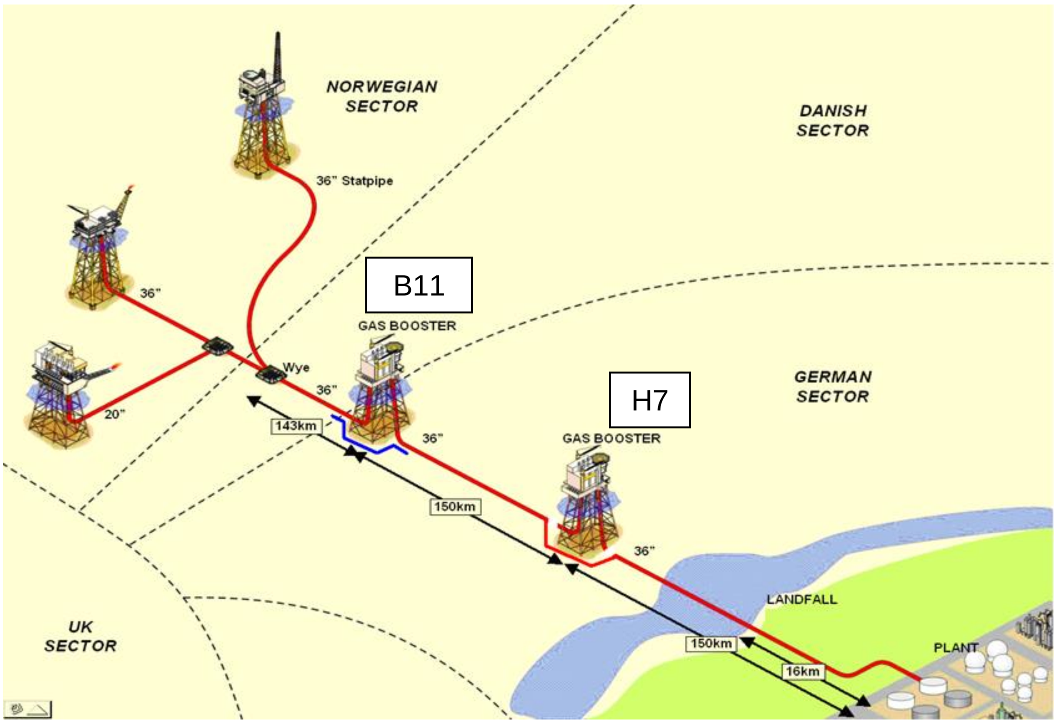

Figure 2: Norpipe pipeline set (Source: PTIL)

Time, cost, and reducing the likelihood of product loss were all considered in planning the bypass operation, which would occur at ambient pipeline pressures. Temporarily decommissioning the entire pipeline was an option, but it would have been costly due to the time involved, provision of pumping capability and chemicals, and the loss of pipeline inventory. In addition, depressurisation would have been extremely disruptive from a supply standpoint: the pipeline is a major gas transport trunk line to Europe.

Instead, the operator chose an alternative method to facilitate the intervention while the pipeline remained pressurized, generating significant savings.

T.D. Williamson (TDW) provided inline, double block and monitor (DBM) pipeline isolation services, using two SmartPlug® tools to isolate the 36-inch pipeline at subsea set locations upstream and downstream of the platform. The tools were tracked and operated in the pipeline using wireless through-wall SmartTrack™ communication systems.

After a successful setting and verification of both isolation tools, the pipeline was cut subsea, both upstream and downstream of the platform, to disconnect the import and export risers. The pipeline ends were then connected through a subsea tie-in operation to a pre-installed bypass spool. Throughout this comprehensive subsea intervention operation, the pipeline isolation integrity was monitored from the crew on the platform through the communication systems. Isolation status was also transmitted through a wireless radio system to a number of vessels involved in the work.

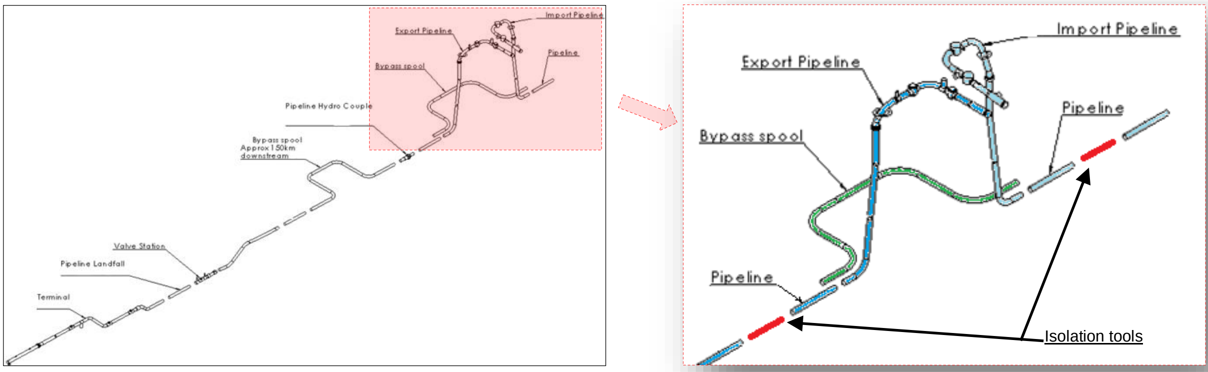

Figure 3: Pipeline layout from platform to terminal (Source: TDW)

Upon completion of the tie-in, the isolation tools were unset and the entire set up of isolation tools, batching pigs, and welding pigs was pigged to the pipeline terminal onshore and successfully retrieved.

Case 2: Platform Decommissioning and Network Reconfiguration in the North Sea

While the Norpipe example is relatively straightforward, the Frigg field case study illustrates how the same isolation methods can be used in a highly complex situation.

The Frigg platform’s original construction dictated a specific intervention be used at decommissioning. In addition, the upstream pipeline network was being reconfigured to take advantage of the fact that the platform was being shut down.

The MCP-01 platform was an integral part of the pipeline between the North Sea Frigg field and the St. Fergus gas terminal near St. Fergus, Aberdeenshire, Scotland. The platform was commissioned in 1977, but by 2004 – as a consequence of field development and expansion – it was no longer required.

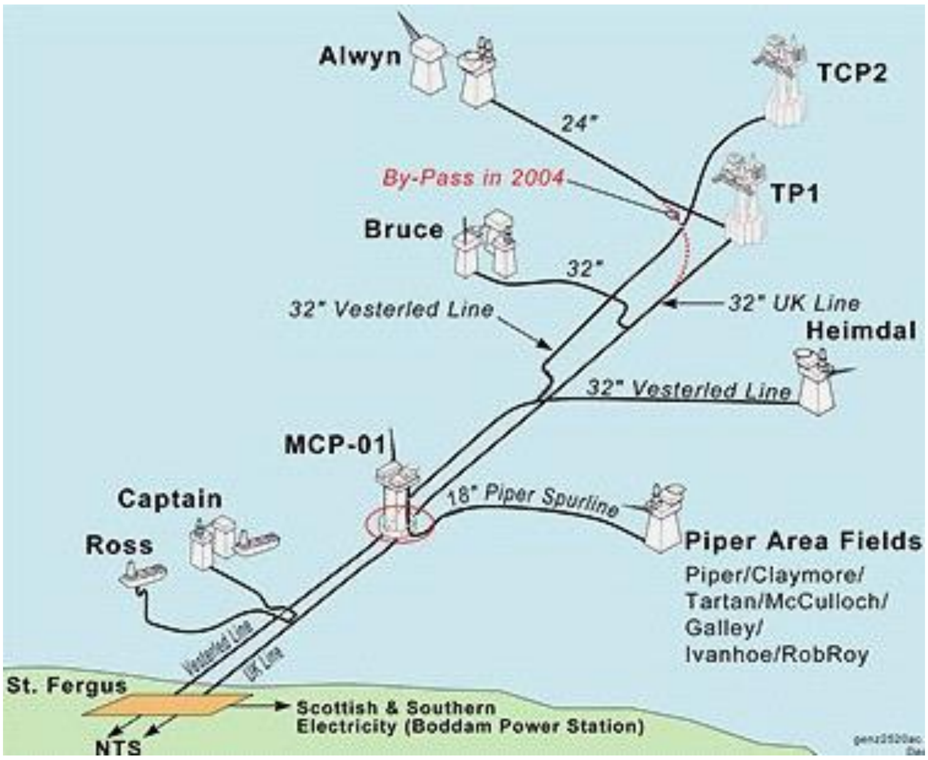

Figure 4: Frigg field overview (Source: University of Aberdeen, Frigg history article).

Because the pipeline was routed through the base of the MCP-01 platform foundation, a bypass was required prior to the decommissioning work. Plans were also made to connect the production line traveling from Alwyn into the TP1 (Frigg) platform directly to the UK line instead, using a subsea tie-in. This would effectively bypass the TP1 platform. However, the lines were different diameters.

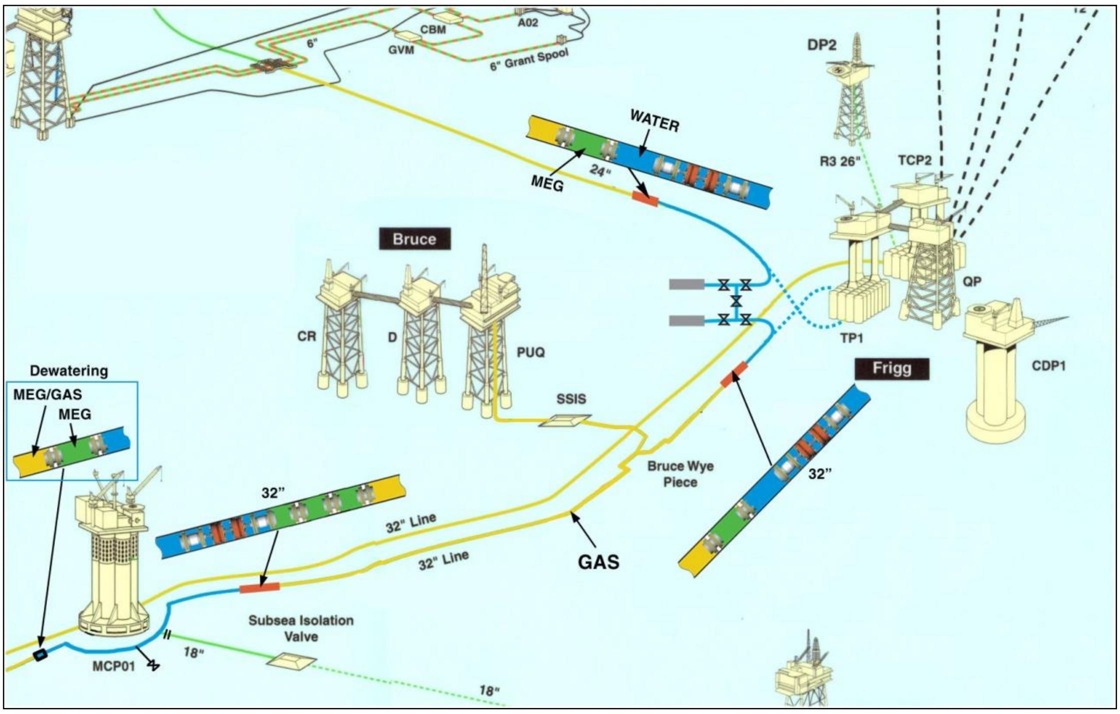

Figure 5: Field overview during bypass operation (Source: TDW)

During the TP1 and MCP-01 bypass project, TDW used two 32-inch and one 24-inch SmartPlug tools to isolate the pipelines.

The 24-inch in SmartPlug tool was pigged 3 km (1.9 mi) with inhibited seawater into the Alwyn line and isolated at pipeline pressure, which prevented the depressurisation of the gas export system from Alwyn/Dunbar. As a result, decommissioning and re-commissioning costs were minimised compared to the traditional methods of pressure depletion and pipeline flooding, and startup was achieved far quicker than would normally be anticipated.

Similarly, two 32-inch SmartPlug tools were used to isolate the Bruce platform from the main construction work, as was required. This permitted the installation of the subsea pipelines as well as connections for valves and subsea launcher/receivers at the interface between the Alwyn and Frigg lines, which were of different diameters.

Figure 6: Isolation operations (Source: TDW)

The 24-inch and one of the 32-inch isolation tools were received into a subsea trap, while the second 32-inch isolation tool was received onshore at St. Fergus.

Case 3: Platform and Pipeline Decommissioning in the Gulf of Mexico

In some cases, the removal of an asset requires the abandonment of a pipeline, and often this spur line has no means of isolation, such as a valve. In turn, this requires the isolation of the spur and fitting of a permanent closure. In 2006, for example, a Gulf of Mexico pipeline operator was required to abandon approximately 762 m (2500 ft) of pipeline to accommodate the removal of the platform. This was achieved using a 20-inch SmartPlug tool to create a double block isolation against the gas pressure in the pipeline.

The isolation tool was launched and pigged with seawater from a temporary launcher installed at the platform. The tool was set in place to permit cutting of the pipeline. After the pipeline section was removed, a flange and 20-inch subsea valve were installed to connect a temporary subsea receiver for recovering the tool. When the installation was completed, the SmartPlug tool was unset, pigged back into the temporary receiver using natural gas, and recovered to the surface.

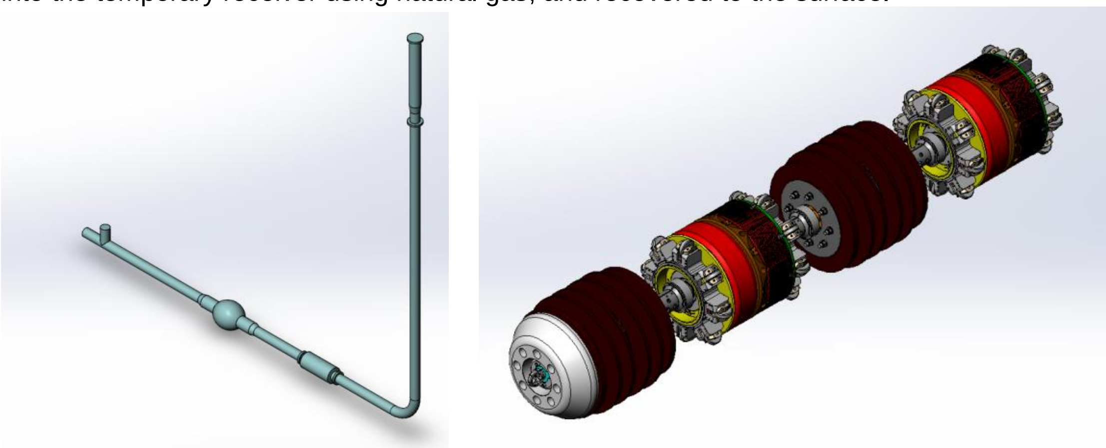

Figure 7: Simplified Pipeline isometric and 20-in SmartPlug® tool (Source: TDW)

Other decommissioning projects performed include:

2005: 2x20in Gulf of Mexico (GOM) region	2005: 16in GOM region
2006: 20in GOM region	2014: 22in North Sea region

Technology Overview – SmartPlug® Isolation Tool

The SmartPlug tool is the most frequently used inline isolation tool for subsea pipelines, with a track record of more than 250 isolations worldwide.

The SmartPlug tool's design provides fail-safe operation through two independent and monitored seals that meet the strenuous safety demands of the offshore oil and gas industry. The SmartPlug tool is non-intrusive, bi-directionally piggable, and remotely controlled. The standard tool configuration consists of two independent plug modules that typically travel on a spring loaded wheel system. Each is independently capable of isolating the full pipeline pressure, thus providing a true double-block isolation anywhere in the pipeline system. In some cases, a third plugging module is added for post-repair hydrotesting, using the same tool without retrieving it from the pipeline and without losing the isolation. Prior to deployment of the tool, every project is subjected to piggability and pipeline hoop stress assessment and must pass a factory acceptance test certified by an independent body.

Figure 8: Double independent seal SmartPlug® train with third seal for hydrotesting (Source: TDW)