

7 well decommissioning executed by following structured process

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Abandonment Delivery Process

A key to success of any project is to follow a structured approach and apply proven processes. Abandonment projects are not so common thus a proven delivery process did not exist. As the need for a structured approach was deemed paramount, a well delivery process was adapted and altered as a framework the project could follow from the onset.

This outlined a phased approach to the project, each phase defined key steps that needed to be followed to proceed to the next phase. This gave the project team clear visibility to not only the key factors affecting project success but also to all interrelated factors. This facilitated with aspects such as early identification of issues and also aided strategic alignment of both the company and the contractors. Utilising this defined mapping process was vital to achieving holistic management of the project.

Project Scoping

The Puffin field lies in water depths of approximately 105m. Production commenced in 2007. Both production wells required gas lift and were tied back to a floating production, storage and

offload (FPSO) vessel. Production ceased in 2009. Prior to disconnection of the FPSO, all subsea production infrastructure was purged of hydrocarbons, flushed, tested and left in-situ. The wells were shut in with approximately 1600 psi of gaslift gas left in the annulus. Subsequent ROV campaigns to monitor the wells detected a minor gas leak on the Puffin-8 well, this led to the decision to P&A this well. Further cost analysis provided justification for combining the P&A of the Puffin-7 well and the 5 temporarily suspended wells into the campaign.

Project Planning Abandonment Barrier Philosophy

The UK O&G guidelines 2012 were adopted as the key guideline for barrier placement. These guidelines focuses on the key concept of restoring the reservoir caprock and isolating all distinct permeable zones both from each other and from the surface. For the Puffin wells caprock reinstatement was all was required to P&A the wells. For operational efficiency and minimisation of operational risks a combination barrier plug was chosen in accordance with the guidelines.

Equipment

The dual bore Puffin trees required a dual bore riser system to be run in order to connect to the trees and reenter the wells. On topside a surface flow tree (SFT) was utilised to maintain well barriers and act as an interface between the riser and topside equipment such as slickline PCE, cementing unit and a bleed back package. A risk assessment highlighted the possibility of hydrocarbon returns thus a bleed back package and tote tanks were included in the equipment spread to enable for the management of any hydrocarbons that may be encountered.

New Technology

To mitigate the risk involved with cementing through the dual bore riser system, special ROV operable connectors were designed and manufactured to connect to the subsea flow support bases (FSB). Flowlines were cut from the FSBs during the pre-abandonment campaign. During the main campaign the cement connector were attached to the FSBs off critical path, a cement umbilical was run from the topside cement unit and stabbed into the cement connectors, this allowed the cement to bypass the riser system and be

This article describes the planning and execution of the Puffin field abandonment which was successfully executed in 2014. The Puffin field is located in the Timor Sea about 200 kilometres off the coast of Western Australia. The field consisted of two gas lifted production wells and five temporarily suspended wells.

The article gives an outline of the processes, technologies and methodologies which were adapted in planning and executing the project. Finally, the article concludes with a look at the main challenges and the key lessons learnt.

pumped directly into the FSB.

Cost Estimation

A probabilistic cost estimation software was utilised to obtain a P10 – P90 cost spread for the abandonment. All phases of the abandonment project from planning to execution were included in the model with associated risks assigned. Once all phase data was incorporated in the model a spread of regional cost data was input. The software then generated a spread of time/cost estimates for the project. This provided clear visibility to areas where the project had high risk of cost blowouts and thus allowed the project team to place more focus on these areas and develop contingency plans to mitigate these risks.

Methodology

The primary abandonment methodology was to carry out a through tubing abandonment and leave the tubing in the wells. Leaving tubing in the wells optimised the program execution times and mitigated the risk of having to recover tubing. Confirmed annuli TOCs and good original cementing data meant running CBLs or performing section milling operations would not be required, this confirmed these

wells were very suitable for through tubing abandonments. Contingency plans were also in place to allow for temporary suspension of the wells, this would enable removal of the trees and running of the marine riser system so the production tubing could be removed if required.

The basic primary abandonment program consisted of the following steps.

- Remove tree caps
- Run dual bore riser system and establish connection to tree
- Bullhead well
- Set slickline plug in tubing tail pipe
- Pressure test tubing
- Connect FSB cement connector (off critical path)
- Perforate tubing above packer
- Circulate out annulus gas
- Circulate cement plug into position
- Tag and test Plug
- Cut tubing and remove SST
- Remove FSB
- Cut casing strings
- Recover PGB, wellhead and casing strings

In order to run the dual bore riser system, pull tubing (if necessary) and accommodate the large equipment spread a semi-submersible rig was chosen to execute the abandonments.

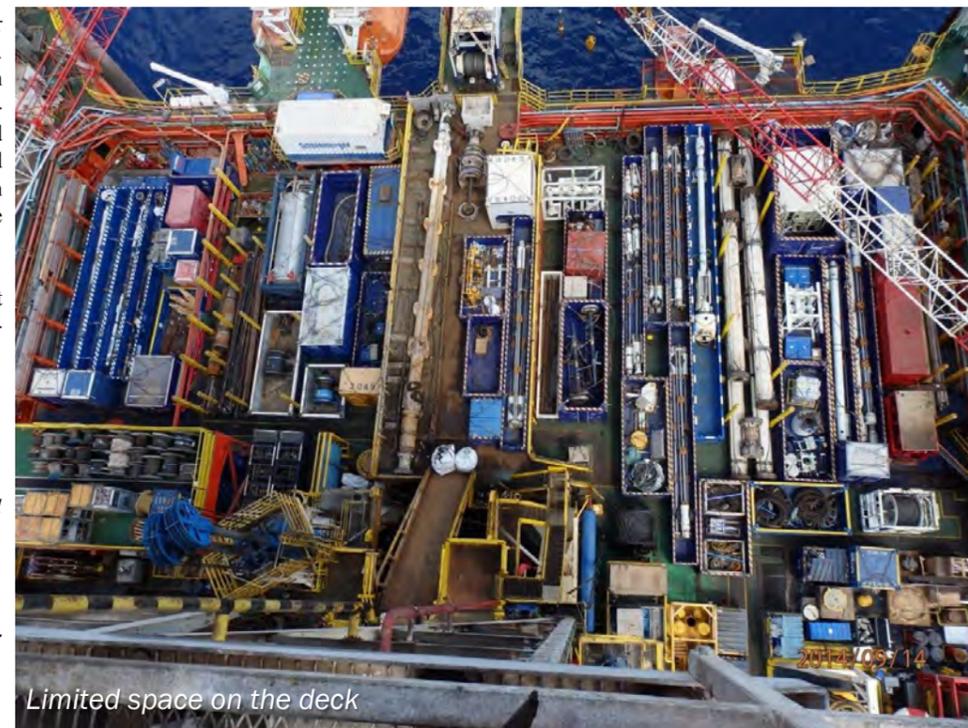
Project Execution

Pre-Abandonment Campaign

A crucial component for the success of any abandonment campaign is to incorporate a pre-abandonment campaign. For Puffin this was executed in July 2014. The main components of this were, cleaning operations, removal of production PODs, removal of FSB flowlines, annulus pressure monitoring and seabed survey. Additional operations which were unknown prior to the campaign also had to be carried out, such as the removal of sheared guidewires from guideposts. The campaign ran for 25 day and came in within AFE. The success of the pre-abandonment campaign was attributed to saving approximately 11 rig days.

Main P&A Campaign

The main campaign commenced offshore operation in August 2014



and ran for 67 days. The campaign required 6 rig moves to abandon all 7 wells, only the two production wells were close enough to allow keding between wells. Three of the suspended wells were completed first to allow a ramp up into full abandonment mode. Initial set up, connection and bullheading of the first production well (Puffin-7) went without major issues, however attempts to drift the tubing failed with numerous gauge cutters runs getting hung up 1000m from target depth. The decision was made to kedge to Puffin-8, this had key benefits in that it kept operations moving forward, it allow time to develop forward plan for Puffin-7 and it enabled testing of Puffin-8 well for similar issues. Puffin-8 had no tubing issues and thus the through tubing abandonment was executed without issue. To complete the Puffin-7 abandonment, firstly, the annulus gas was lubricated out. Lubrication of the annulus gas was successful but unexpected quantities of hydrocarbons were also returned, the inclusion of a bleed back package on-board enabled the hydrocarbons to be effectively dealt with. Next the tubing was severed above the obstruction, e-line plugs were set in the production and annulus bores and the tree was removed.

The BOP stack and marine riser were then installed allowing the tubing hanger and tubing above the obstruction to be removed. To remove the remaining tubing an overshot tool was run to attempt to blind backoff the tubing to the packer. Due to the poor tubing condition blind backoff attempts only succeeded in retrieving small sections of tubing. Next an external tubing cutter was run on wash pipe. The recovered 130m section showed cuts in a box joint suspected to have been caused by gas migrating into the production tubing. Tubing below this section was found to be in good condition. All remaining tubing was then removed by rerunning the overshot tool and carrying out an e-line run to part the tubing at the required depth. Once all tubing was removed a bridge plug was set and tested in the 9 5/8" casing and a combination cement plug was then set using the cement stinger. The program was then completed as per the original program. The final two suspended wells were then abandoned without issue. The team's ability to respond quickly to operational changes in addition to managing to gain time on the easier wells brought the project in within 1% of AFE.

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Conclusion

Abandonment projects can be