Abandonment: the next growth industry

Kevin Illingworth, Global Well Abandonment Manager
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As aging fields reach their productive economic limits, well abandonment has become an emerging requirement in the oil and gas industry.

In the high oil price environment of the mid-2000s, which supported the rising lifting costs associated with off-plateau production profiles, there was a drive to enhance production from depleted wells. Following the decline in oil price from early 2015, operators are now faced with increased lifting costs compounded by aging assets and well integrity issues.

With 46% of the cost of decommissioning a facility associated with well abandonment activity (1), **Kevin Illingworth, Global Well Abandonment Manager at Expro (UK)** discusses how operators and service companies are now focusing on integrated abandonment solutions and rigless intervention in order to drive down these costs.

Aging fields

Across oil producing regions, well stocks are now reaching the end of production and in many cases, have been extended beyond their original design life. Operators are now recognising the large number of idle wells and likewise, governments are introducing legislation to encourage the safe decommissioning of assets.

The boom in the oil industry first experienced in the 1970s and 80s saw fields discovered and developed in new offshore basins. Operators were encouraged by government policy designed to reduce dependency on imported energy and collect revenue from petroleum taxes.

Unlike the drive to achieve first oil, abandonment is not associated with revenue generation. In fact, the cost of decommissioning the world's 6500 offshore platforms was estimated at $29-40bn over 30 years.(2) However recent reports suggest that the global offshore decommissioning of oil and gas installations expenditure is expected to increase at a CAGR of 20.4% from 2015 to 2020.(3)

Whilst individual well abandonment is not new, the industry needs to abandon offshore assets in a size and scale not experienced previously. Many of these assets were

‘technological firsts’ during their construction and present significant challenges in the deconstruction phase of their life cycle.

The reason for deferring abandonment projects are typically cost-driven. Where wells and facilities are ready to be abandoned today, the process involves reversing the original drilling and construction process which is expensive. With limited R+D funding in the current market conditions, the trend has been to ‘watch and learn’ in the hope that experience will lead to innovation, which will eventually drive down costs. In the meantime, the cost to maintain old facilities only increases.

Pre-abandonment

In advance of the cessation of production, there are a number of areas that can be worked on in the late-life management of assets which can help in reducing the final costs of both reservoir abandonment and the full decommissioning of assets.

It is vital to effectively plan late-life asset operations to realise the full potential of a well prior to full decommissioning. Part of this planning involves forecasting, integrity assessment, well maintenance and interventions as well as data acquisition.

The benefits of this planning are two-fold; to allow maximum production optimisation from all assets and reduce the intervention risk to as low as possible, before final reservoir abandonment.

OPEX can potentially be dramatically reduced by utilising fit-for-purpose temporary production facilities. These are better suited to handle the smaller volumes of hydrocarbon production in the late-life asset management phase and also allow the concurrent decommissioning of platform production facilities. However when this also becomes economically unviable, the abandonment process must begin.

Reservoir abandonment – rigless approach

In this fledgling application, the issue of a rig versus rigless approach is at the centre of planning activity. A rig-based approach uses mobile drilling units (MODU), or platform-based rigs to recover downhole equipment and plug the wells.

In late-life production, drilling activity has ceased and very often platform based drilling rigs have been removed or fallen into disrepair, requiring significant investment to return them to an operational status.

However, rigless alternatives can be used for plug and abandonment operations, to reduce expensive rig day costs. This approach can be used either to abandon the wells with completion in-situ or reduce the overall number of rig days to an absolute minimum, performing intervention operations in advance and leaving the rig for tubing or casing handling operations.

Prior to the removal of topside and seabed facilities, individual wells must be made safe, reservoirs isolated and permanent barriers installed throughout the wellbore. Permanent reservoir abandonment accounts for a significant proportion of overall abandonment costs, in higher costs basins like the North Sea, this can be anything up to 60%.(4)

A rigless approach which could include reservoir isolation, wellbore and wellhead remediation working towards a hydrocarbon free facility, can offer significant savings – in both time and cost.

A significant element to any campaign is firstly understanding the well integrity, specifically when placing cement inside multiple casing strings and establishing or verifying integrity behind casing strings.

A project team responsible for candidate well selection, subsurface and well construction review can correlate existing legacy data which may be 25+ years old. Augmenting this information with new data prior to initiating abandonment offers significant cost savings in avoiding unplanned downtime when re-entering aging wells.

Post-abandonment

Where well abandonment is often performed in two stages, *plug* and *lubricate*, followed by permanent abandonment, there is often a gap in activity which can extend to a period of years.

During this phase, there is an opportunity for a recharge in the original reservoir pressure, and the potential for any barriers to leak, creating a well control hazard for re-entry to the well. The placement of wireless pressure gauges below isolation barriers allows for the

monitoring of well bore pressure during re-entry through to the post abandonment phase of the well. Expro's Cableless Telemetry System (CaTS™) uses wireless communications technology to transmit data from below the bridge plug, in real time, while pressure testing is performed on the plug. This makes it possible to verify the sealing integrity of the upper barrier placed in the well. (5)

North Sea

Expro have previously worked with major operators to develop engineered solutions for successful rigless abandonment – most notably with BP on the Miller Platform in the UK North Sea.

Combining proven technology and best practice, Expro performed pre-abandonment logging operations to establish well integrity prior to finalising the abandoned design for each well. The project included drift and casing caliper runs to ascertain through-bore access, establish casing integrity, and acquiring pressure/temperature data – all of which proved to be crucial in defining the final well abandonment methodology.

The reservoir was first isolated through the installation of wireline set mechanical bridge plugs, run-though tubing and then set in the liner above the main reservoir. The tubing strings were then cut and perforated to allow for circulation of cement plugs. The subsurface knowledge of well construction and completion design provided valuable insight into potential hazards including the identification of 'eccentric' casing strings.

Expro's perforating guns were then modified to selectively perforate the tubing and casing strings prior to cementing. This meant that the guns were orientated to sit on the low side and with adjusted charge penetration, could perforate selective tubing and casing strings. During the project, 235 wireline runs were performed with 92% efficiency. (6)

In another recent North Sea plug and lubricate campaign, the company used a multi-disciplinary team to provide pre-abandonment well intervention services, which included logging the wells and setting temporary abandonment plugs ready for full abandonment. Learnings taken from the initial wells allowed Expro, and its client, to implement further efficiencies for the remainder of the campaign. This collaborative approach to the project was so successful, it saved the client 50 days from an initial 180-200 day work scope. While the second phase of the project is yet to be completed, the cost of running and manning a

non-producing platform is considerable, therefore reducing the number of days required for abandonment will add up to millions of dollars in cost savings for any operator.

Gulf of Mexico

In North America, the US government has recognised the large stock of wells (4000+) which are no longer producing. The introduction of NTL 2010-G05 legislation, referred to as the *Idle Iron Policy,* specifies a strict timeframe between a well being left idle before abandonment must take place. Following its introduction, a significant number of wells have been abandoned successfully.

In 2016, Expro worked on its first integrated plug and abandonment project in the Gulf of Mexico which comprised the pre-abandonment and plugging of wells in the ultra deepwater Atwater Valley and Mississippi Canyon areas.

Utilising well intervention services to complete plug and lubricate operations in the first phase of abandonment, the work also included cutting and perforating using slickline and electric-line cased hole services. The innovative use of a combination of a mechanical and electrical dual drum winch unit, offered the operator a saving of 30% in time and budget over previous benchmarks for this type of activity.

Conclusions

Well abandonment is the natural conclusion to the life cycle of a well. After the booming success of the offshore industry in the 1980s-2000s, there is now a global legacy of wells that require abandonment and decommissioning. Very often the wells and facilities have been in production beyond their initial design life with this extended production sustained by a period of high oil prices.

Re-entering a well always comes with a level of risk, and with older wells, this risk is increased. While tentative steps have been taken with a small number of key projects in mature basins, the industry is looking to explore new solutions that can validate the subsurface integrity and allow in-situ abandonment reducing rig activity.

As abandonment costs are not directly related to generating revenue via production, it is important that the challenges associated with re-entry are understood. A robust review of

existing subsurface data and the collection of new information to close any gaps is critical to efficient planning and successful execution of abandonment activities.

The industry is looking for new technologies to drive cost efficiency, however old 'tried and tested' methods and process still dominate - and will sustain this near-term wave of abandonment activity. However it won't be long until the innovative approach developed in the industry's formative years, will be applied to solve the challenges of well abandonment.

References

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