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Quantum Leap in Intervention, Rectification of High Annulus Pressure (HAP) at Offshore Malaysia Using a Novel Annulus Intervention System - Operator Case Study

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Abstract

Through recent years, there have been an increase of well integrity issues arising from the build-up of pressure in a well's casing annulus, or Sustained Annulus Pressure (SAP). The casing annulus (the volume between 2 concentric casings) are typically not designed for intervention and are only accessible from the casing valves at surface. While the A-annulus (the volume immediately next to the production tubing) may have limited accessibility from the tubing itself, for B- and C- annulus, this access is non-existent. Up until now, this has been the primary challenge in rectifying SAP issue in casings. Current well intervention technologies or methodologies are unable to rectify SAP issues and the wells had to be shut-in (production deferment) or required bleed-off facilities installed (additional CAPEX and OPEX). A breakthrough technology and methodology is required to resolve SAP issues and prevent risk escalation and production deferment. The desired solution should have the following characteristics: Ability to enter casing annulus, effectively lubricate the annulus, practicable at offshore and cost effective.

Based on the objectives, a technology selection process was performed concurrently with development of the execution methodology. This resulted in the selection and vetting of the Annulus Intervention System (AIS) Wellspring which utilizes a compact and flexible conveyance system known as ‘wellspring’ to be installed at the casing gate valve, ability to deliver fluid up to 400m away from pumping point and have integrated well control barrier for safe intervention into a live condition well. In addition, a suppression fluid placement methodology was designed using a heavy (14.8 ppg) brine system to replace the existing (lighter) casing annulus fluid. This was calculated to have a net pressure downwards and therefore suppressing the SAP.
With systematic process and procedure in place, team managed to prove the AIS can be conveyed through the casing head valve, passthrough the casing hanger and entered the B-annulus. The suppression fluid which is 14.8ppg brine also was able to be pump into the annulus to replace the degraded water-based mud with an optimum pumping rate and operating pressure. By achieving that, the team managed to suppress the SAP which ultimately safeguard the production from the well.

This paper shall discuss the process of identification, diagnostic and subsequently the step-by-step method that has been taken by the team to ensure the AIS system is well suited to rectify the sustained annulus pressure. It will also discuss the execution strategy, technical challenges faced and lesson learnt during the execution of the project.