

Alternative barriers for well abandonment offshore Norway



CHALLENGE

Needed alternative barrier to cement

SOLUTION

BiSN set a Wel-lok STC inside section milled windows in 30 wells

RESULT

Each plug resulted in elimination of bubbles with approved barriers in place

INTRODUCTION

The Wel-lok STC™ (Seal Through Casing), which creates barriers with bismuth-based alloys, has been developed to achieve a gas tight, VO seal in annuli that cannot be achieved with traditional cement plugs. Due to its viscosity and density, once melted, the liquid alloy flows through perforated holes, or section milled windows, with gravity, into the annuli. This eliminates the need for surface pumping equipment. When the alloy solidifies it expands to create an impermeable seal. The entire process, from melting to solidification, takes place in minutes and the seal is ready to test within a few hours.

ABOUT US

BiSN's Wel-lok technology is a metal-to-metal downhole sealing solution developed to provide a permanent seal through a thermite heat ignition and a rapid solidification process of eutectic bismuth alloy. The use of bismuth alloy is advantageous because once it is heated, the metal liquifies and is equal to that of the viscosity of water. The liquid bismuth alloy can then filter through porous locations prior to solidification, as opposed to conventional methods such as cement or resin.

CHALLENGE

An operator in the Norwegian North Sea wanted to abandon their 30 wells to a high standard, using a bismuth-based alloy plug as their barrier rather than traditional cement. To accomplish this, rigorous qualification testing programs were required over a 3-year period including plug qualification and qualification of the material itself (bismuth alloy) to demonstrate the material is superior to cement. This data would need to be presented to the local regulator to be deemed acceptable as a barrier material. Due to the casing configurations of the wells on this platform, three different tool sizes were required for the campaign. A section milled window would be cut in the inner casings of 13 3/8", 18 5/8" and 20" casing programs with the alloy plug set inside the windows.

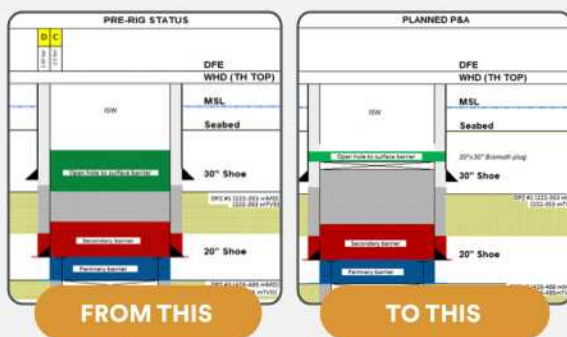
SOLUTION

Following successful qualification of the plugs and material, the operator received acknowledgement of consent from the regulator to utilize BiSN's bismuth alloy as a barrier material in each of the 30 wells. This offered the assurance of a gas tight bismuth alloy barrier to eliminate long term liability. The tools run in these wells resulted in the world's largest bismuth alloy plugs ever deployed with the largest tool (20 x 30") weighing in at nearly 16,000 kg (34,000 lbs) and over 9,000 kg (20,000 lbs) of alloy. After melting the tools downhole, the heater was extracted resulting in a solid bismuth alloy (single material) barrier across the wellbore.

PROCESS AND RESULTS

Rig work:

- Drill out cement plug
- Section mill 3m window
- Place 20" EZSV inside the casing
- Place 20" x 30" premium openhole to surface abandonment plug inside the milled window.
- Surface casing and conductors cut and retrieved.



BUSINESS VALUE

- The abandonment schedule for the Valhall IP platform was reduced from 10 years to 4 years, the BiSN plugs contributing (in a small part) to this.
- Premium quality abandonments successfully executed in 30 wells, with zero gas leakage, thus safe and protecting reputation.
- Bismuth plugs abandonments need less section milling for plug accommodation, saving many days for each well.
- Operational procedures were easier due to needing less special cement formula to set in a cold environment, pumping requirements minimized.
- Seal 1 and Seal 2 (also 3/4/5) plugs were approved by the local regulator.
- Cement manufacture generates significant CO₂, therefore reducing cement usage and less rig operational time are both good for the environment.