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Screenless recompletion earns 300%

Maritech Resources Inc. successfully installs resin-based screenless sand control on recompletion, using a compact coiled tubing and nitrogen spread in limited platform space.

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Acquiring sunset producing properties with near-term plug and abandonment liabilities is a tough way to do business, unless a company has the technology to intervene and extend the lives of wells. These acquisitions are synergistic if the company also runs a well abandonment and decommissioning group, as they provide a baseload of future abandonment work. The primary objectives of the company are to exploit any remaining active production and develop any remaining potential in the acquired properties through workover and drilling initiatives before performing the necessary abandonment operations.

Recently, Maritech, a subsidiary of TETRA Technologies Inc., acquired the **High Island A-442** field located in the federal waters of the Gulf of Mexico. The field's B structure is a single-well caisson structure located in 168 ft (51 m) of water approximately 100 miles (160 km) offshore Texas.

The structure has usable deck dimensions of 27 ft by 33 ft (8 m by 10 m), providing less than 900 sq ft (84 sq m) of work area. Given the small work area and the limitations of the crane capacity, any well activities other than wireline or electric line operations had previously been conducted from a liftboat or a jackup completion rig.

The **B-1/1D** well was initially set up as a dual completion with 2⅜-in. tubing strings. Four conventional gravel packs were used to produce a number of relatively short interval water-drive gas reservoirs deeper in the well bore. However, a fifth completion, the PL6-1 zone at 3,901 ft (1,190 m) measured depth, was produced without sand control. It never produced to expectations, sanded up prior to the recovery of its anticipated reserves, and was eventually abandoned. This zone's disappointing performance, when compared to that of the other four zones, clearly indicated that, in order to effectively produce the remaining four reservoirs at this location, some form of sand control was necessary.

Typically, the through-tubing recompletion method for reservoirs of this type is to isolate the depleted zone via an e-line plug/cement combination and then to perforate/install a vent screen gravel pack for sand control. However, the close proximity of the future completion zones, coupled with the minimum tubular restrictions and large casing completion intervals, precluded the use of conventional vent screen applications as a desirable completion method for the remaining reservoirs.

When designing the first of the four planned recompletions on the B-1/1D well, the operator reviewed the available sand control options and selected a screenless resin-consolidating treatment as the best option for recompleting the PL-6B reservoir.

Resin consolidating treatments are designed to work well in oil and gas wells with small completion intervals where conventional gravel pack treatments are not readily adaptable to the downhole reservoir and/or wellbore conditions. The ultimate objective of the formation consolidation service on the B-1/1D well was to provide formation consolidation by leaving the individual sand grains coated with resin to facilitate effective sand control.

Parameters considered critical to a successful formation consolidation treatment included:

1. ***A short interval.*** In this case, the zone was 10 ft (3 m) in thickness, and the company limited the perforated interval to 6 ft (1.8 m).
2. ***A limited shot density.*** On this recompletion the operator perforated six shots per foot for a total of 36 perforations.
3. ***An accurate placement method.*** Coiled tubing was selected for placement of the treatment across the perforations.

High Island A-442 single well caisson structure shows limited deck space. (All graphics courtesy of Maritech)

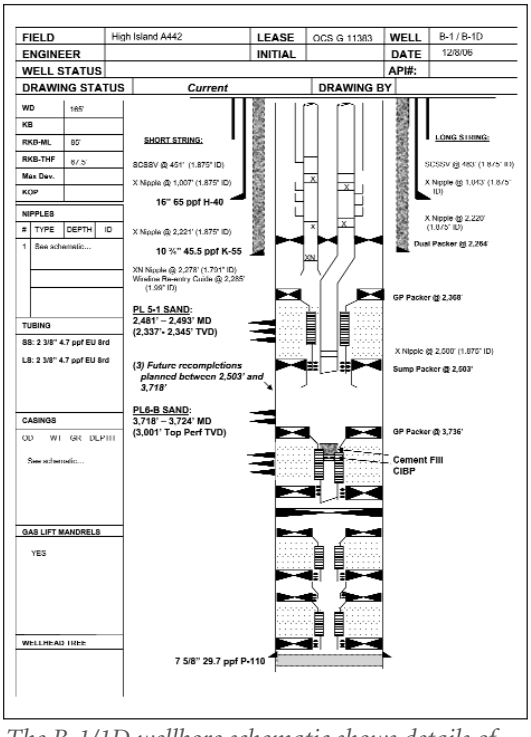
The short interval, with a total of 36 perforations, increased the probability that the entire interval would be effectively treated with the volume of resin pumped. Rather than bullheading the treatment down the tubing, coiled tubing was used to strategically spot the resin across the perforations and decrease the potential for product contamination.

Given the space and load constraints of the single well caisson platform, the company used a third-party engineering firm to evaluate the structure and determine the size and weight of the coiled tubing equipment that could be used without exceeding the structure's space and load limitations. Wise Well Intervention (then known as Production Enhancement Technology) was identified as having equipment that met the design parameters. That company verified that its patented modular coiled tubing and nitrogen system, comprising compact, lightweight skids, would fit in

Deck space allows setup of coiled tubing unit in preparation for pumping operation.

the limited deck space while at the same time staying within the lift capacity of the platform crane.

The modular design of the coiled tubing and nitrogen spread made it possible to make maximum use of available deck space. The coiled tubing and nitrogen spread was rigged up on the platform deck, and the resin treatment pumping spread was rigged up on the deck of the workboat. Coflexip hose was run from the pump on the workboat to the high-pressure coiled tubing manifold on the platform deck. The treatment was pumped through the coiled tubing without incident, and the resin was allowed to cure for 60 hours.



The B-1/1D wellbore schematic shows details of the job.

Coiled tubing was then run in the well to jet with nitrogen, but the completion formation would not feed in during jetting operations. The possibility that the consolidation/post flush treatment had formed a water block was considered, and the zone was treated with a surface tension-reduction treatment, with no positive results. The coiled tubing operations were suspended in order to rig up an electric line unit to recheck the completion depth. The electric line correlation revealed that there was 10 ft (3 m) of fill above the top perforation, effectively isolating the production tubing from the producing formation.

Coiled tubing was once again rigged up, and a bottomhole assembly consisting of a $1^{11}/_{16}$ in. motor and under-reamer was used to clean out the well to plug-back to total depth (PBTD). The well was then successfully nitrogen-jetted to a surface tank and gas buster with a good show of hydrocarbon gas and increasing wellhead pressure.

The fill likely occurred due to a gas head in the tubing/coiled tubing annulus that compressed slightly as the higher viscosity resin was entering the perforations, thus allowing some of the resin to move up the well bore above the perforations.

In the future, this situation can be prevented by ensuring that the coiled tubing/production tubing annulus is completely full prior to pumping the resin while maintaining adequate back-pressure on the coil annulus during pumping operations. Alternatively, if the coiled tubing/production tubing annulus is not full, fluid injection down that annulus while placing the resin treatment through the coiled tubing may prevent the formation of a gas head.

The B-1/1D well is now producing 2 MMcf/d with a shut-in tubing pressure of 1,500 psi and a flowing tubing pressure of 1,300 psi. Provided the risked reserves are recovered, a greater than 300% cash flow rate of return is expected.

The resin consolidating treatment and the use of the Wise compact coiled tubing and nitrogen system has proven to be a technically feasible and economically successful screenless sand control method for this producing zone. Once the existing zone is depleted, this combination may also be applied to effectively recomplete the remaining three undeveloped reservoirs in the well.

Maritech's ability to fit the modular coiled tubing and nitrogen spread in the limited deck space is one of the factors that made this and any future recompletions an economically viable option for the B-1/1D well. The compact equipment eliminated the need to undertake a costly and time-consuming platform expansion. It also helped the company avoid the less desirable option of bullheading the screenless sand control treatment from a workboat or bringing in a liftboat to support coiled tubing operations. **E&P**