Unique Design Using Expanding Foam to Remove Coil Tubing From Natural Gas Wellbores

Overview

Natural gas wellbores use steel coil tubing strings to increase production as the well ages and pressure decreases. Occasionally, these velocity strings need to be removed. Due to the harsh environment inside the well, the velocity strings have corroded and often break during removal. By injecting expandable foam into the tubing and allowing it to solidify and form and anchor, it can be removed safely and easily.

Objectives

- Remove 10,000 ft. of steel tubing while obeying all environmental, state, and national laws
- Navigate holes, part and pinches in the tubing as well as water that may be in the tubing

Approach

- BP gave the team customer needs that the design must meet
- Patent search yielded what is currently in use
- Concept generation session yielded most of the ideas
- Spoke with the sponsor about the potential ideas to gain valuable input as to each design’s feasibility
- Best concept was selected and initial planning began
- Initial testing yielded data on the strength of the foam chosen
- A design for the nozzle delivery system was chosen
- Testing was done on mixing ability of the nozzle
- More testing of the foam and strength characteristics yielded more accurate data
- Finalized all design criteria and did more realistic testing in water environment

Outcomes

- The foam removal method is a novel approach which BP is pursuing
- Patents are being applied for
- Less than 30 feet of foam is required for removal of 10,000 feet of coil tubing
- Could save BP up to $120 million