Wellbore Coil Tubing

Overview

In BP's North American Gas Division, there are approximately 800 wellbores with coiled tubing installed that have been left in the wellbore for 10-15 years. Attempting to pull the coiled tubing can result in breaking it and may require extremely expensive fishing jobs, since leaving the coil in the well causes corrosion/erosion from various different sources. BP is looking for an alternative approach to remove the coiled tubing.

Objectives

To engineer a novel approach of removing coiled tubing velocity strings left in natural gas wellbores, revitalizing well production.

Approach

- The team started the project with review of literature and a patent search of current coiled tubing extraction methods and technology. Also, the team went on a site visit to a coiled tubing unit in Pittsburgh. After that, the team was ready to start the work on finding a solution to the problem.
- Five concepts were generated and a cable-anchor system was selected for the final design. The design consists of a 3000ft long strong galvanized steel cable in which an anchor system is connected at the end. The cable-anchor system will be inserted into the coiled tubing and will travel all the way down to the bottom of the wellbore. The anchor arm will automatically deploy upon reaching the bottom of the wellbore utilizing a pre-loaded constant force spring. The coiled tubing will be sitting on the anchor arm and then the extraction operation can start. This cable-anchor system is used along with the current coiled tubing extraction method.
- CAD drawings of the anchor system were created using SolidWorks®.
- Finite Element Analysis (FEA) was performed on the anchor system model in SolidWorks® to ensure that the system can support the weight of the coiled tubing during the extraction.
- FEA gave a maximum stress of about 50 ksi in the anchor arm and a factor of safety of about ~2.
- A Prototype of the anchor system was fabricated in the Learning Factory using Aluminium 6061 because it is easier to machine than the ASTM A517 Steel that will be used in the actual design. Also, 16 ball bearings were used in the design as shown in the pictures below to aid travel through the coiled tubing.

Outcomes

- BP will save around $25,000 - $30,000 per well if this solution is used.
- The cable-anchor system costs around $2,500 to produce.
- This solution eliminates the need of fishing operations in coiled tubing extraction.
- The team won the Boeing Systems Engineering Award.