PTTC And TORP Offer Advice On Coping With Rod Failure

The University of Kansas Tertiary Oil Recovery Program held a workshop in Russell, Ks., in association with the Petroleum Technology Transfer Council on rod lift failure as part of its mission to provide technology and best practices to the industry. More than 60 people gathered at the Dole/Spector Conference Center to hear Russell Stevens discuss the modes of rod failure, causes of fatigue failure, types of corrosion, and corrective and preventive actions.

Stevens, who works for Schlumberger, has more than 30 years of rod lift design and optimization experience. He is one of the most respected artificial lift experts in the industry. He is a long-time member of the Society of Petroleum Engineers, serves on the board of directors for the Artificial Lift Research and Development Council, and is a voting member of the Field Operating Equipment Subcommittee.

Stephens began by introducing the work of the Artificial Lift Consortium, which spent eight years collecting data from 11 companies and more than 25,000 wells in the Permian Basin. The consortium used a failure frequency rate derived from the average number of failures in pumps, rods or tubing divided by the total number of wells evaluated to analyze overall failure rates in the region.

The consortium’s work resulted in a cumulative additional 10 months of run time between participants’ failures. The data collected show that 39 percent of all failures in the Permian Basin were pump failures, 33 percent were rod failures, and 28 percent were tubing failures. Additionally, the data show that 43 percent of all tubing failures occur in the bottom one-quarter of the tubing string, and that of those failures, 90 percent are in the seating nipple (PSN) joint. Stevens proposed that if operators could fix this one problem, they would see a definite cost savings.

Stevens highlighted various problems and recommended solutions, emphasizing looking at why problems occurred, to make sure operators addressed the cause of the problem and not just the symptom.

Stevens showed images of various failures and discussed possible causes and solutions for each, including abrasion, PSN joint splitting, and various corrosion and holes near the PSN joint. Depending on the failure, potential solutions include mechanically and chemically cleaning the wellbore, treating with biocide to help with corrosion, using a bottom discharge valve, and using rod guides, to name a few. Stevens encouraged the group to beware of gimmicks and untested technology while searching for the best rod failure solution.

Stevens also discussed root cause failure analysis (RCFA), which he described as the process designed to investigate the root causes of failures, and to answer questions about the failure as well as intervention. He said RCFA was intended to be a systems approach to failure prevention, and served as a tool that could be used to identify not only what failed, but also when it failed, where it failed, and how and why it failed.

The RCFA process includes eight basic steps to be effective.

Stevens said step one was to define the intervention; in other words, what failed, when and why. From there it is important to preserve the evidence with images and samples, which are key to identifying the correct solution. Next, data must be collected and examined before the fourth step, which is determining the root cause of the failure. Once the cause of the failure is determined, a plan can be developed and a corrective action implemented to avoid similar future failures. Stevens emphasized the importance of tracking the success of the corrective measure while managing interventions.

The next section included discussion about the variables that can cause failures. According to Stevens, things such as drilling and completion techniques, well design and operating practices, installation, operating environment, and manufacturing defects all can impact failure rates.

Regarding the rod string, he said there were only two types of failures: tensile and fatigue. Tensile failures account for fewer than 1 percent of all failures, while fatigue accounts for the majority of rod failures. Stevens said it was important to note that the vast majority of fatigue failures were not fatigue alone, but were associated with some sort of stress concentration or elevated stress that caused an increase in local stress that initiated a crack.

Stevens finished the day by showcasing images and examples of rod failures, and highlighting the likely causes of each. He discussed how rods were tested and how corrosion could impact the rod string. He concluded with some basic design guidelines, and illustrated how drilling and completion techniques could impact the rod string.

Overall, the workshop was very well received and seemed to be the right information for the right folks at the right time.®