Case Study:
Cascade³ field trial completed successfully in high rate water injection well

Cascade³ completion shows effective backflow prevention without impeding water injection

Well Data

Location: Permian, Texas
Well Type: Salt Water Disposal (SWD)
Installation Date: January 2018
Completion size: 4-1/2"
Max water injection rate: 25,000bpd
Tested water injection rate: 14,400bpd

In collaboration with a major operator, Tendeka has developed and qualified a completion solution to prevent water injection failure due to solids fill in sand prone reservoirs. A field trial was performed to confirm the performance of the technology in a live injection well.

The Challenge

Multiple Gulf of Mexico operators have experienced problems with their deepwater injector wells in recent years. Loss of injectivity has required expensive remedial efforts, and even sidetracking or re-drilling of injectors.

The problem was identified as an accumulation of formation solids inside the lower completion; principally fine matrix sand. These solids can be mobilised during shut-ins (maintenance, pump problems, environmental conditions etc.) due to transient flow effects such as backflow, crossflow and even water hammer. Eventually, enough solid fill can accumulate inside the lower completion to diminish the injection rates.

Tendeka Solution

Two Cascade³ joints with a total injection capacity of 25,000bpd were deployed in the completion of a Salt Water Disposal (SWD) well in the Permian.

The completion was configured with a nipple profile below and sliding sleeve above. The nipple profile was used to install memory gauges capable of high frequency data acquisition to read the tubing and annulus pressures simultaneously. The sliding sleeve was used to bypass the Cascade³ system to create a baseline.

The primary objectives of the test were to:

1. Confirm the non-return valve functionality in field application.
2. Confirm that the Cascade³ does not impact normal injection operations.
3. Evaluate the effect of the Cascade³ system on water hammer.
Project results were as follows:

- Step rate tests were performed up to 14,400 bpd both through the Cascade³ and the sliding sleeve, confirming no negative effects due to Cascade³.
- Shut-in tests were performed to confirm that Cascade³ can prevent backflow and crossflow.
- Multiple hard pump shut-ins were performed to induce water hammer on the formation. Pressure transients from the reservoir were blocked by Cascade³ non-return valves, mitigating water hammer and preventing backflow.
- The well is currently injecting as a disposal well, enabling the long-term performance to be confirmed.