New Well Requires Comprehensive Expertise to Solve Flow Assurance Challenge

A Gulf of Mexico operator planned a well re-completion of a new reservoir and planned to use an existing flowline. Historical data determined significant paraffin deposition across the flowline. Due to well reservoir modeling analysis, the preexisting flowline warranted an aggressive but confident cleaning program to ensure that the volume capacity was realized.

BlueFin conducted preliminary surveys and analysis of records, and upon thorough discussions with the client’s operations team, it was determined that in order to reach the desired outcome, a multiphase approach would be in the best interest for the operator’s schedule.

Plan of Execution

1. Phase 1 Fact Finding Mission: Utilize Gel Surveillance Technology and Data Acquisition Systems
2. Phase 2 Remediation Effort: Engineered Pig Train Consisting of Seawater, LiquiGel Technology, Chemicals, and Aggressive Mechanical Pigging
3. Phase 3 Remediation Effort: Mechanical Cleaning using eelReel Technology

Phase 1: Fact Finding Mission

The execution strategy was to evaluate the extent of the restriction in the flowline by establishing baseline differential pressures at various flowrates. This baseline would assist with the planning and execution of Phase 2. BlueFin provided the personnel, equipment, management, and technical advisory support during the evaluation to determine ideal pressure monitoring locations, effective flowline inner diameters (IDs) and general monitoring of the field’s pressure trends during the process.

To minimize the spread size and any impact on operations, it was decided not to mobilize a full solids handling spread on the receiving side. Therefore, if solids would be received, the operation would cease making it critical to monitor the flow and adapt decisions based on discharge.

In addition, it was planned that BlueFin’s gel surveillance technology would be used to establish a true line volume. However, once the flowline was bled down, solids were immediately pushed out of the flowline and into the process system. The evaluation stopped and Phase 2 remediation was implemented.

Phase 2: Remediation Effort A - LiquiGel Technology

The execution strategy was to remediate the flowline with a combination of seawater flushing, gel surveillance, chemical flushing, and a pig train run. The objective of this phase was to completely remediate the line and be able to send a pig the size of the true ID across the entire flowline. Furthermore, the objective was to avoid the need for mechanical intervention.
Following the seawater flushing, a gel surveillance run was initiated, which included two seawater slugs separated by a LiquiGel pig. Upon a successful run, data acquisition analysis determined that a chemical treatment at a slow flowrate would result in the removal of deposited solids from the flowline. Following this chemical soak, the final step in Phase 2 was to execute a carefully crafted 32 pig progressive pigging plan.

**Phase 2: Remediation Effort B - Progressive Pigging Plan**

The pig train run consisted of 32 pigs that progressively increased in each run by adjusting type, density, and/or size of each pig to safely remove the deposition from the line. BlueFin monitored the pressure changes in the line to verify that the pig train was in fact increasing the effective ID without jeopardizing the flowline asset. The use of Coldsolve chemical and LiquiGel Technology reduces the risk of sticking a pig. More solids were removed from the flowline as the progressive pigging plan continued. Following a successful pigging effort, it was determined the flowline exhibited a clean ID and was ready to be commissioned back into service.

**Conclusions**

The synergy of BlueFin and GATE enabled a comprehensive, turnkey approach to flow assurance challenges that ultimately delivered a desired outcome for the client. Mechanical intervention was unwarranted, which saved the client significant costs not originally budgeted for in this scope of work.

BlueFin cleaned the pipeline from a differential pressure of 1,400 psig at 2 bpm flowrate, to approximately 220 psig at 8 bpm flowrate by removing paraffin deposition from the pipeline. The calculated equivalent ID from the start was approximately 1.9 inch ID. Once completed with the cleaning scope, the calculated equivalent ID of the pipeline was re-established to 5.05 inches. The pipeline was then pressure tested to 2,850 psig for 8 hours in order to be put back into service.

**Additional Achievements**

- Alleviated the need for more expensive coil tubing or pipeline replacement.
- Project completion with zero incidents and no environmental impact.
- Gel pigs used to isolate solvents to reduce the amount of disposal fluids due to intermixing.
- Use of gel pigs reduced the amount of solvent initially estimated and made Phase 3 unneeded.
- Executed 24-Hour SIMOPS schedule.
- Overboard water treatment reduced disposal fluid volume.
- Recorded history of technical data through Data Acquisition System (DAQ).
- Verified trouble areas in flowline through DAQ, thereby allowing for better decision making.

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