CASE STUDY

COATED ENDLESS ROD CER10K | CS-003

LIFTING SOLUTIONS

CLIENT NAME | Cardinal Energy

LOCATION | Provost, Alberta, Canada

FIELD | Hayter

INSTALL DATE | October, 2019

LS PRODUCT | 1" Grade ND Coated Endless Rod

CLIENT CHALLENGE

Raw fluid produced from the reservoir can often be unpredictable and may cause corrosion of the steel used in downhole equipment. The presence of hydrogen sulfide (H_2S), chlorides (salts) and carbon dioxide (CO_2) contribute to corrosion. The pH level is also important because acids will increase corrosion rates and may result in embrittlement of the metal when combined with hydrogen. Bacterial corrosion from sulfate reducing bacteria is another common problem that causes corrosion and surface embrittlement.

In this application, frequent rod failures from corrosion resulted in reduced run time and increased workover frequency. By inflating lifting costs, producing the well was on the verge of becoming uneconomical.

Lifting Solutions conducted engineering level inspections on several rod string failures and determined that corrosion involving H_2S was contributing to localized pits resulting in the propagation of fatigue cracks from pits measuring as deep as 0.048".

Figure 1, Spot reagent testing indicating the presence of H_2S and CO_2 corrosion residuals

Figure 2, Characterization of the corrosion pits, deepest measured pit approximately 0.048"

CLIENT GOALS

Previously installed rod strings experienced relatively quick failures proving the historical configuration was not economically viable. The client company was looking for a solution to increase the operational lifespan of the rod string in this corrosive environment. Viable options included chemical (corrosion) inhibition programs which result in expensive chemicals being deployed downhole to be produced with the returning emulsion and coating of the rod string to prevent access to the underlying base metallurgy thereby eliminating corrosion of the rod string.

LS SOLUTION

Installation of the ND Grade Coated Endless Rod was the solution. The CER 10K is focused on reducing production downtime; therefore, improving operational economics. The cyclic load nature of rotary rod driven systems deployed into wellbores with significant wellbore curvature results in rod strings that are exposed to millions of fatigue cycles. Fatigue from torsional fluctuations is also common.

When sucker rods experience "pitting" from corrosion, it creates a concentrated point of fatigue that may not be able to withstand the torsional/axial loads the rod string experiences. The poly-coating on the outside of the coated rod string prevents the corrosive/abrasive fluid from initiating corrosion pitting. These pits are a stress riser on the external surface of the rod string creating a fatigue crack propagation point during cyclic bending and torsional fluctuation fatigue cycles.

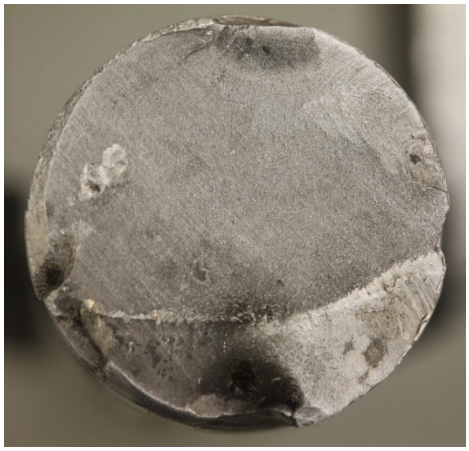

Figure 3, Fracture surface confirming fatigue failure with smooth propagation zone and final rupture

Figure 4, Closeup of the fatigue initiation point originating from the base of a corrosion pit

Table 1 shows a summary of the rod string installation history in the well leading up to the installation of the Coated Endless Rod in the troublesome Hayter field.

Date	Rod Description	Type	Run Days
February 28th, 2019	NEW Endless Rod, Gr CD, 1"	ER	168
August 15th, 2019	NEW Endless Rod, Gr CD, 1"	ER	70
November 24th, 2019	NEW Endless Rod Gr ND Coated, 1"	CER	958 (**Running)

Table 1, Rod string installation history. (**Running as of June 2022)

CONCLUSION

After determining the producing reservoir contained significant amounts of H_2S and CO_2, the use of Coated Endless Rod effectively improved the rod string life by more than 5 times the previous rod string averages. After this trial, CER10K rod strings were installed in several other wells in the same field that contained signs of H2S contribution to rod corrosion. These coated rod strings also proved to be successful at mitigating the effects of corrosion resulting in a longer run time, reduce workover expenses and improved production economics.