

Life Extension Study

Multiple leaks due to corrosion in the presence of high levels of CO₂ and H₂S

A large and complex offshore field in the Middle East was suffering from multiple leaks due to corrosion in the presence of high levels of CO₂ and H₂S in the production, seawater injection, aquifer water injection and produced water injection systems. This was resulting in excessive chemical injection expenditures and was impacting field revenues and uptime. The large, shallow water field consisted of several hundred wells and a complex hub and spoke infrastructure.

The key to success in this challenge was to spend time working with the asset leadership team, the onshore technical staff and the offshore operations team. This enabled the development of a thorough understanding of the facility and the multiple operational, financial and technical challenges faced.

A customized issue database and risk documentation tool was developed to address the needs of the asset stakeholders, from senior leadership to field technicians. Risks were then ranked, prioritized, and an associated integrated action plan developed. This was supported and further validated by field inspections and small-scale optimization trials undertaken by a combined GATE and Client staff team prior to any major changes being implemented in the field.

TECHNICAL ACHIEVEMENTS & BENEFITS

- Created greater delineation of roles, responsibilities and reporting and review requirements between asset integrity management, operations and production chemistry teams.
- Modified iron sulfide cleaning processes to prevent aggressive corrosion of carbon steel portions of the production system and revised sampling and analysis protocols.
- Overhauled the corrosion coupon monitoring program, including placement optimization, criticality identification and the discontinuation of coupon use at less critical locations.
- Modified the seawater injection fine filtration system to prevent transport of erosive solids through the injection system.
- Identified fiber-reinforced plastic (FRP) water injection lines at risk of failure during pressure surges and replaced with copper-nickel piping in susceptible areas.
- Replaced small-pore closed drain and low pressure carbon steel piping with low-grade corrosion resistant alloys.

LOCATION

Middle East

CHALLENGE

Provide actions to ensure continued oil production, water separation and ongoing seawater, aquifer water and produced water injection with parts of the field entering their fifth decade of service.

Achieve this with high CO₂ levels and large variations in H₂S content across different parts of the field.

SOLUTION

The typical strategy when addressing complex corrosion control problems is to focus on the immediate root cause in the field and to develop a reactive plan (increased monitoring, chemical optimization, material substitution, etc.).

The most important and sustainable value was achieved by evaluating the overall management strategy for the field and increasing the level of accountability and transparency between the major teams supporting the integrity management of the facility.