

**Corrosion Mechanism:**

Microbial Induced Corrosion (MIC)

**Alloy:**

Plain carbon steel, X42

**Equipment:**

NPS 3 emulsion flowline

**Corrosive Environment:**

The line transports produced emulsion, as well as sour gas (containing 0.54% CO<sub>2</sub> and 0.04% H<sub>2</sub>S at 1200 kPa and 40 °C). Produced brine has a moderate salinity.

**Comments:**

The line had been in operation for 45 years before the failure. The main defects (at 6:00 o'clock position) were large and circular in nature with sloping defect walls and evidence of edge attack. The pit internal surface was mottled with many ridges and non-uniform attack. This type of corrosion is indicative of MIC (sulfate reducing bacteria) where bacteria produce hydrogen sulfide by their metabolic activities adjacent to the pipewall under a biofilm; the sulfide can precipitate dissolved iron creating

bulky deposits that can accelerate corrosion.

The low fluid velocity in the system increases likelihood of solids deposition. This, in turn, can intensify severity of bacterial activity. Furthermore, lower pigging velocity due to low fluid velocity makes it more difficult for effective solids removal and allowance for the batch inhibitor to penetrate the solids deposited within the defects.

**Remedy:**

The line should be pigged aggressively and batched with a dose of an appropriate biocide. A normal batch inhibition program should then be capable of protecting the system.

