**Case study:** Permian basin

# FULLSWEET removed $H_2S$ downhole, saved CAPEX in the Permian

The release of hydrogen sulfide ($H_2S$), which is toxic and corrosive, occurs during the production of sour crude oil. The increased costs related to removing the potential release of $H_2S$ are due to the metallurgical upgrades and gas sweetening equipment. These concerns and costs can be alleviated if $H_2S$ is removed downhole before reaching the surface.

An operator in the Permian was producing from a shale formation. The production rates varied from 75 to 112 bbl oil, 270 to 360 bbl water, and 73 to 96 MCF gas per day. The produced fluids contained dangerous, corrosive $H_2S$ partitioned in all phases, and measured 1,100 ppm in the gas phase. The wells were being produced to a separator a few feet away. The sales points of the gas and oil were another 100 feet downstream of the separator, and the post-treated target $H_2S$ concentration was 10 ppm in the gas phase.

The operator had tried a scale-inhibited, triazine-based $H_2S$ scavenger to sweeten the production, but it required a high amount of the triazine product. To reach the sales specification, the product had to be massively overdosed with 70 gallons per day. To improve efficiency, one of the options was to increase the contact time by injecting the scavenger downhole. Triazine, however, is normally much less effective in mixed production systems, and it can enhance calcium carbonate scale precipitation. For those reasons, triazines are not applied downhole.

Baker Hughes recommended the new, first-of-its-kind **FULLSWEET™ mixed production $H_2S$ scavenger** as an alternative to triazine-based scavengers, and recommended applying it downhole. FULLSWEET is a non-triazine scavenger developed to work in mixed production environments; to exhibit faster kinetics; to reduce plugging, scaling, and corrosion; and to be cost-competitive in a single-phase treatment.

Prior to the real field injection, an application scientist performed tests on a system mimicking scavenging and fluid compatibility. Testing clearly demonstrated no risk for scaling and emulsion tendency. Following testing, FULLSWEET mixed production $H_2S$ scavenger was injected into the casing at a rate of 15 gallons per day. The result was a reduction from 1,100 to 10 ppm of $H_2S$ in the gas phase. After a couple of days using the FULLSWEET scavenger, no solids, no emulsion, and no scaling tendencies were observed throughout the system. This dosing rate resulted in a very low specific consumption — 1.0 gallon per 1 lb $H_2S$ removed and the scavenger consumption was almost four times lower than the triazine product. The FULLSWEET scavenger not only met the operator's requirements, but also helped eliminate the need for a gas sweetening tower, avoiding additional capital and operational expenditures.

Following the trial, the program was permanently implemented and continues to meet the customer's $H_2S$ specifications.

## Challenges

- Sour multiphase production
- Poor performance and too many side effects with conventional triazine scavengers
- Underdeposit corrosion from iron sulfide, solid deposits, and product specification problems
- Chemical usage and total treatment cost reduction

## Results

- Removed $H_2S$ cost-effectively in mixed production system
- Provided a more cost-effective treatment when compared to triazine or fast-acting metal-based scavengers
- Caused no mineral scale or other solid deposits to form
- Delivered lower $H_2S$ values than other mixed production scavengers at lower dosages
- Required no phase separation
- Saved approximately $250,000 USD in CAPEX