Midwestern Refinery Resolves FGRU H_2S Exceedance Issues with Off-Line Scavenger Treatment

1. Introduction

During a planned turnaround, a refinery in the Midwest experienced significant hydrogen sulfide (H_2S) load in the flare while the flare gas recovery unit (FGRU) was out of service.

The facility historically purged the system with natural gas, but during high H_2S excursions, operators were consistently unable to maintain the three-hour average loadings below the permit target of 162 ppm. During FGRU outages, H_2S rose to levels as high as 1.5–2.0% (15,000–20,000 ppm).

Refinery personnel considered using MEA triazine despite anticipated high treatment costs. However, triazine would not be able to reliably reduce H_2S below the analyzer detection limit of 300 ppm until the FGRU was back in service for an extended period.

Instead, the refinery asked ChemTreat to develop a treatment program to help the facility maintain H_2S levels below target and alleviate environmental exceedances that may lead to fines and reduced profitability.

2. Treatment Methodology and Application

2.1 A Two-Phased Approach to H_2S Treatment

ChemTreat's field engineers devised a two-phased approach to provide an immediate resolution to the issue as well as enhance the permanent scavenger injection application.

1. Applying scavenger treatment to the seal drum water, essentially operating it as an H_2S bubble treater tower.

2. Atomizing the scavenger into the flare gas line with specialized high-pressure pumps and injection nozzles.

2.2 Treatment Technology Selection

The ChemTreat team selected CT9156, a proprietary, non-nitrogen scavenger for treatment.

Unlike MEA triazine, CT9156 does not contain nitrogen, reducing ammonia loading that can inhibit wastewater system performance.

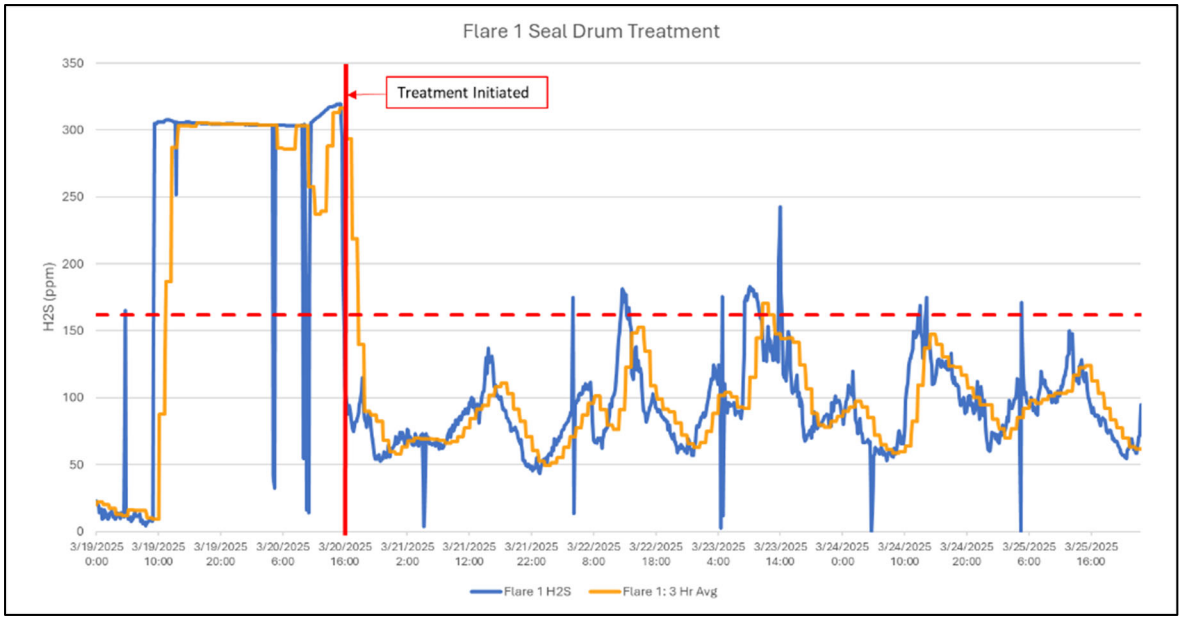
Comparative trials have shown that CT9156 provides several advantages over traditional MEA triazine treatment:

- Converts H_2S to bisulfide and uses a catalyst to speed up subsequent reactions, creating water-soluble compounds.
- Improves cost performance based on a lower required treatment dosage ratio and will not revert H_2S during further processing, unlike MEA triazine.
- Mitigates process salt fouling and underdeposit corrosion when flare gas residual is sent to slop or reused back into operations.

MEA triazine additionally creates reaction byproducts that can inhibit microbial activity in wastewater treatment systems and overload biotreaters. Implementing CT9156 will help facilities avoid these potential issues.

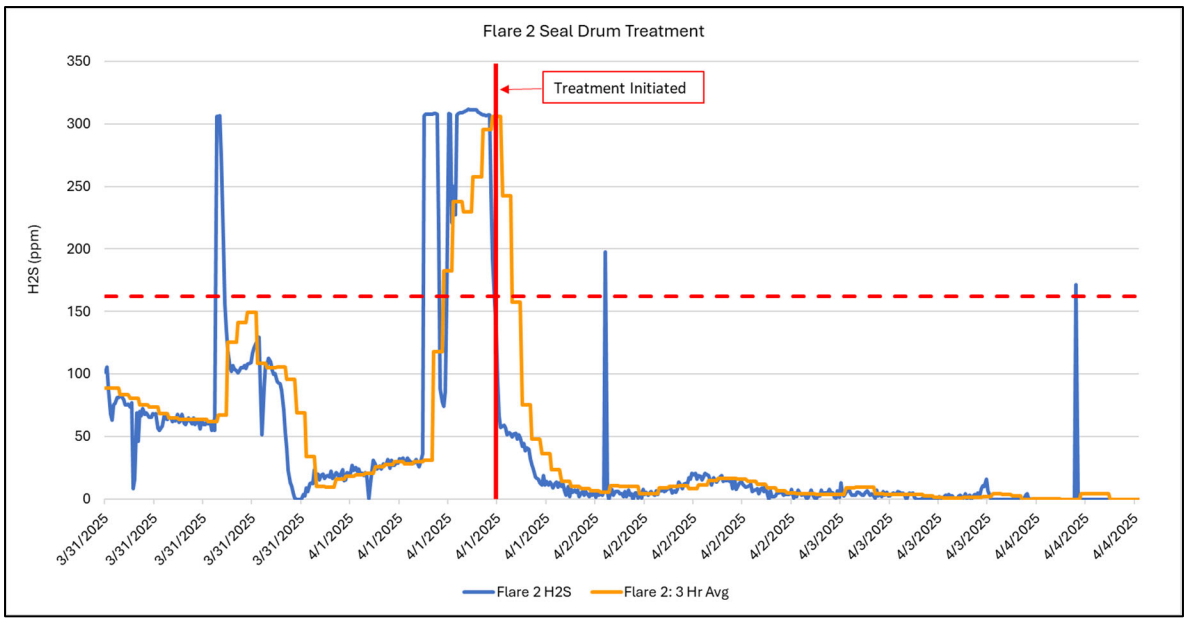
2.3 Phase 1: Seal Drum Treatment

When the FGRU outage began, the H_2S in the flare instantly exceeded the upper limits of the analyzer. ChemTreat worked with the refinery's engineers and operators to treat the seal drum water with CT9156. H_2S levels rapidly dropped and stayed below the three-hour target of 162 ppm.



H_2S levels were rapidly reduced in the flare 1 steam drum after CT9156 treatment was applied.

When the second flare system was brought back on-line, operators again struggled to meet permit limits. CT9156 was applied to this seal drum as well, and H_2S levels were reduced to well below the three-hour 162 ppm limit.



The flare 2 seal drum also saw a rapid reduction in H_2S load after CT9156 treatment.

Results are examples only. They are not guaranteed. Actual results may vary.

2.4 Phase 2: Flare Line Atomization

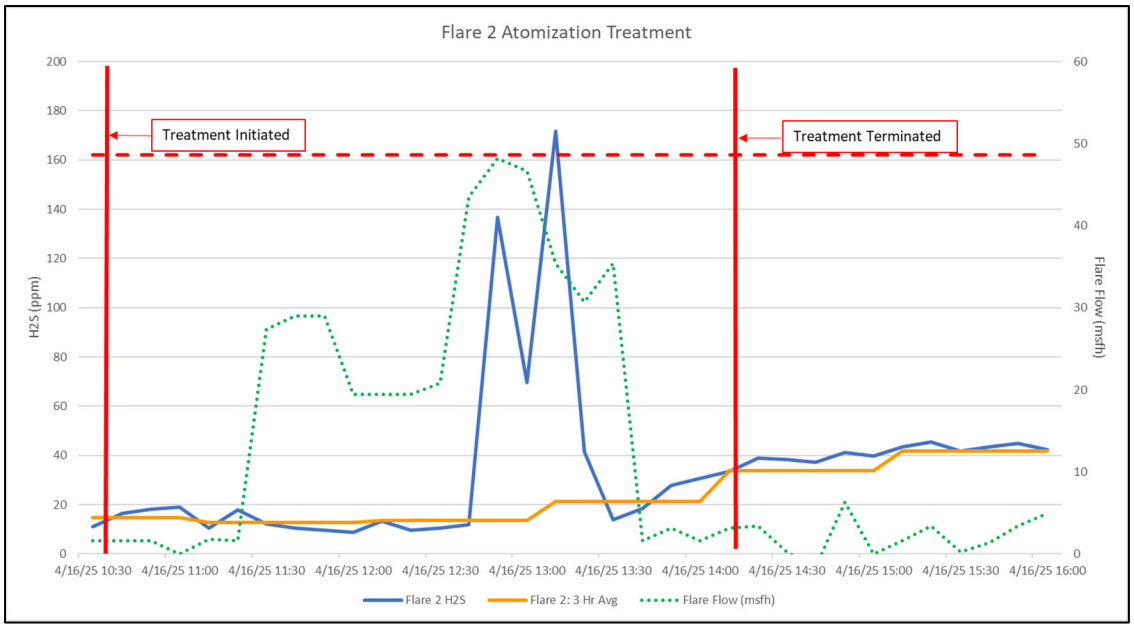
In parallel with the turnaround treatment program, ChemTreat partnered with equipment providers to engineer a scavenger atomization system using high-pressure pumps and injection nozzles designed for variable H_2S loadings and treatment demands. The goal of this treatment strategy was optimizing scavenger demand to control costs and improve system reliability.

After the program was developed, the refinery took the FGRU off-line for a live flare job. To test the new injection system, the scavenger was proactively atomized into the flare line to reduce the potential for environmental permit exceedance.

CT9156 successfully maintained H_2S in the flare below the three-hour limit, even during a gas flow spike.

With an incoming H_2S load of approximately 2%, the CT9156 treatment program successfully maintained H_2S in the flare below the three-hour limit of 162 ppm. The load averaged at 44 ppm during the outage.

Even when the gas flow spiked to nearly 50,000 standard cubic feet (MSCFH), CT9156 treatment successfully maintained target compliance.



With CT9156 treatment, the FGRU maintained H_2S levels within the target range during a live flare job.

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3. Conclusion

3.1 Program Results

Thanks to the success of the CT9156 treatment under extreme outage conditions, the refinery decided to fully implement ChemTreat's treatment strategy to improve reliable H_2S environmental compliance.

3.2 Benefits of CT9156 Technology

Applying CT9156 treatment for H_2S management in FGRU systems offers multiple advantages over traditional MEA triazine treatment, including:

- Lower sub-stoichiometric dosage requirements for better H_2S scavenger treatment cost performance.
- Improved aerobic microbiological system performance and reduced amine/ammonia loading in wastewater treatment plants.
- Decreased tower salting/corrosion concerns in refineries that process flare gas residual through the slop reprocessing system or reuse flare seal drum water in other processes.
- Automated monitoring and injection control system capabilities enabled by rapid scavenging response times.