Turning Rich Sour Gas in the Haynesville into Sweet Profits

A Win/Win Opportunity for Operators and Gas Processors

Presenters:

Robert Hawley, Sr. Technology Licensing Director, Merichem Technologies

Garath Fulks, Director, Operations and Process Engineering, DT Midstream

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Title: Turning Rich Sour Gas in the Haynesville into Sweet Profits – A Win/Win Opportunity for Operators and Gas Processors

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INTRODUCTION

In order to supply the growing market for LNG on the U.S Gulf Coast, DT Midstream had the vision to acquire assets from Momentum Midstream in 2019, including the Pelican midstream facility in DeSoto Parish, Louisiana as well as pipelines going to the Gulf Coast. With expansion and growth in mind, DT Midstream decided to expand the Pelican midstream facility and co-currently develop a greenfield midstream plant, Crossroads, near the Pelican facility. Both facilities have significant amounts of H_2S that had to be treated to make the product usable and DT Midstream had to find an economic solution.

Midstream gas plants condition incoming production gas to meet pipeline specifications of <4 ppmv H_2S and <2% CO_2. Amine units are employed to remove the H_2S and CO_2 from the natural gas before it is compressed and put into the pipeline. To clean up the H_2S from the CO_2 in the amine acid gas, a desulfurization process is required. Once in the pipeline the conditioned gas is transported to the LNG facilities on the Gulf Coast. DT Midstream installed the amine plants as quickly as possible and reviewed alternatives for treating the amine acid gas.

DT Midstream evaluated the suppliers for liquid redox technologies and selected Merichem Technologies' LO-CAT® for its history of reliability, operability, ongoing support and operating cost basis.

The Pelican facility is being expanded to include three new desulfurization trains, and the greenfield Crossroads site is installing two new desulfurization units along with its other equipment. The sour gas flowing through the two facilities must be treated to meet pipeline specifications and LO-CAT was the selected technology to meet those needs.

DT Midstream commissioned their units at both sites in the spring and summer of 2025. Each of the five trains contains up to 4,200 ppmv of H_2S in up to 13.75 MMSCFD of amine acid gas. After the desulfurization units there is less than 4 ppmv H_2S in the carbon dioxide, ensuring DT Midstream meets their required end-product specifications.

LO-CAT PROCESS DESCRIPTION AND PROCESS FLOW

The liquid redox process converts H_2S in the amine acid feed gas into elemental sulfur in the presence of a catalyst via the following equation:

Direct Oxidation Reaction $$H_2S + \frac{1}{2} O_2 \rightarrow H_2O + S^\circ$$

The above redox reaction is carried out in separate sections of the process as summarized below using iron as a catalyst:

Absorber $$H_2S + 2Fe^{+++} \rightarrow S^\circ + 2Fe^{++} + 2H^+$$

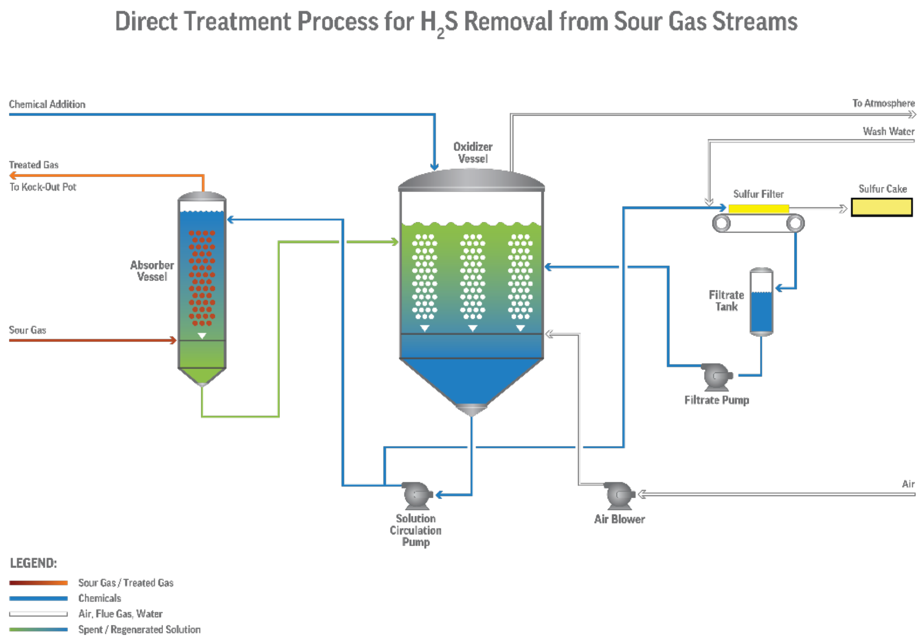
Oxidizer $$\frac{1}{2} O_2 + H_2O + 2Fe^{++} \rightarrow 2OH^- + 2Fe^{+++}$$

The **Absorber** reaction represents the absorption of H_2S where it is ionized to elemental sulfur in the presence of catalyst with the accompanying reduction of the ferric (active) iron to the ferrous (inactive) state. The **Oxidizer** reaction represents the oxidation of the ferrous iron back to the ferric state.

There are four activators used to optimize this reaction. Caustic and Chelants are used to optimize the solubility of Fe+++, which is added as the catalyst. A surfactant is used to help agglomerate the sulfur particles. Antifoam agent may be added on an occasional basis as a way to reduce foaming on the liquid surface.

The design for the DT Midstream system uses the LO-CAT Direct Treat Scheme shown in **Figure 1**.

Figure 1. Process Flow Diagram



The amine acid feed gas is sent to an Inlet Gas Knockout Pot to remove any entrained liquids in the feed gas. Then, the gas enters a Liquid Filled Absorber where it contacts the LO-CAT solution and H_2S is converted to elemental sulfur. The remaining processed gas, which is mainly CO_2, is then routed to the Treated Gas Knock-Out Pot to remove any entrained liquids and sulfur particles before being discharged to atmosphere.

The spent, reduced LO-CAT solution flows out of the bottom of the Liquid Filled Absorbers and is routed to the Oxidizer for regeneration of the iron catalyst. Air is blown into the Oxidizer to regenerate the catalyst. The vent from the oxidizer is primarily air supplemented with a miniscule amount of stripped CO_2. This Oxidizer vent stream is sent directly to atmosphere. Most of the Oxidized LO-CAT solution is pumped from the Oxidizer back to the Liquid Filled Absorbers. A liquid slipstream from the Oxidizer is routed to the Pressure Filter Package for removal of the solid sulfur crystals. The filtrate liquid is routed back to the Oxidizer. The washed and dried sulfur cake is collected in a 20-yard roll-off bin located below the filter. Liquid drains from maintenance of pumps and instruments are collected manually and returned to the Filter Box for recycle through the trains. This practice results in no liquid waste from the process.

START-UP AND OPERATIONS REVIEW

All five trains have started up and are operating successfully as of August 2025. See below for operating charts from the first two trains taken during their startups from March through July. In each chart you will see the initial train startup and excellent control over time after startup.

The H_2S levels in the sour gas and the daily sulfur loads of the first two trains are shown in **Charts 1 and 2**. The H_2S levels depicted in "blue" represent the measured concentration in ppm by volume (ppmv) in the sour gas being fed to the two Crossroads LO-CAT trains from start-up in March 2025 through the end of July 2025. The sulfur load depicted in "orange" represents the calculated removal quantity of elemental sulfur from the sour gas stream expressed in long tons (1 long ton is 2240 lbs) per day (LTPD). Sulfur load is calculated by converting the volume of the inlet sour gas flow rate to pounds per hour and multiplying by the H_2S concentration in weight percent.

Chart 1. H_2S in sour gas and sulfur load – Train 1

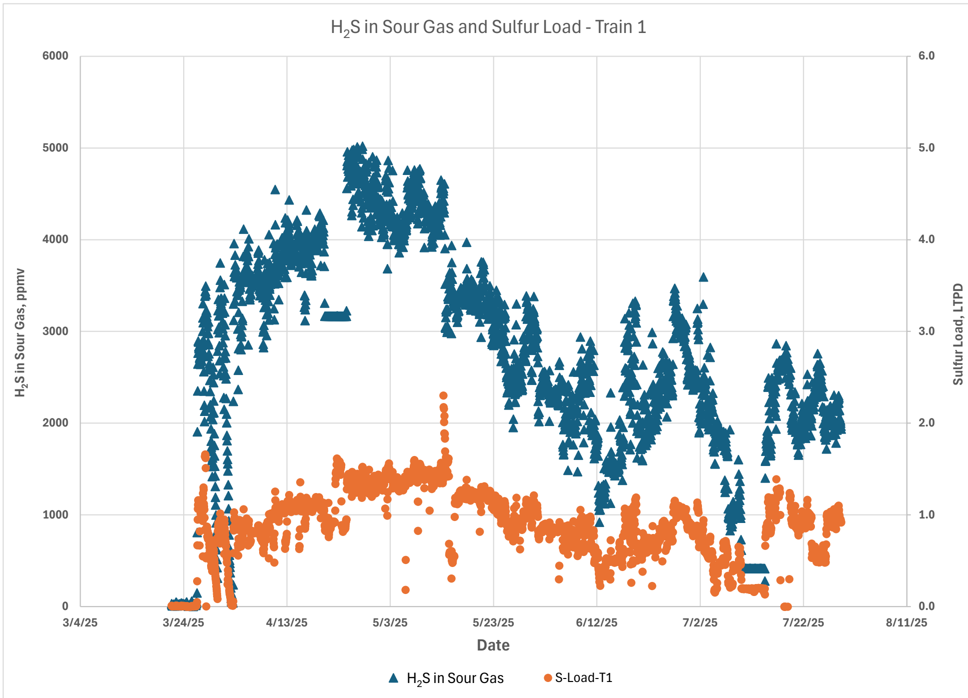
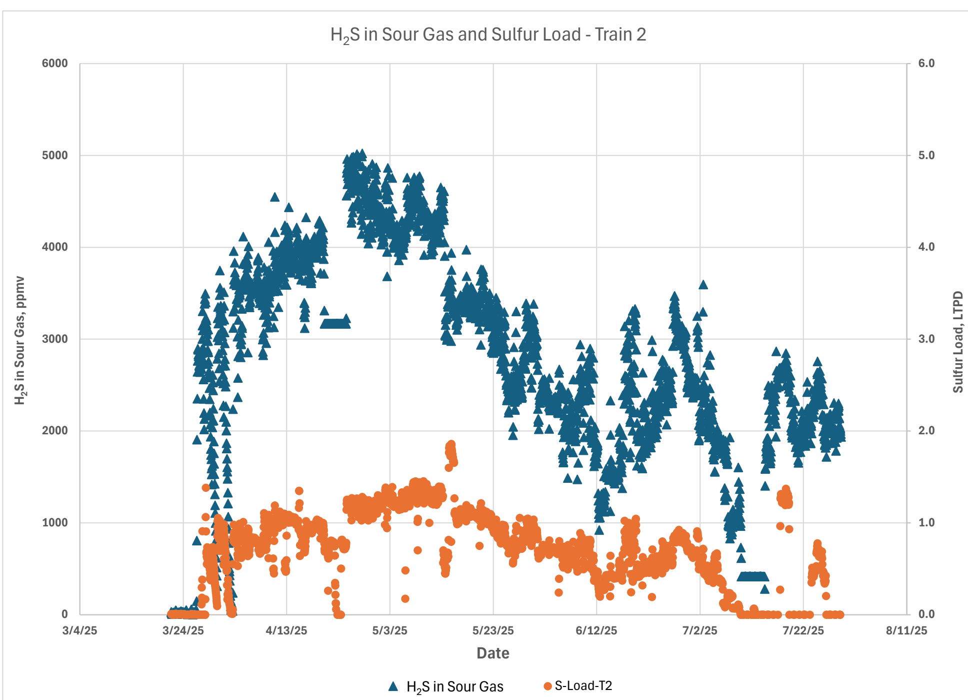


Chart 2. H_2S in sour gas and sulfur load – Train 2



The design inlet H_2S for each train is 4,200 ppmv. During the startup, the two trains were operated between 0 and 5,000 ppmv H_2S. As the operation has settled in, the inlet levels moved to be in the 2,000 to 3,000 ppmv range.

The Sulfur design load is 2.1 LTPD (calculated from the design gas flow rate and design H_2S quantity in the feed stream). Based on the actual inlet H_2S ppmv levels, the Sulfur load for each train varied from 0 to 2 LTPD during the startup and initial operating period. The two LO-CAT trains at Crossroads have been consistently removing the desired sulfur load while the trains themselves have been subjected to a good deal of variability in the daily sour gas flow rates and H_2S impurity levels.

The H_2S levels in the treated gas and the H_2S removal efficiency of the first two trains at Crossroads are shown in **Charts 3 and 4**. The H_2S levels depicted in "blue" represent the measured concentration in ppm by volume (ppmv) in the treated gas being discharged from the Treated Gas Knock-Out Pot of the two Crossroads LO-CAT trains from start-up in March 2025 through the end of July 2025. The H_2S removal efficiency depicted in "orange" represents the calculated percent of removal of H_2S from the sour gas stream as calculated from inlet sour gas composition compared to outlet treated gas composition. Gaps in the data below are due to some occasional issues with plugging of the on line H2S sample lines which have since been resolved.

Chart 3. H_2S Removal performance – Train 1

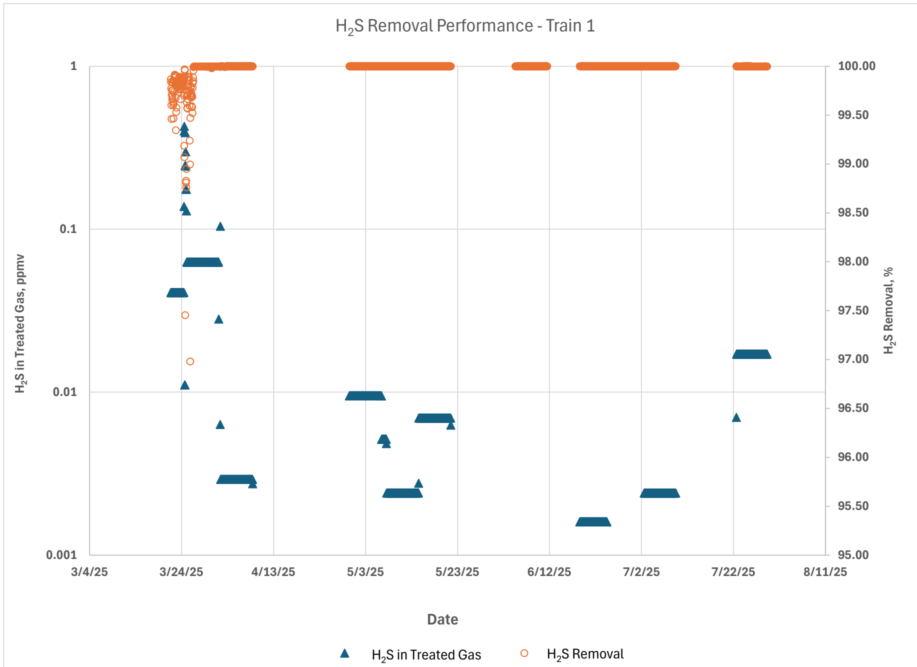
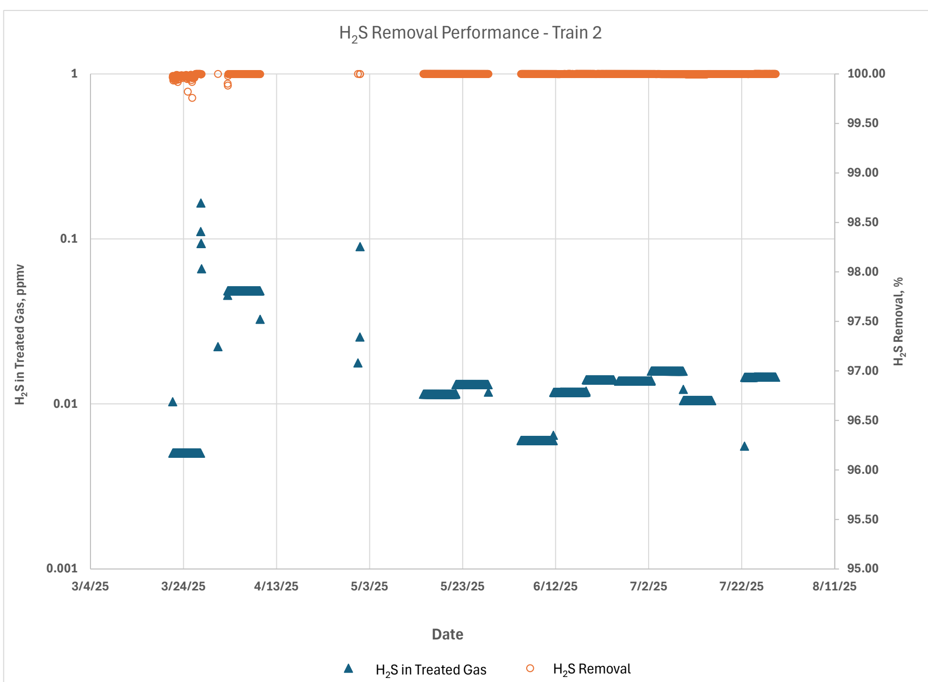


Chart 4. H_2S Removal performance – Train 2



Charts 3 and 4 show online H_2S Removal efficiency data from Trains 1 and 2 respectively. An online Gas analyzer is used for the measurement of H_2S in the inlet and outlet gas streams. The performance guarantee for each LO-CAT train is <4 ppm in the processed gas. The design for inlet gas is based on 4,200 ppmv H_2S.

The performance for both Trains 1 and 2 have been excellent. The H_2S in the processed gas following shortly after the initial startup has been consistently below 0.1 ppmv and is mostly non-detectable. This low H_2S concentration in the treated gas outlet results in nearly 100 percent removal performance as can be seen with the orange data points at the top of the graph. The performance has been a big plus for DT Midstream.

LIQUID REDOX SOLUTION MAINTENANCE

The LO-CAT system's primary control is measured with ORP and pH tests of the LO-CAT circulating solution which can be done at the site by normal operations personnel. These tests ensure there is enough free Fe+3 to absorb all the H_2S and produce elemental sulfur. Caustic and oxidizer air additions are determined by these tests. The operators also run a shake test that measures how quickly the sulfur particles sink to adjust the rate of surfactant addition. There are other tests conducted monthly via a sampling program at Merichem's Research Facility by which the catalyst iron and chelate injection amounts are optimized.

Charts 5 and 6 below show the pH and ORP control for the first two trains at Crossroads. Both the pH and ORP have been maintained in the target ranges throughout the operations.

The pH depicted in "blue" represents the slightly basic nature of the circulating LO-CAT solution from the Oxidizer vessel at the Absorber Feed Pumps of the two Crossroads LO-CAT trains from start-up in March 2025 through the end of July 2025. The ORP (Oxidation-Reduction Potential) depicted in "orange" represents a measure of the regeneration of the iron catalyst.

Chart 5. Solution Analysis for Train 1

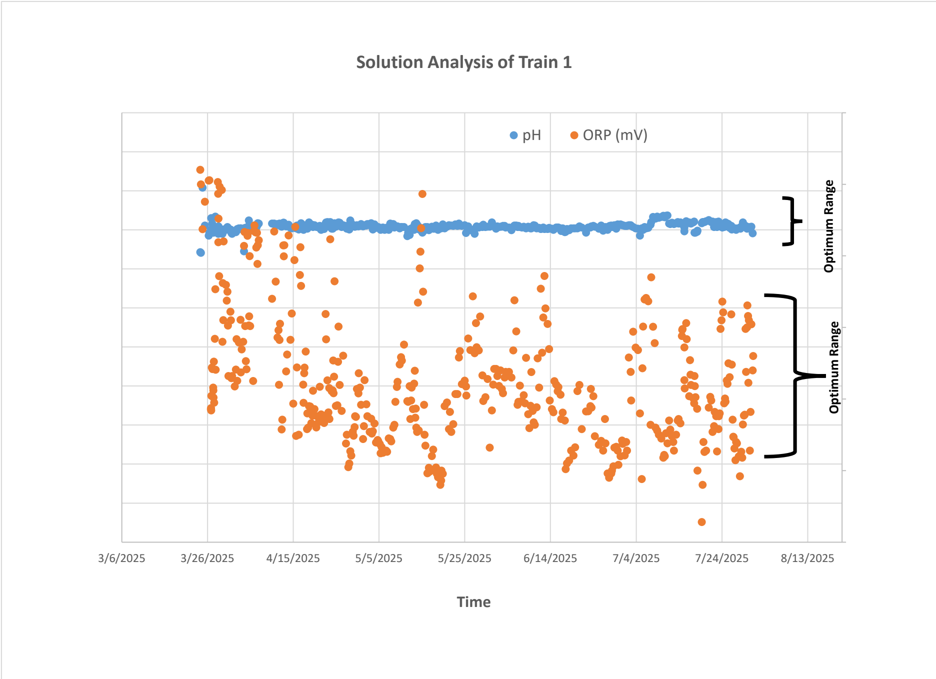
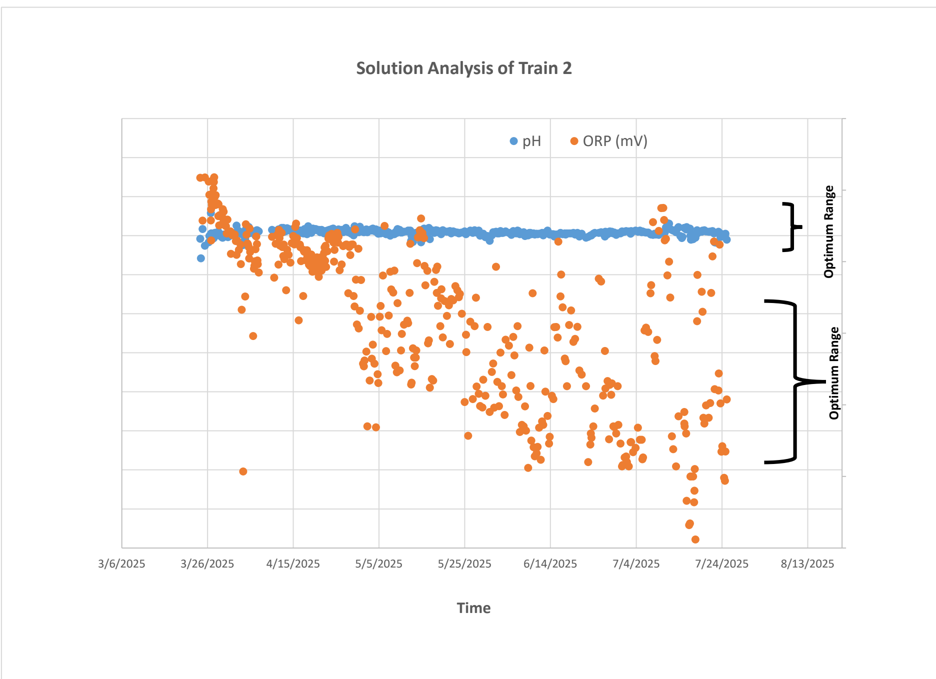


Chart 6. Solution Analysis for Train 2



The control of the LO-CAT solution for both Trains 1 and 2 has been well managed. The pH has been rock steady since the initial startup and has been consistently in the middle of the desired control range. For the ORP, control has been well managed after some expected startup excursion. ORP is primarily controlled by the addition of air rate to the Oxidizer vessel. Due to some periods of low sour gas feed rate to the Trains, it has been necessary to often dial back the air blowers to their minimum output rates. Due to varying production on the front end, the customer often had to rebalance flows of sour gas from one train to the other and even re-allocate gas flows from the Pelican site and vice versa. The trains have responded well in this turndown condition.

CONCLUSION

The five LO-CAT trains have started up and are operating very well. During a number of ups and downs in the sour gas flow to the LO-CAT trains, the robust design of the LO-CAT process has allowed the operations staff to manage chemical catalyst addition rates within the parameters that were specified in the design. This has necessitated operating some equipment outside of its optimal range but at all times, the integrity of the H_2S removal has been solidly maintained.

In summary, the operating data shows the LO-CAT units consistently exceeding H_2S removal specifications and the client, DT Midstream, has been pleased with the performance of the LO-CAT trains.

ACKNOWLEDGEMENTS

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