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Treating Key In Developing Shale Plays

By Stephen Morgan

HOUSTON–The development of shale plays has transformed the nation's energy future, but while applying technologies such as horizontal pad drilling and multistage hydraulic fracturing are of enormous importance in unlocking the hydrocarbons in ultralow-permeability reservoirs, it does not tell the entire story. Neither does the massive investment the industry continues to make in midstream and downstream infrastructure to get gas to market.

Natural gas treating is crucial to the safe, efficient and economic development of U.S. resource plays. Increased process efficiencies, reduced chemical use, improved construction methods, modularized skid designs, the ability to right-size applications, and improved treating processes and component technologies are reducing the costs associated with treating natural gas production while optimizing performance and safety.

Between the wellhead and the pipeline is another critical link in the supply chain connecting the reservoir to the burner tip: the treating facility. What is necessary for ensuring that the natural gas and petroleum products Americans use every day are safely treated after the extraction process? After all, when initially extracted in raw form, some hydrocarbon production streams contain potentially hazardous levels of hydrogen sulfide and/or carbon dioxide compounds. What tactics and techniques can be used to safely and efficiently treat the levels of H_2S or CO_2?

Of course, not all shale plays produce sour or acid gas, but most shale play wells yield multiphase production streams, requiring some form of treatment on the production site. Consequently, the surge in unconventional resource development and implementation of multiwell pads has been among the biggest developments in the natural gas treating industry.

Unlike years past, when natural gas treating companies worked solely at the wellhead, today natural gas treating companies also work hand-in-hand with oil and gas producers on the front end to develop H_2S and CO_2 emission strategies. These strategies are designed to help operators plan their centralized production facilities and associated drilling programs so that as each well is brought on stream, it complies with emissions rules and regulations. Companies that fail to plan such emission strategies on the front end during pad development can exceed emission requirements and subsequently be forced to hold back or shut in wells. This front-

end development strategy is a shift from years past.

Improved Processes

Surprisingly, natural gas treating solutions, unlike many of their cousins in other oil field service areas, have not experienced the technology revolution on the same scale that has driven the industry to new heights in resource plays. In fact, it is safe to say that the natural gas treating processes in use during the 1990s, before the North American shale revolution, are essentially the same basic processes used today.

Nevertheless, the lack of radical advancements in natural gas treating technology has not prevented the industry from providing some of the most essential and fundamental services for getting this vital resource to market. This is made possible by the improved processes and systems being incorporated into proven, time-tested wellhead treating methods.

Some examples of the improved technologies include programmable logic controllers that enable enhanced automation and performance monitoring capabilities, burner management systems that improve safe operations and enable improved fuel gas efficiencies, and new and refined chemical compounds, to name only a few.

It is true that the processes used in natural gas treating may not generate the attention-grabbing headlines that describe technology breakthroughs in horizontal drilling and hydraulic fracturing, but this does not minimize or limit their importance in the safe, efficient and economic development of resource plays. In fact, increased efficiencies related to costs and planning, reduced chemical use, improved construction methods, modularized skid designs, and the ability to right-size applications have saved oil and gas operators billions of dollars through the years.

Add to this the contributions generated in the form of reduced emissions and smaller carbon footprints, and it is easy to understand that improved treating processes have had a positive impact on both the industry and the environment.

Of course, much of the industry's success has come in conjunction with state and federal laws, rules and regulations that require all natural gas extracted from the wellhead to meet strict requirements, including emissions standards. These requirements are in place for a reason; when left untreated, excessive levels of H_2S or CO_2 compounds can be toxic.

Simultaneously, state laws, rules and regulations also are in place to protect the integrity of the upstream, midstream and downstream systems. This is especially true in cases where natural gas transportation is involved. In these instances, regulations require all natural gas being transported to meet "pipeline-quality" gas standards. Most pipelines require natural gas to adhere to pipeline specs of less than 4.0 parts per million of H_2S and no more than 2.0 mole percentage of CO_2.

Prior to entering cryogenic processing plants, CO_2 specifications can be as low as 50 ppm. Untreated, these natural gas hydrocarbons can corrode and impair the systems in which they travel, leading to both operational and environmental consequences. Therefore, it begs the question of what natural gas treating solutions will ensure safe levels of both pipeline-quality natural gas and safe commercial use.

Treating Options

To meet natural gas treating standards, the industry offers oil and gas operators two primary treatment options: amine plants and H_2S scavengers. Amine plants refer to a process that uses various alkanolamines (amines) to remove both H_2S and CO_2 from natural gas streams.

The second natural gas treatment method involves H_2S scavenger vessels. Scavengers offer producers and midstream operators a safe and operationally-friendly alternative to amine treating where H_2S is present in gas streams and CO_2 is below spec. Scavengers are designed to eliminate H_2S entirely.

So what are the primary differences between the two treatment methods, and what factors should an operator consider in deciding whether to use an amine plant or a scavenger? From a pure natural gas treatment perspective, each process has a similar objective: to conform to and abide by all required laws, rules and regulations regarding natural gas treatment. The primary differentiator between the two treatment methods is in their regenerative and nonregenerative capabilities.

Amine plants allow an operator to clean and reuse a significant portion of the expensive chemicals used in the H_2S and CO_2 extraction process. The types of amine agents used during the natural gas treatment process range from diglycolamine (DGA), to diethanolamine (DEA), and methyldiethanolamine (MDEA), each of which serve a different function. Recycling and reusing these chemicals can result in substantial long-term cost savings.

A scavenger is a chemical compound that reacts with H_2S. It can be either a

With most of the wells drilled in shale plays yielding multiphase productions streams that require some form of treatment, the development of unconventional resource plays has had a significant impact on the natural gas treating industry. And unlike in years past, where natural gas treating companies worked solely at the wellhead, today they also are working hand-in-hand with producers on the front end to develop H_2S and CO_2 emission strategies for centralized production facilities and associated drilling programs.

liquid, traditionally triazine, or a solid, such as an iron oxide. During the reaction process, H_2S is converted into an innocuous, nonhazardous compound with no resulting emissions. This is clearly a win for the environment. The downside of this process is that once it is completed, the chemical agents cannot be reused or regenerated for future natural gas treatment projects. Since the scavenger compounds are not regenerative, there can be a higher cost associated with constantly replacing the used material.

In one case, an operator active in the Eagle Ford play in South Texas was able to use the regenerative capabilities of an amine plant to reduce gas treating costs from approximately $130,000 a month to less than $35,000 a month–a savings of more than $1.1 million a year.

This particular operator is using a central facility to produce six oil wells, with approximately 3 million cubic feet a day of associated natural gas production containing a high concentration of H_2S. Treating gas with a liquid scavenger as the first couple wells were brought online was ideal, but once all six wells were flowing, it was no longer an economical solution. Converting to an amine treating process had a significant impact on overall well economics in this scenario.

Operational Considerations

Clearly, with estimated cost savings nearing $100,000 a month, one may ask why anyone would consider using an H_2S scavenger instead of an amine plant. The answer is straightforward: There are other operational considerations aside from potential long-term cost savings.

First, amine plants must be designed, constructed and installed. This often involves higher upfront capital costs. Second, constructing and installing a new amine plant involves an upfront time commitment (typically three-six months), while an H_2S scavenger solution can be deployed rapidly.

And finally, each sour gas well must go through a permitting process. In some cases, such as permit by rule, the approval process requires no more than submitting the relevant paperwork. In other cases, cases such as a Texas Commission on Environmental Quality standard air permit or the U.S. Environmental Protection Agency Title V permit involving the emission of larger quantities of H_2S, the approval process can take more time and require additional ongoing reporting. In the six-well Eagle Ford project, the treating services contract company worked with the operator throughout the permitting process.

Numerous contract treating providers maintain fleets of both new and refurbished treating equipment, which can be exactly as efficient and provide a much quicker solution when considering project lead times.

In addition, leasing an amine plant from a contract treating provider alleviates the need for large upfront capital expenditures, and often includes turnkey services such as installation, startup, commissioning and ongoing operations and maintenance.

The bottom line is that the decision of whether to select an amine plant or an H_2S scavenger must be made on a case-by-case basis and often is tailored to fit the specific needs of the particular application. Contract treating companies can provide the expertise and guidance in helping operators make appropriate choices to best fit their needs.

Multiwell Pad Case Study

Treating processes are used every day to drive value for oil and gas companies. In 2016, a producing company was interested in the possibility of replacing an existing treating unit with a refurbished plant for a multiwell pad. The gas analysis determined that a more appropriately sized amine plant would provide savings in chemical and power consumption, while lowering the monthly lease costs.

The customer needed to flow five wells through the amine plant. From the start, the H_2S concentration was 160 percent higher than expected. To offset the higher H_2S concentration, engineers from the contract treating services provider added DGA to the amine stream. The chemical was added slowly, at the rate of a few gallons a day, to ensure the gas was not overtreated. After several weeks of treating, monitoring and adjusting the chemical blend, the plant treated below the pipeline specification.

The improved efficiencies and reduced costs associated with implementing an appropriately sized amine plant are yet another example of how improved processes are leading the way in the natural gas treating sector.

The stabilization of commodity prices in recent months has created a renewed sense of optimism throughout the industry. Operators are beginning to put capital back to work and production volumes appear to be poised to begin increasing again. And natural gas treating solutions are continuing to play a significant role in their success. No one can say for certain whether a new technology will revolutionize the gas treatment sector, much like horizontal drilling did for the drilling industry, or whether improved processes will remain the dominant form of advancement for treatment companies. Regardless, one certainty does remain: natural gas treatment solutions will continue to play an influential role in America's drive toward safe, reliable oil and natural gas development.❐

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