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Vapor Recovery Technology Creates Revenue Stream While Mitigating Emissions

By Larry S. Richards

MIDLAND, TX.–Vapors emitted from oil and liquids storage tanks and compression equipment are an inevitable occurrence in the world of oil and gas production. The question for producers is not whether vapor gases will be lost, but how to transform the liability of fugitive emissions into a potentially lucrative revenue stream.

Whether vent gas from oil production operations, leaking valves or compressor cylinder packings in a natural gas gathering system, or flare gas from myriad sources, capturing vapors and eliminating emissions have strong economic incentives for oil and gas companies. More than ever, producers are looking to adopt vapor recovery practices in their production operations, driven by both economic and regulatory factors, with liability and safety considerations also key components.

Capturing fugitive gas emissions poses great potential in terms of economic rewards to the company. Even with today's low natural gas prices, fiscally sound reasoning exists for vapor recovery as an alternative or supplement to atmospheric venting, particularly from a "program" perspective.

A typical tank battery vents between $5,000 and $50,000 of recoverable natural gas vapors in a month. With the right vapor recovery unit (VRU) design, producers can capture fugitive emissions and send them into a natural gas pipeline, where they create value from an otherwise missed revenue opportunity. With the payout for the VRU equipment, emission surveys and installation ranging between nine and 14 months, vapor recovery remains a viable option even at a gas price of $2.00 an Mcf.

An even greater revenue stream may be realized when factoring in the value of the high-Btu gases produced in liquids-rich shale plays. This is related largely to the fact that the vapors coming off tank batteries in these plays generally are 2,200-2,500 Btu gas versus the 1,000 Btu typical pipeline gas. Because of the higher API gravity associated with the condensates found in liquids-rich plays, more flash gas is vented from a liquids storage tank.

In addition, higher separator pressures often are found in these plays, compared with what normally is seen in a production facility. As a general rule, the higher the pressure differential, the more gas is vented from the tanks downstream of the separator. The combination of high separator pressures, large volumes of high-API gravity condensates, and high-Btu vent gas makes vapor recovery in liquids-rich shale plays a tremendous economic opportunity.

Vapors from condensate and oil storage tanks in liquids-rich plays contain heavier elements from the wet gas streams that can be sold at a premium to dry gas. Consequently, the combination of large volumes of high-API gravity condensates, high-Btu vent gas, and high separator pressures are creating strong economic opportunities for vapor recovery in liquids-rich plays.

Greatest Opportunity

Because of the heavier elements in wet gas streams, the gas often can be sold at a premium to dry gas. Consequently, the greatest opportunity in vapor recovery is capturing the fugitive gas from condensate and oil storage tanks in liquids-rich plays.

The bottom line is that producers can install vapor recovery equipment to not only comply with regulatory requirements in these plays, but to add a substantial incremental revenue stream at the same time. The key is to install real VRUs that are designed for that field's particular gas stream and discharge pressures, and are engineered for constantly changing volumes of this low-pressure, wet gas. Standard compression packages simply do not work in this application, and there is no payback if the equipment is not running 30 days after installation.

The economics are particularly compelling in situations where the necessary gas gathering and transportation infrastructure is already in place. This, of course, is exactly the case in many liquids-rich shale plays, where new wells are being drilled in areas with historical conventional gas production and existing infrastructure, and where reservoirs often produce oil, wet gas and dry gas, requiring liquids as well as gas production and processing infrastructure.

In addition to boosting revenues by capturing emissions off tank batteries, economic opportunity often exists at compressor sites, where substantial amounts of gas can be lost through faulty valves, gaskets, vents and other components. These fugitive emissions are invisible to the naked eye, but they can add up. In fact, eliminating leaks on larger compressors has yielded $75,000-$150,000 a month in captured natural gas.

These product losses are nearly impossible to detect without special infrared cameras, and can occur even under strong preventative maintenance programs. Once detected, the large majority of compressor site leaks can be mitigated through simple repairs that often cost hundreds rather than thousands of dollars. This, of course, translates into a higher percentage of gas getting into the sales line, which in turn, results in increased revenues to the bottom line.

One of the scenarios that can complicate the picture is compressor ownership versus rental. Obviously, the producer is motivated to monitor and repair leaks on compressor equipment it owns. However, a significant percentage of the compression horsepower in the field is rented by the producer and maintained by a rental company. The rental company's job is simple: keep the compressor serviced and running at the required performance level. It is the producing company that has the economic incentive to find and repair a leaking gasket or valve, because it is the producer's bottom line that is impacted.

Within the past five years, detection technology has improved dramatically as

a result of infrared imaging devices. Although vapor recovery companies have been conducting emission surveys for years to detect gas vapors that are escaping unknowingly, infrared cameras allow producers and vapor recovery experts to not only detect the invisible gases, but also to observe the physical characteristics of the different gas streams.

When the camera pans across a tank battery when the atmospheric pressure is high, the gas venting off the top resembles a liquid streaming out of the tank. Although standardized tank tests are still performed, emission surveys regularly include the use of infrared technology to verify all fugitive vapors are captured. Advancements continue to be made to infrared detection technology, as well as to the quantification tools used to accurately measure the vent gas streams.

While camera users are still waiting for quantification software in the cameras themselves, the vent steams can be measured very accurately with specialized turbine meters, ultrasonic meters, high-flow samplers and other tools. These measurements, combined with an accurate extended gas analysis, form the critical foundation for a successful vent gas management program.

Regulatory Considerations

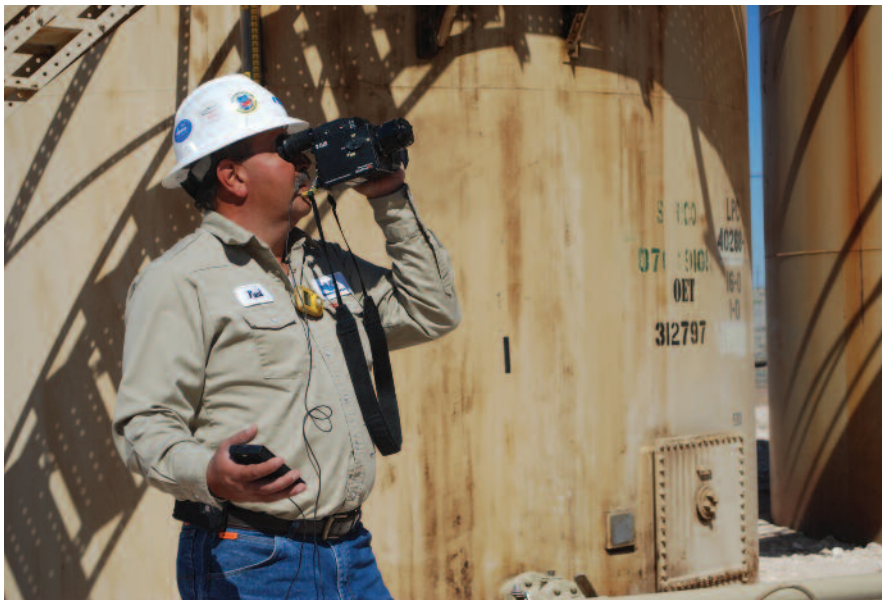
Vapor recovery also has proven invaluable in helping producers meet regulatory requirements. This has become a critical area, with both federal and state regulations mandating stricter limits on emissions. The latest revision to the regulatory standards is the U.S. Environmental Protection Agency's New Source Performance Standards (NSPS) Subpart OOOO, which became effective on April 17.

One key piece of this mandate requires all new tank batteries emitting more than six tons of volatile organic compounds a year to either capture or destroy 95 percent of the vent gas coming off the battery. To put this in perspective, approximately 1 Mcf a day of rich tank vapors typically would exceed this limit. Effectively, every tank battery installed after the one-year grace period will require either a VRU, a flare, or a biofilter program to mitigate emissions below six tons/year.

If a producer chooses to destroy the vapor gas by flaring it, the nitrogen oxides coming off the flare tip have to be accurately tracked and documented to ensure compliance with allowable limits. The new rules will have a tremendous impact on all new batteries, and eventually may be expanded to include existing tank batteries. Given all the economic and operational factors, vapor recovery seems to present the preferred solution to addressing the Subpart OOOO regulations, where applicable.

In terms of state-level fugitive emission regulations, the rules have not changed considerably in recent years, but there does seem to be heightened enforcement in some cases as a result of utilizing infrared technology. Texas, for example, has implemented new permit-by-rule regulations, which are putting greater focus on tank battery emissions. The primary driver behind this is the use of infrared cameras by regulatory agencies.

A similar trend seems to be occurring in other states that are ramping up their focus on vapor gases at tank battery sites. In some instances, producers have reported helicopters equipped with infrared devices hovering overhead and surveying for escaping vapor gas. The agencies then address any noncompliance issues with actual aerial footage, which in some cases shows specific sites to be unknowingly emitting more vapor gas than is allowed without a special permit. These new regulatory practices are forcing producers to take a serious look at compliance from a proactive rather than a reactive standpoint.



Infrared cameras image vapors from storage tanks, compressor stations and production sites that are invisible to the naked eye, and record the physical characteristics of the different gas streams. Advancements continue to be made to infrared detection technology, as well as to the quantification tools used to accurately measure vent gas streams.

Program Approach

Even with new regulatory mandates at hand and the use of new tools to promote compliance, the reality is that producers have an opportunity to avoid a number of pitfalls related to vapor gases. Many producers are reaping the benefits of a program approach to vapor recovery by rectifying the problem of fugitive emissions on a fieldwide level, rather than on individual wells, storage tanks or equipment sites.

By looking at a field in its entirety and identifying problems through emissions surveys, the producer can document the volumes of gas coming off each tank or production site and obtain an exact gas analysis from each site. A vapor recovery program then can be designed to provide

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optimal performance in capturing fugitive gases to meet regulatory requirements while delivering tangible bottom-line benefits to the company and its shareholders.

This vent gas management approach most often is tackled in stages, which include accurate emission surveys, VRU design and standardization, review of tank and tower layouts, and a strong maintenance program. This should be followed by quantifying results, and tracking compliance and payback economics quarterly. Technological advances over the past two years allow vapor recovery at sites with or without electric power to be not only highly reliable, but cost effective.

Most operators start with a pilot program of 10 sites. Because each field has its own nuances, any necessary adjustments can be made during the pilot program, and the success on the initial tank battery sites can be replicated across the entire field. Producers who opt for this program approach find that once the initial assessment has been completed and the front-end data have been analyzed, total payouts on the complete program generally are achieved in less than 14 months.

With the help of vapor recovery experts, producers are finding the program approach to be an obvious "win/win" scenario that makes an entire field 100 percent compliant with state and federal regulations while tapping a new revenue stream for improved overall economics. Gas that once was unintentionally and often unknowingly lost becomes an added source of revenue. And it can be a meaningful revenue stream; in three of the larger vent gas management programs implemented in 2011, more than $1 million worth of vent gas was identified and captured in each field.

While the obvious benefits of vapor recovery are enhanced economics and regulatory compliance, improved personnel safety also is a major component. There are a number of hazardous scenarios that come into play when undetected vapors are present at a tank or compressor site. The most obvious is the risk of an explosion, especially at a compressor station housed in an enclosed building and driven by spark-ignited natural gas engines.

Another serious concern is hydrogen sulfide exposure. Because H_2S is so corrosive, it can easily corrode through steel pipes or tank components and vent off without being visible to the naked eye. Even if H_2S is not present, long-term exposure to high-Btu, high-VOC gas poses potential health and safety issues. Early detection is critical to identify and remediate potential vent gas safety hazards. By using advanced survey tools–including infrared cameras–and installing vapor recovery equipment where applicable, many hazards related to fugitive emissions can be avoided.

For many producers, the advantages of vapor recovery cross the threshold from being a viable choice in dealing with vapor gas to quickly becoming standard practice. The revenue generated from capturing invisible vapors usually far exceeds the expense associated with putting a VRU system or program in place. With capital expenditures in the range of $25,000-$100,000 per site, depending on the size and scope of the vapory recovery program, the financial and HS&E benefits are immediate and the return on investment is long lasting. ❐

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