Infrared Technology Images Vent Gas

By Larry S. Richards

HOUSTON–Few technologies have the potential to dramatically change an industry forever. Three-D seismic revolutionized the exploration and drilling aspects of the oil and gas business by allowing explorationists to easily visualize oil and gas formations that were thousands of feet below the surface. A new technology has emerged in the past 18 months that could have just as dramatic an effect on the production side of the industry. Once again, it is a technology that allows oil and gas companies to easily visualize an aspect of their business that previously only was captured by equations and imagination.

In 1993, a small company in Brownwood, Tx., began working on software to couple with an infrared camera, allowing the camera to "see" invisible natural gas leaks. The company provided helicopter surveys of pipelines for leak detection, and its intent was to develop a tool to assist in the efforts to easily identify leaks from a distance. The patented process the company developed configured the camera to see a specific range of molecules: hydrocarbons.

Ten years later, the company rolled out its first prototype camera, and the technology worked. Now that patented process has been partnered with one of the leading infrared camera companies, FLIR Systems, whose equipment is used around the world in military, government and industrial/commercial applications. In fact, it provides most of the infrared satellite footage shown each evening on the nightly news report. The result is a camera that shows previously invisible gas emissions as a clearly visible white or black cloud, depending on the configuration. Because of the military origins of the camera, with the right lens, it can zoom in on a location from more than 10 miles away. Is your imagination working yet?

Vent gas has been part of oil and gas production since the first Drake well. The venting of gas from oil and condensate stock tanks, the venting of casinghead gas from wells, and similar venting and leaks from field production equipment and compressor stations results in billions of cubic feet of methane (and heavier hydrocarbon gas) vented to the atmosphere each year in the United States. Almost every individual in the industry is aware that this venting takes place, but very few realize the enormous quantities of gas that are involved. Vent gas is easy to dismiss because it cannot be seen, at least until now. With the technology now available to see these "spills in the air," vent gas is officially out of the closet, and I do not think it is ever going back in.

Like most new tools, I can easily envision ways in which this new technology could be used to improve the industry, or to disparage it. However, we have found this new technology to be an outstanding tool to optimize production operations and maximize the profit from an oil or gas production facility (actual camera footage from production facilities can be viewed at www.hy-bon.com

We have yet to show the video highlights from a field audit with this technology that has not been met with amazement from the operations and engineering personnel.

Our company did not invent the technology, nor do we sell the cameras. However, we do have 55 years of experience in identifying, quantifying and capturing low-pressure gas streams in oil production facilities, with equipment operating across the country and in 22 nations around the globe. I am confident in stating that we have learned more in the past six months about gas emissions at production facilities utilizing this technology than anyone on my team would have thought possible–with more than a few surprises along the way. My goal in this article is to share some of the successes and benefits oil and gas operators have experienced with this new technology.

Increased Profits

On most locations that have been surveyed, 90 percent of the gas volume is

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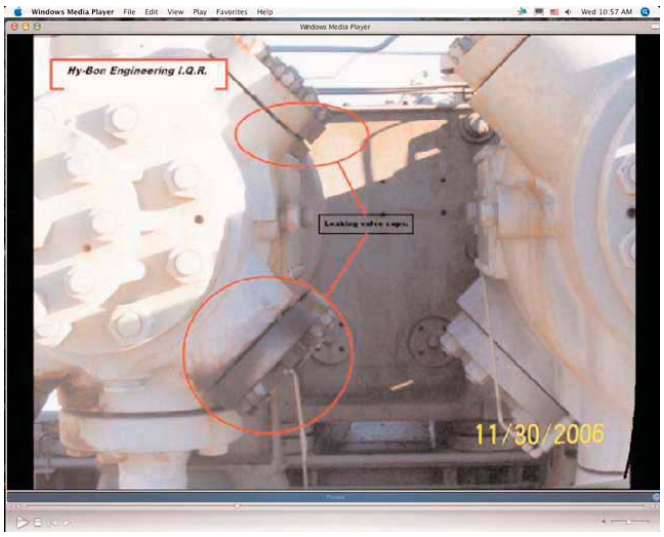
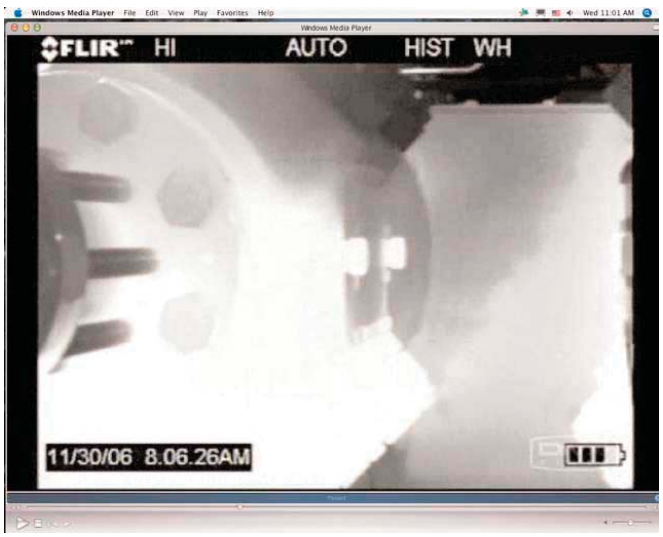
Btu adjustment, the typical oil stock tank produces $5,000-$25,000 in methane gas each month at today's prices.





At one compressor station, the infrared camera showed gas billowing out of the valve caps and outer head of a reciprocating compressor. After a $400 investment in new gaskets and some service work, a large amount of gas was back in the pipeline earning revenue.

lost from 10 percent of the emission sources. The three largest gas streams that are typically recorded on location are from the oil or condensate storage tanks, from leaks on large reciprocating compressors, and vented casinghead gas. Hundreds of millions of dollars of product are lost each year in the United States from these three vent sources alone.

The most compelling footage is usually from tanks. What most people do not realize is that most of the vent gas from oil and condensate storage tanks averages 2,000-2,400 Btu content, making it the most valuable gas on a lease. For operators with a Btu contract, this gas can be sold at twice the going market price, or even higher. Even without the Btu adjustment, the typical oil stock tank produces $5,000-$25,000 in methane gas a month at today's prices. Most of the vapor recovery projects we have identified for operators with this technology have an economic payback of less than six months.

An eye opener for our company has been the number of leaking tank hatches and pressure relief valves documented on almost every location. A minor investment in a preventive maintenance program on hatches and pressure relief valves eliminates leaks and ensures that no oxygen enters the system.

One area where we did not expect to find large amounts of gas was reciprocating compressor sites. One of our first clients for our new service stated that it had been experiencing a large amount of shrinkage in its gas volumes from the wells to the pipeline meter, and therefore, decided to video five compressor stations. Three of the five stations had no major leaks. However, the other two made up for it.

At one location, gas could be seen on the camera billowing out of the compressor station from 40 yards away. Inside the building, gas was pouring out of the valve caps and outer head of the rental reciprocating compressor. The operator had been chasing this gas for months, and had just finished replacing all the relief valves on location in an effort to find the source of his loss. After a $400 investment in new gaskets and some service work (which was actually free to the operator from the rental company), a very large amount of gas was back in the pipeline earning revenue.

The third major area where we have discovered large amounts of gas is the venting of the casinghead gas on individual wells. It is no secret that relieving the backpressure on the well bore helps increase production in many mature fields. What many companies do not realize, however, is that it is often easier for contract pumpers to vent this gas to the atmosphere rather than dealing with the compression involved with getting it into a pipeline. Many of these wells vent more than 200 Mcf a day, and can be easily linked with other wells to consolidate the compression requirements to capture this gas. Cases where large amounts of gas are identified being vented from the casinghead or separators not tied into pipelines are usually a quick fix by the operator once the video is reviewed.

Many "oil" companies have added large profits to their bottom lines by the capture and sale of these "associated gas" streams. Several equipment companies offer programs to install and maintain equipment in return for a percentage of the gas captured.

Safety Applications

After the first day of shooting with the new camera last year, I received a call from a manager in the field with an urgent message. In the first eight hours of shooting, the camera had identified two situations that potentially could have resulted in fatality accidents. The two largest safety hazards we encounter are hydrogen sulfide (H_2S) poisoning and ignition sources.

Many of the locations surveyed contain gas with H_2S contents ranging between 1 and 6 percent. Since it only takes a fraction of this amount to kill a human, H_2S must be taken very seriously. Utilizing the camera, it is easy to see that most of the gas venting from oil storage tanks quickly migrates to the ground. Pure methane is lighter than air and rises when vented. The heavier the volatile organic compound content, the more rapidly the gas falls to the ground. H_2S gas at ground level is always a danger, but in the large volumes often present from stock tanks, it can be a deadly combination.

An example occurred last November.

In addition to imaging vent gas from oil storage tanks, compressors and other production equipment, the infrared camera can help prevent safety hazards from exposure to hydrogen sulfide and ignition sources. In this example, workers replacing a leaking valve on top of an oil storage tank were unaware that gas was exiting the tank through the 3.0-inch pipe until the camera captured this image. The latest field video from Hy-Bon Engineering is available at www.hy-bon.com.

When on location for a client, we noticed that a heavy 2 percent H_2S gas stream coming off the tanks was quickly migrating to the ground and flowing directly across four workers from a roustabout crew. We motioned them to move out of the gas stream (that they could not see) and asked what their H_2S monitors were showing. They informed us that the gang pusher had the only H_2S monitor and he was "in the truck on the phone arguing with his wife."

In heavy H_2S fields, it also is not unusual to document 10-15 small leaks below 4 foot high that are strictly caused by H_2S corrosion. These are usually very easy and inexpensive to fix once identified, but could expose personnel to H_2S poisoning from unexpected sources. The cameras have been able to show many crews the H_2S gas sources on their locations, and it usually is an eye-opening experience for all.

The second major safety hazard is ignition sources. Venting tanks are prone to lightning strikes and other possible ignition sources. One of the scarier situations occurred last month, when a crew was replacing a leaking pressure relief valve on the top of an oil storage tank. The crew had not shut off the oil from entering the tank, and gas was blowing out of the 3.0-inch pipe exiting the tank. The lead man began banging on the end of the metal pipe with a metal 24-inch pipe wrench in an apparent attempt to crimp it enough to slip over this valve. Because he could not see or smell the gas, he did not realize he was banging on the end of a pipe with gas spewing out it. One spark and it would have been a very bad day for the three individuals working on that tank.

Other ignition sources are much less conspicuous, but equally dangerous. For example, the camera recently identified a severely leaking packing case on a three-stage reciprocating compressor where the gas was exiting a bolt hole (the bolt was missing) on the inspection plate. The heat associated with high speed compression, especially coupled with natural gas engines, result in multiple ignition sources in the case of major gas leaks on these units.

Environmental Stewardship

Many companies have been able to show their environmental stewardship by utilizing this technology to identify emission sources across their locations and rectify the leaks. Even the smallest leaks can be pinpointed exactly, eliminating the guesswork and focusing directly on the problem area. Most small leaks are easy and inexpensive to rectify, as long as the individual doing the repair work knows exactly what to fix. The larger emission sources often require a cost/benefit analysis. However, with today's gas prices, the payback economics can be highly profitable–especially where access is available to a low-pressure sales line.

While so much of the national debate on greenhouse gases has focused on the reduction of carbon dioxide, methane gas has 21 times the greenhouse gas effect of CO_2. The capture of vent gas from one oil field stock tank venting 200 Mcf/d is equivalent to planting 8,800 acres of trees or removing 6,498 vehicles from America's highways for one year. One stock tank!

Regardless of whether one chooses to believe in global warming, the focus on greenhouse gases is not going away anytime soon. However, with strong wellhead gas prices, producers truly do have an opportunity to embark on a meaningful environmental project that also has strong financial returns for their companies.

Most new technologies are both exciting and somewhat frightening. The thought of Michael Moore behind one of these new cameras for about six months is probably enough to send chills through the toughest industry executive. However, there is no doubt that this new technology takes the ability to identify vent gas sources to a whole new level that would have been unimaginable 15 years ago.

From an industry standpoint, vent gas represents hundreds of millions of dollars of product lost annually. From the nation's standpoint, it represents the waste of a natural resource that took tens of millions of years to create. From an individual company standpoint, many of these gas streams represent the potential for a fatality accident. Vent gas is bad business, as viewed from almost every stakeholder angle, but the industry now has an awesome new tool to help manage it! ❐

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Larry S. Richards joined Hy-Bon Engineering in March 2003 as president. He previously served as vice president, operations support, for Key Energy. Before that, Richards had served at Continental Emsco Co. as vice president of operations for the engineered products group and as vice president of marketing. He is a graduate of Texas A&M University.