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Going green with the oil and gas industry

Vapor recovery unit meets new environmental regulations, captures gases for sale, reuse

Using Siemens differential pressure transducers to build precision control into its systems, Unimac gives customers the ability to reduce emissions to EPA-mandated levels and earn an attractive return-on-investment in the process.

Industry rarely welcomes environmental regulations. Such measures typically translate into the need for remediation equipment that frequently adds costs and often reduces efficiency for most manufacturing operations. However, when the U.S. Environmental Protection Agency (EPA) restricted fugitive emissions in the oil and gas industry recently, the new rules generated some

surprising benefits and led crude oil producers to embrace the need to “go green” with unexpected enthusiasm.

Leading the way to this positive response is a new Vapor Recovery Unit (VRU) designed and marketed by Unimac LP, a part of Dallas, TX-based Air Mac. Using differential pressure transducers from Siemens Industry to provide unprecedented precision control, the system is helping oil and gas producers reduce emissions to EPA-required levels by effectively capturing crude oil vapors for reuse or sale. The recovery efforts have been successful enough to yield equipment payback periods as short as 7 months, in some cases, and have enabled producers to establish new profit centers.



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The regulations: A new wave of awareness

VRUs have been available for a number of years. However, they had not been particularly popular in the oil and gas industry until they became one of two remediation methods (combustors is the other) approved by the EPA for handling fugitive emissions. The agency mandate was part of a much larger effort, known as New Source Performance Standards under the Clean Air Act, to reduce greenhouse gases not just in the petroleum industry, but in agriculture and wastewater as well. Title 40 CFR Subpart 0000, or Quad0 as it is commonly called, requires onshore oil and gas producers to reduce vapors flashed off in crude oil storage tanks by 95% and limit methane and Potential To Emit (PTE) VOC emissions to no more than 6 tons a year.

“Six tons may sound like a lot, but it is not,” says Jim Keller, owner and president of Unimac and parent company Air Mac. “This directive has impacted a lot of oil and gas producing companies. The regulations are being implemented in stages,” he explains. “April 2014 was the first target date for implementing remediation technologies within 60 to 90 days for new facilities and new construction and for retrofitting all facilities. In April 2015, producers will have to install remediation measures on older sites constructed after 2011.

Many large producers are aware of the need to comply and have been analyzing regulation impact and implementing solutions. Now, a new wave of awareness is reaching smaller companies. Not everyone has implementation strategies in place yet,” points out Keller, “but clearly this will grow over time. It has to.”

With roughly half a million crude oil tanks dotting U.S. oil fields (according to EPA estimates), remediation methods, especially VRUs, can be expected to proliferate. Collecting and reusing crude oil vapors does make economic sense as vapors are energy rich. Their Btu value can run as high as 2,500, while natural gas coming off a wellhead is typically in the 700 to 1,200 Btu range. Because of the attractive ROI they offer and their ability to reduce vapors to mandated levels, the new VRUs are virtually taking a waste product and turning it into a saleable commodity.

The instrumentation: The need for accuracy and precision

Unimac got into the VRU business at the urging of an existing customer, a large oil and gas producer to which Air Mac was already supplying coal bed methane compressors to improve well production. “They had the foresight to see what was coming,” recalls Keller. “When they asked if we would be

interested in building VRUs, we studied the market and the regulations, recognized the potential, and formed Unimac to focus on the new product. It was when we started to develop the unit that we were first introduced to Siemens and its control instrumentation.”

With precision control topping the list of requirements for its new venture, Unimac sought a solution that was unconditionally accurate and reliable at very low pressures. Siemens SITRANS P DSIII differential pressure transducer turned out to be not only just what it was looking for, but the key to the success of the system as well. “We selected it,” says Keller, “because it gave us that precise control within a very narrow range. In fact, I believe the Siemens product was the only device available that could perform at that low a pressure at the level of accuracy we wanted. Without that degree of precision in that range, our control cascade wouldn’t function properly or be fast or reliable enough to respond to the rapid pressure changes. In addition, we liked the device’s local, digital display and easy-to-use menu that lets us change parameters in the field.”

Each Unimac VRU also includes Siemens SITRANS P200 pressure transducers, compact single-range-transmitters that measure absolute and gauge pressure. “We use two DSIII transducers and between three and five P200s on every VRU, depending on the configuration,” adds Keller. “The P200s are used for monitoring, not control. If a variable moves out of range, a P200 lets us know, sounds an alarm, and shuts things down if needed.”

The technology: The ability to recover and reuse

Keller sketches the workings of the VRU to illustrate how the Siemens instrumentation works together to achieve the needed performance levels and how the SIRANS P DSIII, in particular, fit perfectly into the unit’s design. “The DSIII had to control the variable frequency drive (VFD) that controls the speed of the positive displacement compressor,” he begins. “The faster the compressor runs, the more gas it consumes, or draws into the system. The slower it turns, the less gas it consumes.”

Because vapor production varies widely with conditions, Unimac needed a controller that could match compressor speed to vapor production. Keller provides some background: “Vapors coming off of crude are measured in ounces of pressure,” he explains. “That is very low in the compression world. We had to control within extremely small increments and very precisely within a limited range. As a slug of crude enters a tank, the vapors flash off into a sealed container – which is what the EPA requires to capture the fugitive emissions – and the pressure rises. But it rises only to 8 to 10 ounces of pressure. It may be as low as half an ounce.”

In a typical configuration, tanks are piped together with a very large diameter (4 to 6 in.) pipe coming off the top where the vapors collect. The system is piped to a flare line equipped with a relief valve to handle any upset conditions. “One SITRANS P DSIII monitors the pressure in that line,” Keller continues, “controlling the VFD. It sends a 4-20 mA signal to the VFD, actually to a PLC which interprets the signal and sends it to the

VFD. As the pressure in the manifold rises, indicating more vapor production, the compressor speeds up; as the pressure drops, it slows and directs less vapor out of the tanks.”

When it is cold, there is little vapor production, sometimes for extended periods of time. “Then the compressor can’t turn slow enough to reduce the volume sufficiently,” says Keller. “For those cases – and this is unique to our design – we have installed an inlet valve on the suction scrubber that opens and closes under the control of a DSIII (again through a PLC). It acts like a fence around the minimum and maximum operating parameters of the tank. If vapor production stays within the minimum and maximum rpm range of the compressor, the valve remains open. If production drops below the minimum, the valve closes and the system goes into a bypass mode, with the bypass valve also controlled by the DSIII. When vapor production recurs, the inlet valve opens, the bypass valve closes, and the compressor turns faster allowing the VRU to direct more vapor to the sale line once again. All control must take place within a very narrow range. Essentially, we’re adjusting the proportional gain on these valves, which operate in a coordinated fashion with the VFD. All the signals come from the two DSIIIs.”

The environment: Being green and profitable

Clearly, the new regulation is the primary driver behind increased VRU application. However, thanks to the improved technology, recovering the vapors and selling or reusing them is helping defray the cost of a control system sufficiently to yield a reasonable ROI and making it easier for oil and gas producers to be environmentally responsible. “We visited an installation with two VRUs in North Dakota last week that will pay for itself in 7 to 11 months,” says Keller. “That facility is making money on its vapor.”

At this point, Unimac’s VRU business appears to be thriving. The company started building its new offering in a 16,000 square foot facility but quickly ran out of room. It recently moved into a 30,000 square foot space while keeping the original site operating. The first units went into the Niobrara oil field in Colorado in 2012. “Our customer put in roughly a dozen units in 2012,” says Keller. “In 2013, that fell to 3 or 4 when they faced some right-of-way and drilling permit issues. But this year, they’ve installed another dozen or so with more on order. We’ve supplied some 40 large units in the Bakken field in North Dakota this year and are in the process of installing our first unit in the Permian Basin in West Texas.”

Keller frankly admits to being happy with the Siemens’ products and says Unimac will continue to use them. “The key is that we have had no issues in terms of performance,” he says. “There was a learning curve when we were implementing them for the first time. We needed ultimate precision. We had some training issues and needed to learn how to set up the units in the field, but we had good support from Siemens personnel. They gave us a ‘cheat sheet’ to help with the set up. The technical and sales support have been exemplary. One customer asked us to convert to another vendor’s product, but we said no, we weren’t having any problems with the devices we were using. And now they, too, are glad we stayed with the Siemens products.”

Obviously proud of the VRUs Unimac has developed, Keller says it is exciting to be participating in what he calls an energy revolution. "This is a quality piece of equipment," he stresses. "Feedback has been positive. We are pleased to have created a 'thoughtful design' that provides a solution to a current problem. We are producing energy right here."

Comprehensive instrumentation portfolio

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For more about the Unimac Vapor Recovery Unit, go to the company website at unimaclp.com/vapor-recovery.

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