WHITE PAPER

Improving Safety in Oil and Gas Production

UNITED ELECTRIC CONTROLS

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World energy demand will grow at 1.2 percent a year for the next quarter century, according to a 2010 report from the International Energy Agency. Fully half of that growth will come from fossil fuels – coal, gas and oil. Thus, increasing oil and gas production understandably attracts considerable attention, with traditional and unconventional sources both being asked to satisfy the world's growing hunger for energy. However, that production must meet safety and regulatory requirements. Together, these ensure that the extraction of fossil fuels from any source protects equipment, people and the environment. It is important not to skimp in satisfying such requirements, as the cost of a safety-related failure can literally run into the billions. Fortunately, there are technological solutions that help meet this challenge in the form of advanced switches and transmitters. These can help maintain safe casing pressure, improve safety panels, and ensure that blow out preventers do their job. Beyond safety, applying the right technology can improve asset management and increase uptime. This white paper will examine the changing oil and gas production safety environment, explore solutions, and outline the advantages in addition to safety that can result.

Changes in the Oil and Gas Safety Environment

In May 2010, the U.S. Department of the Interior published a final rule for casing pressure management. The rule, designated 30 CFR Part 250 in the Federal Register, pertains to offshore sites but it illustrates the changing nature of safety when it comes to oil and gas wells. Wells consist of production tubing surrounded by a casing string, with an open annulus that allows fluid to circulate between the two. There often are, in fact, multiple sets of tubing, annuli, and casings in a producing well. Maintaining the right pressure in the annuli is important, as it ensures the integrity of the casings and the safety of the entire well. The new rule is intended for those wells with sustained casing pressure and it calls for monitoring all annuli, following the American Petroleum Institute's Recommended Practice 90. The Interior Department instituted the rule because such wells, whether offshore or on land, experience fluctuating pressure between the casing and tubing. This pressure builds up after it has been bled down, and the agency found that untreated sustained casing pressure can lead to serious harm to people and the environment. The ruling requires casing pressure be monitored continuously in some situations, weekly in others, and monthly in still others. The nature of the well determines the frequency of the monitoring.

In addition to new regulations, safety in the production of oil and gas has been impacted by the exploitation of new areas. Examples include oil sands and subsea wells at water depths greater than a mile. This, in turn, is being driven by the growth and projected growth in the demand for oil. The International Energy Agency forecasts that the demand for oil, excluding biofuels, will reach 99 million barrels per day by 2035, up from 84 million in 2009. Furthermore, it predicts that unconventional oil sources will meet 10 percent of world demand in 25 years, up from 3 percent today. The combination of unconventional plays and new regulations has led to an increasingly complex safety environment. Companies have responded by creating safety compliance departments to ensure that regulations are followed, thereby avoiding fines and greater scrutiny. Another and arguably more important responsibility of such a department is to eliminate what is sometimes called a 'CNN event'. These are accidents that

make worldwide news and are therefore followed exhaustively by global news organizations. Besides being expensive in terms of direct outlays, these incidents also can be quite costly due to indirect expenditures and the tarnishing of a company's reputation. Such accidents are not confined to the oil and gas industry. Indeed, some of the most catastrophic incidents have involved chemical companies and nuclear power plants.

Well Safety Solutions – Casing Pressure

For those concerned about well safety, there are a number of solutions for the twin challenges of new regulations and unconventional sources. Advances in technology are steadily expanding the available choices and offering new capabilities that can supplement or replace older options. A case in point can be seen in the TX200H smart pressure transmitter from United Electric Controls. It can handle pressures far above the maximum found in a well, has certifications for use in explosive environments, and utilizes the latest HART 7 digital industrial automation protocol.

Typically, when monitoring casing pressure such transmitters are used as part of a package that replaces a mechanical switch and chart recorder. The former acts to shut off a well when the pressure exceeds a set point. Because they cannot capture data on the fluctuating casing pressure in a well, a chart recorder must also be attached and pressure monitored whenever documentation of this data is needed. With a transmitter, on the other hand, pressure can readily be taken at any time and, thus, regulatory requirements for pressure monitoring satisfied. This is particularly useful for remote locations, where manual monitoring of well pressure is often not practical. If the data from a transmitter is fed into a PLC operating as part of a SCADA system, then trends can be extracted, perhaps yielding important information about the overall health of a well or equipment. The cost of a modern transmitter and electronic control setup is comparable to that of one done with older pneumatic technology, provided that both are being built from scratch.

Improving Safety Control Panels

As for switches, they still provide the fastest method for emergency shutdown, and there have been advances in this technology as well. Consider United Electric's 12 Series of pressure switches, which respond when a set point limit is exceeded. They meet the dual seal approval outlined in ANSI/ISA 12.27.01, thanks to a hermetically sealed switch capsule. Thus, if there is a failure that allows either a gas or liquid to escape into the switch enclosure, the secondary seal will prevent any migration down the conduit. Venting of the escaping fluid or gas, which is detectable a variety of ways, allows the failure warning that is required by the standard. Such switches can play a key role in a safety control panels, which are found on producing wells. Anywhere from a half to multiple dozens of switches can be on a panel, and they can be monitoring pump, compressor, well head, down hole, and other pressures. These panels, and the associated pressure switches, can help ensure that a failing compressor is shut down almost instantaneously and long before it damages a well, for example. Spotting little problems before they become big ones can improve well safety and overall production

Building Better Blowout Preventers

Another key part of the well safety arsenal is a blowout preventer or BOP, a specialized valve that controls, monitors, and, if need be, seals oil and gas wells. A preventer typically consists of a variety of systems intended to force a ram or piston into tubing, thereby restricting or entirely shutting off a well's flow. Since it is a failsafe system that functions as a last line of defense, blowout

preventers tend to be kept as simple as possible. Nonetheless, advances in electromechanical switch design have helped improve them. For example, United Electric's mechanical and electronic switches and transmitters are used on BOP accumulator units, which are also referred to as closing systems. The BOP accumulator unit is a backup to the backup to the primary blowout preventer power source. Although it is unlikely that accumulator bottles will be called upon to act and force a ram to shut off a well, it is important that they be ready to do so, which means they must be at the right pressure. A smart transmitter, like the TX200H, could be used to monitor accumulator and manifold pressure, ensuring adequate hydraulic pressure in accumulator bottles. An advantage of this approach is that it uses a transmitter with an analog and digital output. This means the data can be fed into a PLC, enabling the critical pressure of the system to be actively monitored. Further solidifying the BOP closing system and ensuring the backup is ready to go can be handled by United Electric's 120 Series and innovative electronic switch – the One Series, both of which can be part of setups providing precise pump control.

Benefits beyond Safety

In seeking greater safety through the application of technology, it helps to be smart about the situation. The selection of the right technology for transmitters, switches and other components can also provide benefits in addition to safety. A key consideration should be the method of communication. Unless a system is being built entirely from scratch, there will be a need to interface with older equipment. That is one reason why HART communication, which is found in United Electric's products, is such a good fit. There is a 4-20 mA signal, which is easily handled and understood by older electronics. On top of this analog signal, though, rides a digital one. As a result, smart devices can access the extra data carried on the digital signal. As for what that data can be used for, the possibilities include better asset management, preventive maintenance and greater uptime. Larger wells, which have more complex installations, are already taking advantage of such opportunities.

Take, for example, casing pressure. Regulations require that it be monitored on at most a daily basis, but readings from a smart transmitter that are fed continuously into a PLC can yield trend data. From a safety point of view, a regular pattern in these pressure readings may allow problems and excursions to be spotted earlier. With a more complete picture of the data, it is easier to trace varying readings back to a source, such as particular forcing pressures on the annuli of a well or the beginnings of a problem with the casing itself. In turn, that may make it possible to avoid dangerous situations and prevent problems before they occur. Having a continuous stream of data also means that the response to a problem will be quicker. These readings can also indicate problems in pumps, piping and elsewhere. Any emerging issues can then be addressed at a convenient time, with work scheduled to minimize the impact on oil and gas production. For instance, if the data indicates that one pump is failing and another is starting to have problems, the decision may be made to replace both at one time because that will minimize the overall stoppage.

Conclusion

With some planning, it is possible to meet safety mandates and extract additional benefits. This opportunity will grow, in part because new safety regulations are likely and in part because unconventional oil and gas sources are increasingly important. The key to realizing such gains as improved asset management, better preventive maintenance and greater uptime is to carefully consider the technology found in transmitters and switches. Making the right – and the smart – choice is then much easier.