AVOIDING THE DREADED SHUTDOWN:
BALANCING SAFETY, RELIABILITY AND COST

A single day of lost production at a refinery or chemical plant is expensive. An unnecessary shutdown can easily cost hundreds of thousands of dollars. But a process safety incident — particularly one that causes environmental damage, personal injury or death — carries an even steeper price.

Many U.S. facilities covered by OSHA Process Safety Management regulations might require a safety instrumented system (SIS). This includes any facility with 10,000 pounds or more of flammable material or quantities of toxic materials above threshold levels. Oil refineries, natural gas liquids processing plants and chemical plants are common examples.

For owners in industries that rely on high-risk production processes, maximizing profits requires keeping the production line moving while maintaining a safe working environment. An SIS can be part of this balance. When done right, using an SIS presents an opportunity to minimize risk with little or no impact on productivity.

What Is an SIS?

An SIS consists of an engineered set of hardware and software, including any combination of sensors (transmitters), logic solvers (safety PLC) and final control elements (valves and relays) that take the process to a safe state when unsafe conditions are about to occur.

Engineers assess whether the risk presented by a process is mitigated to a level that is tolerable to the owner. An SIS then acts as a safety net when other means of reducing risk, such as more resilient equipment or operator action, are impractical, insufficient or too costly.

Balancing Safety, Reliability and Cost

An effective SIS considers the needs of a facility throughout its entire life cycle. An SIS with only the highest safety in mind might still cause unnecessary shutdown, resulting in lost production. An SIS is designed to shut down the process automatically, so it also must be designed to take action only when needed.

"Typically, the SIS specialist works with the owner to determine how often the company is willing to tolerate a needless shutdown of its process," says Chad Schaffer, an associate instrumentation and controls engineer at Burns & McDonnell. "Then the SIS specialist determines the types and quantity of sensors and final control elements to use in the SIS in order to meet that reliability target while still achieving the safety goals."

Because an SIS normally is dormant, each part of the system requires periodic proof testing to make sure it functions correctly. More frequent testing allows a higher level of safety to be achieved. However, more devices and frequent testing increase costs, so a well-designed SIS considers the balance of safety, reliability and cost.

"The lost production from a needless shutdown is usually more expensive than the cost of additional devices, which can improve both safety and reliability," Schaffer says. "Every facility is unique, but it usually pays dividends to put the right level and smarter SIS controls in — and to schedule adequate testing — in order to deliver a safe, reliable facility that minimizes the chance of lost production.

"Integrating the design and evaluation of an SIS into an engineer-procure-construct (EPC) project accelerates the process and produces an SIS solution that meets the owner's business needs."