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SIS-TECH Designs SIL3 Diamond-SIS For Pipeline Overpressure Prevention and Rupture Mitigation



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Pete Fuller of SIS-TECH received a call from a corporate engineer needing a safety instrumented system to address 2 hazard scenarios associated with a plant in Louisiana. The corporate engineer had heard about a Diamond-SIS installation at a sister plant in Texas, where the system has provided several years of problem-free protection for some significant safety risk. The client needed a quick solution for the Louisiana plant as the equipment was about to go into a turnaround and the client needed a system that could be installed while they were down for the turnaround.

A LOPA was conducted previously to identify the interlocks required for the following scenarios:

- First scenario: Excess pressure as high as 1000+ psig in the hydrogen header causes overpressure of downstream piping and process equipment, potentially resulting in energy release, flash or jet fire, and personnel injury.
- Second scenario: Pipeline rupture upstream of the hydrogen header tie-in and letdown station resulting in reverse (or misdirected) flow from the hydrogen header through the pipeline break, potentially resulting in flash or jet fire.

For the first scenario, monitoring the pressure is an obvious choice, since high pressure is always indicative of abnormal operation as there are no process operating modes where excess pressure is acceptable. However, the second scenario is not so straightforward. Flow seems like the best thing to monitor, as the rupture will likely provide less resistance to flow than the downstream piping network, so low flow is likely to be seen by downstream equipment. However, low flow is not always indicative of a hazard. For example, there are periods of normal operation where the flow is low but the process is considered to be operating normally, such as when a downstream valve is closed while the pipeline is packed and ready to go. So, a low flow trip would actually be somewhat complicated to implement, as the interlock would need to be able to recognize when low flow indicates a rupture versus when low flow simply means that the process is not fully operational.

A less obvious solution to the second scenario is to detect the rupture by monitoring for low pressure. When the pipe ruptures, the pressure in the pipe will be relieved through the opening in the flange, joint, pipe wall, etc. By monitoring for high and low pressure, the first and second scenarios, respectively, can be addressed using the same set of transmitters. To start-up the process, the low pressure interlock is simply bypassed by system design. Other than for start-up, no other bypasses are needed for any other

process operating mode.

A SIL 3 Diamond-SIS became the technical solution of choice due to its cost and that it was the only logic solver on the market that could be designed, tested and delivered in only a few weeks. A SIS-TECH team designed the system, created the installation and operation manual, and wrote test procedures covering the FAT, SAT and on-going proof testing. The user and SIS-TECH team observed the Diamond-SIS operation under test and demonstrated its functionality per the specification. At the conclusion, the new owner of the Diamond-SIS was ecstatic to have this project initiated and completed as part of the scheduled turnaround.

If you are in need of a Safety Instrumented System and would like to discuss the Diamond-SIS solution, please contact Pete Fuller at (713) 909-2100 or pfuller@sis-tech.com.