



A Rockwell Automation Company

Alyeska Pipeline Services Company Crude Oil Pipeline Process Safety

The Client:

Alyeska Pipeline Services Company (APSC) owns and operates the Trans Alaska Pipeline, a 48-inch sweet crude line that stretches from Prudhoe bay to the Valdez terminal, over 800 miles in all. The Trans Alaska Pipeline transports 25% of the continental USA's transportation energy.

The Alyeska Pipeline Services Company (APSC) is in the process of redesigning the Trans Alaska Pipeline to handle reduced flow rates more efficiently. This has been dubbed the "Strategic Reconfiguration Project."

The Requirement:

APSC needed a process automation company that could help them ensure the new pipeline design would be safer based on their Process Hazards Analysis report (PHA) study results. Hinz was selected for this task.

Most safety systems stay within the confines of a process area, covering a few acres at best. The Trans Alaska Pipeline's new safety system could be accurately described as being an 800-mile long safety system. It has been nicknamed the Safety Integrity Pressure Protection System, or SIPPS for short.

The risks normally associated with operating a crude pipeline are somewhat amplified on the Trans Alaska Pipeline. The line passes over arctic tundra, mountains, and rivers that are very sensitive to environmental changes. All engineered changes are overseen by a regulatory body called the Joint Pipeline Office (JPO). The JPO need verifiable proof that the pipeline will be made safer by each engineered change to the process. This includes all aspects of safety: people, environment, and asset protection.

Delivery outages will affect the profitability of the pipeline. Extended delivery outages can be risky for the entire US economy. There is little tolerance for spurious trips on this pipeline.

The Trans Alaska Pipeline follows a geological fault line. Equipment procured for the project must be able to operate reliably under the extreme temperatures, must be able to withstand earthquake tremors, and must meet the international safety standards (IEC 61508 and IEC 61511).

Generally speaking, failing to command a valve to close on demand, or closing a valve when it should remain open are both equally dangerous. At many locations either failure can cause a rupture. This placed a great deal of emphasis on making the Remote Gate Valve control communication extremely reliable. The protocol used for these critical messages is Modbus RTU. Modbus is not a safety-certified protocol.

The Design Solution:

Hinz guided the product selection and provided safety system integration expertise. Hinz's engineering methods made sure all the pipeline safety functions would meet or exceed the requirements stated in the client's PHA report.

Several safety PLC vendors met the very high requirements for process availability. The one that had all the data communication features was Trusted, by ICS Triplex.

Shutdown functions within the pump stations of a less critical nature are handled by Rockwell ControlLogix PLC systems. (Local safety functions, less than SIL 1.)

Trusted, a full Triple Modular Redundancy system, was selected for handling the SIPPS functions. It has been calculated that for all the Trusted systems that will be installed, the likelihood of one of them having a fault that stops the flow of oil is less than once per thousand years.

The safety system consists of six nodes. These nodes need to communicate with each other all the time. The nodes and

their triplicate communication backbone make up one safety system.

Hinz applied process instruments in ways that supported both high safety integrity and high availability. The pressure relief system designs utilized 1oo2 voting on their pressure transmitters, with diagnostic support for masking spurious trips. All SIPPS field wiring is monitored for short circuits and broken wires

Hinz developed a special message redundancy application in SIPPS for communicating with RGVs over Modbus. This was needed to increase the safety integrity of Modbus. Commands to the RTU at the RGV sites are replicated within a Modbus packet. Duplicate commands are compared before being executed at the receiving node. Any mismatch results in a command failure. If the failed command message was a legitimate attempt to control a valve, the sending station

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automatically tries again. Repeated failures result in a communication outage alarm being sent to the control center. This command replication scheme makes the pipeline virtually impervious to random Modbus packet errors that may cause a wrong or failed operation of a gate valve.

The redesigned pipeline will be safer and more reliable. The SIPPS hardware selection, system architecture, and application designs provided by HinZ have been

mathematically verified to meet or exceed the required risk reduction as stated in the client's PHA.

Payback: Alyeska's risk reduction translates directly to a cost savings forecast. This, and improved process availability, are expected to pay for the SIPPS system within the first two years of operation.

For further information or to contact a HinZ office near you, please check our website at:

www.hinz.com