A petrochemical company in Asia delivers gasoline, diesel and jet fuel through four parallel pipelines of 181 km (112.5 mi) each. The pipes are 12" and 16" carbon steel with an external PE coating of 2.5 mm (.098 in) and are located underground.

In 2007, the company spent a considerable amount of money on a leak detection system from a supplier of acoustic technology for installation on a 50 km (31.1 mi) test segment of pipeline. Unfortunately, the system proved incapable of accurately detecting leaks or determining leak locations. This put the company in a very difficult position as the nature of their business required them to have a suitable method of leak detection in place.
The company immediately began to search for an alternative technology that could replace the existing leak detection system and be applied to the remainder of their pipelines. Because their previous experience had been so negative, they were much more cautious about selecting a new system. To ensure that potential solutions would perform according to their precise specifications, the company insisted on conducting on-site leak detection tests before vendors would even be qualified to bid for the project.

After reviewing the details of the application, Siemens agreed to participate in the test to ease the company’s concerns and gain their confidence in the FUS-LDS Leak Detection System, a non-intrusive system based on clamp-on ultrasonic flow measurement technology. Two other global corporations offering software-based statistical modeling technologies also elected to take part.

**The challenge**
The chosen leak detection system needed to fulfill four typical but important requirements. The company was looking for a system capable of detecting leaks at both static (zero flow) and dynamic (flowing) states as well as all sizes of leaks from small and large openings. In addition, the system needed to detect leaks during major transients such as starts and stops. The third requirement was to detect theft and vandalism along the pipeline, which was particularly challenging since most leak detection systems are not sensitive enough to identify product releases at the very low flow rates and from the very small holes generally associated with theft. Finally, the company wanted a system that would automatically produce a location estimation upon detection of a leak without any user input.

These demands were difficult for the software-based statistical modeling systems, which do not include instrumentation and must be paired with flowmeters that may already exist. The performance of these systems is therefore contingent on the instrumentation installed, resulting in the potential for significant measurement error.

Conversely, Siemens provides both hardware and software in one leak detection package. The Siemens software is optimized to work with – and take advantage of – the superb accuracy and repeatability of SITRANS F US clamp-on ultrasonic flowmeters. These meters use a compensated volume balancing method to detect even the smallest leaks in very short periods of time. The FUS-LDS is also extremely sensitive to any changes in flow caused by a leak and is designed to account for normal transients (valve or pump start/stop, packing/unpacking, etc.) while still maintaining leak detection functionalities.
The solution
The testing segment provided by the company comprised 119 km (73.9 mi) of a single underground pipeline that transported diesel oil at flow rates ranging from 0-300 m³/h (0-1887 barrels/h). Siemens installed three flowmeters along the pipeline with an Ethernet connection between each meter and a master station in the control room. Simultaneous leak detection and location tests were then conducted on two segments measuring 55 and 64 km (34.2 and 39.8 mi) three times a day for a total of six days. The company simulated static, dynamic, packing and unpacking leak states. They also initiated leaks from both small and large openings and discharged differing amounts of liquid.

Throughout the six-day period, the FUS-LDS consistently outperformed the other systems in all leak detection and location tests. In addition, the system accurately detected a leak of 43 L (11.4 gal) in two minutes, which translates to 0.64% change of the nominal flow rate of 202 m³/h (1270.5 barrels/h) in two minutes.

To further investigate the capabilities of the system, the company then conducted another 62 tests at both static and dynamic flow for four different pipelines carrying four different refined products. The FUS-LDS succeeded at all of these tests, and Siemens was invited to make a bid on the pipeline project. Ultimately, the company selected the FUS-LDS after determining that it outperformed all other technologies in both leak detection and leak location.

About the FUS-LDS Leak Detection System
The Siemens FUS-LDS Leak Detection System is a complete hardware and software solution for detecting and locating pipeline leaks. The system consists of a master station computer and two or more site stations, each of which contains a SITRANS FUH1010 clamp-on ultrasonic flowmeter, a clamp-on RTD temperature sensor and a data communication device. The master station uses a compensated volume balance method to continually monitor differences in flow rate between site stations. It then sounds an alarm if the line balance deviates by more than a pre-established threshold, followed by automatic leak location estimation. The FUS-LDS is also capable of supporting pipeline management through interface detection, pig detection/location, product quality monitoring and product sequencing.

The FUS-LDS now uses Siemens' patented SIMATIC WinCC software, a Windows-based process visualization system that has been integrated with the master station to provide a dynamic graphic user interface (GUI). SIMATIC WinCC allows a pipeline operator to quickly and easily identify pipeline locations and leak events on the screen, significantly reducing response time and training needs.
The information provided in this case study contains merely general descriptions or characteristics of performance which in case of actual use do not always apply as described or which may change as a result of further development of the products.

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