

Selecting And Installing A Software-Based Leak Detection System

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Environmental protection and the safe operation of pipelines with-in it are two of the primary concerns facing the Oil and Gas Industry today. In the United States alone, since 1989 there have been more than 5,700 pipeline accidents, resulting in 1,500 injuries, 325 fatalities and \$850 million of environmental damage. Consequently, the effective detection of leaks plays a significant part in helping to control this problem and is a prime consideration for pipeline operating companies worldwide.

Drivers for the installation of a leak detection system include:

- Statutory requirements
- Minimized environmental and financial impact of a leak
- Improved public image
- Minimized litigation

There are many buying criteria to consider when selecting a leak detection system, but the primary needs of the pipeline company can be summarized as follows:

- A new system:
 - Must be better in terms of performance than any existing system
 - Must maximize use of existing instruments to minimize cost
 - Must be user-friendly
 - Must minimize false alarms

Software-Based Leak Detection Systems

Software-based leak detection systems for fluid pipelines have been around for some 30 years and are frequently a subject for debate. During the last ten years, they have developed to the point whereby the software and the employed methodologies have become accepted as a standard supply component in the safe and optimized operation of a pipeline. This includes mathematical model-based approaches that were traditionally regarded as being difficult to understand and expensive.

Rapid configuration tools, improved implementation strategies and enhanced software robustness, mean a model-based solution is now frequently the most cost-effective solution.

ESI Approach



Figure 1

Figure 2



To Leak Detection

Energy Solutions International has 25 years of experience in providing practical solutions to leak detection, with more than 300 installations worldwide. This covers the liquids, natural gas and complete range of chemical pipeline sectors and can protection across all normal and abnormal operating conditions whether applied on a single pipeline or complex pipeline network.

Its tool box of software includes all of the leak detection techniques now available to the market, namely:

- Volume/Mass balance without inventory correction.
- Volume/Mass balance with inventory correction based on simplistic calculations and available instrumentation.
- Volume/Mass balance with inventory correction based on a real-time model.
- Unexpected flow and pressure deviations based on real-time models.
- Analysis of flow and pressure point variations as a result of daily operation in comparison to the signature of a leak.

Solutions work with any combination of instrumentation that is available. The software complies and performs to API standards and forms the basis for authority approval/operating in many countries.

Selecting Appropriate

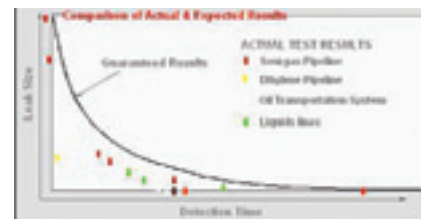


Figure 3

Methodology

A practical approach is available for what appears to be a complicated issue. Based upon available instrument information, telemetry and pipeline operating conditions, product managers can provide guidelines for the system performance.

Selection of the appropriate methodology is a decision based upon an engineering assessment, considering performance criteria and cost.

Leak Detection Performance: Its Impact On Cost

Although there is no industry standard approach to installation of a leak detection system, product managers recognize that performance of the system (as defined by the sensitivity, reliability and robustness) is the most important factor to consider because it impacts significantly upon implementation and maintenance costs.

Careful consideration must be given to the required telemetry and instrumentation that is needed to support the chosen methodology and its sensitivity needs as this will fundamentally affect the cost of the overall installation.

As an example, what may appear to be a trivial decision, when specifying a 1% accurate leak detection system instead of, say 3%, may increase implementation costs by 500%. Similarly, the maintenance costs are highly dependent on choice of performance.

All leak detection methodologies generate a response following a leak (a deviation in either pressure or flow of a recordable magnitude) that can be subject to analysis. The ability to employ both statistical analysis and filtering techniques with annunciation on detection of a true leak is essential.

The methodologies fall broadly into two categories—those that use a balance of

volume or mass and those that monitor the signature of a leak. Methods that utilize the signature of a leak are required to detect the leak as it occurs, otherwise it will be undetected indefinitely. Those that use a balance methodology can be continually assessed, as the effect of the leak on the response is persistent.

It is also important to promote flexibility when it comes to installing leak detection systems, depending on the needs of the end user. Managers can provide and install pre-configured systems or can supply standard licensed-based products for configuration and installation by the end user only. If needed, they support familiar solution techniques for the same methodology within the same product.

A Partnership Approach To Installation

A partnership approach is developed, be it for a fast-track installation using rapid configuration tools and improved implementation strategies or a more traditional engineering study-based approach.

1. Fast Track Installation

The leak detection software is installed by the manufacturer and together with the pipeline operator is integrated with the SCADA system. For most pipelines, this exercise takes several weeks before there is evidence of leak detection in operation in real life. This approach has advantages over the traditional, extensive engineering desk studies—in that it establishes:

- the actual performance of the existing instrumentation and telemetry systems;

- how changing between different modes of operation is being represented by the instrumentation.

In practice, these parameters determine the limitations of any leak detection system. Knowledge of the actual performance information is therefore fundamental for the strategy decided upon, based on real-life performance. There is no other way to establish an equivalent level of knowledge for a decision.

With this information it is possible to assess:

- the ultimate leak detection performance—time to detect a leak of a given size and the accuracy of leak location—that can be achieved under the variety of actual operating scenarios;
- the benefits of alternative leak detection methods.

And perhaps most importantly, the pipeline company can decide the best strategy of implementation that matches their specific needs. Even at this stage it is worth emphasizing that targeting for the “ultimate” performance will most likely not offer the best balance between the efforts needed to maintain the system and the benefit achieved.

The decision on performance determines operating costs during the entire life cycle of a project.

2. Engineering Study-Based Approach

Prior to selection of a leak detection system, a comprehensive engineering study is undertaken. This study considers the true performance that can be achieved with the available instrumentation and identify the

improvements that can be made with upgraded or additional instrumentation.

A successful system requires continued participation in and a recognized ownership of the installation by the end user. With more complex systems, a phased installation to allow the end user to gradually familiarize and gain confidence in the system will be suggested.

The operator’s contribution to ensure continued, robust and accurate performance includes the adherence to recommended instrumentation, telecommunication, computer infrastructure and configuration.

With these basic but highly important factors in place, the end user will be able to take comfort in the fact that the installation will provide the best possible performance for its defined objectives.

From Installation To Production & System Optimization:

When deciding on the operating parameters of the leak detection software, production managers recommend a cautious approach with a focus on simplicity and ensuring that the system does not generate any nuisance alarms. It is an important feature of the software that it “tunes itself to the pipeline, and in so doing it can be observed that the performance improves with no external influence.

The application will also support implementation plans where the pipeline company can gradually improve the performance of the system by manual adjustment and/or upgrades of the instrumentation and telemetry. *P&GJ*