

The Benefits Of Advanced Leak Detection For NGL Pipelines

By **Morten Kristiansen**, Product Manager, and **Alan Jacob**, President, **Energy Solutions International, Inc.**, Houston, TX

During the past few years the interest in integrity management systems for natural gas liquids (NGL) pipelines in North America has increased significantly. Pipeline companies in North America are realizing that NGLs create an operational risk that compels special attention to ensure that the best interests of many internal and external stakeholders are focused on.

The physical properties and behavior of NGL products can be challenging for some leak-detection methods. The fairly high level of compressibility of the products makes accurate calculation of real-time line pack essential for a high performance leak-detection system.

This article highlights some of the technical challenges facing NGL pipelines and illustrates why advanced pipeline integrity management tools make perfect business sense.

Recent NGL Leak Detection Experience

As natural gas production has increased in North America during the past decade, so has the NGL production. Many oil companies have discovered how profitable the by-products from natural gas production can be, and as products like butane, condensate and ethylene are produced in large amounts, the need for transportation via pipelines has increased dramatically.

In the past, pipeline companies have created in-house applications and relied on very basic techniques to assist in pipeline management. This was due to the lack of readily available tried and tested commercial software applications. During the past decade, there has been a change and as vendors began to introduce commercial applications to address pipeline management, pipeline companies have increasingly focused on their core competencies rather than invest in developing and patching their own software systems.

This is particularly evident with companies operating NGL pipelines where, without sophisticated detection mechanisms, a leak can go undetected for an extended period of time, resulting in the buildup of a large, highly flammable and hence dangerous vapor cloud. Many NGL companies now realize the benefits of commercial software applications for leak detection and pipeline management.

Recent Installations

EnergySolutions develops software products for the pipeline industry such as

PipelineManager®, which provides a range of operational applications specifically aimed at supporting pipeline controllers and planners in their daily tasks. In recent years, the company has installed (or is in the process of installing) several advanced leak-detection systems on NGL pipelines in North America.

One common aspect of these projects is the operator's desire to invest in an efficient high-performance leak-detection system that can quickly and accurately warn the operator about any integrity issues and thereby significantly reduce the risk for the potentially catastrophic consequences of an NGL leak.

NGL Characteristics

A common characteristic of NGL products is the fairly high level of compressibility compared to, e.g., refined products. PipelineManager utilizes both internal and proven third-party equation-of-state libraries to ensure that all the properties of NGL are calculated accurately under all operating conditions.

This is a key factor for the thermo hydraulic transient model that is the foundation for the leak-detection application within the PipelineManager product. The result is a highly accurate picture of pipeline operations under all operating conditions, which is absolutely necessary for a high performance leak-detection system.

the characteristics of NGL require more sophisticated systems to function properly.

Basic Leak Detection

Many of the low-end basic leak-detection methods don't work very well on NGL lines. The basic line balance (meter in — meter out) doesn't take packing and unpacking into account, and due to the high compressibility mentioned previously, this method would have to either be filtered over an extended period of time or disabled during transient operations.

The result would be a very ineffective and insensitive leak-detection system that would be disabled a large portion of the time. In addition, the detection time would be extremely long. Similarly, methods that attempt to calculate the line pack via very simple methods will likely add very little value due to the fairly low sensitivity and/or low level of availability.

Advanced Leak Detection

Clearly more advanced leak detection techniques are required for NGL pipelines. Real-time transient model-based systems are often viewed as one of the more sophisticated methods. Historically, such systems have been viewed as expensive and difficult to install and maintain. Over the past five years, however, these systems have evolved.

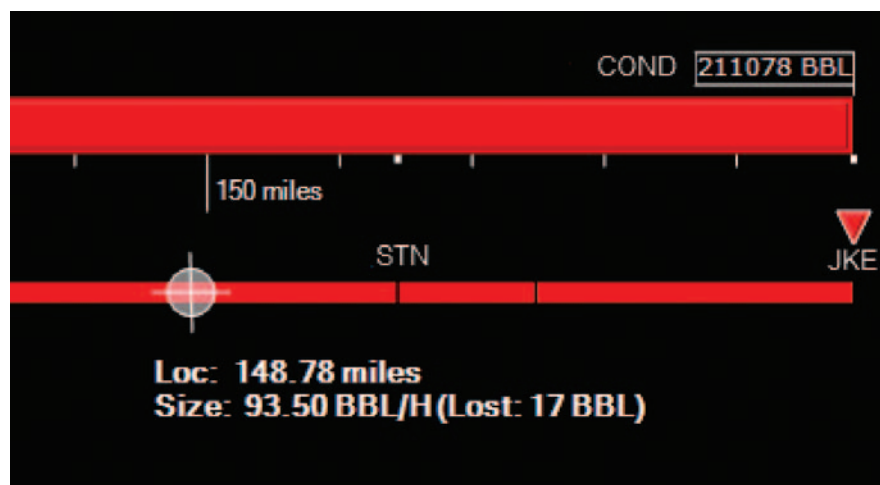


Figure 1: Transient model based leak-detection with dynamic thresholds

Some leak-detection vendors ignore these facts simply because they consider the entire concept too complicated. The result is a less sophisticated system that could be somewhat justified in a much simpler environment. However,

The best leak-detection techniques proven to date, even for NGL pipelines, are available as standard functionality. Not only is system performance significantly enhanced, it is now not uncommon to see much faster

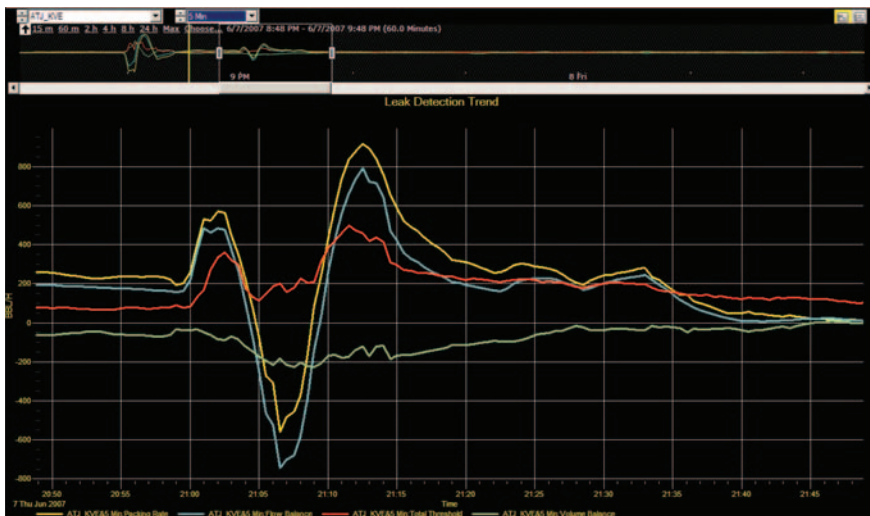


Figure 2: Leak Location and size are clearly identified

implementation times — down from what could take more than a year a decade ago to just a few months today.

Another huge advantage of using a standard off-the-shelf product is the higher likelihood of a successful installation that actually works: it detects leaks fast and accurately, is sensitive and robust and works continuously with little maintenance while providing a minimum of false alarms.

Helping to Ensure Project Success

As we have discussed, the technical capabilities inherent in obtaining a successful outcome for leak detection in an NGL pipeline environment exist. However, success cannot be guaranteed without proper project execution and executive support.

From a project execution point of view, there are two critical factors needed to ensure success. The first is to start with an off-the-shelf product that has been field tested and proven to work with an NGL commodity. By beginning an effort with a mature product, the risk associated with development of specific algorithms and unique operational conditions is elimi-

nated while future maintenance and system upgrades become much easier.

The second major factor in ensuring project success is to deploy the leak-detection system using a field-proven methodology. Utilization of the proper methodology will ensure the project is properly planned and executed. It will also help ensure that all operational and administrative issues that arise during the effort are correctly addressed. Typical high-level phases of a leak-detection project should include:

- Data gathering and model configuration.
- SCADA interface design and development.
- Implementation and testing.
- Optimization of leak-detection parameters via dedicated optimization tools.
- Factory acceptance test with focus on the pipeline configuration.
- Installation, commissioning and tuning.
- Site acceptance test/final acceptance.
- Training.

From an executive support point of view, it is important to gain alignment with senior leadership on final expectations for a successful completion before the project is budgeted and approved. Traditional ROI

calculations may not be the most prudent criteria for success on this type of safety, health and environmental initiative. Alignment around being a prudent operator with a strong focus on operational excellence and being best prepared for an integrity breach caused by a third party may be the most effective alignment with internal stakeholders.

Ready For The Future

Leak detection is often just one of many applications offered by online software packages. Installing a leak-detection system can often be viewed as a first step toward integration of other applications designed to assist with operator training and qualification as well as daily operation of the pipeline.

Operators can be trained in daily operations and emergency management within a safe offline environment. This can significantly reduce the overall training period and on-the-job training requirements. Predictive applications can help operators avoid unwanted operating conditions by providing warnings well in advance of unwanted conditions happening. Such applications can help ensure smooth operations while avoiding costly shutdowns.

Conclusion

The past few years have seen tremendous growth in technical solutions revolving around the successful installation of advanced leak-detection technologies on volatile commodities like NGLs. To help ensure success on a project of this nature, pipeline operators should focus on installing state-of-the-art software solutions based on real-time modeling technology. This method provides the greatest assurance that in a worst-case scenario a leak will be detected in a timely manner, the leak location will be identified and minimal alarm rates will be sent to the control center.

Additionally, adhering to strong project management fundamentals and making sure there is alignment with company leadership about the overall project objectives and final acceptance expectations will facilitate a successful outcome. **PE&GJ**

