



## ***Making Wise Investments When it Comes to Pipeline Safety***

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Morten Kristiansen, Energy Solutions International

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## **INTRODUCTION**

During the past few years the focus on pipeline safety has increased. Pipelines that have been in the ground for many decades are slowly deteriorating. What is not generally known is that many of these are being operated with little or no leak detection functionality. Several serious incidents in North America during the past decade have revealed potential weaknesses in the way operators are trained and qualified for their jobs. This combination of factors can lead to environmental and safety disasters, but fortunately there are solutions that can offset these issues. However, with the myriad of solutions offered, making the best technical and economic investment can be difficult. Pipeline operators need help sifting through these choices and a useful set of metrics to decide upon the best solution to meet their unique operating and economic circumstances.

## **TIGHTER REGULATIONS**

Although regulations often don't require pipeline operators to install and use advanced leak detection systems, regulations are getting tighter in many geographical areas. Recently in the United States, the National Transportation Safety Board (NTSB) issued a set of recommendations to the Pipeline and Hazardous Materials Safety Administration based on a study of several serious incidents during the past decade. These recommendations include requiring pipeline operators to install computer-based leak detection systems on all pipelines as well as including simulators for controller recognition of abnormal operating conditions, in particular, leak events.

Often NTSB recommendations become part of future regulations. Also as the world population grows and people become more aware and concerned about the environment, it is likely that future regulations and requirements for operating pipelines will be much tighter than they are today. With this in mind it is important to select advanced leak detection systems and training procedures that can easily be upgraded to meet future requirements.

## **OPERATOR TRAINING**

Airlines would never dream about asking a pilot to fly a plane without proper training. This training includes a strict regiment of time in flight simulators. Most normal procedures such as navigation and radio communication can be taught using simple simulators. However, when it comes to proper handling of abnormal and unexpected situations a more advanced and highly realistic flight simulator with a sensitive and accurate in-cockpit look-and-feel becomes a crucial part of the pilot's education and daily training.

Similarly various levels of sophistication in pipeline training simulators are offered. Generic offline simulators can be purchased and installed relatively inexpensively. These simulators ensure that the normal training of routine operating procedures, such as pump or compressor starting and stopping, can be performed in a safe offline environment without disrupting the daily pipeline operation. Using the flight simulator analogy, this level

of sophistication corresponds to an off-the-shelf PC-based flight simulator with a simplified user interface and flight dynamics.

More advanced training simulators with a fully realistic control room look-and-feel and true simulation of the specific pipeline offer a safe way to gain exposure to abnormal situations – including leaks, emergency procedures and much more. It allows the operator to see what the unexpected events might look like in the control room and gain invaluable experience in working through those situations: what decisions should be made, how quickly can one react etc. This level of model sophistication is similar to the custom flight simulator used by the airlines – built for a specific type of aircraft with the proper cockpit replication and accurate flight dynamics.

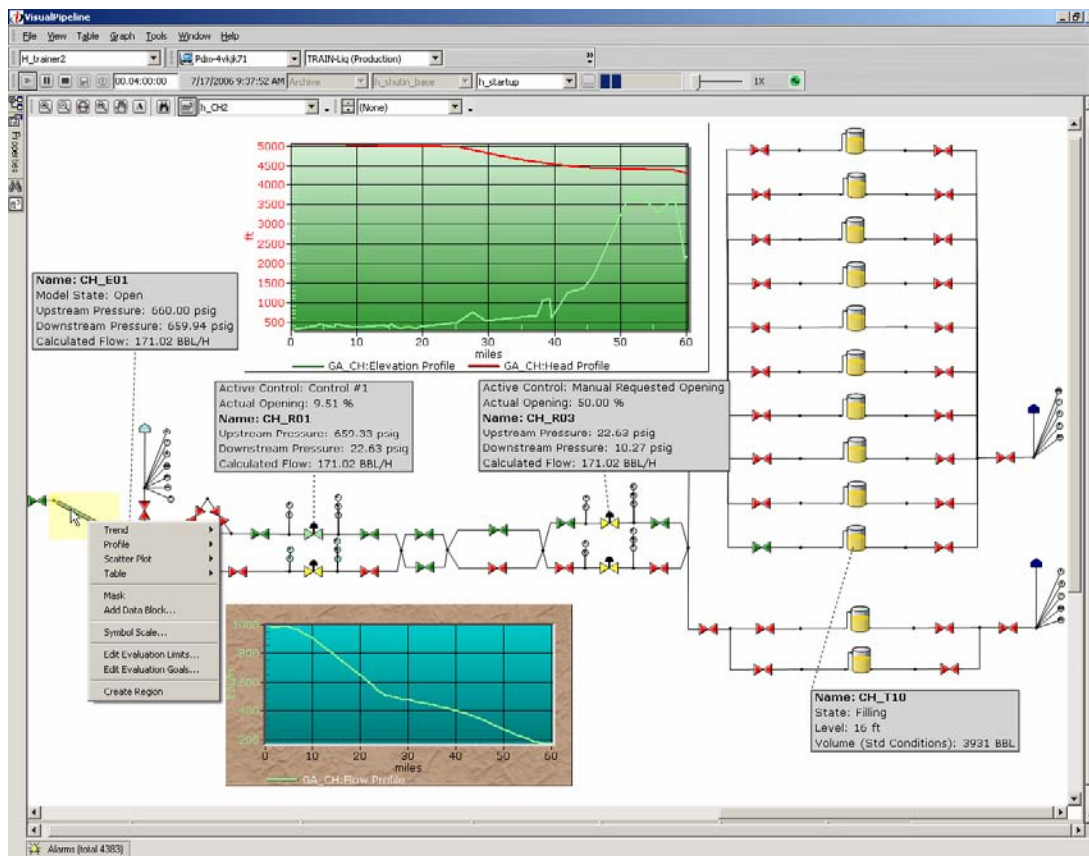


Figure 1: Screen capture of Training Simulator (Instructor View)

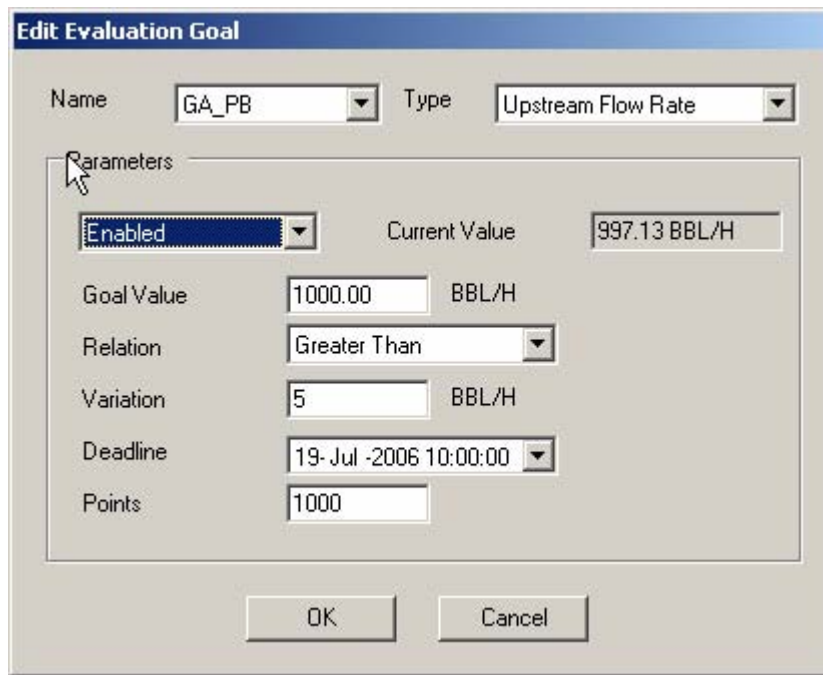


Figure 2: Screen Capture of Training Simulator (Setting up Training Evaluation Goals)

## MAKING THE RIGHT DECISIONS

When it comes to pipeline safety a lot is at stake. People’s safety in the communities surrounding the pipeline as well as the environment can be adversely affected by leaks which go undetected. Tools to enhance operator training and leak detection are part of that safety regimen. Unwise decisions in these areas can lead to serious consequences and cost companies more money in the long run. The cost of a pipeline leak, including associated cleanup and legal costs, can be extremely high. In 2005 accidents on liquid pipelines within the United States caused property damage of more than \$93,000,000, with each incident costing nearly \$700,000. Additionally, cleanup costs add anywhere from \$700 - \$5,000 per barrel depending on the commodity spilled. With an average spill of approximately 1,000 barrels, cleanup typically averages more than \$1,000,000 per incident. Finally, legal consequences (fines and imprisonment) as well as a damaged company reputation easily add to the financial hardship.

Needless to say a smart investment in advanced leak detection systems helps to minimize the environmental, financial and legal impact of a release incident. However it is important to understand that leak detection systems vary widely in approach and implementation refinement. As such, the performance of such systems in terms of detection sensitivity and location accuracy also varies greatly.

## SOLUTIONS THAT CAN GROW WITH YOUR BUSINESS

Energy Solutions is a software provider for the oil and gas pipeline industry. Among the applications developed by Energy Solutions are leak detection and training simulators – both offered as part of the PipelineManager®

suite of control room applications. PipelineManager is based on more than 30 years of experience in transient modeling of pipelines.

One of the main benefits of PipelineManager is its modular structure; every application is scaleable and offers operators a range of leak detection options - from a simple high level solution to a very sophisticated detailed solution. With the transient model as the underlying kernel, it is possible to begin operating with a few mission critical applications and then add more advanced capabilities as operating conditions and economics dictate. Scalability is just one of critical factors to consider when making the decision to invest in leak detection or training simulators.

Use of a transient model based system also means that it is possible to install different levels of leak detection for different pipelines even with the same product. Take the example of a pipeline operator operating pipelines in or near High Consequence Areas (HCA's) as well as pipelines in remote areas where the environmental, health and safety effect of an incident would be much smaller. By analyzing the entire pipeline network a "leak detection roadmap" may be created. Under this roadmap, a leak detection timeline may be established that prioritizes the implementation of advanced leak detection on the high risk areas first while less risky areas are installed later.

Furthermore it is possible to start with a fairly simple solution that requires little in the way of installation and maintenance efforts and then later "upgrade" this solution to higher levels of sensitivity and accuracy simply by investing in more engineering effort to tune the system software. Under this scenario, there is no need to discard the original investment, nor is it necessary to go through the time consuming and expensive process of selecting a new provider. In essence, the transient model based leak detection system can grow with your business and leak detection sensitivity needs, whatever these might be in the future.

Having such a roadmap in place is also a powerful external statement for the pipeline operator. When an incident occurs (which is just a matter of time given almost half of all incidents are caused by 3rd parties), demonstrating that you have thought through the situation and evaluated your pipelines from a risk management and stewardship point of view and have selected and installed the most appropriate leak detection system will go a long way in mitigating legal and commercial consequences of a release incident.

## **SELECTING THE PROPER SOLUTION**

When selecting leak detection and operator training systems it is important to think ahead. As shown above, the cost of installing an advanced leak detection system is typically small compared to just one release incident. Therefore selecting a leak detection system purely based on the upfront purchase price may be an ill-advised approach. It is necessary to look not only at the purchase price, but all of at the long term costs associated with a system. These long term costs, while fairly easy to identify, are not always easily quantified. Among the long term costs of ownership are maintenance costs (cost of keeping the system operational) as well as the costs associated with complying with future, more stringent regulatory requirements for leak

detection. Finally, leak detection systems must be evaluated on their sensitivity to and accuracy in locating a leak, thereby mitigating the effect of such release.

## **DETERMINING RETURN ON INVESTMENT (ROI)**

A training simulator provides a quick return on investment (ROI) by training and certifying pipeline operators much more quickly, without the need to execute shutdowns and emergency procedures on the operating pipeline. Accurate simulation of pipeline operations for training and operator qualification ensures uninterrupted pipeline operation with no risk of equipment failures and emergency situations that can sometimes result when a pipeline is pushed to its limits.

When determining the ROI of a leak detection system several factors must be considered. These include the location of the leak event, the type of commodity being released and when the leak occurs. Although there are several other factors to consider, it is possible to apply some conservative assumptions based on actual leak events to measure the ROI of a leak detection system. With a crude oil price of \$70 per barrel and the cleanup and property damages mentioned above, the cost of the average 1,000 barrel leak was \$1.77 million, calculated as follows:

$$(1,000 \text{ bbl} \times \$70) + (\$1,000/\text{bbl} \times 1,000 \text{ bbl}) + \$700,000 = \$1,770,000$$

ROI for a leak detection system is based on an avoided cost basis. In other words, the investment of software provides a return to the investor when a leak event occurs and the cost of that leak event is less than it would have been had the leak detection software not been installed. Also, the sooner a leak occurs after leak detection software installation, the higher the ROI because the beneficial economic impact of the avoided cost was felt more quickly.

With top-of-the-line leak detection software in place, the \$1.77 million average leak would have cost the pipeline operator significantly less as the leak would have been identified sooner avoiding much of the cost associated with the leak. Performing a simple cash flow and internal rate of return (IRR) analysis, the ROI for a top-of-the-line leak detection systems\ can easily be as high as 350% (depending on the cost of the system) when the leak occurs in the first year after system installation and still as high as 35% when the leak occurs five years after installation. This ROI example as well as others clearly indicates the economic benefits of having such advanced systems in place. They will ultimately save your company money.

## **CONCLUSIONS**

When it comes to leak detection and operator training tools, deciding which systems to install can be a difficult task. Many factors must be considered, so it is important to look at the total cost for the entire system life cycle, including how each system will help reduce the cost of potential incidents. Selecting a solution that provides operator peace of mind and preparedness is also important.

As a prudent pipeline operator, you can easily put a price on the upfront cost of a software system installation. However, the piece of mind that comes from knowing that you purchased a system that provides superior leak detection and training tools for your current and future needs; knowing that you did your best to protect public safety, the environment and all the stakeholders in your company; knowing that you safeguarded the company and its employees from undue legal risk is what rests on your choice of tools.