

Pipeline Integrity: Best Practices to Prevent, Detect, and Mitigate Commodity Releases

by Lars Larsson

Executive summary

Commodity releases can have catastrophic consequences, so ensuring pipeline integrity is crucial for pipeline operators. Pipeline integrity is not just about preventing incidents, but is a holistic approach to the prevention, detection, and mitigation of commodity releases. This paper discusses advanced technologies and tools that enable greater pipeline integrity, particularly computational pipeline monitoring (CPM) methodologies as a means to identify anomalies that signal a possible commodity pipeline release.

Introduction

Commodity pipeline defined

For the purposes of this paper, the term “commodities” refers to both crude oil and raw natural gas transported by pipelines to refineries and processing plants as well as converted, consumer-ready fuels such as gasoline, diesel, and commercial-grade natural gas transported by pipelines from processing plants to distribution terminals.

As aggressive exploration projects around the world uncover new hydrocarbon sources, the demand increases for more pipeline development. However, pipeline operators are under severe financial and social pressure to avoid incidents that cause commodity releases. This means that safe practices must be enforced and that industrial-strength prevention, detection, and mitigation technologies need to be deployed. Regulators are scrutinizing pipeline projects, and the reputation of the industry as a whole is at risk.

“Pipeline integrity” is a term that encompasses a lot of these technologies. It could be argued that in its purest form the term “pipeline integrity” refers to a comprehensive program that ensures hazardous commodities are not inadvertently released from a pipeline and minimizes the impact if a release does occur. Though it is natural to think only in terms of preventing a commodity release, pipeline integrity has a broader definition and comprises three phases:

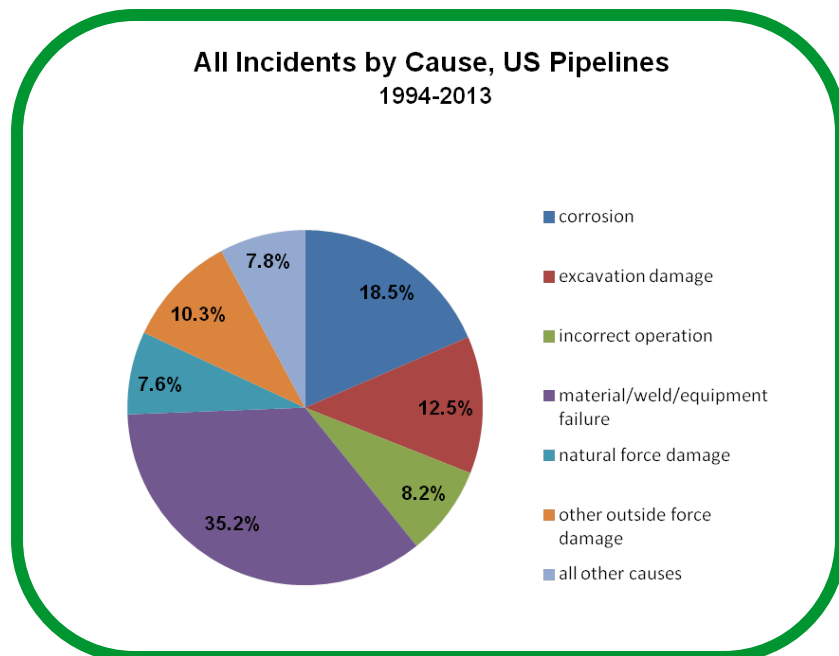
- **Prevention** activities and solutions seek to avoid commodity releases from occurring in the first place through proper design, construction, operation, maintenance, training, and education.
- **Detection** activities and solutions help pipeline operators quickly identify that a commodity release has occurred.
- **Mitigation** activities and solutions minimize the extent or impact of the released volume and related damage.

The activities and solutions associated with each of the phases above are distinctly different and have traditionally been looked upon as three separate areas; however, technology and infrastructure have improved over the years, allowing for a more holistic view of pipeline integrity. Some causes of pipeline incidents are under operators’ direct control, others less so, as seen in **Figure 1**. Pipelines are like all other infrastructure: components and materials degrade over time. Even the most meticulously designed and constructed pipelines must be operated properly and carefully maintained to minimize the risk of a commodity release.

Figure 1

Breakdown of all reported pipeline incidents by cause (United States), 1994–2013

Source: US Department of Transportation, Pipeline and Hazardous Materials Safety Administration



This paper reviews in greater detail the different phases of pipeline integrity and gives examples of various factors that affect each phase. Technologies and tools available today to assist pipeline operators associated with each phase are also discussed.

Pipeline integrity: prevention

Although not the only aspect of pipeline integrity, preventing commodity releases is obviously of paramount importance. The best defense against a release is to proactively minimize the chances of its occurring in the first place. Technology and tools exist today that help anticipate potential threats to the pipeline and identify anomalies or issues before they become problems. The old adage “an ounce of prevention is worth a pound of cure” holds true for pipeline integrity: the costs associated with avoiding a release are much less than the costs of cleanup, fines, and other civil liabilities — not to mention the damage to a company’s reputation. The process of preventing commodity releases from occurring can be split into the following categories:

- Design & construction
- Operation & maintenance
- Training & education

Design & Construction:

Ensuring pipeline integrity starts with properly siting the route and specifying the technical requirements (e.g., hydraulic calculations, physical properties of piping). Advances in construction practices, such as more sophisticated testing prior to the pipeline’s becoming fully operational, and protective technology further safeguard the pipeline’s structural integrity. The following are some of the more important considerations of pipeline design and construction, along with specific tools and technologies to utilize:

- **Avoid geo-hazards along the pipeline route**
Where the points of supply and delivery are located defines many subsequent engineering design decisions. The geography of terrain along the pipeline corridor may be evaluated with offline design tools such as topographical and geological maps, satellite imagery, aerial photography, and surveys available in the public domain to identify geo-hazards such as landslides, fault lines, soft soils (swamps, bogs), and underground cavities (coal mines, caves).
- **Ensure that the pump or compressor is sized correctly**
A steady state pipeline simulation tool can validate the specified size of the pump or compressor through a computational model of the pipeline’s operating conditions (**Figure 2**). This simulation can also ensure that it is hydraulically feasible for the pipeline as designed to cross the terrain with the selected pump/compressor setup in an economical fashion.

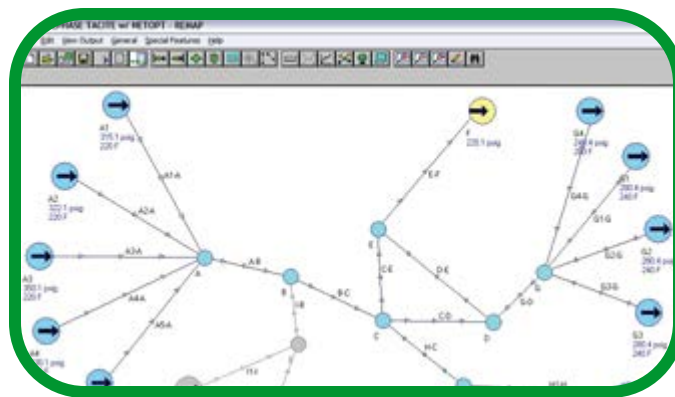


Figure 2

Simulation software tools model the pipeline’s hydraulics and operating conditions

- **Ensure that surge suppression equipment is sized correctly**
A transient pipeline simulation tool can model the pipeline hydraulics to determine the design criteria for surge suppression equipment. Surge effects like water hammer (a pressure wave caused whenever there is a sudden change in flow, as when a valve at the end of a pipeline closes suddenly) can severely damage a pipeline.

- **Protect the pipeline against corrosion**

Most pipelines are painted with special coatings to limit the chance of external corrosion. Corrosion may be further mitigated with a cathodic protection system. Cathodic protection controls corrosion of a metal surface by making it the cathode of an electromechanical cell. This is achieved by placing another more easily corroded “sacrificial” metal in contact with the metal to be protected, to act as the anode of the electrochemical cell. For pipelines, where passive galvanic cathodic protection alone is not sufficient, it’s necessary to use an external DC electrical power source to provide sufficient current. This will typically create a situation of overprotection for parts of the pipeline, something that can be avoided by increasing the number of anodes along the pipeline.

Operation & Maintenance

Once the pipeline is in service, continuously monitoring the operational and structural conditions within the pipeline identifies circumstances that, if not mitigated, could lead to a commodity release. Inspection and monitoring technologies provide pipeline operators with the information they need to accurately assess the health of their pipeline and perform proactive maintenance on “at risk” areas. Some of the more important aspects to monitor and inspect, as well as applicable technologies, include:

“Inspection and monitoring technologies provide pipeline operators with the information they need to accurately assess the health of their pipeline and perform proactive maintenance on ‘at risk’ areas.”

- **Monitor operating pressure**

The pressure or head along the pipeline can vary greatly depending on different factors, e.g., elevation. Having a simulation model depict what is occurring within the pipeline in real time is beneficial. This allows pipeline operators to monitor maximum allowable operating pressures (MAOP) at locations in the pipeline where no physical measurement is available.

- **Inspect the integrity of the pipeline externally**

Advanced non-destructive testing (NDT) methods detect structural damage or degradation in the pipeline from the outside. Ultrasonics or magnetic particle testing are two such NDT methods available in the market today, but there are several others as well. NDT methods uncover anomalies or trouble spots that bear closer inspection by evaluating integrity of welds and alerting operators to corrosion damage.

- **Inspect the integrity of the pipeline internally**

High-resolution in-line inspection (ILI) tools periodically record data about conditions (corrosion, dents, wall thickness) as they move through the pipeline. The data is then analyzed to evaluate the structural integrity of the pipeline.

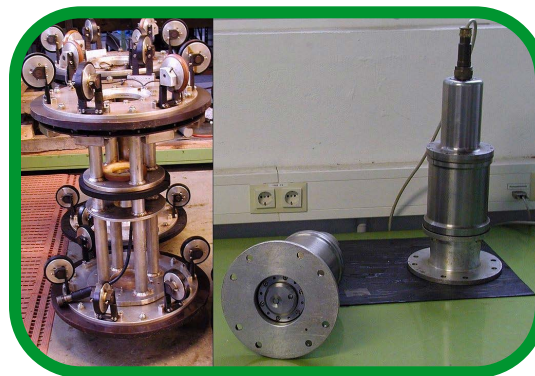


Figure 3

ILI tools used to inspect the pipeline internally

- **Monitor depth of cover**

Pipelines are usually buried to protect the pipeline from general surface activity. The depth of cover depends on both existing regulations and internal pipeline company standards. Electronic equipment is available to assist in monitoring the depth of cover

and could be linked with a global positioning system (GPS) to track the exact location of the pipeline coordinates.

- **Properly calibrate monitoring devices**

Real-time transient models create an accurate hydraulic picture of pipeline operating conditions. These models can be used to compare calculated values (on pressure, flow, temperature, etc.) with actual data received from various measurement instruments. Threshold deviation set points can alert operators via a warning/alarm that a specific instrument may be “drifting” and need calibration.

- **Monitor ground temperature and excavation activity**

Communication for new pipelines is normally provided by a fiber optic cable laid along the pipeline. Modern fiber optic cables have sensing capabilities that could also be used to monitor the ground temperature along the pipeline and give warnings/alerts when the temperature deviates from normal. There are also advanced fiber optic cables available today that allow the pipeline company to monitor if any excavation or similar third-party intrusion is occurring in close proximity to the pipeline.

Other resources

For further discussion about simulator training for pipeline operators, see the following Schneider electric white papers:

[Impact of Oil and Gas Pipeline Simulators on Controller Training and Regulatory Compliance](#)

[3D Virtual Reality Workforce Enablement Technologies for Safer Oil & Gas Operations](#)

Training & Education

Pipeline controllers are in charge of operating some very expensive pipeline assets and should be required to have training or even certification. Training operators on how to recognize situations or conditions that could potentially lead to a commodity release is clearly an important step in prevention. Educating residents living along the pipeline can also help avoid problems. Some considerations to ensure that pipeline operators have the right tools, and other third parties have sufficient information, to prevent a release follow:

- **Leverage operator training simulators (OTS)**

Computer-based simulators for training and evaluation of pipeline controllers are key tools that help improve operational safety and meet regulatory requirements. Enabling the most realistic training experience is essential in making sure the pipeline controller is exposed to both normal operating conditions and abnormal operating conditions.

Figure 4

OTS invoke normal and abnormal pipeline operating scenarios during training sessions

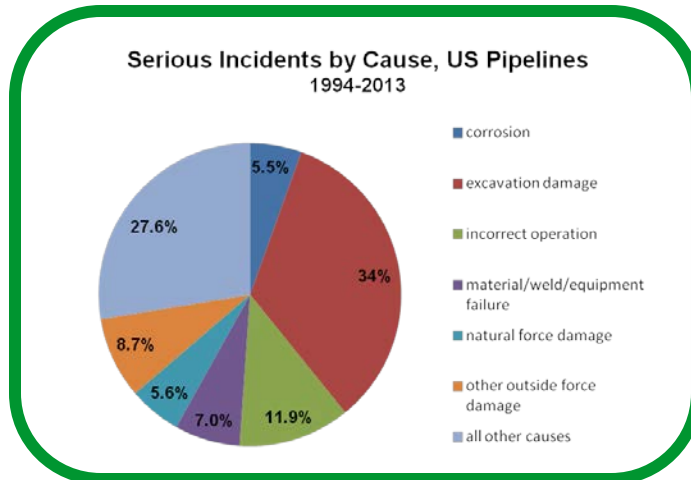


- **Follow best practices for human machine interface (HMI) design**

Most HMI applications are inadequately designed to allow operators to absorb the vast amount of data and then make good decisions quickly. For guidelines on best practices for HMI design that promote “situational awareness,” albeit within the context of industrial plant operations, see the Schneider Electric white paper [How Human Machine Interface \(HMI\) Impacts Business Performance in Industrial Sites](#). More specific guidelines are detailed in the American Petroleum (API) Recommended Practice (RP) publication 1165, “Recommended Practice for Pipeline SCADA Displays.”

- Define alarm management hierarchies**
 Most HMI systems bombard operators with far more alarms than they could ever handle. A well-designed alarm management hierarchy defines different levels of severity, notifying operators only when their intervention is required.
- Avoid inadvertent excavation damage**
 Excavation damage is a leading cause of pipeline incidents — and is a disproportionately larger factor for serious incidents than for all incidents (compare **Figure 1** and **Figure 5**).¹ The pipeline’s right of way should be clearly demarcated with clear and visible signage. A variety of community outreach strategies — flyers, call centers, websites, “Dig Safe” programs — can educate contractors, developers, municipal works departments, and the general public about how to avoid inadvertent damage to the pipeline.

Figure 5
 Causes of serious pipeline incidents in US (1994–2013)



Pipeline integrity: detection

Although moving commodities via pipeline remains the safest means of transport, even the best-constructed and –operated pipelines are at risk of a commodity release. In the United States alone over the past decade, more than 10,600 incidents were reported, with property damage totaling over \$6 billion (€4.75 billion). Even with advances in detection technology, the number of incidents has not decreased significantly as more pipelines are laid (**Figure 6**).² Commodity releases incur liabilities for pipeline operators, with major liabilities usually related to serious incidents where the reliability of the detection system was in question. The ability to notice small changes that could indicate a release and, if a release has indeed occurred, localize the problem or shut down the pipeline quickly is a key component of pipeline integrity.

Figure 6
 The number of US pipeline incidents (1994–2013) remains steady as more pipelines are laid.



¹ US Department of Transportation Pipeline and Hazardous Materials Safety Administration

² US Department of Transportation Pipeline and Hazardous Materials Safety Administration

The tools and technologies for detecting commodity releases after they have occurred can in essence be split in two categories:

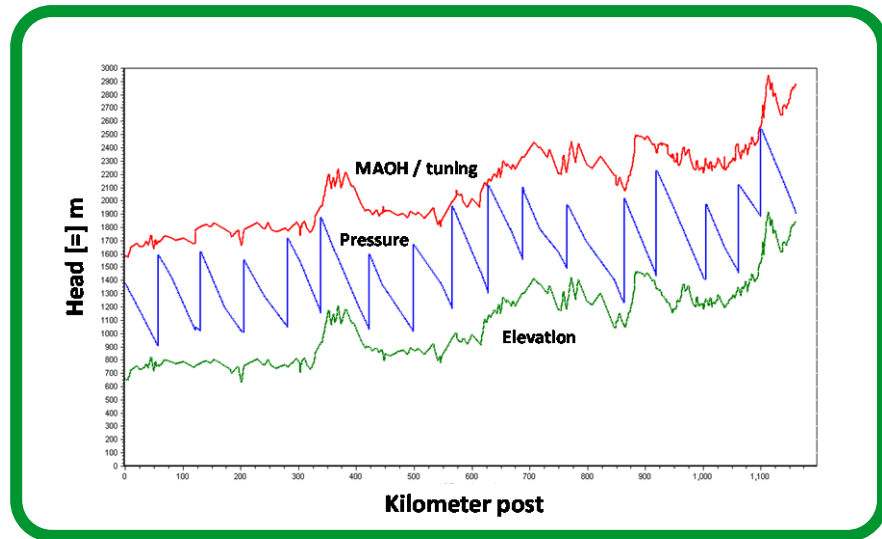
- External-based systems
- Internal-based systems, also called computational pipeline monitoring (CPM)

“Each pipeline is unique, and the specific methodologies used for one pipeline might not be useful for another.”

A pipeline operator could have one or both of these types of detection systems installed on the same pipeline. Each pipeline is unique, and the specific methodologies used for one pipeline might not be useful for another. For example, the hydraulic profile below (**Figure 7**) displays a pipeline that is more than 1,100km (683 miles) long. A pipeline of this length would require different types of detection compared with a pipeline that is only 4km (2 mi.) long. The hydraulic display also shows the head profile for this pipeline (the blue saw-like line), which indicates that this pipeline has at least 16 pump stations and goes over terrain that is gradually increasing in elevation, as seen by the green line at the bottom. A pipeline that goes downhill or over flat terrain would potentially require a different detection methodology.

Figure 7

The most appropriate detection strategy for an individual pipeline depends on its unique characteristics. The pipeline shown here travels over elevated ground (green line) with 16 pumping stations (blue line)



The red line at the top indicates the maximum allowable operating head (MAOH) for this pipeline. The MAOH for a pipeline constructed with different materials would be different from this one, and a different detection methodology might be more appropriate. Notice also that the slope of the blue line occasionally changes, which indicates that this pipeline probably transports multiple products or that the diameter of the pipeline is different in places. All these factors affect which type of detection system operators would choose for their pipeline. No two pipelines are the same, and each needs to be analyzed individually.

“No two pipelines are the same, and each needs to be analyzed individually.”

External-based pipeline detection

External-based pipeline commodity release detection has been around since pipelines were initially used to transport any type of fluid. It essentially involves looking at the external surroundings and detecting the release on the outside of the pipeline wall.

External-based detection systems are increasingly employed because of their ability to detect very small spills and locate commodity releases with a high degree of accuracy. **Table 1** summarizes the technologies associated with external detection:

Table 1

External-based detection essentially involves inspecting the outside of the pipeline using a variety of methods

Type	Technology
Sensing-based	<ul style="list-style-type: none"> Sleeve on outside of pipeline Fiber optic sensing temperature changes Fiber optic sensing distributed acoustic changes, also called DAS fiber optic Acoustic sensors detecting changes on pipeline
Imaging-based	<ul style="list-style-type: none"> Thermal imaging using cameras Imaging using cameras Imaging using satellites/planes
Patrol-based	<ul style="list-style-type: none"> Dogs Car Plane/helicopter

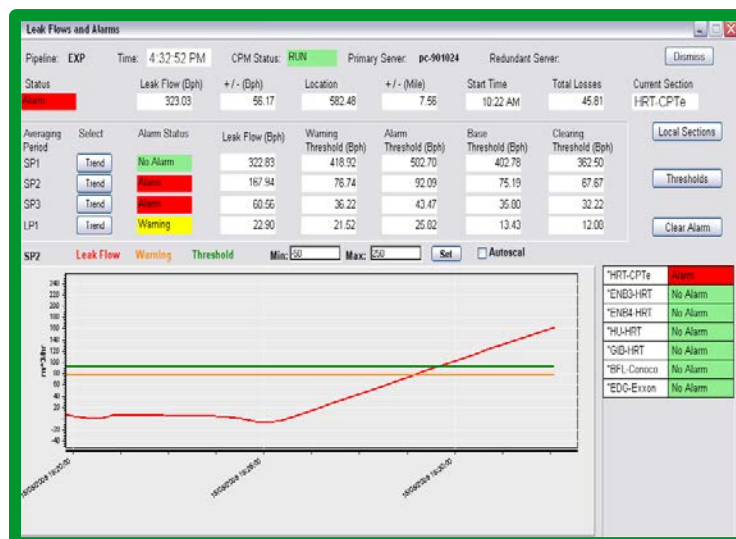
Unfortunately, while external technologies can be retrofitted to existing pipelines, the fieldwork to do so is still relatively expensive, especially so for longer pipelines. However, new and shorter pipelines are increasingly using external technologies to complement internal-based or CPM-based commodity release detection applications.

Internal-based pipeline detection

Internal-based pipeline detection looks at conditions inside the pipeline wall to discover commodity releases. More commonly known as computational pipeline monitoring (CPM), this methodology has been around for about 30 years and uses software that takes a variety of measurements available on the pipeline to establish what is happening within the pipeline. This then lets operators detect anomalies or conditions that could signify a commodity release (Figure 8).

Figure 8

A CPM alarm alerts control room operators of anomalies to defined parameters in the pipeline.



The 2012 American Petroleum Institute (API) Recommended Practice (RP) publication 1130 defines CPM systems as systems that are internally based, utilizing field sensor outputs that monitor internal pipeline parameters such as pressure, temperature, viscosity, density, flow rate, product sonic velocity, and product interface locations. Which parameters are considered and how they are interpreted depends on the CPM method being applied.

The following is a brief description of the five CPM methods in use on pipelines today:

- **Line balance CPM techniques** measure the imbalance between the receipt and delivery volumes. The imbalance is compared against predefined alarm threshold limits for a selected time interval. The capabilities of its simplest form (meter in/meter out comparison) can be enhanced by correcting the meter readings to standard conditions and by compensating for changes in the line pack (amount of commodity actually inside the pipeline) due to temperature and pressure for each product in the pipeline.
- **Real-time transient model (RTTM) CPM** models all the fluid dynamic characteristics, including line pack, slack, shut-in, and transients, under all pipeline flow conditions. This is a very detailed configuration with very fast calculations and the ability to model hydrocarbons in any phase. The RTTM software compares the measured data for a segment of pipeline with its corresponding modeled conditions.
- **Statistical analysis CPM** statistically evaluates pressure and flow inputs that define the perimeter of the pipeline in real time for the presence of patterns associated with a commodity release. A probability value is then assigned to whether the event is a commodity release or not. The degree of statistical involvement varies widely with different methods. An alarm is generated if the statistical changes persist for a certain time period.
- **Pressure/flow monitoring CPM** examines the relationship between various sensors' outputs and applies an algorithm to determine if they indicate an anomaly. Essentially this CPM is what a controller does by nature, looking for unexplained large drops in pressure or flow, but there are applications that look for these anomalies to ensure these large changes are not missed. Please note that when this technique is used for a single variable for pressure/flow rate monitoring, it is not considered CPM.
- The **acoustic/negative pressure wave** technique takes advantage of the two negative pressure, or rarefaction, waves produced when the commodity release occurs and the integrity of the pipeline is compromised. This methodology requires installing high response rate/moderate accuracy pressure transmitters at selected locations on the pipeline. The transmitters continuously measure the fluctuation of the line pressure and transfer data to a central location, where information from numerous transmitters is consolidated and calculations performed to determine if a CPM alarm should be issued.

These five CPM methods can be classified according to two different alarming principles underpinning their detection algorithm:

Conservation of mass methods work on the principle that whatever enters the pipeline must be equal to whatever exits the pipeline, adjusted for change in inventory of the pipeline. The line balance CPM, real-time transient model CPM, and statistical analysis CPM techniques can base detection on this method.

Signature recognition methods consider the relationship of system pressures and/or flows, or recognize anomalies in sensor outputs on the pipeline. The real-time transient model CPM, statistical analysis CPM, pressure/flow monitoring CPM, and the acoustic/negative pressure wave CPM techniques can base detection on this method.

General considerations for evaluating CPM systems

“When selecting a commodity release detection system, it is important to evaluate each pipeline independently.”

No one single commodity release detection system is optimal for the entire range of pipelines operating in widely diverse environments. Different pipelines call for different types of commodity release detection systems. Therefore, a comprehensive analysis is necessary to identify which CPM technologies and methods are best suited for the particular pipeline. A simple A-to-B pipeline route might have simpler operations than a pipeline with many active route connections and elevation changes, multiple receipt and delivery points, and reversible flow. The more complex the pipeline, the more flexible the CPM needs to be to handle all possible operational scenarios.

The following list of key factors to consider when evaluating a new CPM (or re-evaluating a legacy system) for its detection capability should be weighted according to their importance to any particular operation:

- Rate of false alarms and misses
- Sensitivity to pipeline flow conditions such as transients, shut-ins, starts, and stops
- The impact of instrument accuracy and configuration accuracy
- Personnel training and qualification requirements
- Required response time
- Accuracy and precision in estimating location and volume of release
- Ability to detect pre-existing releases
- Robustness/high availability
- Initial cost/tuning costs/maintenance costs

The most important goal in selecting a commodity release detection system is the ability to identify a commodity release quickly enough to mitigate the safety and environmental risk while also meeting the operator’s overall business objective. This includes the potential value of product lost, the cost of clean-up and potential regulatory fines, potential detriment to surrounding environments, and the cost to reputation and potential impact on future projects.

Specific considerations for evaluating CPM systems

In addition to the overall general considerations that need to be taking into account when evaluating commodity release detection systems, some more specific aspects are applicable to particular pipelines.

High consequence areas (HCAs)

High consequence, or high risk, areas are defined as areas where a pipeline commodity release will have a significant impact on people, property, the environment, or all three. HCAs typically demand higher levels of commodity release detection capability and sensitivity to mitigate the higher risk of significant consequences from a release.

Pipeline companies that have pipelines in such HCAs must conduct a more thorough risk analysis and employ additional commodity release detection measures to enhance public safety and protect property and the environment. Some of these measures can be summarized as follows:

- Automated data collection for over-short analysis
- Integrated alarm and status information between connected pipelines
- Use of, or more frequent, operational shut-in tests

- Additional and/or the relocation of instrumentation
- Application or tighter parameters on pressure/flow deviation monitoring
- Higher degree of data integration between operations support applications
- Higher fidelity commodity release detection application
- Multi-tiered commodity release detection approach, where systems work independently of each other

Size of commodity release

API 1149 provides a methodology to determine the theoretical ability of a given commodity release detection application to detect a commodity release of a given size, based on the specifications of a given pipeline. Although an American standard, API 1149 is used around the world either directly or as a baseline for local regulations.

“Pipeline companies can use the API 1149 standard to weigh the cost of commodity release detection systems against the risk of undetected commodity releases.”

While commodity release detection systems do not necessarily need to achieve the lowest theoretical capability as determined by API 1149, pipeline companies can use the standard to weigh the cost of commodity release detection systems against the risk of undetected commodity releases. Further, API 1149 calculations can assist pipeline operators in determining the benefit of specific pipeline infrastructure enhancements to their commodity release detection capability. For example, it can be calculated what increase in commodity release detection sensitivity can be achieved by adding, replacing, or upgrading instrumentation on the pipeline.

Rupture monitoring

Although commodity release detection technology has advanced a long way in terms of detection time and detectable commodity release size, damaging pipeline ruptures and large-volume-release events have still occurred and, unfortunately, been missed. In addition to individual companies taking initiatives to improve their commodity release detection capabilities using the strategies discussed above, the Association of Oil Pipelines (AOPL) has created a Leak Detection Rupture Monitoring project as part of its “Pipeline Leadership Initiative” to develop additional strategies to continue improvements in detection of commodity releases.

A key area of improvement the initiative has identified is executing on the “3R’s”: recognition, response, and reporting. The AOPL has developed performance standards for the industry to follow in this area, with the target goal of 30 minutes for 3R execution (**Table 2**).

Initiative	Duration	Description
Recognize	5 minutes	Recognize a 50% flow change within five minutes
Response	5 minutes	A response to the rupture must come within five minutes of the recognition. Responses can be tailored to particular situations
Report	20 minutes	A report must come within 20 minutes.

Table 2
The 3R’s of detecting a pipeline rupture

While these may seem like basic standards, meeting them is important to the goal of the industry to be “great” in the execution of the 3R’s of rupture detection.

Challenges with systems detecting commodity releases

The uniqueness of each pipeline creates many challenges that might look easy to overcome when selecting a commodity release detection system but become critical factors for its successful implementation. When evaluating the needs and effectiveness of systems for detecting commodity releases, the following factors should be evaluated to determine their impact:

- Batched systems: multiple products, multiple phase products, reversible flow systems
- Transient and steady state flow conditions, turbulent and laminar flow transitions
- Step change product temperature gradients, elevation-induced hydraulic variations (such as over a mountain or under a shipping channel)
- Varying pipeline diameters, telescoping systems, restrictions, block valves, tees, relief systems, control valves, and unique physical characteristics
- Multiple pump configurations: series, parallel, varying and multiple speed, electric and engine drives
- Branch connections and multiple inlets, outlets and partial flow alignments
- Slack line and product separation during static conditions
- Physical properties and hydraulic characteristics of high volatile liquids (HVL) versus crude versus condensate versus refined products, all operated within a single supervisory control and data acquisition (SCADA) console
- Communication outages, variable signal scan and refresh rates, errant signal and data filtering versus non-HCA system variances
- Human factors — operator sensory overload; fatigue
- Varying individual operating procedures
- Employee turnover and limited training time for new controllers
- External and internal resource availability

“The degree to which any of these challenges will be mitigated is directly related to the CPM chosen for the pipeline.”

The degree to which any of these challenges will be mitigated is directly related to the CPM chosen for the pipeline. Others, such as human factors of operator overload and fatigue, will rely on the implementation of control room management, human machine interface, and training best practices.

Minimizing the impact of a commodity release is the third aspect of pipeline integrity. A release is normally classified as either major or minor. Major releases are emergency situations that result from a rupture to the pipeline that would have a negative impact on both the environment surrounding the incident site and the general public. These kinds of incidents require resources from pipeline operators, emergency response personnel, and third-party agencies. A minor release is still regarded as an emergency from a process point of view, but does not require a high level of alertness and mobilization of resources.

Whether the commodity release is classified as a major or minor release the following mitigation process phases would typically be followed:

- **Locate:** The time frame it takes until the physical location of commodity release has been confirmed could be a very short period if the release is found by a third-party person (e.g., farmer in a field). However, normally emergency response teams need to locate the commodity release physically on the pipeline and then start making decisions accordingly. This could range from just minutes to a couple of hours in a worst-case scenario.
- **Recover:** Most of the critical decisions about the containment, routing, or general management of the incident site are made within the first 8 hours after the commodity release.
- **Cleanup:** This phase lasts until the incident site is fully cleaned up. This could take days or even months, depending on the extent of the commodity release.

Pipeline
integrity:
mitigation

Conclusion

All pipeline companies in the world have as their primary goal and concern that the transportation of commodities be safe and reliable. Regulators, operators, and vendors need to continue to invest heavily in detection and mitigation tools and best practices, as commodity releases will continue to happen no matter how strong the prevention measures.

Taking a holistic approach to commodity releases and not looking upon prevention, detection, and mitigation as independent and separate aspects of pipeline integrity benefits the pipeline company, the public in general, and the environment.

Additionally, it is important to realize that there is no optimal “one size fits all” commodity release detection system for all pipelines in every environment. Each pipeline is unique and requires an individual evaluation. Pipeline operators need to weigh business objectives against their threshold for risk. At the intersection of those points is where companies will find the appropriate commodity release detection system solution.

For instance, a sophisticated commodity release detection system may be justifiable for a pipeline in a highly populated area, but impractical in another environment. Different CPM methodologies and external commodity release techniques provide potentially complimentary commodity release detection capabilities, so different methods, or a combination of methods (tiered approach), might be the right fit overall.

The most important goal in selecting a commodity release detection system is to identify a commodity release quickly enough to mitigate the safety and environmental risk while also meeting the operating company’s overall business objective. This includes the potential value of product lost, the cost of cleanup and potential regulatory fines, potential detrimental impact on the surrounding environment, and the cost to reputation and potential impact on future projects.

The following steps are suggested for taking a holistic view of pipeline integrity.

Step 1: Evaluate the activities associated with prevention. Would any of these activities benefit from what is being done in the areas of detection or mitigation?

Step 2: Evaluate detection activities. Is the level of sensitivity per requirements? Or would it be beneficial to upgrade or install a complimentary commodity release detection system?

Step 3: Evaluate the emergency response plan to see if there are any inputs from prevention and detection activities that potentially would be beneficial for emergency response personnel to know prior to their arriving at the incident site.



About the author

Lars Larsson is a Senior Product Manager at Schneider Electric – Global Solutions. He holds bachelor’s degrees in process automation from Telemark Technical College in Norway and control engineering from the University of Sheffield (UK). He is a certified Eur-Ing and has an MBA from the University of Durham (UK) to complement his 22 years of oil & gas pipeline industry experience. He has published multiple articles in global journals focused on pipelines.