**Generic Leak Detection Strategy**

**Instructions:**

This document is intended to be a “Template” that Operators can use to speed implementation of RP-1175 at their companies. As such, Operators are encouraged to modify this document so that it describes **their** strategy. For example, many items are included; some of which may be deleted in any individual plan. Blanks are provided to be filled-in; bracketed items are provided such as [Company Name] so the document can be quickly and easily modified. It will be provided in Microsoft Word format so it can be easily used by others. It is not intended to be a complete and thorough handling of the topic nor will it meet any regulatory requirements. RP-1175 states that “the strategy document may be a single document or divided into multiple documents …”. Users may want to identify and reference other internal documents within the Strategy Document.

**Management Commitment**

[Users: adjust to company general and specific LD goals]

[Company Name] is committed to maintaining and enhancing our leak detection capabilities. While we have already invested a great deal of time and effort toward improving pipeline integrity; thus minimizing some causes of releases, we are committed to the next line of defense which is a robust program of leak detection and timely response.

This Leak Detection Program Manual is an important component of the company’s Leak Detection Program (LDP). Details of the LDP elements are identified in API RP-1175 and include: Culture; Selection of Leak Detection Methods; Performance Targets, Metrics & KPIs; System Testing; Control Center Procedures for Recognition & Response; Alarm Management; Roles, Responsibilities and Training; Reliability Centered Maintenance; Overall Performance Evaluation of the LDP; Management of Change; and the Program Improvement Process.

[Users: adjust to company specific titles and roles]

We are providing and will provide the necessary resources - material, financial and personnel to implement the Leak Detection Program (LDP). This includes:

* A Leak Detection Program Manager (LDP Manager), or designee
* Leak Detection Systems and processes
* Engineers and Technicians to design, install, assess and tune the systems and processes
* Operators and/or Controllers to operate and implement the systems and processes
* Supervision necessary to hire, train, coach, advise, test, qualify, audit, assess, re-train, or remove employees and/or contractors/consultants utilized to implement the Leak Detection Systems (LDSs) and or LDP, and
* Analysts to provide necessary intelligence, including reports.
* Program managers and staff required to implement corollary leak detection functions such as Right of Way (ROW) surveillance, public awareness, corrosion control system and integrity inspections/operations, periodic drills and other such programs which serve to minimize the consequences of releases, whether they be required by regulation or otherwise.
* Technical resources to identify new technologies that can help us improve our leak detection performance.
* Executive and other management resources will be responsible for implementing, assessing and enhancing our systems, people and programs; communication with the rest of the Leadership team and ensuring a culture and strategy that quickly identifies any possible leaks, quickly and appropriately responds to any leak situation and effectively improves response capabilities.

The Strategy Document will be reviewed at the Executive level at least [annually, semi-annually, 3-years, 5-years] with more frequent goal reviews by a Company Steering Committee to ensure the LDP maintains current capabilities and advances the ability to quickly and accurately detect leaks.

[Users: adjust Responsibility Table for specific company requirements]

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**LD Strategy Goals and Requirements**

[Users: adjust to company general and specific LD goals]

The general company and industry goal will be to reduce the number, frequency and volume of releases and improve the timeliness of leak recognition and response. Five-year graphical trends should show ongoing improvement in all categories.

Specific company leak detection goals include the following:

[Users: adjust Responsibility Table for specific company requirements]

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| Control Center | Continuous rupture monitoring | Ongoing |
| Control Center | Leak monitoring using continuous computational methods | Ongoing |
| Control Center Manager | Scheduled surveillance and observational reporting for low leak rate incidents like small or weeper leaks | Annual |
| LDP Manager | Complementary and supplemental methods for specific pipeline requirements | As Required |
| LDP Manager | Alternative, redundant or backup methods when the primary method is not functional | As Required |

[Users: adjust to company general and specific LD goals]

The Leak Detection Program will include assessment of various methods of leak detection including Computational Pipeline Monitoring (CPM), inventory management, aerial patrols, Public Awareness, Control Room Management, Alarm Management, new technologies, etc. Though we don’t plan to change the way we manage various methods of detecting leaks (such as Aerial Patrols managed by the [Department name], for example) we will coordinate our oversight and reporting efforts toward minimizing releases and their consequences through the LD Program.

Each Leak Detection method will have [annual, semi-annual, 3-years, 5-years] goals established at the beginning of each [calendar/fiscal] year. These goals will be reviewed and documented by the Leadership of each responsible area at least twice per year; but typically reviewed monthly.

Leadership will set targets for each performance aspect of the LDP.

False leak indications will be limited to [X] percent per system per year so the confidence in the LDSs is not eroded by too many alarms.

\*\*\*Although the primary measures of leak detection effectiveness revolve around measureable items such as number of leaks or leak volumes; minimizing leak consequences is the actual target. These consequences include minimizing risks to people, property, and the environment, for which the other measures, including response and repair costs are only a proxy.

Our performance targets for number of releases, frequency of releases and volume of releases will have a target reduction of [X] percent per year starting with our baseline values for 2017. Improvements should also be seen in localization, accuracy and/or time to detect measures.

These goals and requirements will be addressed by the application of operational, testing and maintenance procedures and processes. Leak detection operation and maintenance procedures and processes have been developed and will be reviewed and updated [annually, semi-annually, 3-year, 5-year]. Implementation shall be confirmed with ongoing documentation verifying compliance with procedures. Compliance with our procedures should help us reach our goal of minimizing releases.

Performance characteristics of leak detection equipment are included in our procedures and equipment standard specifications.

The LDP Program manager will coordinate with [Engineering] to ensure we are evaluating developing technologies and participating in industry initiatives to validate new technologies and approaches.

**Risk Management Approach to Leak Detection**

[Users: adjust to your specific leak detection risk assessment approach]

The leak detection program uses a risk-based approach to identifying and implementing the leak detection strategy.

Each pipeline shall be reviewed by a risk assessment process with a focus on leak detection requirements. Risk factors shall include:

* Length of the pipeline
* Diameter(s) of the pipeline
* Type of Products handled
* Proximity to a High Consequence area
* Swiftness of leak detection
* Proximity to response personnel
* Leak history
* Other risk assessment results (possibly from the Integrity Management Program)

Using these and/or other measures, a risk score or matrix will be developed for each line, supporting the justification and appropriate application of LDSs.

The application of one or more leak detection methods will be established for each line such that leaks shall be detected as quickly and reliably as possible and in a fashion such that response efforts are initiated immediately. Higher risk lines, in general, should be addressed with applicable leak detection systems with a higher urgency than lower risk lines. Thus higher risk lines will have a higher priority in the planning process when evaluating capital improvements.

It is understood that small leaks may require more time to detect than larger leaks. However, it is our intention to continually improve our ability to detect leaks and minimize consequences.

**Selected Leak Detection Methods**

[Users: identify overall LD methods employed and identify primary system, if any]

The company uses multiple leak detection methods to provide comprehensive and overlapping leak detection capabilities. These methods use different timing, resources and technology to provide a layered leak detection strategy that meets corporate leak detection commitments. This integrated strategy is designed to meet or exceed all regulatory requirements.

At [Company Name] the primary method of leak detection is [CPM], specifically [Name of leak detection CPM system]. This system will be implemented wherever possible unless it will not be effective or possibly unnecessary; especially for short, low pressure lines outside of high consequence areas and/or mixed phase or gaseous commodity throughput. Special care will be taken to ensure that lines with significant elevation changes and/or phase separation situations are adequately instrumented.

The secondary method of leak detection is typically balancing the volume throughput on each line on an hourly basis; typically with the help of simple calculation tools and adequate communication among operating staff at origin and destination facilities.

Other methods of verifying the integrity of our lines will include aerial patrols, physical patrols, our public awareness program, line marking, pressure monitoring, etc.; many of which are required by other regulatory requirements. In many cases, more than one leak detection system or process may be used on a given line to ensure all potential situations are anticipated and addressed.

New technologies will be researched and investigated with an eye toward opportunities to improve our ability to detect large and small leaks as quickly as possible, thus minimizing the adverse consequences of releases.

Any time a system is changed (origin, destination or relocation), or if the operation of a system changes (from low through-put to high through-put, for example), the method of leak detection should be re-evaluated to ensure adequate and appropriate leak detection capability.

All leak detection methods and/or processes will be part of a coordinated effort to ensure leaks of any type are recognized as early as possible and can be responded to as quickly as possible.

[Users: adjust Responsibility Table for specific company requirements]

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**Regulatory Requirements and Industry Standards**

[Users: adjust to company general and specific LD goals]

A means to detect leaks is required by liquid pipelines regulations. For liquid pipelines the reference is 49 CFR 195.452 (i)(3). This is further clarified in an Advisory Bulletin: ADB 10-01. PHMSA has also provided answers to some Frequently Asked Questions (FAQ’s) and items 9.4, 9.5 and 9.6 relate to leak detection.

The pipeline industry has developed a number of Recommended Practices to assist in the process of developing safe and effective leak detection systems and processes including:

* API RP 1175 – Leak Detection Program Management
* API RP 1173 – Pipeline Safety Management Systems
* API RP 1130 – Computational Pipeline Monitoring for Liquids
* API RP 1149 – Pipeline Variable Uncertainties and their Effects on Leak Detection Sensitivity
* API RP 1160 – Managing System Integrity for Hazardous Liquid Pipelines
* API RP 1162 – Public Awareness Programs for Pipeline Operators
* API RP 1167 – Pipeline SCADA Alarm Management

It is [Company Name]’s obligation to meet regulatory requirements and many reasons to exceed these requirements. Further, it is in our best interest to do everything possible to minimize product losses, minimize environmental contamination and maximize the safety of our people and the public.

[Users: adjust Responsibility Table for specific company requirements]

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**Testing the LDS, LD KPI’s and Evaluating the LDP**

[Users: adjust to company general and specific LD goals]

Each primary LDS is tested when implemented, after significant pipeline changes and on a regular [maximum 5 years] basis. Testing is designed to meet the requirements of API-1130 and is completed using a detailed test plan tailored to the specific pipeline LDS. Systems may also be tested there is any indication of a problem meeting the expected performance.

Alternate or complementary systems should be evaluated as well and corrective action taken if outside action limits established by the vendor or Engineering, and as referenced in the LDP Reporting section.

The company has defined operational performance targets for the primary leak detection methods. The performance targets are defined using the four performance metrics defined by API-1130. These include leak detection sensitivity, reliability, accuracy and robustness. These targets are defined by corporate specifications based on engineering estimation and observational responses. The performance targets are specified in the operational plans and manuals for the primary leak detection system.

Operational performance targets are measured using metrics based on Key Performance Indicators (KPIs) that result from pipeline operations or by testing of the leak detection methods. Operational KPIs include:

1. LD sensitivity: [identify composite metrics used such as minimum leak detection capabilities, response times]
2. LD reliability: [identify metrics used for leak event indicator such as false alarm rate]
3. LD accuracy: [identify metrics used such as leak-flow rate, leak size, leak location]
4. LD robustness: [identify system response metrics such as system failures]

Operational KPIs are used to monitor and assess specific leak detection methods and systems.

The overall LDP is evaluated annually, not to exceed 18 months. Leading and lagging evaluation metrics are used by the company to evaluate the overall performance of the Leak Detection Program. The leading metrics include Level 1 and Level 2 KPIs which are collected after events and are used to benchmark against industry performance. Level 3 and 4 are internal leading operational KPIs that are used to assess performance and to drive LD improvements. Key information in the form of Metrics will be provided, according to the following list:

[Choose and adjust the ones that apply; delete the ones that don’t]

* Level 1: most significant lagging indicator(s);
	+ Barrels per reportable leak event where CPM was in service
	+ Estimated clean-up costs per reportable leak event
	+ Time between leak event and LOC alarm per reportable leak event
	+ Pipeline Controller’s shut-down percentage due to leak alarms
	+ Number of reportable leak events
	+ Percentage error in identifying leak location
	+ Number of false negative leak alarms attributable to reportable leak events
* Level 2: KPI’s associated with incidents that do not meet significant incident threshold;
	+ Barrels per non-reportable leak event where CPM was in service
	+ Estimated clean-up costs per non-reportable leak event
	+ Time between leak event and LOC alarm per non-reportable leak event
	+ Pipeline Controller’s shut-down percentage due to leak alarms
	+ Number of non-reportable leak events
	+ Percentage error in identifying leak location
	+ Number of false negative leak alarms attributable to non-reportable leak events
* Level 3: Leading indicators of operational performance;
	+ Percentage of leak alarms analyzed, rationalized, addressed and documented
	+ Number of non-leak alarms produced by CPM system(s)
	+ Amount of time each/any LDS is in alarm state (if operating)
	+ Percentage of total pipeline covered by continuously monitored LDS
	+ Percentage mileage covered by LDSs meeting design criteria
	+ Percentage of time that each/all LDSs are available during operations
	+ Number of tests conducted on each/all LDS’s per year
	+ Percentage of LDS mileage without tuned (or retuned) thresholds
	+ Percentage of LDSs that undergo an annual review of alarms
	+ Percentage of false leak alarms attributed to communication, metering, instrumentation or other causes
	+ Number of times per year that a given LDS has needed to be re-tuned
* Level 4: KPI’s that indicate proactive operating discipline and management system performance.
	+ Percentage of Pipeline Controllers trained/qualified on use of the LDS, annually
	+ New information on leak causes is included in the annual review of the LDP
	+ Average time to correct an instrument malfunction that may impact an LDS
	+ Percentage of MOC items that are included in Pipeline Controller Training
	+ Leak detection staffing levels per mile of operating pipeline
	+ Percentage of LDSs where alarm settings are reviewed and confirmed on an annual basis

The review will include a review and comparison of the performance of other Operators on as many of these characteristics as possible. The API Gap Assessment Tool (GAT) may be used along with other information from PPTS, PHMSA, consultants, etc.

The health of the leak detection program, and associated culture should be assessed and/or tested at least every 5 years, typically by an independent third party, [identified, qualified and approved by the LDP Manager] and include a review of industry best practices. The information will be reviewed with the [Steering Committee] other Stakeholders, including support staff and [Executive Committee, Leadership Team] as needed.

[Users: adjust Responsibility Table for specific company requirements]

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**LDS Tuning and Support**

[Users: adjust to company general and specific LD goals]

Leak detection systems will be reviewed [annually, bi-annually, 3-years, 5-years] and adjusted or tuned if errors or gaps are identified. The objective is to maximize the sensitivity of each system while minimizing false positive alarms. The review and adjustment process is described in the LDS manuals.

Support personnel, including engineers and technicians will be provided, according to the following table and supplemented with vendor and contractor support as required.

[Modify table for your specific situation, Titles and Organization] Should be consistent with Company LDP RACI diagram.

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| **Position** | **Department** | **Task** |
| LDS Engineer | SCADA | Operate, maintain and test LD systems |
| LD Technician | Operations | Ensure LD equipment is properly installed, maintained and periodically tested |
| LD Analyst | Operations | Analyze leak alarms  |
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**LDP Reporting**

[Users: adjust to company general and specific LD goals]

The LDP will include regular reporting of LD metrics and KPIs to monitor performance and to guide overall assessment and improvement planning. Reporting will be completed for both internal stakeholders and for external industry and regulatory stakeholders.

Monthly internal reporting shall be prepared by the LDP Manager, made available to the Steering Committee and published to the identified Stakeholders.

External reporting will be completed to meet regulatory requirements and to help benchmark and improve industry performance. Annual reports the PHMSA and PPTS shall be provided according to our usual process, but will include information on LDSs as indicated. Further, an annual update to our compliance with API RP 1175 using the Gap Assessment Tool will be submitted to PipelineLDP@API.org .

Annually, or when information is available from the PPTS process, we will review our performance against the industry. The LDP Manager, or designee will obtain the information and prepare the report for review.

[Users: adjust Responsibility Table for specific company requirements]

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**Procedures and Training**

[Users: specific procedure and training documents should be identified in this section]

Procedures for Control Center response to LDS alarms are implemented and are reviewed on a regular basis. All LDS alarms are initially considered valid and are then assessed using a root cause analysis procedure. LDS alarm management procedures comply with regulatory requirements.

Procedures for implementation, use and maintenance of the Leak Detection Systems will be maintained according to the Company program of annual review by Subject Matter Experts (SMEs); according to our usual requirements. New procedures for new systems or to meet new requirements will be developed ahead of first-use, in-time to develop training programs and have the necessary individuals and Stakeholders trained and/or qualified.

Training will be provided at various levels to meet the needs of various parties including:

Role and Content of Training

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| **Role** | **General Training Content** |
| Management | Culture, Management, Reporting, Broad Operational and Broad Technical  |
| Control Center | Culture, Management, Reporting, Detailed Operational and Broad Technical |
| Analyst: Leak Detection Staff | Culture, Management, Broad Operational and Detailed Technical |
| Engineering: Support Staff | Culture and Detailed Technical |
| IT Group | Culture and Detailed Technical |
| SCADA Support | Culture and Detailed Technical |
| Field Operations: Field and ROW Staff | Culture, Reporting and Area-Specific Technical |
| Field Operations: Connecting Facilities Staff | Reporting and Area-Specific Technical |
| Public: External Response | Reporting and Area-Specific Technical |
| Public: Government Agencies or Regulators | Culture, Reporting, Broad Operational and Broad Technical |
| Public: Land Owners / ROW Users | Reporting |

The [Manager of the Training Department] will ensure that the information is periodically updated and the LDP Manager will provide the necessary information whenever any significant [need to define] change is being prepared.

Pipeline Controllers, Field Operators, Maintenance Technicians and others involved in operation or maintenance of the LDSs will be qualified and/or requalified as required by regulation or company standard and have their work audited according to the work-audit schedule developed in accordance with company requirements.

[Users: adjust Responsibility Table for specific company requirements]

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**Management of Change[[1]](#footnote-1) (MOC)**

[Users: specific MOC documents relevant to LD should be identified here]

Management of Change (MOC) will be used to identify, evaluate, communicate, manage, and document the impact of changes to pipeline systems, terminals and processing facilities that may affect safety, integrity, operations or the environment. This document addresses the following changes whether they are temporary or permanent:

•   Physical Changes

•   Organizational Changes

•   Technological Changes

•   Procedural Changes

Implementation of these procedures will ensure that safety, integrity, environmental, and operational concerns arising from a proposed change are properly addressed.

The MOC process includes consideration of the following:

•   Reason for the change;

•   Analysis of implications;

•   Acquisition of required permits;

•   Documentation of the change;

•   Approval authority for the change;

•   Communication of the change to affected parties;

•   Timing of the change;

•   Qualification of staff necessary to implement the change.

**Significant change:** May be any change that qualifies [define significant change] including Organizational, Physical, Procedural or Technological changes, as further defined following:

**Organizational Changes:** Adding/Deleting/Modifying items listed below, including but not limited to:

•   Changes to Departments and/or re-alignment of responsibilities

•   Changes in personnel involved in the MOC process such as the Change Administrator, Evaluating Responsible Parties, or MOC Committee members

•   Changing operational responsibilities between Pipeline Controllers and Field personnel

•   Changing operational responsibilities to or from a third-party operator

•   Purchase or sale of physical assets

**Physical Changes:** listed below, including but not limited to:

•   Changes to operating parameters, including MOP changes, (temporary or permanent) of facility/equipment (pressure, temperature, tank levels, etc.) outside their normal operating range

•   Changes that involve adding, deleting, retiring, idling, abandoning, purchase or sale of equipment or changing materials other than replacements-in-kind

•   Changes that involve different product slate, injection points, storage or delivery of products outside normal operations for a specific facility

•   Changes to the programming logic that regulates monitoring, control, safety systems or prover calibration of a specific facility or piece of equipment including SCADA changes to specific equipment

•   Field maintenance activities or changes of a temporary nature that can have a significant impact on operations such as prover calibrations

•   Conversion of assets service from natural or other gas to liquid petroleum products or vice versa

•   Changes from assets being DOT jurisdictional to non-DOT jurisdictional or vice versa

**Procedural Changes:** Significant changes to Operation and Maintenance, Integrity Management, Operator Qualification, Control Room Management, Safety, Environmental, Security, Emergency Response, Welding, Corrosion, and Damage Prevention manuals, procedures, and related training

**Technological Changes:** A change that affects multiple facilities (pipeline, terminal and/or processing), including, but not limited to:

•   Global changes to control system parameters (i.e. control valve operation, surge, PLC, (CPM Leak Detection System), SCADA system changes, etc.)

•   Implementation of a new technology for assessing pipeline, terminal, or processing facilities in Company’s Integrity Management Program

•   A significant change to Company’s Integrity Management risk assessment program

[Users: adjust Responsibility Table for specific company requirements]

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**Ongoing Improvement to the LDP**

[Users: adjust to company general and specific LD goals]

Periodic reviews with the [Steering Committee] other Stakeholders, including support staff and annual reviews with [Executive Committee, Leadership Team] will enable the LDP Manager to present information on: program performance, evolving regulations, potential enhanced technologies, industry best practices, etc. At a minimum the reviews must include specific areas where the [Company Name] should focus to improve the leak detection program enhancements including:

* Evolving industry best practices
* Improving/enhancing existing LDS(s)
* Studying existing LDS to determine how they may be improved/updated
* Research and development activities
* Develop an LDP above minimum requirements
* Implementation of enhanced ROW surveillance
* The use of more complex LDSs such as external leak detection
* Implementing complementary LDSs
* Enhancements in the Control Center
* Enhanced maintenance and sustainability requirements.

[Users: adjust Responsibility Table for specific company requirements]

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**LDP Review and Approval**

[Users: adjust to company general and specific LD goals]

The LD Program Strategy Document will be reviewed by the [President, Vice President General Manager] [Operating, Engineering or other Department or Title] at least annually and at least quarterly goal reviews with the [Steering Committee, Leadership Team, Executive Committee] to ensure we maintain our current capabilities and advance our ability to quickly, reliably and accurately detect leaks. .

IN WITNESS HEREOF, [Company Name] has duly executed this Agreement to be effective as of the day and year first above written by the officers listed following. This program will be reviewed annually.

By:

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Title: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Appendices**

**Company Assets**

[Users: adjust to company general and specific assets – List here or in an Appendix]

This should include pipelines outside regulated facilities, but may include other assets the company chooses to include in the program.

(May already be developed as part of the Company Integrity Management efforts.)

**Company Asset Specific Risks**

[Users: adjust to company asset specific risks – List here or in an Appendix]

Asset specific risk, while not excluding the risk assessment(s) referenced earlier, should include significant risks of note. These may require special resources or requirements for managing the associated risks.

(May already be developed as part of the Company Integrity Management efforts.)

**Company’s Operational Constraints**

[Users: adjust to company specific constraints – List here or in an Appendix]

Operational constraints may involve specific or general operating or situational characteristics that pose additional risk and/or may not be mitigated by standard or typical methods.

(May already be developed as part of the Company Integrity Management efforts.)

**List of Leak Detection Technologies**

[Users: adjust to company asset specific risks – List here or in an Appendix]

This should be a listing of leak detection technologies, which may or may not be used by the company, but reflect technological or practical advances in the industry.

1. Pipeline Operators shall apply their formal MOC process as required in 49 CFR 195.446(f). The MOC process should include the requirements of API 1167, Section 11 and API 1160, Section 13. The Requirements of the two API documents may be tailored to accommodate the unique aspects of LDSs including the Who, How, What and Where. Changes to any aspects of the LDSs (technical, physical, procedural, and organizational) should follow the Pipeline Operator’s formal MOC process. [↑](#footnote-ref-1)