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Pipeline Components Traceability

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2012 is likely to be remembered as a pivotal year for U.S. pipeline safety regulations. On January 3, the Pipeline Safety, Regulatory Certainty, and Job Creation Act was signed into law to amend Title 49 of the Code of Federal Regulations (CFR). Specific changes will include new requirements for pipeline operators to provide geospatial and technical data for pipeline components. Operators will also be required to verify records to ensure they accurately reflect physical and operational characteristics to confirm established maximum allowable operating pressures (MAOPs). This follows exactly one year after the National Transportation Safety Board (NTSB) issued urgent safety recommendations that pipeline operators use "traceable, verifiable, and complete" records for determining valid MAOPs based on the weakest section or component of pipelines to ensure safe operations.

At the pipeline component level, this means operators may need backward traceability to identify when a suspect component was installed, inspected, and maintained, as well as where and how it was manufactured, tested, received, and stored before installation. Operators may also need forward traceability to identify all locations where material from the same batch as a "suspect" component is installed or in inventory.

Current pipeline safety regulations focus on parts marking and record keeping for testing, operations, maintenance, and integrity management—but not for component traceability. Consequently, pipeline operators are not likely to have the full capability to trace specific pipeline components using heat or serial numbers, making it difficult to pinpoint the original source of these components.

Given the regulatory uncertainty and lack of standards, how should pipeline operators proceed?

Drawing lessons from relevant regulated industries

Other regulated industries that have established best practices in components and materials traceability offer valuable lessons for gas-pipeline operators (see Table 1). In the nuclear power industry, for example, many power and utilities companies already have robust materials traceability processes and systems in place for nuclear safety-related and quality-augmented materials. These processes and systems can serve as starting points for pipeline operators. A good example is the batch-management functionality in an Enterprise Resource Planning (ERP) system used to capture unique traceability codes (UTCs) in electronic records for all material transactions.

Table 1: Regulated industries: Best practice keycapabilities

Industry	Key capabilities
Nuclear	Batch management
Aerospace	Configuration management
Medical devices	Certification and record maintenance

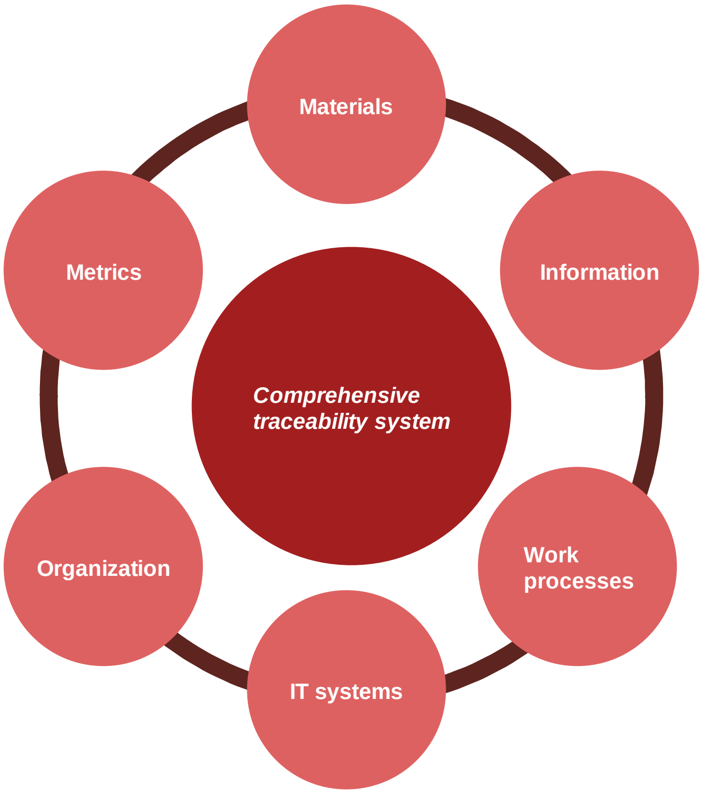
Traceability processes in the aerospace industry, which is also governed by the NTSB, focus on configuration management for aircraft components. Some of the industry's practices—for instance, strict limitations and controls on design modifications—could be applied to gas-pipeline construction.

The medical device industry offers lessons as well. Safety procedures in this industry focus on initial certification and maintenance of records for materials that cannot easily be inspected after installation in the human body (think pacemakers and arterial stents). Such materials may reside within a patient's body—an environment rife with unknowns and uncontrolled hazards—for years. The analogy between medical devices and gas pipelines is strong: Pipeline materials reside underground, and operators must act swiftly to address potential risks without first being able to dig underground and diagnose what's there.

Establishing a comprehensive traceability program

To build comprehensive capabilities for pipeline components traceability, operators must make changes in six dimensions: materials, information, work processes, IT systems, organization, and metrics (see Figure 1).

Figure 1: Six dimensions of a comprehensive traceability system



Dimensions may need to be tackled simultaneously, so implementing a traceability program requires effective planning and coordination. The following guidelines can help:

Materials Operators should define which materials require traceability by identifying components whose failure to perform as specified would pose a potential threat to public safety or pipeline integrity. These components should include pressure-bearing materials, such as pipes, valves, valve actuators, fittings, flanges, mechanical couplings, repair sleeves, and weld rods. Material specifications should be reviewed to determine both potential issues for materials installed in the past and how to strengthen part marking requirements moving forward.

Information Traceability data should be comprehensive, providing complete tracking information for components critical to pipeline performance across end-to-end gas transmission and distribution work processes; accurate by capturing, maintaining, updating, and reviewing so that it correctly reflects actual sources, locations, conditions, and usage for gas-transmission components; and available for regular reporting and quick access by individuals throughout the organization. Many operators are now reviewing pipeline records to validate MAOPs and to upgrade records and information management practices. These efforts should include a focus on component traceability information – both historical records and future improvements.

Work processes Work processes that involve the procurement, receipt, inspection, storage, delivery, construction, maintenance, and removal from service of gas pipeline components should be included in a traceability improvement plan. Work processes should be simple (leveraging existing processes to reduce change management requirements) and clear (defining the required inputs, activities, outputs, and roles and responsibilities for each process step). Work process improvements may be as simple as adding a field to existing bills-of-materials, as-built drawings, or weld maps to record traceability codes.

IT systems IT systems should support the end-to-end collection, organization, and maintenance of unique traceability codes in electronic purchasing, receiving, inspection, and work order records. Otherwise, operators won't be able to easily locate all segments from a problematic manufacturing batch that have been installed in remote locations throughout their pipeline systems. Power and utilities companies could also use bar coding, radio-frequency identification (RFID), and mobile devices to eliminate manual data entry and enable the easy capture of traceability information in the field. Further, fully integrated IT systems can provide the ability to search for records by specific traceability information across multiple systems (e.g. document management, GIS, ERP).

Organization All functions that support gas pipelines should be represented in component traceability plans. These include gas transmission and distribution (engineering, operations, construction, maintenance, mapping, and estimating); shared services (sourcing, procurement, quality, and materials distribution); IT groups that manage traceability data; and suppliers, distributors, and pipe installation contractors. Some utilities have chosen to centralize responsibility for pipeline information management in a dedicated asset knowledge management function. Each player generates specific and disparate information—all of which needs to be pulled together to create a complete picture.

Metrics Quantitative metrics should be used to help operators evaluate the effectiveness of their traceability efforts. Metrics should be defined to enable regular assessment of the quality of process documentation, actual compliance with established procedures in the field, accuracy of component traceability information, and response time for traceability inquiries and reporting requests. Quantitative traceability metrics can also be leveraged for pipeline risk and threat analysis. While many utilities leverage internal audit programs to evaluate documentation quality for regulatory compliance, electronic records and mobile technology now enable automated review of key data to identify and prioritize exceptions for supervisor review. These technologies can also be leveraged for daily or real-time reporting of data quality metrics such as defects per opportunity.

Setting the stage for next-generation pipeline operations

Gas-pipeline operators must move swiftly to address the regulatory demands confronting them. To successfully establish a comprehensive traceability program, changes made to the six dimensions should complement one another and address both historical issues and forward-looking improvements to produce the intended outcome. This kind of harmonious effort requires careful coordination. Operators should first conduct a complete review of which components need to be traceable to support gas operations and integrity management. Then, they need to develop a comprehensive traceability improvement roadmap to identify investments, sequence projects, and coordinate change management planning. Immediate improvements also need to be identified and implemented to improve traceability practices for all new field work to capture and maintain complete data on pipeline components going in the ground now. Finally, traceability improvements and MAOP validation activities should be aligned within a broader corporate records and information management program.

The gas transmission and distribution industry is in a transition period—one that will soon lead to an era defined by stronger pipeline safety regulations. Operators that act now to build up their traceability capabilities will be better prepared to comply with the NTSB recommendations and stay ahead of upcoming changes to Title 49. Most critical, they will position themselves at the forefront of the next generation of pipeline operations.

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