A NEW TREND FOR PIPELINE INTEGRITY MANAGEMENT: GIS AND RISK-BASED ASSET MANAGEMENT INTEGRATION
DYLAN SCHRADER
Dylan Schrader is a graduate from Texas A&M University and holds a B.S. in Aerospace Engineering. He has more than 10 years of experience managing and executing operational maintenance programs in a variety of industries, including O&G. At PinnacleART, Dylan specializes in facility MI assessments and builds MI/RBI implementation plans for current and prospective clients in order to help them optimize costs, reduce risk, and increase their compliance with safety regulations.
INTRODUCTION

Pipeline integrity is critical to ensure maintenance and operational efficiency; however it is becoming an increasingly challenging task for the energy industry. Maintenance managers and inspectors must make sure their pipeline(s) and its associated equipment meet strict integrity requirements and comply with regulations in order to avoid unnecessary downtime and mitigate safety and environmental risks. They must do this while working with increasingly tight budgets.

Any breach of integrity, such as loss of containment, could result in major consequences for a company, including costs from lawsuits and environmental violations, safety hazards, toxic risks for local communities, loss of revenue, damage to the relationship with their client, and a complete shutdown of the pipeline altogether.

Pipeline integrity management relies heavily on current pipeline data and information. For data consistency among operators, Pipeline Open Data Standards (PODS) has been developed and is being adopted as the data architecture frame of reference. Yet, management still has many concerns, such as how to ensure the information and data are readily accessible so the operator can make better-informed repair and replacement decisions. Also, how to ensure the associated inspection and maintenance tasks have been accomplished safely, efficiently, and effectively?

For many pipeline operators, the answer to these questions is quite complex. New pipeline integrity management requirements are having an immediate impact on record-keeping and data management and analysis for pipeline operators. Records must now be traceable, verifiable, and complete. If not, response to an emergency or a regulatory audit could spell disaster for the company.

CURRENT INDUSTRY CHALLENGES

When it comes to managing the integrity of a pipeline, no area is more important than knowing you have accurate and up-to-date data, information, and decision-making processes in place. However, pipeline operators are consistently faced with the following challenges:

Regulations and Historical Asset Management Practices

Governmental, environmental, and organizational mandates drive pipeline operations to comply with integrity regulations, which ultimately place a substantial burden on the operator’s maintenance and inspection departments. As these departments continue to build their practices around these requirements, they can often find themselves with a disorganized and inefficient set of practices that costs the company unnecessary manpower hours and system interruptions.

Ample Data Sources

Figure 1 is a schematic that shows the different information sources that a Pipeline Integrity Management Systems draws from. One challenge is to maintain consistency throughout the operator’s organization so that when making integrity decisions the correct information can be accessed in a uniform manner.

This is one of the main challenges when it comes to ensuring pipeline data is traceable, accessible, verifiable, and complete. Many times, asset software programs, such as Enterprise Resource Planning (ERP), Computerized Maintenance Management Systems (CMMS), and Pipeline Integrity Management Systems (PIMS) are housed separately and do not effectively communicate with one another. Additionally, organizations can be susceptible to “silo” development, which means that each department is working independent of one another, which can add complexity to data and information management.

Sifting through mountains of data and tracking down the appropriate personnel to find a simple answer to a question could take time and resources you may not have during a crisis or emergency. Also, managing many sources of data across various systems can create a potential for errors and inconsistencies across those sources.

Data Inefficiencies

A consistent issue for pipeline operators is that data can be outdated or inaccurate within software programs, leading to endless lost-time. Geographical Information Systems (GIS) is a solution that can help operators organize data, serving as a single repository for information as it relates to specific geographic locations. GIS has many advantages; for example, the ability to document and associate specific data with high-consequence areas (HCAs) can facilitate preventive actions like avoiding dangerous
excavation, eliminating wasted time and resources “searching” for a specific pipe section, and aiding appropriate emergency response. For these reasons, GIS is becoming an increasingly important tool for pipeline operators.

ADDRESSING THE CHALLENGES
A step-by-step process to managing the data will help operators maintain optimal asset integrity control.

**Step 1: Organize asset data**
The abundance of data obtained and managed throughout the lifecycle of a pipeline can be overwhelming. Additionally, good data management and analyses practices can only be defined and executed efficiently if asset data is organized appropriately. There needs to be heavy focus on common data structure and ensuring that all data flow is managed consistently. While there are many potential solutions to data management issues existing in the industry today, the focus needs to center around a standardized data structure such as PODS, or specific ERP/CMMS requirements. This will provide the foundation for effective data gathering, storage, and management in order to make more informed and accurate decisions over the operational life of the pipeline.

**Step 2: Integrate asset data and management processes**
To capitalize on improvements within data structure and foundation, it is important to ensure all of your data sources are linked and updated. This is vital to reduce downtime and errors caused by data misalignment. Information should be housed in a “one-stop shop” location. Because pipeline operators are susceptible to constant geographical and operational changes, it is difficult to manage the entire system efficiently and abide by specific regulations. This is where GIS can help. GIS can help support data recording, measurement, and analysis of this dynamic pipeline information throughout the system. By integrating specific pipeline design information, such as size, coating, construction, and metallurgy, along with pipeline routes and topographical data, companies can run at optimal efficiency when making construction, maintenance, and inspection decisions.

**Step 3: Implement a Risk-based Management model into your pipelines’ integrity management system**
Risk-based analysis is incredibly useful for prioritizing resources towards the most critical locations (higher risk areas) and is a driving factor for all asset maintenance and inspection activities. Currently, risk-based analysis is the future of the industry because it is the most efficient way to manage your assets. It can assist in increasing compliance, optimizing cost, and ultimately mitigating risk. By using solid data management practices and GIS, in conjunction with a risk-based management model, pipeline operators can understand all factors affecting their pipeline(s) and associated assets. Thoroughly understanding factors such as environmental hazards, safety concerns, and business/economic impact will assist in forecasting and predicting failures and issues before they occur, not after.

**CONCLUSION**
As the pipeline industry continues to evolve, so too will new regulations, operational processes, and management practices to keep up with the latest technologies. Organizations that capitalize on progressive ideas and technological advancements, such as GIS and risk-based models, will see themselves move to the forefront of the pipeline industry.

For more information on this subject or the author, please email us at inquiries@inspectioneering.com.
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