Biographical Information

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Product manager
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Specific Responsibilities

Mr. Zamarin is responsible for the management of integrity and data management related products at GE Energy, a leading provider of oil and gas operations and maintenance products and solutions. Prior to joining GE, he was responsible for the technical management of pipeline integrity programs for panhandle energy. He is an engineering specialist in the areas of pipeline integrity, metallurgy, facility design, pipeline operations and maintenance, failure investigation, regulatory compliance, asset integrity management, risk management, corrosion, and stress corrosion cracking (SCC). Mr. Zamarin has actively participated in and led industry research efforts in integrity management, pipeline materials, corrosion, SCC, mechanical damage, pressure testing, in-line inspection, welding and non-destructive testing. In addition, he has worked with pipeline regulators, professional consultants, and other industry experts in the development of numerous standards and technical papers related to the design and operation of gas and liquid pipelines. Mr. Zamarin has been responsible for the investigation of several significant in-service pipeline incidents, the construction of over 1,000 miles of large diameter natural gas pipelines, and has worked closely with pipeline regulators and other industry experts to identify failure causes and ensure pipeline safety and reliability for new and existing pipeline systems.

Educational Information

B.S. – Metallurgical Engineer, Purdue University
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A PRACTICAL EXAMPLE OF GIS APPLIED TO THE INTEGRITY MANAGEMENT PROCESS

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ABSTRACT

Integrity Management relies heavily on the analysis of accurate spatial data and the controlled and consistent implementation of maintenance and mitigation activities. In addition to integrity-related data (above-ground survey and in-line inspection data), other data such as facility and environmental data are required for that analysis. GIS provides an ideal platform to store and spatially analyze that data.

This paper provides an insight into how to apply your GIS to the integrity management process and information lifecycle in order to not only maximize the value of your investment but to also ensure that data is controlled and managed in such a way that decision making is simplified.

Using practical examples of real pipeline situations supported by discussion on the latest techniques for system integration, this paper establishes a clear explanation of how efficiency and consistency can be brought to common integrity management processes such as risk assessment, data collection, response planning and in-field work activity management. Furthermore, the critical role that GIS and data management systems play in performance measurement and documentation of integrity strategies is presented.

INTRODUCTION

The integrity management process is a combination of sub-processes that involve an information cycle of collection, analysis, response and communication. GIS systems can be used to manage this information lifecycle, enabling the documentation and communication of the integrity management process. This paper provides a practical example of the execution of an integrity management plan on a pipeline segment through the use of a GIS data management system integrated with data collection, analysis, and reporting tools.

As a first step in the integrity management process, a GIS system facilitates the identification of a segment as affecting a high consequence area. Next, GIS based threat identification and risk assessment systems are employed for the identification of the threats to which the segment is susceptible and the risk ranking of the segment relative to all other segments. Threat specific integrity assessments are performed, the data from which is loaded and analyzed within the GIS system. Appropriate response is executed and the results of field investigations and repairs are loaded into the GIS system. Once repairs are completed, a summary of the activities on the pipe segment is generated and is communicated to multiple stakeholders including operating personnel and regulators.

Pipeline operators are being challenged by their stakeholders to turn the expense of integrity management into an investment. This daunting task implies that a reasonable return is expected for pipeline assessments and maintenance. However, with many pipelines already exceeding initial design life, one might speculate that every year of replacement avoidance is already delivering a very generous return. The focus of this article is not to reduce integrity expenditure but to discuss how applying information technology can improve the assessment and maintenance program proficiency by streamlining processes and driving towards more effective mitigation practices, which will further extend the pipe asset life and improve safety.

Pipeline inspections generate an enormous amount of data that needs to be transformed into information. The operator in turn must evaluate this information to ascertain which of the reported features or anomalies are actually defects that may or may not require immediate attention. They must, also, document their plans to address those features that need to be either scheduled for future repair or monitored until the next inspection. Post inspection activities such as inspection validation and direct examinations also generate data that needs to be collected and analyzed to validate inspection results, support repair decisions, establish re-inspection intervals, and drive mitigation strategies.

In several cases, information technology has been applied in the form of an innovative decision support solution, which will be referred to in this article as a ***Feature Management System*** to aid pipeline operators in tracking feature-related data, and in performing defect remediation and risk mitigation planning activities. Effective feature management processes are essential to ensure the continued integrity of the pipelines, improve efficiency, reduce unnecessary expenditure and achieve demonstrable compliance with regulatory requirements.

Not all features reported by inspections require immediate validation and repair. Those remaining will have to be either scheduled or monitored until the next inspection, at which time

they will need to be compared to new results. A recent sampling of U.S. pipeline inspection results revealed an average feature rate slightly more than 400 per mile with very few requiring prompt attention. This is an enormous amount of post inspection data that has to be turned into information needed for prescribed scheduling and monitoring actions.

A ***Feature Management System (FMS)*** automates a series of integrity processes that are often very labor intensive. The system links these processes together seamlessly to improve data reliability and remove redundancy. The following schematic depicts the process elements included in the FMS system.

The major functions of a ***Feature Management System (FMS)*** are:

- The ability to efficiently import feature data from ILI inspections, above-ground surveys & in-field NDE into a pipeline data management system and/or GIS
- The ability to automatically align feature data with pipeline stationing & pipe segment data including pipe properties, the pipe environment, and other inspection data
- The ability to calculate current rupture pressure of anomalies, and estimated time to failure
- Automated calculation of remediation date
- Automated generation of integrity sheets that display integrated feature and pipeline asset and environment data.
- Automated generation of feature reports, summaries, queries, and dig sheets.
- QA controls at all appropriate stages of the process

ANOMALY DATA IMPORT AND ALIGNMENT

The import into the pipeline data management system and alignment of inspection and feature data can be performed using an FMS application known as ***Integrity Data Manager***. A set of standard and customized templates, designed to meet operators' requirements and inspection vendor data formats, are available to assist the data import process. The software converts the various vendor feature types into a common code-list, and stations the features in order to align them with the pipeline asset and environmental data in the pipeline database and/or GIS. In addition to features, the templates define the specifications for the import of ancillary inspection information including AGM lists and contract data.

The alignment of feature data with the existing pipeline stationing is a semi-automated process. ***Integrity Data Manager*** positions the inspection features with respect to the pipeline by matching like attributes such as AGMs, valves, wall thickness changes and casings. In addition, the user has the capability to refine the alignment by manually specifying known 'match points' (points that are identified in both ILI data and on pipe centerline – i.e. AGMs that have both WC and stationing). The imported feature data is automatically re-stationed between match points, distributing error between these points and subsequently minimizing the possibility of locational inaccuracies. Other inspection data such as close interval surveys, DCVG, ACVG, C-Scan, etc. can also be loaded into the FMS data management system via the Integrity Data Manager.

On-site feature data from localized above-ground surveys or digs can be entered using another FMS application called ***PipeView Inspection***.

FEATURE DATA PROCESSING

The ***Feature Management System*** provides tools for assessment of the significance of features on the integrity of the pipeline via FMS' **Feature Assessment** module. This enables the pipeline operator to make informed planning decisions on the need for remedial action (either immediately or at a specific time in the future), and to plan future inspection activities. A powerful attribute of the software is the ability to incorporate defect growth information directly into the feature assessment algorithms. The remaining life, and the remaining time until the level of safety becomes unacceptable, are instantly available to assist in the discovery and mitigation planning process.

Feature assessment calculation results are typically presented in the format of a rupture pressure ratio (RPR); defined as the ratio of the calculated failure pressure to the pipeline MAOP. This allows a direct ranking of all defects in a pipeline system to be conveniently performed in terms of their level of safety under the existing operating conditions. This effectively is a screening process that aids operators to drill down and focus only on those most critical defects, which now may benefit from a more rigorous engineering critical assessment.

FEATURE-RELATED RESULTS REPORTING

Several methods of reporting of feature-related data, and assessment calculation results are available. All can be web-enabled for communication and distribution. Integrity alignment sheets can be automatically generated utilizing another GIS application, **Sheetgen**, providing a very powerful means of presenting integrity data alongside the pipeline and ROW details. Feature details, RPRs and remediation plans can all be automatically overlaid. Furthermore, this type of

report can aid in the identification of the causes of features (e.g. clusters of internal corrosion at low-points on a pipeline profile indicating water drop-out), and the identification of high-priority cases on more than a simple RPR ranking (e.g. proximity of corrosion to highway or building).

Dig sheets can be produced, using an ***Integrity Data Manager*** application, for any feature identified as requiring further investigation and/or repair. Tabular reports can be produced for any combination of fields within the pipeline data management system and/or GIS. (See example report below).

Integrity alignment sheets and tabular reports provide a robust means of demonstrating to regulatory authorities that the pipeline operator is maintaining a comprehensive pipeline integrity management system.

QA CONTROL

The ***Feature Management System*** applications are designed to control the nature of the feature data entered into the system, and will record the user name and date of each interaction. Controls in terms of limiting the approval of data changes to authorized personnel ensure the integrity of data updates. Time-dependent activities (e.g. the requirement to repair defects within a fixed timeframe) can be controlled automatically by the software, and automated flags can be raised if data updates do not occur when expected.

For in-field operations, the ***PipeView Inspection*** data collection application enables the user's name and date to be recorded, showing that a specific defect was addressed on time and appropriately. Pictures, RSTRENG results, word files, etc. can be attached to this file and all data is sent to a designee for review, approval, and subsequent updating and storage in GIS. These reports can be queried, viewed, and printed at any time.

CONCLUSION

Pipeline operators desiring to move beyond prescriptive compliance and shift into an asset management gear will greatly benefit from a decision support system that includes the functionality of a GIS enabled system. Automatically integrating inspection data enables more effective feature assessment and drives improvements in executing post inspection planning and remediation activities. Finally, all these capabilities serve to optimize mitigation efforts that not only satisfy regulator requirements, but also go a long way toward further extending pipeline life expectancy.