

Risk based inspection in the pipeline segment (Boosting station E-Pipeline terminal Skikda) of the eastern pipeline network of Sonatrach

Introduction:

Inspection is an important element of an integrated integrity management system for managing risks in the pipeline transportation industry. Pipeline networks suffer degradation due to a variety of causes. One of the main causes of many pipelines deterioration is corrosion. Excessive deterioration leads to system function failure and safety problems. Cathodic protection is the main technique used by operators to deal with corrosion problems, in the other hand pipeline protection requires regular monitoring of its thickness so that further measures can be planned either by reinforcing cathodic protection, or by rehabilitation /replacement. In line inspection is an advanced technique for monitoring pipeline thickness. However the cost of such technique requires a rational method that considers both the risk of failure and the cost of the operation in estimating the inspection intervals. Although prescriptive and worst case methods (adopted in RP580) have provided adequate safety and reliability, they are unable to provide a cost effective inspection strategy simply because they do not consider the variation of inspection parameters and do not take into account both the cost of inspection and failure. Risk based inspection including reliability and financial analysis is a useful tool to justify costly investment such as ILI. Optimisation is an essential aspect of asset management that can be implemented with RBI to establish a cost effective inspection strategy.

Initial Problem:

The organisation lacks a quantitative risk based method to determine inspection intervals for corroded pipelines. This gap results in:

- Lack of objective means in estimating ILI inspection intervals
- Reliance on subjective decisions
- Delayed inspections since there is no mean to justify the decision
- Higher levels of risk to both the organisation and the public
- Difficulty in demonstrating the financial incentives gained from carrying out ILI.

• The recommended solution:

I recommend the pipeline transportation branch of Sonatrach TRC to adopt RBI in setting inspection program so that a cost effective rehabilitation /replacement strategy can be achieved.

A number of multidisciplinary teams are required to assess the risks for the different parts of the pipeline network in a structured manner through FMECA or HAZOP.

- Qualitative RBI using 5*5 risk matrix is required for day-to-day inspections as it uses the experience of personnel and does not need in depth analysis.
- Quantitative reliability based inspection assessment (RBIA) for inspections that require higher investment such as ILI is therefore recommended with however the following elements should be considered during implementation:
 - A management system for maintaining documentation, personnel qualifications, data requirements and analysis updates.
 - A documented method for probability of failure determination.
 - A documented method for consequences of failure determination.
 - A documented methodology for managing risk through inspection and other risk mitigation activities.

Discussion & results:

- After collecting data from the facilities protection department concerning:
 - The current thickness along the pipeline segment (Boosting station E-Pipeline terminal of Skikda) recorded during the last pigging operation
 - The cost of inspection
 - The different costs resulted of previous pipeline failures
- A next step consists of evaluating the probability of failure using Monte Carlo Simulation.
- A third step consists of evaluating risk's financial impact after estimating the consequence of any network failure
- A last step consists of identifying the most suitable inspection interval using the optimisation principle

Conclusion:

Qualitative RBI is an effective tool in pipeline network inspection; however it is unable to provide the most suitable inspection interval for costly investments as it relies only on personnel experience. Accordingly the need to a fully quantitative method arises. Reliability based inspection assessment is necessary in ILI inspection interval determination for inspection planning as higher investment need to be financially justified. For optimum RBI effectiveness, accuracy and precision of data should be considered. The techniques used in the project need to be taught through a formal training programme prior to adoption and implementation.

A rational inspection strategy through fully quantitative models enables the organisation to achieve higher integrity level and enhance its marginal profit.

