Case Study

SENSOR® NETWORKS, INC
Inspection, Testing & Asset-Integrity Solutions

How Corrosion Monitoring of a Buried Pipeline using UT Sensors Post-ILI Saved >$6MM

Regulation: In 2019 PHMSA released 'Phase 1' of the widely anticipated 'Mega Rule' which went into law on July 1, 2020. The 'Mega Rule' outlines an expansion of integrity management requirements for pipelines with an increased focus on assessment and risk modeling which is used to prioritize and inform the pipeline operator of particular conditions affecting the safety of their assets. The gas transmission rule requires operators of gas transmission pipelines constructed before 1970 to determine the material strength of their lines by reconfirming the Maximum Allowable Operating Pressure (MAOP). In addition, the rule updates reporting and records retention standards for gas transmission pipelines. On the liquid side, PHMSA issued a final rule encouraging pipeline operators to "make better use of all available data to understand pipeline safety threats." PHMSA will issue a second part of the Mega Rule which will include requirements for inspecting pipelines following extreme events and updates to pipeline corrosion control requirements which in many cases will call out the use of monitoring technologies in conjunction with inspection practices.

The Response: Given the costs and uncertainties associated with permitting, legal, and changing political climates, many asset owners have been forced to change their strategy from that of new construction to protecting/extending the lives of their precious infrastructure which is already living under/above ground through smarter ways of using asset integrity planning and monitoring techniques.

In such cases, many asset owners are taking a proactive approach and re-writing their asset integrity procedures to include monitoring between inspection intervals especially where anomalies have been found to monitor how active (or inactive) an internal corrosion location may actually be. In some cases MIC (Microbiologically Induced Corrosion) 'clusters' can be one of the reasons for localized thinning. While these sensors are not typically used to find MIC, they are however used to monitor MIC or other potential corrosion cells once a 'low' or 'cluster' area has been identified either by the ILI or manual inspection. By monitoring these identified locations, asset owners now have the ability to track the anomaly to learn and try remediation tactics to slow or eliminate the 'cluster' versus fix, sleeve, or repairing an asset which might otherwise not need such disposing and downtime. Practices such as these, not only satisfy compliance requirements, but they also provide valuable asset integrity information and help pipeline operators understand the effects of cleaning pigs, chemical inhibitor, and other preventive maintenance activities which previously would never have been possible.

Figure 1: Dual element sensors installed permanently on identified cluster of 'low spots' on six-o'clock position of pipeline

One of the most costly and difficult areas to inspect amongst midstream assets are the 'unpiggable' sections of piping. Without the ability to deploy a smart pig, asset owners are forced to perform costly digs and manual inspections. Over time, these digs and manual inspections can cost millions of dollars. Due to the new MEGA Rule, in some area classifications these digs and inspections are now even more frequent than before which are forcing companies to find new and innovative ways to monitor their assets.

Figure 2: Sensors covered with protective coating

The Solution: When comparing current ILI results to those done previously an asset owner found a cluster area which lost between 0.040"-0.089" increase in a particular area on the pipeline. The asset owner decided to install a multi-point permanent UT sensor system to monitor this section of pipe to see what corrosion rate information they could glean. During the next planned dig (direct assessment), manual inspection identified the six areas which showed

thinning clusters in a roughly 6ft. area and sensors were installed at these locations plus two sensors to 'baseline' at unaffected areas. In this case, a datalogger transmitter was used to collect data daily and every 1-2 months the readings would be manually downloaded and sent to a cloud-based back end for data analysis and trending. Alternatively a cellular transmitter could have been used whereby each reading could be wirelessly transmitted without manual download of the data. See below findings from a section of the data.

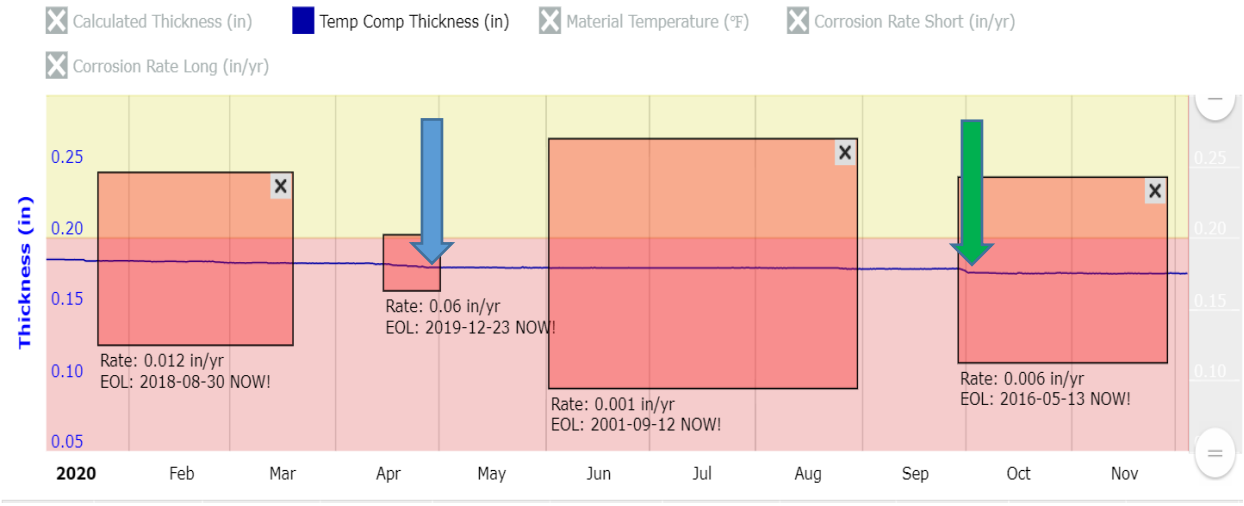

Figure 3: Corrosion data from which shows different rates associated with remediation activities taken by the operator

The Outcome: Using the monitoring approach by installing permanent UT sensors, the asset owner was able to quickly and accurately (to within .001") trend the corrosion rate which saw an abrupt corrosion event to the tune of 60mpy (.060"/yr) at one of the locations. Further, with the help of the operations and corrosion teams, the asset owner sent a cleaning pig and injected a chemical inhibitor to hopefully slow down/remediate the corrosion at this location (blue arrow above). In the figure above, you can see when the corrosion started, the significant increase in corrosion rate, and then the stabilization of the corrosion post cleaning and inhibitor. You can also notice that as the inhibitor's effectiveness declines, the corrosion rate starts to pick back up and another cleaning pig and inhibitor was injected (green arrow above).

Financial Impact: Since this section of pipeline was built in 1974, there have been >45 digs across this ~500-mile section of pipeline costing an estimated ~$20MM in ground removal, construction, inspection, and maintenance cost (this does not account for lost revenue due to downtime of the asset, which is an exponentially higher loss). Never in the history of this asset's service was the asset owner able to glean this kind of information to understand corrosion activity

at different locations of their assets and the effectiveness of their operations to combat corrosion. This data has allowed the operator to maintain their normal inspection intervals, save cost on cleanings and chemicals, and eliminate the need take the asset offline to cut out, fix, and repair sections of the pipeline thus allowing them to extend the life of the asset until maintenance is necessary. These items alone are estimated to save the operator >$6MM over the course of the next 5-7 years on an investment of ~$25K in sensors (an ROI of >100% with a payback period of <6 months). The ability to have access to this precious data and be able to monitor, and in this case, remediate the corrosion, has allowed this asset owner to safely and confidently operate the line for years to come.