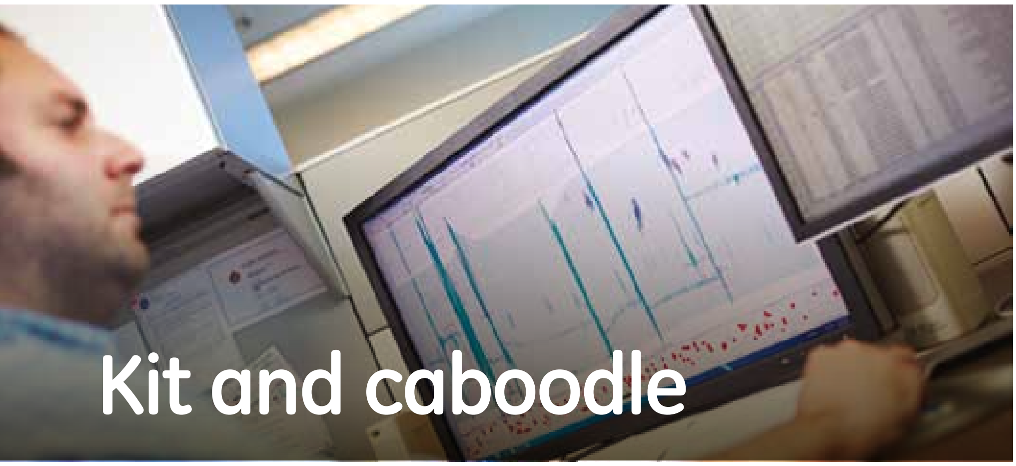
PII Pipeline Solutions
a GE Oil & Gas and Al Shaheen joint venture



Kit and caboodle

PII's entire range of inspection and integrity capabilities has helped protect a key North American pipeline network for over 20 years.

Challenge

We've worked closely with this client for over 20 years to regularly assess and maintain the integrity of its North American natural gas pipeline network — performing over 1,000 miles of in-line inspections (ILIs) annually on about 70 lines, with a typical re-inspection interval of six years for each line.

Always striving for increased knowledge and integrity management abilities, they appreciated our approach of including multiple technologies on our ILI tools. Additional post-ILI services add relatively small increments to the overall project costs, yet they greatly increase data knowledge, and quantifiably enhance both the short-term and long-term integrity of the pipeline.

For many years, therefore, our ILI services for this client have combined high-resolution MagneScan technology with integrated geometry modules and inertial mapping units (IMUs). This enables evaluation of corrosion (mainly external but some internal), mechanical damage (dents and gouges), loss of stability (ground movement), and a degree of vintage girth-weld assessment — all from a single ILI run.

This case highlights just a few examples of valuable, proactive insights we've delivered through the years.

Solution

Corrosion growth

In the last two years, we inspected many of this client's pipelines, including some that were previously inspected by another ILI vendor, and conducted a combination of screening and full corrosion growth assessments on all these lines. The ability to accurately determine corrosion growth rates is essential to the effective integrity management of a pipeline.

ILI with RunCom is the favored method for estimating corrosion growth rates from two or more ILI data sets. Its significant advantage over other methods is that ILI with RunCom can provide growth rate information on the whole defect population, giving visibility of what is happening along the entire pipeline. RunCom's signal-to-signal matching is highly

CHALLENGE

With an extensive network of transmission and distribution lines across North America, maintaining a consistent and reliable level of asset integrity is by no means an easy task.

SOLUTION

We provided a comprehensive range of inspection and engineering analysis services for this client s network, performing about 1,000 miles of in line inspections each year.

BENEFITS

The level of detail possible with our technologies, along with the experience of our people, has avoided pipeline failures and improved integrity planning and budgeting for this vast pipeline network.

accurate when comparing multiple data sets from the same ILI vendor. We used this process for our own data. When comparing data from different vendors, particular care is needed to overcome matching errors. We did this using new PII data versus older third-party data — RunCom was still able to match corrosion sites and estimate growth rates.

From a sample of 35 pipelines inspected in the last two years, the average maximum rate observed was 10 mpy. The maximum rate observed across all the lines was 30 mpy, an instance assumed to be a new corrosion site since it was not detected in the previous third-party ILI data. A critical aspect of corrosion management is to identify features that are growing faster than would normally be expected, since they are at greater risk of failing before the next scheduled ILI. Any fast-growing features can be targeted for proactive remediation such as coating repairs or CP system checks and upgrades. Our use of ILI data in this case complements the DOT 192 discovery process, and supports proactive integrity management decisions.

Mechanical damage

The dent-assessment guidance in various pipeline industry codes is mainly based on dent depth. However, it is generally known in the industry that the dent profile, specifically the bending strain distribution, provides a better indication of dent severity. Both ASME B31.8S and API 1160 acknowledge this and allow operators to utilize engineering assessment against published acceptable limits. A dent that is relatively deep for its length or width will have higher bending strain than a dent with the same depth spread over a greater length or width of pipe surface.

Let's consider two separate dents we detected and analyzed in the same 20" OD pipeline: one 6% OD (1.2") depth and the other 4.3% OD (0.87") depth. Although the shallower dent doesn't exceed the dent depth limit (of 6% OD), it does exceed 6% strain. On the other hand, the deeper dent is more gradual and covers a larger area, so it in fact has a lower and acceptable strain %.

Because its slope is relatively sharp over a small area, this shallow dent has a higher strain than a deeper dent from the same inspection.

We've conducted a large number of dent strain assessments for this client using data from our high-resolution caliper module that runs with our MagneScan tool. Over the last two years, we've assessed 397 dents in 42 different pipeline sections. Of those dents, 70 were unacceptable to depth limits in code guidelines. But only five of those failed the corresponding strain criteria — which significantly reduced the field investigation costs.

Even more critical is the number of potentially injurious dents that would not have been investigated if depth was the only factor considered. Of the 11 dents we found to fail the strain criteria, six would have passed the depth test alone — and quite possibly ended up creating bigger problems down the road.

Pipeline movement

An IMU can be easily included on our ILI tools to provide a synchronized stream of mapping information for easy location of pipeline anomalies, features and fittings. We also use the IMU to determine potential pipe movement from its original position; and the curvature data is used to determine equivalent bending strains — which, when combined with other ILI data on dents, girth weld flaws and metal loss, can identify and assess integrity concerns that may otherwise be missed.

Several years ago, ground movement caused a failure in one of the client's lines. The line had been inspected in 2007 before routine use of IMUs. If the ILI tool had been equipped with an IMU, and bending strain analysis conducted, it is quite possible that the abnormal curvature would have been detected and the costly failure avoided.

Running an IMU has since become routine practice for the client. In the last two years, we've used our IMU data for strain screening and full bending strain assessments on 45 of its pipelines. A screening assessment gives a rapid summary of the top five strain events in the pipeline, which is sufficient to determine if a full bending strain assessment is warranted. Indeed, a high bending strain was identified the very first time we conducted an IMU survey plus strain assessment for the client. When the client's personnel visited this site, they found that a significant land movement had shifted the pipe approximately 10 feet downhill, resulting in a strain of just over 1%. With the potential failure averted, IMU and bending strain assessments were instantly recognized as cost-effective additions to the client's integrity program.

Our IMU data analysis identified a pipe that had been displaced 10 ft. downhill, with a bending strain >1%. Failure was avoided.

Benefits

By taking a proactive approach to integrity management, including PII services such as IMU, RunCom, and pipeline bending strain screening assessments, this client has improved the long-term safety and operability of its pipeline network for minimal incremental cost per inspection — and avoided much more costly unnecessary repairs and accidents.

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