



Post-inspection Evaluation

Increase the value of in-line inspection data for efficient pipeline integrity management.



Getting maximum value from your in-line inspection data.

In-line Inspection is part of your overall investment strategy for maintaining a safe and profitable pipeline. The return on this investment depends on what is done with the results. GE Energy's Post-inspection Evaluation products and services help you minimise maintenance and maximise safety by turning your inspection data into valuable, in-depth knowledge.

Post-inspection Evaluation

In-line inspection (ILI) often finds thousands of corrosion features and other damage in a single pipeline – at rates commonly exceeding 500 features per mile. Since ILI reports generally provide limited guidance regarding the severity of reported features, the operator must evaluate results data to ascertain which features require immediate attention. Integrity Management Plans must also address features scheduled for future repair or monitoring, and identify re-inspection intervals.

GE Energy's Post-inspection Evaluation products and services are designed to assist pipeline operators with this process and to maximise the value of ILI data. Our solutions can help you avoid unnecessary repairs, optimise future remediation activities and provide quality regulatory compliance documentation.

Immediate Integrity Evaluation

The first step in the evaluation process is an assessment of the immediate severity of reported features. GE Energy utilises state-of-the-art assessment methodologies and industry-accepted best practices for these procedures. When complete, you receive a full report of the current pipeline condition and a plan identifying and prioritising required repairs. This will provide an assessment of your pipeline's immediate integrity and the ability to meet requirements – including a recommendation for maximum safe operating pressure.

Future Integrity Evaluation

This is an assessment of the reported features' expected effect on your pipeline's future performance. All ILI data and supporting information are used to maximum advantage in order to assess the future repair and re-inspection needs. With Future Integrity Evaluation, you achieve a cost-optimised future repair plan and re-inspection interval – based on the pipeline's actual condition rather than on fixed intervals.

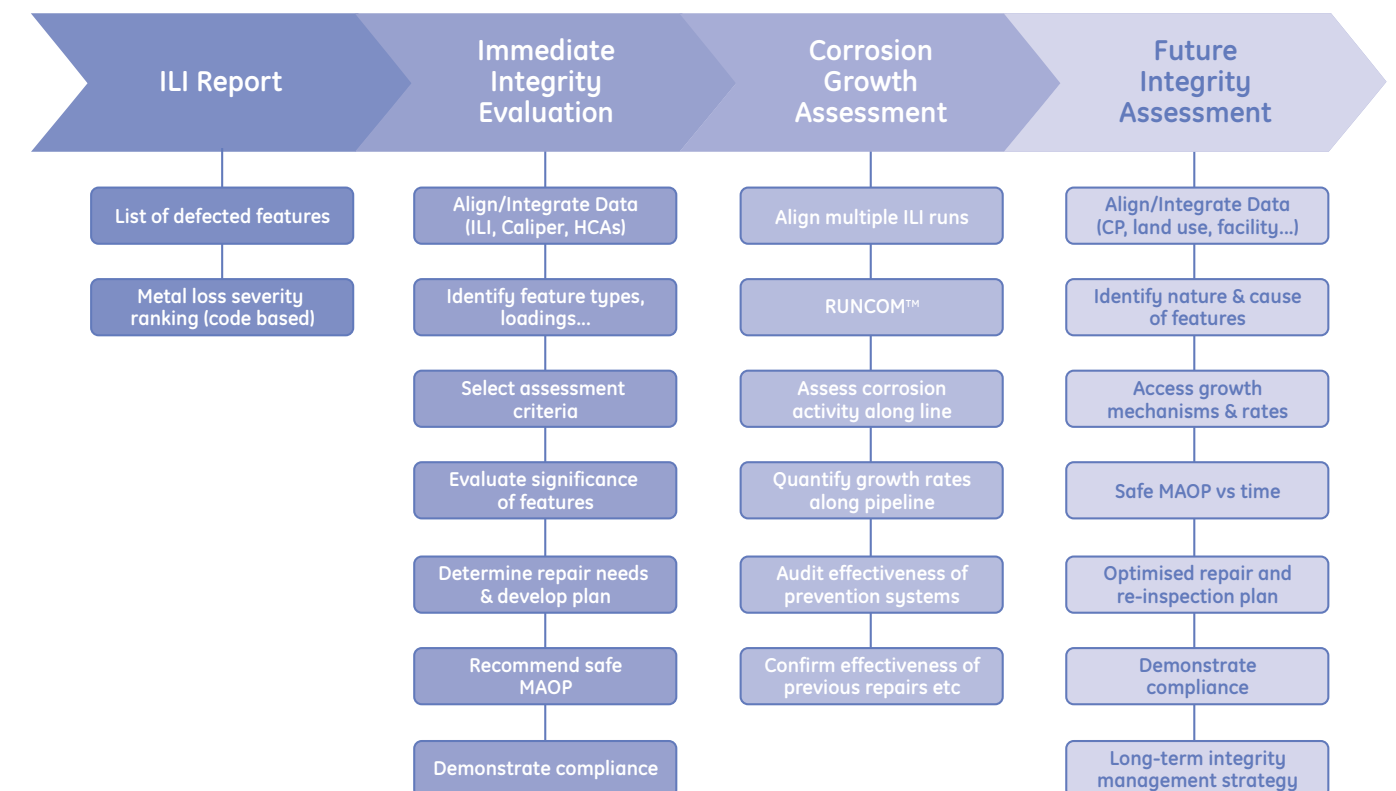
Corrosion Growth Assessment

Accurate determination of corrosion growth is a critical component of any optimised Future Integrity Evaluation. With our RUNCOM™ tools, we can visually identify even the smallest corrosion activity along the pipeline and provide a detailed analysis of multi-year ILI data. The resulting corrosion rates give you the insight you need to understand the effectiveness of your corrosion-control systems.

Best Practice Approach

Our Post-inspection Evaluation products and services are designed to ensure maximum benefit from your ILI data – by turning it into real pipeline information and actionable knowledge. These products and services have grown out of our knowledge and experience performing ILI on more than 500,000 km of pipeline, and as integrity consultants assessing the condition of over 500 pipelines for more than 50 customers worldwide.

Turning data into information



Assessing Immediate Pipeline Condition

The analysis of feature severity, comparison to code and industry best practices for the definition and prioritisation of actions to ensure immediate integrity.

All engineering structures contain defects and pipelines are no exception. Anomalies can be introduced at all stages of a pipeline's life – during manufacturing and construction (e.g. weld and material defects, dents) or while in service (e.g. corrosion, gouges, dents). When such features are discovered, it is essential to establish the effect they have on the integrity of the pipeline.

GE Energy's Immediate Integrity Evaluation utilises advanced fracture mechanics techniques to relate the severity of discovered features to the pipeline's actual operating conditions, geometry and material properties. Our assessment methods apply to all types of pipeline damage, including:

- internal and external corrosion
- dents and third party damage
- cracks
- weld defects
- laminations
- instability events

Our state-of-the-art assessment methods, approved by regulatory authorities worldwide, can greatly reduce the number of repairs required while ensuring the continued integrity of the pipeline.

Our repair recommendations are based on a full evaluation of alternatives in relation to the anomaly type, location, future requirements, as well as cost and safety considerations.

Following our engineering evaluation we provide you with a detailed report describing the pipeline condition, a plan identifying and prioritising repair requirements (for assessments of the pipeline's immediate integrity and its ability to meet regulatory requirements) and a recommendation for the maximum safe operating pressure.

I have my ILI report, why do I need anything else?

Although ILI reports describe the various features detected, they generally provide a relatively simple and conservative code assessment applicable only to the reported corrosion. Planning remediation solely on this basis usually results in a higher than necessary number of repairs.

Since ILI typically results in thousands of identified anomalies, an operator needs a safe yet cost-effective means of dealing with this high volume of data. GE Energy selects the best industry-approved assessment methods based on your pipeline's characteristics, operating conditions and type of anomaly.

By applying appropriate decision criteria, we can help you avoid unnecessary repairs without compromising safety.

It is not unusual for our best-practice approach to save operators upwards of \$100,000 by avoiding unnecessary repairs.

What do I need to do to comply with the regulations?

Regulatory demands vary considerably by country – some pipeline regulations are more prescriptive, while others are based on a risk and goal-setting systems. For example, some regulations set down a specific approach to the integrity management of lines located in High Consequence Areas (HCAs). Operators must demonstrate compliance by documenting integrity issues, identifying immediate repair, various interval and monitored conditions, and by putting an integrity management plan in place.

Using our experience and a knowledge base grown over 25 years, no matter what your specific requirements are, GE Energy can help you make light work of a time-consuming and complex integrity engineering process.

Assessing Future Pipeline Condition

A long-term, cost-optimised repair plan and maintenance strategy based on a clear understanding of the long-term integrity issues facing your pipeline.

Without addressing the cause of pipeline damage, deterioration is likely to continue – particularly with time-dependent mechanisms such as internal and external corrosion, third-party damage and pressure-cycle-induced fatigue crack growth. Any successful long-term maintenance strategy needs to address such time-dependent deterioration by budgeting and planning the necessary remediation activities to safely maintain the pipeline's integrity.

GE Energy's Future Integrity Evaluation takes ILI results one step further by integrating the data with additional sources of integrity information. For example, the occurrence of external corrosion is directly related to the performance of the cathodic protection and coating system and soil environment. By aligning these data sets, we have the ability to visualise integrity data along a pipeline route, identifying interactions that may otherwise go unnoticed – giving you a more rigorous integrity assessment of your pipeline and the information you need to make effective decisions.

What do I get from a Future Integrity Evaluation?

- identification of the nature and cause of detected pipeline features
- determination of growth mechanisms and rates
- a clear picture of future integrity issues
- definition of allowable MAOP with time
- optimised repair and re-inspection plan based on economic and safety issues

How can I plan and budget future repairs, and when should I re-inspect?

Although ILI tools detect more than corrosion damage, the main reason for running these tools is usually to monitor the occurrence and growth of internal and/or external corrosion damage – and to repair before failure can occur. Actual corrosion growth rates along the pipeline length are most accurately determined by the best practice of comparing repeat inspections with our RUNCOM suite of tools.

This process takes full advantage of ILI data and corrosion-growth information, enabling the future repair and re-inspection needs to be assessed based on economic and safety criteria. The resulting future repair plan and re-inspection interval are based on actual pipeline condition rather than on fixed intervals.

What else can affect the long-term integrity of my pipeline?

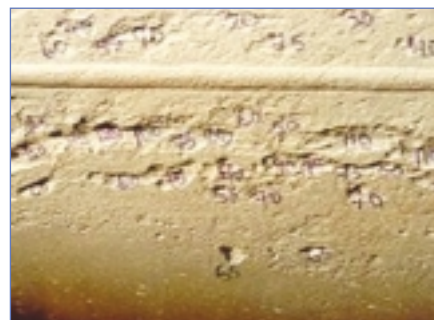
Pressure-cycle-induced fatigue crack growth is particularly prevalent in liquid pipelines where any pressure cycles that occur are transferred, in stress terms, directly to the pipe wall. Any defects (seam-weld or girth-weld cracks) or stress raisers (e.g. dents, undercut, roof topping, gouges or surface-breaking laminations) may lead to damage in the form of fatigue cracks.

Fatigue is a particular threat in old (pre-1970) ERW pipe which is prone to manufacturing defects and poor weld-line material properties. Selective weld-line corrosion, crack-like in nature, is also a threat in this pipe type.

Our Future Integrity Evaluation will assess all the relevant threats to your pipeline and identify the remediation activities required to mitigate them.



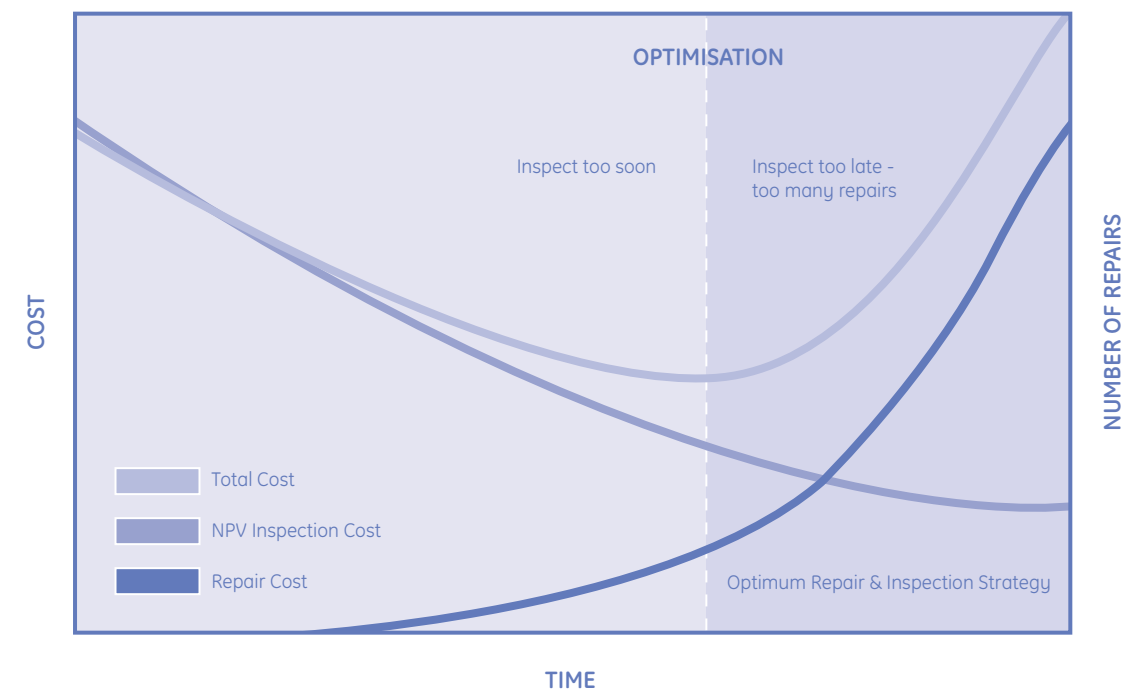
Dent and Gouge



External Corrosion



Surface Breaking Lamination



Cost-optimisation of future repair plan and re-inspection interval.

Calculating Growth Rates with RUNCOM

The ability to accurately determine corrosion growth rates is essential to the development of safe and cost-effective integrity management plans.

Internal and external corrosion have long been recognised as major threats to the integrity of on-shore and off-shore pipelines. Pipeline operators can mitigate the effects of corrosion by applying systems such as an external or internal coating, cathodic protection, chemical inhibition etc. If any of these protection systems fail, then the operator must be able to identify the location and severity of corrosion activity – and how quickly the integrity of the pipeline is deteriorating.

RUNCOM is GE Energy's suite of run-comparison software that analyses repeat ILI data to provide actionable information upon which pipeline operators can make sound corrosion-management decisions. RUNCOM provides direct and quantitative comparison of inspection signals between two or more ILI runs.

The software is used by our highly skilled analysts to compare data from our own MagneScan™ and UltraScan™ WM inspection tools – as well as data from other vendors' tools.

How is RUNCOM different from other methods?

One of the most common sources of error is the incorrect matching of corrosion sites. RUNCOM eliminates this issue by comparing raw inspection signals side by side – rather than using data that's already been processed by other software. RUNCOM ensures 100% accuracy in matching corrosion sites. Through its signal-scaling tools, RUNCOM accounts for tool repeatability and maintains consistent sizing methods to minimise other error sources. Our approach has been shown to be up to three times more accurate than feature comparisons done without the benefit of RUNCOM.

Will RUNCOM work if I've used different ILI vendors to inspect my pipeline?

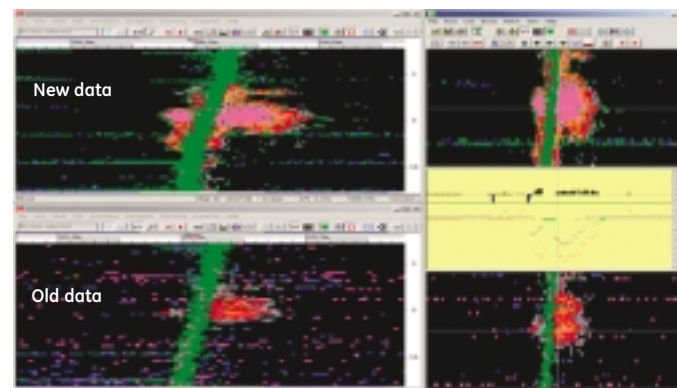
Yes. One of the RUNCOM tools was specifically designed to compare data from different vendors' tools. The application performs a side-by-side matching of reported features and boxes, ensuring the best possible match between the data.

What does a RUNCOM analysis tell me about my pipeline?

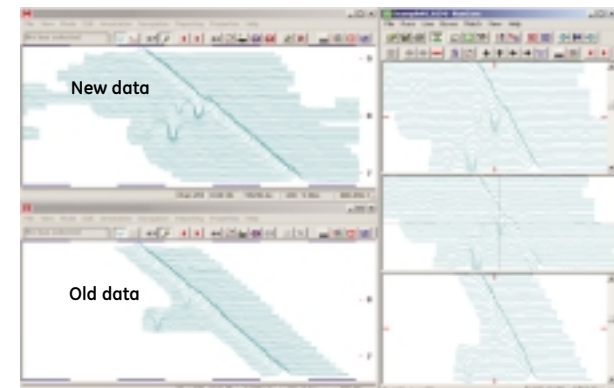
- Gives visibility of corrosion activity along an entire pipeline
- Provides an early warning of active corrosion which enables cost-effective early intervention
- Confirms where remedial measures have been effective
- Enables better-informed integrity and maintenance planning decisions

What kind of track record does RUNCOM have?

RUNCOM has measured corrosion rates in hundreds of pipelines and has already benefited our customers by avoiding unnecessary repairs and identifying improvements to their corrosion-control strategies and systems.



By detailed examination of changes in feature profile between survey runs, USWM RUNCOM gives complete confidence that peak corrosion growth rates have been correctly measured.



RUNCOM performs side-by-side matching of raw signal data from various inspection tools to deliver 100% data-matching accuracy and to identify corrosion growth sites.

Pipeline Integrity Management

Integrity management of oil and gas pipelines has come a long way in recent years. The industry is continually advancing with increasing focus on pipeline safety. For pipeline operators, this usually involves more data and analysis, more field inspection, documentation and maintenance activities – in other words, much more work. Managing this workload and transforming mountains of data into useful, practical information is rapidly becoming the single largest challenge in the integrity management process.

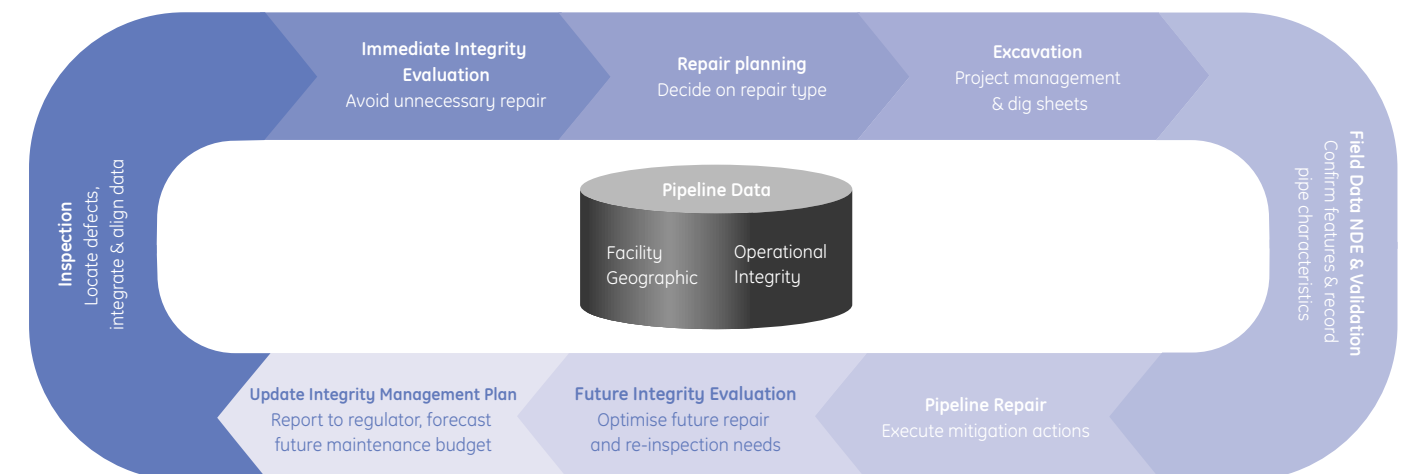
Working against time

Many regulations now outline a very specific approach to pipeline integrity management for lines in High Consequence Areas. One of the most challenging elements in these new regulations concerns Discovery – the interval between first notification of an anomaly and the point at which it is verified, analyzed and remediated. In some cases, the maximum time allowed for this process is 180 days.

Discovery is a complex procedure that may be difficult for an operator to complete in time since many of the specialised services will need to be outsourced. GE Energy's Integrated Pipeline Remediation (IPR) service offers a complete turnkey solution to manage the entire Discovery process. It also allows you to choose only those specific products and services that apply to your situation. IPR is a unique combination of our In-field Services, GIS and Data Management, and Post Inspection Evaluation offerings.

Key benefits of Integrated Pipeline Remediation

- The flexibility to utilise one comprehensive turnkey solution, or to choose from individual service components
- Potential for significant efficiency savings from ILI assessment to repair (Discovery) through simplification of contracting and engineering processes
- Best-practice methodologies for assessing the significance of reported features, avoiding unnecessary repairs and planning optimised repair and re-inspection needs
- The benefit of established protocols and resources for field evaluation of pipeline anomalies
- High-quality reporting and on-time provision of compliance documentation
- A powerful suite of data-management and integrity software tools to manage the growing volume of data and transform it into practical information
- The advantage of GE Energy's comprehensive understanding of corrosion mechanisms, pipeline environments, and our detailed knowledge of regulatory requirements



GE Energy's Integrated Pipeline Remediation solution is specifically designed to help you meet the increasing demands of the integrity management process.

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