Baseline Inspections

Key Insights and Common Questions

Baseline surveys are a critical component of pipeline integrity management, providing essential data to ensure the long-term safety and reliability of pipelines. As these infrastructures are increasingly being built in challenging environments, the importance of accurate, early-stage assessments has never been greater.

To explore the key considerations and emerging technologies in baseline inspections, we spoke with three of our industry experts — Jim Costain, Craig Hall, and Thomas Mrugala.

Sharing their insights on the evolving landscape of pipeline inspections, they discuss the benefits of baseline surveys, the technological advancements shaping the industry, and the common challenges faced by operators.

What are the primary objectives of conducting a baseline inspection for pipelines?

Jim's Response: To ensure the pipeline's integrity before it enters service. It provides a critical reference for subsequent in-service inspections, identifying any integrity threats caused by poor quality control at the mill, defects during the pipelay process, or the harsh environments pipelines are laid in. These inspections establish a clear starting point for assessing pipeline health over its operational life.

Craig's Response: Baseline inspections confirm the pipeline's total integrity, beyond what hydrotesting can prove. While hydrotests verify strength, they may miss issues such as small girth weld cracks that leak during the test but remain undetected. A baseline survey captures all mill, construction, and handling features, providing a foundation for future comparisons. Changes in the pipeline can then be attributed to operational damage, helping to pinpoint causes, assess growth rates, and determine cost-effective corrective actions.

Thomas's Response: A baseline inspection establishes the condition of the pipeline at "hour zero." This has two main advantages:

- Defect Identification: It reveals production-related anomalies or defects caused during storage or the pipelay process. This ensures that any deformations, stresses, or anomalies that could compromise pipeline integrity are addressed early.
- Reference for Comparisons: Subsequent inspections can be compared to the baseline, providing valuable insights into the progression of identified anomalies. This ensures accurate evaluations of the pipeline's condition over time.

How do environmental conditions (e.g., temperature, pressure, and surrounding environment) affect pipelines?

Jim's Response: Environmental conditions significantly impact pipeline integrity. Geohazard threats, such as ground movement or seismic activity, can induce stresses on pipelines. For example, pipelines in mountainous or earthquake-prone areas face unique challenges. Subsea pipelines encounter similar risks due to topography, such as shifting seabeds or landslides, making careful route selection and monitoring essential.

Craig's Response: Pipelines are now constructed in increasingly challenging environments, such as deep water, high-pressure zones, or areas with extreme temperatures. These conditions can significantly impact long-term pipeline operation. This can cause stress corrosion cracking (SCC) and increasingly NDT Global are being requested to inspect using our range of crack detection ttols and identify multiple crack like integrity threats within ageing pipelines.

Thomas's Response: All pipelines are subject to external and internal factors that affect their operational life and safety. Environmental conditions, such as corrosive environments or geohazards, are among the most significant external threats. These factors require precise monitoring to mitigate risks and extend the pipeline's lifespan. Proactive management of environmental influences ensures safe and efficient operation.

What are the industry standards or best practices for conducting baseline inspections? Is this only a concern new pipelines?

Jim's Response: The best practice for baseline surveys is to use the highest-resolution tool available to capture detailed insights into pipeline integrity before service. This includes detecting and sizing the most relevant threats, such as cracks or deformations. Baselines are typically conducted for new pipelines, after modifications (e.g., tie-ins, extensions, or usage changes), or when new threats emerge. For example, if cracking becomes a concern, a UT run can detect and size cracks for subsequent growth analyses.

Craig's Response: Traditionally, baseline inspections involved simple caliper tools to check for deformations. However, industry practices are shifting towards full inline inspections (ILI) with high-resolution tools, even including crack detection. Some operators conduct baseline inspections during dewatering at the construction stage, while others perform them within the first five years, depending on warranty or regulatory requirements. These inspections are critical for new pipelines and existing ones undergoing major changes or facing emerging threats.

Thomas's Response: Experienced operators recognize the value of accurate baseline inspections. Using high-resolution ultrasonic tools, such as EVO Geometry or ART Scan, ensures precise measurements of wall thickness, deformations, and cracks. These tools can even inspect gas pipelines, utilizing ART technology or water-filled pipelines during pressure testing. Baseline inspections are not limited to new pipelines; they are essential for pipelines transitioning to transport new media, such as hydrogen or CO2, which pose unique integrity challenges.

How do ultrasonic and acoustic resonance technologies enhance the accuracy of baseline inspections compared to traditional methods such as MFL?

Jim's Response: UT offers far greater wall thickness accuracy than Magnetic Flux Leakage (MFL), especially in thick-walled pipelines. For example, UT achieves an accuracy of ±0.4 mm on a 28 mm wall, while MFL typically provides ±2.8 mm (10% nominal accuracy). UT also detects mid-wall laminations that MFL cannot, which is critical for identifying defects like sloping laminations near girth welds. These advantages make UT the preferred choice for baseline surveys.

Craig's Response: While MFL is effective for general feature detection, it falls short in key areas. It lacks direct wall thickness measurement and cannot detect mid-wall laminations or cracks. Ultrasonic tools, by contrast, offer unparalleled accuracy for baseline inspections, especially for operators concerned with cracks or complex anomalies. For example, crack detection with UT is essential, as no alternative methods like EMAT are commonly used for baselines.

Thomas's Response: Ultrasound-based tools, such as EVO UMp and ART Scan, deliver high-resolution, direct wall thickness measurements using time-of-flight principles. This ensures superior accuracy for detecting complex anomalies compared to MFL, which relies on indirect volumetric measurements. UT and ART technologies are particularly valuable for inspecting pipelines intended to transport hydrogen or CO2, as these media pose heightened risks of crack growth. These tools also allow precise baseline assessments of axial strain, enabling operators to address structural challenges proactively.

What are the key factors to consider when selecting technologies for a baseline inspection?

Jim's Response: Key factors include the pipeline's medium, expected integrity threats, and criticality in terms of economic, environmental, or safety impact. For example, a liquid-filled pipeline may require UT tools, while a gas pipeline may benefit from ART. Selecting the right technology ensures accurate detection and sizing of relevant threats, supporting long-term pipeline management.

Craig's Response: The future operating conditions of the pipeline are vital when choosing inspection tools. For instance, if the pipeline is currently water-filled but will transport gas later, UT tools may be used initially, with ART for future runs. Consistency is also crucial; running the same tool type for baseline and subsequent inspections ensures accurate comparisons. Securing the baseline run positions NDT Global favorably for future inspections.

Thomas's Response: Selecting the right inspection technology depends on various factors, including the pipeline's internal and external conditions, potential anomaly types, and operational parameters. High-resolution UT or ART tools are ideal for detecting geometric anomalies, metal loss, and cracks. The baseline inspection serves as the benchmark for future assessments, making accuracy and reliability critical in tool selection.

What are the most common challenges faced with conducting baseline inspections?

Jim's Response: One of the biggest challenges is achieving the correct operating conditions for the inspection tool. Offshore pipelines, for instance, may have subsea launches requiring precise pressure and flow controls. Coordination between contractors is essential to ensure smooth operations from trap to trap.

Craig's Response: Infield time and construction schedule can always present challenges to baseline surveys, however the security in knowing the pipeline construction and the elimination of any manufacturing defects within the pipeline is of paramount inportance to the end user.

Thomas's Response: Baseline inspections during construction are challenging due to logistical complexities. Gas pipelines must be filled with water for the inspection, then drained and dried, adding time and cost. Despite these challenges, investing in baseline inspections prevents costly issues later. Reliable inspections lay the foundation for maintaining pipeline integrity and operational safety.

Baseline inspections are an essential step in ensuring pipeline integrity and long-term safety. They provide a critical reference point for detecting and monitoring anomalies, whether caused by construction, environmental conditions, or operational factors.

Using advanced technologies like ultrasonic and acoustic resonance tools ensures superior accuracy compared to traditional methods, enabling proactive management of integrity threats. While challenges such as cost, operational complexity, and environmental factors exist, investing in high-quality baseline inspections lays the groundwork for reliable, efficient pipeline operations.

Meet our Experts

Jim Costain
Director, Commercial Sales

With over 30 years of experience in the non-destructive testing (NDT) industry. Currently at NDT Global, he has held key roles at Eddyfi, Silverwing UK Ltd, and GE among others.

Craig Hall
Commercial Account Executive MEAA

Craig Hall brings over 35 years of experience in the inline inspection (ILI) industry. Based in the UK, Craig supports the growth of markets in Australia, New Zealand, India, and Africa.

Thomas Mrugala
Director, Commercial Sales

Thomas has been in the inline inspection (ILI) industry since 2013, with a background in industrial engineering, project management, and sales. His current focus is delivering high-accuracy ILI solutions and building strong customer relationships.

Learn More

For more information about NDT Global and our inline diagnostics solutions, visit www.ndt-global.com

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