Pipeline Material Verification
Take a Smart Look Into Your Pipe Wall
The Challenge
What is Pipeline Material Verification?

Where pipeline operators do not have adequate records to substantiate and validate the material properties of their pipeline, they will need to undertake further material properties verification efforts to determine or verify key attributes, including, but not limited to, the following:

- Grade/SMYS
- Seam type
- Diameter
- Wall thickness
- Toughness

Why Do You Need to Understand the Properties of Your Pipeline?

To ensure safe operation
Where traceable, verifiable and complete (TVC) records are not available key integrity decisions are fraught with uncertainty. Knowing the materials your pipelines are made from is critical for ensuring safe operation.

To support integrity management programs
Robust knowledge of material properties based on TVC records is critical to supporting integrity management programs. To ensure safe, cost-efficient and code-compliant operation of a pipeline throughout its life, operators must understand their pipeline properties in order to accurately identify and address specific integrity threats.

To be compliant
The new safety regulations for gas pipelines, 49 CFR Part 192, demand TVC records with detailed knowledge of a pipeline to determine maximum allowable operating pressure (MAOP). The intent of compliance is to ensure pipelines are operated safely for the lifetime of operation supported by continued data gathering.

The Mega Rule for Gas Pipelines
How to Address § 192.607.

Pipeline Safety Regulations ensure that pipelines are operated under standards accepted industry-wide. 192.607 sets out a number of options for progressing the collection of essential material properties. It permits the use of opportunistic data collection, while recognizing and supporting a strategic approach based on identifying populations and the statistical use of the data.

The fundamental requirement for addressing 192.607 effectively is accurate determination of the populations and an understanding of what types of pipes are present in the pipeline system.

The guidelines for the Pipeline Material Verification process are defined under §192.607, which is referred to in multiple sections of the code relating to MAOP verification, feature assessments and IMPs.
A framework for a holistic approach to material property verification is the key to going beyond compliance. Taking into consideration all required data to support threat management allows for asset safety and compliance, lifetime extension and maximizes the optimal asset performance. Minimizing in-field sampling efforts during the determination of pipe populations saves time and cost.

ROSEN’s Material Verification Framework offers a complete solution through every step of the comprehensive process, from defining the current status to achieving full compliance and beyond. Understanding that every pipeline is different, each element of the framework is applied as needed – creating a customizable solution.
Consultancy
How Are You Addressing Pipeline Material Verification?

Consider § 192.607 and § 192.624

In one element of the Material Verification Framework, the ROSEN Group will assist with defining the strategic aims of the Pipeline Material Verification process in line with an operator’s specific needs and wider system strategy.

Understanding integrity threats is key to establishing a strategy for the Material Verification process. Threats can be identified based on existing inspection data or susceptibility analysis and are aligned with the records status to determine critical gaps in material property information. In-line inspections (ILI) enable a complete and traceable means to providing the right data for integrity engineering. ROSEN can provide support in selecting the appropriate ILI system to close the gap in material property information.

We are able to offer a thorough understanding of regulations. We assist in creating a comprehensive review and alignment of records, which is essential in breaking down the specific implications for your pipeline system into manageable processes based on an understanding of the quality of existing records in the context of integrity threats. ROSEN assists by including digitizing and assimilating information into a structured format to be integrated into the operator’s system of record.

These steps allow us to answer the key questions that define the strategic aims of the Material Verification program: why, what, where and how?
Technology
In-line Inspection Services

Are You Using the Right Technology?
ROSEN offers a suite of innovative ILI services to support data gathering and initial analysis for the Pipeline Material Verification process with a combined diagnostics approach, encompassing:

- **RoMat PGS** for strength and pipe grade determination
- **RoMat DMG** for hard spot detection and assessment
- **RoCorr MFL-A + RoGeo XT** for joint length, wall thickness, diameter, seamless vs. long seam differentiation, metal loss, and geometry feature detection and assessment
- **RoCorr MFL-C** for long-seam discrimination
- **RoGeo XYZ** for special alignment, route analysis, bending strain analysis, pipe movement and feature localization

Pipe Grade Determination
The RoMat PGS service provides a measurement of the yield strength for each pipe, characterizes the types of pipe within the pipeline as distinct populations with a specific set of characteristics and then establishes a pipe grade for each population. Utilizing the only in-line inspection technology able to report strength values, this proven service offers unique advantages in progressing through the Pipeline Material Verification process:

- A first appreciation of pipe grade before any digs are performed
- A single pipe grade calculated across each population, immediately confirming records or indicating a discrepancy for further assessment
- Outliers from surrounding populations are detected at the individual component level

Crucially, incorporating RoMat PGS into the Pipeline DNA process ensures that pipes within each population are known to possess consistent material properties. This opens the path for a robust statistical approach to defining valid material properties, including grade, leveraging the relative benefits of complete ILI data and in-field inspection and testing.
In-Field Inspection Services

Are You Getting the Most out of Your Digs?

The Material Verification process is progressed through an optimized program of primarily non-destructive testing (NDT), performed in excavations. Testing is conducted with a specific scope and in locations that are available opportunistically or designed specifically to gather the data relevant to the requirement.

We will accompany you through the ongoing task of gathering data to develop the most complete picture possible and close out the Pipeline Material Verification through our comprehensive offering of non-destructive field-testing services.

Using state-of-the-art in-field techniques, the following properties of a pipeline can be determined:
- Tensile properties
- Confirmation of longitudinal weld type and seam location
- Chemical composition
- Microstructural characterization
- Hardness
- Accurate wall thickness
- Coating type
Laboratory Testing Services

Do You Know Where and How to Test?

Where needed, it makes sense to combine non-destructive testing (NDT) of pipelines with laboratory-based testing to support the verification of pipeline material properties.

Destructive testing programs may include the following:

- Mechanical testing
  (tensile testing, Charpy testing, hardness)
- Material characterization
  (microstructure, chemical composition)
- Fracture toughness testing

All services are delivered by dedicated in-house technical teams, led by subject-matter experts. These teams, in turn, have access to a wide range of in-house and proprietary engineering assessment tools. Every Pipeline Material Verification project is a consultancy project, unique in itself, and conducted and delivered as a complete service to ensure you really have the most accurate understanding of your pipeline.
Data Integration
Review and Alignment of Available Data

Are Your Records Accurate?
ROSEN can assist in structuring, transforming, integrating and analyzing data that comes from various sources and is in different formats to digitize and incorporate pipe information into a structured format.

Our services include:
- Data Management
- Data Alignment
- Data Integration
- Data Verification

Records Status
Managing Your Data to Make Decisions

As the Pipeline Material Verification progresses and gaps in record quality are filled, the data must be managed, assimilated, integrated and interpreted. ROSEN’s customized software solutions allow efficient management of the process and interpretation of data through:

- Integrating and overlaying available datasets from multiple inspection services in a single software package, aligned to a common baseline and spatial locations
- Facilitating targeted digs for optimized data capture and aligning data from opportunistic digs on an ongoing basis
- Keeping track of gathered information and remaining gaps along the pipeline section, by location and by population.

Software solutions support operators in their daily decision-making processes and are designed to easily interface with existing systems. The modular approach helps operators to focus on specific needs.

NIMA is an intuitive and reliable framework comprised of a guide, a set of tools and resources that delivers the data you need, in the way you need it, to make better integrity decisions. The resources include a platform, personnel and training elements that are pieced together according to what you already have and what you need.
A Complete View
Pipeline DNA

Creating the Big Picture

A pipeline’s DNA continues to evolve throughout the Pipeline Material Verification process until a robust understanding of properties and attributes is reached in line with the strategic aims. ROSEN’s Pipeline DNA process uses in-depth analysis and integration of multiple datasets, determined from ILI, to allocate all pipes into populations with shared properties and attributes.

Incorporating strength values from RoMat PGS ensures the most accurate possible population assessment and allows a first pipe grade to be assigned to each population without digs. Pipeline Material Verification through in-field or laboratory testing is then used to verify or enhance the data where needed through additional testing.

Populations are essential to create an optimized and streamlined strategy for Pipeline Material Verification, maximizing value from field data while eliminating duplication of effort. Not only can operators optimize future in-ditch activities, data collected opportunistically can be confidently linked back to specific populations in the pipeline.

From Data to Integrity

We know that data collection and engineering must go hand in hand. At ROSEN, we deliver industry-leading integrity assessment support, ensuring that operators get the most from their valuable data.

Our expert team of integrity engineers and technical specialists works closely with operators to provide pragmatic and proactive decision support to ensure operational integrity across the full asset lifecycle.

Various integrity services are used to develop an understanding of existing threats and susceptibilities and interpret data and any integrity management implications.

Pipe population indicated by different colors.
The Benefit
Beyond Compliance

With ROSEN’s Pipeline Material Verification Framework, pipeline operators benefit from:

- Clear strategies for achieving regulatory compliance and safe pipeline operation
- The most complete picture of your pipeline properties and attributes through ROSEN’s Pipeline DNA process, supported by a combined diagnostic approach leveraging unique and innovative ILI technologies
- Optimized and streamlined Pipeline Material Verification, gathering maximum benefit from each dig
- Material testing and characterization services backed up by experts in material testing and metallurgy
- A smart approach to pipe grade determination for inadequately documented pipeline sections through robust statistical methods
- Software solutions to help inform decisions and manage data as the process progresses
- Compliance consultancy to implement results within your IMP and formally document the process.

Delivering reliable and flexible solutions that address the challenges of day-to-day pipeline operations is ROSEN’s way of creating ultimate value for operators.
The ROSEN Group

The ROSEN Group is a leading global provider of cutting-edge solutions for all areas of the integrity management process. Since its origins as a one-man business in 1981, ROSEN has grown rapidly and continues to do so. Today, the business is still privately owned and employs a team of more than 3,000, operating in more than 120 countries.

The four key ROSEN areas of expertise are:

- Inspection of critical industrial assets to provide the high-quality information needed to ensure reliable and effective operation
- Customized engineering consultancy ensuring efficient asset integrity management
- Production and supply of customized novel systems and products
- Market-driven, topical, state-of-the-art research and development providing “added value” products and services

“Empowered by Technology,” we approach the components of asset care, operational efficiency, diagnostics and integrity by understanding the needs of the industry and continuously innovating solutions to provide the optimal response.