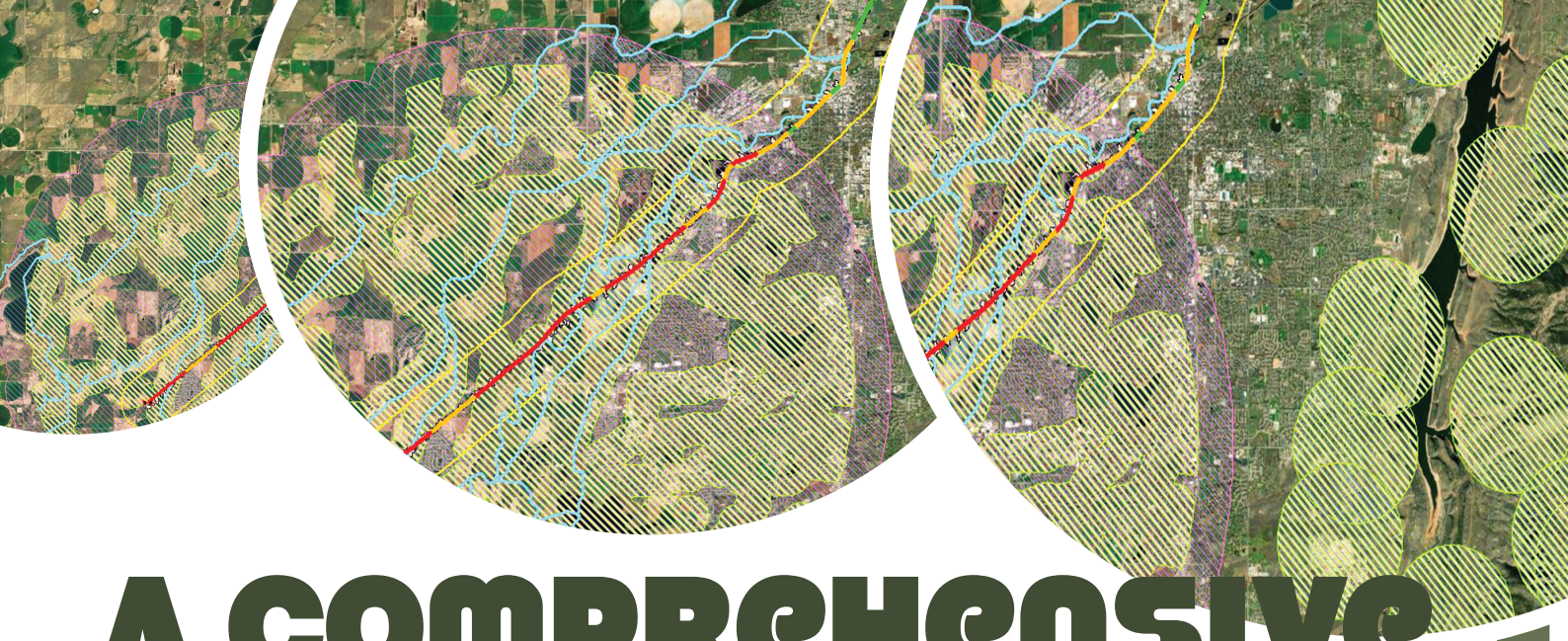
WORLD PIPELINES®
Volume 23 Number 11 - November 2023

Navigating the maze of *MEGA RULE* Compliance

Your Guide to *Simplifying* Pipeline Integrity



A comprehensive approach to compliance

Russ Davis, MISTRAS Group, USA, writes about how to achieve 'Mega Rule' compliance by meeting the requirements on pipeline material properties and MAOP.

On 1 July, 2020, the Pipeline and Hazardous Materials Safety Administration (PHMSA) revisions to 49 CFR 192 Part 1 – popularly known as the 'Mega Rule' – went into effect. This includes pipeline material verification and maximum allowable operating pressure (MAOP) reconfirmation, and records required to reconfirm MAOP must be traceable, verifiable, and complete (TVC).

However, where records are not traceable, verifiable, and complete for the pipeline material of construction, the owner must

perform material identification. Records required to be verified include:

- Diameter.
- Wall thickness.
- Seam type.
- Pipe material grade (yield strength (YS), ultimate tensile strength (UTS), pressure rating of valves and flanges, etc).
- Pipe material charpy V-notch toughness values.

There are multiple methods for gathering the data required to reconfirm MAOP, but the preferred method is to utilise in-situ non-destructive methods. This methodology can be performed at opportunity digs by qualified technicians utilising approved tools, or by a prescriptive approach (scheduled repairs, excavations, etc.). The prescriptive approach consists of 1 excavation per mile, or 150 excavations, if comparable population is more than 150 miles.

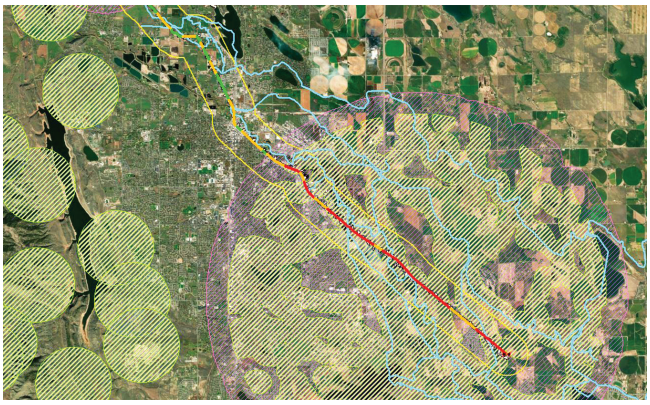


Figure 1. Quantitative risk models help to assess the current and future condition of the pipeline, along with the consequences of a potential failure, to help operators make confident integrity management decisions.

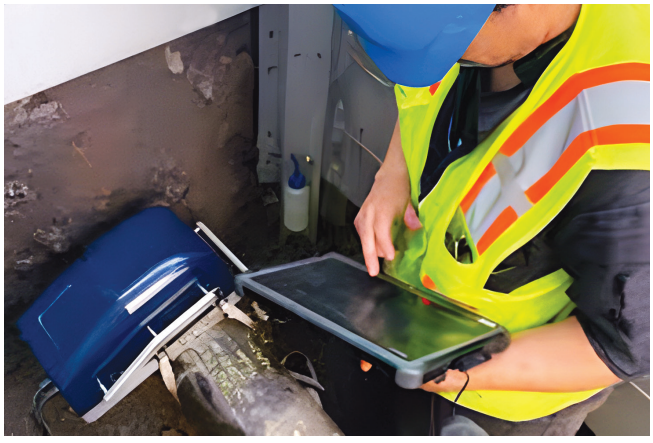


Figure 2. Advanced hardness, strength, and ductility (HSD) services can provide TVC records for missing integrity data to allow full utilisation of the MAOP, enabling additional pipeline capacity.

The scope of the new regulations, the lack of overall industry guidance, and often incomplete historical integrity records, have left many operators struggling with how to utilise their resources most effectively to achieve compliance. With so many different disciplines required to reach compliance – ranging from non-destructive examination (NDE) and inline inspection (ILI) material classification, to in-ditch material verification and engineering support services for establishing material verification programmes – operators typically require support to implement these programmes. Operators can benefit from working with a third-party service provider – like MISTRAS Group, a One Source provider of asset protection solutions – with the engineering expertise and complete solution toolbox required to achieve 'Mega Rule' compliance.

NDE methods and tools

It is critical that qualified companies train, test, and provide qualified and certified technicians to perform testing with PHMSA-approved tools for data collection. Experienced service providers typically invest considerable resources in training quality technicians and in purchasing tested and qualified tools to accurately collect data in-situ at opportunity and scheduled dig sites.

The tools required to accurately collect material of construction data must be validated by a subject matter expert (SME) as comparable to destructive testing results for material of comparable grade and vintage. The NDE method must conservatively account for measurement inaccuracies and uncertainties using engineering tests and analyses. The NDE method must also use test equipment that has been properly calibrated for comparable test materials prior to each usage.

In May 2018 the Pipeline Research Council International (PRCI) released a report titled 'Validation of In-Situ Methods for Material Property Determination'. The report provided a summary of test protocols applied and the performance results from various techniques. The Massachusetts Materials Technologies (MMT) 'Hardness, Strength, and Ductility (HSD)' advanced non-destructive material verification solution was tested by PRCI, and they found that the HSD was marginally the best technique with the lowest mean absolute percentage error (MAPE), highest correlation coefficients, and highest quantity of data within the specified error bands for both yield strength (YS) and ultimate tensile strength (UTS) of the methods tested.

The HSD utilises frictional sliding of four styluses to gather data and a proprietary algorithm to determine YS and UTS. It is important to work with a service provider with certified technicians experienced in using this NDE technology. The HSD tool provides quality data for reconfirmation of MAOP and determination of ERW seam weld classification and seam toughness.

MAOP

MAOP must be determined per the requirements of 49 CFR 192.619(a) for any steel pipelines that do not have TVC

documentation for any of the variables necessary to calculate designed MAOP. An operator may also determine to use the guidance provided by 49 CFR 192.620 "alternative maximum allowable operating pressure for certain steel pipelines." These methodologies are conservative in the determination of MAOP. By collecting the variables necessary for calculating MAOP per the formulas in ASME 31.8, owners/operators can document the full allowable MAOP and not be required to follow the conservative approach to determine MAOP. Advanced HSD tools can provide TVC records for missing YS and UTS data to allow full utilisation of the MAOP, thereby giving operators additional capacity in the pipelines they operate. Expert service providers, like MISTRAS, have a crew of qualified pipeline engineers who can lead the required data collection activities and perform the MAOP calculations for owners/operators to meet the requirements of 49 CFR 192.

Engineering critical assessments (ECA) for MAOP reconfirmation, critical flaw size determination and metal loss defects

A service provider that offers pipeline integrity engineering experts in addition to geographic information system (GIS) software and services is best suited to perform the ECA per 49 CFR 192.632. By utilising the data collected from the owner/operator and in-situ materials data collection, a wide variety of data can be integrated to support information analysis and risk assessment. Some key areas that must be consumed as part of the data analysis include:

- Pipe material properties.
- Product characteristics.
- Operating conditions.
- Environmental conditions.
- Pipe and coating condition assessments.
- Engineering and corrosion management surveys.
- Cathodic protection data.
- Population impacts and encroachment.
- Natural hazards.

This information is used to feed algorithms that create a digital twin of the pipe and its environment. The current and future condition of the pipeline is modelled along with the consequences of a potential failure to estimate risk.

The outputs of such models are quantifiable and verifiable units of risk (in $/y or $/mile per year) that can be used to make confident integrity management decisions. Benefits of this approach include:

- Identifying potential pipeline integrity threats.
- Zeroing in on the highest-risk areas.
- Focusing on what is driving risks higher.
- Evaluating risk reduction using 'what-if' analysis and mitigation planning.
- Producing reports, maps, dashboards, and other visuals to communicate and document findings.

Designed for transmission pipelines, this type of risk model is also suitable for gathering and distribution systems with adequate data to support quantitative risk. Mature models, like the quantitative risk assessment (QRA) variance that runs on New Century Software by MISTRAS' Spatial Risk Analyst platform, produce exceptional results and have passed many regulatory audits. However, perfecting a digital twin is an evergreen process.

Supporting services

Working with an experienced service provider, operators gain access to a risk team that includes diverse skills and experience to support a variety of risk management needs, including:

- Data collection, consolidation, and preparation.
- Adaptation to company data sources, data models, and domain types.
- Customisation of algorithms.
- Verification and validation of model results.
- Customised maps, dashboards, and other visualisations.
- Risk analysis to develop insights, identify issues, and propose actions.
- Facilitating development of company risk criteria.
- Integrating risk management within the integrity management process.
- Updating integrity management plans.

Comprehensive programme for MAOP reconfirmation

By utilising the complete toolbox delivered by qualified engineers, certified technicians, tested and validated tools for in-situ testing, and risk modelling software written specifically for meeting the requirements of 49 CFR 192, owners/operators can meet the PHMSA requirements by the regulatory due dates. Additionally, service providers can supply engineering and qualified technical resources to augment owner/operator needs. A lack of resources and having access to the proper tools should not be a roadblock when it comes to meeting this new set of regulations, as an experienced service provider, like MISTRAS, is ready, willing, and able to help you meet your critical compliance needs.

MISTRAS

One Source for Asset Protection Solutions®

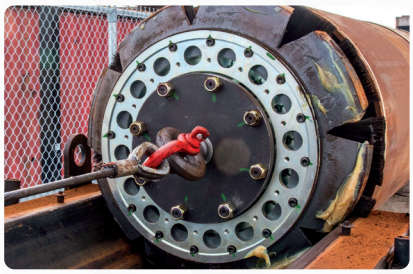
MEGA CHANGES TO PIPELINE INTEGRITY

Updated Regulations Kick-Start New Verification Needs

With the complex Mega Rule and a lack of available historical data, many pipeline operators are struggling to meet material verification requirements. MISTRAS Group delivers the expertise and solution portfolio to help you **achieve Mega Rule compliance**.

- Analyze pipe material properties and product characteristics
- Assess risks across operating and environmental conditions
- Data collection, material classification, and asset verification

MATERIAL VERIFICATION SERVICES



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