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NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D.C.

Pipeline Integrity Management
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(13 Pages)

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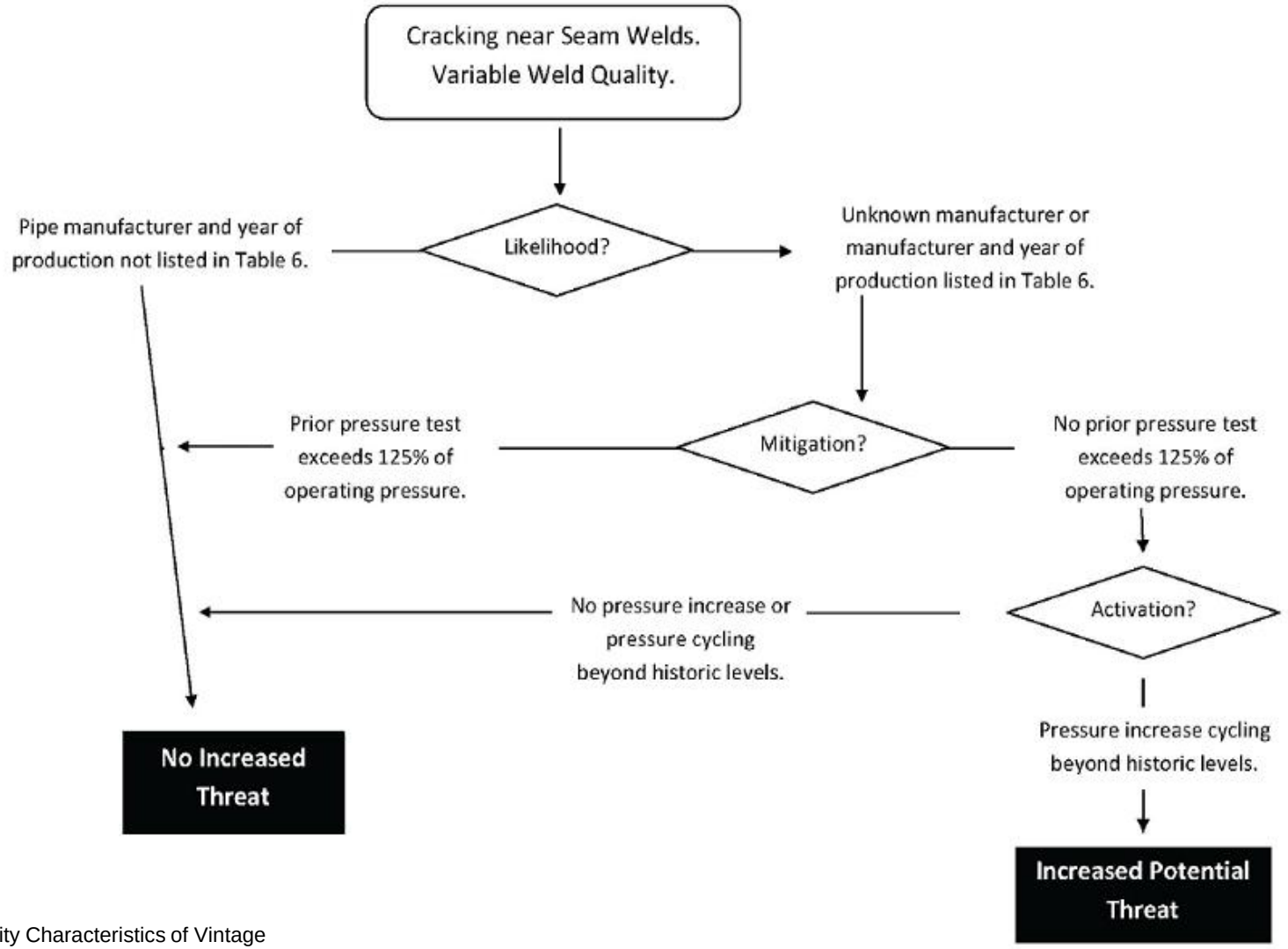
Addressing Gas Transmission Pipeline Threats

Threat Category	Time Based Behavior	Mitigation
Corrosion: - External - Internal - Stress Corrosion Cracking	**Time Dependent**	**Periodic Assessment**
Defects: - Manufacturing Defects - Fabrication & Construction Defects - Equipment Defects	**Stable unless activated by a change in service conditions**	**One-Time Assessment**
Excavation Damage **Incorrect Operation** **Natural Force Damage** **Other Outside Force Damage** **All Other Causes**	**Time Independent or Random**	**Prevention & Surveillance**
References: ASME B31.8s Integrity Characteristics of Vintage Pipelines, INGAA, 2005		

Addressing Seam Weld & Variable Weld Quality



Source: Integrity Characteristics of Vintage Pipeline, INGAA, 2005

Current ILI Technology

- **High-resolution MFL**
  - Axial field MFL
  - Extra High-res tri-axial sensor Axial Field MFL
- **Transverse field inspection MFL ("TFI")**
  - Circumferential field MFL
- **Ultrasonic wall thickness**
  - Normal Beam UT
  - Smaller diameter pitting corrosion UT
- **Ultrasonic crack detection**
  - Angle Beam UT
- **EMAT crack detection**
  - Guided Wave UT
- **Standard & high-resolution deformation tools**
- **Inertial measurement geometry tools**
- **Combo defect and geometry tools**

ILI Tools Suitability For Seam Defects

- **Angle Beam Shear Wave UT**
  - Requires liquid couplant – difficult to use in gas pipelines

- **Circumferential MFL (TFI)**
  - Not effective for tight defects – small gap must be present

- **EMAT CD tools**
  - Does not require couplant – works in gas & liquid pipelines
  - Least operator experience

ILI Limitations & Benefits

Limitations	Benefits
• Many lines are not piggable. An estimated 61% of LDC transmission pipe is not piggable.	• It is a non-destructive test
• Complex character of some seams or flaws makes accurate detecting, identifying, and sizing difficult	• It is more sensitive and efficient than a hydrotest
• Sometimes important flaws are missed	• Many operators have had good success finding significant flaws
• Meticulous non-destructive evaluation in the field required to validate ILI – Difficult to consistently achieve.	• Periodic runs can compare defects for growth

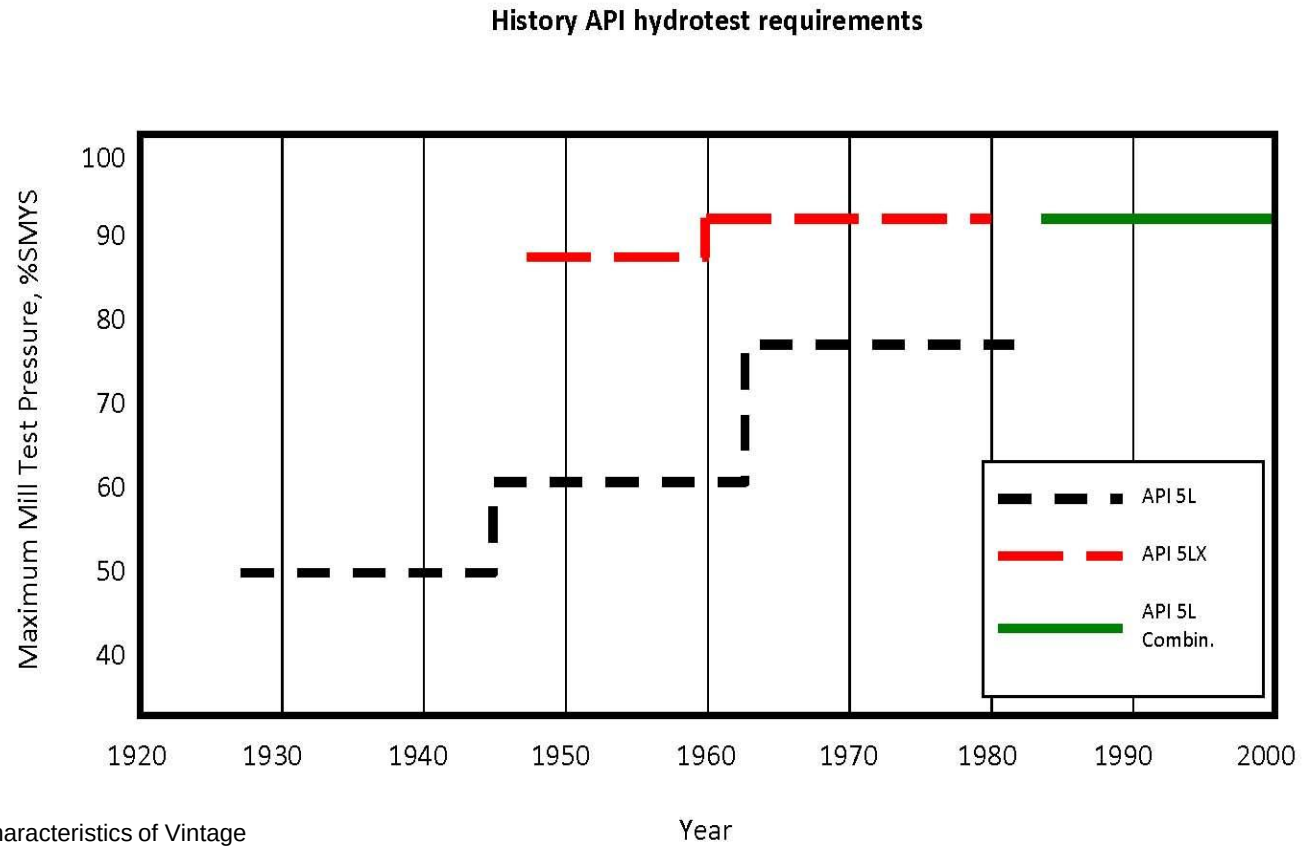
Hydrostatic Testing

Hydrotesting (and gas pressure tests) are conducted to:

- Expose defective materials that have missed prior detection
- Ensure that any remaining defects are insignificant enough to allow operation at design pressures
- Expose possible leaks and
- Serve as a final validation of the integrity of the constructed system.

Hydrostatic Testing

Pipe mills have tested pipe since the 1930s. The percent of SMYS mill test have increased over the years.



Source: Integrity Characteristics of Vintage Pipeline, INGAA, 2005

Hydrotest Limitations & Benefits

Limitations	Benefits
• In-service pipe difficult to shutdown for testing	• Applies to corrosion, SCC, fatigue, and seams
• Incomplete dewatering can cause severe corrosion problems	• Capability is generally predictable
• Effectiveness is reduced by variable pipe properties	• Proven success for managing progressive degradation conditions
• Not a mitigation of circumferential defects	
• Less sensitive than ILI for many defect types	
• Can grow subcritical defects to unknown size	

Pressure Testing Vintage Pipe

- A significant portion of vintage pipe was field hydrotested
- Older pipe was mill tested, but not as high as today
  - Extremely difficult to set-up, test and dewater "in-service" gas transmission
  - High field test levels may exceed historically demonstrated capability of pipe and cause damage
- Repeated attempts to test too high can cause damage
- Operator and regulator need to decide whether to place pipe under the high stress of a pressure test or maintain the stability of historically low operating pressure.
- There are 187,837 miles of pre-1970

Other Considerations: Low-Stress Pipelines

- Because pressure drives fracture initiation and propagation, low wall stress pipelines have different failure characteristics
- Lines below 30% SMYS tend to leak, not rupture, reducing the potential likelihood and consequence of an incident
- Pipelines below 30% SMYS are treated differently in:
  - ASME B31.8s
  - 49 CFR 192.507 *Test requirements for pipelines to operate at a hoop stress less than 30 percent of SMYS and above 100 psig*
  - 49 CFR 192.557 *Uprating: Steel pipelines to a pressure that will produce a hoop stress less than 30 percent of SMYS; plastic, cast iron, and ductile iron pipelines*
  - 49 CFR 192.941 *What is a low stress reassessment?*

Summary

- Operator need the flexibility to use all tools to address threats to pipeline safety.
- ILI and pressure tests have benefits and limitations
- Operators must weigh the benefits and risks to hydrotesting vintage pipe.
- Low stress pipelines have different leak versus rupture characteristic compared to higher stress pipelines.

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