

# CASING INSPECTION

## Standards, Tools, and Options

Presented by:

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**FARWEST CORROSION CONTROL COMPANY**

# About Farwest Corrosion Control Company

- Farwest Corrosion Control Company is a provider of corrosion materials, equipment, engineering and inspection services across the US.
- Established in 1956, Farwest is headquartered in Gardena, CA and has eight regional offices including new locations outside Houston and in the Northeast.
- Recently opened regional office in Newtown, PA providing Materials and Engineering Services – Stop by for a visit!
- Farwest provides casing services and materials including EMW casing monitoring, casing spacers, end seals, casing filler and more.



**Complete Cathodic Protection™**  
**Materials · Engineering · Installation**  
*Integrity – Service – Quality*  
**... Since 1956**

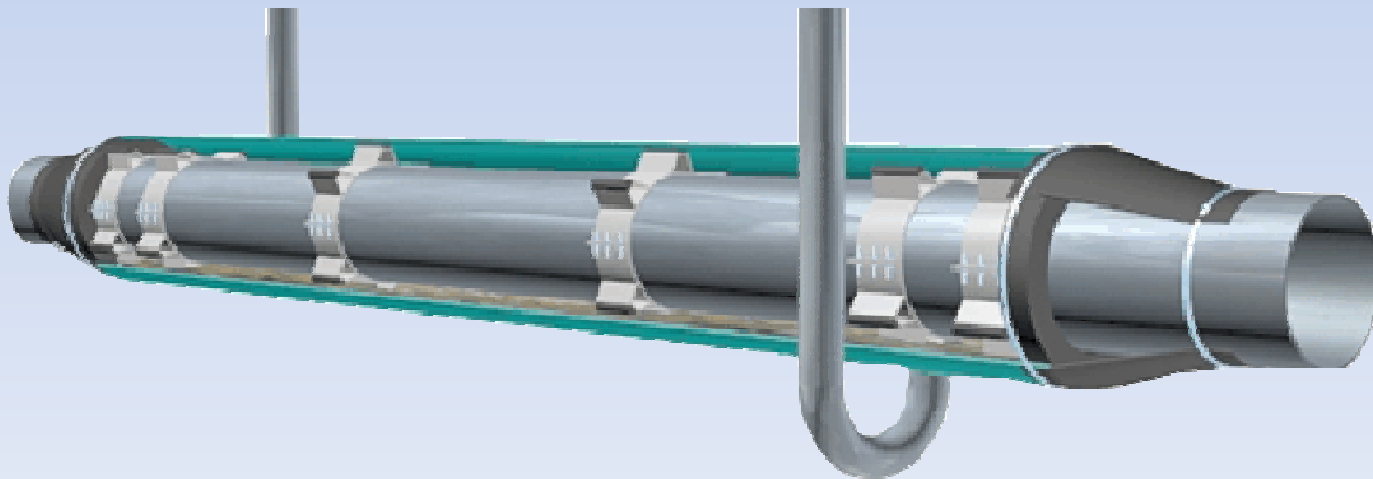


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# Casing Inspections

This discussion will address the matter of Casing Inspections by summary of currently available standards, tools, and remedial options.

- What's with Casings?
- Standards and Regulations
- Assessment Options – Above Ground, Electrical Isolation, Integrity Related
- Casing Monitoring Tools
- Remedial Action Options



# What is the Issue with Casings?

While statistically speaking the percentage known casing related incidents is small, the primary threat to cased crossings is corrosion.

Possible Causes of Corrosion inside a Casing:

- Water / Earthen Material in contact with pipeline at holiday (Electrolytic Couple) & lack of CP
- Short between Casing and Carrier
- Humidity / Condensation – Atmospheric Corrosion on pipeline
- Microbial

Casings present a challenge to many conventional inspection methods, limiting available options .



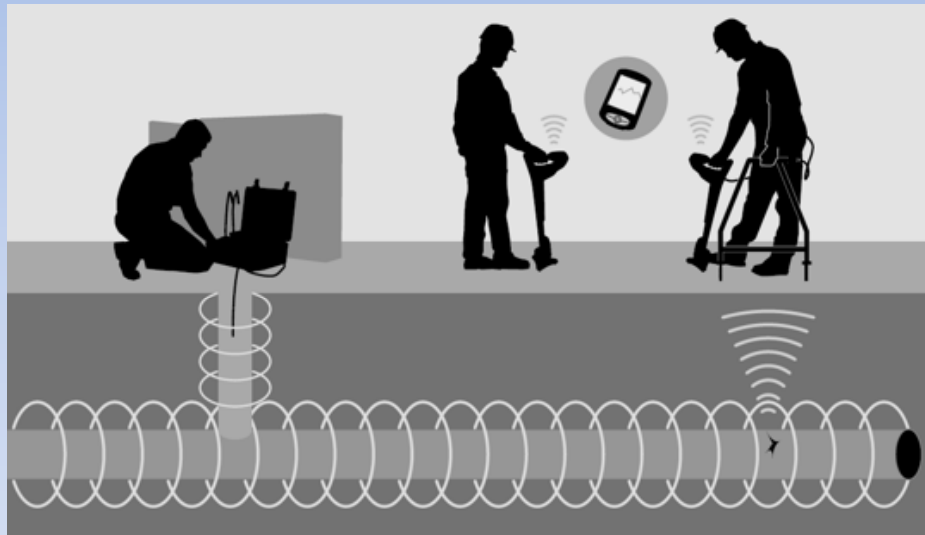
# Casing Standards and Regulations

- NACE SP0200-2008 - Steel-Cased Pipeline Practices
  - Industry standard practices for the design, installation, maintenance, repair, and monitoring of casings.
- CFR 192 Subpart I – Corrosion Control - 192.467 Electrical Isolation
  - Requirement to inspect for and maintain electrical isolation from casings, or take other measures to minimize corrosion if isolation is not practical.
- CFR 192 Subpart O – Gas Transmission Pipeline Integrity Management
  - Requirement to Assess all HCA pipeline sections (including cased pipe) by ILI, Pressure Test, ECDA, or Other (Approved) Technology
- PHMSA Guidelines for Integrity Assessment of Cased Pipe for Gas Transmission Pipelines in HCAs
  - November 2010 guidance for ECDA, filling, and monitoring of casings.



# Assessment Options – Above Ground

- Commonly used above ground tools are often used as a first step to assess condition at a cased crossing.
  - Close Interval Survey
  - Pipeline Current Mapper
  - ACVG (A-Frame)
  - DCVG



PCM and A-Frame from Radiodetection shown.

- These tools can help to identify the presence of coating holidays near casing ends and/or the presence of a shorted casing. Locating within a casing may be limited depending on conditions.



# Assessment Options – Electrical Isolation

- Potential Survey – Compare Pipe-to-soil and Casing-to-Soil readings. If both within 100mV of each other, potentially shorted.
- Internal Resistance Test – Measure potential difference between pipe and casing with/without current and calculate resistance. Low resistance (<.01ohm) indicates metallic short.
- Cycle Rectifier – If casing is isolated from pipeline, casing-to-soil should not shift with cycling of rectifier.
- Casing Depolarization – Pipeline depolarization should have little/no effect on casing potentials
- Pipe/Cable Locator – A pipe trace with transmitter setup between pipe and casing can approximate the location of a short.



# Assessment Options – Pipeline Integrity

If using ILI or pressure test as assessment method within HCA, no further inspection is necessary for cased crossings.

If using Direct Assessment option ECDA may be used and the recently published “Guidelines for Integrity Assessment of Cased Pipe for Gas Transmission Pipelines in HCAs” should be consulted.

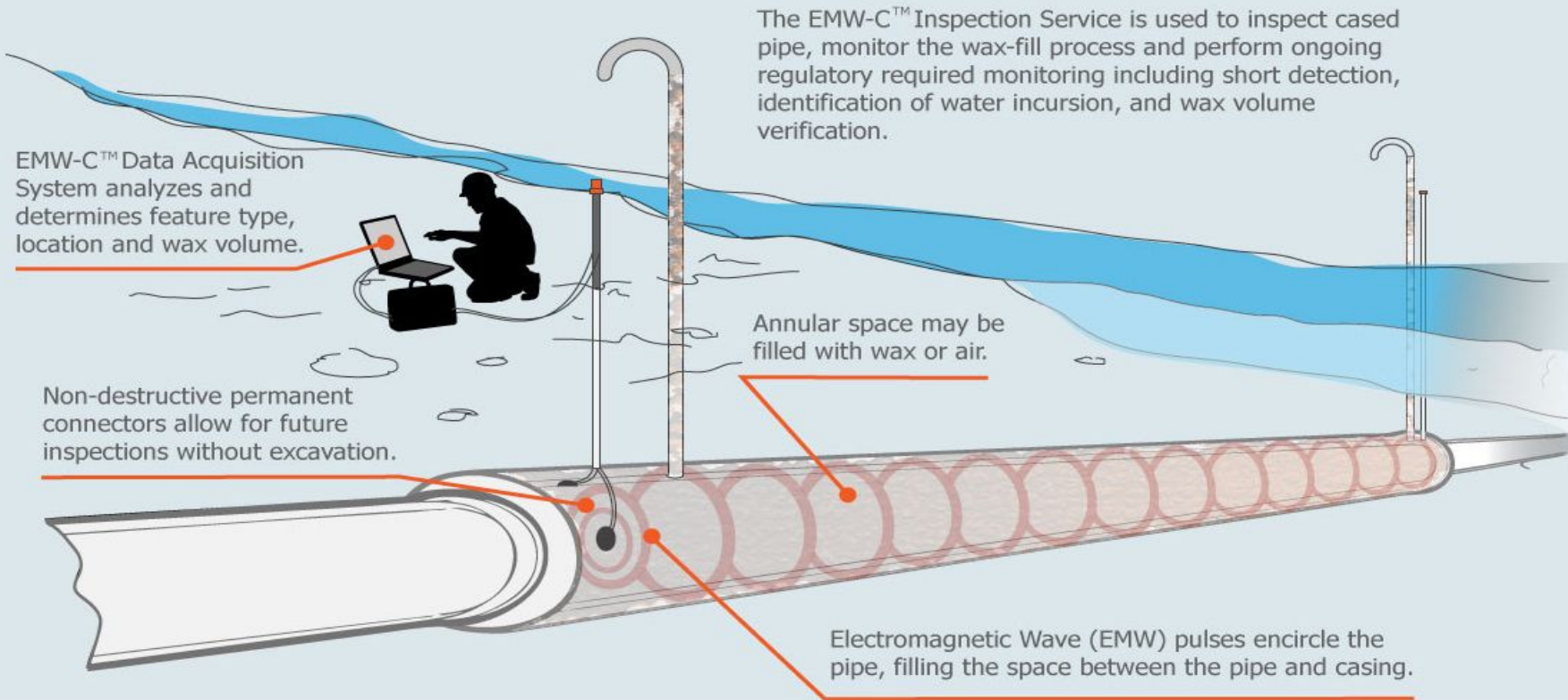
The Guidelines include:

- A “modified” ECDA process for Cased Crossings including Indirect Inspection tools and Establishing Regions
- Indirect Inspection using Guided Wave
- Guidelines for Severity Classification (i.e. shorted casing condition)
- Best Practices for Filling a Casing and Recommended Monitoring.



# Wax Filled Casing Monitoring Summary

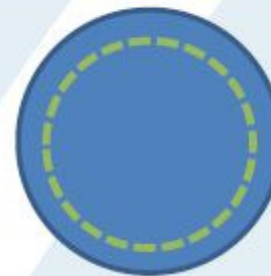
## Profile Technologies EMW-C™ Inspection for Wax Filled Casings



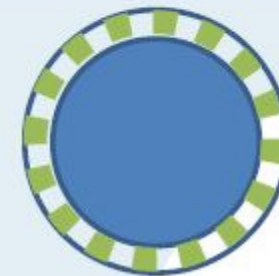
# Comparison of Long Range Monitoring Tools

Method	Wave Type	Wave Source	Waveguide
LRUT, GUL	Mechanical - Acoustic	Piezoelectric Transducers	Pipe cross-section
MsS	Mechanical - Acoustic	Magnetostrictive Sensors	Pipe cross-section
EMW-C™	Electromagnetic	Pulse Transmitter / Coaxial Connectors	Annular space between pipe and casing

Cross – Sectional view of pipe and casing. The dashed sections show the waveguide and “inspection area” for each method.



LRUT, GUL, MsS



EMW-C



## PHMSA Casing Guidelines Casing Monitoring

- In November 2010, PHMSA published Guidelines for Integrity Assessment of Cased Pipe in Gas Transmission Pipelines.
- The guidelines suggest **casing monitoring** as “other assessment activities” to satisfy the requirements of NACE ECDA RP0502.
- Under Section 3.2.2:

*“The other assessment activities (such as monitoring casing integrity) supplement the indirect inspection tool data with additional data which is indicative of the effectiveness of engineered systems (such as casings, end seals, and wax fill) in preventing corrosion and protecting carrier pipe integrity.”*

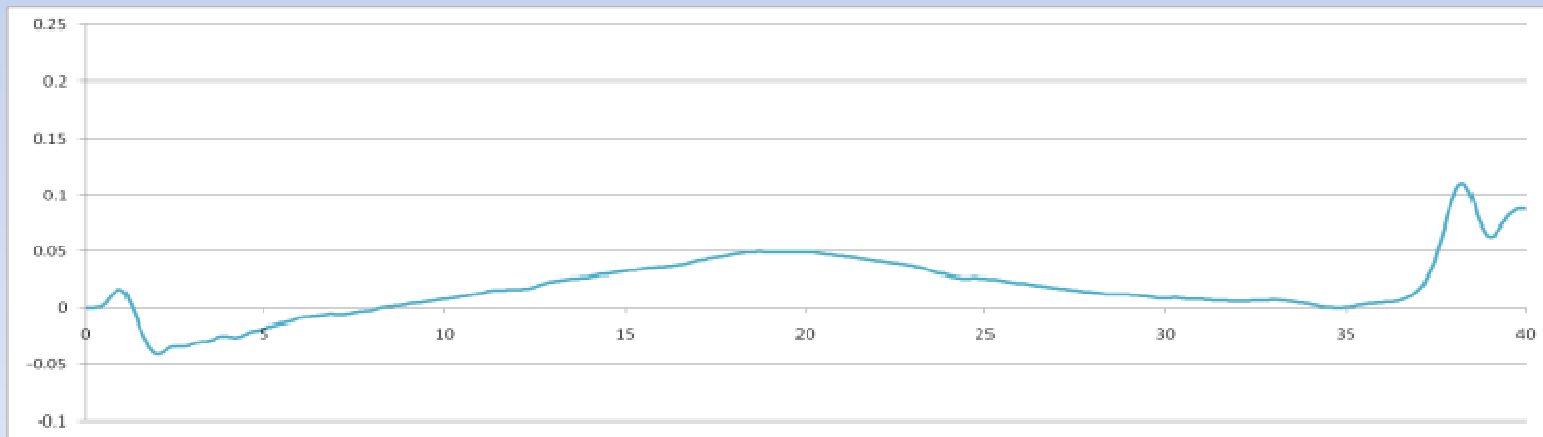


## Other Assessment Activities – Casing Monitoring

- Under D.1.1.3 Casing Fill Procedure...

*“Once the fill material level has stabilized, the total volume of fill material pumped into **the casing and vents must be compared to the calculated volume**. The difference in fill volume should be within 10% of expected.”*

Long Range EMW can determine the volume of wax fill immediately after filling to determine if this requirement has been satisfied. Profile can also determine locations along the casing where fill problems may occur.



## Other Assessment Activities – Casing Monitoring

- Under D.1.2 Guidance for Filled Casings Free of Metallic Shots and Electrolytic Contacts...

*“To ensure the continued effectiveness of the casing and fill material at preventing external corrosion:*

- *The fill material must remain in place and continue to encapsulate the carrier pipe.*
- *The level of fill material in the annulus of a casing must be monitored to ensure that the annulus remains effectively filled. Field verification of fill material effectiveness must include verification of casing integrity to assure that fill material is not lost through corroded or damaged casing.*
- *Electrical isolation of the casing from the carrier pipe must also be monitored.”*

Long Range EMW can verify that the wax remains in place through above ground monitoring and identification of new voids or water incursion.

Similarly, the level of fill material can be monitored and verified versus original baseline data.

Electrical Isolation is monitored by Long Range EMW by identification of metallic shorts and electrolytic coupling.



## Other Assessment Activities – Casing Monitoring

- Under D.1.2.5 Periodic Monitoring...

After the integrity assessment of the carrier pipe and casing has been completed, the operator must periodically monitor casing integrity as described below.

- **Structural integrity of the casing and end seals** (i.e., that the casing pipe and end seals are not leaking) must be monitored.
- **Fill quantity and fill level must be monitored** (i.e., that fill material is not leaking out or melting).
- **Electrical isolation of the casing from the carrier pipe must also be monitored.** The electrical isolation condition of the casing pipe to the carrier pipe must be in the clear or isolated condition. Testing techniques commonly utilized include Panhandle Eastern “B”, Internal Resistance, DCVG, ACVG, Current Attenuation, etc.

Long Range EMW can verify that the end seals are not leaking through monitoring of the entire annulus for (air) voids, and water incursion.

Similarly, the level of fill material can be monitored and verified versus original baseline data.

Electrical Isolation is monitored by Long Range EMW by identification of metallic shorts and electrolytic coupling.

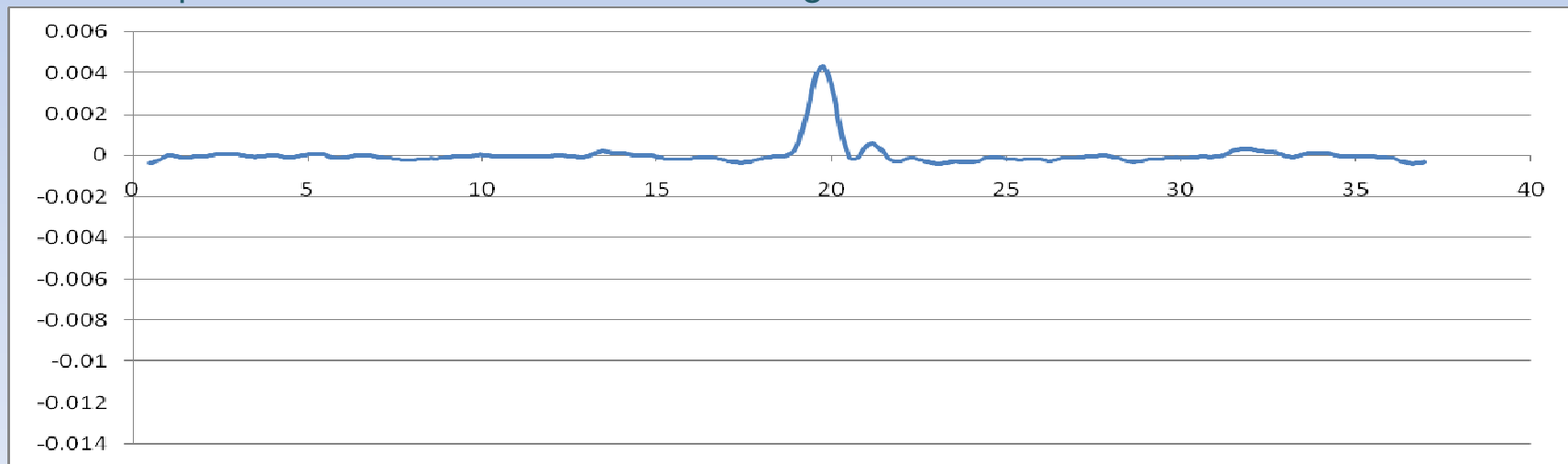


## Other Assessment Activities – Casing Monitoring

- Under D.1.2.5 Periodic Monitoring...

Documentation of these quarterly, annual or periodic tests for isolation between the carrier and casing pipe and fill level stability is required. The information must be used in the next reassessment as described in Section 3.

Long Range EMW provides documentation of each inspection with graphical representation of the full length of each casing. Consecutive inspections are compared to determine and isolate changes.



## Other Assessment Activities – Casing Monitoring

- Section D of the guidelines also provides monitoring requirements for unfilled casings.

### **D.2.1 Guidance for Monitoring Unfilled Casings Free of Metallic Shorts and Electrolytic Contacts**

After the integrity assessment of the carrier pipe and casing has been completed, the operator must periodically monitor casing integrity as described below.

- **Structural integrity of the casing and end seals** (i.e., that the casing pipe and end seals are not leaking) must be monitored.
- **Electrical isolation of the casing from the carrier pipe must also be monitored.** The electrical isolation condition of the casing pipe to the carrier pipe must be in the clear or isolated condition. Testing techniques commonly utilized include Panhandle Eastern “B”, Internal Resistance, DCVG, ACVG, Current Attenuation, etc.

Just as with filled casings, Long Range EMW can be used to perform the same monitoring as required by Section D.2.1 for unfilled casings.



# Remedial Action Options

When there's an issue with a casing, what can be done about it?

- Eliminate metallic contact
- Remove the casing
- Replace the carrier pipe
- Provide supplemental cathodic protection to the casing
- Fill the casing with a dielectric material
- Install a new crossing
- Monitor the condition of the casing
- Coat or recoat the carrier pipe
- Replace end seals
- Remove electrolyte from inside the casing



# Thank You!

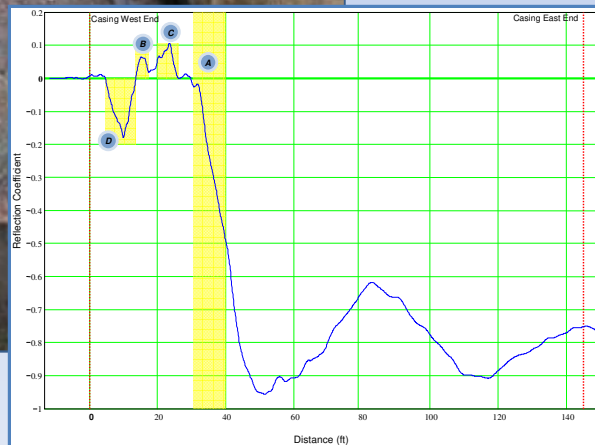
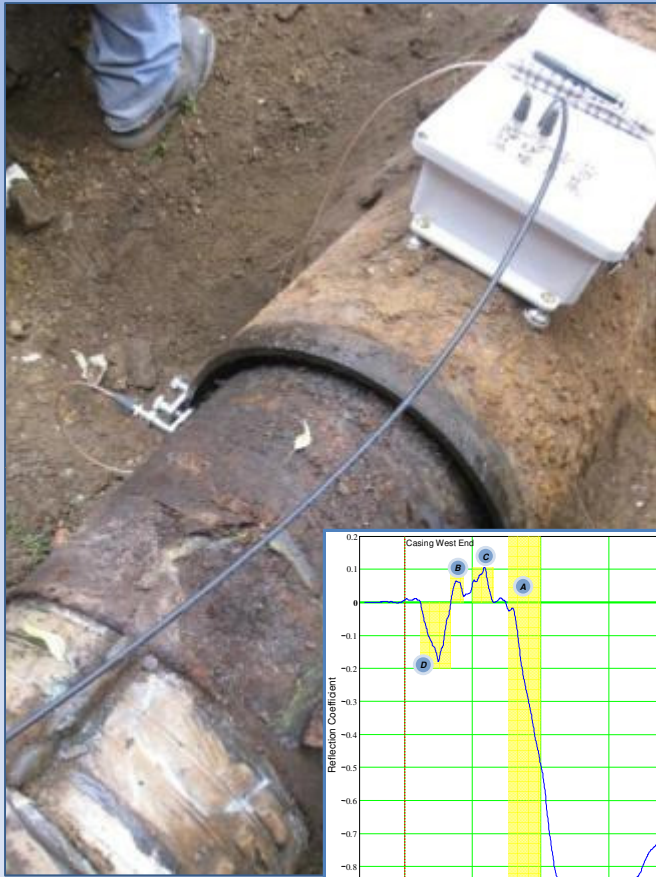
For Answers, Please Contact:

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