



UPT NDE Technology Update

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NRC/Industry UPT Meeting

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White Flint, MD

UPTI NDE Technology Update Overview

- EPRI UPTI Program Overview
- Tank NDE update
- Pipe NDE technology assessment update



2014 EPRI UPT NDE Technology Projects

EPRI has invested significantly in UPT NDE technology since 2007 and continues in 2014

- Ten 2014 NDE UPT projects
 - Several projects continuing from 2013
 - Two important projects scheduled to sunset in 2013 were extended into 2014
 - Five additional EPRI NDE projects bring value to UPT



2014 EPRI UPT NDE Research Projects

- Assessment and Evaluation of NDE for Tanks and Containment Liners (extended into 2014)
- Assessment and Development of Buried Pipe NDE Technology (extended into 2014)
- Criteria to credit guided wave as a direct examination (continuation from 2013)
- Revision to the Buried Pipe NDE Reference Guide
 - Additional technologies and operating experience will be added
- Guided Wave Structural Health Monitoring (continuation from 2013)

2014 EPRI UPT NDE Research

- Leveraging other industry resources – EPRI engaged with PRCI NDE technology development (>\$2.5M)
- Capabilities of NDE for quantification of real corrosion in buried piping (continuation from 2013)
- Investigation of new techniques for permanently mounted guided wave sensors (continuation from 2013)
- Technique development for HDPE pipe butt fusion weld strength evaluation (continuation from 2013)
- Examination through coatings (continuation from 2013)
 - Quantifying NDE capabilities through various coatings

Guided Wave Structural Health Monitoring

Purpose

- Install during excavation
- Data can be collected remotely
- Monitor for changes over time allows for detection of small wall loss
- Project will:
 - Include various GW systems
 - Assess the effects of variables that can affect guided waves
- Co-funded by PRCI
 - Engagement with major oil company and National Lab on new technology



Criteria to Apply Guided Wave as a Direct Exam

- Research results were published in December, 2013
 - *Guidelines for Obtaining Credit for Buried Pipe Guided Wave Examinations* (3002000468)
- Industry review of performance criteria and configuration restrictions scheduled for first week of July, 2014
 - Need to establish industry consensus
- Subsequently, the framework with criteria and guidelines will be submitted to NRC

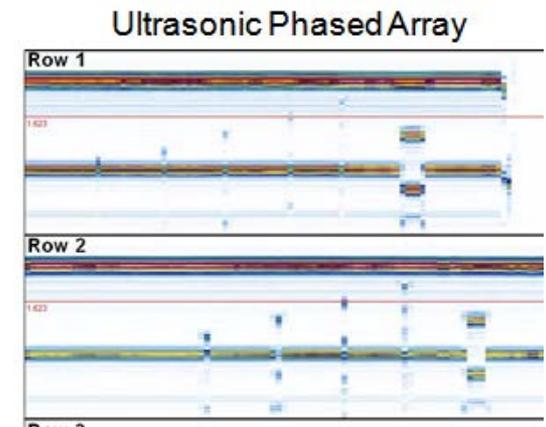
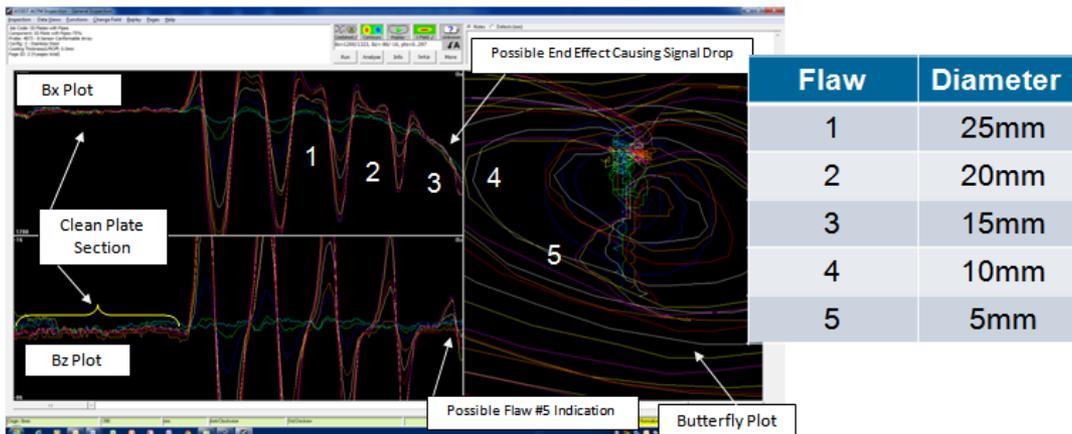
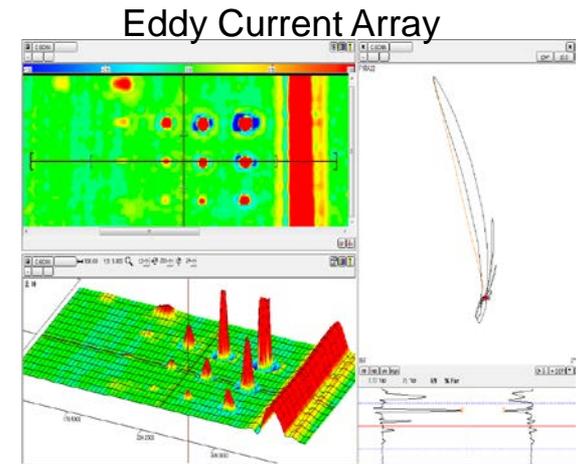
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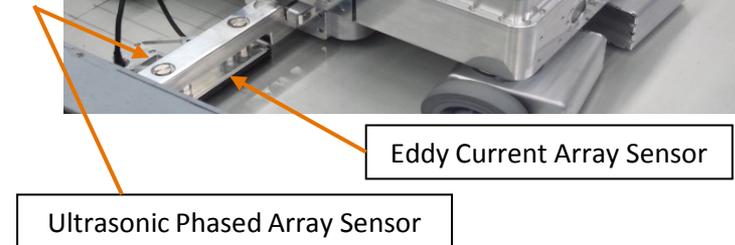
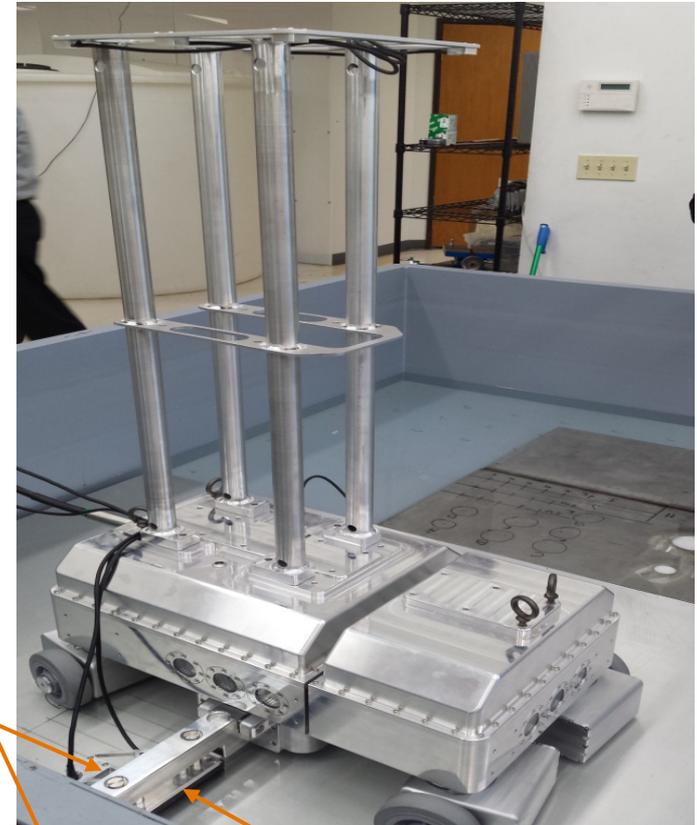
Assessment and Evaluation of NDE for Tanks and Containment Liners (2014-16)

- Purpose
 - Assessment tank NDE technologies
 - Assess tank NDE robotics
- Leveraging PRCI R&D results
- *NDE for Tanks and Containment Liners* (Report 3002000462 published in Dec. 2013)



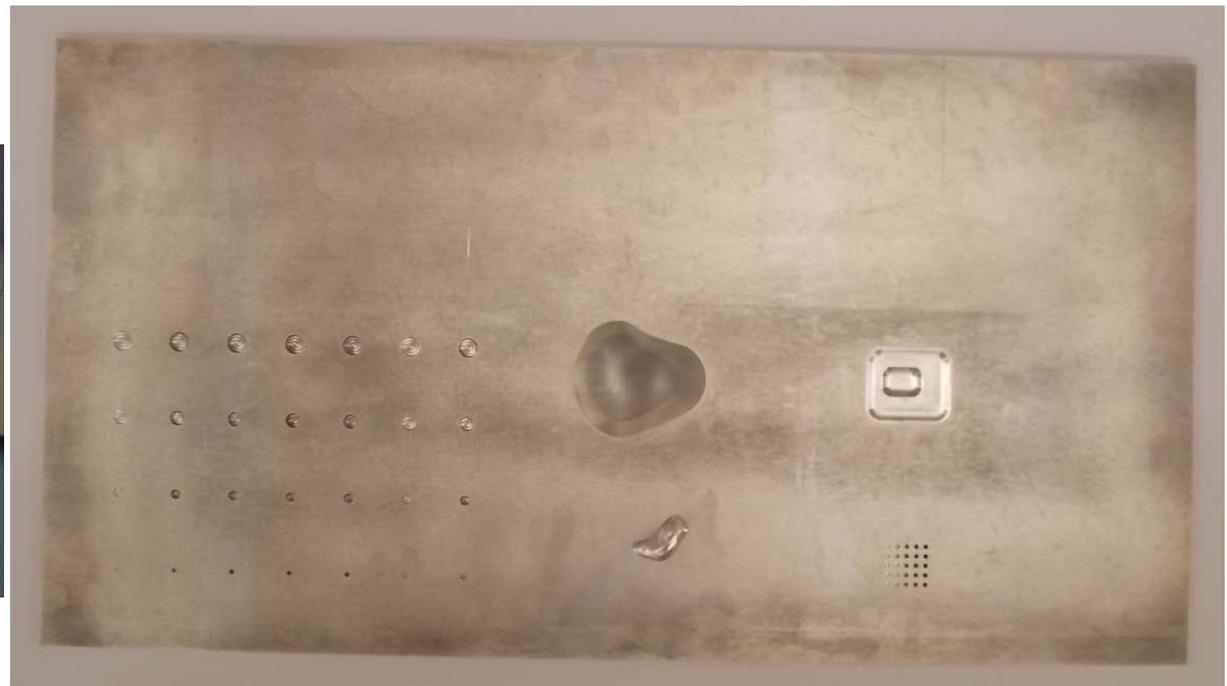
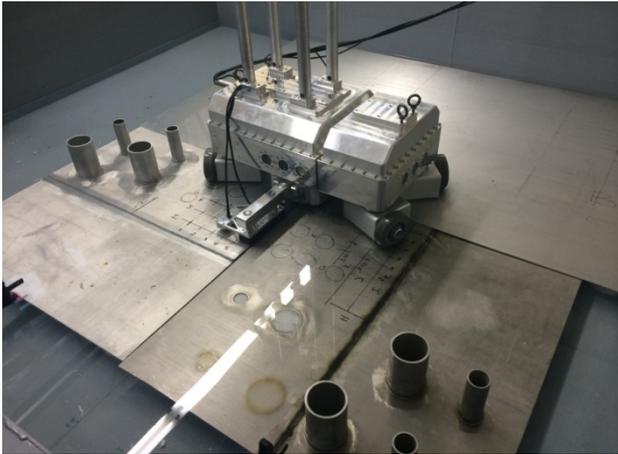
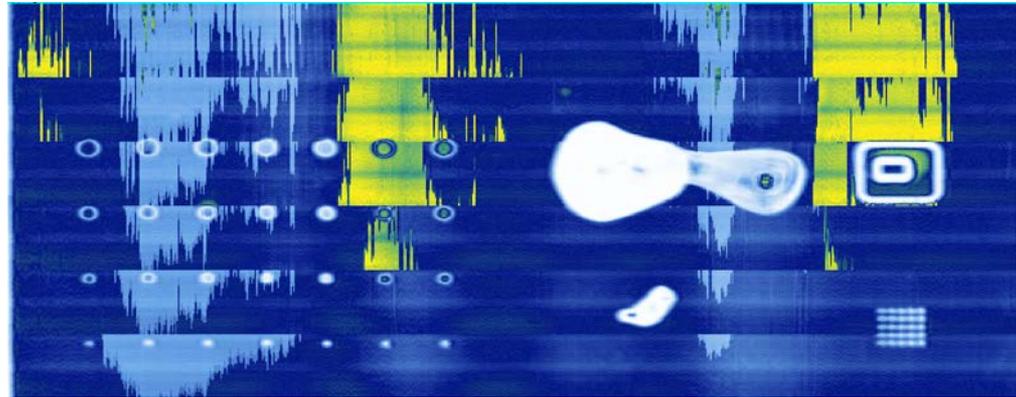
Recent Tank NDE Activities

- Demonstration of an inspection robot in a tank mock-up
 - Robot submersed in water
 - Eddy current array and ultrasonic phased array sensors
- A further demonstration and site inspections planned for Fall 2014
 - Stainless steel CST tank
 - Eddy current array and ultrasonic phased array sensors



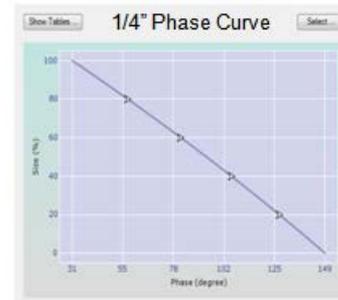
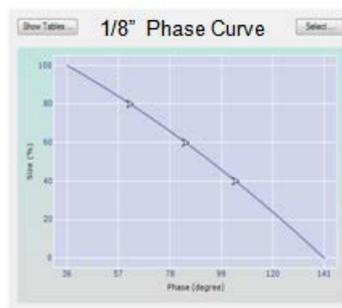
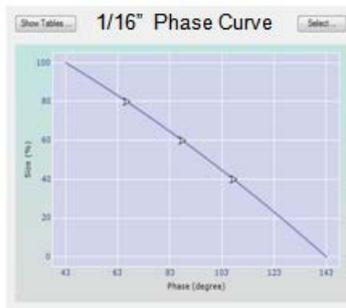
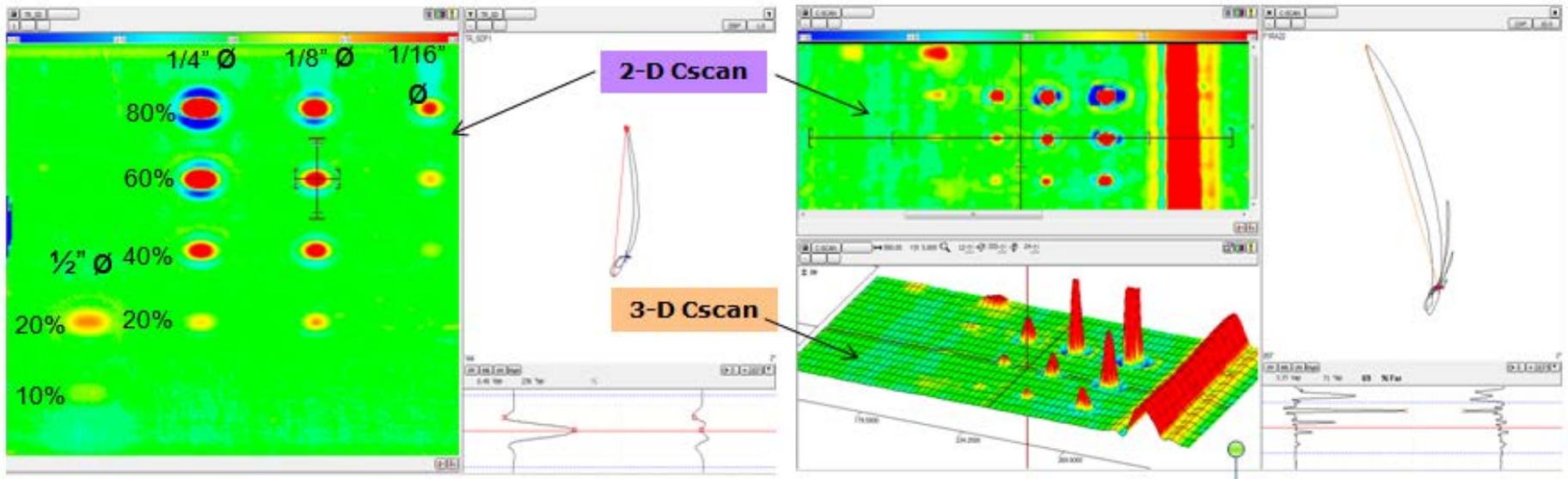
Recent Tank NDE Activities

- Ultrasonic phased array results obtained on EPRI mock-up



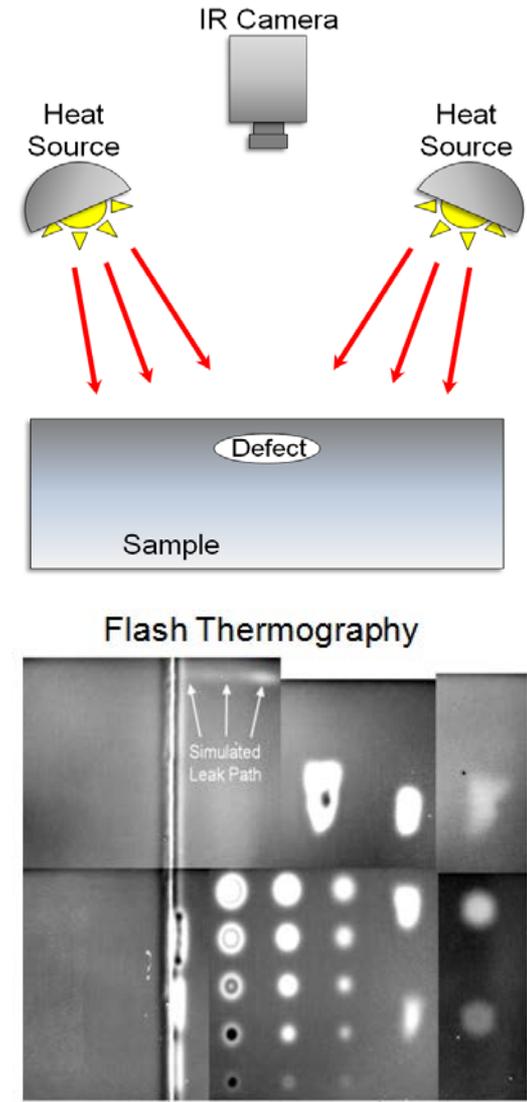
Recent Tank NDE Activities

Eddy current array sensor operated at 800Hz (1/4" Aluminum plate)



Tank NDE Update

- Thermography experiments performed on fabricated plate mock-ups
- Feasibility study using the short-range guided wave testing
 - Electromagnetic Acoustic Transducers (EMATs) sensors
 - Carbon steel, stainless steel and aluminum plate mock-ups with fabricated flaws and service induced pits
- EPRI held the “Symposium on Concrete Structures, Liner Barriers and Tanks”



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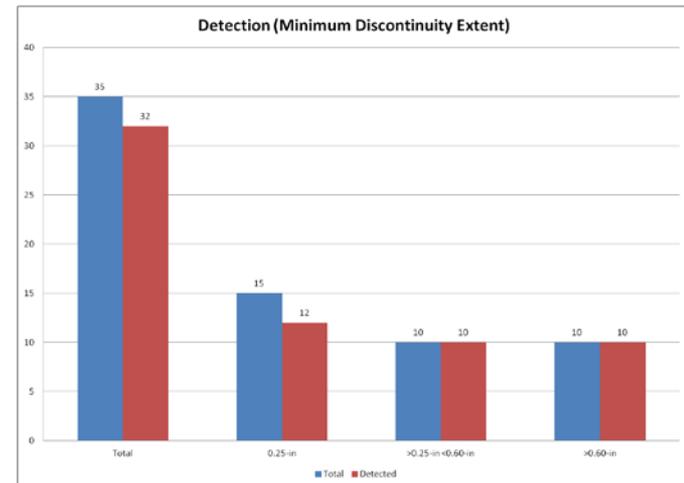
Assessment and Development of Buried Pipe NDE Technology (2014-16)

Purpose

- Benchmark buried pipe NDE capabilities
- Provide resources for vendors to tweak procedures
- Provide utility support in implementing technology
- Identify new NDE technologies



2-in wide array of 64 ultrasonic elements



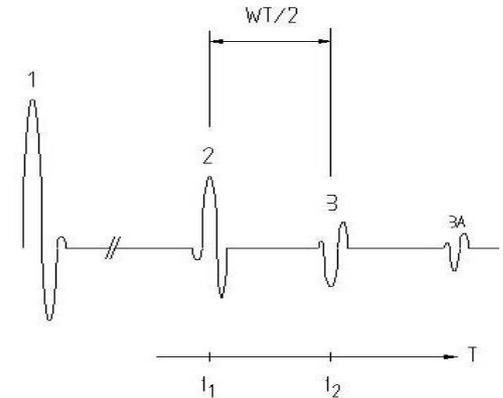
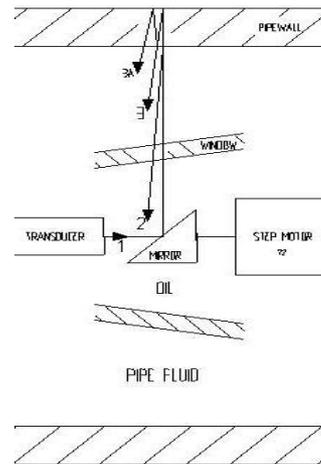
Recent Piping Technology Assessment

- ILI device propelled through the pipe with the flow of fluid
 - Capable of bi-directional tool
- Assessment conducted on EPRI's 8-in diameter 60-ft long mock-up
 - 6 elbows
 - 1-diameter bend elbow
 - Maneuvered through mock-up without issue
- Results to be published in upcoming report



Recent Piping Technology Assessment

- Ultrasonic flow through in-line inspection technology
 - Single transducer with a rotating mirror
 - Onboard pulser, receiver, digitizer, data storage
 - Data stored on-board
 - Real time view of ultrasonic data can be obtained
- Technology has been used at a US nuclear plant

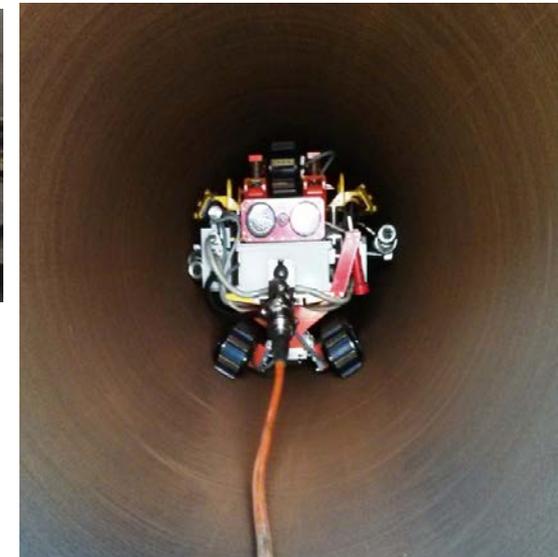
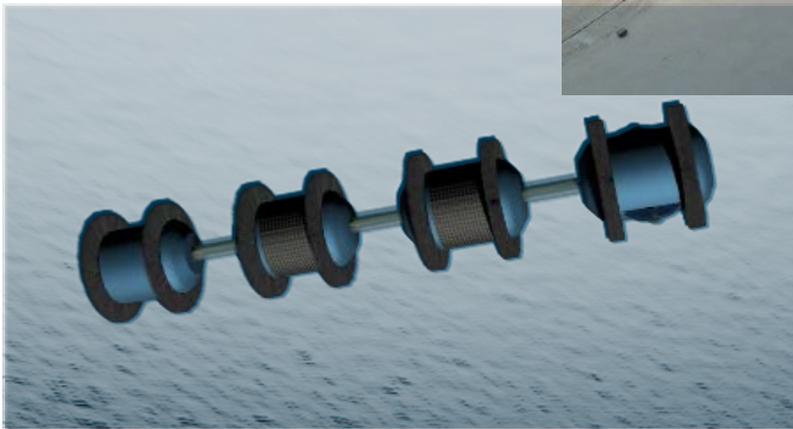


Assessed NDE Technologies Used in the Field

- Inline flow through ultrasonics
- Ultrasonic robotics – Electromagnetic Acoustic Transducer (EMAT)
- In-line Remote Field Eddy Current (RFT)
- Phased array ultrasonics



2-in wide array of 64 ultrasonic elements



EPRI Buried and Underground Pipe NDE Reports

(Red – denotes results published in 2013)



- ✓ Nondestructive Evaluation: Buried Pipe Nondestructive Evaluation Reference Guide—Revision 2 (1025220)
- ✓ Nondestructive Evaluation: Buried Pipe NDE Reference Guide—Revision 2, Addendum 1 (3002000447)
- ✓ Nondestructive Evaluation: Assessment and Development of Buried Pipe NDE Technology (3002000463)
 - Replaces interim report 1025219
- ✓ Buried Pipe Direct Examinations Through Coatings (1025228)
- ✓ Nondestructive Evaluation: Buried Pipe In-Line NDE Depth Sizing Procedure (1025231)

EPRI Buried and Underground Pipe NDE Reports



- ✓ Intermediate Diameter Buried Piping Instrumented Vehicle--Evaluation (1022926)
- ✓ Remote Field Technology Assessment for Piping Inspection Including Buried and Limited Access Components (1021153)
- ✓ Catawba Field Trial of EPRI's Large Diameter Buried Pipe Instrumented Vehicle (1016676)
- ✓ Buried Pipe Guided Wave Examination Reference Document (1019115)
- ✓ Guided Wave Analysis Tools for Buried Pipe (3002000466)
- ✓ Guidelines for Obtaining Credit for Buried Pipe Guided Wave Examinations (3002000468)

EPRI Buried and Underground Pipe NDE Reports



- ✓ Nondestructive Evaluation: Guided Wave Analysis Tools (1025212)
- ✓ Nondestructive Evaluation: Guided Wave Status Report (1022929)
- ✓ Nondestructive Evaluation: Further Developments of Guided Wave Examination Application 2009 Status Report (1019116)
- ✓ Nondestructive Evaluation: Further Developments of Guided Wave Examination Application (1016675)
- ✓ Nondestructive Evaluation: Buried Pipe Structural Health Monitoring (1025213)

EPRI Tank and NDPE NDE Reports



Tank NDE Deliverables

- ✓ **Nondestructive Evaluation: NDE for Tanks and Containment Liners (3002000462)**
- ✓ **Inspection Methods for Tanks and Containment Liners (1025215)**
- ✓ **Inspection Methodologies for Buried Pipes and Tanks (1021561)**

High Density Polyethylene (HDPE) NDE Technology

- ✓ **Nondestructive Evaluation: High-Density Polyethylene NDE Technology (3002000439)**

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