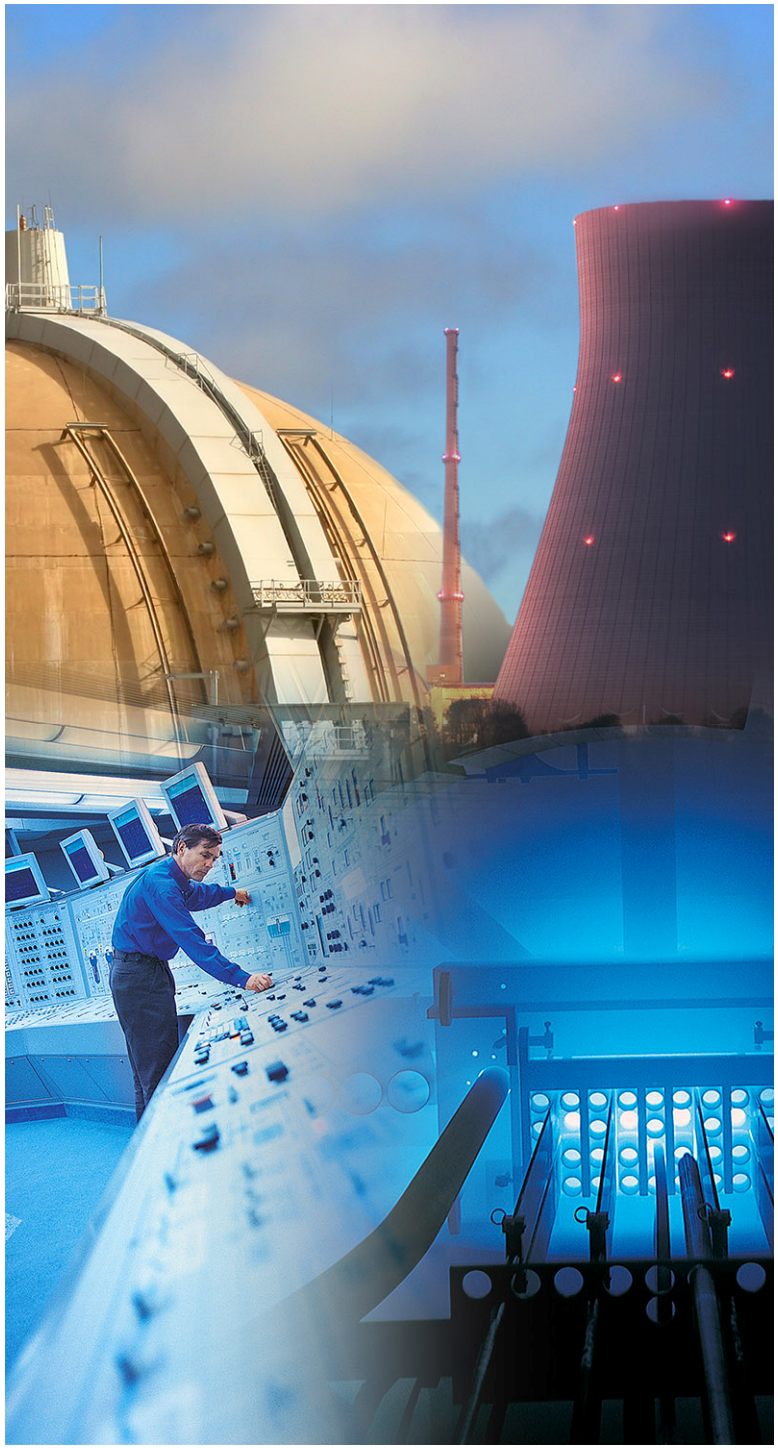

ELECTRIC POWER RESEARCH INSTITUTE

Buried Pipe Integrity Initiative

Inspection technology development

February 24, 2010

Bo Clark

Program Manager-Balance of Plant Corrosion, EPRI

Perspective

- Inspection technology is a challenge
  - Configuration of buried piping at our sites does not allow use of many of the technologies utilized by other industries
  - Visible inspection by excavation is not reasonable in many situations
  - Guided wave is one of the developing technologies for condition assessment
    - Limitations apply
- Following slides provide overview of technology being investigated
  - Status will be reported periodically

EPRI's Buried Pipe NDE Technology Roadmap

Category	Projects	Prior	2009	2010	2011	2012	2013	Beyond
Reference Material	Guided Wave Reference Document							
	Guided Wave Workshop							
	Buried Pipe NDE Reference Document							
Resources	Mock-ups							
	GW Equipment Procurement							
	GW Industry Support							
NDE Technology	Identification of Buried Pipe NDE Technology							
	Assess Electromagnetic Technology for Small Bore Piping							
	Develop Electromagnetic Inspection Vehicles							
	Assess / Develop Buried Pipe NDE Technology							
Guided wave	Technique Assesment & Development							
	Technology Assesment & Development							

Guided Wave Reference Document

EPRI Report 1019115 "Buried Pipe Guided Wave Examination Reference Document" (Published in 2009)

- Resource for utility when examining buried pipes with guided wave technology
- Provides basic guided wave theory
- Identifies critical data acquisition and analysis variables
- Identifies limitations
- Identify and provide guidance on variables effecting GW capabilities
- Literature study that identifies many key documents
- Document state of the art as well as gaps

Guided Wave Workshop

Purpose

- Lays basic foundation of buried pipe guided wave examination
- For utility buried pipe owners and NDE personnel responsible for implementing Guided Wave examination
- Based on EPRI Report 1019115 “Buried Pipe Guided Wave Examination Reference Document”

Schedule

- 1st Workshop held in December 2009
  - Well attended by both buried pipe owners and NDE
- Plans for additional workshops in 2010 and 2011

Buried Pipe NDE Reference Document – State of the Art Summary

Project (In Progress)

- Document the state of the art in buried pipe NDE technology
- Provide utility personnel a reference document for planning and implementing NDE technology
  - Guidance on selecting and applying buried pipe NDE technologies
  - Identify capabilities and limitations to the extent known (does not assess capabilities)
  - Identify limiting piping conditions and configurations
  - Identification of gaps in inspection technology

Schedule

- Initial version to be published in 2010
- Project proposed to provide updates

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Resources – Equipment

- TeleTest guided wave system (Piezoelectric)
  - 2009 EPRI Capital purchase
  - Hardware and software
  - Various transducer assemblies
- SwRI MsSR 3030 System (Magnetostrictive)
  - Hardware and software
  - Various sensors
- EMAT Generated Guided Wave
  - Have some resources
  - Plans to purchase additional resources in 2010
- Modeling (Finite element modeling analytical tool)

Pipe Mock-ups

Resources – Mock-up

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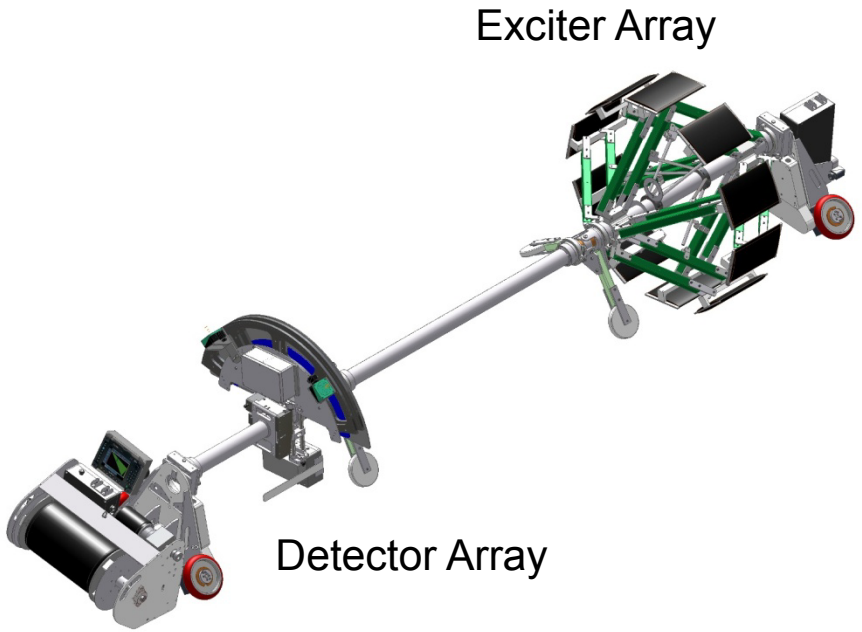
Identification and Assessment of Buried Pipe NDE Technology (In progress)

- Identify potential NDE technologies for inspection of buried pipe
  - Immediate use
  - Further development
- Examples:
  - EMATs generated ultrasonic
  - Remote Field Technology (RFT)
  - Acoustic Emission & Leak Detection
- Establishing relationships with other industries more experienced with buried pipe inspection
  - Petrochemical and gas industry
  - PRCI
  - Pipeline inspection vendors

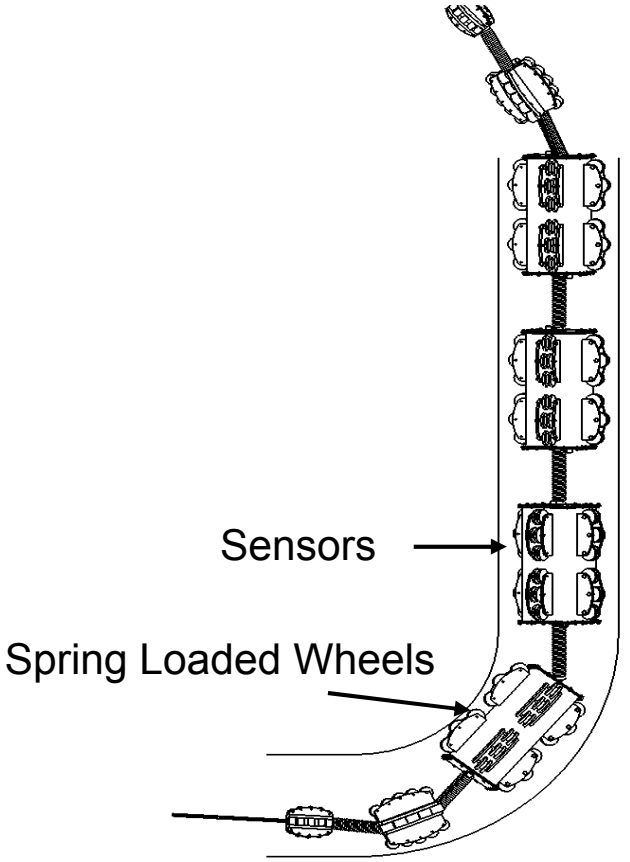
Vehicle for Very Large Diameter Pipe

- Development and field testing of vehicle for very large diameter buried pipe (36” ≤ D ≤ 12’) was completed in 2008
- Detect
  - Internal and external pits
  - Circumferential weld degradation
  - Longitudinal weld degradation
- Install through 24” diameter manway
- Can dissemble to pass through elbows



Vehicle for Medium Diameter Pipe

- Being developed to inspect pipes form 12” to 30” diameter
- Runs along a guide wire
- 1” of radial clearance to allow for mud, tubercles, coatings, etc
- Can traverse
  - Change of elevations
  - Branches, tees
  - Multiple elbows (at least 6)
- Retrieval safety – 2 levels
  - Cable pull
  - 2nd vehicle
- Field testing in 2011



Commercialization inquiries received

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Guided Wave Applications

Project Proposal

- Focused scanning to improve sensitivity and sizing capabilities
  - Develop and test guided wave routines
- Develop techniques for using guided wave in small “keyhole” digs
  - reduce excavation cost
- Evaluate guided wave’s effectiveness for assessing coating integrity
- Develop and assess techniques to perform on-line condition monitoring
- Develop a data base for the industry’s guided wave data

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