Pipeline Research Council International, Inc.

Advancing Leak Detection Technologies for Operating Energy Transmission Pipelines

PRCI Research Programs – Review & Challenges

PHMSA 2009 R&D Forum

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LEADING PIPELINE RESEARCH

PRCI Membership Drives Research

- **38 Energy Pipeline Operating Companies**
  - 25 Natural Gas Transmission; 11 Liquid
  - 2 Operators - both Liquid and Natural Gas Transmission
- **World-wide Research Organization**
  - 26 U.S. Companies
  - 12 Non-U.S. (Brazil, Canada, Europe, Saudi Arabia)
- **14 Associate Members**
  - U.S.; Canada; Mexico; Japan
- **Total mileage represented ~355,000 miles**

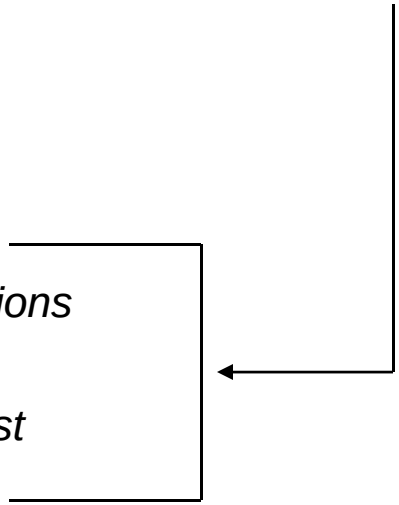
PRCI™

LEADING PIPELINE RESEARCH WORLDWIDE

PRCI Research Development & Implementation

- **Research Project Development**
  - Annual process - ballot voting and project funding
  - Approximately $10-13 MM annual funding commitments
    - *Includes membership allocations and other funding sources*

- **Success through Collaboration**
  - Within the membership
  - Other organizations
    - *Industry groups and trade organizations*
    - *PHMSA*
    - *Other cofunding sources with interest*



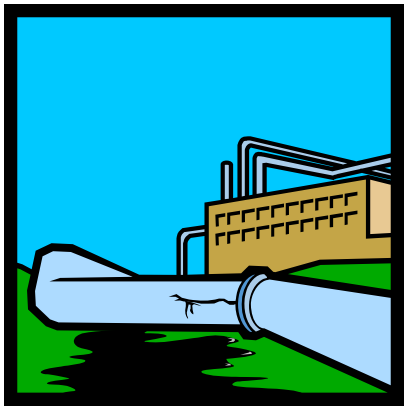
Why is this Forum & Process Important?

- **Demonstrated, Positive Benefits of PHMSA R&D**
  - Standards
  - Knowledge
  - Technology
- **Leveraged Research Investment**
- **Broad Access to Research Results**
- **Sustaining & Expanding the Industry Knowledge Base**
- **Peer-based Planning, Implementation, and Results**
- **A Consortium of Ideas and Solutions**
- **A Proactive Commitment to Industry and the Public**

Leak Detection - Drivers & Challenges

Research Drivers for Leak Detection

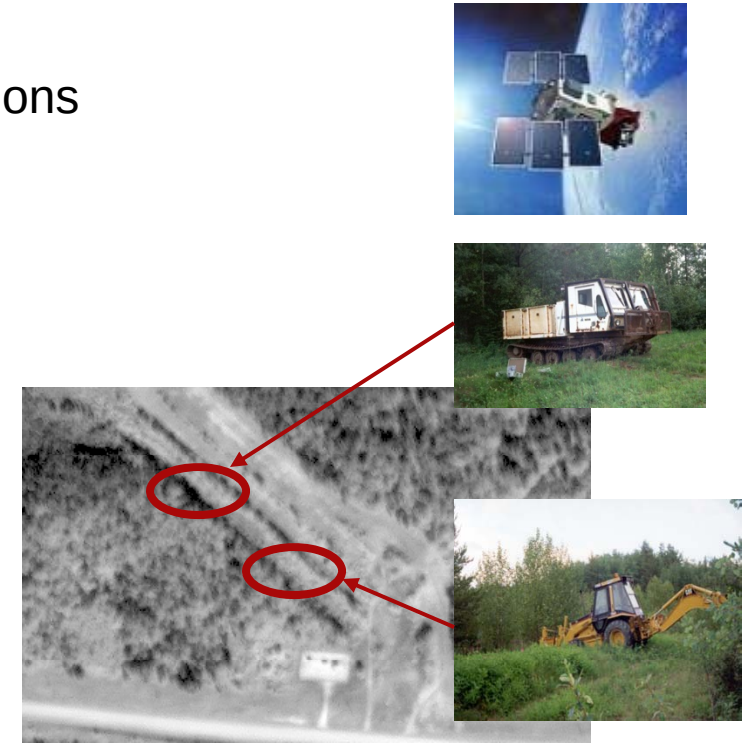
- **Safety and Environmental Performance**
  - Potential for unknown/unexpected worker and public exposure
    - *Incidental contact*
    - *Vapor/gas intrusion concerns (liquids)*
  - Liability for natural resource impacts and damages
    - *Remediation and restoration*
    - *Legal claims*
  - LAUFE – emphasis on greenhouse gas releases



- **Financial and Economic Considerations**
  - Keeping product in the pipe and delivery to market
  - Paying for liabilities from above
  - Credits and trading
- **Public Perception and Corporate Citizenship**
  - Encroachment
  - Enhanced awareness
- **The Best Leak is One that Never Happens (API website)**

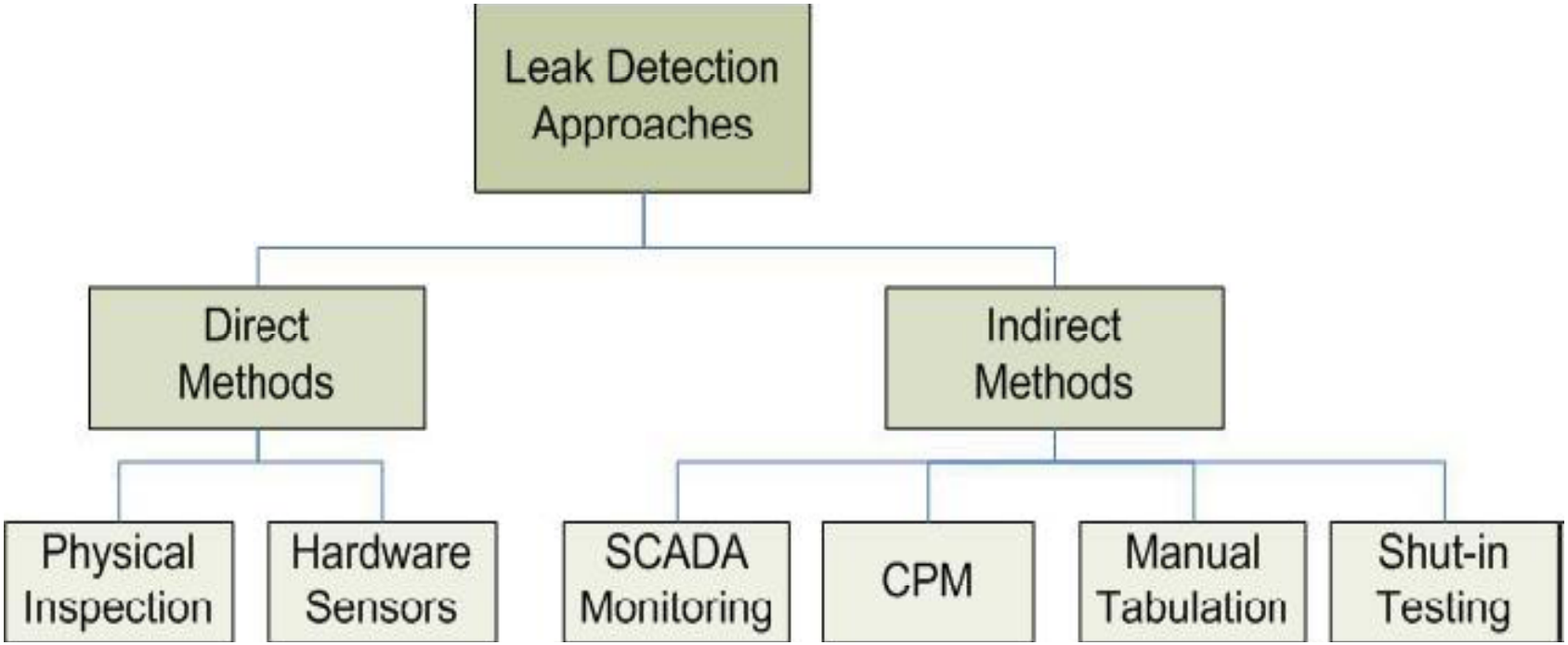
PRCI Leak Detection Research

- **Past Efforts Conducted to Research a Number of Leak Detection Approaches and Technologies**
  - Satellite and remote sensing – linked to Damage Prevention
  - Fiber Optic cables
  - Human Factors and Control Room Operations
  - Computational Pipeline Monitoring (CPM)
  - Acoustic methods
- **Recent Gap Analysis**
  - 2007 Report from SwRI
  - Aerial reconnaissance - primary method
- **PRCI Facilities Program**



Current State of Leak Detection

- Two General Approaches to Leak Detection
- Direct – visual, soil sampling, instruments & sensors
- Indirect – changes in measurements/data



Key Industry Challenges and R&D Needs

- **Challenging Environments and Conditions (e.g., urban/asphalt, ice, water)**
- **Continued Aging of Infrastructure**
- **New Standards and Regulations – Technology Adaptability**
- **Sensitivity of Measurement Systems Relative to Minimal Release Volumes/Rates – False Calls and Reliability**
- **Locating a Release after Detection**
- **Increased Scrutiny on LAUFE**
- **Development of Cost Effective Approaches**
  - Substantial mileage of energy transmission systems
  - Varying needs based on unique conditions for individual operators
  - No single technology can address all pipeline issues – tiered approach, multiple technologies
  - Inside & outside the fence

Research Focus for Path Forward

- **Renewed focus on leak detection – interest increasing as a key aspect of GHG programs**
- **Improved ROW monitoring identification of small leaks – early detection and mitigation – understanding of L vs R boundary**
- **External leak detection and slack line conditions**
  - Imaging – IR, GPR, laser-dispersion
  - Vapor monitoring
  - Acoustic emission sensors
- **Capitalize on current commercial methods and technologies**
- **Research new and emerging technologies**
  - Land-based, fixed wing, UAV, and satellite
  - Continued Human Factors analysis
  - Methods for monitoring both internally and externallly
  - Opportunities with new construction/systems
  - Improving SCADA & CPM capabilities

Key Industry Challenges and R&D Needs

- Improve understanding of current system performance and capabilities – POI, POD, POFC; satellite, aerial patrol, ground surveillance, in-situ monitoring etc.
- Improved integration of industry-government databases; mining existing information and extracting the value – Predictive Modeling (PPTS)
- Developing new technologies that can be integrated into existing platforms
- Application of emerging technologies – hyper-spectral, DIAL, LiDAR
- Real time processing, communication, and reporting
- Continued focus on public awareness and Best Practices

Additional Projects Being Considered

- PRCI 2010 Ballot Items
  - Several projects that focus on leak detection and threat prevention

Questions?