

# *Pipeline Research Council International, Inc.*

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PRCI Technology Development Center

## **Introduction to PRCI and Research Program Update**

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Development

EPA Natural Gas STAR PRCI Tour  
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# Introduction to PRCI

# Pipeline Research Council International, Inc.

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## PIPELINE

- Natural Gas
- Crude Oil & Petroleum Products
- Biofuels
- CO<sub>2</sub>
- Related Facilities

## RESEARCH

- Knowledge
- Technology
- Deployment & Transfer
- Innovation

## COUNCIL

- Forum for Ideas & Opportunities
- Peer-based
- Industry-driven
- Source of Research Inventory

## INTERNATIONAL

- North America
- Europe
- South America
- Asia
- Australia
- Africa

# PRCI Mission

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**To be the global leader in collaborative energy pipeline research that provides safe, reliable, environmentally conscious and efficient means of delivery.**

Note: Mission Statement being evaluated during PRCI Strategic Planning in 2017

# PRCI Membership

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- **33 Energy Pipeline Operating Companies**
  - 18 Natural Gas Transmission; 9 Liquid
  - 6 Liquid/Natural Gas
  
- **3 Pipeline Industry Organization (PIO) Members**
  - Association of Oil Pipe Lines (AOPL)
  - Electric Power Research Institute (EPRI)
  - Operations Technology Development (OTD)
  
- **35 Associate Members & Technical Program Associate Members**
  - Australia, Canada, China, Europe, Japan, Mexico, U.S.
  - Special Membership – Australian Pipeline & Gas Association (APGA)
  
- **Worldwide Research Organization**
  - 41 U.S. Companies
  - 31 Non-U.S. (Australia, Brazil, Canada, China, Europe, Japan, Mexico)



# Current Operator Membership

## ▪ Natural Gas

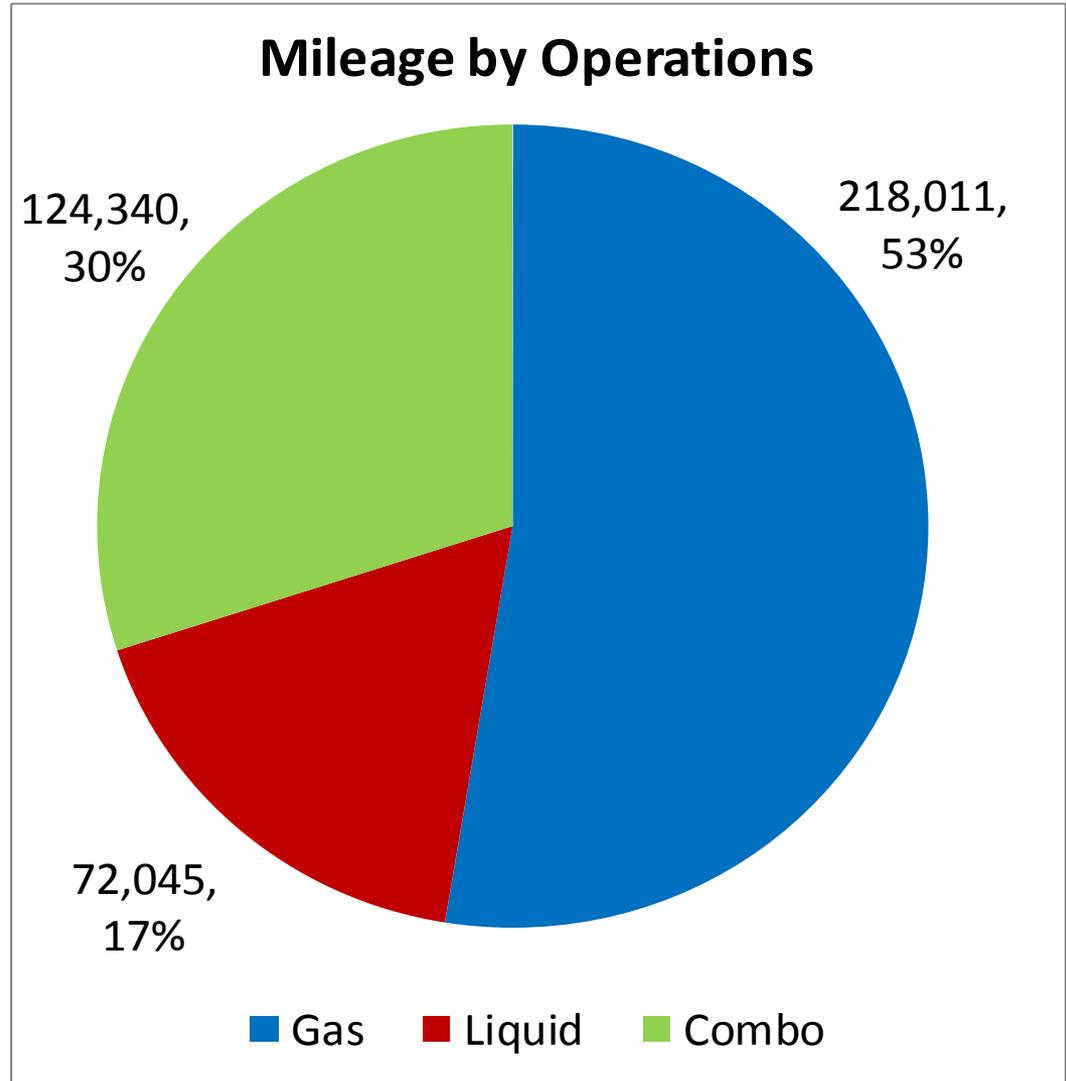
- Alliance
- ATCO
- Boardwalk
- Columbia
- Dominion
- Energy Transfer
- ENGIE
- Gassco
- Gasunie
- Kinder Morgan
- National Fuel
- National Grid
- OTD
- PG&E
- SoCalGas
- Spectra
- Total
- TransGas
- Williams

## ▪ Liquid

- AOPL
- Buckeye
- Chevron
- Colonial
- ExxonMobil
- Koch
- Marathon
- Phillips 66
- Plains
- Shell

## ▪ Combo

- ConocoPhillips
- Enbridge
- Enterprise
- Petrobras
- PetroChina
- TransCanada



# PRCI Research Implementation

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## ■ Technical Committees (7)

- Four addressing Pipeline issues & Three addressing Facilities issues
- Each operates under a Executive Assembly-approved charter
- Develop & maintain roadmaps to achieve PRCI research objectives
- Provide essential peer review of research results
- Provide oversight & continuity of, and among, projects under the TC

## ■ Project Teams & Area Leaders

- Comprised of voting members from funding companies
  - *Hold the decision-making authority on each project*
  - *Approve research results on behalf of their companies & PRCI*
- Larger projects usually led by 3-5 person core management group
- Emphasis Areas led by Vice Chairs or Interest/Emphasis Area Leader(s)
- Any PRCI member company can participate on the team
- This is where the core mission is executed

# Pipeline Technical Committees & Focus

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## ■ Design, Materials & Construction

- Assessment & Repair
- Construction
- Design
- Fracture
- Geohazard Management (Overlap with SO&M)
- Materials
- Welding & Weld Inspection
- Structural Integrity Assessment

## ■ Corrosion

- Detection, Assessment, Prevention, & Management of Galvanic Corrosion & SCC; Coatings
- Improvement & Enhancement of Cathodic Protection; Design & Operations
- Quantitative Risk Assessment

# Pipeline Technical Committees & Focus

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- **Integrity & Inspection**

- NDE Technology Development & Inspection Methods
- Mechanical Damage
- Pipeline Integrity
- Subsea (Overlap with DMC)

- **Surveillance, Operations & Monitoring**

- Threat Analysis & Damage Prevention
- ROW Management – Environmental & Third-party Interference
- ROW Protection & Monitoring
- Leak Detection (liquids)

# Facilities Technical Committees & Focus

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## ■ Compressor & Pump Station

- Cost-effective Emissions Reduction and Emissions Monitoring (Overlap with SOM)
- All Equipment in Stations – Engines, Turbines & Drives
- Equipment Reliability, Availability & Life Extension
- Improve Fuel Efficiency and Greenhouse Gas Emissions Mitigation & Reporting

## ■ Measurement

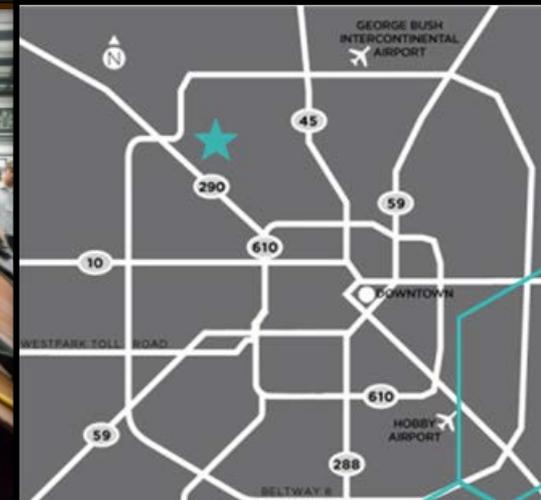
- Improve Custody Transfer Accuracy and Reduce Metering Errors and Bias
- Support the Technical Underpinnings of Measurement Standards
- Reduce Lost & Unaccounted For Gas and Reduce Measurement O&M Expenses
- Expand the Operating Range of Existing Equipment

## ■ Underground Storage

- Storage Reservoirs, Bedded Salt Structures & Salt Caverns
- Wellbore and Cavern Integrity and Inspection
- Field Deliverability and Facility Integrity & Reliability

# Technology Development Center - TDC

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# TDC Existing Capabilities

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- **Services available to PRCI members and nonmembers**
  - Pull test facility for In-line Inspection tools
    - 24", 16", 12" & 8" pipe strings containing hundreds of fully characterized real & manufactured defects.
    - Main winch is capable of running consistent velocities from 1 mph to 11 mph while pulling over 5,000 lbs.
  - Liquid loop test facility
    - 12" & 6" nominal pipe utilizing water as the liquid medium
    - Variety of configurations ranging from easily piggable to "difficult to inspect"
    - Design incorporates the ability for continuous test cycles at a pressure of ANSI Class 150 (285 psi)

## TDC Existing Capabilities (2)

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- **Services available to PRCI members and nonmembers**
  - Large inventory of pipe Samples with real-world and manufactured defects
  - Qualification testing of NDE professionals and tools
  - Technology demonstrations
  - Warehouse space for conducting research and storing pipe samples sensitive to the elements
  - State-of-the-art meeting space with conferencing capabilities

## Pull Test Strings

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## Liquid Test Loop



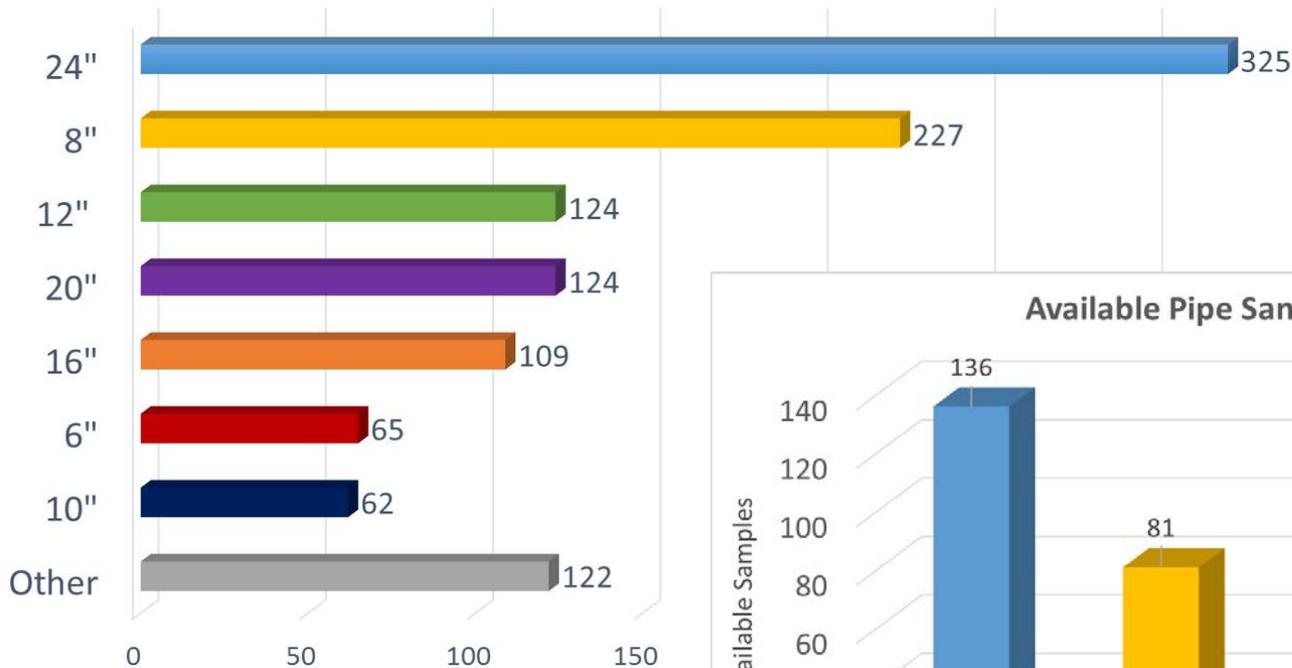
## Pipe Warehouse & Testing Space



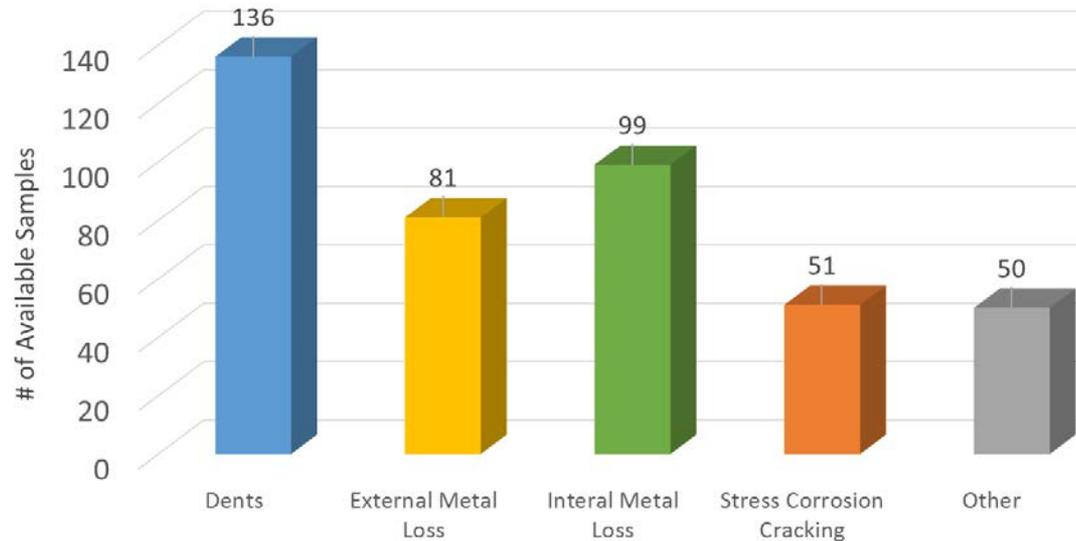
# Pipe Sample Inventory at TDC

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Available Pipe Samples by Diameter



Available Pipe Samples by Defect Type

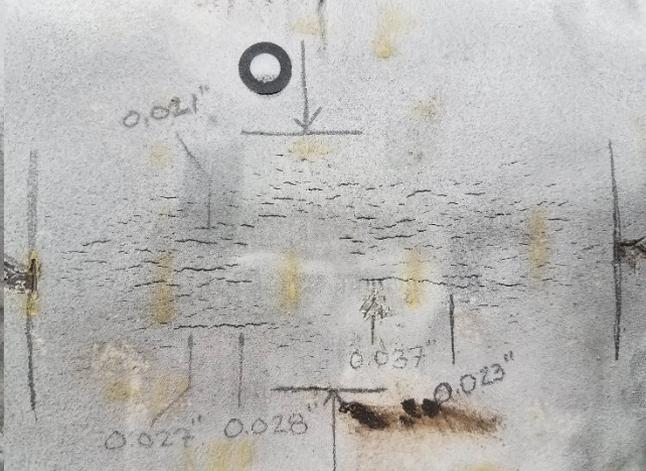


- 1,158 total pipe samples; pipe size range from 2" to 52"



External Corrosion

Stress Corrosion Cracking



Dents & Gouges

# How to get Involved

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Visit [www.prci.org](http://www.prci.org) (or [TDC@PRCI.ORG](mailto:TDC@PRCI.ORG))

Click on “**TDC**” tab at top of page

Click on “**Services**” button

Under “**ACTIONS**”, click on “**Request a Service**”

# **Greenhouse Gas Related Research**

# PRCI Technical Committees

## Pipeline TCs

## Facilities

Inspection & Integrity

Surveillance,  
Operations &  
Monitoring

Corrosion

Design,  
Materials &  
Construction

Compressor  
& Pump  
Stations

Measurement

Underground  
Storage

# **Compressor & Pump Stations**

# Objectives

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- **Quantifying and develop efforts to reduce greenhouse gas emissions associated with natural gas transmission**
  - Methane emissions
  - Carbon dioxide emissions
- **Optimizing efforts to return the highest reductions**
  - Understanding the most frequent/larges sources
- **Affected equipment**
  - Pipeline and compressors
    - *Blowdowns*
    - *Leaks*
  - Combustion related
    - *Compressor engines*
    - *Auxiliary generators*
    - *Boilers*

# Completed work

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- **Multiple efforts associated with leak detection**
  - Ambient sensors development
  - Optical detector development
  - Acoustic measurements
- **Enhancing equipment efficiency**
  - Enhanced power cylinder mixing
  - Ultra high energy ignition methods including screw-in pre-chambers
  - Real-time methods to detect declining equipment performance
  - Improved pump efficiency
- **Alternate equipment designs to reduce methane emissions**
  - Low-bleed pneumatic controllers and alternative to eliminate natural gas pneumatics
  - Evaluation of real-time detection methods for packing leaks

# Completed Work

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## ■ **Minimizing blowdowns**

- Developing meter cleaning methods that can be performed without blowdown
- Capture and recovery method evaluations
- Methods to reduce the carbon footprint of pipeline compressor and pump stations

## ■ **Preventing leaks**

- Alternatives for leak detection after hydrotesting
- Reducing corrosion and associated factors
- Pipeline threat detection to minimize 3<sup>rd</sup> party damage

## ■ **Waste energy capture assessments**

- Exhaust heat recovery
- Engine cooling heat recovery
- Pressure recovery

# Ongoing work

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## ▪ Emissions inventory

- Reviewing reported emissions data to
  - *Better understand the total emissions by the industry*
  - *Understand the largest sources and highest contributors to emissions*
    - Some leak detection and repair requirements appear to cause more GHG emissions than they save
      - » *Emissions from the blowdowns are higher than the leak*
    - Optimize repairs

## ▪ Emissions avoidance

- Multiple projects associated with reducing 3<sup>rd</sup> party damage and corrosion
- Enhancing dry gas seal reliably
- Evaluation of capture/combustion of compressor rod packing emissions
- Evaluation of gas composition analysis techniques that can be performed at line conditions (no gas extraction)

# Dry gas seals

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- **Dry gas seals are the preferred options under Subpart OOOO**
- **Dry gas seals are not as reliable as wet gas seals in dirty/wet gas applications**
  - May result in increased GHG emissions resulting from dry gas seal failures and blowdowns required for the associated repairs
- **A long term research effort in coordination with the Gas Machinery Research Council is evaluating alternative designs/operating practices to enhance dry gas seal reliability in dirty/wet conditions**

# Surveillance, Operations & Monitoring

# On-going Work

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## Methane Detector UAS – Phase 2/3 Underway

- Phase 4 approved for 2017/2018
- **Objective:** Phased development of a methane detector for handheld and UAS platforms (VTOL & fixed-wing) to include ethane for biogenic differentiation
  - *The sniffer optical head is an open-path, multi-pass tunable laser spectrometer and plots all data atop a 2D map in real-time on a tablet*



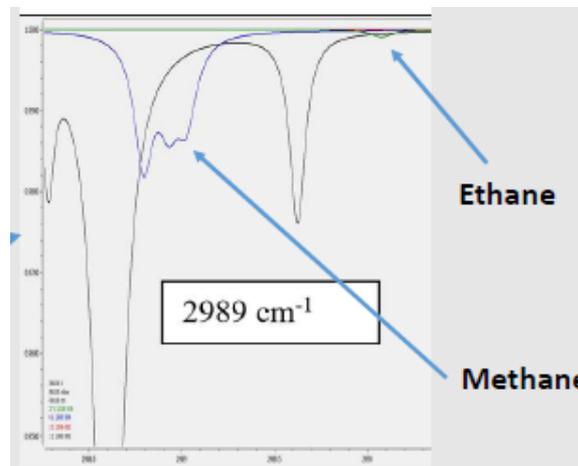
# On-going Work

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## : Methane Detector UAS – Phase 2/3 Underway Cont.

### ▪ Status & Expected Completion Dates:

- Handheld platform system validated and completed for methane (ethane TBD Phase 3)
- Finalization of UAS system modification and flight validation underway and to be completed by end of 2016
- Phases 3 & 4 - Modification to Handheld & UAS systems to include ethane detection started and to be completed by end of 2017



# On-going Work

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## Demonstration of the Use of Long Endurance Unmanned Aircraft System (UAS) to Conduct Machinery Threat Detection and Oil Spill Detection on a Pipeline Corridor in the National Airspace System

- **Objective:** Demonstrate the operation of long endurance fixed-wing UAS to conduct pipeline patrols. Evaluate the performance differences between manned & unmanned aircraft BVLOS
- **Status:**
  - Flight campaigns completed in partnership with the MAAP VaTech FAA Center of Excellence
  - Final Report being finalized
- **Expected Completion Date :** November 2017



## 2017 Approved Work

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### Evaluation of Current ROW Threat Monitoring, Applications and Analysis Technology

- **Objective:** Determining which ROW monitoring systems are best suited to specific information requirements of the pipeline sector, and determining which systems add value to the existing monitoring approaches. This project should provide an understanding of those information requirements that need to be acquired to drive threat reduction.
- **Status:** New
- **Expected Completion Date:** December 2017