



YEAR IN REVIEW

2019

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2019 Year in Review**

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OUR MEMBERS

AUSTRALIA
AUSTRIA
BRAZIL
CANADA
CHINA
FRANCE
GERMANY
INDIA
IRELAND
JAPAN
NETHERLANDS
NORWAY
SAUDI ARABIA
UNITED KINGDOM
URUGUAY
UNITED STATES



PIPELINE MEMBERS

ATCO Pipelines
Boardwalk Pipeline
Buckeye Partners, L.P.
Cadent Gas Ltd.
Chevron Pipe Line Company
Colonial Pipeline Company
ConocoPhillips
Dominion Energy Transmission, Inc.
Enbridge Pipelines Inc. and
Enbridge Energy Partners LP
Energy Transfer
Enterprise Products
ExxonMobil Pipeline Company
Flint Hills Resources
Gassco A.S.
GRTgaz
Kinder Morgan
Marathon Pipe Line LLC
N.V. Nederlandse Gasunie
National Fuel Gas Supply Corporation
National Grid
Pacific Gas and Electric Company
Petrobras
PetroChina Pipeline Company
Phillips 66 Pipeline LLC
Plains All American Pipeline, LP
Saudi Aramco
Shell Global
Southern California Gas Company
TC Energy
Total S.A.
TransGas Limited
Trans Mountain Canada Inc.
Williams Companies, Inc.



PIPELINE INDUSTRY ORGANIZATIONS

American Petroleum Institute
Association of Oil Pipe Lines
Canadian Energy Pipeline Association
Operations Technology Development



ASSOCIATE MEMBERS

Applus+
Baker Hughes
China Petroleum Pipeline Engineering Co., Ltd.
DNV GL
The ROSEN Group



TECHNICAL PROGRAM ASSOCIATE MEMBERS

Aegion Corporation
ArcelorMittal
Australian Pipelines & Gas Association -
Research & Standards Committee
Baoshan Iron & Steel Co., Ltd.
CNPCTubular Goods Research Institute
Cybernetix
Diakont
Dresser-Rand Corporation
Emerson Process Management
Enduro Pipeline Services, Inc.
Evraz North America
HOERBIGER Wien GmbH
Innospection Ltd
JFE Steel Corporation
KROHNE, Inc.
Lincoln Electric Company
NDT Global
Nippon Steel & Sumitomo Metal Corporation
Quest Integrity
ShawCor Ltd.
SICK
Solar Turbines, Inc.
T.D. Williamson
Tenaris Global Services S.A.
Welspun Tubular LLC
Worley Group



A LETTER FROM OUR CHAIRMAN, WALTER KRESIC

“

The Year in Review provides insights into some of PRCI's accomplishments in 2019 related to new technologies, knowledge sharing, and the role of enabling an inclusive and diverse environment for global thought leaders to engage and work collaboratively on scientific challenges.

A significant highlight from 2019 pertains to the restructuring of the PRCI Funding Model and the creation of Strategic Research Priorities (SRPs) that will ready PRCI for its next big 'step change' by driving greater coordination on how research is scoped, executed, and implemented. An additional benefit of the SRPs will be an enhanced readiness to partner with external stakeholders on joint R&D interests: already we are seeing stronger partnerships with regulators, trade associations, and other R&D bodies. The first effort within the new model is to execute a pilot SRP - *Optimize the Detection and Mitigation of Mechanical Damage*. Visit the PRCI website for additional information about the pilot SRP, the new PRCI Funding Model, and our next steps forward.

It's difficult to express in only a few words how the dynamics of the pipeline business, and my involvement in PRCI, have impacted me professionally and personally. I've been in the industry for 30 years and, if I were to sum up my view of this business, it's simply that, I've learned something new each and every week. Over the years of changing technologies, business systems, economics, societal interests and so on, one would think that we have seen it all, but quite the contrary. Anyone reading the PRCI Year in Review will be able to point to a variety of tensions and opportunities that are in front of us. The PRCI community stands ready to take on these challenges and I look forward to the privilege of influencing its progress.

W. Kusin



A LETTER FROM OUR PRESIDENT, CLIFF JOHNSON

“

There's no other way to put it, 2019 was a dynamic and exciting year for PRCI. And now, as we move into a new decade, let's pause to look back at 2019 to acknowledge some of our successes. I will highlight just a couple of areas...

#1 Knowledge Transfer: In 2019, PRCI held more webinars than in any previous year, covering a wide-range of relevant topics from *Guidelines for the Integrity Assessment of Difficult to Inspect Pipelines* to *The Compatibility of Polymeric Materials in Hydrogen Service*. These webinars reached over 3,000 attendees, either live or via on-demand viewing, which is the exact goal of our webinar program: to reach industry and turn research results into implementable solutions.

The 2019 Research Exchange saw our largest attendance yet with nearly 400 attendees, 40+ presentations and four roundtable discussions. The Research Exchange is a key event for sharing research results and we look forward to its continued growth.

The creation of more compendia - creating a single document to use as a reference for accessing research on a related topic - is another great accomplishment of the organization last year. A keyword search in the online PRCI store for "compendium" will return a list of available topics, with more being added as we go into 2020.

Workshops also played a role in our knowledge transfer activities in 2019. We utilized the Technology Development Center for many of the sessions, and held workshops on topics related to dent management, non-destructive testing, and low-strain hardening. We also held a geohazard management workshop in conjunction with the Pipeline Technical Committee meetings in May. These were focused events that provide a deeper dive on key issues facing industry and the solutions that PRCI has developed.

Be sure you are signed up for PRCI communications so you don't miss any of the knowledge transfer events happening in 2020.

#2 Research Program: You will continue to hear a lot about PRCI's Strategic Research Priorities (SRPs). The SRPs currently under development are a strategy to solve key industry challenges from the point of view of various technical disciplines. The SRPs are intended to consist of three to four years' worth of research efforts to resolve larger issues and move the industry further toward its goal of attaining zero incidents. These SRPs are being developed with input from our members, industry, government, and public stakeholder groups.

Speaking of input from other groups, PRCI has strengthened its partnerships with many different regulator bodies in 2019. As an example, we participated on the U.S. Department of Energy - National Petroleum Council U.S. Oil & Natural Gas Transportation Infrastructure Study and worked with the Environmental Protection Agency (EPA) to review the AERMOD rules. These engagements have enabled PRCI to impact the direction of policies for pipeline systems through our research output.

Finally, saving the best for last, PRCI was awarded seven contracts for research problems from the Pipeline and Hazardous Materials Safety Administration (PHMSA) with a total value of nearly \$4 million in co-funding over three years. This is the largest single award given to any group in the history of PHMSA's research program. Continue reading the Year in Review for more details on these collaborative research projects.

These are just a couple of the key activities that brought PRCI and its members great success in 2019. In closing, I would ask, *if you are not a member of PRCI, why not?* The benefits of membership are countless, as are the positive impacts we make on the industry at large.



FUNDING MODEL:

PRCI'S COMMITMENT TO FUND STRATEGIC INDUSTRY RESEARCH

It has been a monumental year for PRCI, as it embarked on developing a new model to more effectively address key strategic industry initiatives and issues.

With the Executive Assembly's approval of the model in September 2019, PRCI is now positioned to realize its full potential as the leading energy pipeline research body for the industry. The new model will allow for members to collectively fund high-priority, high-impact industry research and maintains the flexibility to address other important research needs as they develop.

The desire to address significant industry challenges demonstrates PRCI's recognition of the current state of the industry and the position that it has in providing the key solutions needed to enhance the safety and integrity of our global pipeline systems. In the new model, PRCI will be taking action and improving the reputation for the industry which will ultimately benefit every operator, all PRCI members, and the public interest. High-priority, core research that has the potential to enhance public health and safety provides a substantial return on each member's research investment whether or not a company is directly impacted by the specific research. By collectively identifying and prioritizing Strategic Research Priorities in the new model, PRCI will improve efficiency and engagement by being more strategic and intentional about breaking down silos and working cohesively as groups to solve a problem that will likely cross disciplines. The new model will allow PRCI to lead industry research in a more significant way by making impactful advancements in technology and R&D to improve pipeline safety and performance. As an industry body, PRCI needs to focus its energy and resources on R&D that has the greatest impact on and benefit to the industry.

A key component of the new model will be utilizing the strength of the Research Steering Committee's (RSC) expertise to ensure there is strategic alignment across the whole research portfolio and with the pipeline industry at large. The RSC plays a critical role working across all of the Technical Committees (TCs) to understand the key issues that need to be addressed

for the global industry. Capitalizing on its technical and industry knowledge, and supported by data-driven metrics, the RSC will be responsible for recommending a prioritized set of Strategic Research Priorities and budget allocations that will make the highest impact on the membership and the industry. The recommendation will also be considerate of the resources needed to achieve them. This method reflects a very strategic and collaborative effort to prioritize as industry rather than as individual companies and make quicker progress to meet common goals.

The TCs will also be vital to the process and they will be responsible for developing and maintaining the roadmaps that identify the research needed to achieve the Strategic Research Priorities. Engagement by each company at the TC level will be essential to ensure we have considered all of the elements across the membership and developed detailed research execution plans that will be most widely applicable to the industry at large. Active participation will be critical to ensure each member company has influence in the development of the Strategic Research Priorities and ultimately the research that PRCI conducts. Executive Assembly members are responsible for assigning the appropriate subject matter experts to the TCs and allowing them the bandwidth to participate in meetings and discussions. Since the model's approval in September, the RSC and TCs have been working collaboratively to develop Strategic Research Priorities. The new funding model will be implemented in time for the 2021 funding allocation.

PRCI is looking forward to an exciting 2020 and beyond as it continues with implementing the new model, which is a clear demonstration of the members' commitment to making impactful advancements in technology and R&D to improve pipeline safety and performance.



A high-angle, top-down photograph showing two workers in high-visibility yellow and blue shirts, white hard hats, and khaki pants walking away from the camera along a large, light-colored pipeline. The pipeline runs vertically through the center of the frame. The surrounding terrain is arid, with dry, scrubby vegetation and reddish-brown soil. The workers are positioned on either side of the pipeline, facing away from the camera as they inspect the line.

**PRCI COLLABORATES WITH
PHMSA TO ENHANCE PIPELINE
SAFETY AND INTEGRITY**



In 2019, PRCI was awarded seven contracts for research projects from the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) that will be co-funded by PRCI and will be a platform to enhance the safety of our nation's critical pipeline infrastructure.

PRCI is honored to have received the most awards of any organization from one Research Announcement in PHMSA's history. This unprecedented award and nearly \$4 million dollar investment of government funding represents a significant opportunity to work collaboratively with PHMSA to further improve pipeline safety and integrity.

PRCI President Cliff Johnson stated, "This announcement and decision by PHMSA is a true indication that PRCI is recognized as the leading energy pipeline research organization and showcases our members' commitment to making impactful advancements in technology and R&D to improve pipeline safety and performance."

The specific research projects that PRCI has been awarded are:

- *Validate In-Line Inspection (ILI) Capabilities to Detect/Characterize Mechanical Damage*
- *Advance Computed Tomography (CT) for Pipeline Inspection*
- *Improve ILI Sizing Accuracy*
- *Systematize 20 Years of Mechanical Damage Research*
- *Improve Dent/Cracking Assessment Methods*
- *Increase Computational Pipeline Monitoring (CPM) Performance with Liquid Leaks*
- *Develop Remote Sensing and Leak Detection Platforms that can Deploy Multiple Sensor Types*

A key factor in PRCI being awarded these PHMSA projects was PRCI's Technology Development Center (TDC). PRCI's reputation for delivering exceptional research, along with the state-of-the-art research facility that is the TDC, made PRCI the ideal partner for PHMSA to collaborate with.

For additional information on the projects, please visit PHMSA's R&D website.



PHMSA Inspector Yi Zhong Lin, Ph.D., EIT (pictured on left) visits the PRCI Technology Development Center after learning about the facility while reviewing PHMSA research proposals.

BACKGROUND ON RESEARCH ANNOUNCEMENT:

In February 2019, the U.S. Department of Transportation (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA) released a Research Announcement (RA) to solicit proposals for research projects to address key pipeline safety challenges.

The basis of the content of the RA stemmed from the outcomes of the PHMSA Pipeline R&D Forum which was held in September 2018 in Baltimore to identify key pipeline safety challenges, share information on current R&D efforts, and recommended research to meet the identified challenges.

The forum was attended by approximately 200 representatives from government agencies, academia, natural gas and liquid pipeline operators, industry trade associations, and industry researchers, including numerous PRCI members and staff. The RA featured many topics identified by PRCI members at the forum and are aligned with PRCI's highest priority Research Objectives.

TECHNOLOGY DEVELOPMENT CENTER

*A catalyst and hub for industry-wide
pipeline research and activities.*

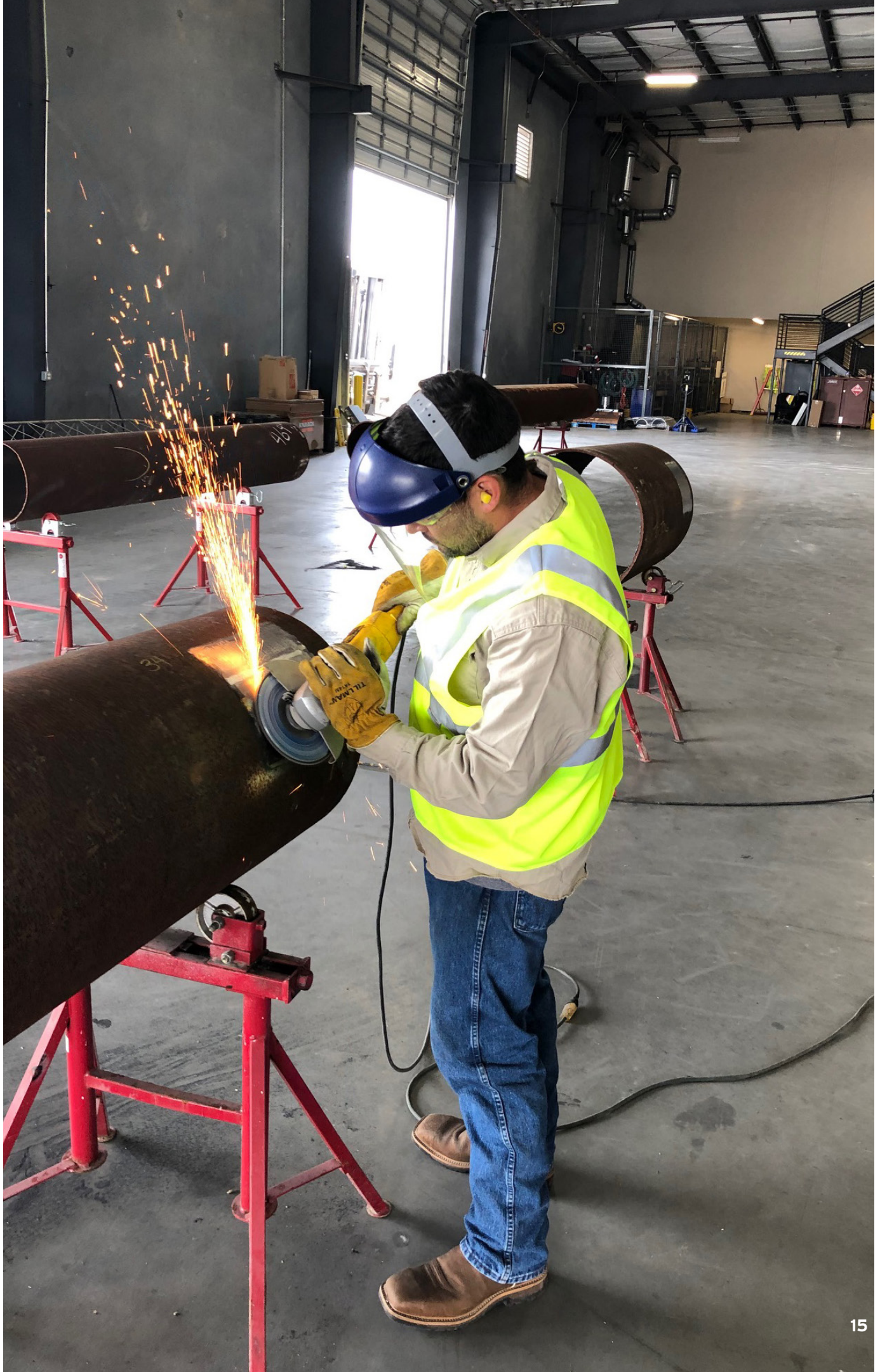
The Technology Development Center continues to be a hub for industry-wide pipeline research and development activities. PRCI-related work in 2019 included projects that utilized the flow loop, both dry and wet pull-string tests, and a large amount of NDE-related work.

The TDC is a key catalyst for allowing PRCI to grow more ambitious with its research goals. As an example, the *Performance Evaluation of ILI Systems for Detecting and Discriminating Metal Loss, Cracks, and Gouges in Geometric Anomalies* project. Led by PRCI's Research Steering Committee Chair Mark Piazza, this project takes on the impressive task of evaluating ILI system performance on a scale never before seen in our industry.

At the center of the project is the TDC and pull-test facility. The project is leveraging an already existing mechanical damage pull-test string at the TDC and has tested a range of ILI technologies, both well-established and emerging. The predicted outcome of the project is an improved understanding of ILI system capabilities to detect and discriminate between injurious and non-injurious mechanical damage features, which are critical drivers for an operator to decide if it is necessary to use additional assessment methods and in making repair decisions. Again, the TDC is an essential tool for PRCI research to provide more key information that supports an operator in improving its integrity management programs.

The opportunity for industry collaboration that the TDC provides was made especially apparent when PRCI was awarded an unprecedented seven research projects valued at nearly \$4 million USD by the Pipeline and Hazardous Materials Safety Administration (PHMSA). While certainly not the only deciding factor for the awards, it was noted by visiting PHMSA delegates that the TDC provided an exceptional venue for executing pipeline research.

The TDC played host to several PRCI and industry workshops in 2019 that brought additional learning opportunities to members and non-members alike as it continues to be utilized in a variety of ways that often combine classroom learning with hands-on training. The TDC provides not only a place to execute research, but also to demonstrate how to put the research into practice. PRCI is working to enhance the tools, processes, and personnel involved in pipeline safety and integrity.



KNOWLEDGE TRANSFER

TURNING RESEARCH INTO OPERATIONAL EXCELLENCE



ABOUT OUR WEBINARS

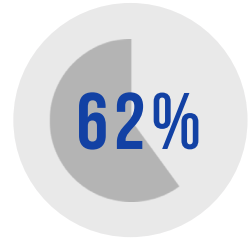
Translating research from scientific methods and laboratory results into practical applications has been a key focus at PRCI in recent years. PRCI webinars provide the industry with the opportunity to learn firsthand, from the research partners and project teams that executed the research, how an operator can benefit from using the results, and how best to implement them.



WEBINARS



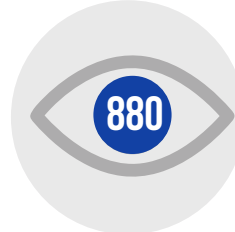
ATTENDEES



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THE TOP 3 WEBINARS OF THE YEAR



Use of Aerial LiDAR Data for Geohazard Management



Guidance for Assessing Buried Pipelines after a Ground Movement Event



Peer Review of the Plausible Profile (Psqr) Corrosion Assessment Method

Visit www.PRCI.org/research/webinars.aspx to view a complete list of available webinars.
Members: Login to view member-only content.



ACCOMPLISHMENTS & IMPORTANT FINDINGS IN RESEARCH

COMPRESSOR AND PUMP STATION TECHNICAL COMMITTEE



The Compressor & Pump Station (CPS) Technical Committee focuses research efforts on minimizing the operating costs and capital requirements of compression and pump service while meeting market demands and all applicable environmental regulations.

Technical Committee Chair: Thomas Lumadue, TC Energy

Vice Chairs: Howard Koop, Enbridge; and Daniel Rem, Enbridge

FEATURED RESEARCH

PR-703-19205-R01 Pre-Chamber Compendium Review

For lean combustion on reciprocating engines, the pre-chamber is a critical engine component for reliability and reduced engine emissions. Recent upgrades to legacy engines have indicated that there is more optimization achievable with the pre-chamber and that the fundamental combustion mechanisms may be significantly different than current theories. This compendium provides a review of the historical catalog of previously completed pre-chamber research, as well as discusses gaps in knowledge that warrant further investigation.

PR-309-14212-R01 Field Demonstration of Fully Integrated NSCR System

While superficially a “simple and proven” technology, non-selective catalytic reduction (NSCR) control is in fact extremely complex, far more complex than the control of lean burn engines. Using a systems approach, PRCI research partners defined the most common failure modes for each of the components of the NSCR system. The resulting research offers regulators and operators guidelines on procuring and/or developing NSCR systems that will satisfy regulatory expectation.

ADDITIONAL RESEARCH

PR-309-15209-R01 Evaluation of NSCR Specific Models for Use in CEPM 

PR-457-17201-R02 Residual Gas Fraction Estimation Based on Measured Engine Parameters 

PR-471-16206-R02 Suction Piping Effect on Pump Performance CFD 

PR-312-12210-R01 CEPM Monitoring Plan for Two-Stroke Cycle Lean Burn Engines 

PR-309-15205-R01 Continuous Engine Performance Monitoring Technical Specification 

PR-559-15210-R01 Suction and Discharge Piping Effect on the Performance, Reliability and Integrity of Pumps 

PR-471-16206-R01 Suction Piping Effect on Pump Performance Testing 

PR-457-18204-R01 Variable Fuel Effects on Legacy Compressor Engines Phase IV - Predictive NOx Modeling 

PR-179-16207-R01 Oxidation Catalyst Degradation on a 2-Stroke Lean-Burn NG Engine - Washing 

PR-471-14207-Z03 Evaluation of Field Pump Performance Testing Procedure 

PR-312-16202-R03 Methane Emissions from Transmission and Storage Subpart W Sources 

PR309-19202-R01 Current Control Technology for Compressor Stations 

PR-312-18209-E01 Methane Emission Factors for Compressors in Gas Transmission and Underground Storage 



A group of Compressor & Pump Technical Committee members touring the Colorado State University METEC Facility

CORROSION TECHNICAL COMMITTEE



The Corrosion Technical Committee focuses on industry challenges related to internal and external corrosion prevention and mitigation, as well as stress corrosion susceptibility evaluation and repair.

Technical Committee Chair: Didier Caron, GRTgaz

Vice Chairs: Mohammad Al-Amin, TC Energy; Thierry Cassagne, TOTAL; David McQuilling, PG&E; Benny Mumme, Flint Hills Resources; Trevor Place, Enbridge; and Bi Wuxi, PetroChina

FEATURED RESEARCH

PR-405-163602-R01 Evaluation of AC Corrosion Coupons for Monitoring Applications (EC-6-7)

Research included activities related to the development of a dynamic direct current (DC) stray current corrosion criteria by applying an advanced DC corrosion prediction model.

PR-405-173610-R01 Development of New Criteria for DC Stray Current Interference (EC-6-9A)

This report offers further refinement of the advanced DC corrosion prediction model and is related to PRCI research report PR-405-163602-R01.

PR-218-183607-Z01 Peer Review of the Plausible Profile (Psqr) Corrosion Assessment Model (EC-2-9)

Findings from a peer review conducted by a team of world-renowned pipeline experts, led by Dr. John Kiefner, on a new corrosion assessment model developed by TC Energy. The new model utilizes multiple plausible profiles to assess the remaining strength of a corroded pipe. A safe failure pressure is derived from these plausible profiles. This safe pressure can result in fewer excavations needed in response to ILI-identified areas of metal loss.

ADDITIONAL RESEARCH

PR-015-163601-R01 Determining Corrosion Conditions and Inhibitor Effectiveness under Pipeline Deposits 

PR015-183601-Z01 Enhancement of Internal Corrosion Threat Guidelines for Dry Natural Gas Pipelines 

PR-186-163608-R01 Resistance of TMCP Line Pipe Material to Sulfide SCC in Sour Service 

PR-405-153600-R01 Validation of the AC Corrosion Criteria Based on Real-World Pipeline Measurements 

PR-405-163600-R01 Assessing High Voltage DC Interference Risks on Buried Pipelines 

PR-575-183603-R01 Performance of External Profiling Inspection 

PR-620-173603-R01 Process for Precise Location, Measurement, and Evaluation of DC Stray Currents 

PR-575-183603-R01 Performance of External Profiling Inspection 

PR238-163605-R01 Methodology for Assessing Seam Weld Anomalies Using In-Line Inspection Data 



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DESIGN MATERIALS & CONSTRUCTION TECHNICAL COMMITTEE



The Design Materials & Construction (DMC) Technical Committee focuses research efforts on the development of safe, environmentally responsible, cost-effective, and reliable solutions for the design, construction, and operation of energy pipelines. DMC research enhances the performance of new pipelines through development and implementation of new design methods, materials, and construction technologies.

Technical Committee Chair: Stephen Rapp, Enbridge

Vice Chairs: Michael Cook, ExxonMobil; Frederick Fisher, ExxonMobil; Eduardo Hippert, Jr., Petrobras; Nick Khotenko, ATCO; Junfang Lu, Enbridge; Jorge Penso, Shell; and Russell Scoles, Enbridge

FEATURED RESEARCH

PR-350-164501-R01 Guidance for Assessing Buried Pipelines After a Ground Movement Event

The research conducted by Dr. Yong-Yi Wang set out to improve pipeline design to better accommodate significant localized ground movement such as that caused by landslides, earthquakes, or subsidence/settlement. When such a ground movement event occurs along the right-of-way (ROW) of a buried pipeline, it is imperative that the pipeline operator determine whether the ground movement is a threat to pipeline integrity in order to protect those responding to the event, those living near the affected ROW, and the environment. This research provides guidance to operators responding to a ground movement event.

PR-214-134502-R01 Weld Hydrogen Cracking Risk Management Guide

This report used existing industry research to understand where gaps in knowledge exist related to hydrogen cracking from weldments. Some concepts, identified in this document, are demonstrated to illustrate what can be achieved in support of weld hydrogen cracking management.

PR-631-174506-R01 Substandard Properties in Pipeline Fittings and Flanges

This research project reviewed instances of high-yield (42-80 ksi) fittings and flanges that occurred over the past few years in Canada and the USA. The main activities in this project included a survey of operators and manufacturers, a few of the scientific literature pertinent to the metallurgy of fittings and flanges, a critical review of the relevant MSS and CSA manufacturing standards, as well as a summary of proposed changes for MSS-SP-44 that have been recommended by API Sub Committee 21 (Materials working group on pipeline flange and fitting quality).

ADDITIONAL RESEARCH

PR-350-174500-R02 Characterization of Pipeline Wall Loss for Strain Capacity 

PR-350-134500-R01 Girth Weld Thermal Analysis Tool 

PR-201-174510-R01 Removal and Repair of Hot Taps 

PR-350-154502-R02 Implications of Low Strain Hardening Steels on Design Construction and Maintenance 

PR-350-124504-R03 Essential Welding Variables Methodology for X70 Line Pipe Steels 

PR-218-104509-R01 Field Validation of Surface Loading Stress Calculations for Buried Pipelines Milestone 2 

PR-350-114511-R04 Refined Methodology for Assessment of Weld High-Low Misalignment 

PR-186-124510-Z02 Pipeline Lifting and Lowering-in Stress Application Tool  

PR-214-114509-R01 Standardization of Weld Testing for Fracture Toughness using Single Edge Notched Tests 

PR-214-174517-Z01 Development of Sleeve End Fillet Weld Stress Intensity Factor Calculator  

PR-350-154501-R01 Evaluation of Girth Weld Flaws in Vintage Pipelines 

PR-214-154503-R01 Pipeline Strains Induced by Slope Movement 

PR-350-174508-Z01 Girth Weld ECA Software and User Manual 

PR-350-144501-R04 Characterization of Mechanical Properties of Vintage Girth Welds 

INTEGRITY & INSPECTION TECHNICAL COMMITTEE



Products resulting from research activities conducted under the Integrity & Inspection (I&I) Technical Committee improve the reliability of the pipeline infrastructure and ensure the continuity of public service through the development and successful deployment of technologies associated with mechanical damage, pipeline integrity management, and associated inspection technologies.

Technical Committee Chair: Vacant

Vice Chairs: Richard Kania, TC Energy; Dave Katz, Williams; Satish Kulkarni, Chevron Sean Keane, Enbridge; Travis Sera, SoCalGas; Taylor Shie, Shell; and Mures Zarea, ENGIE

FEATURED RESEARCH

PR-430-173869-R01 Guidelines for Integrity Assessment of Difficult to Inspect Pipelines

This report provides guidelines for the inspection of difficult to inspect pipelines using new or alternate technologies. Integrity management codes, standards, and regulations recognize the potential for new/alternate technologies to emerge to address physical challenges to inspection, or provide improved capability to assess selected threats, but U.S. regulatory guidance requires operators to demonstrate “equivalent understanding” of line pipe condition when using “other” technologies; however, do not specify any process or criteria to do so. This research was initiated to fill that gap.

PR-328-133702-R02 Full Scale Fatigue Testing of Crack-in-dent with Framework for Life Prediction

Dents coincident with cracks are often observed in liquid pipelines and require immediate attention by pipeline operators. This PRCI research established a framework for the remaining life prediction of crack-in-dent by corrosion fatigue.

ADDITIONAL RESEARCH

PR-328-133702-R01 Study of the Mechanism for Cracking in Dents in a Crude Oil Pipeline 

PR-214-153739-R01 ERW Fatigue Life Integrity Management Improvement-Phase III  

PR-462-143703-R01 Development and Evaluation of Guided Wave Structural Health Monitoring for Buried Pipe 

PR-201-183830-R01 Evaluating Low Field MFL in Measuring Loading Conditions at Branch Connections - Phase 2 

PR-000-073850-R02 Development of a PRCI ILI Performance Test Loop for Liquid Coupled Technologies 

PR-244-173856-R01 In-line Inspection Crack Tool Reliability and Performance Evaluation 

PR-335-15370-R01 Evaluation of NDE Methods for In-Ditch Characterization of ERW Seam Anomalies 

PR-469-173823-R01 In-Line Inspection and Evaluation of Pinholes in Oil & Gas Pipelines 

PR-186-183825-R01 Continuous Improvement of ILI Capabilities Joint Industry Project (Phase I) 

PR-366-173814-R01 Assessment of SCC with Advances in NDE including EMAT & IWEX Imaging Task 1 Report 

PR-328-173866-R01 Performance Capabilities Evaluation of ILI for Long Seam Features in ERW Pipe 

PR-328-183838-R01 Hard Spot NDE Verification and Validation - Phase II 

Add PR-535-183856-R01 Small Diameter Acoustic Resonance ILI Tool Feasibility Study 



Mr. Harvey Hains of Applus delivers his last presentation, before retiring, to the Integrity & Inspection Technical Committee after many years of valuable contributions.

MEASUREMENT TECHNICAL COMMITTEE



The Measurement Technical Committee focuses research efforts on providing measurement technologies that result in increased customer satisfaction and achieve cost savings through more accurate metering, better gathering and management of real-time pipeline data and the associated instrumentation, improved operation efficiency, and reduced capital expenditures.

Technical Committee Chair: Chris Levy, Chevron

Vice Chairs: Lori Curtis, Kinder Morgan; and Jonatan Mustafa, Energy Transfer

FEATURED RESEARCH

PR-363-18604-R01 Mass-based Proving Methods for Mass Flow Meters

Due to the increased utilization of mass-based flow meters for flow measurement of hydrocarbons, there is a requirement for a direct method for proving/calibrating a mass flow meter directly using a measured mass. The objective of this project was to identify, review and rank suitable methods for proving/calibrating a mass-based flow meter directly using a measured mass. The preferred method has been recommended and potential changes to industry standards have been highlighted. This research report discusses the preferred method and the recommended changes to industry standards.

PR-015-18603-R01 Review of PRCI Research on Piping and Header Effects on USM Performance

This project provides a review of previously completed PRCI projects on the topic of the effects of upstream disturbances on ultrasonic meter performance. This compendium document includes brief summaries of the projects along with comparisons of the results and general conclusions and recommendations. A gap analysis was also performed to inform the path forward for future research.

ADDITIONAL RESEARCH

PR-015-17606-R04 Gas Ultrasonic Meter In-Situ Proving 

PR-015-17606-Z02 Elbow Meter Test Results 

PR663-18602-Z01 Guidance for Applying Revised AGA Report #8 Based on Measurement Uncertainty 

PR-015-17606-R01 End-Fed Header Design on Ultrasonic Meter Performance 

PR-015-17610-Z01 Effects of Changing Gas Composition on Flow Measurement Error  

PR-015-17606-R03 Flow Conditioner Swirl Reduction Testing 

PR-352-16603-Z01 Standardized Meter Calibration Data Protocol and Storage 

PR-015-17608-R01 Assess and Identify Methods to Reduce Ultrasonic Noise Effects on Ultrasonic Meters 

PR-616-17607-R01 Sulfur Condensation in Pressure Reduction Equipment 

PR-000-16600-R01 Correlative Estimation of Hydrocarbon Dewpoint 

L52315 Testing of Environmentally Friendly Sampling Methods at Hydrocarbon Dew Point Conditions 

PR-352-15600-Z01 USM Uncertainty Estimate From Diagnostics 



Measurement Technical Committee members meet for the winter 2019 meeting at the PRCI Technology Development Center.

SURVEILLANCE, OPERATIONS & MONITORING TECHNICAL COMMITTEE



Products resulting from research activities conducted under the Surveillance, Operations, & Monitoring (SOM) Technical Committee improve the integrity of the pipeline infrastructure and the continuity of public service through the development and successful deployment of technologies to identify Right-of-Way threats, leak detection, and damage prevention.

Technical Committee Chair: Nikos Salmatanis, Chevron

Vice Chairs: Mike McCutcheon, TC Energy; and Chris O'Neil, Enbridge

FEATURED RESEARCH

PR-459-133750-R03 Fast, Accurate, Automated System to Find and Quantify Natural Gas Leaks

This research was conducted by NASA Jet Propulsion Laboratory (JPL) and is related to the Open Path Laser Spectrometer (OPLS). New advances in sensor technology, with high sensitivity towards detecting methane and ethane, present the energy pipeline industry with cost-effective ways to improve safety, comply with state and federal regulations, decrease natural gas emissions, and attribute natural gas indications to thermogenic or biogenic sources. The result of this research includes both laboratory and field testing.

PR-680-183907-R01 Use of Aerial LiDAR for Geohazard Assessment

This operator-led research is related to the use of LiDAR and 3-D geospatial analytics for geohazard assessment and management. The report provides specific examples of how LiDAR and 3-D geospatial analytics assisted PG&E's damage prevention efforts when they deployed LiDAR analytics on their entire gas transmission network of approximately 7,000 miles.

ADDITIONAL RESEARCH

PR-271-173903-R01 Evaluation of Current ROW Threat Monitoring, Application, & Analysis Technology 

PR-649-173905-R01 Competency in the Pipeline Industry, an Industry Survey  

PR-624-173901-R01 Human Organizational Factors in Pipeline Incidents  

SUBSEA TECHNICAL COMMITTEE



The Subsea Technical Committee focuses on issues and challenges unique to the offshore pipeline environment.

Technical Committee Chair: Jamey Fenske, ExxonMobil Upstream Research Company

Vice Chairs: Ludovic Assier, TOTAL; and Farzan Parsinejad, Chevron

FEATURED RESEARCH

PR-328-183838-R01 Hard Spot NDE Verification and Validation - Phase II

The presence of hard spots, a localized confined region of relatively higher hardness, cause pipelines to be prone to crack initiation and hydrogen embrittlement. Early detection and mitigation of hard spots following plate manufacturing are essential to mitigation of any hard spot-related failures. This issue of early detection of hard spots and the related verification and validation of applicable technologies are the primary focus of this PRCI research project.

ON-BOTTOM STABILITY SOFTWARE

The PRCI OBS software tool is a specialty application for the analysis of on-bottom pipeline stability in subsea applications. The new release, version 4.0, includes modernization updates, bug fixes, and the addition of new software functionalities. The latest interface was designed to maintain the overall layout and workflow of the previous version so that existing users can quickly and easily become familiarized with the new features. OBS features include the calculation of kinematics from 3-D irregular waves, several hydrodynamic force models, models for partial burial, non-linear, time dependent interaction between pipeline and soil (sand and clay), and non-linear pipeline material properties (for boundary elements). These features allow for detailed analysis of specific pipeline sections subjected to specified environmental conditions. Additionally, the new release consists of three (3) levels with Level 1 being used for quick simplified analysis, Level 2 for comprehensive detailed design and modeling, and Level 3 for advanced and very complex subsea pipeline design modeling.

Existing software users are encouraged to upgrade to the latest version, as all previous versions of the software will no longer be supported as early as August 2020. To purchase, upgrade existing software, or for licensing information, contact Technical Toolboxes, an authorized PRCI reseller at www.technicaltoolboxes.com.

UNDERGROUND STORAGE TECHNICAL COMMITTEE



The Underground Storage Technical Committee is focused on developing and deploying technologies to ensure the safety, integrity, reliability, and productivity of new and existing storage facilities, including both reservoir and cavern storage.

Technical Committee Chair: Stephanie Sexton, ExxonMobil

Vice Chairs: Anders Johnson, Kinder Morgan; and Mark Thompson, Enterprise Products

FEATURED RESEARCH

PR-317-17700-R01 Accuracy of Temperature Logging for Calculating Gas Inventory in Storage Caverns  

Results of this research project evaluated the accuracy of downhole wireline temperature logging, and the related calculation methods to estimate gas inventory in storage caverns.

ADDITIONAL RESEARCH

PR-244-16704-R01 Casing Corrosion Logging Tool Test 

PR-317-10701-R01 Temperature Logging as a Mechanical Integrity Test (MIT) for Gas-Filled Caverns 

PRCI 2019 AWARD RECIPIENTS

IN-KIND SUPPORT AWARD

The in-kind support award is issued to companies that have provided significant contributions and support for furthering PRCI research programs that went substantially “above and beyond” the expectations PRCI and its members.

*Colonial Pipeline Company
ExxonMobil Pipeline Company*

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For dedicated and distinguished service and scientific achievements that have enhanced the integrity, reliability and environmental performance of energy pipelines around the world.

*Dr. Chris Alexander, ADV Integrity, Inc.
Shane Siebenaler, Southwest Research Institute*

DISTINGUISHED SERVICE AWARD

For distinguished service to the energy pipeline industry through a sustained commitment to PRCI and noteworthy contributions to the achievement of its mission, goals, and programs.

*Greg Beshouri, Hoerbiger Wien GmbH
Richard McNealy, Chevron Pipe Line Company
Mark Piazza, Colonial Pipeline Company
Mary Beth Whitfield, Williams Companies, Inc.
Mures Zarea, ENGIE*

OF, BY, AND FOR THE ENERGY PIPELINE INDUSTRY.

OF worldwide pipeline industry organizations:

Since 1952, PRCI has been recognized around the world as a unique forum within the energy pipeline industry delivering great value to its members and the industry - both quantitative and qualitative - through the development and deployment of research solutions to the operational, maintenance, and regulatory challenges that face it.

BY members working together through PRCI:

The collaboration achieved through members' funding and resource/expertise contributions results in the development of pipeline industry research and technological advances that benefit member organizations and all energy users.

FOR the global pipeline industry and those who have an interest in it:

Members vote for research projects most relevant to their organizations, so projects truly reflect the industry's priorities. The results provide intelligence and allow the industry to continue reducing risks from and to pipelines.



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