

2020 YEAR IN REVIEW

Of, by, and for the energy pipeline industry.



LETTER FROM THE CHAIRMAN

WALTER KRESIC

"Our PRCI community continues to be an industrious bunch! This report is an excellent primer on the deep thought, hard work, and cooperation that turns tough challenges into clear-cut solutions..."

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LETTER FROM THE PRESIDENT

CLIFF JOHNSON

"As we reflect on 2020, the words resiliency, flexibility, creativity, sustainability, and productivity echo in my mind. In spite of the challenges we all faced, I am proud to report that PRCI experienced an increase in member and non-member involvement..."

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STRATEGIC RESEARCH PRIORITIES

From a list of 24 suggested Strategic Research Priorities (SRPs) and issues in August of 2019, the field was carefully narrowed and submitted to Executive Assembly for approval by March of 2020. View the selection for the first round of SRPs.

[View Projects](#)

RESILIENCE

By early January of 2020, the word Coronavirus became a focal point of conversation and quickly changed the way we worked and lived. As our world seemed to change almost overnight, many sought advice on how to survive and thrive, both physically and mentally.

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EMERGING FUELS & SUSTAINABILITY

As more and more companies include sustainability in their business practices, PRCI is a partner in that development within the energy pipeline industry.

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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 collaboratively drive and fund research 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.

WALTER KRESIC



Our PRCI community continues to be an industrious bunch! This report is an excellent primer on the deep thought, hard work, and cooperation that turns tough challenges into clear-cut solutions. The topics reported here are worthy of recognition, especially for those that dedicated the time to plan, debate, organize, document, review, and participate congenially. Getting there is never easy, and most of the accomplishment is behind the scenes. I'm mostly amazed at how, on top of the specific deliverables, so many of the participants serve passionately as

coaches, imparting experience and multiplying our collective knowledge. All of these results come from high-minded norms of doing the right things for the right reasons. I'm honored to be a part of the team and have taken great benefit back to the pipeline company I represent.

Annual accomplishments are worthy of highlight. In a future version of this report, we'll consider dedicating a bit of space to measure progress over a longer timespan. I think there's a revelation that comes from taking a long view (look back in time or envisioning the future). The gradual changes stack up and, notably, so much of what's typical today was mostly at a genesis only three to five years ago (machine learning, reliability analytics, sensor technology, GHG scope, etc., etc.). PRCI excels at bringing thought leaders together, imagining the needs into that next three to five year block, and composing technological improvements. I'll take this opportunity to express my appreciation to all of you that enable this forward drive. Even if you're not closely involved in ongoing PRCI work, I hope this report helps you find scientific resources for improving your environment.

There will be interesting and exciting times. When hasn't that been the case?! At PRCI, we know the drill, and we look forward to continually serving for the benefit and utility of our communities.

W. Kresic

[< Emerging Fuels & Sustainability](#) | [Home](#) | [Letter from the President](#) >

FROM OUR PRESIDENT

CLIFF JOHNSON

As we reflect on 2020, the words resiliency, flexibility, creativity, sustainability, and productivity echo in my mind. In spite of the challenges we all faced, I am proud to report that PRCI experienced an increase in member and non-member involvement. Participation in our meetings and events increased by over 67% compared to 2019, including an all-time high in the number of participants joining webinars and our largest ever attended Technical Committee meetings. We also saw a significant increase in downloads of PRCI final reports and software.



We have advanced the development of our research efforts and established three [Strategic Research Priorities \(SRPs\)](#) that will have a key impact on our members and the pipeline industry. We have completed two State-of-the-Art (SOTA) reports in the Emerging Fuels area. The SOTAs provide a roadmap of the research needed to ensure the safe transmission and storage of [Renewable Natural Gas \(RNG\)](#) and [Hydrogen](#) in the new energy environment.

In 2020, a considerable work undertaking at the [Technology Development Center \(TDC\)](#), advancing the [Optimize the Detection and Mitigation of Mechanical Damage](#) and [Pathway to Achieving Efficient and Effective Crack Management](#) SRPs to position the activities for success in 2021. Several PRCI members have begun leveraging the TDC as a center for validating in-line inspection (ILI) tools. Using the four pull strings and the two current flow loops, PRCI members demonstrate the effectiveness of ILI tools prior to implementation by operators on their systems. Combined with the inventory of real-world samples available, the TDC is able to test tools and evaluate their performance. This enables operators to understand the strengths and challenges of the tools and vendors.

PRCI would not have been able to provide the value that our members seek without a strong staff. The flexibility and creativity required to shift from in-person to completely virtual events was a major undertaking. Staff's dedication enabled our members to progress the research issues needed by the industry. The joint determination from PRCI staff and members was shown through the delivery of 57 final reports, 12 compendia, 29 webinars, and two SOTA reports for Emerging Fuels completed this year.

Great work, team!

Investing in research is more important than ever. We encourage the industry to collaborate with PRCI to ensure the safety and integrity of the global pipeline systems and reduce environmental impact.

< [Letter from the Chairman](#) | [Home](#) | [Strategic Research Priorities](#) >

STRATEGIC RESEARCH PRIORITIES

NOW, MORE THAN EVER, WE NEED RESEARCH

Research is at the foundation of everything, elevating our basic needs to improved living standards and beyond. It enables us to build successful industries which create new opportunities to collaborate with others to further success. The results of research allow us to make informed, effective decisions to mitigate, adapt, and solve problems. Research requires and deserves commitment and investment. Identifying and executing [Strategic Research Priorities](#) (SRP) allows PRCI to collaboratively address key strategic industry initiatives and issues in which there are near-term



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OPTIMIZE THE DETECTION AND MITIGATION OF MECHANICAL DAMAGE

A key research priority for PRCI is to close the gaps on mechanical damage (MD) research and produce a comprehensive set of guidelines and engineering assessment tools for managing the threat of MD that are aligned with current ILI & NDE inspection technologies. The consolidation of dent and dent management research is the target of this effort. Results will close the gaps on mechanical damage (MD) research and provide all pipeline operators with technically defensible cases to effectively manage deformations identified through condition assessments, and in turn, focus energies and resources to ensure repairs are being made when and where repairs are truly needed.

PATHWAY TO ACHIEVING EFFICIENT AND EFFECTIVE CRACK MANAGEMENT

The pipeline industry has made significant improvements in reducing GHG emissions, there is a drive to address the issue more aggressively through efficiency improvements and reducing methane emissions. The greatest amount of GHG emissions by pipeline transportation stem from the power used to drive compressors and pumps. Even marginal improvements in efficiency of equipment that has high utilization can have a high impact in the reduction of GHG emissions, primarily CO2.

GREENHOUSE GASES EMISSIONS REDUCTION

Operators continually strive to make their crack management programs more effective and efficient. The efforts of this SRP will strengthen the management of integrity resources leading to more comprehensive risk reduction, including improved cracking threat risk assessment, as well as improved matching of in-line inspection tools to the threat, and operational practices to mitigate cracking mechanisms will be optimized.

Visit the PRCI website to

[view the webinar series conducted in 2020 on SRPs.](#)

< [Letter from the President](#) | [Home](#) | [Resilience](#) >



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RESILIENCE

By early March of 2020, the word Coronavirus became a focal point of conversation and quickly changed the way we worked and lived. As our world seemed to change almost overnight, many sought advice on how to survive and thrive, both physically and mentally. Resilience became another keyword in conversation. The irony is that the road to resilience requires the very things we are loathed to experience, among them disaster and distress. However, if the world operated perfectly, the things we care about, like PRCI, wouldn't need to exist. There would be zero incidents to prepare for. Like it or not, the reality is that nothing is perfect, and things will happen. Yet this foresight leads to resilience and is the difference between surviving and thriving. Touting resiliency, experts point to specific behaviors to encourage success.



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NETWORKING

Developing relationships with others offers a wide range of physical and mental health benefits. Being actively engaged with like-minded people strengthens resilience. PRCI has over 4,000 volunteers and 65 companies from over 14 countries from all over the world. Networking is the core of PRCI.

SERVICE

Thinking about others is the foundation of service. In return, service can minimize stress, reduce depression, increase mental acuity, and provide a sense of purpose. Our shared goal is ultimately the safety of self, colleagues, the pipeline system, and the environment. In fact, it is so critical to our shared identity that it is our mission statement.

ACCOMPLISHMENTS

Developing goals and working on them regularly, even in small increments, bolsters resilience. When the country stopped meeting in-person, our operations continued virtually. As soon as we learned how to protect ourselves and others, we returned to in-person work cautiously. While we saw some impact on our research production, the majority of the portfolio remained on target.

REFLECTION

Resilience develops by learning from experience. When a group shares their experiences, their reflection can ripple out to affect greater numbers of groups and individuals. Over this past year, an impressive number of [12 compendia](#) were published. The valuable knowledge transfer these research results offer is steeped with resilience-building insight.

Resilience demands intentionality and takes time. We might like to forget most of 2020, yet we cannot and should not forget the many good things that have come from it. PRCI was built for resilience, and we not only survived, we thrived.

[< Strategic Research Priorities](#) | [Home](#) | [Emerging Fuels & Sustainability](#) >



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EMERGING FUELS & SUSTAINABILITY

Sustainability is a complex concept. The UN's World Commission for Environment and Development explains it as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. As more and more companies include sustainability in their business practices, PRCI is a partner in that development within the energy pipeline industry.

As the research to identify and develop new fuels expands, we must be ready to transport and store these energy sources safely. In 2019, the Executive Board approved the request to perform State-of-the-Art (SOTA) studies to explore PRCI's role in the Hydrogen and Renewable Natural Gas transmission efforts in order to identify the gaps in those needs. By the end of 2020, two SOTAs were published.

[PR306-20604-R01](#)

Emerging Fuels - Renewable Natural Gas (RNG) SOTA, Gap Analysis, and Future Project Roadmap

Renewable Natural Gas (RNG) injection in natural gas networks presents a valuable solution for decarbonizing traditional energy systems, including heavy industry, heating, power generation, and transport, while enabling the transition to RNG economy. However, injecting RNG into existing natural gas systems can have wide ranging impacts that needs to be understood for transmission network operators, distribution network operators, and natural gas end-users. The overall goal of the study was to develop a concrete path forward to define the necessary projects that need to be completed for companies to transport RNG into their pipelines at best cost while managing impacts.

GRTgaz led the project for the Pipeline Research Council International (PRCI) and was also the project contractor for this project. The project involved the expertise and efforts of a project team comprised of experts from over 12 member organizations of PRCI, as well as external input from a range of non-member organizations from around the world including gas network operators, experts, and research and development institutions.

[PR-720-20603-R01](#)

Emerging Fuels - Hydrogen SOTA, Gap Analysis, and Future Project Roadmap

Hydrogen injection and blending in natural gas presents a valuable solution for decarbonizing traditional energy systems, including heavy industry, heating, power generation, and transport, while enabling the transition to a hydrogen economy. Injecting hydrogen into existing natural gas svstems can have wide rangaina impacts that need to be understood for transmission network



Pacific Gas & Electric (PG&E) led the project for the Pipeline Research Council International (PRCI), with GHD as the project contractor reporting to PG&E. The project involved the expertise and efforts of a project team comprised of experts from 13 member organizations of PRCI, as well as external input from a range of non-member organizations from around the world including gas network operators, end-users, experts, and research and development institutions.

These two SOTA studies mapped over 160 worldwide projects and over 455 technical resources combined through document and project reviews, as well as interviews with operators and researchers, and other relevant contributors. The knowledge gaps identified opportunities for further research. In the world's quest for increasing energy sustainability through Hydrogen and Renewable Natural Gas, PRCI has embarked upon a truly global collaboration.





Australia - **Brazil** - Canada - **China** - France - **Germany**
India - **Ireland** - Japan - **Netherlands** - Norway
Saudi Arabia - United Kingdom - **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
- Phillips 66 Pipeline LLC
- PipeChina North Pipeline Company
- Plains All American Pipeline, LP
- Saudi Aramco
- Shell Global
- Southern California Gas Company
- Storengy
- TC Energy
- Total S.A.
- Trans Mountain Canada Inc.
- TransGas Limited
- Williams Companies, Inc.

PIPELINE INDUSTRY ORGANIZATIONS

- American Petroleum Institute
- Association of Oil Pipe Lines
- Operations Technology Development

ASSOCIATE MEMBERS

- Baker Hughes
- China Petroleum Pipeline Engineering Co., Ltd. (CPP)
- DNV GL
- The ROSEN Group

TECHNICAL PROGRAM ASSOCIATE MEMBERS

- Aegion Corporation
- ArcelorMittal
- Australian Pipelines & Gas Association - Research & Standards Committee
- Baoshan Iron & Steel Co., Ltd.
- CBMM
- CNPC Tubular Goods Research Institute
- Cooper Machinery Services
- Cybernetix
- Emerson Process Management
- Endress+Hauser
- Enduro Pipeline Services, Inc.
- Evrax North America
- Innospection Ltd
- JFE Steel Corporation
- KROHNE, Inc.
- Lincoln Electric Company
- Mears Group, Inc.
- NDT Global
- Quest Integrity
- RMG Messtechnik GmbH
- SICK
- Siemens Energy Inc.
- Solar Turbines, Inc.
- T.D. Williamson
- Welspun Tubular LLC
- Worley Group

COMPRESSOR & PUMP STATION TECHNICAL COMMITTEE

ABOUT THE 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.



Tour of Zachary Engineering Education

TECHNICAL COMMITTEE CHAIR:

Thomas Lumadue, *TC Energy*

VICE CHAIRS:

Howard Koop, *Enbridge*; Dan Rem, *Enbridge*

FEATURED REPORTS

[PR-283-18202-R01](#) ★

Improved SoLoNox T70S and T130S Controls to Reduce Part Load Emissions

This report includes findings from field trials of Solar Turbines' improved control algorithms on their Taurus 70S and 130S units. The new algorithms provide greater flexibility to the operator with extended temperature control to lower engine speed settings now covering operation from full load to idle. Previous control methods included full load to 50% load. Included in this research were the reductions seen in carbon monoxide and unburnt hydrocarbons from 50% load to idle.

[PR-309-20201-R01](#) ●

Study of Prechamber Ignition Mechanisms for GHG Reduction

Pre-combustion chambers are commonly used in large-bore natural gas engines to improve the repeatability of ignition and the completeness of combustion, particularly when the engine operates near the lean limit. A study of the ignition of the main combustion chamber in a two-stroke lean burn natural gas engine was conducted using computational fluid dynamic simulation software to provide design parameters that will aid pre-combustion chamber manufacturers in improving combustion and reducing methane emissions. The effects of temperature and chemical intermediates were investigated, as well as the combination of thermal and intermediate effects. Additionally, this study examined the effect of main combustion chamber mixing on the completeness of combustion. This study contributes an important first step in understanding how a pre-combustion chamber ignites the main combustion chamber and gives the reader a guide to selecting upgrade technologies when examining fuel injection systems and pre-combustion chamber configurations.

[PR-312-18208-E01](#) ●

Statistical Technique for Estimating NOx Emissions from Infrequently Operated Emission Units

This white paper presents a new approach for modeling emission inputs for dispersion modeling assessments. The current requirement includes simulation of source emissions for all sources operating simultaneously for every hour during the year. The current approach does not accurately reflect actual emissions from infrequently and non-continuously utilized sources. This white paper focuses on modeling emissions from natural gas-fired reciprocating engines in service at natural gas transmission pipeline compressor stations, and includes two case studies and example calculations.

ADDITIONAL RESEARCH

[PR-703-19205-R01](#) ●

Compendium of Precombustion Chamber Research Needs of Lo-NOx and Lo-GHG Legacy Engines

[PR-179-18203-R01](#) ●

Experimental Evaluation of Stack Testing Methods for Accurate VOC Measurement

[PR-312-18209-E02](#) ●

GHG Reporting - Transmission Pipeline Blowdown Data Review and Emission Factor Trends

[PR-471-18210-R01](#) ★ ●

Pump Failure and Performance Degradation Prediction

[PR-457-18204-R02](#) ●

Variable Fuel Effects on Legacy Compressor Engines Phase V Engine Control Enhancement

WEBINARS

Key:
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FROM THE COMMITTEE:

The lack of in-person meetings was definitely an unforeseen challenge for 2020. The Compressor and Pump Station Technical Committee leadership thanks all of its members who remained engaged and helped further the research objectives for the year. One of these challenges included the commencement of a new project execution model that included the Greenhouse Gas Emissions Reduction Strategic Research Priority which was approved in 2020. The initiative includes research projects across four different Technical Committees with over \$4.1M in funding allocated to research that aims to reduced greenhouse gas emissions across the pipeline system.

CORROSION TECHNICAL COMMITTEE

ABOUT THE 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.



Member and contractor PetroChina, now PipeChina North Pipeline Company, working on EC-8-9.

TECHNICAL COMMITTEE CHAIR:

Didier Caron, *GRTgaz*

VICE CHAIRS:

Mohsen Achour, *ConocoPhillips*; Mohammad Al-Amin, *TC Energy*; Drew Hevle, *Kinder Morgan*; David McQuilling, *Pacific Gas & Electric*; Benny Mumme, *Flint Hill Resources*; Trevor Place, *Enbridge*; Bi Wuxi, *PipeChina North Pipeline Company*

FEATURED REPORTS

[PR185-173611-R01](#)

Applicability of Existing Metal-Loss Criteria to Low-Hardening Steels

This project has evaluated the applicability of B31G and Modified B31G corrosion assessment criteria for applications to low-hardening pipe steels, whereas these criteria were originally developed and calibrated for high-hardening steels common in lower strength grades and in older steel production. This project builds upon previous work by trending changes in pipe properties over time and by quantifying the role of the flow response, including the influence of strain hardening on failure response and predicted failure pressure for metal loss defects in pipelines. This report presents the need for corrections for these criteria, and where required, considers suggested corrections to ensure the usual margin of safety afforded by these criteria.

[PR218-173602-R01](#)

Assessment of Fitness-for-Service for Crack-within-Corrosion Anomalies

Continuous crack defects in corroded areas of pipe have been identified as a potential cause of failures and significant accidents. This project provides a model to pipeline operators with detailed step-by-step procedures for evaluating the effect of interacting corrosion and crack threats on the integrity of pipelines. There are several existing assessment methodologies for different types of anomalies such as blunt type and crack-like type. The predicted failure pressure (PFP) results from existing assessment methods were compared and reviewed in this research.

[PR579-183608-R01](#)

Expert Review of Past PRCI and PHMSA SCC Studies and Road Mapping

This project reviewed past studies on stress corrosion cracking (SCC) sponsored by the PRCI Corrosion Technical Committee (TC) and the US Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA). The aims of this report were (a) to summarize the results of past PRCI and PHMSA SCC studies and, thereby, serve as a resource for current and future TC members, (b) to identify gaps in current understanding, and (c) to assist in future road-mapping exercises.

ADDITIONAL RESEARCH

[PR644-183602-R01](#)

Cathodic Protection Design Considerations for Facilities with Congested Areas

[PR676-183606-R03](#)

Remote CP Monitoring Guidelines for an Efficient Use

[PR469-183600-R01](#)

The Influence of Solid State Decouplers on Pipeline CP Surveys

WEBINARS

[Assessment of Fitness-for-Service for Crack-within-Corrosion Anomalies](#)

[Expert Review of Past PRCI and PHMSA SCC Studies, Gap Analysis and Road Mapping](#)

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“During a PHMSA audit, the auditor inquired if there were any corrosion concerns for a 10 year old FBE coated pipe that were experiencing blisters, which resulted in an extensive data request. Our company used existing PRCI research as background information that the blisters on FBE piping are not a corrosion concern. The PRCI research paper was referenced in the response.”

— Karen M. Bowman, PE
Engineer III, Corrosion Prevention
Dominion Energy Transmission, Inc.

DESIGN, MATERIALS & CONSTRUCTION TECHNICAL COMMITTEE

ABOUT THE 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:

Mike Hill, *Enbridge*; David Horsley, *TC Energy*; Nick Khotenko, *ATCO Pipelines*;
Junfang Lu, *Enbridge*; Jorge Penso, *Shell Global Solutions*;
Russell Scoles, *Enbridge*; Mery Turner, *ExxonMobil*

FEATURED REPORTS

[PR-350-144502-R01](#)

Assessment of Cracks Clusters with Intelligent Interaction

This project developed intelligent flaw interaction rules that can more accurately account the impact of multiple cracks without being overly conservative. These rules use the principles of equivalent impact among multiple interacting cracks and represent the magnitude of the impact by a single virtual crack. These rules do not rely on a critical spacing to determine whether there is an interaction. The magnitude of the interaction is a continuous function of the size of adjacent cracks and the spacing between them

[PR-201-084504-R01](#)

Long-Term Composite Repair Study - Burst Test

The study sought to answer the question of how does the performance of a composite repair change over an extended period (up to 10 years) when subjected to environmental conditions representative of those encountered during pipeline operation. To examine the long-term performance of composite repairs used for pipeline applications, the project installed commercially available composite repair systems on pipe samples with regions of machined wall loss of depths up to 75% of the pipe wall-thickness. Following fabrication, the corrosion areas were reinforced with composite repairs and buried in the ground for up to ten years. Composite repair systems were sourced from 13 different manufacturers and were installed on over 180 pipe samples prior to burial. Of these 13 reinforcement systems, four were tested to the end of the designated 10-year hold period. All samples underwent hydrostatic and periodic cyclic pressure testing while buried. Three unreinforced test samples, one of each wall loss depth, were burst at the onset of the study to provide baseline comparisons.

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ADDITIONAL RESEARCH

[PR-685-184506-R02](#)

Additional Hydrotechnical Hazard Pipeline Integrity

[PR-387-11200-R01](#)

All-Weld-Metal Strip Tensile Testing of Narrow Groove Pipeline Girth Welds

[PR-350-174511-R01](#)

Development of Rational Ovality Limits

[PR-685-184506-R01](#)

Development of Risk Assessment Procedures and Tools

[PR-186-184507-R01](#)

Evaluate Higher Strength Consumables for Manual Root Beads in X70 Girth Welds

[PR306-184502-R01](#)

Evaluating Composites in Reinforcing Mechanically Damaged Pipelines with Dent and Gouge

[PR-652-184505-R01](#)

Evaluating Installation Techniques for Pipeline Repair Methods

[PR186-184507-R01](#)

Guidance for Application of Higher Strength E8010 Electrodes for Root Pass Welding

[PR-186-184509-R01](#)

Guideline for Erosional Velocity

[PR-685-184506-R06](#)

Web-Based Monitoring Dashboard

WEBINARS

[Characterization of Pipeline Wall Loss for Strain Capacity](#)

[Composites Part I - History of Composites Repair Technology](#)

[Composites Part II - Composite Systems for the Repair of Corrosion and Mechanical Damage](#)

[Guidelines to Calculate Erosional Velocity for Liquid Hydrocarbon Transmission Pipelines](#)

"ATCO has utilized and successfully applied the research and recommendations provided by PRCI in the MATH-5-4 [Evaluate Higher Strength Consumables for Manual Root Beads in X70 Girth Welds](#) and MATH-5-3B [Guidance on the Use, Specification, and Anomaly Assessment of Modern Linepipes](#) research projects. These projects have directly improved the way that ATCO approaches the design and construction of higher-grade pipelines. ATCO has also been afforded the opportunity to provide the PRCI project teams additional data from our projects to support the on-going and important research work that is conducted on this topic by PRCI."

— Nick Khotenko, ATCO Pipelines

INTEGRITY & INSPECTION TECHNICAL COMMITTEE

ABOUT THE COMMITTEE

The [Integrity & Inspection](#) (I&I) Technical Committee improves 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.



For NDE-19: A dig site in China where in-ditch NDE is being used to assess I&I performance for detecting and sizing pinholes.

VICE CHAIRS:

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

FEATURED REPORTS

[PR-610-183867-R01](#)

Fracture Toughness via In-ditch Non-destructive Testing – Validation

A challenge for many pipeline operators is missing or incomplete records for sections of their transmission pipeline networks, especially fracture toughness properties, which are necessary for performing fitness for service calculations and engineering critical assessment. New regulations for gas transmission pipelines stipulate conservative default values for applicable assets when traceable, verifiable, and complete (TVC) records are not available. The new rules allow for the use of validated nondestructive techniques within material verification programs to measure the actual steel properties in lieu of conventional destructive cut-outs. The aim of this research program was to assess the capabilities and limitations of the Nondestructive Toughness Tester (NDTT) to meet the requirements of a material verification process for measuring fracture toughness properties through a contact mechanics technique known as frictional sliding. This project consisted of testing on 41 vintage steel pipe joints to compare the NDTT measurement of the tensile fracture response in a superficial volume of surface material with conventional laboratory measurements of toughness on the same sample. The outcomes included the development and assessment of nondestructive prediction models for the initiation fracture toughness from compact tension (CT) testing and the upper shelf Charpy V-Notch (CVN) impact energy.

[PR-366-173814-R0](#)

Assessment of SCC with Advances in NDE including EMAT and IWEX Imaging

In-line inspection (ILI) is often used to estimate failure pressure from anomalies as part of the integrity management of pipelines. The goal of this project was to improve failure pressure estimates of stress corrosion cracking (SCC) colonies by advancing field measurements and comparing ILI tool data. Electromagnetic acoustic transducer (EMAT) ILI technologies have made significant strides in providing crack depth measurements for SCC colonies, and emerging technologies such as ultrasonic testing (UT) imaging are providing more accurate in-ditch validation data. For new ILI technologies, feeding back accurate field measurements to vendors is an essential part of the process for improving ILI estimates of failure pressure. Along with the specific results, this project successfully demonstrated a general approach for improving crack ILI technology using field NDE methods.

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ADDITIONAL RESEARCH

[PR-670-183826-R01](#)

Assessment of Science Behind LSM for Pipeline Integrity

[PR-328-173865-R01](#)

Evaluation of ILI Capabilities on Mechanical Damage Feature

[PR-469-173823-R02](#)

In-Line Inspection and Evaluation of Pinholes in Oil and Gas Pipelines - Phase II

[PR-335-173844-R01](#)

NDE Crack Depth Sizing Performance Validation for Multiple UT Techniques

[PR-320-113706-R01](#)

Neutron Diffraction Measurements of Residual Strain from Dents and Gouges in Pipelines

[PR-214-163713-R01](#)

Review of Response Requirements and Criteria for Plain Dents

WEBINARS

[Assessment of SCC with Advances in NDE including EMAT & IWEX Imaging](#)

[Fracture Toughness via In-Ditch Nondestructive Testing – Validation](#)

[Hard Spot NDE Verification and Validation - Phase II](#)

[Quantification of ILI Sizing Performance for Severe Corrosion Anomalies](#)

MEASUREMENT TECHNICAL COMMITTEE

ABOUT THE COMMITTEE

The [Measurement Technical Committee](#) focuses on measurement technology research related to improving the safety, performance, environmental impact, and operating cost of oil and gas transportation systems.



Adam Hawley (SwRI) and Kerry Checkwith (Enbridge) at the Winter 2020 MTC Meeting – Southwest Research Institute (MEAS-6-17A)

TECHNICAL COMMITTEE CHAIR:

Chris Levy, *Chevron*

VICE CHAIRS:

Lori Curtis, *Kinder Morgan*; Jonatan A. Mustafa, *Energy Transfer*

FEATURED PROJECTS

[PR-720-20603-R01](#) 

Emerging Fuels, Hydrogen - State of the Art Gap Analysis and Future Project Roadmap

[PR-306-20604-R01](#) 

Emerging Fuels, Renewable Natural Gas - State of the Art Gap Analysis and Future Project Roadmap

As the prevalence of emerging fuels increases, consideration for the utilization of these fuels needs to be examined. This research developed a concrete path forward in defining the necessary projects that need to be completed for companies to inject hydrogen and renewable natural gas safely and reliably into their pipeline. The studies included mapping of worldwide projects and references, state-of-the-art analysis, gap analysis, and recommendations for research and development topics.

[PR-015-20606-R01](#) 

Practical Effects of Rough-Walled pipe in Gas Metering Applications

The influence of upstream pipe roughness on the performance of multipath ultrasonic flow meters was examined through a set of experiments involving three different brands of ultrasonic flow meters. Tests were conducted with 16-inch meters with piping, having a wide variation in surface roughness values with and without a flow conditioner. These results, when combined with the earlier testing of 8-inch diameter meters, can be used to support changes in the practices currently recommended by industry standards.

[PR-015-19602-R02](#)  

Water in Oil Meter Technology Testing

Water-in-oil meters, or online water measurement devices, are key instruments in crude oil allocation metering systems and in pipeline transportation networks. Water-in-oil metering is also a potential enabling technology to further automate measurement systems and has been identified as key in the conversation of low-staffed or unstaffed oil production or transportation facilities. Inaccurate or unstable water-in-oil meter can have adverse effects of wasted transportation energy, manufacturing process upsets, and increased measurement uncertainty. Various water cut meter technologies were performance-tested across the water-in-oil range of 0 to 20% to aid operators in selecting accurate and stable water cut meter technologies, increase reliability, and lower maintenance costs. This research also supports ongoing industry standardization work for water in oil meters.

Key:

-  Public Access
-  Members Only
-  Webinar Available
-  Software Download

ADDITIONAL RESEARCH

[PR-663-19600-Z01](#)  

Develop Guidance for Calculation of HCDP in Pipelines

[PR-461-18601-R01](#) 

Feasibility of Solvent Replacement for Sediment and Water Content Methods in Crude Samples

[PR-363-18605-R01](#) 

High Pressure Calibration of Turbines with an Inert Gas

Water in Oil Meter Technology Testing

[PR-015-19602-R01](#) 

Water in Oil Meter Technology Testing

WEBINARS

[Capturing Calibration and Diagnostic Data from Ultrasonic Meters into a Common Database](#)  

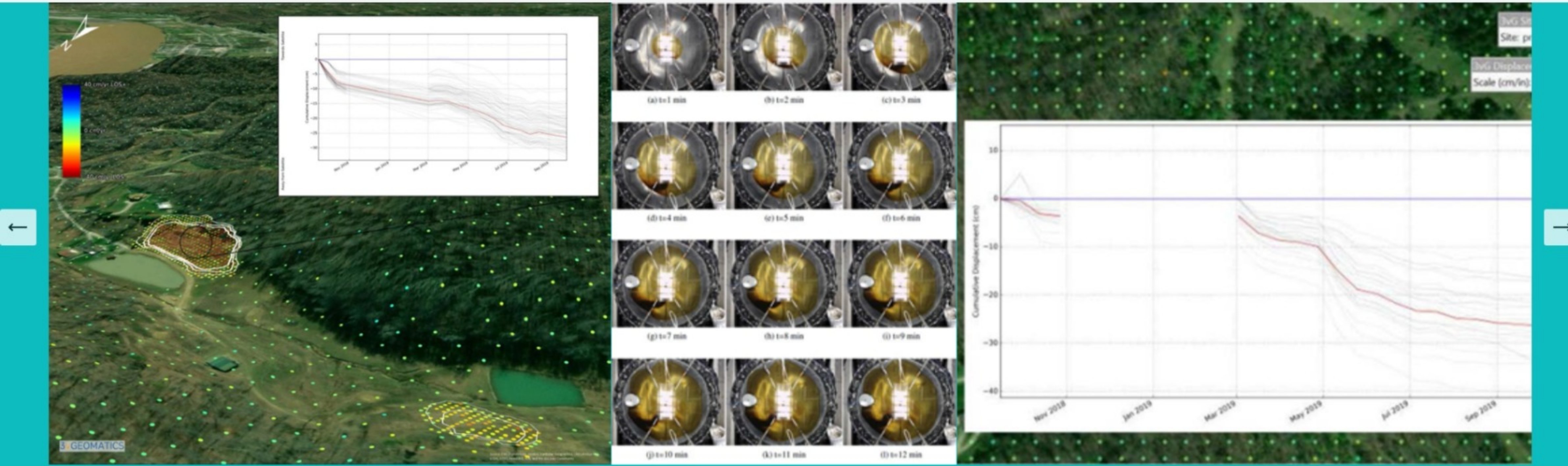
[Multi-vendor USM Test and Calibration Database with Common Diagnostics](#)  

[Water in Oil Meter Technology Testing](#)  

SURVEILLANCE, OPERATIONS & MONITORING TECHNICAL COMMITTEE

ABOUT THE 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 identify Right-of-Way threats, leak detection, and damage prevention.



Time lapse images from On-Water Leak Detection Technology Evaluation

TECHNICAL COMMITTEE CHAIR:

Nikos Salmatanis, *Chevron Energy Technology Company*

VICE CHAIRS:

Mike McCutcheon, *TC Energy*; Chris O'Neill, *Enbridge*

FEATURED REPORTS

[PR-686-183908-R01](#)

InSAR Monitoring of Pipeline Geohazards in Vegetated and Very Large Non-Vegetated Areas

Using InSAR, 3vGeomatics has performed a proof of concept on the effectiveness, reliability, and precision of using L-band SAR satellites for InSAR monitoring of vegetated areas and C-band satellites for monitoring in non-vegetated areas. The InSAR displacement estimates are compared to ground truth data including differential light detection and ranging (LiDAR), in-line-inspection, and ground survey measurements. The goal of this project was to operationalize ongoing InSAR monitoring programs for pipeline networks in vegetated areas and very large non-vegetated areas for operating members.

[PR-244-193900-R01](#)

Oil-on-water Leak Detection Technology Evaluation Phase 2

Industry is directing efforts toward reducing the environmental impact of operation through improving pipeline performance and addressing evolving regulatory requirements. As a result, external leak detection technologies have been recently developed. However, testing these systems with real hydrocarbon products in-situ is challenging. This research project was developed to assess these external leak detection technologies' abilities to identify the presence of hydrocarbon products on the surface of water. In the first phase of the project, testing was limited to an idealized freshwater environment under ambient conditions. The second phase, described herein, was expanded to a freshwater environment under freezing conditions, where the surface of the water is frozen over. Testing was performed by releasing each test fluid (diesel, Synthetic Sweet Blend and Access Western Blend) into basins containing individual sensors. Releases were performed above the ice surface, below the ice surface, and onto the water surface after freeze/thaw cycles. Each sensor's response to contact with the test fluid was monitored and compared based on time to detection and estimated slick thickness at detection.

Key:

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[PR-670-183906-R0](#)

Literature Survey of Sensor Capability Embedded in Coating for Leak Detection

[PR667-183902-Z01](#)

Pipeline Assessment Tool for Human Factors (PATH) Users Guide

WEBINARS

[InSAR Monitoring of Pipeline Geohazards in Vegetated and Very Large Non-Vegetated Areas](#)

[On-water Leak Detection Technology Evaluation – Phase 1 & 2](#)

SUBSEA TECHNICAL COMMITTEE

ABOUT THE COMMITTEE

The [Subsea](#) Technical Committee focuses on issues and challenges unique to the offshore pipeline environment.



TECHNICAL COMMITTEE CHAIR:

Jamey Fenske, *Exxonmobil Pipeline Company*

VICE CHAIRS:

Ludovic Assier, *Total S.A.*; Farzan Parsinejad, *Chevron Technical Center*

FEATURED RESEARCH

[PR393-205100](#)

Subsea X-Ray Computed Tomography In-Service Riser Inspection System (IRIS) Extended Research

Building up the success in the project's X-ray computed tomography research for flexible riser inspection, the Subsea Technical Committee and Team Lead Farzan Parsinejad have identified promising results with an in-service riser inspection technology. A consortium is being formed to further refine use cases and marginalization design. This important research is poised to dramatically improve available resources for flexible riser integrity, which is projected to have a significant impact on asset life extension and field economics.

Key:

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- Software Download

ADDITIONAL RESEARCH

[PR-453-134504-R04](#)

CFD Simulation of Hydrodynamic Forces on Submarine Pipelines



[Home](#) [Members](#) [Accomplishments & Findings](#) [Awards](#) [Knowledge Transfer](#) [Technology Development Center](#)

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Qualification and Guideline of Inspection Technologies for Flexible Pipe Integrity

WEBINARS

[On-Bottom Stability Version 4](#)

[Qualification and Guideline of Inspection Technologies for Flexible Pipe Integrity Management; Baker Hughes MAPS inspection technology excerpt](#)

[Small Diameter Acoustic Resonance \(ART\) ILI Tool Feasibility Study & Concept Design](#)

[< Surveillance, Operations, & Monitoring](#) | [Home](#) | [Underground Storage](#) >



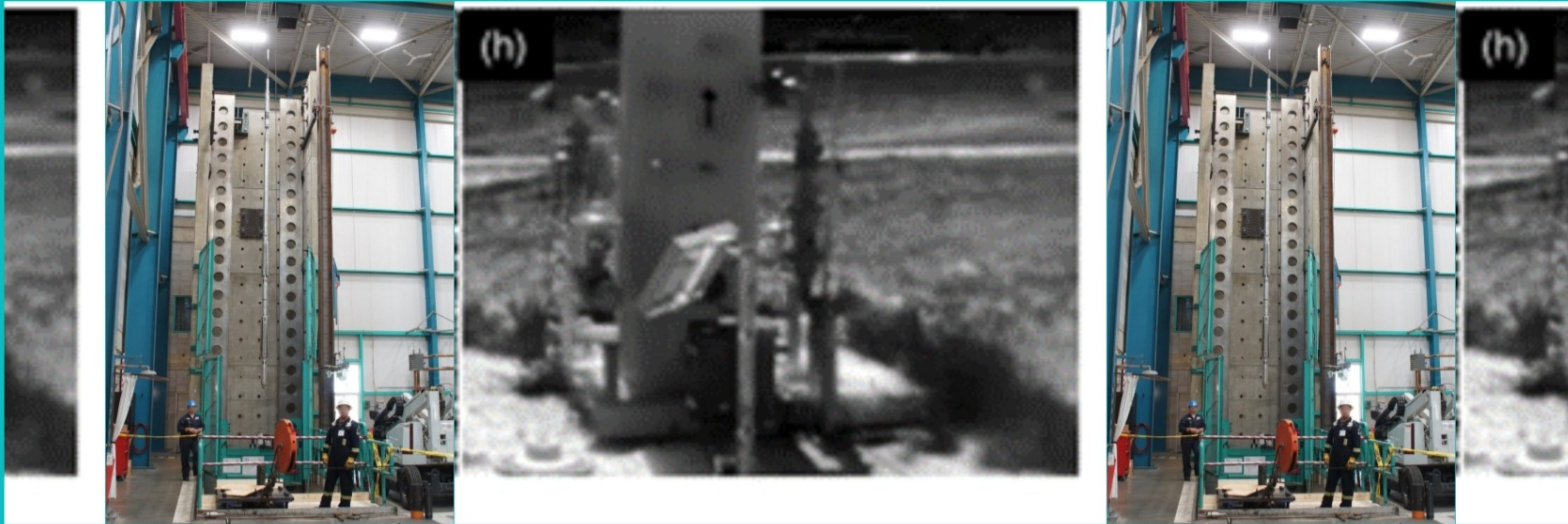
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UNDERGROUND STORAGE TECHNICAL COMMITTEE

ABOUT THE 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.



Methane Leak Image from PR-681-18701-R01

TECHNICAL COMMITTEE CHAIR:

Stephanie Sexton, *ExxonMobil*

VICE CHAIRS:

John W Jackson, *Enbridge Pipelines Inc. and Enbridge Energy Partners LP*;
Anders Johnson, *Kinder Morgan*; Mark Thompson, *Enterprise Products*

FEATURED PROJECTS

[PR-681-18701-R01](#)

Evaluating the Use of Optical Gas Imaging Cameras for Above Ground Facilities

Natural gas is the largest primary energy source in the United States. Reliance on natural gas is only increasing as its role in electricity systems becomes more significant and that of coal diminishes. While this has air quality and health benefits over the use of coal, the global warming potential of methane - the primary component of natural gas - cannot be ignored. In order to mitigate methane leaks, periodic leak detection and repair programs are required in the United States. Various different technologies exist to detect and/or quantify methane leaks. Studying them and

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systems were carried out at the Methane Emissions Technology Evaluation Center in Fort Collins, Colorado over two weeks. The study evaluated and tested both technologies at a variety of leak size and imaging distance combinations. In order to better simulate real-world conditions, the performance of the two systems was tested in the presence of different types of interference.

ADDITIONAL RESEARCH

[PR-427-12701-R01](#)

Review of Mechanisms That Lead to Well Cement Deterioration

AWARDS

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.



Emerson



KROHNE, Inc.



SICK

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.



Kerry Checkwitch
Engineer Specialist Mechanical
Enbridge Pipelines Inc.



David McQuilling
Chief Engineer
Pacific Gas and Electric Company



Natalie Tessel
Director, Brand & Member Engagement
Pipeline Research Council International

DISTINGUISHED RESEARCHER AWARD

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



Aaron Dinovitzer
Vice President
BMT Canada Limited



Terry Grimley
Staff Engineer
Southwest Research Institute



Patrick Vieth
Sr Vice President - Technical Services
Dynamic Risk Assessment Systems, Inc.

KNOWLEDGE TRANSFER

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 who executed the research on how an operator can benefit from using the research and how best to implement it.

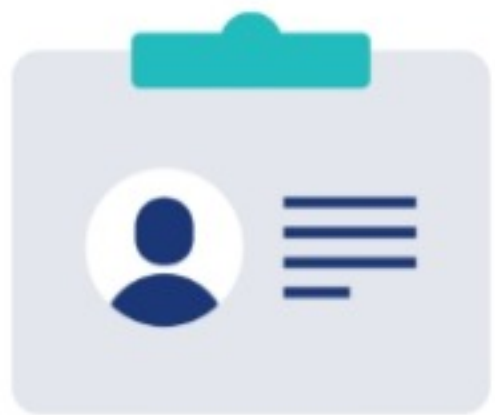
BY THE NUMBERS:



29 WEBINARS



2.2K RECORDING VIEWS



7.7K REGISTRANTS



4.8K ATTENDEES



63% ATTENDANCE RATE

TOP 3 WEBINAR ATTENDANCE



1. Expert Review of Past PRCI and PHMSA SCC Studies and Road Mapping
2. Assessment of Fitness-for-Service for Crack-within-Corrosion Anomalies
3. Quantification of ILI Sizing Performance for Severe Corrosion Anomalies

TOP 3 WEBINAR RECORDING VIEWS



1. Assessment of Fitness-for-Service for Crack-within-Corrosion Anomalies
2. InSAR Monitoring of Pipeline Geohazards in Vegetated and Very Large Non-Vegetated Areas
3. Quantification of ILI Sizing Performance for Severe Corrosion Anomalies

PRCI WEBINAR LIBRARY

[View All](#)

Members must login to view member-only content.

**excludes member-only research*

TECHNOLOGY DEVELOPMENT CENTER

In July 2014, PRCI broke ground on the Technology Development Center (TDC) in Houston, Texas, which became the physical manifestation of a major commitment by the energy pipeline industry to address key issues to ensure the safety of the national and international pipeline system. Within a year, the grand opening drew over 200 PRCI members and industry stakeholders in attendance. Five years and dozens of projects later, the TDC continues to be a hub for industry-wide pipeline research and development activities.



The 24" mechanical damage ILI project was based on the results of many pull tests.

Offering a world-class pull test and flow loop enables PRCI to partner with the ILI industry to enhance the tools that are a key aspect of pipeline integrity management, as well as providing testing opportunities to develop and characterize new nondestructive evaluation tools and techniques. The TDC houses over 1,500 pipe & coupon samples with defined and measured defects that allow service companies to work on real-world samples to improve inspection technologies and provide a greater degree of assurance of the integrity of pipeline systems. Additionally, the TDC contains state-of-the-art meeting and classroom space that enables PRCI to more effectively transfer these research results to our members and the industry.

The events of 2020 made it a tough year for everyone. The TDC adjusted to the "new normal" as recommendations became available and continued operations with a completely additional set of safety standards. "Social distancing" and masks became the norm, along with new sanitation measures. Retrospectively, although these changes are simple and now commonplace, we were able to safely host over 40 events at the facility, including pull tests, sample scanning, and conferences.

This year also saw a major undertaking in maximizing the value of the extensive pipe and coupon inventory housed at the TDC. It became increasingly obvious that the TDC needed a way for members and customers to search our samples, and so we kicked off a major campaign to better organize, label, and store our physical samples. Additionally, a searchable, publicly available database has been commissioned to be completed in 2021.

ACKNOWLEDGEMENTS

PRCI would like to acknowledge the TDC Advisory Committee for their dedication and support, as well as member companies that have and continue to contribute samples and whose financial support helps to supplement the TDC's operations.

FORECAST FOR THE FUTURE/GOALS FOR 2021

These examples of the PRCI research work and events conducted in 2020 showcase the collaboration within the membership and the industry. The TDC provides not only a place to execute research but also to demonstrate how to put the research into practice. While this year did not allow for many opportunities to host PRCI and industry workshops to provide learning opportunities to members and non-members alike, the TDC is cautiously optimistic about 2021 to combine classroom learning with hands-on training.

If you are interested in the available services at the TDC or would like to schedule a tour, please contact us at TDC@prci.org.