

# OF, BY, AND FOR THE ENERGY PIPELINE INDUSTRY

Develop innovative solutions that provide for the safest, cleanest, and most efficient transportation and storage of energy via global pipeline systems.



## THE 2023 PRCI YEAR IN REVIEW

To collaboratively deliver relevant and innovative applied research to continually improve the global energy pipeline systems.



**WALTER CROMMELIN,**  
Chairman

In a one-on-one interview, Executive Board Chair Walter Crommelin offers insights on his plans and expectations for his tenure.

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**CLIFF JOHNSON,**  
President

President Cliff Johnson shares the highlights of PRCI's accomplishments and activities over the past year.

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## WHO WE ARE

PRCI is a community of the world's leading pipeline companies, and the vendors, service providers, equipment manufacturers, and other organizations supporting the industry.

**MISSION** [▼](#)

**VISION** [▼](#)

**CORE VALUES** [▼](#)



### ACTIVITIES

The knowledge and networks of members and event attendees are expanded and strengthened through the many meetings, courses, and opportunities offered through PRCI.



### TECHNOLOGY CENTERS

Enhancing the Technology Centers enables members and the industry to build upon real world samples and learnings to inform business decisions.



### ENVIRONMENTAL COMMITMENT

Building upon on PRCI's legacy of environmental commitment assists members and the industry in achieving a low carbon future and zero emissions.



### CORE RESEARCH

Advancing PRCI's Core Research Program and enhancing the adoptability/usability of the findings.

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**Main Office**  
15059 Conference Center Drive  
Suite 130, Chantilly, VA 20151  
Main +1 703.205.1600  
Fax +1 703.205.1607  
[prci.org](http://prci.org)

**Technology Development Center**  
6410 Langfield Road, Building J  
Houston, TX 77092  
Main +1 281.846.7570  
[prci.org/tdc](http://prci.org/tdc)

# INTERVIEW WITH THE CHAIRMAN



**WALTER CROMMELIN,  
CHAIRMAN**

**Accepting the responsibilities of chairman of an Executive board is not a decision to be taken lightly. What inspired you to take the role of the board of the board chair?**

**Walter:** As a member of the European Pipeline Research group (EPRG), I had already seen how you can collectively do research to get good results and also put those results into standards. From a safety point of view, getting verified knowledge and actual facts into the standards is very important because otherwise it leaves too much open to interpretation. As far as topics go, integrity and safety must come first for all companies. And there you have to continually do research to deal with new developments which are always coming.

My manager encouraged me to become active in PRCI because this was a good way to learn more about the industry and broaden horizons. Europe is just one part of the world; America's another part. I very much believe diversification is key. You have to expand your knowledge all the time, talk to people to see their perspective. It doesn't matter which business they are in. They have insights, so just talk to them.

I became part of the Executive Assembly, and my manager at the time was a new member of the Executive Board. About one month after he joined the EB, he left to do another job within the company. I felt obliged to take on his EB position, and then at some point soon after, I found it an entertaining idea to, you know, sort of pick up where he left off.

What I really enjoy about the EB is that you get to think about how we are going to tackle these issues, our mission, and our vision. How do we move forward into the world? How do we show who we are and what we want to achieve? I have a stake in this.

At the moment the industry has moved into a dynamic phase. People have all sorts of ideas, and the energy transition and the discussions between different groups of stakeholders is ongoing, and it is unclear exactly where we will go in the future. And if it's dynamic, then of course it's an interesting time, especially if you're a member of the board. And then, why not be chairman of the board? You can get even more involved with the discussions and think about it all, and that's basically what I'd like to do.

**Your term as board chair spans only two years, which is simultaneously a really short period of time, and also a pretty long period of time. What do you want to achieve during this time?**

**Walter:** I think it is very important that we look to the vision and mission we have, to look at the strategy and look at how we do research, and then prepare the organization for the next 10 years. I really like the diversity within the organization because it leads to good ideas, but it also requires management. Otherwise ideas go in all different directions or you get various groups that focus on doing their own thing, and we lose connection to each other.

So what I really want to achieve is make everybody think about how we put PRCI on track for the next 10 years as an organization. How do we get members; how do we keep members? How do we do research? How do we engage internationally; how do we engage with governments?

PRCI is a unique organization because it has the ability not just to do research, but to also organize events and publishes compendiums and developing knowledge transfer courses and training. It's an organization which can do so much more with knowledge generated than most of the other organizations, and that's what I find very interesting. We can leverage this position to get more of this knowledge out there, to engage more with governments, to engage more with standardization bodies and educate the new generation of engineers. That's what I like about PRCI: these abilities to really do something more with the results of your research.

**PRCI is based in North America. As a chair who represents an operator outside of North America, you have an added layer of insight from an international perspective that you spoke about earlier. How do you plan to leverage your unique perspective and experiences to foster global collaboration and knowledge exchange within PRCI?**

**Walter:** These different perspectives, which you see in the board meetings and the Executive Assembly, help people to realize that there are different solutions to their problems. This realization can open your mind to new ideas and help you to run your business.

Another aspect are the standards we all use. If you want to really understand the standards, or if you want to influence them, it's good to speak to other people who have used them or are closer to the process that resulted in the standard. They can explain what was meant and how they can be interpreted. Because what ends up in a standard can be a minimum level that everyone could agree on, but perhaps it is not the absolute best that could be done. Then it is interesting to know what didn't make the final version.

The same applies if you participate in a project at PRCI. Being a part of the process enables you to understand the decisions which were made during the project, and you can take this knowledge back to your company when you implement the results.

Any result from research or any published standard still requires humans to look at it, and to interpret it, and to decide which parts are relevant for them and which parts are not. That's what global collaboration can bring because you're getting this diversity of thought and insight. Otherwise, you're going to be solely focused on just your country or your area, your pipeline and your regulator and in the end, this can lead to weaknesses in the system. It'll just drive you down a tunnel and in the end, you'll see a lot of common cause failures. Why? Because you've been doing exactly the same thing. You didn't realize there was somebody in some other country or some other place who saw this problem and solved it.

**Sustainable growth and innovation are critical to the success of organizations. Do you have any strategies that you envision implementing or expanding upon to foster growth and innovation within PRCI?**

**Walter:** With PRCI, you look at the issues that you face and try to come up with solutions, and try to find out what you perhaps don't know or what people outside the direct industry are working on.

Around sustainability now, there's a lot to do with leak detection: improving how quickly leaks can be detected and identifying where they are happening to limit the amount of methane that leaves the system. The question is, are we doing enough to develop this technology?

We see the creativity of other parties can affect this as well. For example, there are environmentalists who utilize technology for leak detection to basically point out to operators where they have a problem, and they're not doing that from the kindness of their hearts, per se. On the one hand, they are doing it to help the environment, but on the other hand, they use it as a means to pressure operators to take action. You can look on that as a negative, but you can also embrace it as a positive. If there are techniques out there which can help limit leaks, then you should use them. You should embrace them and go forward to ask, "How did you do this and where did you come up with this?"

So on the one side, sustainability helps you achieve the mission that the public would generally want you to achieve, and that's improving life on the planet. The other side is also very simple. If you don't move with the times, at some point you're going to end up with stranded assets which basically have no value. So it doesn't really matter if you look at it from a perspective of a shareholder or an environmentalist.

You have to always continuously look forward and adapt and change. It's not the strongest that survive; it's the most flexible that survive. The most adaptable are the ones that come out on top in the end.

**How will you leverage your diverse experience and expertise to enhance the collaboration that you want to see between the industry stakeholders, the government bodies and PRCI and anyone else involved?**

**Walter:** I think it depends greatly on how we can get people interested to share and participate. One of the things which I find very interesting is knowledge transfer. At first it's seen as getting knowledge out there to the members, and then it's getting it out there to non-members who can buy reports or courses. But then you can also get it out even broader than that, moving towards regulators and other stakeholders, and the public.

At Gasunie, we set up a training course for the government to learn about pipelines. It was a course where we explained everything about pipelines and storage, basically about how the entire gas system works. The aim was, that in the end, you could have a good dialogue about the things operators are facing and the challenges that are there so that when they make rules, they understand some of the constraints for the rules. When they look at the risk, they have a sense of the balance between risk reduction and cost. Then when you have a dialogue with them, they understand why you are doing what you do.

One of the ways you can promote collaboration is to just be transparent about your challenges. Now, what PRCI's role should be as research organization, is something to discuss. We aren't an advocacy group; we're a research group, but there are ways to foster collaboration and engage. That's something that you should keep it in the back of your mind. We can use our position and our knowledge to be a part of improving collaboration for a broad group of stakeholders.

**Because communication is critical, are there any core messages or vision regarding the importance and impact of PRCI's research initiatives that need to be communicated to our existing Members? What do you see that we could what the common Member should know about?**

**Walter:** It starts with a basic value proposition. On the one hand, there's the research and the other hand, there's communication and interaction.

I tell people I'm a safety guy, you know. Organizations and pipelines and buildings, those are just static assets. They are why we do things, but a means to an end. Our goal is to safely and reliably provide products for people to use and it's the people in our companies who make the difference in the end.

That's one of the huge benefits from PRCI. When you get engaged, you can talk to a lot of other people who have similar interests, similar backgrounds, but from different companies with different perspectives. You can engage on a technical level with them, which is what a lot of subject matter experts really enjoy, you know, technical details and what can help you make it better and safer at your own company.

One of the things which is always good, and actually very important for PRCI, is engaging people at events. These events are where you present research, but also have open forum discussions, working sessions, poster sessions or even, presenting awards. You have to keep the people enthusiastic and engaged. That's why a lot of people join organizations. All of the knowledge that is available is nice, but you stay because you meet people, you engage with people, you make connections, you might visit them and their companies. Your network is really strengthened.

As a board, we're trying to make a calling card, in effect, from the vision and the mission statements. We want to take be able to take them to colleagues and say, "I'm a member of this great organization. Do you have somebody engaged in safety or integrity or design, and want them to get to know colleagues in the industry, exchange ideas and just generally get better?" That is what PRCI really good at and what I really like.

**To ensure the transparency and understanding of PRCI contributions to the industry, what is one way that you plan to champion and support initiatives that effectively communicate our research outcomes to industry, stakeholders, policymakers and the public?**

**Walter:** One of the things I'm very enthusiastic about is that PRCI is now working together with ASME organizing the International Pipeline Conference (IPC) in Canada. This is a very well-known and well-respected conference that a lot of people from Europe attend. If there's one way to really get the message out there, it's to collaborate with something which is already well-known and well-respected. This collaboration will really help build the PRCI brand and target people already interested in pipelines but perhaps not yet familiar with PRCI.

**What advice do you have for member companies?**

**Walter:** My advice is look to the young people that you have and send them to PRCI now so that they can engage with the great SMEs that we have while they're still active and pick their brains. Get them engaged now while there's a chance to get educated, while the knowledge is still there and still accessible. If you wait too long, too many SME's will have left towards retirement and you will have to build that experience up all over again, reinvent the wheel, and that's just not efficient.

Another thing I really love about PRCI is that if you're enthusiastic about something and you want to research it, you will get support. If you put in the time, if you champion it, you will get the support to do it. It's also a great opportunity for young people to learn to manage a project and budget responsibility, to learn how to engage people and keep them active, and how to organize things. A lot about getting things done in collaboration with people and getting them to do something. These are very important skills, and it's about communication, and they can be practiced at PRCI. Get somebody in there and get them active.

**Any advice for the industry?**

**Walter:** My advice to the industry is to be an early adopter. Don't be the incumbent who tries to protect their stake because you're just going to lose in the end. Move with the times. People will expect different things from you in different areas, but be flexible. If that means that some part of your system is more gas based and others are more oil based, and yet other parts want to do hydrogen because it's in another state or country, then do that, but be flexible. That's the only way you will keep your license-to-operate.

**Is there anything else you'd like to add?**

**Walter:** Something a lot of people don't realize is that we are working on something which will last longer than the average human lifetime. The pipeline system will last longer than their own lives. By the time we retire, these pipelines will still be there, still being taken care of. That's why I see it as very important to be flexible.

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**Main Office**  
15059 Conference Center Drive  
Suite 130, Chantilly, VA 20151  
Main +1 703.205.1600  
Fax +1 703.205.1607  
[prci.org](http://prci.org)

**Technology Development Center**  
6410 Langfield Road, Building J  
Houston, TX 77092  
Main +1 281.846.7570  
[prci.org/tolc](mailto:prci.org/tolc)

# LETTER FROM THE PRESIDENT



CLIFF JOHNSON, PRESIDENT

PRCI concentrated efforts in 2023 on enhancing stakeholder engagement, outreach, influence, and operational excellence. Guided by our mission and vision, PRCI pursued innovative research, fostered collaboration, and shared knowledge to enhance the safety, efficiency, and environmental sustainability of energy transportation and storage. Our strategic goals shaped initiatives throughout the year to better enable us to meet the needs of members and the broader pipeline community.

Reflecting on the accomplishments and milestones of 2023, this past year stands as a testament to our collective commitment to advancing the global pipeline industry.

## ENHANCING STAKEHOLDER ENGAGEMENT

PRCI deepened its commitment to enhancing stakeholder engagement by highlighting the essential role of collaboration in the advancement of pipeline safety and integrity.

- One landmark initiative was our partnership with the American Petroleum Institute (API) to host their first-ever API Technology Summit at the PRCI Technology Development Center (TDC). This event showcased crucial technological advancements that support the energy pipeline industry, and marked a significant step towards it becoming an annual highlight to emphasize the technologies underpinning our industry's safety and integrity.
- PRCI's contributions to the INGAA Climate report underscored our dedication to environmental stewardship and demonstrates our proactive efforts to mitigate the energy pipeline infrastructure's impact on the environment.
- Coinciding with the Research Exchange Meeting (REX), one noteworthy event was Government Day at the TDC. Gathering together members of Congress, their staff, and Deputy Administrator at the Pipeline Hazardous Materials Safety Administration (PHMSA) Tristian Brown offered a unique platform to showcase PRCI's advancements and discuss support for the industry.
- Participation in PRCI's Congressional Testimony before the US House Science, Space, and Technology Committee highlighted our proactive engagement in shaping policy and regulatory frameworks to enhance pipeline safety and sustainability.

Pivotal in fostering meaningful dialogue and collaboration, these initiatives strengthened our relationships with key stakeholders, ensuring that our collective efforts align with the industry's evolving needs and contribute to the overarching goal of enhancing pipeline safety and integrity globally.

## EXPANDING STAKEHOLDER OUTREACH

In 2023, PRCI intensified its efforts to broaden our impact within the pipeline community.

- Underscoring the relevance of our research, the 2023 Research Exchange Meeting (REX) attracted nearly 500 attendees, including representatives from several North American government agencies.
- In collaboration with leading industry organizations, the first-ever Emerging Fuels Symposium (EFS) and the European Research Forum (ERF) highlighted global research on safely transporting and storing next-generation fuels and enhancing pipeline safety.
- The creation of the Government Engagement Committee (GEC) and the Emeritus Program further enables focused engagement and research development.
- The launch of PRCI Connect was a significant step in facilitating continuous conversations that advance our research program and provide solutions to the industry.

By expanding our communication channels, leveraging social media, and enhancing our online presence, we were able to disseminate valuable insights, research findings, and best practices to a wider audience.

## ENHANCING OPERATIONAL EXCELLENCE

PRCI has remained steadfast in our dedication to enhancing operational excellence across all facets of our organization. Recognizing the importance of optimizing resources and investing in talent development, PRCI took significant steps in 2023 to improve the efficiency and effectiveness of our operations. This commitment to operational excellence not only ensures that we deliver greater value to our members and stakeholders but also strengthens our foundation for future growth and innovation.

- One key aspect of our operational improvements in 2023 was the emphasis on a cornerstone of our mission, knowledge transfer, to drive innovation and share best practices within the pipeline industry. The initial development from this focus is a comprehensive course for the Pipeline Repair Manual, which aims to standardize and disseminate best practices for pipeline repair to enhance the industry's ability to maintain safe and efficient operations.
- We were thrilled to announce the addition of Shahani Kariyawasam as the Executive Director of Knowledge Transfer. Her wealth of experience, expertise, and leadership is instrumental to advancing our knowledge transfer initiatives.

Strategic additions to our team and focus on operational excellence enable PRCI to continue delivering on our promise of advancing the pipeline industry through research, collaboration, and knowledge sharing. We are poised to tackle the challenges ahead with renewed vigor and determination, driven by our mission to enhance the safety, efficiency, and sustainability of global energy pipeline systems.

## LOOKING AHEAD

One highlight of upcoming PRCI activities includes collaborating with the American Society of Mechanical Engineers (ASME) in 2023 to co-host the 2024 International Pipeline Conference (IPC), and again in 2026 and 2028. This collaboration represents a significant opportunity to showcase our research to the wider pipeline community and further establish PRCI as the leading resource for cutting-edge research and innovation. Through events like these, we foster greater engagement, share knowledge, and facilitate discussions that advance the industry's collective goals.

As we move into 2024 and beyond, PRCI remains steadfast in its commitment to driving innovation, collaboration, and excellence in the pipeline industry. We will embark on exciting new partnerships and initiatives that promise to broaden our impact and reinforce our role as a leader in pipeline research. We will remain focused on a range of priorities, from maintaining current pipeline assets at the highest standards, to providing the necessary technical resources for the safe transportation and storage of next-generation energy, to reducing greenhouse gas emissions from pipeline systems. Embracing the challenges ahead as opportunities to innovate and excel, our efforts build a safer, more sustainable future for energy pipelines worldwide.

On behalf of the Executive Board and PRCI staff, I extend our sincere gratitude to our members, partners, and stakeholders for their unwavering support and dedication. Together, we are not only responding to the industry's immediate needs but also shaping its future through proactive leadership and collaboration.

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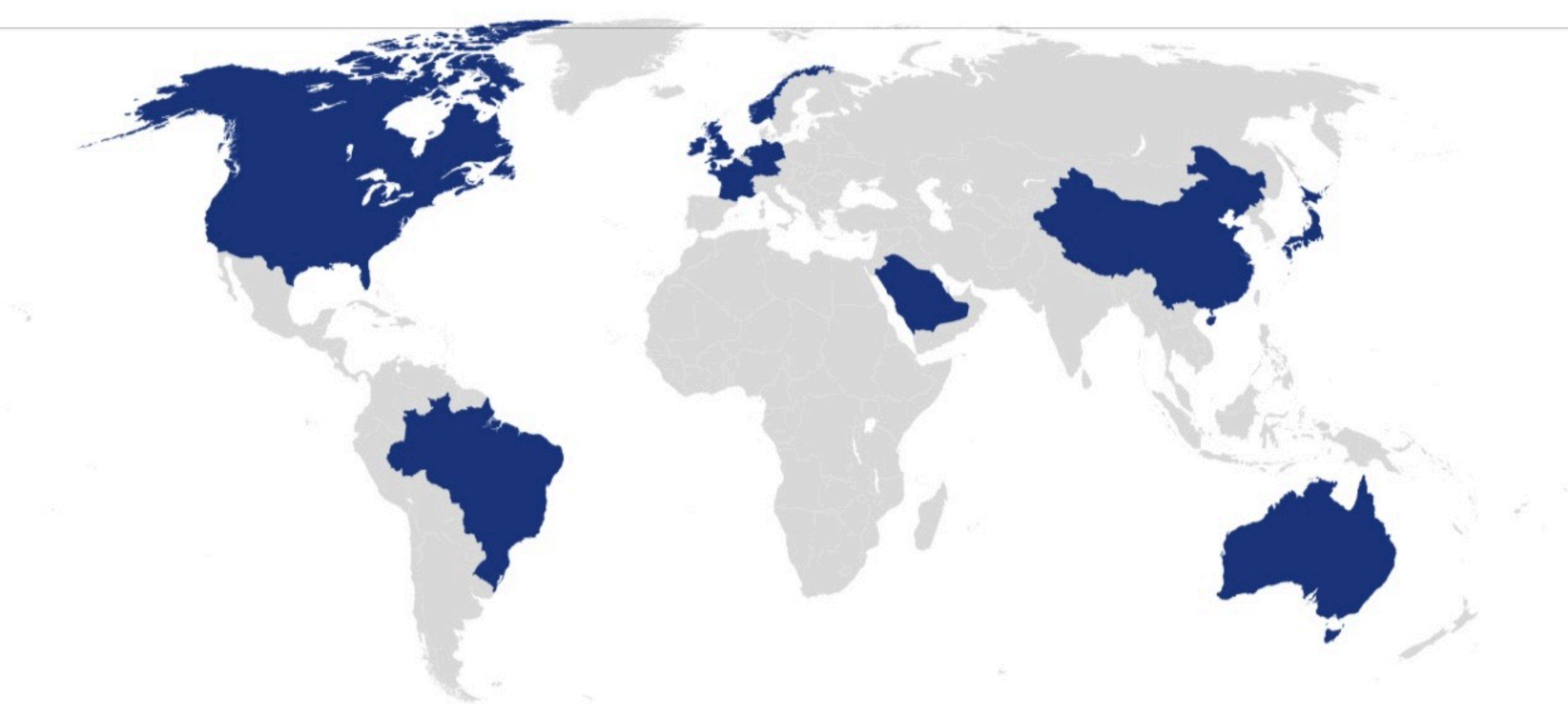


**Main Office**  
15059 Conference Center Drive  
Suite 130, Chantilly, VA 20151  
Main +1 703.205.1600  
Fax +1 703.205.1607  
[prci.org](http://prci.org)

**Technology Development Center**  
6410 Langfield Road, Building J  
Houston, TX 77092  
Main +1 281.846.7570  
[prci.org/tdc](http://prci.org/tdc)

# OUR MEMBERS

## MEMBERSHIPS BY COUNTRY AND TYPE



Australia | Brazil | Canada | China | France | Germany | Japan  
Netherlands | Norway | Saudi Arabia | United Kingdom | USA

## PIPELINE MEMBERS

### ^ Pipeline Members

- ATCO Pipelines
- Berkshire Hathaway Energy Gas Transmission and Storage
- Boardwalk Pipelines
- Buckeye Partners, L.P.
- Chevron Pipe Line Company
- Colonial Pipeline Company
- ConocoPhillips
- Enbridge Pipelines Inc. and Enbridge Energy Partners LP
- Energy Transfer
- Enterprise Products
- ExxonMobil Pipeline Company
- Flint Hills Resources
- Gasco A.S.
- GRTgaz
- Kinder Morgan
- Marathon Pipe Line LLC
- N.V. Nederlandse Gasunie
- National Fuel Gas Supply Corporation
- National Gas
- ONEOK
- Phillips 66 Pipeline LLC
- PipeChina North Pipeline Company
- Plains All American Pipeline, LP
- Saudi Aramco
- Shell Global
- Southern California Gas Company
- Storengy
- TC Energy
- TotalEnergies
- Trans Mountain Canada Inc.
- TransGas Limited
- Williams Companies, Inc.

### ^ Associate Members

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

### ^ Technical Program Associate Members

- Ageion Corporation
- ArcelorMittal
- Baoshan Iron & Steel Co., Ltd.
- CBMM Technology Suisse SA
- CNPC Tubular Goods Research Institute
- Cybetmetix
- Emerson Process Management
- Endress+Hauser
- Enduro Pipeline Services, Inc.
- Evsaz North America
- JFE Steel Corporation
- KROHNE, Inc.
- Mears Group, Inc.
- Saipem
- SICK
- Siemens Energy Inc.
- Solar Turbines, Inc.
- T.D. Williamson
- TechnipFMC
- Worley Group

### ^ Pipeline Industry Organizations

- American Petroleum Institute
- Australian Pipelines & Gas Association - Research & Standards Committee
- Liquid Energy Pipelines Association
- Operations Technology Development

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**Main Office**  
15059 Conference Center Drive  
Suite 130, Chantilly, VA 20151  
Main +1 703.205.1600  
Fax +1 703.205.1607  
[prci.org](http://prci.org)

**Technology Development Center**  
6410 Langfield Road, Building J  
Houston, TX 77092  
Main +1 281.846.7570  
[prci.org/tcdc](http://prci.org/tcdc)

# KNOWLEDGE TRANSFER

Translating research from scientific methods and laboratory results into practical applications has been a key focus at PRCI in recent years. Publicly available 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.

## 2023 BY THE NUMBERS



Produced **40 final reports** from across the PRCI research portfolio, including **2 from the Emerging Fuels Institute**

[Validation of Digital Twins for Monitoring, Optimization, and Compliance of CP Systems](#)

[Improvements in Compressor and Pump Station Facility Efficiency](#)

[Remaining Life Model and Assessment Tool for Dents and Gouges](#)

[Modernize the Assessment of Pipeline Water Crossings](#)

[Distributed Fiber Optic Sensors and Wireless Sensors for Pipeline Monitoring and Field Demonstration](#)

[DOE NETL & PRCI WEBINAR: Raman Gas Analyzer for Hydrogen Blends](#)

[LAMAR UNIVERSITY & PRCI WEBINAR: Building Pipeline Infrastructure Resilience through Monitoring, Mapping and Modeling](#)

[State of the Art Review, Transportation of CO2 Gap Analysis and Roadmap](#)

[Effect of Upstream Piping on Ultrasonic Meter Bias - End Treatment Effects](#)

[API 1163 Performance Validation Guidelines](#)

[PR-746-22204-R01 Review of Technologies to Enable In-situ Valve Service to Reduce Methane Emissions](#)

[PR-746-22602-R01 In-situ, Cost-Effective Detection and Quantification of Emission from Vents](#)

[PR-700-22202-R01 Potential Approaches to Remote Monitoring of Facility Efficiency and GHG Emissions](#)

[ETH Zurich & PRCI WEBINAR: A Critical Review of the Science and Engineering of Cathodic Protection of Steel in Soil](#)

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**Main Office**  
15059 Conference Center Drive  
Suite 130, Chantilly, VA 20151  
Main +1 703.205.1600  
Fax +1 703.205.1607  
[prci.org](http://prci.org)

**Technology Development Center**  
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Houston, TX 77092  
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[prci.org/tdc](http://prci.org/tdc)

# PRCI AROUND THE WORLD

## PRCI SHARED EXHIBITS, PRESENTATIONS, AND KEYNOTE ADDRESSES AT:

- Pipeline Pigging Integrity Management Conference (PPIM). Houston, Texas.
- Offshore Technology Conference. Houston, Texas.
- China International Pipeline Conference. Beijing, China.
- API Pipeline Conference. Nashville, Tennessee.
- YPP USA 2023 Symposium. Houston, Texas.
- Pipeline Technology Conference. Berlin, Germany.
- Rio Pipeline Conference. Rio de Janeiro, Brazil.
- PHMSA R&D. Arlington, Virginia.
- Pipeline Safety Trust. New Orleans, Louisiana.

### Additional Activities of Note:

- The Committee on Science, Space, and Technology of the US House of Representatives requested PRCI to testify at the hearing for the exploration of future research challenges for key energy infrastructure technologies in the United States. The hearing examined the status of grid security, hydrogen, and pipeline research and development activities carried out or supported by the US Department of Energy (DOE).
- The Young Pipeline Professionals (YPP) Bridge Workshop and White Paper competition was sponsored by PRCI. Colton Sheets, Stress Engineering Services, drafted the the winning entry entitled "Fueling the Global Energy Demand: History Highlights Future Opportunity for the Pipeline Industry."
- The PRCI Technology Development Center hosted the inaugural annual API Technology Summit.
- An increased focus from our governmental partners in the work that PRCI does and on how they can enhance regulations based on our outcomes was seen throughout the year.
- PRCI worked closely with key standards associations to enhance industry standards
- The Executive Assembly approved a new Government Engagement Committee to participate in an advisory relationship with the Research Steering Committee (RSC).
- The Executive Assembly approved a new Emeritus Program to participate in an advisory relationship with the Technical Committee Leadership (TCL).

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15059 Conference Center Drive  
Suite 130, Chantilly, VA 20151  
Main +1 703.205.1600  
Fax +1 703.205.1607  
[prci.org](http://prci.org)

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# CONGRATULATIONS TO OUR 2023 AWARD WINNERS

Presented at REX2023 in Houston, Texas, four individuals and two members were honored for their dedication and service. Without the participation and commitment of our members, much of the research conducted would not be completed nor relevant to the industry. We are proud to acknowledge members who have gone above and beyond in service to the energy pipeline industry's success through a sustained commitment to PRCI.

## CONGRATULATIONS 2023 DISTINGUISHED SERVICE AWARDEES

Recipients of the Distinguished Service Award have dedicated their time and effort to help advance PRCI's initiatives through noteworthy contributions to the achievement of its mission, goals, and programs. These awards are a token of our appreciation and gratitude for their continued dedication. Thank you for your years of service as a leader within PRCI.



### TAYLOR SHIE, SHELL

Currently within the Hydrogen group of Shell's Project and Technology organization, Taylor Shie joined the operator in 2013 and started his volunteer efforts with PRCI in the corrosion technical committee in 2014.

Taylor has over 20 years of experience in pipeline integrity management with a variety of focus areas. His career began with DNV in Columbus, OH where he developed expertise related to fracture mechanics, stress corrosion cracking, in-line inspection tool validation, root cause analysis, and risk management. He developed expertise related to coatings, corrosion, crack management, hydrotesting, facility integrity, and now hydrogen. Taylor became involved in industry organizations and activities such as ASME where he was nominated and elected as an ASME Fellow, and the International Pipeline Conference, which he chaired last year.

After moving to the Integrity and Inspection Technical Committee, he served as the Vice Chair and a rotating chair from 2018 to the end of 2022. Taylor is currently a co-champion of the Pathway to Achieving Efficient and Effective Crack Management Strategic Research Priority and an active participant within the Emerging Fuels Institute. Taylor played an instrumental role in Shell's PRCI 2022 In-Kind Support Award.



### ERIC AMUNDSEN, ENERGY TRANSFER

Eric Amundsen is responsible for all operating aspects of gathering, treating, and processing relative to natural gas and liquid transport assets as the Senior Vice President of Operations at Energy Transfer.

In his 40 years of professional experience, Eric has held over 20 direct leadership positions in areas that include pipeline construction management and quality assurance, pipeline integrity management, corrosion control, metallurgical services, underground natural gas and liquids storage.

Eric has served on the PRCI Executive Assembly since 2005. He has been a member of the Executive Board since 2007, in addition to serving as Vice Chair and now as the Chair.

Eric was instrumental in the inception and development of the Technology Development Center (TDC). Without his leadership the TDC would not be what it is today.

## CONGRATULATIONS TO OUR 2023 IN-KIND SUPPORT AWARDEE

Recipients of the In-Kind Support Award are companies which have provided significant contributions deemed "substantially above and beyond" the expectations for member participation and for supporting the furthering of PRCI research programs to enhance the integrity, reliability, and environmental performance of energy pipelines around the world. These awardees have provided the support in a manner which has made major contributions to the success of many PRCI research initiatives. Thank you for your significant contributions and support of PRCI.



As one of PRCI's founding members, TC Energy has a long and exciting history collaborating with PRCI and the industry.

With its sights set high on the future and focus on enhancing the industry's sustainability through investment in research, TC Energy has invested approximately \$158 million in R&D projects across North America over the past decade.

TC Energy Problem Solvers are empowered to participate and contribute industry knowledge to support the advancement of tools and technologies to continue keeping pipelines safe and reliable. This point of pride is demonstrated through an outstanding PRCI membership engagement of over 350 active TC Energy Problem Solvers, enabling its staff to serve in leadership positions across all roles in PRCI including boards, technical committees, strategic research priorities, and projects.

Consistently a leader in pipeline industry research and a significant contributor to PRCI programs, TC Energy recognizes the benefits of innovating with PRCI and values the collaborative international forum that PRCI provides.



As one of world's largest integrated oil and gas companies and a world leader in hydrocarbon exploration, production, refining, distribution and marketing, Saudi Aramco has been a significant contributor and provides a unique perspective contributing to the significance of the global nature of our pipeline operations since recommitting to PRCI in 2019.

The men and women of Saudi Aramco are firmly dedicated to the resolution that energy is opportunity, and Saudi Aramco actively provides opportunities to enable its staff to serve in leadership positions across all roles in PRCI including the board, technical committees, strategic research priorities, and projects. Saudi Aramco enables its employees to step up to lead and oversee the execution of research, which places PRCI in a position to achieve its goals of the Strategic Plan, and ultimate mission and vision of the organization.

Saudi Aramco has graciously provided in-kind support to PRCI, most recently for inline inspection data on over 50km of pipelines.

## CONGRATULATIONS TO OUR 2023 DISTINGUISHED RESEARCHER AWARDEES

Recipients of the Distinguished Researcher Award have enhanced the integrity, reliability, and environmental performance of energy pipelines around the world through the dedication of their time and effort. These awards are a token of our appreciation and gratitude for their continued dedication. Thank you for your dedication and service as a researcher within PRCI.



### RICK BARLOW

Rick began his career as a researcher in applied atmospheric sciences with the Alberta Research Council. After 15 years, Rick joined Enbridge Pipelines and learned about the developing area of computational pipeline monitoring and included time as Supervisor of the Enbridge Pipeline Modeling team. His research interests continued as a recognized SME with the Enbridge Leak Detection Testing & Research team.

Retiring from Enbridge in 2020 after almost 28 years of service, he had the opportunity to make contributions to various industry efforts through PRCI, API, CSA, IPC, and IPIPE throughout his Enbridge career.

Rick was introduced to PRCI in 2008 by Enbridge's Don Scott, also now retired, who championed the industry value of PRCI and the SOM Technical Committee. His active participation in applied pipeline research in partnership with highly qualified SME talent and a significant commitment by operators was an invaluable education and provided a rewarding research landscape. Projects in leak detection technology development and testing provided many challenges and rewards, as well as being a critical part of developing the PRCI Leak Detection Strategic Research Priority.

Rick has shared that his time working with PRCI and industry colleagues was a much-appreciated career highlight.



### BILL BRUCE, DNV

Bill Bruce is a Senior Principal Consultant of Welding Technology, at DNV in Dublin, Ohio.

He has been involved in pipeline welding research and development continuously since his graduation from The Ohio State University in 1981. Prior to joining DNV, Bill was a Technology Leader in the Materials Section at Edison Welding Institute that included a four-month secondment at TWI in Cambridge England and a Senior Engineer at Panhandle Eastern Pipeline Company.

Bill has carried out numerous projects pertaining to safety and integrity aspects of repair and modification of in-service pipelines by welding. His areas of interests include pipeline construction, repair welding, inspection techniques, and failure analysis. He also pioneered the use of lasers for mapping corrosion damage on exposed pipelines.

In addition to his leadership within PRCI, Bill serves as a leader in a number of industry associations including the American Welding Association and the American Petroleum Institute.

Bill received the PRCI Distinguished Researcher Award in 2002, and his continued dedication to the organization and his commitment to pipeline safety has him recognized again.

# RESEARCH PROJECTS AWARDED

PRCI was awarded three contracts for research projects from the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA).

PHMSA released the Research Announcement (RA) #693JK323RA0001 in April, 2023. PRCI staff worked with the Research Steering Committee, Technical Committee Leaders, and contractors to define which PHMSA projects were most closely aligned with our research programs. Staff then actively worked with members to identify the needed funding for the efforts for the projects recommended to meet the RA. These activities happened over a very short span of six weeks. PRCI responded with six submissions as these collaborations are great opportunities to leverage member funding and to further build upon our relationship with PHMSA.

Two of the contracts awarded to PRCI in 2023 are within the Corrosion Technical Committee, and the third was for work with the Emerging Fuels Institute. Details about the three are:

## **EC-6-5D: STANDARDIZE THE APPLICATION OF VAPOR CORROSION INHIBITORS (VCI)**

This project aims to standardize procedures for testing VCI performance, develop performance criteria with various aspects of VCIs' application, and obtain approvals from AMPP/ASTM and PHMSA of the VCI performance evaluation standard.

## **EC-6-5E: TANK FOUNDATION AND FLOOR DESIGNS AND BEST PRACTICES FOR IMPROVED CORROSION CONTROL**

This project aims to review data to identify trends as to which tank floor, foundation, cathodic protection, leak detection systems, or combination of systems that result in enhancing safety improvements for breakout tank operators, the public, and the environment with a related best practices/ standard for the design, construction, retrofitting, maintenance, and monitoring of tanks for effective corrosion control and release prevention.

## **JEFI-05-03: IMPLEMENT FIBER OPTIC TECHNOLOGY FOR UNDERGROUND GAS STORAGE WELL MONITORING**

This project aims to establish guidelines and best practices to guide the implementation of the fiber optic technology for continuous downhole integrity monitoring of underground natural gas storage wells with consideration of applications for future underground hydrogen storage.

[< Awardees](#) | [Home](#) | [Research Exchange](#) >



**Main Office**  
15059 Conference Center Drive  
Suite 130, Chantilly, VA 20151  
Main +1 703.205.1600  
Fax +1 703.205.1607  
[prci.org](http://prci.org)

**Technology Development Center**  
6410 Langfield Road, Building J  
Houston, TX 77092  
Main +1 281.846.7570  
[prci.org/tdc](http://prci.org/tdc)

# 2023 RESEARCH EXCHANGE

On March 7th and 8th in Houston, Texas, PRCI hosted its largest ever Research Exchange with over 450 registrants representing over 145 companies and organizations from twelve different countries, including twelve exhibitors. Eight prospective new members were introduced to PRCI. Six North American government agencies were represented, and a meeting was held with several US Congressional members and Tristian Brown, Deputy Administrator at the Pipeline & Hazardous Materials Safety Administration (PHMSA) at the Technology Development Center

Keynote speaker Kenneth Medlock, III broadened insights on the future of energy. REX attendees collaborated and networked with roundtables focused on Energy Transition and Putting Research to Work and over 50 technical sessions represented eleven different topic tracks that included:

- Construction Quality & Management
- Corrosion Monitoring & Assessment
- Data Mining & Business Analytics (incl. Machine Learning & Artificial Intelligence)
- Design & Materials
- Emerging Fuels (e.g. Hydrogen, Biofuels, CO2)
- ESG & Innovation
- Geohazard Management
- Leak Detection
- Pipeline Crack Management & Monitoring
- Pipeline Inspection & Integrity Management



Thank you to Gold Sponsor TC Energy and Bronze Sponsor Allan Edwards.



REX attendees collaborating



REX attendees expanding networks



PRCI Staff enjoy a quiet moment at the registration desk



REX2023 would not have been possible without the assistance of the Planning Committee members. Their active engagement and dedication developed a successful program.

- Mohsen Achour, ConocoPhillips
- Tom Bubenik, DNV
- Kalen Jensen, ATCO
- Justin Johns, TC Energy
- Amelie Louvat, GRTgaz
- Christopher Newton, Phillips 66
- Mark Piazza, API
- Matt Romney, TD Williamson
- Deli Yu, TC Energy

[< Research Projects Awarded](#) | [Home](#) | [Emerging Fuel Symposium](#) >

# 2023 EMERGING FUELS SYMPOSIUM

The Emerging Fuels Symposium is a forum for discussion of current research, research outputs to date, and the next steps needed.

The inaugural Emerging Fuels Symposium was held 05 through 08 June 2023 and addressed challenges and opportunities for the transport and storage of hydrogen, renewable natural gas, and carbon capture, transport, and sequestration (CCTS) through 38 presentations and a poster session. Approximately 160 attendees representing twelve countries and five government agencies from around the world gathered in Orlando, Florida to discuss current research, research outputs to date, and the next steps needed.

Executive Director of Pipeline Safety Trust Bill Caram offered comments from the Trust's perspective and initiated an engaging dialogue with attendees on the technical aspects associated with pipeline safety in his keynote address.

A roundtable of officials focused on what is being done around the world from a governmental perspective and how to continue to collaboratively advance emerging fuels initiatives and achieve stated goals in stipulated transition timelines. The panel consisted of Stuart Hawsworth, Head of the Centre for Energy and Major Hazards, Health and Safety Executive's Science and Research Centre UK; David Norman, Chief Executive Officer of Future Fuels Cooperative Research Centre AU; and Tristan Brown, Deputy Administrator of Pipeline & Hazardous Materials Administration, US Department of Transportation US.

Co-hosted by Pipeline Research Council International (PRCI), Australian Pipeline & Gas Association (APGA), Future Fuels CRC (FFCRC), European Gas Research Group (GERG), and European Pipeline Research Group (EPRG), the Emerging Fuels Symposium is a global collaborative opportunity to resolve the technical gaps that exist as the global industry transitions to low carbon energy solutions using the existing pipeline asset infrastructure.



Cliff Johnson, Stuart Hawsworth, David Norman, and Tristan Brown



Bill Caram and Cliff Johnson



EFS attendees taking a moment to observe International Women in Engineering Day



[< Research Exchange](#) | [Home](#) | [TDC Open House >](#)



**Main Office**  
15059 Conference Center Drive  
Suite 130, Chantilly, VA 20151  
Main +1 703.205.1600  
Fax +1 703.205.1607  
[prci.org](http://prci.org)

**Technology Development Center**  
6410 Langfield Road, Building J  
Houston, TX 77092  
Main +1 281.846.7570  
[prci.org/tdc](http://prci.org/tdc)

# TDC OPEN HOUSE

Over 300 attendees shared the rainy morning of Thursday 05 October with over 30 exhibitors and presenters at the 2023 TDC Open House. Together, they learned about new technologies and best practices to enhance safety and efficiency.

## TDC OPEN HOUSE

Pipeline safety and innovation are ongoing concerns, and new technologies and research findings are continuously emerging. The annual TDC Open House allows stakeholders to learn about and engage with cutting-edge technologies and research aimed at enhancing pipeline safety and reliability. By staying up to date on the latest developments in pipeline technology, attendees can contribute to reducing environmental risks associated with pipeline operations and help industry professionals and regulators ensure that pipelines meet or exceed safety and environmental standards.

The annual TDC Open House provides a platform to regularly update stakeholders about the latest developments in the field. Providers of equipment, materials, and services to the pipeline industry are able to showcase their products and services, potentially expanding their customer base. Attendees are able to see how the TDC offers opportunities to meet their needs.



Attendees didn't mind avoiding the rain.



Good coffee kept the chill of the rain away.



Exhibitors and attendees connecting over coffee.



[< Emerging Fuel Symposium](#) | [Home](#) | [European Research Forum](#) >



**Main Office**  
15059 Conference Center Drive  
Suite 130, Chantilly, VA 20151  
Main +1 703.205.1600  
Fax +1 703.205.1607  
[prci.org](http://prci.org)

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Houston, TX 77092  
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[prci.org/tdc](http://prci.org/tdc)

# 2023 EUROPEAN RESEARCH FORUM

The European Research Forum was an invitation-only event for PRCI members outside of North America to engage and discuss topics of interest with their industry peers. Hosted by Shell at the Energy Transition Campus in Amsterdam and designed to engage with member volunteers who don't typically travel to PRCI in-person events or engage with the membership-at-large, 52 delegates from 13 countries learned about the PRCI collaborative model for producing research solutions and increasing the value of participation.



Recent research results from the PRCI portfolio were shared on topics such as corrosion, emerging fuels, mechanical damage, crack management, greenhouse gas emissions, and the CO2 taskforce state-of-the art report and gap analysis. Roundtables focused on European concerns, research integration and value extraction provided attendees the opportunity to share experiences from their own operations. Speakers from EPRG and GERG shared topics of mutual interest, and attendees shared in-house research efforts to round out the program.

A reception was held on the evening of November 8 at Eye Film Museum.



The start of Day One



PRCI President Cliff Johnson welcomes delegates



The evening reception was held in the cool, white building housing the Eye Filmmuseum, next to the Sir Adam Hotel. The River IJ, pronounced "eye," is in the foreground.



[< TDC Open House](#) | [Home](#) | [TDC >](#)



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15059 Conference Center Drive  
Suite 130, Chantilly, VA 20151  
Main +1 703.205.1600  
Fax +1 703.205.1607  
[prci.org](http://prci.org)

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## TDC

Collection and management of pipeline defect samples from around the world and performing technology testing services to advance the integrity of the pipeline industry.

### TDC ADVISORY GROUP

**Chair:** John Haldiman, Plains All American

Nick Homan, Marathon  
Jennifer Klementis, TC Energy  
Sean Keane, Enbridge  
Aaron Schwing, Flint Hills Resources

The research labs were used **105 times** within the year.

Pull testing occurred on **58 different occasions**.

The flow loop was utilized **6 times**.

Pipe samples were **requested 14 times**.

Conference rooms were booked for **66 different occasions**.

Requests for tours continued to increase, **totaling 37 visits**.

## TDC

The Technology Development Center (TDC) is a major commitment by the energy pipeline industry to address the key issues that it faces to ensure the safety of the national and international pipeline system.

Having a single location able to accumulate former in-service pipe materials with real-world pipeline features/flaws is invaluable to PRCI's R&D Program and the industry, and provides a central point for hosting industry-sponsored training and workshops.

The TDC provides the industry with an independent third-party site to fully understand the capabilities of current tools and to guide the development of the new technologies needed to push towards that goal.

Located across eight acres in Houston, Texas, the TDC includes a five-acre state-of-the-art pull test facility, liquid loop facility, and an over 20,000 sq. ft. workshop and test facility with an additional 9,000 sq. ft. of office and meeting space.

PRCI maintains a library of over 1,600 samples of pipe containing natural and manufactured defects for R&D. Sample sizes range from coupons to full joints of pipe in a variety of diameters. Pipes strings up to 250-feet long can be constructed to your specifications and the pull test facility employs a winch capable of consistent velocities from 1 to 11 mph while pulling over 40,000 lbs.



During REX2023 week, PRCI and members of our Executive Board hosted Pipeline and Hazardous Materials Safety Administration (PHMSA) Deputy Administrator, Tristan Brown, Representative Fletcher (TX-07) and Representative Sheila Jackson Lee (TX-18) at the Technology Development Center (TDC) for a tour and discussion on the importance of critical research to ensure pipeline integrity and reduce the environmental footprint of the pipeline network.



Good questions, networking, and exchange of information happening at the TDC.



Specific features are introduced into pipes samples as simulated flaws by employing techniques like grinding, EDM notching, and acid etching to achieve remarkable results, such as simulated corrosion.



A technical seminar on protective coatings in the energy industry highlight breakthroughs in corrosion under insulation (CUI), passive fire protection (PFP), and thermal insulative coatings (TIC).



< [European Research Forum](#) | [Home](#) | [VTDC](#) >

# VTDC

Learn more

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**VTDC**

The Virtual Technology Development Center (VTDC) is a virtual center for industry members to develop technology-based solutions for operating problems in the energy pipeline industry through data collected and shared information/learnings. The safety and integrity of the global energy pipeline system relies upon detailed analysis of relevant data leading to informed decision making. Shared learning significantly improves the ability to perform this critical analysis.

Launched in 2022, the first stage of the platform hosts databases allowing users to utilize anonymized data and information from multiple projects that have been standardized across projects and sources. The inaugural databases were Pipe Material Properties Database and Ultrasonic Test Results Database, with the Database of All Burst Tests for Corrosion, Cracking, Dent, and Interacting Defects published in 2023.

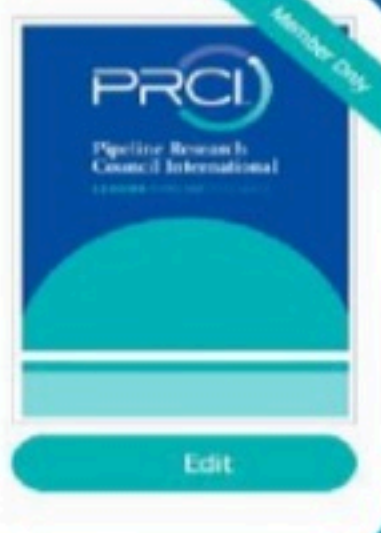
Throughout 2023, the next phase of VTDC progressed. A literature review of USM OEM Diagnostics and Evaluate Certain Abnormal Flow Conditions [MEAS-6-26] is currently adding additional reports and will be adding operator supplies data to the VTDC Ultrasonic Meter Test Results Database for 2024. Pipeline Material Property Database Enhancement [NDE-4-17A - SRP CM] has collected additional data that is in the process of being added to the VTDC Pipe Materials Properties Database to be completed in Q1 2024. Understanding Why Crack Fail - Results Sharing [MAT-8-3C - SRP CM] is planning to add the operating data collected by this project to the VTDC in 2024. Additionally, test data was added to the VTDC Ultrasonic Meter Test Results Database from Effect of Upstream Piping on Ultrasonic Meter Bias - End Treatment Effects [MEAS-6-5C].

The VTDC leverages collaboration to create opportunities to have greater impact in the pipeline industry by using data and information not previously consolidated in one convenient location.

### Pipe Materials Properties Database

Release Date January 24, 2022

A database with reports that have the material properties of yield strength and Charpy energies for pipes of different vintages, diameters, wall thicknesses, chemical compositions, and manufacturers.



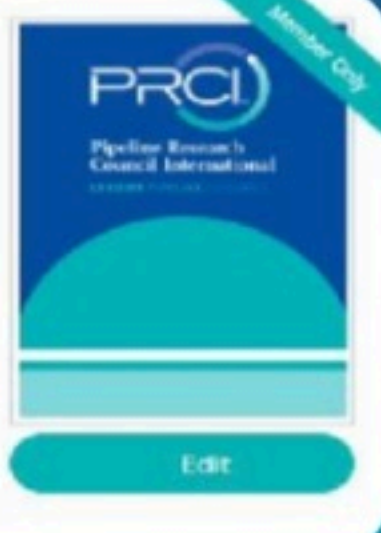
Edit

Currently being updated with Data Collected in 2023

### Ultrasonic Meter Test Results Database

Release Date January 24, 2022

Through standard collection, storage and analysis of PRCI's extensive investment in ultrasonic meter installation effect testing test results, this data can be used for inter-comparison of test results, what-if analysis of different test conditions, and the discovery of additional insights.



Edit

Updated in 2023



[< TDC | Home | PRCI Connect >](#)



**Main Office**  
15059 Conference Center Drive  
Suite 130, Chantilly, VA 20151  
Main +1 703.205.1600  
Fax +1 703.205.1607  
[prci.org](http://prci.org)

**Technology Development Center**  
6410 Langfield Road, Building J  
Houston, TX 77092  
Main +1 281.846.7570  
[prci.org/tdc](http://prci.org/tdc)

# PRCI CONNECT

Learn more



PRCI Connect launched publicly in October and is our dedicated online platform for industry professionals to engage in open discussions, seek answers to pressing questions, and collaborate with subject matter experts. It is a virtual hub for knowledge exchange, fostering a vibrant community where members can tap into a wealth of collective wisdom and insights from across the pipeline industry.

In the energy landscape of today and tomorrow, pipelines play a pivotal role in transporting and storing resources that power our world. Ensuring the integrity, safety, and efficiency of these critical systems is a collective responsibility that transcends borders and industries.

PRCI Connect is the space where stakeholders from around the globe can easily come together to exchange ideas and find solutions to the challenges that lie ahead. By removing the barrier of geography, the very conversations that lead to solutions can be had easily from anywhere in the world, at any time of the day, over long periods of time. PRCI Connect is an invaluable tool to explore the diverse communities within PRCI and the industry, engage in professional discussions, contribute your expertise, and be an active participant in shaping the future of the global energy pipeline system.

Built for engineers, researchers, policymakers, and passionate advocates for pipeline safety, PRCI Connect is the place to join like-minded individuals and drive positive change. The shared professional experiences, insights, and passion are invaluable assets to our collective mission. Together, we have the power to continue progress, share knowledge, and make a positive impact on the world.

Communities are centered around industry needs.

Sample of an invitation-only community's page.

A member's home pages collects content of personal interest.



< VTDC | [Home](#) | [Environmental Commitment](#) >



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15059 Conference Center Drive  
Suite 130, Chantilly, VA 20151  
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Fax +1 703.205.1607  
[prci.org](http://prci.org)

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# ENVIRONMENTAL COMMITMENT

Building upon on PRCI's legacy of environmental commitment assists members and the industry in achieving a low carbon future and zero emissions.

Low carbon footprint fuels are a foundational component for a sustainable energy society. With energy transitions expected as early as 2026 in some parts of Europe to 2050 throughout much of the United States, the goals demand collaboration with industry stakeholders to optimize the overall transition effort.

Building upon the rich history of the current energy infrastructure, it is critical to ensure that safety is the driver in this energy transition. Whether transporting a hydrogen blend or 100% hydrogen, there are key technical issues that will need to be overcome.

As a leader in pipeline research, PRCI is positioned to be the primary research body for eliminating emissions and enabling emerging fuels transportation & storage via the global pipeline network.

## EMERGING FUELS INSTITUTE



The Emerging Fuels Institute (EFI) works to resolve the technical gaps that exist as the industry transitions to low carbon energy solutions using the existing pipeline asset infrastructure. Many governments are planning or have begun mandating transitions to renewable energy sources to achieve their stated goals of stabilizing the climate, making low carbon footprint fuels a foundational component for a sustainable energy society.

The EFI expanded its global outreach to include 22 members in 2023.

VANGUARD



CHAMPION



## RESEARCH RESULTS COMPLETED IN 2023

JEFI-00-03 Terminology

JEFI-06-03 Inspection Procedures for pipelines in H2 service - Safety HAZOP

JEFI-04-03 HyTap

EFI-02-01 Renewable Natural Gas Trace Components Database

## WHITE PAPERS PUBLISHED

As the focus on the next generation of fuels continues to grow around the world, research is being collaboratively discussed, conducted, and implemented to ensure the safe transport and storage of these fuels. The [release of eight technical white papers around emerging fuels and pipeline safety & integrity](#) in late 2022 consolidated global research outputs to define the current state of knowledge surrounding hydrogen and natural gas blends and refine what remains to be learned. The impact of their publication was felt throughout 2023.

### TITLES INCLUDE:

- Hydrogen/Natural Gas Blends and Pipeline Integrity
- Hydrogen/Natural Gas Blends in Existing Natural Gas Pipelines
- Hydrogen/Natural Gas Blending and Safety, Inspection, and Maintenance
- Hydrogen/Natural Gas Blending and Separation
- Hydrogen/Natural Gas Blend Measurement and Gas Quality
- Storage of Hydrogen/Natural Gas Blends
- Hydrogen/Natural Gas Blends and Compressor Stations
- Hydrogen/Natural Gas Blends and End-User Equipment

These white papers provide the basis for identifying and establishing the safest and most efficient methods for transporting and storing hydrogen in the world's energy pipeline systems and will be updated to provide the industry, government, and public with the latest information and be leveraged to support the development of industry guidance for the transportation and storage of hydrogen.

## PROJECT FUNDING AWARDS

The US Department of Energy awarded Colorado School of Mines grant funding for their project proposal on "Assessment of Toughness in H-Containing Blended Gas Environments in High Strength Pipeline Steels." The PRCI Emerging Fuels Institute was active in the proposal development and will be acting in a technical advisory role for the project. The EFI was asked to present at the Colorado School of Mines' upcoming Advanced Steel Processing and Products Research Center consortium. Opportunities like these help forge strong relationships with premier academic researchers who support the pipeline industry.

The EFI was awarded one of the three PRCI contracts for research projects from the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA). JEFI-05-03: Implement Fiber Optic Technology for Underground Gas Storage Well Monitoring aims to establish guidelines and best practices to guide the implementation of the fiber optic technology for continuous downhole integrity monitoring of underground natural gas storage wells with consideration of applications for future underground hydrogen storage.

## EFI INCLUDES CO2



The Executive Assembly approved the inclusion of research dedicated to ensuring the safe transport and storage of CO2 into the EFI. This expansion reflects PRCI's commitment to addressing the pressing challenges in the industry and pursuit of sustainable solutions.

### THE EFI NOW HAS TWO DISTINCT RESEARCH TRACKS:

- Future Fuels continues to focus on exploring innovative technologies for transport and storage of emerging fuels and strategies that drive the future of the energy industry.
- CO2 will concentrate on researching methods and technologies for the safe transportation and storage of carbon dioxide, an area of critical importance in efforts to mitigate the environmental impact of energy production.

< [PRCI Connect](#) | [Home](#) | [Core Research](#) >



**Main Office**  
15059 Conference Center Drive  
Suite 130, Chantilly, VA 20151  
Main +1 703.205.1600  
Fax +1 703.205.1607  
[prci.org](http://prci.org)

**Technology Development Center**  
6410 Langfield Road, Building J  
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# CORE RESEARCH

Advancing PRCI's Core Research Program and enhancing the adoptability/usability of the findings.

At the heart of PRCI is the safety of the energy pipeline system. The goal of this initiative is to support members and the industry in this knowledge transfer. Research results must ultimately be able to be used to improve the industry's understanding of and solutions to the issues that drive the need for this research/

## STRATEGIC RESEARCH PRIORITIES

Strategic Research Priorities (SRP) allow PRCI to address key strategic industry initiatives and issues in which there are near term opportunities to develop significant outcomes for the industry and for the interest of the public.

Focusing efforts and funding 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.

By collectively identifying and executing SRPs, PRCI will improve efficiency and engagement by being more strategic and intentional about breaking down silos and working cohesively as groups to solve problems that cross disciplines. SRPs allow PRCI to lead industry research in a significant way by making impactful advancements in technology and R&D to improve pipeline safety and performance.

**MD GHG CM LD GHZ**

## TECHNICAL COMMITTEES

PRCI plans and develops research projects through Technical Committees (TC). These committees are comprised of technical and operations experts from member companies. They are critical in developing and managing PRCI's research to assure collaboration in identifying gaps and avoiding duplication.



[< Environmental Commitment](#) | [Home](#) | [SRP: Mechanical Damage](#) >



**Main Office**  
15059 Conference Center Drive  
Suite 130, Chantilly, VA 20151  
Main +1 703.205.1600  
Fax +1 703.205.1607  
[prci.org](http://prci.org)

**Technology Development Center**  
6410 Langfield Road, Building J  
Houston, TX 77092  
Main +1 281.846.7570  
[prci.org/tdc](http://prci.org/tdc)

# MD SRP: MECHANICAL DAMAGE

This Strategic Research Priority consolidates mechanical damage research to effectively manage deformations identified through condition assessments to ensure repairs are made where truly needed.

## OUTCOMES & VALUE TO INDUSTRY

- Improving operator management systems to advance safety, protection of the environment, reliability, and cost-efficiency.
- Eliminating unnecessary excavations and failures.
- Impacting industry recommended practices and standards, including standards for ILI reporting criteria for mechanical damage.

## INDUSTRY IMPROVEMENT

**DAMAGE PREVENTION**

- Performance assessment for damage prevention and mitigation measures.
- Establishment of key performance indicators for tools, techniques, and approaches.
- New technologies for sensing and responding to unauthorized encroachment on ROW corridors.

**INSPECTION TECHNOLOGIES**

- Detecting, discriminating, and sizing MD using ILI tools and in ditch technologies and methods, including the effects of coincident features.
- Establishing consistent and uniform inspection reporting requirements for deformations on pipelines and for deformations with coincident features.

**ASSESSMENT**

- Improving engineering assessment approaches including indentation strain-induced cracking, risk, failure pressure, pressure-cycling fatigue failure for plain dents and those interacting with other threats/features.

**REPAIR**

- Connects related PRCI work on composite materials for repair of mechanical damage, and NDE (Non-Destructive Evaluation) studies on the inspection of composites after being installed to address features.
- Provides technically credible justification for updates to PRCI Pipeline Repair Manual regarding mechanical damage.

## CURRENT RESULTS

- Completed ILI test trials at the PRCI TDC (Technology Development Center) including seven ILI technology providers with 70+ mechanical damage samples and multiple ILI systems in both air and liquid coupled environments.
- Led industry-changing feedback sessions with ILI service providers to establish uniform dent shape and coincident features reporting criteria.
- Expanded the ILI test string at the PRCI TDC with 140+ mechanical damage samples with associated features (metal loss, crack, gouge, weld); testing continuing in 2023 on a minimum of four technology providers participating to improve industry standards on mechanical damage inspection and assessment.
- Reviewed multiple presently applied methods for performing dent/strain/fatigue assessments, evaluating the accuracy of the assessment methods, and making suggestions to improve them.
- Completed 2 reports for screening tools for dents and 1 for ILI performance evaluation for Metal loss, cracks, and gouges in dents.
- Collected pipeline operator data to assess real-world experience and support engineering assessment model validation.

## LEADERSHIP

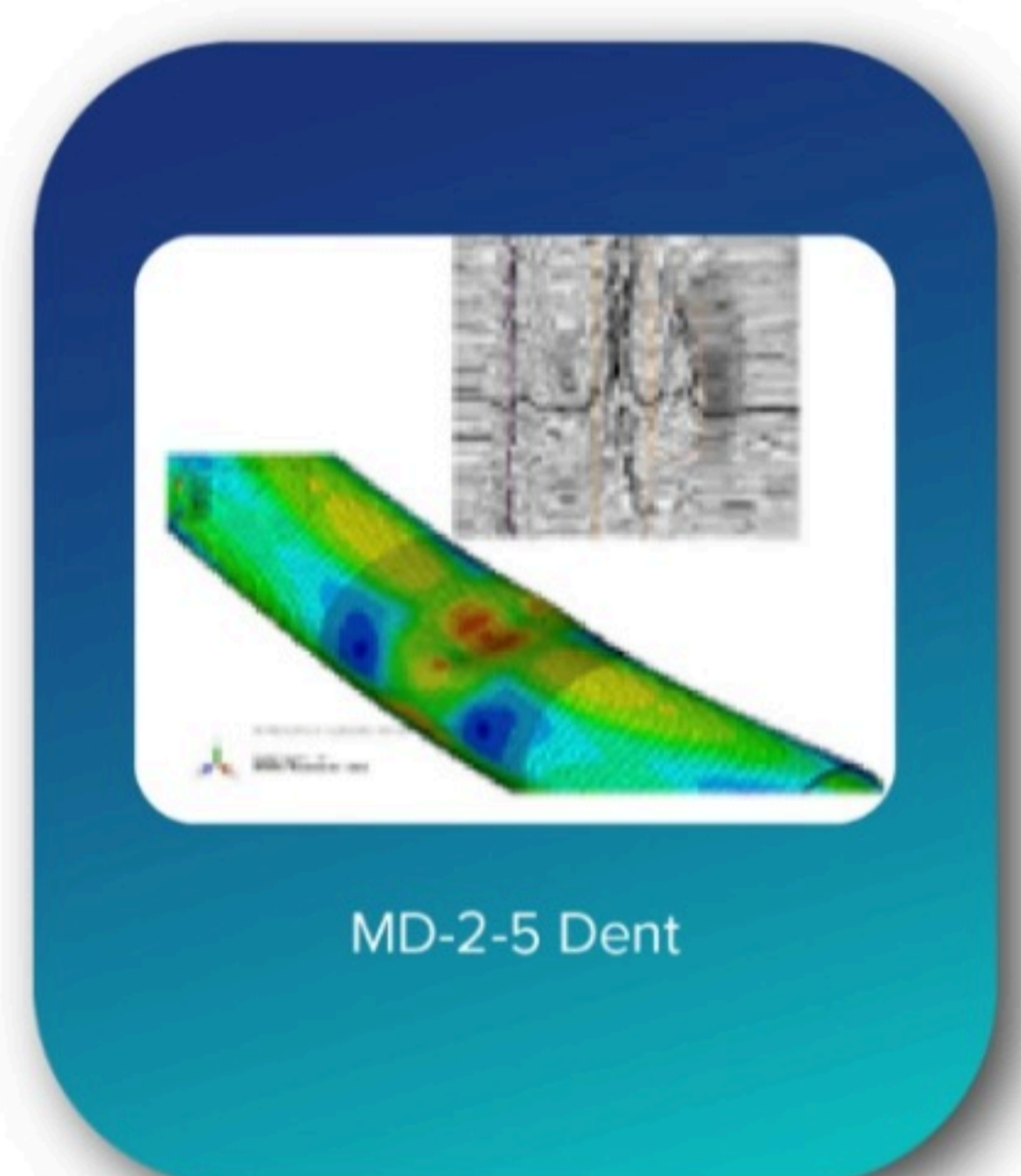
**TIM BURNS, SHELL GLOBAL**

The MD SRP has significantly progressed the data supporting API 1183 and bolstered the API committee team's ability to dramatically improve the document's value to the pipeline industry.

As the MD SRP approaches its conclusion, the work accomplished has highlighted the performance typical to detection and sizing of mechanical damage. It has also highlighted areas with improvement opportunities that ILI vendors can now work on with real world truth data.

This SRP being the first of its kind had some challenges with funding, alignment of intent and collaboration in the first year. These challenges were overcome by relationship building and willingness to trust. For instance the promises of anonymity of the participants was kept, which will bolster future willingness to participate if the same approach is used.

- Tim Burns



# GHG SRP: GREENHOUSE GAS REDUCTION

This Strategic Research Priority will provide greenhouse gas reduction technology in the combustion process for both fugitive and vented natural gas.

## OUTCOMES & VALUE TO INDUSTRY

- Understanding the carbon footprint of an operating company for the purposes of permitting new facilities.
- Improving standards for assessing performance, technological advancement and tools to mitigate emissions, and providing a standardized approach for assessing alternatives.
- Technology advancement and standards development to encourage agencies to implement more efficient and lower cost GHG regulations or permit requirements.
- Evolving regulations at the state, federal, and international levels, including carbon trading/carbon tax approaches.

## INDUSTRY IMPROVEMENT

- Developing an economic prioritization model/tool to identify the GHG reduction efforts that provide the largest net reduction in GHG emissions per net present value of spend.
- Increasing the efficiency of both compression driver and driven equipment.
- Enhancing leak mitigation programs to efficiently implement alternatives to conventional regulatory leak detection and repair programs.
- Reducing fugitive leaks through compressor rod packing, gas seals, and
- Developing alternatives to natural gas pneumatic control and actuation devices, and assessing the feasibility and optimization of current alternatives.
- Reducing natural gas blowdowns associated with pipeline repair and equipment shutdowns.
- Developing enhanced natural gas leak detection/ quantification methods.
- Working to change regulations that inhibit economically viable methods to reduce greenhouse gas emissions.

## CURRENT RESULTS

Developed an economic analysis tool that identifies the largest net reduction in emissions for different technologies and operating conditions.

Completed a market review of currently available, and emerging technology that will replace obsolete high-flow sampling equipment. Currently conducting lab and field testing of identified technologies.

A comprehensive examination of both established and evolving technologies for detecting and measuring methane leaks has been conducted. This involved a thorough evaluation of the technology landscape and market, leading to the creation of an assessment tool designed to assist operators in selecting the most suitable leak detection and quantification technology for their specific circumstances.

Completed a literature review that depicts current techniques for minimizing blowdowns by pipelines during repairs and replacements. Currently conducting experimental testing of repair technologies as well as developing a best practice document for making temporary repairs permanent.

Completed a literature review that assessed retrofitable, low-cost flow sensors for compressor stations that will facilitate continuous monitoring and diagnostics of equipment.

Completed an in-depth analysis, utilizing desktop research, to explore a methodology for monitoring facility efficiency through the application of established technology and calculation methods. Employed real-world telemetry data to showcase specific instances of potential reductions in greenhouse gas emissions.

Conducted an examination of valve technology designed to facilitate the secure restoration of a leaking valve without necessitating its removal from service. Currently exploring various sealing technologies and techniques suitable for on-site repairs.

Research was recently launched on operation and maintenance gas venting activities at meter stations to evaluate opportunities for reduction or elimination of these activities.

Completed an initial numerical screening of new ignition techniques to determine which, if any, techniques are promising for reducing methane emissions through ignition system improvements and should be further examined with on-engine experimental evaluation.

## LEADERSHIP

### THOMAS LUMADUE

The GHG Emissions Reduction SRP has provided solutions to help operators meet their corporate GHG intensity & reduction metrics. The research projects have provided GHG emissions reduction opportunities on both the pipelines & the compressor station facilities with projects from multiple PRCI Technical Committees (CPS, MTC, SOM, DMC).

The input from multiple PRCI Technical Committees to reduce both combustion & fugitive/vented GHG emissions was one of the most important goals achieved this past year, in addition to research project co-funding opportunities with INGAA, DOT (PHMSA), and GMRC. Noteworthy projects from the year include:

*CPS-17-06 CO<sub>2</sub>e economic analysis tool which provide operators a tool to compare GHG emission reduction alternatives to identify the GHG reduction technologies with the most benefit.*

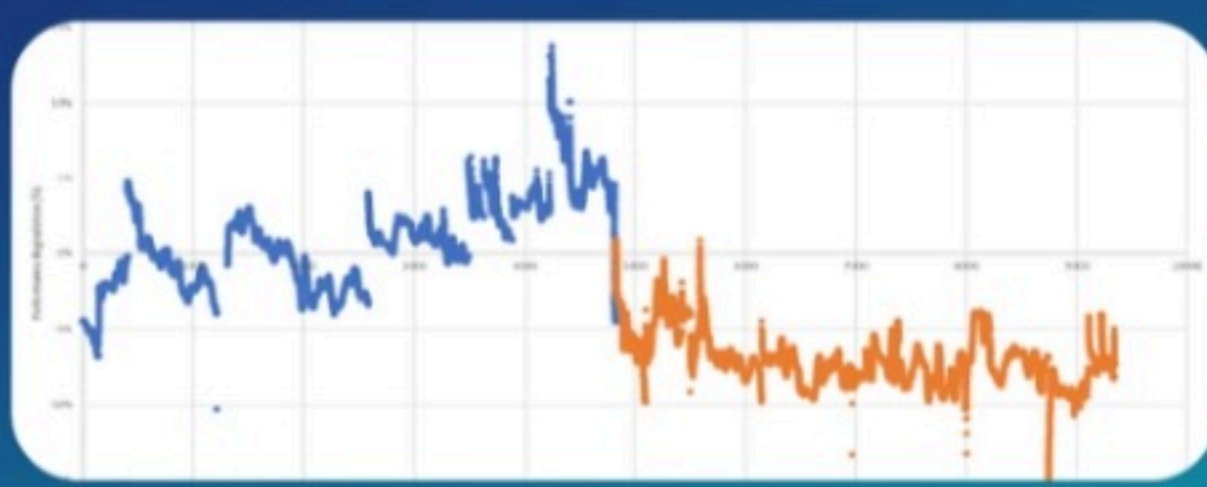
*CPS -17-08 Reciprocating Engine Exhaust Methane Slip Reduction projects includes multiple technologies to improve combustion efficiency and thus reduce not only GHGs but also NO<sub>x</sub> & CO.*

*MATR-3-15 Methods to reduce pipeline blowdowns to allow repairs & inspections.*

*MEAS-9-03 High Flow Sampler Replacement to provide a means to measure methane leaks*

This year has been full of exciting new technology, challenging solutions to reduce GHGs, and opportunities for operators to minimize GHG emissions at their facilities.

- Tom Lumadue



Demonstration of performance degradation versus running time as shown in PR700-22202-R01 Potential Approaches to Remote Monitoring of Facility Efficiency and GHG Emissions



As part of PR-746-22204-R01 Review of Technologies to Enable In-situ Valve Service to Reduce Methane Emissions (a) WVU researchers surveying components for leaks, (b) example of leaking packing on automated control valve, (c) example of leaking packing on manual isolation valve.



# CM SRP: CRACK MANAGEMENT

This strategic research priority focuses on the prevention of failures due to crack-like defects by making improvements in the integrity management life cycle of susceptibility, inspection, Assessment and Remediation, and Management for the threat.

## OUTCOMES AND VALUE TO INDUSTRY

- Close identified gaps in performance demonstration for crack ILI and NDE
- Close identified gaps in material properties performance data
- Providing the next generation of susceptibility models by cracking threat/morphology
- Broadly communicating outcomes to advance crack management within industry fabric
- Further operationalizing the TDC and VTDC for crack management

## INDUSTRY IMPROVEMENT

**SUSCEPTIBILITY**

- Susceptibility assessments by cracking threat/ morphology lead to selection of the appropriate integrity assessment method.

**INSPECTION**

- Known strengths and limitations of the inspection technique(s) provide confidence in assessment and remediation programs, ultimately improving threat management.

**ASSESSMENT & REMEDIATION**

- Effective and efficient response to inspections including improved remaining strength equation variables, dig criteria, repair criteria, and reassessment intervals.

**MANAGEMENT**

- Management of known crack-related threats to reduce failure rates and minimize likelihood of releases before reassessment.

## CURRENT RESULTS BY DESIRED KEY OUTCOME

### 1. Close identified gaps in performance demonstration for crack ILI, and NDE

#### Key Successes to Support Key Outcomes

- Established a set of test samples to perform crack inspections in at the TDC
- Established a pathway for NDE technicians and ILI service providers to communicate key variables of the feature
- Established a pathway for NDE technician improvement

#### Projects to support Key Outcomes

- NDE-4-12 - Continuous Improvement of ILI Capabilities
- NDE-2-14 - NDE Technician Improvement Training Course for LSW Testing
- NDE-4-25 - Fast and Accurate Feedback from Site to ILI Vendor
- NDE-4-27 - Protocol for PRCI Pipe Sample Evaluation and Documentation
- NDE-4-26 - In-Line Inspection Performance on Tight Cracks
- NDE-4-28 - Protocol for Testing New Technologies at the TDC

### 2. Close identified gaps in material properties performance data

#### Key Success to Support Key Outcomes

- Developed a material property database within the Virtual Technology Development Center

#### Project to support Key Outcomes

- NDE-4-17A - Pipeline Material Property Database Enhancement

### 3. Providing the next generation of susceptibility models by cracking threat/morphology

#### Key Successes to Support Key Outcomes

- Developed a susceptibility model for fatigue
- Developed a susceptibility model for stress corrosion cracking
- Developed a susceptibility model for selective seam weld corrosion

#### Projects to support Key Outcomes

- EC-2-12 - Evaluation of Selective Seam Weld Corrosion Susceptibility
- NDE-4-22 - Guidelines for When to Perform a Crack Detection ILI Survey
- NDE-4-24 - Circumferential Crack Management Risk Evaluation Framework
- MAT-7-2 - Hard Spot Susceptibility Review
- EC-08-13 - Influence of External Hydrogen on Crack Growth

### 4. Broadly communicating outcomes to advance crack management within industry fabric

#### Key Successes to Support Key Outcomes

- Results from NDE-4-22 will be in the next edition of API RP 1176
- Results from EC-2-12 will be in the next edition of API RP 1160

#### Projects to support Key Outcomes

- NDE-4-20 - Considerations for Crack ILI Response in Liquids Pipelines
- NDE-4-22 - Guidelines for When to Perform a Crack Detection ILI Survey

### 5. Further operationalizing the TDC and VTDC for crack management

#### Key Successes to Support Key Outcomes

- Significant utilization of the TDC for SRP projects
- Established material property database in the VTDC
- Established crack failure database in the VTDC

#### Projects to support Key Outcomes

- NDE-4-12 - Continuous Improvement of ILI Capabilities
- NDE-4-17A - Pipeline Material Property Database Enhancement
- MAT-8-3C - Understanding Why Crack Fail - Results Sharing
- NDE-2-14 - NDE Technician Improvement Training Course for LSW Testing
- NDE-4-27 - Protocol for PRCI Pipe Sample Evaluation and Documentation
- NDE-4-26 - In-Line Inspection Performance on Tight Cracks
- NDE-4-28 - Protocol for Testing New Technologies at the TDC

## LEADERSHIP

**SEAN KEANE,  
ENBRIDGE PIPELINES  
INC. AND ENBRIDGE  
ENERGY PARTNERS  
LP**

**Improvement to Susceptibility Models** – When we started the SRP, we had the assumption that the major area for improvement was related to inspection. With the MAT-8-3 “Why Cracks Fail” project, we realized that not knowing a crack inspection survey was required (i.e. susceptibility) was the biggest gap. The SRP has developed projects to develop improved susceptibility models for fatigue, selective seam weld corrosion, and stress corrosion cracking. These models will aid operators in having efficient and effective crack management programs.

**TAYLOR SHIE, SHELL  
GLOBAL**

**Sharing of Results of the SRP** – The overarching goal of the SRP is for crack management to be efficient and effective for all operators. Not every operator has the opportunity to be a PRCI member. In an industry where one operators failure reflects on all operators, we established protocols for sharing project results with the industry. The next editions of API RP 1160 and API RP 1176 will have significant updates as a result of SRP projects. The key areas being in the susceptibility models referenced previously.

**Relationship of ILI and NDE** – In-line inspection (ILI) and Non-Destructive Examination (NDE) work hand in hand to improve integrity management programs. ILI identifies the location to examine while NDE examines the defect. The key element of this relationship is the feedback loop from NDE to ILI. A series of projects have been performed to make sure that ILI and NDE service providers are on the same page and speaking the same language whenever possible.

## WHAT’S NEXT FOR THE CRACK MANAGEMENT SRP

In the fall of 2023 both the research steering committee and the Executive Assembly approved the continuation of the Crack Management SRP for two more years (2024 and 2025). A budget of \$1.3MM and \$1.1MM has been approved for 2024 and 2025 respectively. The Crack Management Strategic Research Priority has a proven track record of being good stewards of PRCI resources. This additional scope of work will make a final work package that improves all member company integrity management programs.

**At the time of this writing the scope for the next phase is still being confirmed. It is anticipated that the next two years will include projects to:**

- Develop a Database of Crack-Like Defects Created by Pipe Manufacturer
- Develop a methodology to match ILI tool to expected crack morphology
- Advance circumferential crack detection in gas service
- Determination of when do SSWC features behave as cracks
- Determination of when to utilize crack profiles in defect assessment
- Determination of when do lack of fusion defects start to behave as sharp cracks
- Develop a MAT-8 software for circumferential defects
- Advance the utilization of machine learning for integrity management
- Additional scope for:

- EC-8-13 - Influence of External Hydrogen on Crack Growth
- NDE-4-12 - Continuous Improvement of ILI Capabilities



Samples prepared for full-scale testing



EDM notching of corrosion features coincident with long seam



< SRP: Greenhouse Gas Reduction | Home | SRP: Leak Detection >

# LD SRP: LEAK DETECTION

This Strategic Research Priority closes the primary gaps in standardizing the way that technologies and methods for leak detection are validated and qualified for energy pipelines (gathering, transmission, and distribution), and their associated facilities.

## OUTCOMES & VALUE TO INDUSTRY

- Identifying, developing, and confirming effective leak detection monitoring technology options for the industry.
- Significantly reducing liquid and gas leak impacts and improve confidence in pipeline safety.
- Impacting industry recommended practices and standards.

## INDUSTRY IMPROVEMENT

### LIQUID HYDROCARBON SYSTEMS

- Improved detection technology.
- Comprehensive leak detection strategy for gas and liquids operators (internal/external).
- External detection and quantification guidance.

### NATURAL GAS PIPELINE

- Accelerated event identification through remote sensing.
- Application of continuous pipeline monitoring for natural gas transmission operations.
- Validation of technology capabilities and limitations.

### GREENHOUSE GAS EMISSIONS IDENTIFICATION & QUANTIFICATION FOR NATURAL GAS PIPELINES

- Industry guidance for continuous monitoring of facilities.
- Clarify capabilities and limitations of large area remote monitoring.
- Identify advanced leak detection technologies capable of accurate quantification of leak rates and leak locations.
- Improving characterization of release and emissions intermittency for detection and quantification.

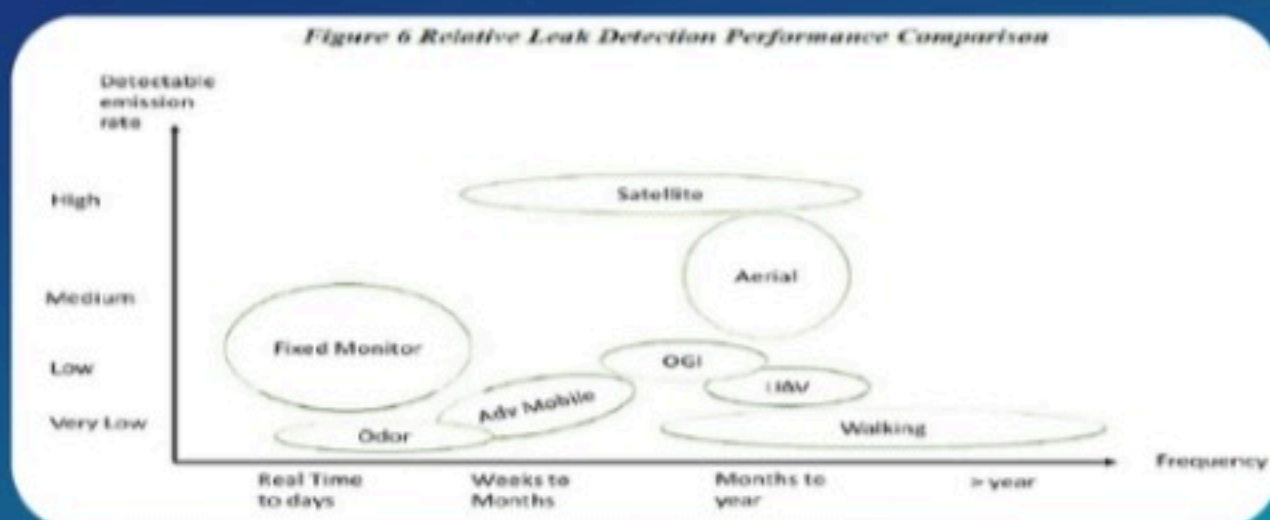
## CURRENT RESULTS

- Evaluate the effectiveness and limitations through 3rd-party field trials of a cable-deployed polymer absorption sensor (PAS) in rapidly detecting small pipeline hydrocarbon leaks, whether installed on or placed near new or existing pipelines.
- Advance cable-based technology by providing a gap analysis of retrofitting existing pipelines with these types of sensors and testing the performance of locating the lateral position of pipeline and depth of cover of the pipeline for a full implementation and adoption.
- Evaluate the effectiveness and limitations of methane leak detection and quantification technologies and approaches and provide along with the gap analysis, a technology assessment tool operators to use.

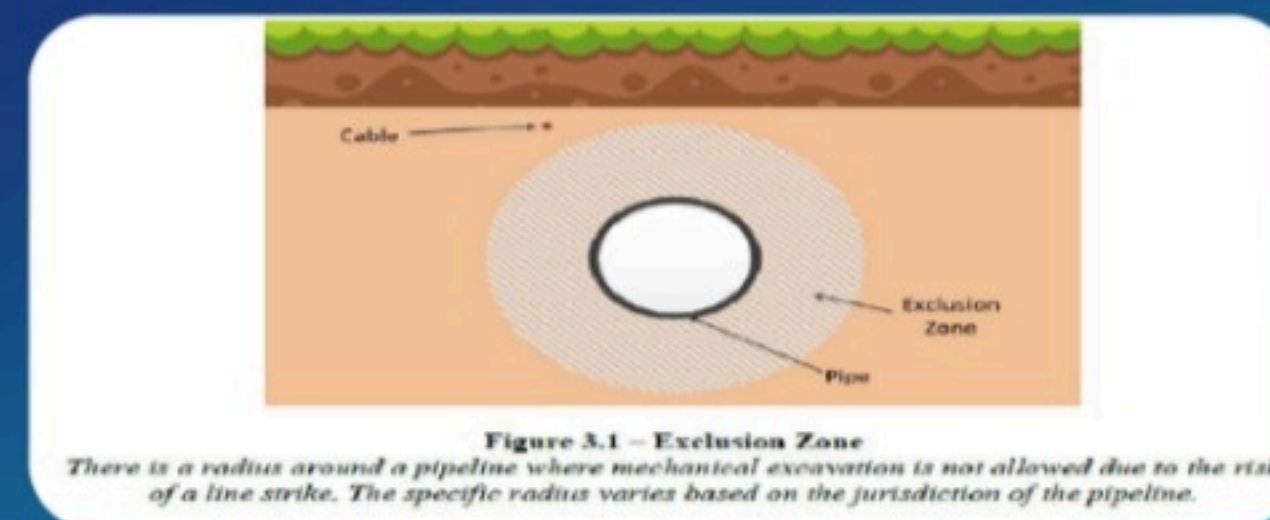
## LEADERSHIP

**NIKOS SALMATANIS,  
CHEVRON  
TECHNOLOGY  
COMPANY**

We have stood up a Strategic Research Program for Leak Detection in industry that aligns within many of the objectives from API, LEPA, AGA, INGAA, PHMSA, and EPA. The LD SRP Reports reflect well-rounded, comprehensive peer-reviews of leak detection technologies and approaches. The SRP is "Buying Down Risk" by identifying leaks faster and facilitating the quicker adoption of technology which leads to less hydrocarbon in the environment, property, and people, ultimately reducing risks and better safety.



PR-004-213900-R01 Existing and Emerging Technologies in Methane Leak Detection and Quantification Figure 6



PR-015-183901-R01 - Retrofitting Pipelines with Cable-Based Technologies



< SRP: Crack Management | Home | SRP: Geohazard Management >

# GHZ SRP: GEOHAZARD MANAGEMENT

The SRP has been proposed in response to the expected increase in the frequency of extreme climatic events, such as atmospheric rivers, that are destined to increase the exposure to hydrotechnical events. Hydrotechnical hazards are a subset of geohazards (natural hazards) related to water crossings that lead to exposure of buried pipelines and potential failure due to unexpected forces on an exposed pipeline. The risk is heightened during extreme events such as hurricanes, tropical storms and other precipitation events that can lead to floods or large hydrodynamic forces.

## OUTCOMES & VALUE TO INDUSTRY

Remediation at water crossings costs significantly higher than other types of remediation such as recoating, sleeving or cut-out. There are significant economic benefits in reducing the number of mitigations and selection of effective mitigation methods for water crossings.

The outcomes of this SRP is to field validate river-crossing monitoring technologies that inform accurate assessment of threats and threat interaction to pipeline integrity and develop guidelines for effective mitigation options. Prioritization and effective remediation through improved assessment and monitoring would lead to significant economic benefits. Remediation cost savings of \$1 million per crossing would result in \$100 million savings over each 1000 kms of pipelines.

## INDUSTRY IMPROVEMENT

**THE IMPLEMENTATION OF THE SRP ROADMAP INTENDS TO ADDRESS THE FOLLOWING GAPS:**

- Geotechnical threats near water crossings following an extreme hydrotechnical event (either precipitation or flood events), and the interaction between the hazards.
- Technologies for remote and continuous monitoring of the water crossings and pipeline condition to enable reinstatement of operations after an extreme event.
- Effectiveness of the temporary and permanent remediation options at water crossings.

## CURRENT RESULTS

- SRP has kicked-off the steering committee meetings and prepared to issue RFPs for the projects to be initiated in 2024.
- Project roadmap and developments are shared at PHMSA R&D Forum for Threat Prevention and impacts of climate change for coordination of funding research to address geohazards.

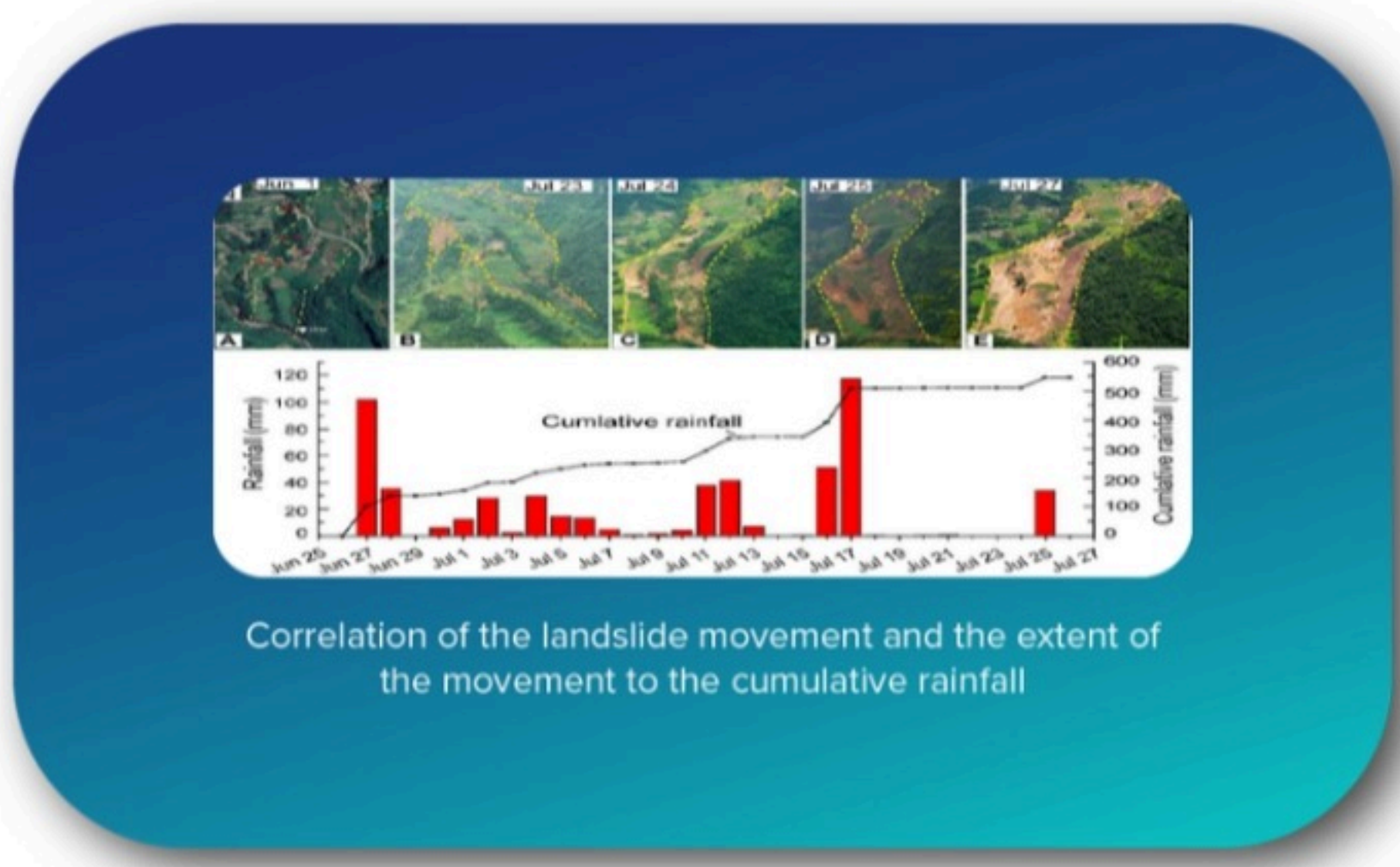
## LEADERSHIP

**SMITHA KODURU,  
ENBRIDGE PIPELINES  
INC. AND ENBRIDGE  
ENERGY PARTNERS  
LP**

The Geohazard Management SRP has been partially in response to the regulatory interest, such as the U.S. Department of Transportation (DOT) Pipeline Hazardous Material Safety Administration (PHMSA) recent regulation for gas transmission pipeline inspection following an extreme event, and funding announcements around technology developments that address regulatory and oversight drivers. Lack of industry-driven research could drive regulatory regime to impose overly conservative interpretation of thresholds for response to extreme events, require monitoring methods with inconsistent outcomes or mitigation methods that may be resource-intensive without corresponding increase in safety or optimized with other integrity management actions.

Sharing of this SRP initiative at PRCI specifically address the requirements of climate change impacts on pipelines at PHMSA R&D Forum has indicated serious industry interest in tackling this threat:  
<https://primis.phmsa.dot.gov/meetings/FilGet.mtg?fil=1462>

The three words to best describe this past year will be collaboration, collaboration and collaboration. The SRP project team has collaborated across TCs and stakeholders to develop a research roadmap that is practical and important for managing extreme event threats and continues this approach in project planning and identifying collaboration partners at State DOTs, U.S Army Corps, EPA and other research and government bodies where the technologies would be used and impactful.



< [SRP: Leak Detection](#) | [Home](#) | [Compendiums](#) >



# COMPENDIUMS

From member suggestions for new and refreshed compendiums, PRCI added eleven compendiums to its library in 2023. These publications feature the broad range of PRCI's research, from a selection of an individual Technical Committee reports to industry focused topics.

## 2023 COMPENDIUMS

### [PR-000-23COMP-R11 PIPELINE RIVER CROSSING MANAGEMENT](#)

A list of PRCI and other reports related to the design and operation of pipelines as they cross rivers. This work does not include content on horizontal directional drills which is the subject of its own compendium.

### [PR-000-23COMP-R10 PIPELINE RUNNING FRACTURE](#)

A list of reports from PRCI and others on designing pipeline systems to minimize the potential for running ductile fracture.

### [PR-000-23COMP-R08 PIPE IN CASINGS COMPREHENSIVE COMPENDIUM](#)

PRCI has carried out several research projects related to design, procedures, processes, and methods related to installing and operating pipe installed inside casings. Since not all studies sponsored by other industry groups (e.g., API, EPRG, APIA, etc.) or by individual pipelines companies are not included, this report does not represent a review of the topic in the broader industry-wide sense. Instead, it is designed to provide a guide to past work so that facility operators and researchers to help identify and locate research reports on the topic.

### [PR-000-23COMP-R09 DISBONDED, DAMAGED, AND FAILED COATING](#)

This compendium is a selection of past PRCI research related to corrosion and temperature. Metadata is provided for each resource (when available) including the length of the report, its abstract, author(s), and company that performed the research.

### [PR-000-23COMP-R06 TEMPERATURE IMPACT ON CORROSION](#)

This compendium is a selection of past PRCI research related to corrosion and temperature. Metadata is provided for each resource (when available) including the length of the report, its abstract, author(s), and company that performed the research.

### [PR-000-23COMP-R02 UNATTENDED FACILITY OPERATION](#)

This compendium is a selection of past PRCI research that facilitates the operation of facilities in unattended modes. Reports were selected based on their final report abstracts and does not include further analysis or an additional technical review of the final report. Metadata is provided for each resource (when available) including the length of the report, its abstract, author(s), and company that performed the research.

### [PR-000-23COMP-R07 ETHANOL - BIODIESEL TRANSPORTATION AND STORAGE](#)

This compendium is a selection of past PRCI research related to biofuels. Metadata is provided for each resource (when available) including the length of the report, its abstract, author(s), and company that performed the research.

### [PR-000-23COMP-R03 PIPELINE RISK MANAGEMENT](#)

The PRCI Technical Committees have carried out many research projects related to identifying and managing pipeline safety risks. Since not all studies sponsored by other industry groups (e.g., API, EPRG, APIA, etc.) or by individual pipeline companies are not included, this report does not represent a review of the topic in the broader industry-wide sense. Instead, it is designed to provide a guide to past work so that current PRCI members and its research contractors can identify and locate project reports that might be of use in understanding pipeline risk management.

[See all Compendiums](#)

[< SRP: Geohazard Management | Home | Corrosion >](#)



**Main Office**  
15059 Conference Center Drive  
Suite 130, Chantilly, VA 20151  
Main +1 703.205.1600  
Fax +1 703.205.1607  
[prci.org](http://prci.org)

**Technology Development Center**  
6410 Langfield Road, Building J  
Houston, TX 77092  
Main +1 281.846.7570  
[prci.org/tdc](http://prci.org/tdc)



# CORROSION

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. As one of the oldest focus areas in PRCI and with strong ties to DMC, I&I and SOM, the importance of corrosion is reflected in nearly a quarter of all PRCI documents.

**Chair:** Trevor Place, Enbridge Pipelines Inc. and Enbridge Energy Partners LP


**Vice Chair(s):** Mohsen Achour, ConocoPhillips  
 Mohammad Al-Amin, TC Energy  
 Didier JC Caron, GRTgaz  
 Jeff Liang, Enbridge Pipelines Inc. and Enbridge Energy Partners LP  
 David McQuilling, Pacific Gas and Electric Company  
 Jocelyn Nelson, ExxonMobil Pipeline Company

"As measured by projects in-flight, 2023 was a busy and productive year for the Corrosion TC. Although challenged by structural changes at PRCI and the departure of two extremely active vice-chairs in 2023, our focus on project execution and maximizing the value and productivity of in-person meetings was effectively maintained. The Corrosion TC is also pleased that some of the procedural tools and strategies we developed over the past few years were adopted by another TC in 2023. Imitation, so they say, is the highest form of flattery.

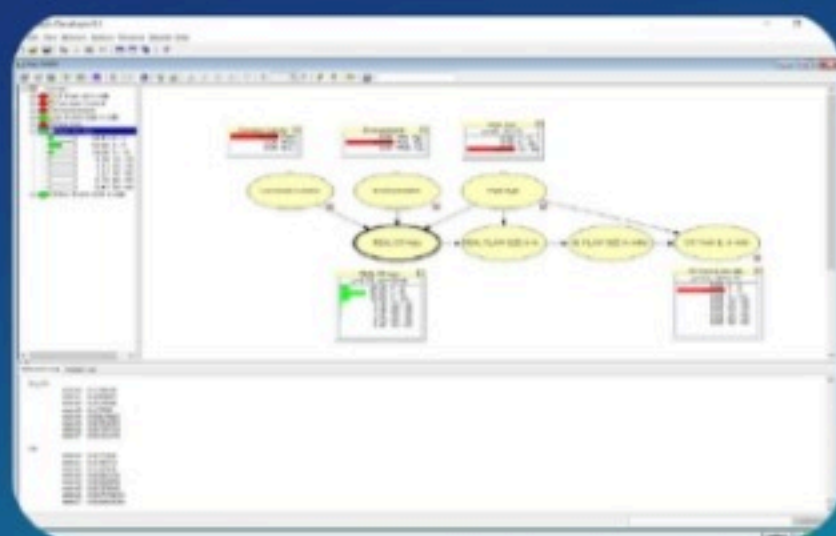
The Corrosion TC continues to struggle with the dichotomy created when the need for creative solutions to immediate problems (AKA 'timely research') collides with the need for ever greater financial and procedural stability that is expected of a multi-million dollar organization. So long as these conflicting imperatives are afforded equal priority (as advocated by our TC), improvements will be achieved in both.

Finally, we are pleased that the Corrosion TC was able to help secure a number of unscheduled projects brought forth through PHMSA. The utilization of public funding on PRCI projects further amplifies the return on investment made by our member companies.


- Trevor Place



Example of digital twin model for CP









Hugin Explorer running BN model for updating CR using ILI measurement [EC-1-13: External Corrosion Growth Rate Distributions – ILI versus Bayesian Model using MARV]



Comparison of MARV with ILI run comparison results [EC-1-13: External Corrosion Growth Rate Distributions – ILI versus Bayesian Model using MARV]



## PUBLISHED REPORTS IN 2023

- [PR405-213601-R04 Validation of Digital Twins for Monitoring, Optimization, and Compliance of CP Systems](#) 
- [PR-000-23COMP-R04 Aboveground Tank Corrosion Comprehensive Compendium](#) 
- [PR-000-23COMP-R06 Temperature Impact on Corrosion](#) 
- [PR-000-23COMP-R09 Disbonded, Damaged, and Failed Coating](#) 
- [PR-000-23COMP-R08 Pipe in Casings Comprehensive Compendium](#) 
- [PR352-213603-R01 Burst Tests for Corrosion, Cracking, Dent, and Interacting Defects Hosted on VTDC](#) 

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 Suite 130, Chantilly, VA 20151  
 Main +1 703.205.1600  
 Fax +1 703.205.1607  
[prci.org](http://prci.org)

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 6410 Langfield Road, Building J  
 Houston, TX 77092  
 Main +1 281.846.7570  
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# COMPRESSOR & PUMP STATION

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

**Chair:** Daniel Rem, Enbridge Pipelines Inc. and Enbridge Energy Partners LP


**Vice Chair(s):** Howard Koop, Enbridge Pipelines Inc. and Enbridge Energy Partners LP  
Hemanth Satish, TC Energy

Leading the way to cleaner emissions, the 2023 Pump and Compressor team continued their work of reducing industrial emissions in response to increasing clean air regulations. New ground was broken through research in computational modeling of reciprocating compressor engine methane emissions. Additionally turbo machinery research saw improvements in combustion and predictive emissions research.

- Daniel Rem



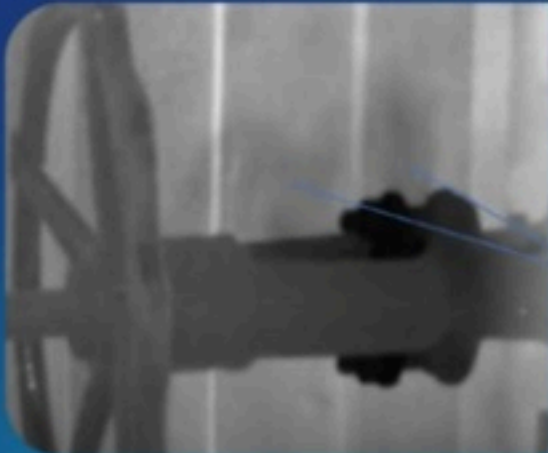
Station meeting in progress




Snapshot from the CO<sub>2</sub>e Economic Analysis Tool as part of PR-663-20208-Z01 CO<sub>2</sub>e Economic Analysis Tool



Demonstration of performance degradation versus running time as shown in PR700-22202-R01 Potential Approaches to Remote Monitoring of Facility Efficiency and GHG Emissions



Example of a packing leak on a valve from PR-746-22204-R01 PR-746-22204-R01 Review of Technologies to Enable In-situ Valve Service to Reduce Methane Emissions



Colorado State engine used for research of CPS-17-08 R01 Exhaust Methane Emissions



## PUBLISHED REPORTS IN 2023

- [PR266-18201-R01 CEPM for Turbochargers](#) 
- [PR-457-21204-R01 Evaluation of New Ignition Concepts on Large Bore NG Engines for Methane Emissions](#) 
- [PR-663-20208-Z03 CO<sub>2</sub>e Economic Analysis Tool Warren Peterson](#)   
- [PR-457-21206-R01 CFD Study of Prechamber NO<sub>x</sub> Production Mechanisms](#) 
- [PR-000-23COMP-R02 Unattended Facility Operation](#) 
- [PR-700-22202-R01 Potential Approaches to Remote Monitoring of Facility Efficiency and GHG Emissions](#)  
- [PR-312-18209-E04 White Paper Compressor EFs Sensitivity to Larger Leaks](#) 
- [PR-312-18209-E05 Compressor and Facility Leak EFs for Transmission and Storage: Clarifying Different Program Approaches](#) 
- [PR-746-22204-R01 Review of Technologies to Enable In-situ Valve Service to Reduce Methane Emissions](#) 

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**Main Office**  
15059 Conference Center Drive  
Suite 130, Chantilly, VA 20151  
Main +1 703.205.1600  
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# DESIGN MATERIALS & CONSTRUCTION

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.

**Chair:** Matthew Fix, Marathon Pipe Line LLC

**Vice Chair(s):** Daniel Castro, Williams Companies, Inc.  
Cindy Guan, TC Energy  
Smitha Koduru, Enbridge Pipelines Inc. and Enbridge Energy Partners LP  
Junfang Lu, Enbridge Pipelines Inc. and Enbridge Energy Partners LP  
Atheel Mutammara, ExxonMobil Pipeline Company  
Jorge Penso, Shell Global  
Russell Scoles, Enbridge Pipelines Inc. and Enbridge Energy Partners LP



Pipe section being hydrostatically pressure tested



Pipeline bulging that is associated with the second 1500 psi (10.3 MPa) ethylene weld



Branch welds made with low heat inputs and with water flow.



## PUBLISHED REPORTS IN 2023

- [PR-685-184506-R09 Improve Upon Existing Tools to Estimate Hydrotechnical Concerns](#)
- [PR-186-214508-R01 In-Service Welding onto Ethylene Pipelines](#)
- [PR723-224503-R01 Technology Transfer to the Fitness-for-Service Standard API 579-1](#)
- [PR723-224503-R02 Technology Transfer to the Fitness-for-Service Standard ASME FFS-1](#)
- [PR182-224504-R01 Transportation of CO2 SOTA, Gap Analysis and Future Project Roadmap](#)
- [PR-000-23COMP-R10 Pipeline Running Fracture](#)
- [PR-350-214511-R01 Integrity Impact of HAZ Softening with Type-B Sleeves and Branch Connections](#)
- [ENV-4-1A -Modernize the Assessment of Pipeline Water Crossings | PRCI](#)

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Suite 130, Chantilly, VA 20151  
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Fax +1 703.205.1607  
[prci.org](http://prci.org)

**Technology Development Center**  
6410 Langfield Road, Building J  
Houston, TX 77092  
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# INSPECTION & INTEGRITY

The Integrity & Inspection 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.

**Chair:** Joshua Bremner, Phillips 66 Pipeline LLC

**Vice Chair(s):** Paul Monsour, Southern California Gas Company  
Sean Moran, Williams Companies, Inc.  
Chris Newton, Phillips 66 Pipeline LLC  
David Xu, Pacific Gas and Electric Company  
Shenwei Zhang, TC Energy

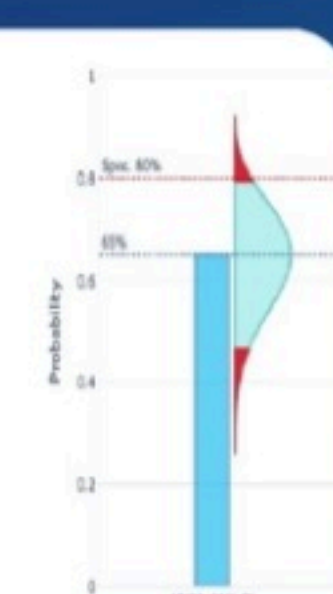
In 2023, the Integrity and Inspection Committee successfully completed projects to advance integrity management and address integrity gaps. Through diligent project management and a focused team effort, IM-1-06 was completed in less than a year and is an example of a project that has had an immediate positive impact for operators by creating industry consensus guidance, and a tool for API 1163 ILI performance validation.

Multiple projects addressing inspection and management of dents, cracks, and ILI performance were completed and the results will be incorporated for improvements into industry recommended practices. Through round tables and brainstorming sessions, the I&I committee also identified emerging integrity gaps and created meaningful projects, notably for improved selective seam weld corrosion inspection and management, and hard spot identification.


Thanks to all the committee members for your ideas, thoughts, discussions, and active participation!

-Josh Bremner


- Level 1: Do I need to validate the ILI tool performance with field measurements?
- Level 2: Is the vendor-specified ILI tool performance plausible?
- Level 3: What is the ILI tool performance?



Threat level breakout



Hardness grid



Samples set up for NDE



## PUBLISHED REPORTS IN 2023

- [PR-000-23COMP-R01 Stress Corrosion Cracking Susceptibility](#)
- [PR-000-23COMP-R05 Pipe Wrinkles Comprehensive Compendia](#)
- [PR-719-223803-R01 API 1163 Performance Validation Guidelines](#)
- [PR-000-23COMP-R03 Pipeline Risk Management](#)
- [PR-328-203803-R01 Improve ILI Sizing Accuracy](#)
- [PR-214-203820-R01 Performance Evaluation of ILI for Dents with Cracks and Gouges](#)
- [PR-328-223807-R01 Development of guidance document for performing ECA in accordance with Megarule](#)
- [PR-214-223806-R01 Guidance for Performing Engineering Critical Assessments for Dents on Natural Gas Pipelines](#)
- [PR-214-223808-R01 Verification of Screening Tools for Classifying ILI Reported Dents with Metal Loss Features](#)
- [PR-328-223812-R01 Tools and Methods to Assess Pipe Material Properties from Inside the Pipeline](#)

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# MEASUREMENT



The Measurement Technical Committee focuses on measurement technology research related to improving the safety, performance (accuracy, uncertainty), environmental impact, and operating cost (operability, maintainability, reliability) of oil and gas transportation systems. The Measurement Technical Committee prioritizes research that supports industry standardization.

**Chair:** Chris Levy, Chevron Pipe Line Company

**Vice Chair(s):** Nathan Feldpausch, Enbridge Pipelines Inc. and Enbridge Energy Partners LP  
Jonatan A Mustafa, Energy Transfer

2023 was a productive year for PRCI's measurement technical committee. Standard portfolio research focused on improving accuracy, increasing reliability, reducing risk, and optimizing costs of gas and liquid measurement systems. The Measurement Technical Committee also continued partnering across PRCI technical committees to make strides on strategic research priorities, specifically greenhouse gas emissions reduction and the more recently launched Leak Detection Strategic Research Priority. In addition, committee collaboration with industry standards organizations, including the American Petroleum Institute's Committee on Petroleum Measurement, continued to align road-mapped research with industry needs so that research results are applied to industry requirements.

Our research activity consisted of studies, lab tests, and field tests, which were the result of significant dedication by our researchers, project team members, and PRCI staff. In addition to the dedication of project team leads, success is often heavily reliant upon the provision of equipment for testing by our manufacturer members and the allowance of testing at field sites by our operating members. A heartfelt thank you to our committee members for the success of 2023, and my gratitude is especially extended to our 2023 project team leaders, equipment providers, and field-testing hosts:

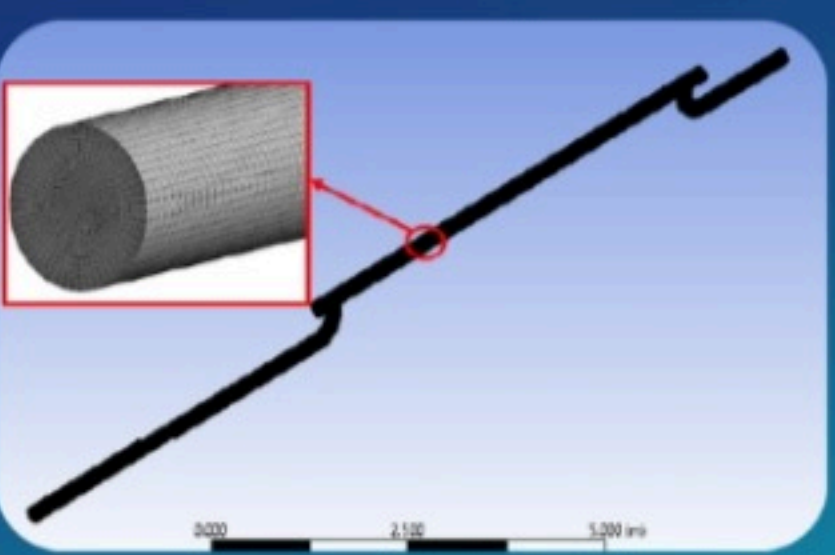
*Project Team Leaders: Kerry Checkwitch, Enbridge; Lori Curtis, Kinder Morgan; Nathan Feldpausch, Enbridge; Robert Heltzel, BHE T&S; Chris Levy, Chevron; Swarandeeep Sandhawalia, TC Energy; Austin Sorensen, Williams; Allen Wong, Enbridge*

*Equipment Providers: ADD GLOBE, Colorado State University, GRTGaz, Ohio Lumex, SEMTECH*

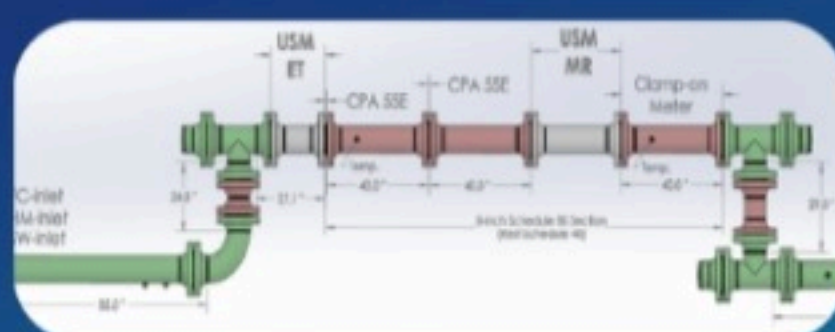
*Field Testing Hosts: BHE T&S, SoCalGas*

Lastly, 2023 marks the end of my term as Chair of the Measurement Technical Committee, which has been an honor. I'm excited about the great value this amazing committee will deliver under the direction of the new chair, Nathan Feldpausch of Enbridge!

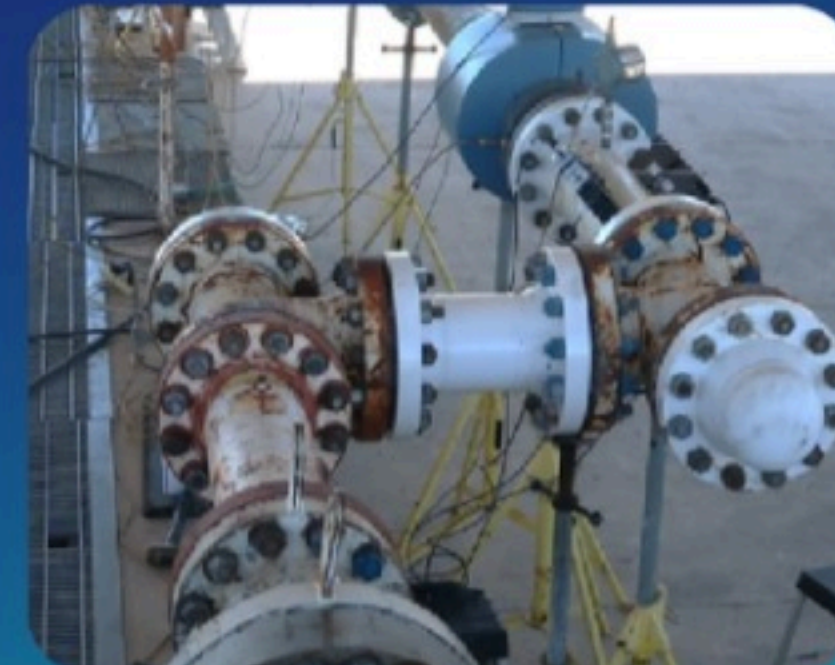
- Chris Levy



Example of mesh density setup for end treatment simulations as conducted in PR-015-19605-R01 Effect of Upstream Piping on Ultrasonic Meter Bias – End Treatment Effects












Piping geometry case used to study end treatment effects on flow profiles from PR-015-19605-R01 Effect of Upstream Piping on Ultrasonic Meter Bias – End Treatment Effects



End Treatment Piping Setups used during flow testing of PR-015-19605-R01 Effect of Upstream Piping on Ultrasonic Meter Bias – End Treatment Effects



## PUBLISHED REPORTS IN 2023

- [PR-015-19605-R01 Effect of Upstream Piping on Ultrasonic Meter Bias - End Treatment Effects](#)   
- [PR-179-22600-R01 Evaluation of High Flow Sampler Technologies](#) 
- [PR-746-22602-R01 In-situ, Cost-Effective Detection and Quantification of Emission from Vents](#)   
- [PR-000-22605-R02 Literature Review for Leak and other Lost and Unaccounted In Pipeline Systems](#) 
- [PR-000-22605-R01 Design Guideline for Retrofittable Inline Flow Measurement](#) 

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# UNDERGROUND STORAGE

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.

**Chair:** Anders Johnson, Kinder Morgan

**Vice Chair(s):** Andrew Lloyd, Enterprise Products  
Dan Neville, Southern California Gas Company  
Delphine Patriarche, Storengy  
Stephanie Sexton, ExxonMobil Pipeline Company

The UGS TC focused on development in 2023. While no final reports or webinars were completed, three successful projects were on-going:

[US-2-03 Brine String Dynamics](#)

[US-4-04 Advancement of Through-Tubing Casing Inspection for UGS Wells \(PHMSA\)](#)

[US-4-05 UGS Failures and Near Miss Trending \(started in 2023\)](#)

All three of these projects are scheduled to be completed next year. We also intend to add idea 3713 “Deep Cavern Abandonment” to the list of projects for 2024.

The UGS members actively assisted teams for Storage related Emerging Fuels Institute (EFI) projects

[JEFI-05-01 DNV JIP - Guidelines for Material Selection for Underground Hydrogen Storage](#)


[JEFI-05-03 SHASTA – DOE-funded study of Hydrogen affects on various aspects of Underground Storage](#)

[JEFI-05-03 Incorporating Fiber Optics into Wellbore Design and Monitoring](#)

**Tour of Totem Underground Storage Field**

Sponsored by:  
Kinder Morgan

Wednesday, October 18, 2023  
2:00 pm - 3:30 pm  
54260 E. 104<sup>th</sup> Ave., Bennett, CO



A visit to the real thing!

## PUBLISHED REPORTS IN 2023

- [PR-000-23COMP-R07 Ethanol - Biodiesel Transportation and Storage](#)

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# SUBSEA



The Subsea Technical Committee focuses on issues and challenges unique to the offshore pipeline environment through research focusing on Subsea Pipeline Integrity Management (SPIM) and Subsea Pipeline Direct Assessment (SPDA). The research deliverables target improvements to risers, on-bottom stability and pipe to enhance the performance through development and implementation of new design methods, materials, and construction technologies

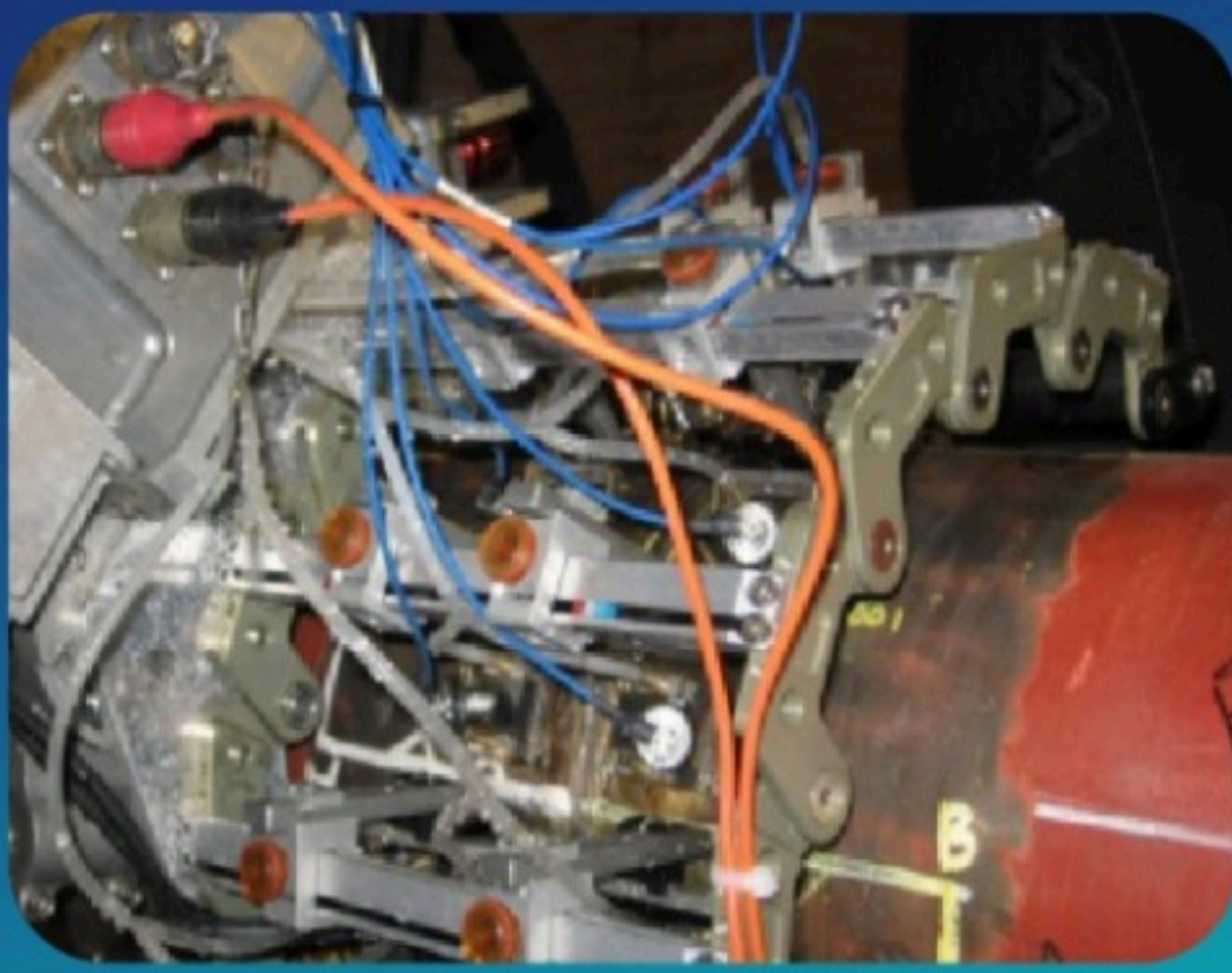
**Chair:** Farzan Parsinejad, Chevron Pipe Line Company

**Vice Chair(s):** Benjamin Damonville, Total S.A.  
Wilson Zeng, ExxonMobil Pipeline Company

"In 2023, the Subsea Technical Committee achieved a few significant milestones. These include Assessment of High Frequency Welded (HFW) Line Pipes for Offshore Use, On-Bottom Stability (OBS) Software, API Connectivity Enhancement and High-Resolution X-Ray Computed Tomography (HR XCT) Design Phase 1. The assessment of HFW line pipe has large potentials for saving cost of the production and installation of subsea pipelines. Enhancements of OBS software improves the modernization capabilities of the software and allows for it to connect with other well established industry tools. OBS is a world-class software that is the culmination of decades of industry research and collaboration of operators, and engineering service companies. The HR XCT is the most advanced technology for the detailed inspection of flexible pipes and subsea cables. The phase 1 design defined in detail the architecture of the subsea tool and identified specification for the source and receiver.

Subsea TC leadership developed a 3-year roadmap of research activities and have identified new ideas and projects starting early 2024. The main challenges for the TC is to enhance participation of the members to ensure lively progression of ideas and research activities."

- Farzan Parsinejad




Automated ultrasonic girth weld inspection system



Installation of a subsea sand detector



## PUBLISHED REPORTS IN 2023

- [PR-453-205101-R02 On-Bottom Dynamic Simulation](#)
- [PR-164-2151-R01 Assessment of High Frequency Welded Line Pipe for Offshore Use](#) 

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# SURVEILLANCE, OPERATIONS, & MANAGEMENT

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.

**Chair:** Nikos Salmatanis, Chevron Pipe Line Company

**Vice Chair(s):** Marzie Derakhshesh, Enbridge Pipelines Inc. and Enbridge Energy Partners LP  
Chris O'Neill, Enbridge Pipelines Inc. and Enbridge Energy Partners LP  
Zach Locks, TC Energy

From all that the Surveillance, Operations & Management Technical Committee accomplished in 2023, three are especially noteworthy: ROW-1-01, ROW-3-1/1A's final reports approved, and PI-1-9 being started and nearly completed last year with final report already under review. Each of these projects helped move technology steps closer to industry deployments and adoption. Additionally, SOM changed industry this year by kicking off two Strategic Research Priorities: the Leak Detection SRP and the GeoHazard Management SRP.

Also of note, in PI-1-09, the smallest leak that the technology was able to detect using the Data Analytics tool was 1/32" or .79375 mm which is less than 1 mm and less than most conventional ILI tool tolerances. This is very impressive using a low-fidelity multi-sensing inspection ball (MSIB) with the PipeHawk software. I believe the researcher from ROW-3-1/1A has achieved BVLOS waiver from the FAA using the process outlined the R&D project.

This year could best be described with the phrase Reduce Asset Risks. Identifying right-of-way threats and lowering loss of containment through proper prevention and mitigative measures identified in the R&D projects leads to better environmental stewardship in the industry.

Basic premise of TDLAS sensor operation

Polymer absorption sensor (PAS) cable and cable node



## PUBLISHED REPORTS IN 2023

- [PR-004-213900-Z01 Existing and Emerging Technologies in Methane Leak Detection and Quantification](#)
- [PR-015-183901-R01 Retrofitting Pipelines with Cable-Based Technologies](#)
- [PR-015-183901-R02 Retrofitting Pipelines with Cable-Based Technologies-Additional Information](#)
- [PR-000-23COMP-R11 Pipeline River Crossing Management](#)
- [PR-740-223900-R01 Common River Assessment and Information Sharing Platform](#)
- [PR-396-163702-R03 Petroleum Pipeline Polymer Absorption Sensor \(PAS\) Leak Detection Cable](#)

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