

Government & Industry Pipeline Research and Development (R&D) Forum



Event Summary Report

**Westin Arlington Gateway
Arlington, VA**

July 18-19, 2012

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Event Forward

The Government/Industry Pipeline Research and Development (R&D) Forum was held in Arlington, Virginia on July 18-19, 2012. The 2 day event is held periodically to generate a National research agenda that fosters solutions for the many challenges with pipeline safety and with protecting the environment. The forum allows public, government and industry pipeline stakeholders to develop a consensus on the technical gaps and challenges for future research. It also reduces duplication of programs, factors ongoing research efforts, leverages resources and broadens synergies. The national research agenda coming out of these events is aligned with the needs of the pipeline safety mission, makes use of the best available knowledge and expertise, and considers stakeholder perspectives. Specifically the forum:

1. Identifies key pipeline technical challenges facing industry and government;
2. Disseminates information on current research efforts; and
3. Identifies new research that can help to meet known challenges.



Key Challenges Executive Summary

The Department of Transportation (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA) led a steering committee of ten government and industry organizations that organized, planned and executed this forum. The forum brought together approximately 215 representatives from Federal, State and foreign government offices along with domestic and foreign natural gas and hazardous liquid pipeline operators. The forum's goals included identifying key challenges facing industry and government, sharing information on current research efforts, and identifying research that can help meet known challenges.

Within Panel 1 addressing national perspectives on key pipeline challenges, we first heard a perspective from PHMSA that future research will remain resource shared on technology development but PHMSA will fund 100% of project costs on research which is inherently governmental. This policy will clearly be illustrated in future solicitations. We also heard from PHMSA that we have a great opportunity to find solutions through research relevant to recent horrific pipeline failures. Some of the focus noted was in assuring new pipe is manufactured and installed correctly and that problems can be prevented through good maintenance and threat mitigation. The goal for all is to identify and address risks before problems occur. All stakeholders with an interest in pipeline safety will need the tools and knowledge to be successful in this focus.

The perspective from the National Association of Pipeline Safety Representatives (NAPSR) identified several challenges for distribution piping made of non-metallic materials and cast iron. Some challenges included the ability to predict the future performance of distribution pipe materials, understanding the effects of hydrocarbon permeation on plastic pipe and to develop the ability to monitor cast iron pipe for failure due to frost heave. Finally leak detection concerns were noted, including the need to develop a device for inside meter sets that could continuously monitor for flammable gas concentrations and notify operators when a dangerous situation is detected.

Next up was the hazardous liquid pipeline perspective which put a strong focus on improving Leak Detection capabilities across all ranges of pipeline operations, physical properties, and products. The perspective went on to stress the enhancement of Damage Prevention Technologies including

remote surveillance and sensor development and the enhancement of In-Line Inspection (ILI) technology capabilities and other means to improve understanding of flaws in longitudinal pipe seams that lead to failures.

The perspective from the natural gas transmission pipelines noted that advances in ILI technology are occurring through research however gaps remain. One area of focus was on pressure testing pipelines that are lacking records or are unpiggable by ILI technology. One possible improvement would be the development of a Fitness For Service (FFS) process specifically applicable to pre-regulation pipelines where the information about the commissioning of these lines are not well known. Any near-term technology development associated with FFS assessment for pre-regulation pipe is a priority. Finally it was also noted that a long-term focus on new sets of tools to support integrity management is also a priority.

The perspective from the natural gas distribution pipelines noted some similarities to the transmission pipelines such as inspecting unpiggable pipelines and installing remote controlled or automatic valves but focused on the need to understand the integrity of cast iron pipeline liners and implement a process for acceptance of new materials used for rehabilitation. The challenges were also noted with verifying records with maximum allowable operating pressure, cast iron and vintage plastic pipe replacement management, and using emergency flow valves for multi-family and small commercial structures. Finally we heard that the Nation will see an enormous increase in natural gas gathering pipelines to support the shale gas development and that for all challenges, moving research results to market will be key in solving these challenges quickly and completely.

There were other panels that morning which discussed research roadmaps from three different private pipeline research organizations and advancing technology into the market. These panels blended nicely with the challenges noted in the national perspectives and with what would be covered in the afternoon and following day working groups. Please find much more on those aspects of the forum later in this report.

All presentation material from the forum is available for download from the following webpage: https://primis.phmsa.dot.gov/rd/mtg_071812.htm.

Introduction

Approximately 215 people attended the Government/Industry Pipeline R&D Forum held in Arlington, Virginia on July 18-19, 2012. The 2 day event is held periodically to generate a National research agenda that fosters solutions for the many challenges with pipeline safety and with protecting the environment. The forum allows public, government and industry pipeline stakeholders to develop a consensus on the technical gaps and challenges for future research. It also reduces duplication of programs, factors ongoing research efforts, leverages resources and broadens synergies. The national research agenda coming out of these events is aligned with the needs of the pipeline safety mission, makes use of the best available knowledge and expertise, and considers stakeholder perspectives.

The forum was structured so attendees would hear national perspectives on key challenges from federal and state regulators and the entire pipeline industry. The forum factored other panel discussions about current industry research roadmaps and the challenges with transferring solutions into the marketplace. Finally the forum provided public roadmapping sessions in the following five subject working groups:

1. Threat Prevention
2. Leak Detection/Mitigation & Storage
3. Anomaly Detection/Characterization
4. Anomaly Repair & Remediation
5. Design/Materials/Welding-Joining/Valves

These five groups were charged with developing a consensus agenda of technical gaps and challenges for future research that does not duplicate existing efforts. The output must identify both short and long term research objectives for hazardous liquid/natural gas and transmission and distribution pipelines. Basic roadmapping was conducted on identified technical gaps so identified research is addressing the need effectively. Details were then provided of the ultimate research goals so appropriate end users are factored into project scopes.

The forum was successful in identifying key pipeline technical challenges facing industry and government and disseminating information on current research efforts. It also did well in identifying new research that can help meet known challenges. See the working groups 1-5 report out file posted on the below webpage for much more information.

All presentation material from the forum is available for download from the following webpage: https://primis.phmsa.dot.gov/rd/mtg_071812.htm.

Panel 1 National Perspectives on Key Technical Challenges

On this panel we heard various national perspectives from government and industry. PHMSA noted that we have a great opportunity to find solutions through research relevant to recent horrific pipeline failures. Some of the stated focus was in assuring new pipe is manufactured and installed correctly and that problems can be prevented through good maintenance and threat mitigation. The goal for all is to identify and address risks before problems occur. All stakeholders with an interest in pipeline safety will need the tools and knowledge to be successful in this focus.

The perspective from the NAPSRS identified several challenges for distribution piping made of non-metallic materials and cast iron. Some challenges included the ability to predict the future performance of distribution pipe materials, understanding the effects of hydrocarbon permeation on plastic pipe and to develop the ability to monitor cast iron pipe for failure due to frost heave. Finally leak detection concerns were noted, including the need to develop a device for inside meter sets that could continuously monitor for flammable gas concentrations and notify operators when a dangerous situation is detected.

Next up was the hazardous liquid pipeline perspective which put a strong focus on improving Leak Detection capabilities across all ranges of pipeline operations, physical properties, and products. The perspective went on to stress the enhancement of Damage Prevention Technologies including remote surveillance and sensor development and the enhancement of In-Line Inspection (ILI) technology capabilities and other means to improve understanding of flaws in longitudinal pipe seams that lead to failures.

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Panel 2 Current Industry Research Roadmaps

The audience received the following paragraph background and context on research roadmaps from the panel moderator before hearing the detailed panel discussions. Research roadmaps are plans that match short-term and long-term goals with the specific technical solutions needed to help meet those goals. In general research roadmaps have three major uses. They help convey a consensus about a set of technical needs or gaps and the solutions required to satisfy those needs; they provide a mechanism to help forecast technology developments; and they provide a framework to help plan and coordinate technology developments both in time and resources. The organizations participating on this panel are three different private pipeline research funding organizations. Each organization roadmap is at varying levels of completeness, is considered a living document and is revised as needed. Each organization has different member company interests and may not focus on the same pipeline types or challenges. These differences drive a more or less focus on technology development, materials testing and impact on standards developing organizations.

There was consensus within all three roadmaps that the following attributes and goals need coordination, collaboration and wide dissemination.

- Leverage funding and provide adequate funding to achieve desired outcomes for all roadmap focus areas
- Stakeholder based consensus on priorities – topically, sector-based and regionally
- Assurance of a rigorous process; Peer Review
- Managing deployment and transfer of technology and information – Products, Standards, Best Practices, Rules
- Achieving transparency with better & wider communication of progress and impact
- Provide faster returns with research plans
- Develop and maintain partnerships with key industry groups & government agencies

Please find the specific roadmap areas within each presentation file posted on the PHMSA research program webpage at https://primis.phmsa.dot.gov/rd/mtg_071812.htm.

Panel 3 Advancing Technology Into The Market

Collaborative and co-funded pipeline research is producing results that are making it into the marketplace. However there are a myriad of issues that must be factored into technology development that, if not done right, will stifle or lower the likelihood that improvements made will enter the market. The roadmaps from Panel 2 must incorporate the following ideas early and throughout the process of developing technology. The following are key factors for consideration with improving the likelihood of commercialization.

- Formal processes, venture coalitions and seed funding are necessary to turn challenges into opportunities/solutions

- Coalitions need to incorporate multiple members where relevant (i.e. industry, government, academics, service provider/vendors and standard developing organizations)
- Smart and sometimes risky choices are needed by industry, regulators and companies who commercialize technology
- Development plans need to both factor regulatory and technical risk into the steps which need to be taken

Many more points were made between the four panelists. Please find these specifics within each presentation file posted on the PHMSA research program webpage at https://primis.phmsa.dot.gov/rd/mtg_071812.htm .

Five Focused Working Groups

The working groups each addressed focused areas for research roadmapping. Some subject overlap is possible but was kept to a minimum. These groups were charged with three phases of operation in order to generate the desired output.

Phase 1 sets the stage and identifies the challenges for the working group subject matter via an appropriate number of short presentations and group discussion. This period of time is also used to identify the top priorities for new research and begins to review if any ongoing work will address the specifics of each challenge.

Phase 2 can continue Phase 1 activities but quickly transitions to road mapping the identified priorities. As part of the charge for this phase the specifics to the desired output from the research priorities will be determined including the output type. For instance, is the gap best addressed by a technology, an improvement to a consensus standard or a paper study to gather more information or create a new process with some goal? Gathered details are critical here for soliciting for good research projects.

Phase 3 can continue Phase 2 activities but quickly transitions to populating a provided template output presentation using audience participation. The template categories coincide with the data that the working group is gathering.

Two PHMSA facilitators were assigned to each group to assist the working group leaders in executing these three phases and in capturing the necessary details that were reported out. The scope of and top gaps defined by each working group are provided below.

WG#1 - Threat Prevention

Leader: Brian Weeks, Research manager, Gas Technology Institute

Leader: Gweneyette Broussard, Sr. Legislative & Regulatory Representative,
Shell Pipeline Company LP

Audience participants in this group discussed the following areas: excavation damage; pipeline locating; emergency response; Right of Way (ROW) monitoring; preventing damage at mills, during transportation or in ditch; improved padding or backfill; improved coatings and application practices; and identifying or mitigating geo-forces.

The group identified five gaps for future research depicted below. More details on the presentations given within the group and the identified gaps are available for download in the working group report-out file on the PHMSA research program webpage for this forum.

Gap #1 – Threat / Change Detection of Right Of Way (ROW) that might result in Damage
(Knowledge/Technology)

Gap #2 – Need improvements in plastic pipe location techniques (Technology)

Gap #3 – Need better method of documenting pipe materials installed in the ground
(Knowledge/Standards/Technology)

Gap #4 – Common Industry database (Knowledge/Standards)

Gap #5 – Need a location device with multi-utility capability (Technology)

WG#2 – Leak Detection/Mitigation & Storage

Leader: David Bolon, Director, Pipeline & Facility Control Systems, Enterprise Products Partners

Leader: Ray Philipenko, Manager Leak Detection, Enbridge

Audience participants in this group discussed the following areas: leak detection technology development for all pipeline types from any deployment platform and understanding capabilities and limitations. This group recapped the leak detection information from the March event. As additional topic on natural gas storage was discussed.

The group identified four gaps for future research depicted below. More details on the presentations given within the group and the identified gaps are available for download in the working group report-out file on the PHMSA research program webpage for this forum.

Gap #1 – Reducing False Alarms of Leak Detection Systems (Technology/Knowledge)

Gap #2 – Leak Detection for New and Existing Systems (Technology/Knowledge/Standards)

Gap #3 – Smart System Development (Technology)

Gap #4 – Mobile Based Leak Detection System Testing (Technology)

WG#3 – Anomaly Detection/Characterization

Leader: Jerry Rau, Director, Interstate Pipeline Integrity and Corrosion Services, Energy Transfer

Leader: Francois Rongere, R&D & Innovation Manager, Gas Operations,
Pacific Gas & Electric Company

Audience participants in this group discussed the following areas: inside or outside (through coating) the pipe technology to better detect, size and shape anomalies; Burst testing to improve remaining strength calculations; and Improving approaches to interpret integrity management data such as Risk Based Design Assessments.

The group identified five gaps for future research depicted below. More details on the presentations given within the group and the identified gaps are available for download in the working group report-out file on the PHMSA research program webpage for this forum.

Gap #1 – Improve and develop ILI to locate and size girth weld, ERW, and Long seam defects including cracks and in pipe body (Technology)

Gap #2 – In the Ditch Validation methodology for the determination of sizing and Probability Of Detection (POD) (Technology)

Gap #3 – Improve and develop ILI to locate and size metal loss features including complex long defects and dents (Technology)

Gap #4 – ILI Validation methodology for the determination of sizing and POD (Technology)

Gap #5 – Above-ground detection tools including coating disbondment and metal loss for all metals including cast iron graphitization (Technology)

WG#4 – Anomaly Repair & Remediation

Leader: Steve Rapp, Manager Metallurgical Services and Quality Assurance, Spectra Energy

Leader: Phil DePriest, Integrity, Damage Prevention & Risk Manager, Marathon Pipe Line LLC

Audience participants in this group discussed the following areas: understanding how to improve repair integrity and long term fitness for service. The group also discussed further exploring the use of composites, health monitoring within repair options and the use of liners for rehabilitation.

The group identified three gaps for future research depicted below. More details on the presentations given within the group and the identified gaps are available for download in the working group report-out file on the PHMSA research program webpage for this forum.

Gap #1 Threat/Anomaly Mitigation Decision Making Process (Standards)

Gap #2 – Considerations for Pre-Regulation Pipe (Standards)

Gap #3 –Trenchless Renewal/Rehabilitation Methods for Piping Systems (Technology)

WG#5 – Design/Materials/Welding-Joining/Valves

Leader: Jim Fekete, Leader, Structural Materials Group, Materials Reliability Division, National Institute of Standards and Technology

Leader: Yong-Yi Wang, President, Center for Reliable Energy Systems

Audience participants in this group discussed the following areas: creating or improving design approaches (Strain Based/Limit State/ Risk Based Design Assessments); Improving metallic and non-metallic materials and expanding usage; Improving the welding or joining process and usage with new materials; Impacts to materials from alternative products such as biofuels, hydrogen or CO₂; and issues with valve performance and actuation.

The group identified six gaps for future research depicted below. More details on the presentations given within the group and the identified gaps are available for download in the working group report-out file on the PHMSA research program webpage for this forum.

Gap #1 – Strain-based design and assessment (SBDA) of segments of pipelines with and without fittings (General Knowledge, Guidelines/Standards)

Gap #2 – Interaction of high longitudinal strain and anomalies from corrosion and mechanical damage (General Knowledge, Guidelines/Standards)

Gap #3 – Effects of hydrocarbon permeation on plastic pipe strength and fusion performance (General Knowledge, Guidelines/Standards)

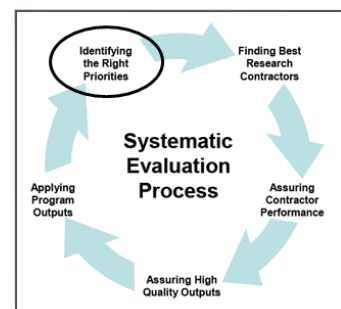
Gap #4 – Advanced pipeline sensing (line break detection) systems (Technology/General Knowledge)

Gap #5 – Characterization of linepipe toughness for fracture arrest assessment of modern high toughness steels (Technology/ Standards)

Gap #6 – Fatigue study of steels and welds in hydrogen environment (General Knowledge, Guidelines/Standards)

Next Steps

The forum is Step 1 in PHMSA's process for successful research outcomes. It should be noted that identifying the right priorities in this manner is a form of peer review prior to soliciting for new research. Stakeholder driven consensus on what topics to solicit is key in leveraging resources, existing efforts and for removing duplication. PHMSA will now review the findings from the forum in preparation of its next research solicitation. The details illustrated in the working group report out files will drive the development of synergies necessary for comprehensive proposals and ultimately good research projects that align with the current needs for pipeline safety. When ready the solicitation will be posted at <https://www.fbo.gov/> with additional requirements posted therein.



Acknowledgments

The forum would not be possible without the volunteered time and efforts coming from the steering committee. The representation coming from these organizations were instrumental in searching and securing speakers and working group leaders. Both PHMSA and NAPSIR are grateful for this effort and comprehensive recommendations for the forum.

American Gas Association
American Petroleum Institute
American Public Gas Association
Department of Commerce National Institute of Standards and Technology
Department of Transportation Pipeline and Hazardous Materials Safety Administration
Interstate Natural Gas Association of America
National Association of Pipeline Safety Representatives
Northeast Gas Association/NYSEARCH
Operations Technology Development
Pipeline Research Council International