Peer Review Report

Pipeline & Hazardous Materials Safety Administration

Pipeline Safety Research & Development Program

Peer Reviews Conducted
April 11 & 24, 2012

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Pipeline and Hazardous Materials Safety Administration's (PHMSA) Pipeline Safety Research and Development (R&D) Program is holding annual structured peer reviews of active research projects since 2006 in accordance with mandates by the Office of Management and Budget (OMB) and the Office of the Secretary of Transportation (OST) to maintain research data quality. PHMSA holds these reviews virtually via teleconference and the Internet saving time and resources. This execution is also working well with panelists, researchers, Agreement Officers' Technical Representatives and project co-sponsors. Most impressively, the PHMSA approach facilitates attendance from all U.S. time zones, Canada and Europe.

The annual peer review continues to build on an already strong and systematic evaluation process developed by PHMSA's Pipeline Safety R&D Program and certified by the Government Accountability Office. The 2012 peer review panel consisted of six government and academic experts. One panelist represented the Bureau of Safety and Environmental Enforcement, one panelist was a retired government representative from the National Institute of Standards and Technology with the remaining panelists representing independent experts, academics and the American Society of Mechanical Engineers.

Fifteen active research projects were peer reviewed by expert panelists using 13 evaluation criteria. These criteria were grouped within the following five evaluation categories:

1. Project relevance to the PHMSA mission.
2. Project management.
3. Approach taken for transferring results to end users.
4. Project coordination with other closely related programs.
5. Quality of project results.

The rating scale possibilities were "Ineffective," "Effective," "More than Effective" or "Very Effective." During the April 2012 review, the average program rating between all the evaluation categories was "More than Effective." For this year, 7 projects were rated "Very Effective" with 8 projects ranked as "More than Effective." The average sub-criteria scoring were also rated very high and underpin these findings. The majority of peered projects and the overall program rating is down from the "Very Effective" average seen since 2006 to "More than Effective." The program attributes this lower rating to lower scoring seen in the Project Management category. The majority of peered projects were renegotiated (to replace some funding sources with PHMSA funds) since the CY 2011 reviews by order of OST and caused a noticeable impact to project timelines and milestone achievement. Additional details are available in Section 7 and Tables 4, 5 and in Appendix C of this report.

PHMSA is very satisfied with the process performed to conduct these reviews, as well as the findings and recommendations provided by the panelists. PHMSA accepts the findings and recommendations summarized in the report. The official PHMSA response memorandum is found in Appendix A.

1.0 Introduction

The purpose of this document is to report findings from the research peer reviews held April 11 and April 24, 2012 for PHMSA's Pipeline Safety Research and Development Program. The findings and recommendations in this report are derived from the scoring and comments collected from the peer review panelists.

Department of Transportation (DOT) Operating Agencies (OA) are required to develop and execute a systematic process for peer reviews and for all influential and highly influential information that the OA plans to disseminate in the foreseeable future.

Through the Information Quality Act[1], Congress directed the Office of Management and Budget (OMB) to "provide policy and procedural guidance to Federal agencies for ensuring and maximizing the quality, objectivity, utility, and integrity of information, (including statistical information) disseminated by Federal agencies." A resulting OMB Bulletin, titled "Final Information Quality Bulletin for Peer Review," was issued, that prescribe required procedures for Federal programs.

The Office of the Secretary of Transportation (OST) produced procedures governing modal implementation of this OMB Bulletin. These procedures, as well as the OMB Bulletin, serve as the basis and justification for the PHMSA Pipeline Safety R&D Program peer reviews.

The purpose of these peer reviews is to uncover technical problems to keep projects on target or aligned with stakeholder needs and to give technical guidance using technically competent and independent, objective experts. These reviews are held annually for active research projects and usually occur in the second quarter of each calendar year.

2.0 Research Program Background

PHMSA regulates safety in the design, construction, operation and maintenance, and spill response planning for over 2.5 million miles of natural gas and hazardous materials pipelines. It is focused on the continual reduction in the number of incidents on natural gas and hazardous liquid pipelines resulting in death, injury, or significant property damage. Additionally PHMSA aims to reduce spills that harm the environment.

The vision of the PHMSA Pipeline Safety R&D Program is to support the pipeline safety mission of PHMSA, which is "to ensure the safe, reliable, and environmentally sound operation of America's energy transportation pipelines." The mission of the PHMSA Pipeline Safety R&D Program is "to sponsor research and development projects focused on providing near-term solutions that will improve the safety, reduce environmental impact, and enhance the reliability of the Nation's pipeline transportation system."

PHMSA has regulatory responsibility for the safety of natural gas and hazardous liquid pipelines. Over the past several years, PHMSA has strengthened its role in assuring the safety of the Nation's pipeline system in numerous ways, including promulgating new regulations on integrity

[1] Pub. Law. No. 106-554-515(a)

management.[2,3,4] These new regulations, together with the new inspection processes being used by regulators to evaluate operator compliance, rely on operator access to new technologies that support improved safety and integrity performance and on regulator access to information on the appropriate use and limitations of these technologies. To address the need for new integrity-related technologies and information on the validity of these technologies, Congress expanded the support for the PHMSA Pipeline Safety R&D Program in 2002.[5] As authorized by Congress, PHMSA sponsors research and development projects focused on providing near-term solutions that will increase the safe, reliable, and environmentally sound operation of America's energy transmission and distribution pipelines.

The R&D program contributes directly to the PHMSA mission by pursuing three program objectives:

1. Fostering the development of new technologies that can be used by operators to improve safety performance and to more effectively address regulatory requirements.
2. Strengthening regulatory requirements and related national consensus standards.
3. Promoting and improving the state of knowledge for pipeline safety officials so industry and regulatory managers and PHMSA pipeline safety field inspectors can make better decisions with safety issues and resource allocation.

The R&D Program is organized around seven R&D program elements. Each program element has associated safety issues, technology needs or gaps, and R&D opportunities. Ongoing and future planned projects are linked to at least one of these program elements. The program elements reflect the responsibilities of DOT in the Five-Year Interagency R&D Program Plan[6] and guidance from pipeline experts and stakeholder groups.

Program goals are associated with each program element. The goals define the desired outcomes for the R&D projects. Each goal bears a direct relationship to longer-term enhancement of pipeline safety. Table 1 identifies these program elements and the improvements desired.

[2] "Pipeline Integrity Management in High Consequence Areas for Hazardous Liquid Operators" (49 CFR Part 195); Rules effective May 29, 2001, and February 15, 2002 . <http://primis.phmsa.dot.gov/iim/ruletextamended.htm>
[3] "Pipeline Safety: Pipeline Integrity Management in High Consequence Areas (Gas Transmission Pipelines)"; Final Rule. December 15, 2003. < http://primis.phmsa.dot.gov/gasimp/docs/GasTransmissionIMRule.pdf>
[4] "Pipeline Integrity Management in High Consequence Areas (Gas Transmission Pipelines)". Final Rule (as amended), May 26, 2004. <http://primis.phmsa.dot.gov/gasimp/docs/FinalRuleAmended_gas_full.pdf>
[5] Pipeline Safety Improvement Act of 2002 < http://ops.dot.gov/Pub_Law/107_cong_public_laws.pdf>
[6] Five Year Interagency R&D Program Plan < http://primis.phmsa.dot.gov/rd/psia.htm

Table 1. Program Elements of PHMSA Pipeline Safety R&D Program		
	Program Element	**Program Element Goal**
1.	Damage Prevention	Reduce the likelihood of incidents and accidents resulting from excavation damage and outside force.
2.	Pipeline Assessment and Leak Detection	Identify and locate critical pipeline defects using inline inspection, direct assessment, and leak detection.
3.	Defect Characterization and Mitigation	Improve the capability to characterize the severity of defects in pipeline systems and to mitigate them before they lead to serious incidents or accidents.
4.	Improved Design, Construction, and Materials	Improve the integrity of pipeline facilities through enhanced materials, and techniques for design and construction.
5.	Enhanced Operation Controls and Human Factors Management	Improve the safety of pipeline operations through enhanced controls and human factors management.
6.	Risk Management & Communications	Reduce the probability of incidents and accidents, and mitigate the consequences of hazards to pipelines.
7.	Safety Issues for Emerging Technologies	Identify and assess emerging pipeline system technologies for opportunities to enhance safety.

More information on the program strategy is outlined in the R&D Program Strategic Plan and on the program website at http://primis.phmsa.dot.gov/rd/

Research Program Quality

While the program addresses the general strategy, a systematic evaluation process has been designed and implemented for raising and validating program quality. The process contains five steps and follows research projects from their inception to their resulting implementation. Each step of this systematic process ensures that project outcomes will be of high quality, relevant to PHMSA's mission, and applied to the appropriate end users.

Figure 1 identifies the steps in the systematic evaluation process and how it follows the lifecycle of research projects. Please visit http://primis.phmsa.dot.gov/rd/evaluation.htm to view more information on this process.

Figure 1. Systematic Evaluation Process

The quality of the research projects is first established while identifying the right priorities. This pre-solicitation input at joint Government and industry R&D forums and other meetings collaboratively identifies the right priorities and structures the projects to meet end user technical needs. This allows government and industry pipeline stakeholders to develop a consensus on the technical gaps and challenges for future R&D. It also minimizes duplication of programs, leverages funds, broadens synergies and factors ongoing research efforts with other agencies and private organizations.

Appropriate priority and good project design are refined while finding the best research contractors. A merit review panel comprised of representatives from Federal and State agencies, industry operators, and trade organizations uses strong evaluation criteria to review research white papers and proposals.

PHMSA uses its Management Information System (MIS) to assure that awarded projects are performing well. The MIS electronically monitors and tracks contractor performance as the project moves toward completion. This system provides the necessary oversight so that specific contractual milestones and contract accounting are systematically followed as prescribed in the award documents. The system design improves and maintains program quality, efficiency, accounting and accountability. Additional oversight is provided by Agreement Officers' Technical Representatives (AOTRs) who are trained, certified, and designated to each project in accordance with the Federal Acquisition Regulations.

The peer review is designed to further improve quality and keep research projects on track to meet their ultimate goal(s). If the first three steps of the systematic evaluation process are applied correctly and efficiently, PHMSA pipeline safety research projects have a higher probability of being successful which means that the results are used by end users.

3.0 Peer Review Panelists

Peer review panelists are chosen based on three criteria: expertise, balance, and independence. Specifics for choosing panelists are derived from the OMB Bulletin and panelists can range from academics to active and/or retired personnel from regulators, academics, independent consultants and standards developing organizations.

The 2012 peer review panel consisted of six government and academic experts. One panelist represented the Bureau of Safety and Environmental Enforcement, one panelist was a retired government representative from the National Institute of Standards and Technology with the remaining panelists representing independent experts, academics and the American Society of Mechanical Engineers. Table 2 identifies the panelists.

Each panelist provided a short biography describing their work history and qualifications of technical knowledge. These biographies are included in Appendix B.

Table 2. Peer Review Panelists

	Name	Affiliation
1	Timothy Steffek	Department of the Interior, Bureau of Safety and Environmental Enforcement
2	David McColskey	Department of Commerce, National Institute of Standards and Technology (retired)
3	Louis E. Hayden, Jr., Ph.D., P.E.	Lafayette College, Easton, PA & American Society of Mechanical Engineers
4	Jay N. Meegoda, Ph.D., P.E.	New Jersey Institute of Technology, Newark, NJ
5	Salvatore Salamone, Ph.D.	State University of New York at Buffalo
6	Ahmed Nisar, M.S., P.E.	Independent Consultant

4.0 Panelist Charge

The Peer Review Panelist charge, initially developed in December 2005 and revised annually, is provided to each panelist prior to the review. It contains specific instructions regarding what is expected in terms of their review. This charge is important for the following reasons:

1. It focuses the review by presenting specific questions and concerns that PHMSA expects the peer reviewers to address.
2. It invites general comments on the entire work product. The specific and general comments should focus mostly on whether the scientific and technical studies have been applied in a sound manner.

The charge is a separate document not attached to this report. It is publicly available for each year's review at http://primis.phmsa.dot.gov/rd/annual_peer_review.htm and may be revised after researcher and panelist post review feedback.

5.0 Scope of the Peer Review

During the annual peer review of projects, the members of the panel reviewed focused, high-level presentations from researchers addressing 13 evaluation criteria within five specific evaluation categories. Presentations take no more than 20 minutes with ten minutes of panelist questions including any possible written public questions. In its entirety, the review of each project is approximately 2.5 hours. This entails the time to review provided project background information including reporting, the advanced copy of the review slides, the actual 30 minutes of review and questioning from the panel and time in the post review including possible follow up questioning, consensus review meeting and review of the peer review report. An underlying R&D Program objective is not to compare one project to another, but to provide the best assessment of each project's performance addressing the specific criteria. A scorecard for rating performance on the specific categories is provided. Each category has equal rating from one to five. The scorecard included the following questions in five performance categories:

1. Project relevance to PHMSA mission.

- Is the project still relevant for enhancing pipeline safety and or protecting the environment?
- Does the project address a technology gap, consensus standard or produce general knowledge?

2. Project management.

- Is the project making progress toward the work scope objectives and the PHMSA goals?
- Is the project being managed on budget and schedule?

3. Approach taken for transferring results to end users.

- Is there a plan for dissemination of results, including publications, reporting, and patents?
- How much end user involvement is incorporated into the work scope?
- For results that may include marketable products and technologies, are commercialization plans established?

4. Project coordination with other related programs.

- Does the project build on, or make use of, related or prior work?
- Is the work of the project being communicated to other related research efforts?
- Has consideration been given to possible future work?

5. Quality of project results.

- Are the intended results supported by the work performed during the project?
- Are the intended results consistent with scientific knowledge and/or engineering principles?
- Are the intended results presented in such a manner as to be useful for identified end users?

Essentially, projects rating well on these criteria are expected to have a high likelihood of success in the objectives they were designed to accomplish.

These criteria will provide a numeric rating, which will be converted and illustrated as "Ineffective," "Effective," "More than Effective," or "Very Effective." This rating conversion is illustrated in Table 3.

Table 3. Peer Review Rating Conversion	
Rating Scale	
Very Effective	4.5 - 5.0
More than Effective	3.0 – 4.4
Effective	1.9 - 2.9
Ineffective	0.0 – 1.8

The rating scale is defined to illustrate how well a project is addressing the goals of the peer review.

Very Effective
The most clarity of method in accomplishing the purpose; producing the intended or expected result in a superior manner.

More than Effective
Better, clearer and more distinct in accomplishing the purpose; producing the intended or expected result in more than a satisfactory manner.

Effective
Adequate to accomplish the purpose; producing the intended or expected result in a satisfactory manner.

Ineffective
Not effective; not producing desired results; ineffectual or lacking in the details to support a satisfactory desired outcome.

6.0 Associated Research

Specific research project subject matter will vary from one annual peer review to another. Generally, subject matter falls within the eight program elements shown in Table 1. Technical issues usually address metallurgical, structural, technological, and risk-based subjects commonly seen in the pipeline industry.

The research peered during the April 2012 review varied among welding, corrosion mitigation, biofuels, technological, and general knowledge focused projects. A short description of each peer reviewed project is found in Appendix D.

7.0 Peer Review Findings

During the April 2012 review, the average program rating between all the evaluation categories was “More than Effective.” For this year, 7 projects were rated “Very Effective” with 8 projects ranked as “More than Effective.” The average sub-criteria scoring were also rated very high and underpin these findings. The majority of peered projects and the overall program rating is down from the “Very Effective” average seen since 2006 to “More than Effective.” The program attributes this lower rating to lower scoring seen in the Project Management category. The majority of peered projects were renegotiated (to replace some funding sources with PHMSA funds) since the CY 2011 reviews by order of OST and caused a noticeable impact to project timelines and milestone achievement. Table 4 summarizes the overall program performance based on the summary of the reviewed projects. Table 5 itemizes the project ranking order, where projects of the same score have an equal ranking.

At the time of the reviews, roughly two thirds of the projects were approximately 40-60 percent complete with the remaining third 70 to 100 percent complete.

The panelists made several recommendations in the course of the review. These recommendations were categorized into “Strong” and “Weak” points and were associated with each project. However, none of these comments identified critical actions required to salvage a project from failing, but recommended actions to further improve upon good performance.

Appendix C, Table 6 itemizes the strong and weak points collected from all 15 projects reviewed by the nine panelists. These points were consistent among several panelists and are reflected in the scoring of multiple evaluation categories. Any specific recommendations will be disseminated to researchers and AOTRs as necessary so individual decisions on scope changes can be determined.

Table 4. Summary of Total Average Score & Rating for the Review Categories and Sub-Criteria		
Review Categories and Sub-Criteria	**Score**	**Rating**
1. Project relevance to PHMSA mission.	**4.6**	**Very Effective**
1.1. How well does the project illustrate its relevance for enhancing pipeline safety and or with protecting the environment?	4.7	Very Effective
1.2. How well does the project describe its relevance to research program goals (technology, consensus standard or produce general knowledge)?	4.4	More than Effective
2. Project management.	**4.2**	**More than Effective**
2.1. How well is the project making progress toward the work scope objectives?	4.4	More than Effective
2.2. How well is the project being managed (on budget and schedule)?	4.0	More than Effective
3. Approach taken for transferring results to end users.	**4.3**	**More than Effective**
3.1. Is there a plan for dissemination of results, including publications, and reporting?	4.4	More than Effective
3.2. How much end user involvement is incorporated into the work scope?	4.2	More than Effective
3.3. For results that may include marketable products and technologies, are commercialization or U.S. Patent plans established?	4.4	More than Effective
4. Project coordination with other related programs.	**4.5**	**Very Effective**
4.1. Does the project build on, or make use of, related or prior work?	4.9	Very Effective
4.2. Is the work of the project being communicated to other related research efforts?	4.5	Very Effective
4.3. Has consideration been given to possible future work?	4.1	More than Effective
5. Quality of project results.	**4.5**	**Very Effective**
5.1. Are the intended results supported by the work performed during the project?	4.6	Very Effective
5.2. Are the intended results consistent with scientific knowledge and/or engineering principles?	4.5	Very Effective
5.3. Are the intended results presented in such a manner as to be useful for identified end users?	4.4	More than Effective
Program Summary:	**4.4**	**More than Effective**

Table 5. Summary Ranking & Rating of Individually Reviewed Research Projects					
Rank	**Project ID**	**Project Title**	**Contractor**	**Rating**	**Score**
1	DTPH56-09-T-000005	Performance Evaluation of High-Strength Steel Pipelines for High-Pressure Gaseous Hydrogen Transportation	Center For Reliable Energy Systems	Very Effective	4.9
1	DTPH56-10-T-000001	Cost-Effective Techniques for Weld Property Measurement and Technologies for Improving Weld HE and IGSCC Resistance for Alternative Fuel Pipelines	University of Tennessee	Very Effective	4.9
2	DTPH56-10-T-000008	Completion of Development of Robotics Systems for Inspecting Unpiggable Transmission Pipelines	Northeast Gas Association/NYSEARCH	Very Effective	4.8
2	DTPH56-10-T-000009	MWM-Array Characterization of Mechanical Damage and Corrosion	JENTEK Sensors, Inc.	Very Effective	4.8
3	DTPH56-10-T-000010	Development of a Model to Accurately Predict the Conditions of Carrier Pipe within Casings Based on Conditions at the Casing Ends	Southwest Research Institute	Very Effective	4.7
3	DTPH56-10-T-000016	Realistic Strain Capacity Models for Pipeline Construction and Maintenance	Center For Reliable Energy Systems	Very Effective	4.7
4	DTPH56-10-T-000017	Fuelfinder: Remote Leak Detector for Liquid Hydrocarbons	Physical Sciences, Inc.	Very Effective	4.6
5	DTPH56-10-T-000019	Advanced Development of PipeGuard Proactive Pipeline Damage Prevention System	Northeast Gas Association/NYSEARCH	More than Effective	4.2
5	DTPH56-10-T-000021	Advanced Learning Algorithms for the Proactive Infrasonic Pipeline Evaluation Network (PIGPEN) Pipeline Encroachment Warning System	Physical Sciences, Inc.	More than Effective	4.2
6	DTPH56-10-T-000018	Odorant Effectiveness	Gas Technology Institute	More than Effective	4.1
6	DTPH56-10-T-000022	Development and Field Testing of a Highly Sensitive Mercaptans Instrument	Northeast Gas Association/NYSEARCH	More than Effective	4.1
7	DTPH56-10-T-000003	Feasibility of Chemical Inhibition of Ethanol SCC	DNV Columbus	More than Effective	4.0

7	DTPH56-11-T-000003	Comprehensive Study to Understand Longitudinal ERW Seam Failures	Battelle Memorial Institute	More than Effective	4.0
8	DTPH56-09-T-000003	New Design and Construction Techniques for Transportation of Ethanol and Ethanol/Gasoline Blends in New Pipelines	Electricore, Inc.	More than Effective	3.9
8	DTPH56-10-T-000014	Selection of Pipe Repair Methods	Operations Technology Development	More than Effective	3.9

8.0 PHMSA Official Response to Panelists Findings and Recommendations

Being the sixth structured peer review of its pipeline safety R&D program, PHMSA is satisfied with the process for conducting these reviews as well as the findings and recommendations provided by the peer review panelists. PHMSA accepts these findings and recommendations summarized in the report. The panel indicated that some immediate actions can be taken to further safeguard research projects in achieving contractual milestones. These recommendations are summarized in Appendix C, Table 6. PHMSA will address specific recommendations with the project co-sponsor and the researcher and will use these to improve the likelihood that project scopes can achieve proposed goals. The official PHMSA response memorandum can be found in Appendix A.

PHMSA will continue refining the annual peer review process as needed and by incorporating feedback submitted by the researchers and peer review panelists. Other specific recommendations from panelists will be disseminated to researchers and AOTRs.

A number of initiatives are planned to provide further guidance on commercialization of technology projects and better coordination with projects strengthening standards. These program initiatives will bring transparency to the panel's recommendations. PHMSA can still make improvements even with high annual ratings.

APPENDIX A

PHMSA Acceptance Memo

U.S. Department of Transportation
Pipeline and Hazardous Materials
Safety Administration

1200 New Jersey Ave, S.E.
Washington, D.C. 20590

MEMORANDUM FOR THE RECORD

From: Jeffrey D. Wiese, Associate Administrator for Pipeline Safety

Subject: Pipeline Safety Research Program Peer Reviews, April 11 & 24, 2012

SUMMARY

The Pipeline and Hazardous Materials Safety Administration (PHMSA) is pleased with the process for conducting these reviews as well as the findings and recommendations provided by the peer review panelists. The CY 2012 average quality rating for the reviewed projects is "More Than Effective," the second highest possible rating indicating that these projects are performing well and on track to deliver desired results. In addition, a number of suggestions were identified by the panelists for maintaining or improving research quality. This rating is down from the prior year due to impacts to project management resulting from addressing the U.S. Department of Transportation Secretary Ray LaHood actions toward the PHMSA program.

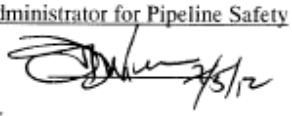
PHMSA will use feedback submitted by researchers and panelists to refine the process for holding annual peer reviews. Since none of the reviewed projects are rated "Ineffective" no immediate project modifications are warranted. Specific recommendations from panelists will be disseminated to researchers and Agreement Officer's Technical Representatives to decide if any scope changes are warranted.

PHMSA will continue refining the process, the review criteria and the guidance so future review outcomes better support our goals.

RECOMMENDATION

The PHMSA Pipeline Safety Program accepts the findings and recommendations summarized in the Peer Review Report.

The Associate Administrator for Pipeline Safety

APPROVED: 

DISAPPROVED: _____

COMMENTS: _____

DATE: _____

APPENDIX B

Peer Review Panelist Bios

Timothy Steffek

Timothy graduated from The Pennsylvania State University in 2009 with a B.S. in Petroleum and Natural Gas Engineering. He has worked for the Department of the Interior's Bureau of Safety and Environmental Enforcement since 2009. He is leading a wide variety of projects related to Operational Safety and Engineering Research for the Technology Assessment and Research (TA&R) Program.

David McColskey

David McColskey, now retired but formerly a Physical Scientist at the National Institute of Standards and Technology (NIST), has over 43 years experience as a materials researcher. This experience has been in the measurement of properties of materials in a variety of environments (cryogenic to elevated temperatures, gaseous hydrogen, and gaseous and liquid oxygen), on a variety of specimen scales (micrometer-size thin films to 9-meter-long wide-plate specimens) and on a variety of materials (ferrous and non-ferrous alloys, glass-fiber, graphite-fiber and aramid-fiber composites and combinations of each of these). He has experience in NDE measurement techniques, specifically acoustic emission on bridge steels and on composite tubulars for offshore risers. He has been principal investigator of several projects, including the Superconducting Magnetic Energy Storage (SMES) composite insulator program, and he led the NIST-Boulder effort in the analysis of the steels for the World Trade Center collapse investigation. He is currently co-PI on the establishment of a standard test method for the use of fire-resistant steels in high-rise construction and was co-PI on the establishment of a high pressure hydrogen test facility at NIST-Boulder under a proposed Hydrogen Initiative. In addition, he was co-PI on the DOT/PHMSA funded research effort on high-strength pipeline steels. He has authored or co-authored numerous papers on properties of materials, acoustic emission, and thin-films for electronic packaging.

He is currently an active member of ASTM E28 and serves as a U.S. delegate to ISO Committees TC164 on mechanical properties testing and TC 58 on gas cylinders.

Louis E. Hayden Jr, Ph.D., P.E.

Louis Hayden has over 35 years of experience as a mechanical engineer, project manager and vice president of engineering. This experience has been in the design, analysis, fabrication, installation, start-up and maintenance of industrial piping and equipment. Systems have included above and below ground piping and pipelines in process plants, fossil and nuclear power plants, transmission pipelines and industrial manufacturing facilities. He has managed and directed the

manufacturer of high yield pipeline pipe fittings and developed new pipeline closure and flange products as well as managed the efforts of new product development and research groups.

Currently a consulting mechanical engineer and adjunct professor of mechanical engineering at the Lafayette College, Easton, PA. Previous employers have been Fluor Corp., Houston; Brown&Root Inc., Houston; Tube Turns, Inc., Louisville; Victaulic Corp., Easton, PA.

Member of ASME B31 Piping Standards Committee since 1985
Vice Chair ASME B31 Piping Standards Committee 1990-1993 and 2001-2004
Chairman ASME B31 Piping Standards Committee 1993-2001
Member ASME Board on Pressure Technology Codes and Standards 1993-2005
Vice Chair ASME Board on Pressure Technology Codes and Standards 2005-2008
Vice President and Chair of ASME Board on Pressure Technology Codes and Standards 2008 - 2011
Chairman ASME Task Group for development of B31.12 Hydrogen Piping and Pipeline Code 2006 - present
Member Board on Pressure Technology Codes and Standards Materials for Hydrogen Service Task Group

Salvatore Salamone, Ph.D.

Dr. Salvatore Salamone is an Assistant Professor at the Department of Civil, Structural and Environmental Engineering, at the SUNY at Buffalo. He earned a Laurea (MS) in Civil Engineering from University of Palermo in 2002, and a PhD in Structural Engineering from of Palermo in 2007. He was a postdoctoral fellow at the University of California San Diego. He is a member of the, the Acoustical Society of America, the American Society for Nondestructive Testing (ASNT), American Concrete Institute, American Society of Civil Engineers and Consortium of Universities for Research in Earthquake Engineering. He received the 2011 ASNT Faculty Grant. His primary research interests are in Structural Health Monitoring, Non-Destructive Evaluation, Ultrasonic sensing methods for smart structures, Digital signal processing and pattern recognition. He is currently PI on the US-DOT funded research effort on corrosion assessment in post-tensioned concrete structures using ultrasonic guided waves-based methods. He has published 40+ papers in international peer-reviewed journals and conferences.

Dr. Jay N. Meegoda, Ph.D., P.E.

Dr. Jay N. Meegoda, P.E., is a professor of civil and environmental engineering at NJIT and has been working as educator, consultant and researcher in engineering for over 30 years. He utilizes scientific concepts and engineering technologies in his research to provide solutions to real world problems. Dr. Meegoda has worked with state and local governments, and foreign governments to provide technical input for broad range of problems. At NJIT, Dr. Meegoda as PI has successfully concluded several multidisciplinary research projects worth over $5M from agencies such as NSF, USEPA, US Army, FHWA, NJDOT and NJDEP that provided broader impact to the society. Some of those technologies are now extensively used while others are to

be commercialized. He has published over 150 papers. He had many research collaborations with many nations spanning all five continents. He received the research implementation award from the New Jersey Department of Transportation in 2011 for his Culvert Information Management Research, the best theoretical paper award from the Environmental and Water Resources Institute of ASCE in May 2012 for his collaborative research with China and the best practice paper award from the Environmental and Water Resources Institute of ASCE in May 2001 for the paper describing the results of one USEPA SITE demonstration project. He was instrumental in setting up the NJIT chapter of Engineers without Borders and is currently the faculty advisor for the chapter.

Ahmed Nisar, M.S., P.E.

Mr. Nisar is a Principal Engineer at InfraTerra, Inc., a firm specializing in infrastructure reliability. He obtained his MS degree in Structural Engineering and Mechanics of Materials (SEMM) from the University of California at Berkeley in 1988. He has 25 years of consulting experience in structural engineering and structural dynamics. He has directed numerous multi-disciplinary studies related to infrastructure reliability and has been a technical lead on projects ranging from probabilistic seismic hazard analysis, probabilistic flood hazard assessment, non-linear soil-structure interaction analysis for pipelines and natural hazard mitigation design for lifeline infrastructure. He is a specialist in seismic response of pipelines for oil and gas and water/wastewater infrastructure. His expertise lie in the design of major pipelines subjected to large permanent ground deformation such as surface rupture at major fault crossings. Mr. Nisar has extensive experience with codes and criteria documents applicable to structural/earthquake engineering and has performed several research studies funded by the National Science Foundation (NSF), Building Seismic Safety Council (BSSC), California Geological Survey (formerly California Division of Mines and Geology) and the California Department of Transportation (CalTrans). He is a contributing author of a ASCE special publication on seismic design and evaluation of petrochemical facilities and a National Institute of Standards and Technology (NIST) publication on reliability and restoration of water supply systems for fire suppression and drinking following earthquakes. He has performed post-earthquake reconnaissance to assess the performance of built infrastructure from several major earthquakes.

APPENDIX C

Table 6 – Peer Reviewed Project Strong and Weak Points

(In Day 1-2 Agenda Order)

Project Title	Strong Points	Weak Points
MWM-Array Characterization of Mechanical Damage and Corrosion - JENTEK Sensors, Inc.	High likelihood of commercialization. Builds well off of prior work. Strong end user involvement.	Some uncertainties in application context with detecting though thick coatings and cracks in welds. Overall details low with dissemination of results
Feasibility of Chemical Inhibition of Ethanol SCC – DNV Columbus	Testing regime very well matched to expected pipeline conditions. Builds well off of prior work. Strong end user involvement.	Delay in project timeline. Not much mentioned about communication with other related efforts. More information about how long the inhibitor will last in presence of ethanol. Final validation in real system may be warranted. More work needed on potential impacts the inhibitor may have to automotive fuel.
Fuelfinder: Remote Leak Detector for Liquid Hydrocarbons – Physical Sciences, Inc.	High likelihood of commercialization. Great technology lineage to prior successes.	More emphasis on presenting progress to potential end users to work out false positives and overall details low with dissemination of results.
Cost-Effective Techniques for Weld Property Measurement and Technologies for Improving Weld HE and IGSCC Resistance for Alternative Fuel Pipelines – University of Tennessee	Testing regime very well matched to expected pipeline conditions. Builds well off of prior work. Strong end user involvement such as ASME.	More confirmation needed to validate how long hydrogen stays in samples during testing. Need to compare spiral notch testing more with standard toughness testing in hydrogen.
Performance Evaluation of High-Strength Steel Pipelines for High-Pressure Gaseous Hydrogen Transportation - Center For Reliable Energy Systems	Promising results. Testing regime very well matched to expected pipeline conditions. Strong end user involvement.	More information on the model development should be shared with end users.
Realistic Strain Capacity Models for Pipeline Construction and Maintenance - Center For Reliable Energy Systems	Promising results. Strong end user involvement. Good communication with other related efforts.	Project is over budget at the time of the reviews. Possible more consideration to how regulatory bodies

		will implement results (i.e. performance vs. prescriptive based)
Project Title	**Strong Points**	**Weak Points**
Development of a Model to Accurately Predict the Conditions of Carrier Pipe within Casings Based on Conditions at the Casing Ends - Southwest Research Institute	Promising results. Strong end user involvement.	More data need to better validate the developing model. More validation in the field warranted.
Advanced Development of PipeGuard Proactive Pipeline Damage Prevention System – Northeast Gas Association/ NYSEARCH	Promising results. Strong end user involvement.	Any cost benefit analysis with competing technology available? Innovation level seems low. Need for longer distances of tech application and procedures for operators to respond to remote areas.
Completion of Development of Robotics Systems for Inspecting Unpiggable Transmission Pipelines – Northeast Gas Association/ NYSEARCH	High likelihood of commercialization. Builds well off of prior work. Strong end user involvement. Good project management.	Completing the field testing in real pipelines.
Development and Field Testing of a Highly Sensitive Mercaptans Instrument – Northeast Gas Association/ NYSEARCH	Promising results for use with inspections.	More emphasis on presenting progress to potential end users and overall details low with dissemination of results. There is a large bit of work to complete in order to commercialize.
Advanced Learning Algorithms for the Proactive Infrasonic Pipeline Evaluation Network (PIGPEN) Pipeline Encroachment Warning System – Physical Sciences, Inc.	Builds well off of prior work. Strong end user involvement.	Any cost benefit analysis with competing tech available? Project is behind schedule. Overall details low with dissemination of results.
Selection of Pipe Repair Methods - Operations Technology Development NFP	Good job of showing lineage to prior work and connection to possible future work.	More emphasis on presenting progress to potential end users and overall details low with dissemination of results. The project scope is broad and general in nature. It appears that there is lack of focus, which may lead to a fairly general set of guidelines.

Project Title	Strong Points	Weak Points
Odorant Effectiveness – Gas Technology Institute	Promising results. Good update to decades old guidance.	More emphasis on how end users will qualitatively use results. Quality of obtained data should have a stronger consideration.
Comprehensive Study to Understand Longitudinal ERW Seam Failures – Battelle Memorial Institute	Promising results. Strong end user involvement. Good communication with other related efforts.	More information needed on answering if testing will compare to real pipeline conditions? Delays in project pose many questions with how future tasks will be accomplished.
New Design and Construction Techniques for Transportation of Ethanol and Ethanol/Gasoline Blends in New Pipelines – Electricore, Inc.	Strong end user involvement. Good application of prior results into new design criteria.	More emphasis on presenting progress to potential end users with developing procedures and overall details low with dissemination of results.

APPENDIX D

Peer Review Project Summaries
(In Day 1-2 Agenda Order)

Additional summaries and publicly available reports are available at:
http://primis.phmsa.dot.gov/matrix/

MWM-Array Characterization of Mechanical Damage and Corrosion

JENTEK Sensors Inc.

This project will advance the JENTEK Meandering Winding Magnetometer (MWM) -Array technology to provide quantitative characterization of corrosion and mechanical damage. This includes characterization through coatings/insulation; followed by higher resolution imaging with coatings/insulation removed. For mechanical damage, quantitative characterization includes geometric variations and multidirectional residual stresses (near the surface and deeper within the pipeline). In addition, this project will develop capability to detect cracks at damage sites. For corrosion, enhanced high resolution imaging of both external and internal corrosion will be developed for specific applications to support life management decisions. This team will build on demonstrated MWM-Array (and MR-MWM-Array) detection capabilities to deliver substantially enhanced characterization of damage and practical means for implementation. Matching funding will be provided by Chevron, BP, TransCanada, PRCI, GDF Suez and others.

Feasibility of Chemical Inhibition of Ethanol SCC

DNV Columbus

Using inhibitors to prevent Stress corrosion cracking (SCC) in pipeline transporting fuel grade ethanol (FGE) poses unique challenges in that the impact on the fuel end users and the limited solubility of some inhibitors in ethanol need to be considered. Thus, this project proposes to work with the inhibitor manufacturers, pipeline operators and possibly the end users in order to select inhibitors that can potentially prevent SCC and are acceptable based on technical and end user compatibility considerations. More importantly, the ability of the inhibitors to prevent SCC will be evaluated under flowing conditions created by jet impingement, which can simulate pipe flow conditions in the pipelines. The results will help identify the appropriate inhibitors, the optimum dosage and guide the application of inhibitors (e.g. batch vs. continuous) in operations. Furthermore, a method will be developed for rapid evaluation of inhibitors in FGE.

Fuelfinder: Remote Leak Detector for Liquid Hydrocarbons

Physical Sciences Inc.

The project goal is to develop a commercially successful Remote Methane Leak Detector (RMLDTM) platform to a general purpose hydrocarbon leak detector – FuelfinderTM. Fuelfinder will adopt recent advances in room-temperature diode laser technology operating near

3 microns to enable remote sensing of gasoline, petrochemicals, biodiesel, and ethanol leaks from pipelines with man-portable, mobile, and airborne platforms in a low-cost, commercially-viable product offering.

Cost-Effective Techniques for Weld Property Measurement and Technologies for Improving Weld HE and IGSCC Resistance for Alternative Fuel Pipelines

The University of Tennessee

Comprehensive knowledge of mechanical properties of pipeline steels in high-pressure hydrogen is essential for the structural integrity of a pressurized hydrogen transport system. This project focuses on obtaining much needed data on fracture toughness and fatigue life for weld regions. For testing of weld regions, cost-effective testing techniques developed in previous federal-funded programs will be further refined and applied to investigate the effects of pressure and temperature on the degradation of weld fracture toughness in high-pressure hydrogen. A novel cost-effective low-frequency fatigue test apparatus will be developed to determine the weld fatigue life under realistic in-service cyclic loading frequencies of hydrogen pipelines. These property data will be critical to support industry consensus standards for hydrogen transport via pipeline, and to support the design and maintenance operation by pipeline operators. In addition, advanced welding techniques will be demonstrated to control the weld residual stress and to tailor the weld microstructure for improving weld resistance to Hydrogen Effects and Inter Granular Stress Corrosion Cracking.

Performance Evaluation of High-Strength Steel Pipelines for High-Pressure Gaseous Hydrogen Transportation

Center for Reliable Energy Systems

The project addresses the most critical issues related to the safe and efficient transportation of hydrogen using pipelines. The objects are to: Produce performance data for materials used in hydrogen pipelines; Use mechanistic-based analysis procedures and models for correlating the test data and predicting material behaviors under practical conditions; and finally the test data and the analyses results will be used to enable informed updates and revisions of relevant codes and standards for industrial applications.

Realistic Strain Capacity Models for Pipeline Construction and Maintenance

Center for Reliable Energy Systems

Pipelines may experience large longitudinal strains in areas of large ground movements. Such movements may come from frost heave and thaw settlements in arctic regions, seismic activities, mine subsidence, etc. For offshore pipelines, large longitudinal strains may be induced by thermal expansion of the pipelines within certain spans. At least two failure modes are possible when pipelines are subjected to large longitudinal strains: tensile rupture and compressive buckling. These two failure modes are treated separately with different levels of refinement in the current industry practice. Some of the newly emerging tensile strain models incorporate the

effects of more material and geometric features of pipelines than most compressive strain models used in the industry.

In actual pipelines, the two failure modes, tensile rupture and compressive buckling, interact and work simultaneously. The main objective of this project is to develop a unified approach to the two failure modes and bring the compressive strain design models to the same level of refinement as the tensile strain design models. The industry and regulators are expected to benefit from the outcome of this project through (1) enhanced safety from the refined compressive strain design models and (2) effective allocation of resources to address the varying levels of possible threats to pipeline safety and integrity in the event of large ground movements.

Development of a Model to Accurately Predict the Conditions of Carrier Pipe within Casings Based on Conditions at the Casing Ends

Southwest Research Institute

The objective of this project is to develop a general model that will allow for the prediction of conditions in the middle section of a casing based on conditions at the casing ends. This model will also be capable of predicting the conditions in the entire casing (casing ends and middle section) based on the conditions outside of the casing. The locations and levels of cathodic protection depressions at downstream and upstream locations from the casing ends can also be predicted given the conditions away from the casing.

The model is to be developed starting from fundamental principles. It will be validated with field data gathered from operators. Following simplification of the model into easy-to-use tools such as operating charts, guidelines for field application of the tools will be developed. The tools and guidelines will permit field engineers to make predictions rapidly and allow them to apply the results into their integrity management plans.

Advanced Development of PipeGuard Proactive Pipeline Damage Prevention System

Northeast Gas Association/NYSEARCH

The program objective is to develop an in-ground warning system that uses advanced security technology to proactively warn against encroachment to transmission and distribution lines. The Senstar "PipeGuard™" technology addresses damage prevention monitoring issues of accuracy, reliability, cost, real-time response, ease of installation, response time and advanced data processing.

It is the objective of this program to improve Pipe Guard™ software, hardware and develop new techniques to meet distribution company needs in proactively monitoring critical pipeline sections and providing 24/7 alarm activity in the event of nearby 3rd party excavating.

Completion of Development of Robotics Systems for Inspecting Unpiggable Transmission Pipelines
Northeast Gas Association/NYSEARCH

The completion of a research, development and demonstration effort that was initiated in 2001 for the development of two robotic systems for the in-line, live inspection of unpiggable transmission natural gas pipelines, supported by PHMSA/DOT since 2004. Two robotic platforms have been developed: (a) Explorer II, which carries a remote field eddy current (RFEC) sensor for the inspection of 6" and 8" unpiggable pipelines, and (b) TIGRE, which carries a magnetic flux leakage (MFL) sensor for the inspection of 20" to 26" unpiggable pipelines. The work will allow certain design enhancements for Explorer II, identified through the field demonstrations that the systems underwent, as well as the development of commercial grade defect sizing algorithms for the RFEC sensor. The work will also complete the development of the TIGRE system and will carry out a series of field demonstrations in dead and live pipelines that will bring it to the point of commercial deployment. This work will be conducted by a team consisting of NYSEARCH/NGA and Invodane Engineering (IE), the commercializer of this technology.

Development and Field Testing of a Highly Sensitive Mercaptans Instrument
Northeast Gas Association/NYSEARCH

This project will development and field test a new portable, low-cost instrument for the measurement of hydrogen sulfites and mercaptans, which are routinely encountered in natural gas, renewable natural gas, biogas, landfill gas, etc. The instrument will allow the detection and measurement of such compounds at the part per billion (ppb) level, thus also serving as an artificial human nose. This highly innovative technology will greatly advance the state of the art, making ppb level measurements of mercaptans possible outside the realm of full size, benchtop laboratory grade, gas chromatograph instruments. Low levels of detection are needed in order to measure these compounds in alternative fuel gases where many times they exist as trace gases. In addition, such levels of detections are needed if the current practices of sniffing natural gas in order to determine appropriate level of odorization are to be replaced or enhanced. The work will build an engineering pre-commercial prototype system, based on an already proven concept, and will test it in the field. A follow up phase will be needed to build a market-ready instrument and commercialize it. This work will be conducted by a team consisting of NYSEARCH, the R&D organization within the Northeast Gas Association (NGA), and Applied Nanotech Inc. (ANI).

Advanced Learning Algorithms for the Proactive Infrasonic Pipeline Evaluation Network (PIGPEN) Pipeline Encroachment Warning System
Physical Sciences Inc.

Physical Sciences Inc. (PSI), with American Innovations Ltd. (AI) and NYSEARCH, are addressing the technology gap of Early Warning Damage Prevention Monitoring Systems, specifically Advanced Development of Algorithms for Detecting Digging Threats and Avoiding

Alarms. This research will implement and evaluate self-training algorithms in the Proactive Infrasonic Gas Pipeline Evaluation Network (PIGPEN) autonomous distributed seismic sensor system. PIGPEN provides real-time warning of unauthorized right-of-way encroachment and excavation activity near a pipeline. Early warning enables a response to the potential intrusion in time to prevent pipeline damage, and thus preclude the additional cost and risk of repairs. The ideal PIGPEN alarm system would activate an intruder notification with 100% reliability and no alarms. The project will enhance reliability by enabling PIGPEN to learn the characteristics of its local environment and optimize its intruder detection algorithms based on learned experience. Field tests are expected to demonstrate better than 97% alarm reliability with few alarms.

Selection of Pipe Repair Methods
Operations Technology Development

The research project will establish procedures and perform long-term tests to evaluate the performance of metallic and composite pipe repair methods, improve the selection and installation of the repair methods, and ultimately reduce the risks associated with faulty or ineffective repairs. The results will allow operators to properly select repair systems based on sound engineering tests. Working with the manufacturers will accelerate the implementation of the results that the industry needs regarding the products' long-term reliability. The work will benefit industries with transmission lines as well as utility distribution lines. The benefit of the results will not only be useful for the natural gas industry but will extend to cover liquid transmission pipes.

Odorant Effectiveness
Gas Technology Institute

The objective of the project is to provide a "Practical Pipeline Operator Guide" to manage odor fade issues associated with typical gas system operating conditions and materials of construction. This will require identification, prioritization, and quantification of the most important variables leading to odor fade. Ultimately, the project will develop a predictive model that can be used to counter odor fade, validate this model on a subset of variables, and incorporate a methodology to enable the validation of additional combinations of gas, system, and material scenarios. Ideally, the project results, guide, and validation data will also be incorporated into the next update of the American Gas Association (AGA) Odorization Manual (after discussions with the appropriate AGA committee).

Comprehensive Study to Understand Longitudinal ERW Seam Failures
Battelle Memorial Institute

The objective of the proposed project is to assist PHMSA in favorably closing National Transportation Safety Board (NTSB) Recommendation P-09-1 arising from the Carmichael MS pipeline rupture involving an ERW seam, which directed that PHMSA conduct a comprehensive study of ERW pipe properties and the means to assure that they do not fail in service. Three primary objectives –

1. Integrate industry and PHMSA data to quantify vintage seam failure statistics with focus on LFERW seams;
2. Understand longitudinal ERW seam failures and on that basis quantify the effectiveness of inspection and hydrotesting to manage integrity and ensure safety to avoid/eliminate catastrophic failures; and
3. Combine outcomes of the first two objectives to help favorably close NTSB Recommendation P-09-1

New Design and Construction Techniques for Transportation of Ethanol and Ethanol/Gasoline Blends in New Pipelines

Electricore, Inc.

The project objectives are to: Develop supporting data, related analyses and recommendations for cost-effective design and construction methods for reducing the effects of stress-corrosion cracking (SCC) that can be implemented in new pipeline systems to allow safe and efficient transportation of Fuel Grade Ethanol (FGE); Evaluate design aspects for control and monitoring of oxygen uptake and internal corrosion for pipelines transporting FGE; and Recommend the most advantageous direction for expanded and improved pipeline design and testing standards for operations involving exposure to FGE.

APPENDIX E

The Peer Review Coordinator (PRC) organizes, coordinates, monitors, and facilitates the annual panel peer review. The PRC is the main contact for panelists and the researchers involved with a peer review and for public inquiries. The PRC for the 2012 peer reviews was Mr. Robert Smith of PHMSA.

Robert Smith
R&D Manager
Department of Transportation
Pipeline & Hazardous Materials Safety Administration
Office of Pipeline Safety
P(919) 238-4759
C(202) 330-1132
Email robert.w.smith@dot.gov