Peer Review Report

Pipeline & Hazardous Materials Safety Administration

Pipeline Safety Research & Development Program

Peer Reviews Conducted
May 13 & 27, 2015

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EXECUTIVE SUMMARY

The Pipeline and Hazardous Materials Safety Administration's (PHMSA) Pipeline Safety Research and Development (R&D) Program has held 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' 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 2015 peer review panel consisted of four retired Federal employees, one active Federal employee, and one active academic representative.

Fifteen projects were peer reviewed by expert panelists using 11 evaluation criteria. These criteria were grouped within the following four evaluation categories:

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

The rating scale possibilities were "Ineffective," "Effective," "More than Effective," or "Very Effective." During the May 2015 review, the average program rating between all the evaluation categories was "More than Effective." For this year, 10 projects were rated "Very Effective," with five 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 remained the same from the 2014 rating of "More than Effective." Weakness in project management contributed to the no-change in the program average. 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. Additional details are available in Section 7, Tables 4 and 5, and in Appendix C of this report.

PHMSA is very satisfied with the process performed to conduct these reviews, as well as the CY 2015 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 May 13 and 27, 2015, 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 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, which prescribes required procedures for Federal programs.

The 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 2.6 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. Beginning in 2001, PHMSA began strengthening 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 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 six 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 < https://primis.phmsa.dot.gov/rd/psrcjca.htm

Table 1. Program Elements of PHMSA Pipeline Safety R&D Program		
	Program Element	**Program Element Goal**
1.	Damage Prevention	Develop new or improved tools, technology, or practices for reducing damage to pipelines that will prevent releases to the environment.
2.	Leak Detection	Develop new or improved tools and technology solutions for reducing the volume of product released to the environment.
3.	Anomaly Detection and Characterization and	Develop new or improved tools, technology, and assessment processes for identifying and locating critical pipeline defects and to improve the capability to characterize the severity of such defects identified in pipeline systems.
4.	Anomaly Repair and Remediation	Enhance repair materials, techniques or processes, repair tools, and technology for quickly bringing pipeline systems back on line and serving the Nation.
5.	Design, Materials and Welding/Joining	Improve the industry's ability to design and construct safe and long lasting pipelines using the most appropriate materials and welding/joining procedures for the operating environment.
6.	Alternative Fuels, Climate Change & Other	Identify and remove technical issues preventing the safe transportation of alternative fuels in pipelines and for addressing other emerging technological or policy issues of a national scale.

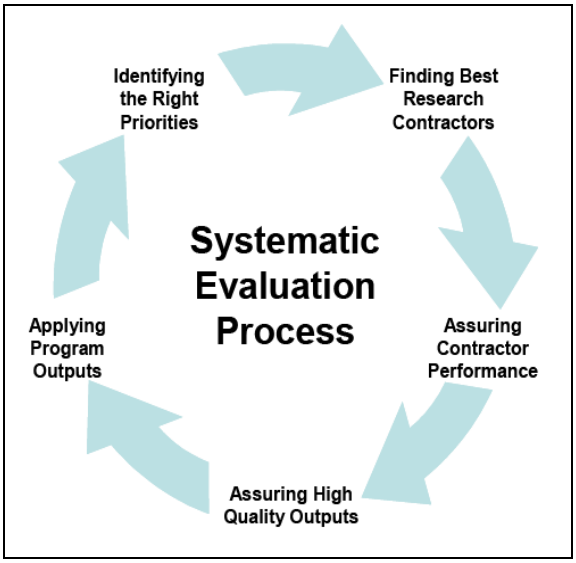
More information on the program strategy is outlined in the R&D Program Strategy portion of the program website at http://primis.phmsa.dot.gov/rd/

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 roadmapping 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 agree 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 composed 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 contract accounting and specific contractual milestones 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' Representatives (AORs) 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 2015 peer review panel consisted of primarily retired government employees, some of which are now independent contractors. The panel also had an active government employee and one academic representative. Table 2 identifies the panelists.

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

Table 2. Peer Review Panelists

	Name	Affiliation
1	Edward J. Ondak	Independent Consultant, representing NACE International/DOT/PHMSA (retired)
2	Tom Siewert	Department of Commerce, National Institute of Standards and Technology (retired)
3	Daniel Lind	Department of the Interior, Bureau of Safety and Environmental Enforcement
4	Richard Fields	Department of Commerce, National Institute of Standards and Technology (retired)
5	Dave McColskey	Department of Commerce, National Institute of Standards and Technology (retired)
6	Dr. Salvatore Salamone	State University of New York at Buffalo

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 review focused, high-level presentations from researchers addressing 11 evaluation criteria within five specific evaluation categories. Presentations are scheduled to take no more than 20 minutes followed by 10 minutes for panelist questions including any possible written public questions. In its entirety, the review of each project by the panelists should occupy approximately 2.5 hours. This entails the time to review project background information including reporting, the advance copy of the review slides, 30 minutes of review and questioning from the panel and the time in 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. Scorecards for rating performance on the specific categories are provided to the panelists. Each category has equal rating from one to five. The scorecard included the following questions in four performance categories:

1. Project management.

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

2. 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?

3. 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?

4. 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 six 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 2015 review varied among metallurgical, corrosion mitigation, various technological solutions, 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 May 2015 review, the average program rating between all the evaluation categories was “More than Effective.” For this year, 10 projects were rated “Very Effective” with 5 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 remained the same from the 2014 rating of “More than Effective.” Weakness in project management contributed to the no-change in the program average. 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, the majority of the projects were approximately 80 to 90 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 six 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 AORs as necessary so that 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 Management.	**4.4**	**More than Effective**
1.1. Is the project being managed on budget and schedule?	4.1	More than Effective
1.2. Is the project making progress toward the work scope objectives?	4.7	Very Effective
2. Approach taken for transferring results to end users.	**4.5**	**Very Effective**
2.1. Is there a plan for dissemination of results, including publications, reporting and patents?	4.6	Very Effective
2.2. How much end user involvement is incorporated into the work scope?	4.6	Very Effective
2.3. For results that may include marketable products and technologies, are commercialization plans established?	4.4	More than Effective
3. Project coordination with other related programs.	**4.5**	**Very Effective**
3.1. Does the project build on, or make use of, related or prior work?	4.7	Very Effective
3.2. Is the work of the project being communicated to other related research efforts?	4.4	More than Effective
3.3. Has consideration been given to possible future work?	4.3	More than Effective
4. Quality of project results.	**4.6**	**Very Effective**
4.1. Are the intended results supported by the work performed during the project?	4.5	Very Effective
4.2. Are the intended results consistent with scientific knowledge and/or engineering principles?	4.6	Very Effective
4.3. Are the intended results presented in such a manner as to be useful for identified end users?	4.6	Very 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	DTPH56-14-H-000005	Threat/Anomaly Mitigation Decision-Making Process	*Kiefner Applus RTD*	4.9	Very Effective
2	DTPH56-14-H-000002	Consolidated Project Full Scale Testing of Interactive Features for Improved Models	*Electricore, Inc.*	4.8	Very Effective
2	DTPH56-14-H-000008	Definition of Geotechnical and Operational Load Effects on Pipeline Anomalies	*BMT Fleet Technology Limited*	4.8	Very Effective
3	DTPH56-11-T-000004	Advanced Leak Detection LiDAR	*Ball Aerospace & Technologies Corp*	4.7	Very Effective
4	DTPH56-13-T-000012	Evaluation of Structural Liners for the Rehabilitation of Liquid and Natural Gas Piping Systems	*Operations Technology Development*	4.6	Very Effective
4	DTPH56-13-T-000008	In-Ditch Validation Methodology for Determination of Defect Sizing	*RTD Quality Services USA, L.P.*	4.6	Very Effective
5	DTPH56-13-T-000009	Improve and Develop ILI Tools to Locate, Size, and Quantify Complex/Interacting Metal Loss Features	*Kiefner Applus RTD*	4.5	Very Effective
5	DTPH56-14-H-000001	Effects of Hydrocarbon Permeation on Plastic Pipe Strength and Fusion Performance	*Gas Technology Institute*	4.5	Very Effective
5	DTPH56-13-H-000003	Strain-Based Design and Assessment of Segments of Pipelines with and without Fittings	*Center for Reliable Energy Systems*	4.5	Very Effective
5	DTPH56-13-H-000007	Improving Leak Detection System Design Redundancy & Accuracy	*Kiefner Applus RTD*	4.5	Very Effective
6	DTPH56-13-T-000010	Development of an Industry Test Facility and Qualification Processes for Inline Inspection (ILI) Technology Evaluation and Enhancements	*Pipeline Research Council International*	4.4	More than Effective
7	DTPH56-13-T-00003	INO Technologies Assessment of Leak Detection Systems for Hazardous Liquid Pipelines	*Electricore, Inc.*	4.2	More than Effective

8	DTPH56-13-T-00002	Real-Time Multiple Utility Detection During Pipe Installation Using Horizontal Directional Drilling (HDD) System	*Operations Technology Development*	4.1	More than Effective
8	DTPH56-13-T-000011	Above-ground Detection Tools Including Disbondment and Metal Loss for all Metals Including Cast-Iron Graphitization	*Gas Technology Institute*	4.1	More than Effective
8	DTPH56-14-H-00004	Improving Models to Consider Complex Loadings, Operational Considerations, and Interactive Threats	*Kiefner Applus RTD*	4.1	More than Effective

8.0 PHMSA Official Response to Panelists Findings and Recommendations

The CY 2015 reviews were the ninth structured peer review of PHMSA's 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 the 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 by incorporating feedback submitted by the researchers and peer review panelists. Other specific recommendations from panelists will be disseminated to researchers and AORs.

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 Avenue, SE
Washington, D.C. 20590

MEMORANDUM FOR THE RECORD

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

Subject: Pipeline Safety Research Program Peer Reviews, May 13 & 27, 2015

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 2015 average quality rating for the reviewed projects was "More Than Effective." Weakness in project management contributed to the no-change in the program average from CY 2014. In addition, a number of suggestions were identified by the panelists for maintaining or improving research quality.

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 Officers' 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: 8/17/15

APPENDIX B

Peer Review Panelist Bios

Edward J. Ondak

Mr. Ondak is an Electrical Engineer having received a Bachelor of Science Degree in Electrical Engineering from the Indiana Institute of Technology in 1964.

He began his career as a corrosion engineer with the Columbia Gas System, working on distribution systems and then went to the transmission side of Columbia Gas where he oversaw the cathodic protection of the piping in the company's seven state operating area.

In 1974, the U.S. Department of Transportation, Office of Pipeline Safety (OPS), hired Mr. Ondak to write and teach Corrosion Control to all of their Federal and State inspectors. He remained in that position for 6 years, teaching corrosion and pipeline safety in every state in the U.S., through the seminars put on by the DOT.

In 1980 he was promoted to Region Director of the Central region, overseeing the pipeline safety in a 12 state area. In 1990 he assumed the responsibilities as Region Director of the Western Region where he was given the oversight of the cathodic protection of the Trans-Alaska Pipeline, along with overseeing the pipeline safety of 11 states in the region.

He was then promoted to Senior Technical Advisor, overseeing the research conducted by OPS.

He retired from the Government in 2002.

Mr. Ondak is a Registered Professional Engineer and an NACE International Corrosion Specialist.

He is also a certified NACE instructor and has been a member since 1968.

Tom Siewert, Ph.D.

Education:

B.S.	Applied Math and Physics	Univ. of Wis.- Milw.	1969
M.S.	Materials Science	Univ. of Wis.- Madison	1973
Ph.D.	Metallurgy	Univ. of Wis. - Madison	1976

Experience:
Government: Retired - Leader of structural materials, welding, and then process sensing and modeling groups at the National Institute of Standards and Technology (NIST). Publications in the areas of joining, cryogenic properties, nondestructive evaluation, and mechanical properties. Leadership in conference and workshop organization committees, Active in various societies.

Industry: Supervisory Research Engineer, then Manager of Research and Development, Alloy Rods (welding filler metal developer) 1976 to 1984.

Academic: Active with a number of Universities teaching short courses in Materials, Welding, and Non Destructive Evaluation (NDE) for Occupational Safety and Health Administration (OSHA) inspectors (OSHA Training Institute), about 25 one-day courses since 1989. Adjunct Professor and Research Scientist in the Metallurgical and Materials Engineering Department, Colorado School of Mines

Professional Society Memberships:

- American Society for Metals
- American Welding Society
- International Institute of Welding (IIW)
- Welding Journal Reviewer

Active Committee Work:

- American Welding Society
    - American Council of the IIW
    - International Standards Activities Committee
    - Government Affairs Activity Committee

Daniel Lind

Dan is currently a Systems Reliability Engineer for the Department of the Interior, Bureau of Safety and Environmental Enforcement but has over 7 years of technical experience from a wide variety of government and private companies some of which span multiple economic sectors including oil and gas and the automotive industry.

Education:

2012 - Master of Science in Automotive Engineering (MSAE)
Clemson University, Greenville, SC

2009 - Bachelor of Science in Mechanical Engineering (BSME)
University of Miami, Coral Gables,

Richard Fields, Ph.D.

Relevant Highlights: R. J. Fields has conducted metallurgical research and participated in mechanical test standards development activities for more than 40 years. He has been the Chairman of the ASTM Subcommittee on Ductility and Formability since 2004. He was the Head of the US Delegation to the ISO Subcommittee on Ductility between 2004 and 2014. He received a Bronze Medal from the Bureau of Standards for his research on fracture and crack arrest in high strength steels and a Silver Medal from the Department of Commerce for research on mechanical properties and modeling. From 2002 until 2004, he was the principal technical investigator on metallurgical aspects of the congressionally mandated investigation of the collapse of the World Trade Center Towers. He has performed research and written numerous papers relevant to the prediction of fracture behavior in pipeline steels. In particular, he was principal author on NIST Report 89-4136 written at the request of Senators Bond and Danforth entitled "An Assessment of the Performance and Reliability of Older ERW Pipelines" and coauthor of the American Academy of Science report on Corrosion Prevention Standards for Ductile Iron Pipe. He was appointed by Secretary of Transportation E. Dole to the Office of Pipeline Safety's Hazardous Liquid Pipeline Safety Committee and served for six years, three of these as secretary. He was part of a research team that developed experimental and analytical methods to assess the high rate fracture and crack arrest behavior of high strength pipeline steels.

Education: Undergraduate degrees in Chemistry and Metallurgical Engineering were awarded to R. J. Fields in 1971 by the University of Pennsylvania in Philadelphia. He received a Masters in Engineering and Applied Physics from Harvard University in 1973 and a PhD in Engineering Materials from Cambridge University in 1977 in England.

Work History: From 1977 until 2004, R. J. Fields worked at the National Bureau of Standards (NBS)/ National Institute of Standards and Technology (NIST). His expertise is in advanced microstructural analysis, mechanical properties, and modeling microstructural origins of mechanical behavior. He retired in May of 2004 and now works on a contractual basis for a number of technical organizations. While at NBS/NIST, his career included 6 years as a Supervisory Metallurgist managing the Time Dependent Failure Group in NBS's Fracture and Deformation Division. This group ran the metallographic facilities as well as carrying out mechanical testing research programs for the US Navy, the Federal Railroad Administration, the National Transportation Safety Board, and the Nuclear Regulatory Commission. More recently, R. J. Fields was Group Leader for the Materials Performance Group in NIST's Metallurgy Division. Part of this group of 11 professionals runs the US National Hardness Standardization Facility, certifying primary hardness standards. As the supervisor of the Materials Performance Group, he started a program on sheet metal forming with the auto industry. This is now the largest program in the Division. He also started a program on modeling bullets and armor for the National Institute of Justice and a program on fire resistant structural steels. He has an extensive list of publications, patents, and awards available on request.

Professional Society Membership: R. J. Fields is a member of ASTM International and the American Academy of Mechanics.

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.

Salvatore Salamone, Ph.D.

Dr. Salvatore Salamone is an Assistant Professor in the Department of Civil, Structural and Environmental Engineering (CSEE) at the University at Buffalo (UB). He received his PhD (2007) from the University of Palermo, Italy, and was a post-doctoral fellow at the University of California, San Diego. He joined UB in 2010 where he established the Smart Structures Research Laboratory (SSRL). Dr. Salamone's current research interests include structural health monitoring (SHM), non-destructive evaluation (NDE), ultrasonic sensing methods for smart structures, wave propagation in solids, digital signal processing and pattern recognition. His research has been supported by the National Science Foundation, the United States Department of Transportation, the New York State Pollution Prevention Institute, the University Transportation Research Center 2, and the American Society of Nondestructive Testing. Dr. Salamone has published 33 peer-reviewed journal papers and 50+ conference papers and presentations. His research contributions have recently been recognized by the 2014 Achenbach Medal, an international award that recognizes an individual who, within 10 years of Ph.D., has made an outstanding contribution to the advancement of the field of structural health monitoring. He has also received the 2011 Faculty Grant Award from the American Society for Nondestructive Testing. He is serving in several technical committee including, the ASCE Structural Health Monitoring and Control, and ASME Ultrasonics for Mechanical Systems.

APPENDIX C

Table 6 – Peer Reviewed Project Strong and Weak Points

(In order as shown in Table 5)

Project Title	Strong Points	Weak Points
Threat/Anomaly Mitigation Decision-Making Process - *Kiefner Applus RTD*	Making good progress toward work scope objectives. Excellent plan for dissemination of results. Great end user involvement. Clear communication to other related efforts. Results to date seem well supported by performed work.	Slightly over budget.
Consolidated Project Full Scale Testing of Interactive Features for Improved Models - *Electricore, Inc.*	Promising results. Great end user involvement. Excellent plan for dissemination of results. Clear communication to other related efforts. Results to date seem well supported by performed work.	Slightly behind schedule.
Definition of Geotechnical and Operational Load Effects on Pipeline Anomalies - *BMT Fleet Technology Limited*	Promising results. Great end user involvement. Excellent plan for dissemination of results. Clear communication to other related efforts. Results to date seem well supported by performed work. Great use of prior related project results.	Slightly behind schedule. Suggestion to follow work on strain based design and coordinate related issues.
Advanced Leak Detection LiDAR - *Ball Aerospace & Technologies Corp.*	Great end user involvement. Excellent plan for dissemination of results. Great use of prior related project results. Clear communication to other related efforts. Good corrective actions proposed to improve project schedule.	Slightly behind schedule. Difficulties seen on air speed vs accuracy of readings.
Evaluation of Structural Liners for the Rehabilitation of Liquid and Natural Gas Piping Systems - *Operations Technology Development*	On schedule. Results to date seem well supported by performed work. Great end user involvement.	Improve plan for dissemination of results.

Project Title	Strong Points	Weak Points
In-Ditch Validation Methodology for Determination of Defect Sizing - *RTD Quality Services USA, L.P.*	Making good progress toward work scope objectives. Great use of prior related project results. Clear communication to other related efforts. Great use of prior related project results.	None of major mention.
Improve and Develop ILI Tools to Locate, Size, and Quantify Complex/ Interacting Metal Loss Features - *Kiefner Applus RTD*	Great end user involvement. Excellent plan for dissemination of results. Great use of prior related project results. Clear communication to other related efforts.	Slightly over budget.
Effects of Hydrocarbon Permeation on Plastic Pipe Strength and Fusion Performance - *Gas Technology Institute*	Excellent plan for dissemination of results. Great use of prior related project results. Results to date seem well supported by performed work.	Slightly over budget. Plan for involving end users not clear. Seems like additional work not in the scope would be required to meet project objectives.
Strain-Based Design and Assessment of Segments of Pipelines with and without Fittings - *Center For Reliable Energy Systems*	Great end user involvement. Great use of prior related project results.	Slightly behind schedule. Plan for involving end users not clear.
Improving Leak Detection System Design Redundancy & Accuracy - *Kiefner Applus RTD*	Very good end user involvement. Great use of prior related project results.	None of major mention.
Development of a Test Facility for Qualifying Processes for Inline Inspection (ILI) Technology Evaluation and Enhancements - *Pipeline Research Council International*	Making good progress toward work scope objectives. Very good end user involvement.	Expand coordination to other related technology development efforts.
INO Technologies Assessment of Leak Detection Systems for Hazardous Liquid Pipelines - *Electricore, Inc.*	Very good end user involvement. Great use of prior related project results. Good plan for dissemination of results.	More data needed to judge progress toward work scope objectives.
Real-Time Multiple Utility Detection During Pipe Installation Using Horizontal Directional Drilling (HDD) System - *Operations*	None of major mention.	Expand coordination to other related technology development efforts. Plan for involving end users not clear.

Technology Development		
Project Title	**Strong Points**	**Weak Points**
Above-ground Detection Tools Including Disbondment and Metal Loss for all Metals Including Cast-Iron Graphitization - *Gas Technology Institute*	Very good end user involvement.	Not factoring soil moisture levels as possible interference of technology readings.
Improving Models to Consider Complex Loadings, Operational Considerations, and Interactive Threats - *Kiefner Applus RTD*	Great use of prior related project results. Good end user involvement.	Slightly over budget. Improve plan for dissemination of results.

APPENDIX D

Peer Review Project Summaries
(In order as shown in Tables 5-6)

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

Threat/Anomaly Mitigation Decision-Making Process
Kiefner Applus RTD

Better guidance is needed for deciding when the combined effects of two or more threats and the associated anomalies create a higher probability of failure than the individual threats/anomalies themselves. While satisfactory models exist for calculating the effects on pressure-carrying capacity of individual types of anomalies (e.g., corrosion-caused metal loss, cracks, gouges, plain dents), better guidance is needed regarding how to assess the effects of combined threats/anomalies.

Consolidated Project Full Scale Testing of Interactive Features for Improved Models
Electricore, Inc.

This project addresses pipeline crack growth as influenced by complex operational circumstances by expanding on existing work performed through PHMSA and Pipeline Research Council International, Inc. Through full scale testing, the team will gather data on mechanical damage interacting with secondary features – gouges (with cracks and micro-cracks), corrosion, and welds. The team will create a database, which will be used by others to validate and improve burst and fatigue strength models. The team will also gather experimental data to estimate when cracks in stress corrosion cracking (SCC) colonies coalesce. The project will improve knowledge on the influence of complex loadings on both mechanical damage exposed to environmentally assisted cracking (EAC) or to combined pressure and high axial strains, and on crack growth dynamics of SCC. The primary objectives of the project are to strengthen industry consensus standards and to generate data which will promote new knowledge. The benefits of the program will improve safety and environmental protection by filling critical knowledge gaps on pipeline response to crack growth in mechanical damage and SCC as driven by complex loads and interacting threats.

Definition of Geotechnical and Operational Load Effects on Pipeline Anomalies
BMT Fleet Technology Limited

The objective of this project is to use the previously validated pipe soil interaction model to develop an engineering tool to define the effects of operational and geotechnical loads on liquid and gas pipeline systems to support decision making regarding threat severity or repair scheduling. This tool would be incorporated in strain based design and assessment to facilitate the consideration of complex loading scenarios inducing significant flexural loads, including pipeline subsidence or lowering, and ground movements inducing lateral pipeline movements.

The results of this project will define the local nominal strain state that can be used to assess localized anomalies / defects (e.g. corrosion, cracks, dents, weld faults, gouges).

Advanced Leak Detection LiDAR
Ball Aerospace & Technologies Corp.

This R&D project will accomplish design, analysis, fabrication and test of the Advanced Leak Detection LiDAR (LIght Detection And Ranging), culminating in a flight demonstration proving feasibility of detecting gases evolving from liquid leaks from petrochemical pipelines. Key elements of the Advanced Leak Detection LiDAR are to be built and integrated onto a pallet including an optical bench with instrument testing within a laboratory environment. Thereafter, flight testing will further validate the technical performance and pave the way for industry implementation.

Evaluation of Structural Liners for the Rehabilitation of Liquid and Natural Gas Piping Systems
Operations Technology Development

The project will conduct an assessment of structural liners and composites and their interaction with the pipe to demonstrate their capability to carry the loads of a degraded host pipe. The focus will be on the systems installed using trenchless technologies for remediation to the pipe and its appurtenances. This will be achieved by: - Establish performance criteria, testing and analytical procedures. - Coordinate field installations with the manufacturers and organizations to establish best practices.

In-Ditch Validation Methodology for Determination of Defect Sizing
RTD Quality Services USA, L.P.

The project will develop, improve and demonstrate a robust technology for accurate and reliable sizing of complex crack like anomalies by adopting an existing, proven technology for the purpose. Applus RTD has developed the technology over the last several years, primarily for girth weld inspection in new pipeline construction. However, the capabilities of the technology and the robustness of the tool make it ideally suited for in-ditch application for pipeline integrity. The tool's ability to discriminate closely spaced defects and accurately size cracks irrespective of their orientation make it an ideal solution for sizing complex cracks such as stress corrosion cracks and seam weld defects. Successful completion of this project would provide the industry with valuable defect measurements as well as enable a step change in the way in-line inspection data from crack tools is used.

Improve and Develop ILI Tools to Locate, Size, and Quantify Complex/Interacting Metal Loss Features
Kiefner Applus RTD

The ability to accurately locate and size individual metal loss pits within an area of large corrosion and characterization of metal loss associated with dents/gouges and the longitudinal seam are three of the remaining problems with in-line inspection (ILI) integrity assessment of

metal loss defects. The regulations address each of these type anomalies by requiring the remediation of: * metal loss with a calculated burst pressure less than the maximum operating pressure for liquid pipelines or 1.1 times maximum allowable operating pressure for gas pipelines * any dent that has any indication of metal loss, cracking or a stress riser * corrosion of or along a longitudinal seam weld. We will use two measurement technologies and computer comparisons to investigate these three problems: a Multi-measurement ILI tool, state-of-the-art in-ditch Non Destructive Evaluation measurements, and computer based comparisons of the technologies.

Effects of Hydrocarbon Permeation on Plastic Pipe Strength and Fusion Performance
Gas Technology Institute

The objective of this project is to develop a validated method to be used by any plastic testing laboratory to quantify the effects of hydrocarbon permeation on: 1) the fusibility of plastic pipe, 2) the life expectancy of existing fused joints that have been subjected to hydrocarbon permeation, 3) the Hydrostatic Design Basis (strength) of plastic pipe, and 4) the impact on slow crack growth.

Strain-Based Design and Assessment of Segments of Pipelines with and without Fittings
Center For Reliable Energy Systems

The overall objective of this project is to develop a set of practical and ready-to-use guidelines and tools for SBDA of pipelines containing fittings, and corrosion and mechanical damage subjected to high longitudinal strains.

Improving Leak Detection System Design Redundancy & Accuracy
Kiefner Applus RTD

Leak detection systems are an important part of any overall pipeline safety and integrity strategy. The benefits of reliably and rapidly identifying a leak, so that the resulting fluid loss can be controlled and contained as soon as possible, can be very significant, particularly in High Consequence Areas (HCAs). The mission of this project is standardize the approach to designing an appropriate LDS for all pipelines, and that will be accessible to all operators – including the smaller ones – without extended and laborious front-end engineering. A central part of this approach is to concentrate upon certain key issues: 1. Beginning any LDS design process with a systematic focus on assessing requirements. 2. Accepting that one single technology will probably not provide perfect performance for all objectives, on a given pipeline. Therefore, a key issue is exploring ways to combine multiple technologies / physical principles into one system in order to address each requirement optimally. 3. Allowing the operator to be able to predict performance – and therefore cost/benefit – more reliably from the design.

Development of an Industry Test Facility for Qualifying Processes for Inline Inspection (ILI) Technology Evaluation and Enhancements
Pipeline Research Council International

The project will standardize a process for evaluating in-line inspection technologies for the energy pipeline industry. The project will complete the design and construction of a highly flexible and modern pipeline pull test facility at PRCI's Non Destructive Evaluation repository, where a range of real world pipeline test samples have been accumulated and are retained to support technology improvements and developments for pipeline inspection.

INO Technologies Assessment of Leak Detection Systems for Hazardous Liquid Pipelines
Electricore, Inc.

This project will assess the stand-off capabilities of National Optics Institute (INO) developed instruments for the detection of vapors from liquid petroleum pipeline leaks. The prototype sensor on a mobile platform will include one or more of three spectroscopic instruments: 1) a standoff UV laser induced fluorescence device, 2) a UV Raman remote sensor, and 3) an open path, active, laser based IR Differential Optical Absorption Spectroscopy (DOAS) sensor. Remote capability up to 100 yards will be evaluated for several concentrations of vapors from petroleum products (typically transported by pipelines) in a laboratory and in a simulated pipeline setting.

Real-Time Multiple Utility Detection During Pipe Installation Using Horizontal Directional Drilling (HDD) System
Operations Technology Development

This project will integrate acoustic and radar technologies to detect buried pipes/objects in front and adjacent to the drill-head during installation of pipes using the horizontal directional drilling (HDD) machine.

Above-ground Detection Tools Including Disbondment and Metal Loss for all Metals Including Cast-Iron Graphitization
Gas Technology Institute

The project will develop, test, and then commercialize a mobile platform for detecting coating disbondment and external corrosion by measuring magnetic fields from above ground. Alternating current is injected into the pipe being tested. The current creates magnetic fields around the pipe. These fields are affected by corrosion and disbondment.

Improving Models to Consider Complex Loadings, Operational Considerations, and Interactive Threats
Kiefner Applus RTD

Some pipeline failures suggest that more complex situations need to be accounted for than is currently the practice. Interactions of pipe defect conditions with variable loadings, increased loadings, complex loadings, or changing conditions have led to failures under conditions

normally considered safe. The industry should be applying a second level of complexity to the evaluation of degraded conditions where one or all of the following circumstances could exist: (a) loadings are biaxial, (b) loadings vary with time, or (c) environments interact with conditions to adversely alter the condition's stability or rate of degradation. Recognizing and quantifying these effects will require integration of data from ILI (perhaps from tools an operator would not normally use such as slope-curvature tools or crack-detection tools), ground or aerial patrols, or at some sites, actual monitoring or measurement of changing conditions. Thus the outcome of this project will be guidance in the form of decision processes and data needs for identifying and evaluating complex and/or interactive situations.

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 2015 peer reviews was Mr. Robert Smith of PHMSA.

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