Peer Review Report

Pipeline & Hazardous Materials Safety Administration

Pipeline Safety Research & Development Program

Peer Reviews Conducted
April 1, 2, 14 & 15, 2009

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EXECUTIVE SUMMARY

The Pipeline and Hazardous Materials Safety Administration's (PHMSA) Pipeline Safety Research and Development (R&D) Program held its first structured peer review of active research projects in February 2006 and the most recent peer review in April 2009. Mandates by the Office of Management and Budget (OMB) and the Office of the Secretary of Transportation (OST) govern these reviews and are keeping PHMSA "Green" in addressing research data quality. Conducting these peer reviews via teleconference and the Internet is saving time and resources. It 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 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 peer review panel consisted of twelve government and industry experts. One of the twelve panelists is an active Government representative from the Minerals Management Service. The remaining eleven panelists are retired Government and retired and active industry personnel who play vital roles as peers for the American Petroleum Institute, the American Society of Mechanical Engineers, the National Association of Corrosion Engineers and other standards developing organizations.

Forty-two active research projects were peer reviewed by expert panelists using 15 evaluation criteria. These criteria were grouped within the following five evaluation categories:

1. Is the project still relevant to the PHMSA mission?
2. Is the project still well managed?
3. What approaches are taken for transferring results to end users?
4. Is the project well coordinated with other closely related programs?
5. Is the project producing high quality results?

The rating scale possibilities were "Ineffective," "Moderately Effective," "Effective," or "Very Effective." During the May 2008 review, the average program rating was "Very Effective" for each of the evaluation categories. For this year, 34 projects were rated "Very Effective" with 8 projects ranked as "Effective." The average sub-criteria scoring were also rated very high and underpin these findings. This marks the fourth annual peer review where the majority of peered projects and the overall program rating were very effective. Additional details are available in Section 7 and Tables 4, 5 & 6 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 1, April 2, April 14 & April 15, 2009 for PHMSA's Pipeline Safety Research and Development Program. The findings and recommendations in this report derive 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 prescribing 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, keep projects on target or aligned with stakeholder needs and to give technical guidance with technically competent and independent, objective experts. These reviews are held annually for active research projects and usually occur in the second quarter of each fiscal year.

2.0 Research Program Background

PHMSA regulates safety in the design, construction, operation and maintenance, and spill response planning for over 2.3 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 other gases and hazardous liquid pipelines resulting in death, injury, or significant property damage, and in addition aims to reduce spills that can cause harm to 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 is sponsoring 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 eight 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 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.	Systems for Pipeline Mapping and Information Management	Enhance the ability to prevent and respond to incidents and accidents through management of information related to pipeline location (mapping) and threats definition.
6.	Enhanced Operation Controls and Human Factors Management	Improve the safety of pipeline operations through enhanced controls and human factors management.
7.	Risk Management & Communications	Reduce the probability of incidents and accidents, and mitigating the consequences of hazards to pipelines.
8.	Safety Issues for Emerging Technologies	Identify and assess emerging pipeline system technologies for opportunities to enhance safety.

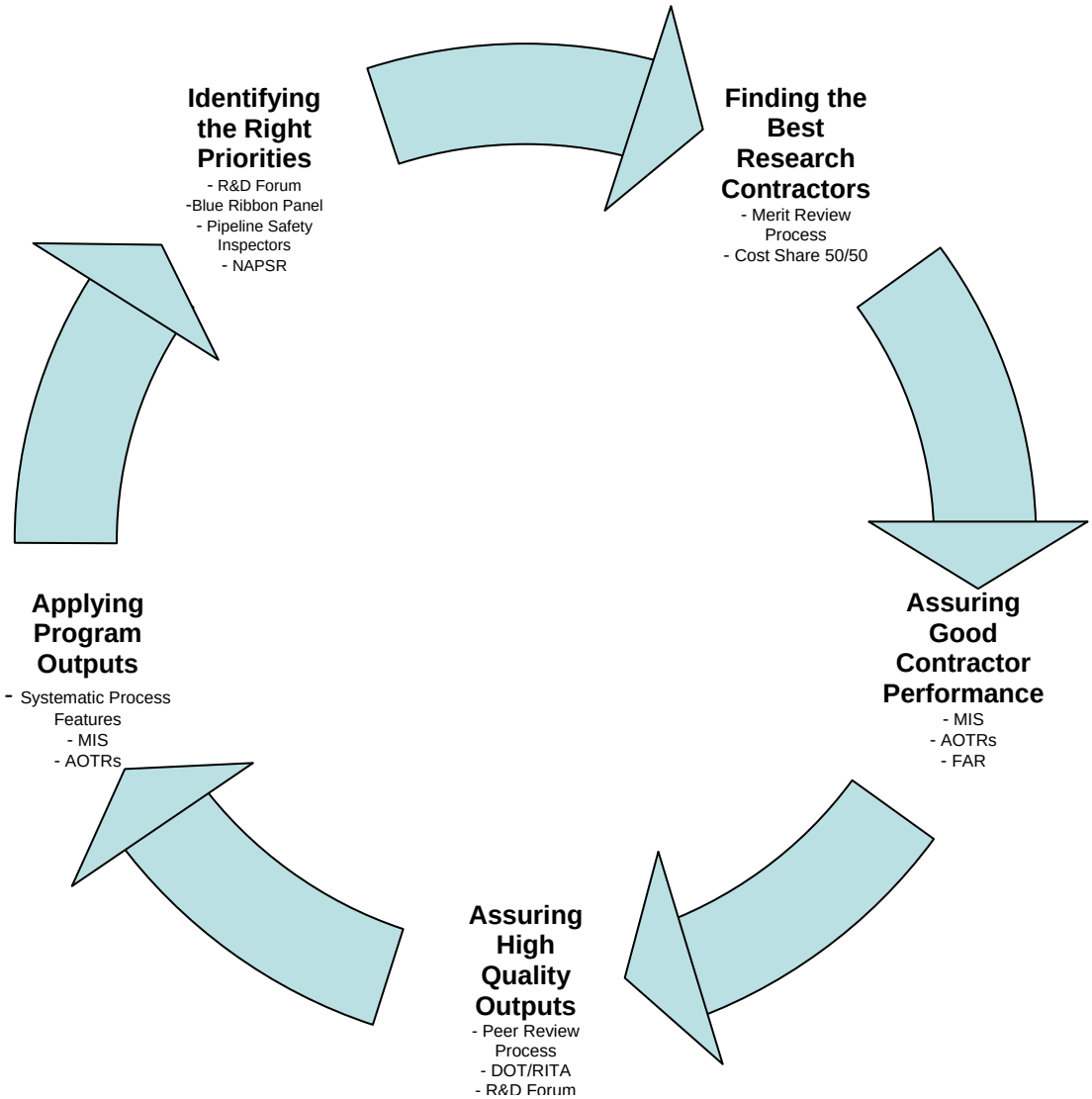
More information on the program strategy is outlined in the R&D Program Strategic Plan and on the program website at http://primis.phmsa.dot.gov/rd/

Research Program Quality

While the program addresses 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 for 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 priority and structures 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 comprising of representatives from Federal and State agencies, industry operators, and trade organizations uses strong evaluation criteria to review research white papers and proposals. In addition, a 50 percent cost share between the Government and industry is required, which forces researchers to organize with credible groups increasing the credibility and applicability of the proposed work, while providing for technical input.

PHMSA uses its Management Information System (MIS) to assure 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 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 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 pipeline personnel from operators, regulators and industry trade organizations.

The peer review panel consisted of twelve Government and industry experts. One of the twelve panelists is an active Government representative from the Minerals Management Service. The remaining eleven panelists are retired government and retired and active industry personnel who play vital roles as peers for the American Petroleum Institute, the American Society of Mechanical Engineers, the National Association of Corrosion Engineers and other standards developing organizations. 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	Dave McColskey	Department of Commerce, National Institute of Standards and Technology (retired)
2	Michael Else	Department of the Interior, Minerals Management Service
3	Richard Fields	Department of Commerce, National Institute of Standards and Technology (retired)
4	Joe C. Bowles, Jr., P.E.	Past President of National Association of Corrosion Engineers (retired)
5	Louis E. Hayden, Jr., P.E.	Lafayette College, Easton, PA
6	Rick Eckert	BP Exploration Alaska, Inc.
7	Mario Macia	ExxonMobil Upstream Research Company
8	Andrew G. Hevle	El Paso Corporation
9	Tom Emerson	Explorer Pipeline
10	Michael Rosenfeld	Kiefner & Associates
11	Randall Webb	Southwest Gas (retired)
12	George Ragula	Public Service Electric & Gas Company

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 the scientific and technical studies that 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 15 evaluation criteria within five specific evaluation categories. Presentations are no more than 30 minutes with five minutes of panelist questions and five minutes of possible written public questions. 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. Is the project still relevant to the PHMSA mission?
    - Is the project still relevant for enhancing pipeline safety and or protecting the environment?
    - Does the project support rulemaking, statutory requirements or inspection activities?
    - Does the project address a technology gap, consensus standard or produce general knowledge?

2. Is the project still well managed?

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

3. What approaches are taken in 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. Is the project well coordinated with other closely 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. Is the project producing high quality 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 appropriate for the resources expended?
    - 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 of a high likelihood to be successful in the objectives they were designed to accomplish.

These criteria will provide a numeric rating, which will be converted and illustrated as "Ineffective," "Moderately Effective," "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
Effective	3.0 – 4.4
Moderately Effective	2.0 - 2.9
Ineffective	0.0 – 1.9

These criteria are 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.

Moderately 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 2009 review varied among welding, coating, technological, and general knowledge focused projects. Specific technical subjects addressed corrosion, welding, fracture mechanics, material property issues and now biofuels. Projects focusing on technology included several new tools for external and internal pipeline inspection. Research for general knowledge involved projects addressing risk assessment for natural gas distribution pipelines, and human factors, fatigue and control room design.

A short description of each peer reviewed project is found in Appendix C.

7.0 Peer Review Findings

During the May reviews, 42 research projects were peer reviewed by twelve expert panelists using 15 different evaluation criteria. The rating scale possibilities were "Ineffective," "Moderately Effective," "Effective," or "Very Effective." The average program rating was “Very Effective” for each of the five evaluation categories. For this year, 34 peered projects were rated “Very Effective” with eight projects ranked as “Effective.” The average sub-criteria scoring were also rated very high and underpin these findings. This marks the fourth annual peer review where the majority of peered projects and the overall program rating were very effective. Table 4 itemizes the project ranking order, where projects of the same score have an equal ranking.

At the time of the reviews, the majority of these projects were approximately 65 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. Having these high ratings precluded the need for itemization of recommendations on specific research projects. None of these comments identified critical actions required to salvage a project from failing, but recommended actions to further improve upon good performance.

Table 6 itemizes the strong and weak points collected from the twelve panelists. These points were consistent among several panelists and are reflected in the scoring of multiple evaluation categories. Specific recommendations will be disseminated to researchers and AOTRs 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. Is the project still relevant to the PHMSA mission?	**4.7**	**Very Effective**
1.1. Is the project still relevant for enhancing pipeline safety and or protecting the environment?	4.7	Very Effective
1.2. Does the project support rulemaking, statutory requirements or inspection activities?	4.6	Very Effective
1.3. Does the project address a technology gap, consensus standard or produce general knowledge?	4.7	Very Effective
2. Is the project still well managed?	**4.6**	**Very Effective**
2.1. Is the project making progress toward the work scope objectives and the PHMSA goals?	4.7	Very Effective
2.2. Is the project being managed on budget and schedule?	4.5	Very Effective
3. What approaches are taken in transferring results to end users?	**4.5**	**Very Effective**
3.1. Is there a plan for dissemination of results, including publications, reporting, and patents?	4.6	Very Effective
3.2. How much end user involvement is incorporated into the work scope?	4.5	Very Effective
3.3. For results that may include marketable products and technologies, are commercialization plans established?	4.6	Very Effective
4. Is the project well coordinated with other closely related programs?	**4.5**	**Very Effective**
4.1. Does the project build on, or make use of, related or prior work?	4.6	Very Effective
4.2. Is the work of the project being communicated to other related research efforts?	4.4	Effective
4.3. Has consideration been given to possible future work?	4.4	Effective
5. Is the project producing high quality results?	**4.6**	**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?	4.7	Very Effective
5.3. Are the intended results appropriate for the resources expended?	4.5	Very Effective
5.4. Are the intended results presented in such a manner as to be useful for identified end users?	4.5	Very Effective
Summary:	**4.6**	**Very Effective**

Table 5. Summary Ranking & Rating of Individually Reviewed Research Projects					
Rank	**Project ID**	**Project Title**	**Contractor**	**Rating**	**Score**
1	DTPH56-05-T-0001	Understanding Magnetic Flux Leakage (MFL) Signals from Mechanical Damage in Pipelines	Electricore, Inc.	Very Effective	4.9
1	DTPH56-07-T-000005	Update of Weld Design, Testing, and Assessment Procedures for High Strength Pipelines	Electricore, Inc.	Very Effective	4.9
1	DTPH56-08-T-000009	MWM-Array Detection & Characterization of Damage through Coatings and Insulation	JENTEK Sensors, Inc.	Very Effective	4.9
1	DTPH56-08-T-000009	Adaptation of MWM-Array and MFL Technology for Enhanced Detection/Characterization of Damage from Inside Pipelines	JENTEK Sensors, Inc.	Very Effective	4.9
1	DTPH56-08-T-000011	Structural Significance of Mechanical Damage	Electricore, Inc.	Very Effective	4.9
1	DTPH56-08-T-000013	Effect of Ethanol Blends and Batching Operations on Stress Corrosion Cracking of Carbon Steel	DNV Columbus	Very Effective	4.9
2	DTPH56-08-T-000013	Effect of Ethanol Source on Stress Corrosion Cracking of Carbon Steel	DNV Columbus	Very Effective	4.8
2	DTPH56-08-T-000023	Validation for Flaw Acceptance of Mechanical Damage to Low Stress Natural Gas Pipelines	Operations Technology Development	Very Effective	4.8
3	DTPH56-06-T-000014	Validation and Documentation of Tensile Strain Limit Design Models for Pipelines	Pipeline Research Council International	Very Effective	4.7
3	DTPH56-06-T-000014	Second Generation Models for Strain-Base Design	Pipeline Research Council International	Very Effective	4.7
3	DTPH56-06-T-000023	Effect of Surface Preparation on Residual Stress in Multi-layer and Other Pipeline Coatings	NOVA Research & Technology Centre	Very Effective	4.7
3	DTPH56-07-T-000010	Butt Fusion Joint Integrity and Evaluation of NDE Technologies	Northeast Gas Association/NYSEARCH	Very Effective	4.7
3	DTPH56-07-T-000009	In-Situ Hydrogen Analysis in Weldments: Novel NDE for Weld Inspection	Colorado School of Mines	Very Effective	4.7
3	DTPH56-07-T-000005	Development of Optimized Welding Solutions for X100 Linepipe Steel	Electricore, Inc.	Very Effective	4.7
3	DTPH56-08-T-000002	Enhanced Defect Detection and Sizing Accuracy Using Matrix Phased Array	Edison Welding Institute	Very Effective	4.7

		Ultrasonics Tools			
3	DTPH56-08-T-000004	Improving Magnetic Flux Leakage In-Line Inspection Corrosion Sizing Using Phased Array Guided Ultrasonic Waves	Battelle Memorial Institute	Very Effective	4.7
3	DTPH56-08-T-000006	The Effect of Cathodic Protection on Stress Corrosion Cracking of High-Strength Pipeline Steels	CAMNET Materials Technology Laboratory	Very Effective	4.7
3	DTPH56-08-T-000005	Development and demonstration of an integrated tool for mapping, sizing and evaluation of SCC for remaining strength prediction	RTD Quality Services USA, L.P.	Very Effective	4.7
3	DTPH56-08-T-000014	Effect of Concentration and Temperature of Ethanol in Fuel Blends on Microbial and Stress Corrosion Cracking of High-Strength Steels	Colorado School of Mines	Very Effective	4.7
3	DTPH56-08-T-000015	Pipeline Segment-Specific External Corrosion Rate Estimation to Improve Reassessment Interval Accuracy	DNV Columbus	Very Effective	4.7
3	DTPH56-08-T-000016	Evaluation and Method for Qualification of Fiber Reinforced Composite Repair Techniques for Transmission and/or Distribution Pipelines	DNV Columbus	Very Effective	4.7
3	DTPH56-08-T-000018	Pipeline Quality Biogas: Guidance Document for Dairy Waste, Wastewater Treatment Sludge and Landfill Conversion	Gas Technology Institute	Very Effective	4.7
3	DTPH56-08-T-000008	Achieving Maximum Crack Remediation Effect from Optimized Hydrotesting	University of Alberta	Very Effective	4.7
3	DTPH56-08-T-000022	Validation of External Corrosion Growth-Rate Using Polarization Resistance and Soil Properties	Operations Technology Development	Very Effective	4.7
4	DTPH56-07-T-000006	Validation of Assessment Methods for Production Scale Girth Welding of High Strength Pipelines with Multiple Pipe Sources	Electricore, Inc.	Very Effective	4.6
4	DTPH56-07-T-000007	Hybrid Laser Arc Welding (HLAW) System Development for Pipeline Construction	BMT Fleet Technology, Ltd.	Very Effective	4.6
4	DTPH56-08-T-000003	Development of Tools to Estimate Actual Corrosion Growth Rates (Internal and External) of Gas Pipelines	Southwest Research Institute	Very Effective	4.6

4	DTPH56-08-T-000013	Monitoring Conditions Leading to SCC/Corrosion of Carbon Steel	DNV Columbus	Very Effective	4.6
4	DTPH56-08-T-000019	Advanced Development of Proactive Infrasonic Gas Pipeline Evaluation Network	Northeast Gas Association/NYSEARCH	Very Effective	4.6
5	DTPH56-06-T-000021	Method for Qualification of Coatings Applied to Wet Surfaces	DNV Columbus	Very Effective	4.5
5	DTPH56-07-T-000002	Advanced Technologies and Methodology for Automated Ultrasonic Testing Systems Quantification	Edison Welding Institute	Very Effective	4.5
5	DTPH56-07-T-000008	Automated Laser Ultrasonic Testing (ALUT) Of Hybrid Laser Arc Welds For Pipeline Construction	Intelligent Optical Solutions, Inc.	Very Effective	4.5
5	DTPH56-08-T-000021	Feasibility of Using Plastic Pipe for Ethanol Low Stress Lines	Gas Technology Institute	Very Effective	4.5
5	DTPH56-08-T-000020	Internal Corrosion Detection in Liquids Pipelines	AGINOVA, Inc.	Very Effective	4.5
6	DTPH56-07-T-000004	Development of HAZ Hardness Limits for In-Service Welding	DNV Columbus	Effective	4.3
6	DTPH56-08-T-000024	Broadband Electromagnetic Technology Sensor to Assess Ferrous Pipes without Removing Coatings in Both Traditional and Keyhole Excavations	Operations Technology Development	Effective	4.3
7	DTPH56-07-T-000003	Hybrid Laser/GMAW of High Strength Steel Gas Transmission Pipelines	Edison Welding Institute	Effective	4.2
7	DTPH56-08-T-000007	Development of a Free-Swimming Acoustic Tool for Liquid Pipeline Leak Detection Including Evaluation for Natural Gas Pipeline Applications	Arizona State University	Effective	4.2
7	DTPH56-08-T-000010	Direct strain measurements and failure pressure prediction in mechanically damaged and strained pipes	Luna Innovations Inc.	Effective	4.2
8	DTPH56-08-T-000012	ECDA - Potential Measurements on Paved Areas	CORRPRO Companies, Inc.	Effective	3.9
9	DTPH56-08-T-000012	ECDA Cased Pipes	CORRPRO Companies, Inc.	Effective	3.8
10	DTPH56-08-T-000012	Severity Ranking of ECDA Indirect Inspection Indications	CORRPRO Companies, Inc.	Effective	3.5

Table 6. Summary of Strong and Weak Point Recommendations	
Strong Points	**Weak Points**
• Overall high level of industry involvement in most projects.	• Improve researcher documentation of coordination with standards developing organizations and expand literature searches for other relevant efforts.
• Technology demonstrations are applied with most project scopes.	• Better tailor results targeting standards into the format of that standard developing organization.
• In some cases, consolidated awards seem to increase the coordination among other closely related projects.	• Several contractors have ambitious schedules and have problems adhering to them with multiple factors causing delays. More time should be factored by researchers conducting significant testing.
• Some projects have relevance to both onshore and offshore challenges.	• Some projects only address the main line pipe issues and need to address the same technical issue but with other pipeline components.
• Projects are mostly well managed	• Improve the clarity of researcher intellectual property plans for technology development projects.
• Technology transfer is working well on some projects	• More care needed in documenting and clarifying the metallurgical properties and how they affect the application of results.
• Projects are producing high quality results	• More welding contractor involvement called for in projects addressing welding issues.
• Project impacts addressing several industry challenges	• Improve coordination with other related projects within PHMSA and other related programs
	• For technology projects, more clarity needed in determining the market niche of that technology.
	• Some projects could use more distribution pipeline operator involvement.
	• Researchers need to better define how the project possibly only addresses one facet of a challenge or if the project is only one step toward solving the challenge.
	• Improve the efficiency and rigor with literature searches – Can improvements here save time and further remove

	duplication? Can more data be shared among researchers?

8.0 PHMSA Official Response to Panelists Findings and Recommendations

Being the fourth 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 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 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.

In addition, the guidance and presentation template provided to the researchers will be slightly revised to more streamline the reviews. This will improve the manner in which questions are answered, support effective reviews by the panelists, and increase project and program quality.

APPENDIX A

PHMSA Acceptance Memo

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

1200 New Jersey Ave., S.E.
Washington, DC 20590

JUL 27 2009

MEMORANDUM FOR THE RECORD

From: Rick Kowalewski, Acting Assistant Administrator/Chief Safety Officer

Subject: Pipeline Safety Research Program Peer Reviews, April 1, 2, 13 & 14, 2009

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 2009 average quality rating for the reviewed projects is "Very Effective," the highest possible rating. 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" or "Moderately Effective," 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

PHMSA accepts the findings and recommendations summarized in the Peer Review Report.

The Acting Assistant Administrator/Chief Safety Officer

APPROVED: MCD

DISAPPROVED: _____

COMMENTS: _____

DATE: 7/27/09

APPENDIX B

Peer Review Panelist Bios

Andrew G Hevle (Drew)

Professional Experience

El Paso Corporation, Houston, Texas - *Principal Corrosion Engineer*, 1997–2005 & 2007–Present

- Technical review and direction of technicians for the Gulf Coast division, which includes more than 10,000 miles of ANR, SNG, and TGP onshore and offshore natural gas transmission pipelines and gas storage facilities.
- Write scopes and manage engineering projects with an annual budget of over $15M including painting and pipeline rehabilitation, cathodic protection system design and monitoring, close-interval survey, internal corrosion mitigation system design and monitoring, material specifications for new pipe and coating, and SCC monitoring and mitigation.
- Develop company standards and company training programs, including O&M procedures, operator qualification program, and pipeline integrity management plan.
- Active in industry organizations, conferences, seminars, and roundtables such as AGA, API, ASME, INGAA, NACE, PRCI, and SGA conducting research and developing standards to improve the company's corrosion and pipeline integrity programs.

Enbridge Inc., Houston, Texas - *Senior Pipeline Integrity Engineer*, 2005–2007

- Technical support of technicians for Enbridge Energy Gas Transportation, Enbridge's natural gas pipeline business unit, more than 15,000 miles of pipelines including natural gas gathering, non-rural gathering, transmission, offshore, and jurisdictional liquids pipelines.
- Developed company standards and training for O&M, design, construction, painting, coating, and integrity management direct assessment procedures.
- Managed company Corrosion Control Manual, Painting Coating and Lining Manual, Direct Assessment section of the Integrity Management Plan, and Corrosion Control sections of the company's natural gas and liquid O&M and Engineering Design and Construction Manual.

FERA Corporation, Houston, Texas - *Engineering Project Manager/Corrosion Engineer*, 1990–1997

- Managed projects including close-interval surveys and other field surveys, stray current testing and mitigation, data interpretation and engineering analysis, cathodic protection design, data acquisition and data management software and hardware development, and training.
- Managed technicians in Close-Interval Survey crews

Education: Louisiana Tech University, Ruston, Louisiana
Bachelor of Science in Mechanical Engineering, Dean's list, successful completion of FE (EIT) exam

Certifications

NACE Corrosion Specialist, CP Specialist
NACE Instructor
NACE Internal Corrosion Technologist
NACE Certified Coating Inspector
NACE Pipeline Integrity Management Specialist
SGA Inline Inspection Course

Richard Fields

Relevant Experience:
R. J. Fields has conducted metallurgical research and participated in mechanical test standards development activities for nearly 40 years. He is currently the US representative on the Ductility Subcommittee of ISO, Chairman of the ASTM Subcommittee on Ductility and Formability, and an active member of the ASTM Fire Resistive Steel Task Group and the National Materials Advisory Board's Committee on Corrosion Prevention Standards for Ductile Iron Pipe. 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". 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 is now part of a research team that is developing 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/National Institute of Standards and Technology (NIST). He retired in May of 2004, and now works for KT Consulting on a contract with NIST. Highlights of his career include 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.

Joe C. Bowles, Jr.,P.E.

Forty-nine years experience in all aspects of pipeline corrosion control (external-underground/submerged, internal, and atmospheric). Served as Manager of Corrosion Control for major pipeline company with more than 19,900 miles of pipeline, onshore and off-shore, 96 compressor stations, off-shore platforms and meter stations. Established and supervised the operations, maintenance, budget, construction, design, and monitoring for nine subsidiaries.

Served as President of NACE International for the 1996-97 term and as a Director for eleven years. Received the NACE International Distinguished Service Award in 1990, and the NACE International Technical Achievement Award in 1992. A member of nine Technical Practices Committees.

A Registered Professional Engineer in Corrosion Engineering, in state of California, and a certified Corrosion Specialist with NACE International.

Participated as a member of Pipeline Research Committee (Corrosion Supervisory Committee), and Gas Research Committee, (Biocorrosion Task Group).

Authored and presented numerous papers on pipeline corrosion control.

Michael (Mik) Else

Mik has served the US Energy Industry for 26 years including 8 years in private industry and the past 14 with the USDOI, Minerals Management Service. Mik's primary focus has been oil & gas development, transportation, and research with secondary attention on alternative energy and process systems development.

Academic Degree:

B.S., Petroleum Engineering, University of Montana, College of Mineral Science &Technology, May 1983.

Relevant Experience:

Mik's role as senior engineer for the MMS Offshore Safety and Technology Research Program is:

- Manage research studies that emphasize pipeline and facility operation, safety, and technology advancement. Perform research solicitation, selection; funding; administration oversight and documentation of contractor activities and performance including site/facility inspections; technical guidance and communications; deliverables review/approval; and dissemination of information.
- Perform inspection of O&G facilities to ensure safe operation of personnel and equipment, security, operation and integrity of process and measurement equipment, storage and disposition, and transportation of O&G products.

- Lead accident/incident investigations of facilities, operations, equipment and systems.
- Develop operational programs, performance expectations, and policies for safety improvement and establish objectives and strategies to define and resolve energy industry challenges and barriers through coordination with national and international industry and regulatory authorities.
- Serve as MMS technical representative and subject-matter-expert for safety and regulatory issues; prepare technical and informational reports and presentations; serve on technical committees and review boards; and speak and defend MMS positions at forums, workshops, and conferences. Coordinate with officials both internal and external to MMS to ensure consistent application of policies and procedures.

Mario L. Macia

Mario Macia has 13 years of work experience at ExxonMobil Upstream Research Company and currently working in the Pipeline Technology section.

Assignments have included research in the areas of metallurgy, welding, fracture mechanics and pipeline design. Research projects experiences include the evaluation of 13Cr stainless steels for flowline applications, the development of X120 pipeline steels and girth welding technology, reliability based design for arctic pipelines, development of methods to evaluate pipeline strain capacity and development of welding technology for pipelines with strain based designs. In addition to research activities, he has provided support to ExxonMobil affiliates on materials engineering issues, including assignment to the Mackenzie Gas Project team to support development and qualification of materials for a strain based pipeline design.

He holds degrees in Materials Science and Engineering including a Bachelor of Science from Rice University and a PhD from the Georgia Institute of Technology. He is an active member of the API Task Group on Linepipe and a voting member of API SC5 for linepipe related standards.

Louis E. Hayden Jr, PE

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-present
Chairman ASME Task Group for development of B31.12 Hydrogen Piping and Pipeline Code.
Member Board on Pressure Technology Codes and Standards Materials for Hydrogen Service Task Group

David McColskey

David McColskey, now retired but formerly a Physical Scientist at the National Institute of Standards and Technology, has over 42 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 is co-PI on the establishment of a high pressure hydrogen test facility at NIST-Boulder under a proposed Hydrogen Initiative. In addition, he is co-PI on the existing 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 has served as a U.S. delegate to ISO Committee TC164 on Mechanical Properties Testing.

T. Randall Webb

Randall has more than 28 years of corrosion control experience obtained through education and employment with a gas distribution utility and a corrosion engineering firm. He has an extensive background in cathodic protection testing, design, and installation.

After working for five years in the power industry, he went to work for a corrosion engineering firm. While working for this firm, he performed testing on, design and installation of cathodic protection systems for pipelines, tanks (internal, external, below ground, and above ground), well casings, docks, and other structures. He also performed design and installation for lightning protection and structure grounding. After going to work for Southwest Gas in 1990, he developed and taught two, two week training courses for the corrosion technicians. He was responsible for all Corrosion Control Training, Policies, Procedures, Material Specifications and Operator Qualification for corrosion personnel. He has been active in NACE International serving on a number of task groups developing recommended practices, serving a term on the Public Affaires Committee and the Annual Program Coordinating Committee for NACE

symposia. He has become a NACE International instructor teaching CP Level I and CP Level II classes.

Member NACE International
BS Degree Electrical Engineering, Mississippi State University, 1974

Michael J. Rosenfeld, P.E.

Education
B.S., Mechanical Engineering, University of Michigan, 1979
M.S., Mechanical Engineering, Carnegie-Mellon University, 1981

Qualifications
Since joining Kiefner & Associates, Inc. in 1991 Mr. Rosenfeld has participated in a broad range of projects including fitness-for-purpose assessment of pipelines and piping, pipeline loading and stress analysis, failure investigation, pipeline codes and standards development, and pipeline research.
Relevant Experience

Fitness-for-Purpose:
Determined that mechanical damage features identified on a major oil pipeline were not immediate integrity threats, enabling the operator to avoid pressure reduction and immediate investigation, and realize significant cost savings. Assisted pipeline operators with successful waivers to operate in the US at 80% of SMYS by demonstrating fitness of the lines for uprated service.

Pipeline Stress Analysis:
Analyzed numerous pipelines for stresses induced by external loadings due to spanning, currents in water crossings, and soil movement due to subsidence or settlement. Established criteria for monitoring or mitigation based on condition of the lines.

Failure Investigation:
Performed investigations of failures in line pipe, appurtenances, and mechanical equipment involving diverse causes of failure such as manufacturing defects, fatigue, hydrogen cracking, stress-corrosion cracking, soil movement, welding practices, and corrosion.

Codes and Standards:
Primary author of major revisions to the ASME B31.8 code concerning longitudinal stress design, and evaluation and repair of mechanical damage. Primary author of major rewrite of ASME B31G currently in final approval stages.

Pipeline Research:
In research projects for PRCI and GTI, demonstrated the application of B31G for pipe bends and elbows, the importance of dent shape on fatigue behavior of dents, and a method for evaluating dents affecting welds; was the first to evaluate dent strain as a screening tool; developed a criterion now in ASME codes for evaluating ripple deformations in bends; prepared

comprehensive review of research on mechanical damage; demonstrated low susceptibility of gas pipelines to pressure-cycle fatigue.

Professional Affiliations
Member, ASME B31.8 Gas Transmission Piping Systems Section Committee
Member, ASME B31 Mechanical Design Technical Committee
Member, ASME B31 Standards Committee
Member, American Welding Society
Former Member, Joint ASCE-ASME Task Group on Design of Buried Pipe
Former Member, API RP-1117 Task Force on In-Service Relocation of Pipelines
Instructor, ASME Professional Development Short Course on ASME B31.8 Code
Presenter, SGA Integrity Management Web Conference Series
Registered Professional Engineer, State of Ohio

George Ragula

Summary
Results oriented, highly motivated, assertive engineering professional with over 25 years diversified experience in all aspects of gas distribution engineering and operations management. Innovative self-starter with excellent technical knowledge and practical experience capable of handling any challenge and delivering desired results. Proven leader in the design, development and deployment of new technologies. Recognized leader in the gas industry with strong networking skills and established relationships on a national and international scale.

Experience

Public Service Electric & Gas Company, Newark/Harrison, NJ	1988 - Present
Gas Distribution Technology Manager	1992 - Present

Education:

1971 - 1975	BS, Polytechnic Institute of Brooklyn, Brooklyn, New York Mechanical Engineering, Dean's Honor List

Professional Development
Gas Distribution Engineering, Institute of Gas Technology (IGT)
Gas Distribution Operations, IGT
Management Development, IGT
Welding Engineering, Technical Seminars
ASME Boiler & Pressure Vessel Code Welding Seminar
Litigation Avoidance for Contracts & Purchasing Decision Makers, The Condor Group
Maintenance of Cast Iron Mains Adjacent to Foreign Construction, Cornell University
Situational Leadership, Hakker & Associates
Labor Relations, Brooklyn Union Gas Company
Men & Women In the Organization, Hakker & Associates

Gas Leakage Control, Heath Consultants
Gas Control, Fisher Controls
Effective Communicating, Decker Communications
Influence Management, American Management Association
Leader Facilitator, PSE&G Company
Process Improvement, PSE&G Company

Professional Activities

Treasurer, Northeast Gas Distribution Council (NEGDC)
Chairman, NYSEARCH – Northeast Gas Association R&D Committee
Chairman, Increase in PE Design Factor, GTI/AGA Joint Industry Task Group
Chairman, PE Rework Project, GTI/AGA Joint Industry Task Group
Distribution Project Advisor, Gas Research Institute (GRI)
Member, American Gas Association (AGA)
Member, American Society of Mechanical Engineers (ASME)
Director, Board of Directors North American Society for Trenchless Technology (NASTT)
Member, NJ Society of Asphalt Technologists

Thomas D. Emerson Jr.

Thomas is currently with Explorer Pipeline.

CERTIFICATIONS

National Association of Corrosion Engineers (NACE)
Coating Inspector Level I-Certified -2007
Corrosion Specialist – 1997
Cathodic Protection Specialist - 1995
Sr. Corrosion Technologist – 1994
Corrosion Technologist – 1987
Corrosion Technician-1985

REGISTRATIONS

NACE Corrosion Specialist/Cathodic Protection Specialist – No. 5060
Steel Structures Painting Council (SSPC) – No. 132728

PROFESSIONAL AFFILIATIONS

National Association of Corrosion Engineers (Since 1976)
Technical Advisory Committee (NACE)
Member of General Committee – Appalachian Underground Corrosion Short Course – West Virginia University (Since 1990)
Member of the Oklahoma University Corrosion Short Course Committee and Instructor (Since 2003) (Chair Person 2009-2011)
Proctor and Instructor (NCCER) Operator Qualification (Since 2004)
Steel Structures Painting Council (SSPC) (Since 1993)

NACE COMMITTEES

STG 05 Cathodic/Anodic (Stirring Committee)
STG 35 Pipelines, Tanks, and Well Casings (Steering Committee)
TEG 267x In-Line Inspection
TEG 367x Corrosion Awareness-Promotion of Costs, Concerns, and Other Related Issues
TG 013 External CP of On-Grade Metallic Storage Tank Bottoms
TG 211 The Application of 100mv Polarization Criterion
TCC Historical Technical Committee

OTHER

Tom is also heavily involved with Operator Qualification and the Integrity Management Programs

Richard B. Eckert

Richard is currently with BP Exploration Alaska, Inc.

EDUCATION

B.S., Engineering, Western Michigan University, Kalamazoo, Michigan

PROJECT MANAGEMENT

Created and reviewed materials specifications, welding procedures, NDE procedures, engineering drawings, and related specifications. Conducted plant quality audits, in-plant inspections, and project kick-off meetings. Worked with all common pipeline commodity items such as large valves, pressure vessels, heaters, filters, separators, and pulsation bottles. Perform departmental and project budget analysis, calculations and forecasting.

SYSTEM INTEGRITY

Supported system integrity efforts by incorporating data from failure investigations and internal corrosion monitoring into a risk management program. Developed procedures for direct assessment of pipeline inspection sites and documentation of field/lab information. Evaluated ILI anomalies and assisted with tool calibration efforts. Led corporate effort to standardize stress corrosion cracking related (SCC) field information, and incorporate into a risk management program.

INTERNAL CORROSION CONTROL

Served from 1988-1998 on the Gas Research Institute Microbial Corrosion Committee overseeing research efforts and directly participating in field/lab testing. Developed innovative techniques to monitor for biological involvement in pipeline corrosion and for investigation of corrosion damage suspected of being influenced by bacteria. Worked with a team to develop an enterprise-wide database system for managing internal corrosion monitoring and mitigation information.

FAILURE ANALYSIS
Extensive experience in failure investigation of pipeline and reciprocating/rotating compressor components. Managed investigations of major ruptures and coordinated investigations activities with legal and regulatory representatives. Conducted root-cause determination, developed programs to reduce the incidents of various types of failures, and leveraged key information from failure investigations to improve system integrity

PERSONNEL TRAINING AND QUALIFICATION
Developed and conducted training seminars in corrosion analysis/preservation, field investigation of ILI anomalies, SCC investigation and microbial corrosion. Chaired development of the first internal corrosion certification course for NACE International.

NON-DESTRUCTIVE TESTING
Managed all internal NDE activities and provided quality-assurance programs for contracted services. Familiar with the appropriate application of all common NDE methods. Developed procedures and personnel qualification programs. Evaluated the mechanized UT method for application on company offshore projects and developed AUT inspection specifications.

PROFESSIONAL ACTIVITIES
NACE –
Chairman, TG254 Microbiological Influenced Internal Corrosion of Pipelines
Chairman, Internal Corrosion Course Development Subcommittee
Certification: NACE Internal Corrosion Technologist
NACE Education Committee-Vice Chair
Lead Instructor, Internal Corrosion for Pipelines (2003)
Books Chair, Publications Committee and NACE Press Council
Contributing Editor, TG293 Internal Corrosion Direct Assessment of Pipeline Transporting Normally Dry Natural Gas
PRCI –
Principal Investigator, Development of a MIC Bench Test Protocol, 2004
Contributing Researcher, RPTG-0028, GRI-8264, Differentiation of Corrosion Mechanism by Morphological Feature Characterization, (2000-2001)
Committee Member, GRI Contract No. PR 15-9916, “The Interdependent Effects of Bacteria, Gas Composition, and Water Chemistry on Internal Corrosion of Steel Pipelines,” (1194-2001)
Corrosion Supervisory Committee Member, GRI-3967, Environmentally Benign Mitigation of Microbiologically Influenced Corrosion, (1998-2001)
GRI –
Committee Member of Microbiological Influenced Corrosion (MIC) Advisory Task Group (committee member 1986-1997)

APPENDIX C

Peer Review Project Summaries

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

Hybrid Laser/GMAW of High Strength Steel Gas Transmission Pipelines

Edison Welding Institute

The project aims to develop innovative hybrid Yb-Fiber Laser and Gas Metal Arc Welding (GMAW) processes and technologies for pipeline girth welding and to demonstrate the system under field conditions. Internal diameter root pass welding with GMAW will be the baseline with external hybrid root pass welding techniques developed for variations of laser power and root face thickness. This combination has the greatest potential to meet existing pipeline integrity requirements and facilitate the use of new and existing Yb-Fiber Laser GMAW hot and fill pass techniques. Advanced automation will be used to improve and develop root and fill pass processes, and for attainment of mechanical property requirements.

Validation and Documentation of Tensile Strain Limit Design Models for Pipelines

Pipeline Research Council International

The project objective covers the following goals: 1. Obtain high quality experimental data on the most important parameters for the tensile strain capacity of pressurized pipes; 2. Using the experimental data, and building on previous work, determine the accuracy of existing models (FEA and other engineering models) to predict full-scale results, make initial modifications to improve model accuracy and identify requirements for next generation model developments; 3. Prepare initial recommended procedures, for design and material testing, for establishing project-specific, tensile strain limits for pipelines designed using strain based design methods; and 4. Develop next generation tensile strain limit models and strain-based design procedures.

Second Generation Models for Strain-Based Design

Pipeline Research Council International

Pipelines that are subjected to large ground movements, such as those resulting from frost heave, thaw subsidence, or seismic actions, can only be economically designed using strain-based design (SBD) methods. There is an urgent need to properly address the lack of physical test data, which would allow for further verification and development of tensile strain capacity models, and consequently, documented procedures for establishing tensile strain capacity limits. Objectives: 1. Obtain high quality test data to identify the dominant parameters governing the tensile strain capacity of pressurized pipes; 2. Building on previous work, apply test data to

assess the accuracy of existing numerical and engineering models, modify the models to improve accuracy and identify requirements for second generation model development; 3. Prepare a state-of-the-art guidance document to establish tensile strain limits based on existing SBD models; and 4. Develop second generation tensile strain limit models and SBD procedures.

Butt Fusion Joint Integrity and Evaluation of NDE Technologies
Northeast Gas Association /NYSEARCH

The objective of the program is to improve and/or validate the existing butt fusion process by developing novel analytical solutions and new test approaches that will help ensure the safe long-term performance of polyethylene (PE) butt fusion joints. The new test approaches are designed to address overall joint integrity related to long-term destructive testing and evaluate the latest innovations in Non-Destructive Examination (NDE) techniques.

Method for Qualification of Coatings Applied to Wet Surfaces
CC Technologies Inc.

The objective is to develop a test methodology which addresses the application of rehabilitation and repair coatings on wet surfaces is proposed. The method will encompass the extremes of wet surface coating application, namely a continuously wet and cold surface.

Advanced Technologies and Methodology for Automated Ultrasonic Testing Systems Quantification
Edison Welding Institute

The overall objective of the program is to reduce the uncertainty of Automated Ultrasonic Testing (AUT) detection and sizing accuracy with the goal of dramatically improving the predicted reliability of pipelines in the early design stage. This will be accomplished by the following manner: 1. Develop a methodology for quantification of AUT systems; 2. Advance and quantify AUT systems image-capture capabilities; 3. Quantify the performance of multiple AUT systems and establish a guidance document; and 4. Implement the quantification methodology in field tests and guidance document in Reliability Based Design and Assessment (RBDA) standards. The deliverables for this program will include a methodology to quantify imaging capabilities and AUT systems, probability of detection (POD) and sizing accuracy curves for multiple representative systems, guidance for AUT capabilities and ECA/strain-based design approach applicability, and technical justification for modifications of the current requirements for AUT quantification trails demanded by the global practices of majors companies and codes.

Validation of Assessment Methods for Production Scale Girth Welding of High Strength Pipelines with Multiple Pipe Sources

Electricore, Inc.

The goals of the proposed project are: 1. To test a large set of girth welds produced under realistic conditions by a state of the art high productivity GMAW system; 2. To demonstrate the effect of material variability between pipes, between heats and between pipe manufacturers; and 3. To validate current and proposed new weld defect assessment methods against the performance of a large set of welds made under field production conditions.

Effect of Surface Preparation on Residual Stress in Multi-layer and Other Pipeline Coatings

NOVA Research & Technology Centre

The project objective is to improve the performance of multi-layer coatings through an understanding of the factors that affect the level of residual stress in the coating and the consequences for coating disbondment. This improved understanding is expected to 1. Lead to the identification of improved methodologies for surface preparation and coating application, 2. Enable the evaluation of construction or in-service damage on the long-term integrity of the pipeline and, consequently, 3. Result in a greater acceptance by the North American pipeline industry for the use of these inherently safer, advanced coating systems.

Hybrid Laser Arc Welding (HLAW) System Development for Pipeline Construction

BMT Fleet Technology Limited

The objective of this program is to take lessons learned from the lab and input from industry sponsors to develop, test, and validate a "field ready" Hybrid Laser Arc Welding (HLAW) system for full circumferential girth welding of large diameter (NPS30 and above) high strength pipelines.

Automated Laser Ultrasonic Testing (ALUT) Of Hybrid Laser Arc Welds For Pipeline Construction

Intelligent Optical Systems

Girth welds in new pipeline construction have stringent inspection requirements to ensure pipeline safety. Current automated ultrasonic inspection testing systems are complex and are limited to post process application. Laser ultrasonics is a noncontact technique that can perform ultrasonic measurements on hot, moving surfaces. The goal of this project is to apply laser ultrasonics for monitoring the integrity of girth welds in real time, using a measurement sensor that is mounted in tandem with the weld head. This project is consolidated with a parallel project on the development of hybrid laser arc welding for girth weld production.

Development of HAZ Hardness Limits for In-Service Welding
CC Technologies, Inc.

The objective of the proposed project is to develop heat-affected zone hardness acceptance criteria that can be used to evaluate welds during the qualification of procedures for welding onto in-service pipelines. Welds made onto in-service pipelines are particularly susceptible to hydrogen cracking. During qualification of welding procedures, limits are often imposed on heat-affected zone hardness (*e.g.*, 350 HV max.) as a way to avoid cracking. The hardness level below which hydrogen cracking does not occur is not a fixed value, but varies as a function of several parameters. The results of previous work resulted in the development of hardness evaluation criteria that can be used to quantify the trade-offs that can be made between HAZ hardness, hydrogen level, and the chemical composition of the materials being welded for welds made onto in-service pipelines. Further development and validation is required prior to the widespread use of these criteria, particularly for microalloyed materials used for modern high-strength pipelines. The use of these criteria will reduce the cost and increase the reliability of pipeline modifications and repairs.

Update of Weld Design, Testing, and Assessment Procedures for High Strength Pipelines
Electricore, Inc.

The objectives of this work are to fill critical gaps and provide guidelines on the effective use of high strength linepipes, from design and testing to weld integrity assessment procedures. The planned work builds up the extensive research and development efforts completed by the project team members. Several key deliverables are: 1. A recommended format for the specifications of high strength linepipes; 2. Relevant testing procedures and protocols for the assessment of strength and toughness that are consistent with the design, construction, and maintenance requirements of high strength pipelines; 3. inclusion of weld strength mismatch requirements for different design conditions; and 4. Updated ECA (Engineering Critical Assessment) procedures for the construction and maintenance of high strength pipelines.

Development of Optimized Welding Solutions for X100 Linepipe Steel
Electricore, Inc.

The objectives of the proposed work are to establish the range of viable welding options for X100 line pipe, define essential variables to provide for welding process control that ensures reliable and consistent mechanical performance, validate the new essential variables methodology for relevant field welding conditions, and verify weldment performance through a combination of small and large scale tests. Full implementation will be achieved through changes to applicable codes and standards.

Understanding Magnetic Flux Leakage (MFL) Signals from Mechanical Damage in Pipelines

Electricore, Inc.

The objective of the project is to provide understanding, identification, and characterization of the MFL signals arising from the geometric and residual stress components to enhance the reliability of employing MFL tools for mechanical damage detection.

In-Situ Hydrogen Analysis in Weldments: Novel NDE for Weld Inspection

Colorado School of Mines

In this program, the Colorado School of Mines and the National Institute of Standards and Technology - Boulder will collaborate in the development of non-destructive technology for weld inspection, assessment, and repair in high strength pipeline steels and their weldments. Advanced sensors will allow the pipe integrity to be frequently or continuously monitored to assure pipeline safety and environmental protection. The research would be further advanced by the characterization of hydrogen in pipeline steel weldments. The characterization of hydrogen content and behavior in high strength steel weldments is timely and important with the introduction of new higher strength steels (*e.g.* X100, which have higher susceptibility to hydrogen damage) in the pipeline industry.

MWM-Array Detection & Characterization of Damage through Coatings and Insulation

JENTEK Sensors Inc.

In this program JENTEK is delivering a new capability for inspection from outside pipelines, without coating/insulation removal. The goal is reliable/rapid imaging of external/internal corrosion, mechanical damage, and Stress corrosion Cracking (SCC) by adapting Meandering Winding Magnetometer (MWM)-Array technology for external damage, using high frequency methods. This includes integrated field demonstrations within twenty-four months. Solution for internal corrosion will transition later, using lower frequency methods.

Adaptation of MWM-Array and MFL Technology for Enhanced Detection/Characterization of Damage from Inside Pipelines

JENTEK Sensors Inc.

In this program JENTEK is adapting Meandering Winding Magnetometer (MWM)-Array technology and using JENTEK multi-variate inverse methods to deliver hybrid MWM-Array/MFL methods for ILI applications. This program will also develop solutions for conventional pigs and platforms for unpiggable lines to detect/size internal/external corrosion, mechanical damage and SCC with internal liners and coatings.

Structural Significance of Mechanical Damage
Electricore, Inc.

The primary objective of the project is to establish a detailed experimental database to support the development and validation of improved burst and fatigue strength models for assessing the interaction of mechanical damage with secondary features (gouges, corrosion, and welds). The use of this data to develop and validate mechanistic models will produce reliable tools to assess a wide range of mechanical damage forms, thereby increasing safety, reducing unnecessary maintenance, and supporting the improvement of pipeline standards and codes of practice.

Effect of Ethanol Blends and Batching Operations on Stress Corrosion Cracking of Carbon Steel
DNV Columbus

This program will categorize ethanol blends into three categories: blends that can be transported in existing pipelines without significant modification of the system and operations (Category 1), blends that require significant modifications (Category 2), and blends that cannot be transported in existing pipelines, but could be moved in specially designed systems (Category 3). It will develop data necessary to make engineering assessments of the feasibility of transporting fuel-grade ethanol (FGE) and FGE blends in existing pipelines in a batching or dedicated mode.

Effect of Ethanol Source on Stress Corrosion Cracking of Carbon Steel
DNV Columbus

This program will determine the stress corrosion cracking susceptibility of steels in ethanol from different sources. In addition, it will develop an understanding of the factors that cause source to source to variation in the potency of ethanol towards corrosion/SCC. It will also identify parameters that can be used to determine the degree of potency of a given source of ethanol in causing SCC for transportability decisions.

Validation for Flaw Acceptance of Mechanical Damage to Low Stress Natural Gas Pipelines
Operations Technology Development

The ability to discriminate flaws that do and do not affect pipeline integrity is important for low stress pipelines which are subject to new DOT pipeline integrity management regulations. Current federal regulations do not provide guidance on the need to repair mechanical damage to low stress pipelines. The objective of this research is to demonstrate that flaw acceptance criteria normally applied to high stress pipelines are overly conservative and may be relaxed for low stress pipelines.

Enhanced Defect Detection and Sizing Accuracy Using Matrix Phased Array Ultrasonics Tools

Edison Welding Institute, Inc.

This program has the following objectives: To develop a concept for Matrix Phased Array Ultrasonics probes/modules applicable for either outside or inside pipe inspection and carried by different inspection tools, platforms and systems; To define and optimize detection and sizing capabilities of the modules via modeling and simulation; To design and fabricate (2) two probes/modules, one for outside and one for inside inspection; and To determine and demonstrate the detection and sizing performance of the probes/modules.

Improving Magnetic Flux Leakage In-Line Inspection Corrosion Sizing Using Phased Array Guided Ultrasonic Waves

Battelle Memorial Institute

The goal of this development is to improve corrosion anomaly depth sizing of magnetic flux leakage (MFL) tools by adding phased array Guided-Wave Ultrasonic (GWUT) inspection technology.

The Effect of Cathodic Protection on Stress Corrosion Cracking of High-Strength Pipeline Steels

CANMET Materials Technology Laboratory

This program will establish the effectiveness of cathodic protection in mitigating stress corrosion cracking (without causing hydrogen damage) for a range of high-strength pipeline steels from X-70 to X-120. It will also assess the effects of overprotection and underprotection.

Development and demonstration of an integrated tool for mapping, sizing and evaluation of SCC for remaining strength prediction

RTD Quality Services USA, L.P.

The goal of this project is to develop and demonstrate a tool that enables operators to make judicious decisions about repairs and re-inspections with regard to pipeline segments affected by Stress Corrosion Cracking (SCC). One expected result is a solution that integrates the latest developments in non-destructive evaluation technology and provides a comprehensive, field ready, tool to evaluate, assess and determine repair requirements for SCC.

Effect of Concentration and Temperature of Ethanol in Fuel Blends on Microbial and Stress Corrosion Cracking of High-Strength Steels

Colorado School of Mines

The Colorado School of Mines (CSM), in association with the National Institute of Standards & Technology (NIST), will measure the effect of concentration and temperature of ethanol in fuel blends on microbiological and caustic corrosion of high strength steels used in handling and transportation. The project will also determine tested solutions for identified corrosion problems while transporting ethanol-fuel blends.

Pipeline Segment-Specific External Corrosion Rate Estimation to Improve Reassessment Interval Accuracy

DNV Columbus

The primary objective is to provide a simple tool to optimize determination of integrity reassessment intervals by more accurately predicting external corrosion rates that are: 1) representative of a specific pipeline segment, and 2) include distribution of corrosion rates as a function of location and time (allowing prediction of time-to-first-failure). Secondary objectives include: 1) putting recently reported NIST data into a context that can be used by pipeline operators, and 2) including the ability to allow reduction of predicted corrosion rate based on close-interval-survey and/or other data.

Evaluation and Method for Qualification of Fiber Reinforced Composite Repair Techniques for Transmission and/or Distribution Pipelines

DNV Columbus

The project is developing a method for qualification of fiber reinforced composite repairs while simultaneously evaluating the products that are currently available for operators. There is no existing standard for the application and use of composite repairs and field trials are limited to the existing conditions during the repair. In addition, a lack of published data increases the risk for improper installation and use of composite repairs under inappropriate conditions, such as exceedingly wet soils, over-protection with cathodic protection systems, and pipelines susceptible to mechanical damage. Thus a guideline for appropriate use, proper preparation, and compatible conditions must be developed. The end result would be a "buyer's guide" for operators and a reference manual providing data concerning appropriate usage, application, and conditions for the use of composite repair patches.

Pipeline Quality Biogas: Guidance Document for Dairy Waste, Wastewater Treatment Sludge and Landfill Conversion
Gas Technology Institute

GTI plans to develop guidance on analytical criteria necessary for the introduction of biogas, a new and interchangeable fuel from dairy waste, wastewater treatment, landfills facilities, into existing pipeline networks, in order to assess quality, safety, and compatibility with existing supplies and pipeline delivery infrastructure.

Achieving Maximum Crack Remediation Effect from Optimized Hydrotesting
University of Alberta

The project will develop a working model to allow industry to predict the overall benefits of hydrotests. Such a prediction will be made with a consideration of various characteristics of a pipeline including the type of operation, stage of cracking, environmental susceptibility, steel metallurgy, and operation history. When hydrotesting is necessary, the model will help operators select the best parameters that would generate the most effective crack remediation.

Validation of External Corrosion Growth-Rate Using Polarization Resistance and Soil Properties
Operations Technology Development

The objective is to estimate corrosion growth-rates, reduce assessment costs, and improve the selection of reassessment intervals of pipelines and increase their safety. This will be achieved by: 1 Perform field tests and demonstrations using LPR and ER technologies, 2. Correlate results with weight-loss of buried coupons, 3. Evaluate soil parameters that affect corrosion, and 4. Incorporate the measurements into a database and program that improves corrosion-rate estimates.

Development of Tools to Estimate Actual Corrosion Growth Rates (Internal and External) of Gas Pipelines
Southwest Research Institute

The main objectives are: 1. Improving the current existing internal corrosion rate model for wet gas pipelines and further verifying the model using field corrosion growth rate data, 2. Developing a thin-film internal corrosion model to predict corrosion rates in dry gas pipelines with gas quality upsets, and verifying the model using field corrosion growth rate data, and 3. Using the existing external corrosion model to predict external corrosion rates with including the effect of CO2 permeation from soil into a disbonded region through a holiday and through the coating itself.

Monitoring Conditions Leading to SCC/Corrosion of Carbon Steel
DNV Columbus

This project will develop a field operable monitoring system to determine the conditions under which steel pipelines or other equipment may be susceptible to SCC. It will install an oxygen monitoring system and conduct studies over an extended period of time. Finally, it will develop guidelines for decision making from monitoring and other laboratory information.

Advanced Development of Proactive Infrasonic Gas Pipeline Evaluation Network
Northeast Gas Association/NYSEARCH

The primary objective of this project is to advance the PIGPEN technology to pre-production status by completing development of advanced algorithms, field testing in a range of pre-production scenarios and developing practical procedures for deploying and utilizing the technology. This effort will address PHMSA's and Industry's need to develop technology that will monitor encroachment and prevent damage while construction equipment is digging and/or boring.

Feasibility of Using Plastic Pipe for Ethanol Low Stress Lines
Gas Technology Institute

This research project will address the non-metallic issues associated with use and conversion of existing pipelines for ethanol/biofuel transport, as well as develop low-cost options for new non-metallic pipelines. Evaluating effects of ethanol/biofuel blends on non-metallic pipeline components and relevant pipe lining applications are included for existing pipelines. For new pipelines, GTI will research new materials as potential low cost alternatives to specially designed metallic pipelines.

Internal Corrosion Detection in Liquids Pipelines
AGINOVA INC.

This project will build upon previous successful development of a sensor system for gas pipelines that is capable of locating areas of water accumulation, determining the corrosivity of any found liquids, is low cost, and can be operated in both piggable and non-piggable pipelines and extend it to liquids pipelines. This methodology would compliment the Liquid Petroleum-Internal Corrosion Direct Assessment and traditional In-Line Inspection methods but would provide a direct measure of corrosivity/corrosion rate (an improvement upon LP-ICDA) and would be low cost and could be used in unpiggable pipelines (potential improvements over traditional ILI methods).

Broadband Electromagnetic Technology Sensor to Assess Ferrous Pipes without Removing Coatings in Both Traditional and Keyhole Excavations

Operations Technology Development

The objective of the project is to enhance and evaluate a portable, cost effective, and reliable direct-assessment tool capable of detecting metal loss, pits, and cracks in ferrous pipes that does not require the removal of pipe coatings, and has the ability to be used through keyhole and traditional excavations.

Development of a Free-Swimming Acoustic Tool for Liquid Pipeline Leak Detection Including Evaluation for Natural Gas Pipeline Applications

Arizona State University

The main objective of the proposed research is to leverage a free-swimming acoustic leak detection tool that is currently used in the water pipeline industry and further develop the device for application in oil product pipelines and evaluate its potential for natural gas pipelines. The target is to develop a device capable of detecting very small leaks (< 1 gpm) and further develop a software program to provide on-site evaluation of results to the end user. The goal is to have a commercially available device within a 24 month project duration.

Direct strain measurements and failure pressure prediction in mechanically damaged and strained pipes

Luna Innovations Incorporated

The objective of this project is to couple in-service measurements with predictive tools to determine the maximum safe operating pressure and Code margins of safety. This would be based on direct measurements of the strains in pipelines that have suffered mechanical damage, or have been subjected to bending, either intentionally in construction or unintentionally from the effects of ground movement.

ECDA - Potential Measurements on Paved Areas

Corrpro Companies Inc

The project is addressing External Corrosion Direct Assessments for cased crossings, severity ranking of indirect inspection indications and potential measurements on pavement. Specifically, the project will identify assessment technologies for shorted, electrolytically-coupled and electrolytically isolated conditions of cased crossings; to better define severity-ranking classification criteria for data and to develop procedures for recording pipe-to-soil potential and CDVG measurements on pipelines under paving.

ECDA of Cased Pipes

Corrpro Companies Inc

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Severity Ranking of ECDA Indirect Inspection Indications

Corrpro Companies Inc

The project is addressing External Corrosion Direct Assessments for cased crossings, severity ranking of indirect inspection indications and potential measurements on pavement. Specifically, the project will identify assessment technologies for shorted, electrolytically-coupled and electrolytically isolated conditions of cased crossings; to better define severity-ranking classification criteria for data and to develop procedures for recording pipe-to-soil potential and CDVG measurements on pipelines under paving.

APPENDIX D

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 2009 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, Room E22-321
1200 New Jersey Avenue S.E. (East Bldg.)
Washington D.C. 20590
P(202) 366-3814
F(202) 493-2311
Email robert.w.smith@dot.gov