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Peer Review Report

Pipeline & Hazardous Materials Safety Administration

Pipeline Safety Research & Development Program

Peer Reviews Conducted
April 20, 26, & 27, 2011

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EXECUTIVE SUMMARY

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

The annual peer review continues to build on an already strong and systematic evaluation process developed by PHMSA's Pipeline Safety R&D Program and certified by the Government Accountability Office. The 2011 peer review panel consisted of nine government and industry experts. Three panelists were active Government representatives from the Bureau of Ocean Energy Management, Regulation, and Enforcement, the National Institute of Standards and Technology, and from the Department of Energy Biomass Program. The remaining six panelists were independent contractors and retired Government or retired pipeline operator employees some of which 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.

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

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

The rating scale possibilities were "Ineffective," "Moderately Effective," "Effective," or "Very Effective." During the April 2011 review, the average program rating between all the evaluation categories was "Very Effective." For this year, 24 projects were rated "Very Effective" with 9 projects ranked as "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 remain "Very Effective" since the initial reviews in 2006. Additional details are available in Section 7 and Tables 4, 5 and in Appendix C of this report.

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

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1.0 Introduction

The purpose of this document is to report findings from the research peer reviews held April 14, April 20, April 26 & April 27, 2011 for PHMSA's Pipeline Safety Research and Development Program. The findings and recommendations in this report are derived from the scoring and comments collected from the peer review panelists.

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

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

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

The purpose of these peer reviews is to uncover technical problems, to keep projects on target or aligned with stakeholder needs and to give technical guidance 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 2.5 million miles of natural gas and hazardous materials pipelines. It is focused on the continual reduction in the number of incidents on natural gas and hazardous liquid pipelines resulting in death, injury, or significant property damage. Additionally PHMSA aims to reduce spills that harm the environment.

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

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

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

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

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

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

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

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

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

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

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

Research Program Quality

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

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

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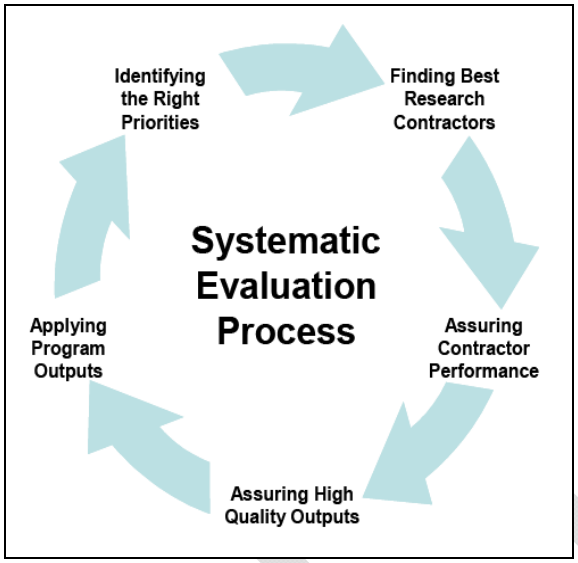
Figure 1. Systematic Evaluation Process



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

Appropriate priority and good project design are refined while finding the best research contractors. A merit review panel comprised of representatives from Federal and State agencies, industry operators, and trade organizations uses strong evaluation criteria to review research white papers and proposals. In addition, a 50 percent cost share between the Government and industry is required, which forces researchers to partner 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 that awarded projects are performing well. The MIS electronically monitors and tracks contractor performance as the project moves toward completion. This system provides the necessary oversight so that specific contractual milestones and contract accounting are systematically followed as prescribed in the award documents. The system design improves and maintains program quality, efficiency, accounting and accountability. Additional oversight is provided by Agreement Officers' Technical Representatives (AOTRs) who are trained, certified, and designated to each project in accordance with the Federal Acquisition Regulations.

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

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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 nine government and industry experts. Three panelists were active Government representatives from the Bureau of Ocean Energy Management, Regulation, and Enforcement, the National Institute of Standards and Technology, and from the Department of Energy Biomass Program. The remaining six panelists were independent contractors and retired Government or pipeline operator employees some of which play vital roles as peers for the American Petroleum Institute, the American Society of Mechanical Engineers, NACE International 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	Theresa Bell	Department of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement
2	James R. Fekete, P.E., Ph.D	Department of Commerce, National Institute of Standards and Technology
3	Shabnam (Shab) Fardanesh	Department of Energy, Energy Efficiency and Renewable Energy's Office of Biomass
4	David McColskey	Department of Commerce, National Institute of Standards and Technology (retired)
5	Richard Fields	Department of Commerce, National Institute of Standards and Technology (retired)
6	Edward J. Ondak	Independent Consultant, representing NACE International
7	T. Randall Webb	Independent Consultant, representing NACE International
8	Keith Leewis, Ph.D, P.Eng.	Independent Consultant
9	Robert J. Appleby	Independent Consultant, representing the American Society of Mechanical Engineers

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:

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

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

5.0 Scope of the Peer Review

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

1. Project relevance to PHMSA mission.
   - How well does the project illustrate its relevance for enhancing pipeline safety and or protecting the environment?
   - How well does the project describe its relevance to research program goals (technology, consensus standard or produce general knowledge)?

2. Project management.
   - Is the project still making progress toward the work scope objectives and the PHMSA goals?
   - Is the project still being managed on budget and schedule?

3. Approach taken for transferring results to end users.
   - Is there a plan for dissemination of results, including publications and reporting?
   - How much end user involvement is incorporated into the work scope?
   - For results that may include marketable products and technologies, are commercialization or U.S. Patent plans established?

4. Project coordination with other related programs.

   - Does the project build on, or make use of, related or prior work?
   - Is the work of the project being communicated to other related research efforts?

- Has consideration been given to possible future work?

5. Quality of project results.

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

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

These criteria will provide a numeric rating, which will be converted and illustrated as "Ineffective," "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

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

Very Effective
Exceptional clarity in describing the method to 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 needed to support a satisfactory desired outcome.

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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 2011 review varied among welding, corrosion mitigation, biofuels, technological, and general knowledge focused projects. A short description of each peer reviewed project is found in Appendix D.

7.0 Peer Review Findings

During the April 2011 review, the average program rating between all the evaluation categories was "Very Effective." For this year, 24 projects were rated "Very Effective" with 9 projects ranked as "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 remain "Very Effective" since the initial reviews in 2006. Table 4 summarizes the overall program performance based on the summary of the reviewed projects. Table 5 itemizes the project ranking order, where projects of the same score have an equal ranking.

At the time of the reviews, roughly half of the projects were approximately 10 percent complete with the remaining half 70 to 100 percent complete.

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

Appendix C, Table 6 itemizes the strong and weak points collected from all 33 projects reviewed by the nine panelists. These points were consistent among several panelists and are reflected in the scoring of multiple evaluation categories. Any specific recommendations will be disseminated to researchers and AOTRs as necessary so individual decisions on scope changes can be determined.

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Table 4. Summary of Total Average Score & Rating for the Review Categories and Sub-Criteria		
Review Categories and Sub-Criteria	**Score**	**Rating**
1. Project relevance to PHMSA mission.	**4.7**	**Very Effective**
1.1. How well does the project illustrate its relevance for enhancing pipeline safety and or protecting the environment?	4.7	Very Effective
1.2. How well does the project describe its relevance to research program goals (technology, consensus standard or produce general knowledge)?	4.7	Very Effective
2. Project Management	**4.5**	**Very Effective**
2.1. How well is the project making progress toward the work scope objectives?	4.5	Very Effective
2.2. How well is the project being managed (on budget and schedule)?	4.4	Effective
3. Approach taken for transferring results to end users.	**4.6**	**Very Effective**
3.1. Is there a plan for dissemination of results, including publications and reporting?	4.6	Very Effective
3.2. How much end user involvement is incorporated into the work scope?	4.6	Very Effective
3.3. For results that may include marketable products and technologies, are commercialization or U.S. Patent plans established?	4.5	Very Effective
4. Project coordination with other related programs.	**4.6**	**Very Effective**
4.1. Does the project build on, or make use of, related or prior work?	4.8	Very Effective
4.2. Is the work of the project being communicated to other related research efforts?	4.5	Very Effective
4.3. Has consideration been given to possible future work?	4.4	Effective
5. Quality of project results.	**4.6**	**Very Effective**
5.1. Are the intended results supported by the work performed during the project?	4.5	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 presented in such a manner as to be useful for identified end users?	4.5	Very Effective
Summary:	**4.6**	**Very Effective**

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Table 5. Summary Ranking & Rating of Individually Reviewed Research Projects					
Rank	**Project ID**	**Project Title**	**Contractor**	**Rating**	**Score**
1	DTPH56-06-T-000016	Development of Dual Field MFL Inspection Technology to Detect Mechanical Damage	Pipeline Research Council International	Very Effective	5.0
1	DTPH56-09-T-000005	Performance Evaluation of High-Strength Steel Pipelines for High-Pressure Gaseous Hydrogen Transportation	Center For Reliable Energy Systems	Very Effective	5.0
1	DTPH56-09-T-000004	Stress Corrosion Cracking of Pipeline Steels in Fuel Grade Ethanol and Blends	Georgia Tech Research Corporation	Very Effective	5.0
2	DTPH56-08-T-000009	MWM-Array Detection & Characterization of Damage through Coatings and Insulation	JENTEK Sensors, Inc.	Very Effective	4.9
2	DTPH56-10-T-000013	Dent Fatigue Life Assessment - Development of Tools for Assessing the Severity and Life of Dent Features	BMT Fleet Technology Limited	Very Effective	4.9
3	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	4.8
3	DTPH56-10-T-000006	Landfill and Wastewater Treatment RNG Chemical and Physical Profiling: Increasing the Database Set	Gas Technology Institute	Very Effective	4.8
4	DTPH56-05-T-0001	Understanding Magnetic Flux Leakage (MFL) Signals from Mechanical Damage in Pipelines	Electricore, Inc.	Very Effective	4.7
4	DTPH56-09-T-000003	New Design and Construction Techniques for Transportation of Ethanol and Ethanol/Gasoline Blends in New Pipelines	Electricore, Inc.	Very Effective	4.7
4	DTPH56-10-T-000004	Technical and Economic Feasibility of Preventing SCC through Control of Oxygen	DNV Columbus	Very Effective	4.7
4	DTPH56-10-T-000005	Compatibility of Non-Ferrous Metals with Ethanol	DNV Columbus	Very Effective	4.7
4	DTPH56-10-T-000009	MWM-Array Characterization of Mechanical Damage and Corrosion	JENTEK Sensors, Inc.	Very Effective	4.7

Rank	Project ID	Project Title	Contractor	Rating	Score
4	DTPH56-10-T-000018	Odorant Effectiveness	Gas Technology Institute	Very Effective	4.7
5	DTPH56-08-T-000001	Development of a Commercial Model to Predict Stress Corrosion Cracking Growth Rates in Operating Pipelines	Southwest Research Institute	Very Effective	4.6
5	DTPH56-09-T-000002	Modeling of Microbial Induced Corrosion on Metallic Pipelines Resulting from Biomethane & the Integrity Impact of Biomethane on Non-Metallic Pipelines	Gas Technology Institute	Very Effective	4.6
5	DTPH56-10-T-000008	Completion of Development of Robotics Systems for Inspecting Unpiggable Transmission Pipelines	NGA/NYSEARCH	Very Effective	4.6
5	DTPH56-10-T-000011	Integrated Internal Inspection and Cleaning Tool Technology for Pipelines	Electricore, Inc.	Very Effective	4.6
5	DTPH56-10-T-000022	Development and Field Testing of a Highly Sensitive Mercaptans Instrument	NGA/NYSEARCH	Very Effective	4.6
6	DTPH56-10-T-000003	Feasibility of Chemical Inhibition of Ethanol SCC	DNV Columbus	Very Effective	4.5
6	DTPH56-10-T-000007	Setting Safe Limits on Biodiesel Constituents for Pipeline Integrity	DNV Columbus	Very Effective	4.5
6	DTPH56-10-T-000014	Selection of Pipe Repair Methods	Operations Technology Development NFP	Very Effective	4.5
6	DTPH56-10-T-000017	Fuelfinder: Remote Leak Detector for Liquid Hydrocarbons	Physical Sciences, Inc.	Very Effective	4.5
6	DTPH56-10-T-000020	Acoustic-based Technology to Detect Buried Pipes	Operations Technology Development NFP	Very Effective	4.5
6	DTPH56-10-T-000021	Advanced Learning Algorithms for the Proactive Infrasonic Pipeline Evaluation Network (PIGPEN) Pipeline Encroachment Warning System	Physical Sciences, Inc.	Very Effective	4.5

Rank	Project ID	Project Title	Contractor	Rating	Score
7	DTPH56-08-T-000014	Effect of Concentration and Temperature of Ethanol in Fuel Blends on Microbial and Stress Corrosion Cracking of Pipeline Steels	Colorado School of Mines	Effective	4.4
7	DTPH56-08-T-000008	Achieving Maximum Crack Remediation Effect from Optimized Hydrotesting	University of Alberta	Effective	4.4
7	DTPH56-10-T-000002	Corrosion and Integrity Management of Biodiesel Pipelines	DNV Columbus	Effective	4.4
8	DTPH56-10-T-000001	Effect of Microstructure of Pipeline Steels on Ductility and Fatigue Properties in High Pressure Hydrogen Atmosphere	The University of Tennessee	Effective	4.3
8	DTPH56-10-T-000010	Development of a Model to Accurately Predict the Conditions of Carrier Pipe within Casings Based on Conditions at the Casing Ends	Southwest Research Institute	Effective	4.3
8	DTPH56-10-T-000019	Advanced Development of PipeGuard Proactive Pipeline Damage Prevention System	NGA/NYSEARCH	Effective	4.3
9	DTPH56-10-T-000001	Cost-Effective Techniques for Weld Property Measurement and Technologies for Improving Weld HE and IGSCC Resistance for Alternative Fuel Pipelines	The University of Tennessee	Effective	4.1
10	DTPH56-10-T-000016	Realistic Strain Capacity Models for Pipeline Construction and Maintenance	Center For Reliable Energy Systems	Effective	4.0
11	DTPH56-10-T-000015	Optimization of Multi-Wire GMAW Welding Procedure for Heavy-Wall Offshore Pipeline Construction	Center For Reliable Energy Systems	Effective	3.9

8.0 PHMSA Official Response to Panelists Findings and Recommendations

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

PHMSA will continue refining the annual peer review process 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.

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APPENDIX A

PHMSA Acceptance Memo

MEMORANDUM FOR THE RECORD

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

Subject: Pipeline Safety Research Program Peer Reviews, April 20, 26, & 27, 2011

SUMMARY

The Pipeline and Hazardous Materials Safety Administration (PHMSA) has finalized the process for conducting these reviews as well as the findings and recommendations provided by the peer review panelists. The CY 2011 average quality rating for the reviewed projects is "Very Effective," the highest possible rating indicating that these projects are performing well and on track to deliver desired results. In addition, a number of suggestions were identified by the panelists for maintaining or improving research quality.

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

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: 8/4/11

APPENDIX B

Peer Review Panelist Bios

Theresa Bell

Theresa P. Bell is a Petroleum Engineer at U.S. Department of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement since 1991. Ms. Bell currently works in the BOEMRE Pacific OCS Region's Office of Field Operations and has worked on a variety of issues related to pipelines since 1994. She is the BOEMRE Pacific OCS Region's representative on the pipeline research team. She also works on a variety of pipeline projects including repairs, inspections, leak detection systems, new pipeline permitting and installation, and regulations. Ms. Bell has extensive experience with pipeline inspections and integrity issues. She is also involved with the re-write of the BOEMRE pipeline regulations. Ms. Bell received her Bachelor of Science degree in Engineering at California State University, Northridge in 1991. Her prior work experience included aerospace working on the International Space Station and military lasers.

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.

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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.

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Robert J. T. Appleby

Robert Appleby has over 38 years experience in research, design and construction of onshore and offshore pipelines. His professional experience includes pipeline engineering design and analysis, research and development, technical consulting, engineering management, project management and standards development. He is currently providing consulting services to the pipeline industry after 29 years with the research and development companies of ExxonMobil. While there he coordinated pipeline research on many topics including of arctic and strain based pipeline design, pipeline repair, pipeline abandonment, and provided engineering and project management for high strength steel onshore pipeline construction, deepwater pipeline construction as well as technical consulting on many other projects. Prior activities included field engineering for offshore pipeline construction in the North Sea, and consulting engineering for projects in Chile, Nigeria, as well as Canada and the USA.

Robert Appleby has been an active member of ASME B31.8 Committee for over 25 years and is the incoming chair of this committee. He also represents the USA as Head of Delegation at the ISO TC67SC2 Plenary Committee Meetings, is Convener of WG13 (responsible for ISO 13623 Pipeline Design Code) as well as participating in several other ISO Working Groups. Robert has MA and BA Degrees in Engineering from the University of Cambridge.

Keith Leewis, Ph.D., P. Eng.

Keith Leewis has over twenty years of extensive and comprehensive experience in pipeline engineering, design, materials, operations, and integrity management, in the operations and engineering sectors of the natural gas industry. As an engineer he provides technical assessments that assist clients in achieving timely regulatory approvals. As an American Society of Mechanical Engineers B31.8 committee member, he improves the international standards for the design and integrity management of natural gas pipelines, including those American Petroleum, Institute & NACE International standards related to integrity assessment. In addition Keith has over 50 published public papers into a wide variety of domestic and international pipeline topics.

Dr Leewis at DOFASCO made and rolled steel for skelp, was the Technology Director of the Welding Institute of Canada, a welding metallurgist and integrity engineer at TransCanada Pipelines, a tenured engineering professor at NSTU and a senior pipeline integrity scientist at GRI, GTI, & PRCI, before helping operators with materials, regulatory, and standards issues at P-PIC. Keith graduated with B.ENG. from McMaster University, a M.A.Sc. from the University of Toronto and PhD. from Nova Scotia Technical University, all in metallurgical engineering. He is a PE registered in Ontario and Nova Scotia.

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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 over saw the cathodic protection of the piping in the companies 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 Corrosion Specialist.

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

Dr. James R. Fekete, P.E.

Dr. Fekete is Group Leader - Structural Materials, Materials Reliability Division, National Institute of Standards and Technology. In this position, he is responsible for research programs in Pipeline and Infrastructure Safety, Hydrogen Pipeline Safety, and Microsystems for Harsh Environment Testing. In addition, his group is responsible for the Charpy Impact Verification Program which produces Standard Reference Materials for certification of Charpy impact machines to ASTM E23.

Prior to this appointment, he spent 15 years at the General Motors Company, ultimately achieving the position of Technical Fellow in the Vehicle Engineering Center. His responsibilities included development of new sheet steel materials and related technologies for motor vehicle structural applications. He joined GM after working 10 years in a series of technical and managerial positions in the steel industry.

He holds a B.S. from Carnegie Mellon University, an M.S. from Case Western Reserve University and a Ph.D. from the University of Michigan, all in Metallurgical Engineering and Materials Science. He is a member of SAE International, past chairman of its Ferrous

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Committee and was cited for outstanding contributions to its Sheet and Strip Technical Committee by the SAE Technical Standards Board. He has also received Special Recognition from the U. S. Council for Automotive Research.

Dr. Fekete is a member of ASTM International, ASM International, and is a Licensed Professional Engineer in the State of Michigan.

Shabnam (Shab) Fardanesh

Shab is the Infrastructure & Deployment lead in the Energy Efficiency and Renewable Energy's Office of Biomass for the U.S. Department of Energy. Prior to this role, Shab had been managing the Federal fleets' compliance activities for the Energy Policy Acts of 1992 and 2005, as well as Executive Order (E.O.) 13149. Shab was also the chairperson of the Interagency Committee on Alternative Fuels and Low Emission Vehicles, better known as INTERFUELS.

While on temporary assignment to the White House Council on Environmental Quality's Office of the Federal Environmental Executive, Shab was charged with oversight of Federal fleet compliance with E.O. 13514 sustainable transportation activities. Prior to joining the Department of Energy in January 2000, she was a senior associate at the consulting firm of Gladstein & Associates in Southern California, involved in various alternative fuel projects throughout the state, including the U.S. DOE's Clean Cities Program.

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

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APPENDIX C

Table 6 – Peer Reviewed Project Strong and Weak Points

(In Day 1-3 Agenda Order)

Project Title	Strong Points	Weak Points
Compatibility of Non-Ferrous Metals with Ethanol – DNV Columbus	Well coordinated with other PHMSA related projects. Well managed and within budget. Good integration of end users into work scope.	Lacking further coordination with National Laboratories. DOE or otherwise. More confidence on the idea of lab vs. field conditions.
Technical and Economic Feasibility of Preventing SCC through Control of Oxygen – DNV Columbus	Results consistent with other efforts. On budget and schedule. New oxygen measurement tool available to industry.	Need to consider effects of oxygen scavengers on pipeline components. More coordination to other related efforts. More confidence on the idea of lab vs. field conditions.
Feasibility of Chemical Inhibition of Ethanol SCC – DNV Columbus	Project builds on previous efforts. On budget and schedule. Very good progress in achieving project goals.	More coordination to other related efforts. More information or work needed on dosage guidelines for effective inhibitors.
Corrosion and Integrity Management of Biodiesel Pipelines – DNV Columbus	The project is facilitating a good technical gap analysis. Good end user involvement.	Project slightly behind schedule. Improve planning and need to better craft strategy for dissemination of results.
Setting Safe Limits on Biodiesel Constituents for Pipeline Integrity – DNV Columbus	Well coordinated with other PHMSA related projects.	Small survey pool in determining severity information.
Landfill and Wastewater Treatment RNG Chemical and Physical Profiling: Increasing the Database Set – Gas Technology Institute (GTI)	Excellent project. On budget and schedule.	Put more of a focus on the scrubbing technology to better understand if identified threats can be mitigated.
Modeling of Microbial Induced Corrosion on Metallic Pipelines Resulting from Biomethane & the Integrity Impact of Biomethane on Non-Metallic Pipelines - GTI	Excellent project. Results in line with end user needs.	Project slightly behind schedule and may need more resources to produce desired output.

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Project Title	Strong Points	Weak Points
Effect of Concentration and Temperature of Ethanol in Fuel Blends on Microbial and Stress Corrosion Cracking of Pipeline Steels – Colorado School of Mines	Revised scope working well. Great stakeholder involvement. Results in line with end user needs.	Project slightly behind schedule and may need more resources to produce desired output. Better planning in project management.
New Design and Construction Techniques for Transportation of Ethanol and Ethanol/Gasoline Blends in New Pipelines – Electricore, Inc.	Good dissemination plan. Well managed and within budget. Good integration of end users into work scope.	
Stress Corrosion Cracking of Pipeline Steels in Fuel Grade Ethanol and Blends – Georgia Tech Research Corporation	Excellent project. On budget and schedule.	
Fuelfinder: Remote Leak Detector for Liquid Hydrocarbons – Physical Sciences, Inc.	Excellent project. On budget and schedule.	Looking for better description on how project results will aid end user needs.
Advanced Development of PipeGuard Proactive Pipeline Damage Prevention System – Northeast Gas Association/ NYSEARCH	Good integration of end users into work scope. Well managed project.	More information on false calls.
Completion of Development of Robotics Systems for Inspecting Unpiggable Transmission Pipelines – Northeast Gas Association/ NYSEARCH	Good integration of end users into work scope. Well managed project.	More information on validations and understanding of defect severity.
Development and Field Testing of a Highly Sensitive Mercaptans Instrument – Northeast Gas Association/ NYSEARCH	Good integration of end users into work scope. Well managed project.	Wider distribution of technology usage needed. May need additional funds to expand deployments.
Advanced Learning Algorithms for the Proactive Infrasonic Pipeline Evaluation Network (PIGPEN) Pipeline Encroachment Warning System – Physical Sciences, Inc.	Project based on previous work.	Limited deployment and demonstrations.
Effect of Microstructure of Pipeline Steels on Ductility and Fatigue Properties in High Pressure Hydrogen Atmosphere - The University of Tennessee (UT)	Good technical team.	More information about project progress and dissemination.
Cost-Effective Techniques for Weld Property Measurement and Technologies for Improving Weld HE and IGSCC Resistance for Alternative Fuel Pipelines - UT	Good technical team.	More information about integrating end users, project progress and dissemination.

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Project Title	Strong Points	Weak Points
Performance Evaluation of High-Strength Steel Pipelines for High-Pressure Gaseous Hydrogen Transportation - Center For Reliable Energy Systems		More information about project progress and dissemination.
Development of a Commercial Model to Predict Stress Corrosion Cracking Growth Rates in Operating Pipelines - Southwest Research Institute	Well coordinated with industry experts.	More information about soil chemistry, project results dissemination.
Acoustic-based Technology to Detect Buried Pipes – Operations Technology Development NFP	Well planned project. Good plan for tech transfer.	
Achieving Maximum Crack Remediation Effect from Optimized Hydrotesting - University of Alberta	Well planned project. Good plan for tech transfer.	More confidence on the idea of lab vs. field conditions.
Realistic Strain Capacity Models for Pipeline Construction and Maintenance - Center For Reliable Energy Systems	Good integration of end users into work scope.	More information about project results dissemination.
MWM-Array Characterization of Mechanical Damage and Corrosion - JENTEK Sensors, Inc.	Well matched project output with industry need. Excellent plan for dissemination of results and commercialization. Strong project team.	Consider offshore operating environments.
MWM-Array Detection & Characterization of Damage through Coatings and Insulation - JENTEK Sensors, Inc.	Well matched project output with industry need. Excellent plan for dissemination of results and commercialization. Strong project team. Based on previous research.	Consider offshore operating environments.
Adaptation of MWM-Array and MFL Technology for Enhanced Detection/Characterization of Damage from Inside Pipelines - JENTEK Sensors, Inc.	Well matched project output with industry need. Excellent plan for dissemination of results and commercialization. Strong project team. Based on previous research.	Slightly over budget. Consider offshore operating environments. Long lead time to deployment - Can commercial deployment timeline be accelerated?
Optimization of Multi-Wire GMAW Welding Procedure for Heavy-Wall Offshore Pipeline Construction - Center For Reliable Energy Systems	Builds upon previous work and models.	Behind schedule, need to secure additional industry co-funds. Will results match with field experience?

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Project Title	Strong Points	Weak Points
Understanding Magnetic Flux Leakage (MFL) Signals from Mechanical Damage in Pipelines – Electricore, Inc.	Well matched project output with industry need. Very good background information. Excellent plan for dissemination of results and commercialization. Builds upon previous work.	Slightly behind schedule. More information on likelihood of achieving large scale model.
Development of a Model to Accurately Predict the Conditions of Carrier Pipe within Casings Based on Conditions at the Casing Ends - Southwest Research Institute		Slightly over budget and falling behind on schedule. More information on likelihood of achieving large scale model.
Selection of Pipe Repair Methods - Operations Technology Development NFP	Good integration of end users into work scope. Builds upon previous work.	Better formatting of results to targeted end users.
Dent Fatigue Life Assessment - Development of Tools for Assessing the Severity and Life of Dent Features – BMT Fleet Technology Limited	Well developed project. Excellent plan for dissemination of results.	More information on how previous efforts could assist current effort.
Odorant Effectiveness – Gas Technology Institute	Well matched project output with industry need.	
Development of Dual Field MFL Inspection Technology to Detect Mechanical Damage - Pipeline Research Council International	Well matched project output with industry need. Excellent plan for dissemination of results and commercialization.	
Integrated Internal Inspection and Cleaning Tool Technology for Pipelines - Electricore, Inc.	Well matched project output with industry need. Excellent plan for dissemination of results and commercialization.	

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APPENDIX D

Peer Review Project Summaries
(In Day 1-3 Agenda Order)

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

Compatibility of Non-Ferrous Metals with Ethanol

DNV Columbus

Pipeline transportation of fuel grade ethanol (FGE) is vital to the cost effective delivery of this fuel to the end-users. While the potential for stress corrosion cracking (SCC) of steel in the presence of ethanol is one of the main concerns in the transportation of FGE, the compatibility of non-ferrous metals found in pipeline and downstream systems also is an area of concern. Previous studies have addressed the compatibility of some non-ferrous metals with ethanol and other alcohols but a comprehensive assessment of this issue, with respect to ethanol transportation, has not been conducted. This research project aims to develop guidelines on the selection of non-ferrous metal for use in FGE. The major benefit of the project is the development of comprehensive guidelines that could be used to develop ethanol transportation standards.

Technical and Economic Feasibility of Preventing SCC through Control of Oxygen

DNV Columbus

Stress corrosion cracking (SCC) has been observed in carbon steel tanks and piping in contact with fuel grade ethanol (FGE) in user terminals, storage tanks, and loading/unloading racks. In this project, the feasibility of oxygen removal methods for FGE will be evaluated using the following four methodologies: a) the performance of oxygen scavengers under flowing conditions; b) the consumption of oxygen under natural conditions (i.e., without using scavengers); c) a method for direct and rapid oxygen concentration determination; and d) the feasibility of oxygen control in pipeline operations. The information obtained from the first three methodologies will be combined to conduct the final feasibility evaluation, taking into consideration the potential oxygen contamination or downstream oxygen in-take in pipeline operations. The results from the execution of this project will provide guidance on selecting the optimal methods, from both economic and engineering perspectives, for oxygen control of different pipeline operational situations.

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Feasibility of Chemical Inhibition of Ethanol SCC

DNV Columbus

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

Corrosion and Integrity Management of Biodiesel Pipelines

DNV Columbus

The Pipeline Biodiesel Steering Committee (PBSC) together with five major multi-product pipeline operators have identified several areas that need further research to assure the safe transportation of blends above B5. According to the committee, there are relatively few technical challenges associated with movement of up to B5 blends in pipelines carrying only gasoline, diesel, or heating oil. There are, however, a number of technical items that need to be scrutinized before approval of biodiesel blends above B5 in pipelines. Two critical issues included in the document published by the PBSC are related to the efficiency of corrosion inhibitors and the degradation resistance of non-metallic components in biodiesel blends. Therefore, the objectives of this work are twofold. Firstly, the performance of selected corrosion inhibitors commonly used in diesel transportation will be investigated to determine whether new corrosion-related issues could arise from the use of biodiesel blends above B5. The second objective will be to understand and quantify the degradation of non-metallic and non-ferrous metallic pipeline system components in biodiesel blends above B5. Likewise, an added objective is to generate awareness and to facilitate technology and knowledge transference between pipeline operators, biodiesel producers, research laboratories, and regulatory agencies.

Setting Safe Limits on Biodiesel Constituents for Pipeline Integrity

DNV Columbus

It is anticipated that biodiesel production will increase in the coming years and will come from increasingly diverse sources, such as jatropa, algae, etc. Therefore there is a need to identify the potential corrosive contaminants from these sources and set appropriate limits for pipeline transportation. The objectives of this work are to: (1) understand the effects of minor constituents beyond the ASTM D 6751 on corrosivity of biodiesel under pipeline specific conditions, (2) develop safe limits for any deleterious constituents in biodiesel, and (3) develop a method to rapidly monitor biodiesel corrosivity in terms of any deleterious effect on pipeline integrity. The

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project will be performed in collaboration with CANMET laboratories in Canada and aims to simulate realistic flow conditions in pipelines to determine the safe limits.

Landfill and Wastewater Treatment RNG Chemical and Physical Profiling: Increasing the Database Set

Gas Technology Institute

GTI's goal is to help the natural gas industry establish renewable gas as a fungible zero-carbon product "fit for purpose" for injection into natural gas pipelines. Therefore, GTI proposes to continue the development of a draft guidance document for the safe introduction of renewable gas into natural gas pipelines. This project will build upon previous studies executed by GTI to further characterize and understand the chemical and biological composition of fully upgraded renewable gas. It will supply critical information for safe, reliable, and controlled delivery of biomethane into existing natural gas pipelines. Identification of the key and predominant trace constituents present in processed landfill and Waste Water Treatment Plant derived renewable gas will alleviate concern, and allow where deemed necessary, the development of instrumentation to specifically detect these compounds for proper monitoring.

Modeling of Microbial Induced Corrosion on Metallic Pipelines Resulting from Biomethane & the Integrity Impact of Biomethane on Non-Metallic Pipelines

Gas Technology Institute

As biogas production sources increase, they will eventually be fed into a gathering network that allows the common collection and distribution of the fuel to processing locations followed by distribution to the end user. The main objective of this research is on the immediate need to understand the impacts of transporting various biogas blends on the integrity of non-metallic materials (thermoplastics and elastomers) that could be used to construct regional gathering networks.

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, 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.

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New Design and Construction Techniques for Transportation of Ethanol and Ethanol/Gasoline Blends in New Pipelines
Electricore, Inc.

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

Stress Corrosion Cracking of Pipeline Steels in Fuel Grade Ethanol and Blends
Georgia Tech Research Corporation

This project will evaluate and use standard test methods to investigate stress corrosion cracking (SCC) of pipeline steels in fuel grade ethanol (FGE)and gasoline/FGE blends as alternative tests for slow strain rate tests. Ethanol from different sources, including corn, sugarcane, and cellulose based FGE will be tested in this three year project. Two graduate and three undergraduate students will be actively involved in this project. Industrial sponsors including Colonial Pipeline Company, Archer Daniels Midland (ADM), and others industry representatives will serve as advisors on this project.

Fuelfinder: Remote Leak Detector for Liquid Hydrocarbons
Physical Sciences Inc.

The project goal is to develop a commercially successful Remote Methane Leak Detector (RMLDTM) platform to a general purpose hydrocarbon leak detector – FuelfinderTM. Fuelfinder will adopt recent advances in room-temperature diode laser technology operating near 3 microns to enable remote sensing of gasoline, petrochemicals, biodiesel, and ethanol leaks from pipelines with man-portable, mobile, and airborne platforms in a low-cost, commercially-viable product offering.

Advanced Development of PipeGuard Proactive Pipeline Damage Prevention System
Northeast Gas Association/NYSEARCH

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

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

Completion of Development of Robotics Systems for Inspecting Unpiggable Transmission Pipelines

Northeast Gas Association/NYSEARCH

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

Development and Field Testing of a Highly Sensitive Mercaptans Instrument

Northeast Gas Association/NYSEARCH

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

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

Physical Sciences Inc.

Physical Sciences Inc. (PSI), with American Innovations Ltd. (AI) and NYSEARCH, are addressing the technology gap of Early Warning Damage Prevention Monitoring Systems, specifically Advanced Development of Algorithms for Detecting Digging Threats and Avoiding Alarms. This research will implement and evaluate self-training algorithms in the Proactive Infrasonic Gas Pipeline Evaluation Network (PIGPEN) autonomous distributed seismic sensor system. PIGPEN provides real-time warning of unauthorized right-of-way encroachment and excavation activity near a pipeline. Early warning enables a response to the potential intrusion in time to prevent pipeline damage, and thus preclude the additional cost and risk of repairs. The ideal PIGPEN alarm system would activate an intruder notification with 100% reliability and no alarms. The project will enhance reliability by enabling PIGPEN to learn the characteristics of its local environment and optimize its intruder detection algorithms based on learned experience. Field tests are expected to demonstrate better than 97% alarm reliability with few alarms.

Effect of Microstructure of Pipeline Steels on Ductility and Fatigue Properties in High Pressure Hydrogen Atmosphere

The University of Tennessee

Comprehensive knowledge of mechanical properties of pipeline steels in high-pressure hydrogen is essential for the structural integrity of a pressurized hydrogen transport system. This project focuses on obtaining much needed data on fracture toughness and fatigue life for base steels. For testing of base steels, compact tension specimens will be employed in cost-effective testing techniques developed in previous federal-funded programs will be further refined and applied to investigate the effects of pressure and temperature on the degradation of base metal fracture toughness in high-pressure hydrogen.

A novel cost-effective low-frequency fatigue test apparatus will be developed to determine the base metal fatigue life under realistic in-service cyclic loading frequencies of hydrogen pipelines. These property data will be critical to support industry consensus standards for hydrogen transport via pipeline, and to support the design and maintenance operation by pipeline operators.

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

The University of Tennessee

Comprehensive knowledge of mechanical properties of pipeline steels in high-pressure hydrogen is essential for the structural integrity of a pressurized hydrogen transport system. This project focuses on obtaining much needed data on fracture toughness and fatigue life for weld regions. For testing of weld regions, cost-effective testing techniques developed in previous federal-funded programs will be further refined and applied to investigate the effects of pressure and

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temperature on the degradation of weld fracture toughness in high-pressure hydrogen. A novel cost-effective low-frequency fatigue test apparatus will be developed to determine the weld fatigue life under realistic in-service cyclic loading frequencies of hydrogen pipelines. These property data will be critical to support industry consensus standards for hydrogen transport via pipeline, and to support the design and maintenance operation by pipeline operators. In addition, advanced welding techniques will be demonstrated to control the weld residual stress and to tailor the weld microstructure for improving weld resistance to Hydrogen Effects and Inter Granular Stress Corrosion Cracking.

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

Center for Reliable Energy Systems

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

Development of a Commercial Model to Predict Stress Corrosion Cracking Growth Rates in Operating Pipelines

Southwest Research Institute

The objective of this proposed project is to develop a crack growth rate (CGR) model for pipeline operators to use to: a) Identify locations that should be given a high priority for assessment of Stress Corrosion Cracking (SCC), and b) Determine the re-assessment and re-inspection intervals. The outcome of this project will be a tool to predict where SCC is most likely to occur, to prevent SCC failures, to ensure continued reliable pipeline operation, and to improve public safety.

Acoustic-based Technology to Detect Buried Pipes

Gas Technology Institute

In the past, Gas Technology Institute (GTI) and SoniVerse Inc (SVI) with the support from Operations Technology Development, NFP (OTD) has developed an acoustic-technology-based technology to detect buried natural gas pipes, with emphasize on detecting buried PE pipes. The concept is to send the acoustic signal into the ground and detect reflected signal from the pipe at the ground level. The device has been referred as an Emulator, and has been successfully tested in the laboratory and at several utility locations under variety of field conditions to detect both metal and PE pipes buried up to 5 feet. The current Emulator consists of a laptop computer, off-the-shelf data acquisition module, high power class D amplifier, deep cycle car battery, and exchangeable sensor modules. The project will improve, develop and build an integrated, hand-

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held device – pre-commercial unit – to detect buried pipes. The integrated device will be tested at field sites. The detection of buried natural gas pipes, especially PE pipe, will assist the gas industry and pipe locator companies to locate pipes before excavations/construction. This will reduce the third party damages to the underground utilities and increase safety of the natural gas distribution system.

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.

Realistic Strain Capacity Models for Pipeline Construction and Maintenance

Center for Reliable Energy Systems

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

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

MWM-Array Characterization of Mechanical Damage and Corrosion

JENTEK Sensors Inc.

This project will advance the JENTEK Meandering Winding Magnetometer (MWM) -Array technology to provide quantitative characterization of corrosion and mechanical damage. This includes characterization through coatings/insulation; followed by higher resolution imaging with coatings/insulation removed. For mechanical damage, quantitative characterization

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

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.

Optimization of Multi-Wire GMAW Welding Procedure for Heavy-Wall Offshore Pipeline Construction

Center For Reliable Energy Systems

As energy demand for oil and gas increases, offshore pipelines have been moving into deeper water with longer distance. The increases in both external water pressure and the internal operation pressure require higher strength and higher toughness of pipeline materials. Among the technical challenges in deep water pipeline construction, the quality and productivity of girth welds made during pipeline-laying operation have been two of the major concerns for safety and cost-effective reasons. In particular, as modern high-strength linepipe steels such as X70 or X80 and multi-wire gas-metal arc (GMAW) welding processes have been increasingly applied by the pipeline industries, there is an urgent need to understand the dependency of weld quality and mechanical properties on the selected welding procedure and its parameters.

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With focus on the high-strength steels and multi-wire GMAW processes, the objectives of the proposed work are to understand the relation between weld properties and welding conditions, especially the new welding variable(s) that are associated with the multi-wire GMAW processes; and based on this knowledge, establish the optimal welding conditions for heavy-wall offshore high-strength line pipe steels for better weld quality and higher welding productivity.

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

Electricore, Inc.

The project aims to study MFL Signals from Oval Dents. Finite Element Analysis (FEA) modeling of MFL signals from dents having shapes and sizes that are more characteristic of those found in mechanically damaged pipelines will be reviewed. Investigate MFL Signals From Dents Containing Single Corrosion Pits. This will involve FEA modeling of MFL signals from circular dents containing corrosion pits. Stress FEA modeling will be used to model the dent + corrosion pit stress fields (due to the fact that pits will create stress concentrations around themselves. The resulting stress state and the geometry of the pit + dents will be incorporated into to the magnetic FEA model. Experimental verification will involve creating circular dents in plate samples with our existing circular denting tool, and then electrochemically machining pits into the base. MFL patterns from these defects will be used to experimentally verify the modeling results.

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

Southwest Research Institute

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

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

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Dent Fatigue Life Assessment - Development of Tools for Assessing the Severity and Life of Dent Features
BMT Fleet Technology Limited

Failures in transmission pipelines are often the result of mechanical damage. The US DOT has indicated that 20 to 40 percent of the serious pipeline incidents in any given year are related to mechanical damage. A majority of the mechanical damage is caused by third party activities, mishandling during construction, pipeline bedding material consolidation, or ground movement. Damage usually takes the form of a dent and may be associated with a gouge.

The primary objective of the project is to predict the local stress-strain state of a dented pipeline segment and to develop criteria for ranking and estimating the remaining life of dents (plain dents and dents interacting with welds) features interacting with welds, considering through life fatigue initiation and growth in pipelines fabricated from a range of steel grades commonly used in transmission and distribution pipelines. This project builds on the existing PRCI (MD 4-2)/DOT (339) contract developing full-scale mechanical damage experimental data to facilitate the development and validation of models for undertaking fitness for assessment and developing guidance documents. The project will produce procedures for evaluating the severity of plain dents and those interacting with welds considering their geometry and operating conditions.

Odorant Effectiveness
Gas Technology Institute

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

Development of Dual Field MFL Inspection Technology to Detect Mechanical Damage
Pipeline Research Council International

This project will evaluate the capability of in-line inspection (ILI) to detect and characterize mechanical damage defects. The primary objective of the research is to provide guidance to the pipeline industry regarding the use of ILI to prioritize excavation and repair of mechanical damage. The secondary objective is to influence research on related topics such as the development of mechanical damage fitness-for-purpose models. The main scope is to evaluate the use of magnetic flux leakage technologies although other sensor methods will be considered for applicability to meet the primary objective.

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Integrated Internal Inspection and Cleaning Tool Technology for Pipelines

Electricore, Inc.

Electricore, Inc., in teaming with Chevron Energy Technology Company (ETC) and Pipeline Research Council International, Inc. (PRCI) propose an innovative and comprehensive program for a new, multi sensor approach to monitoring the integrity of pipelines. This program has been termed 'The Integrated Internal Inspection and Cleaning Tool' or 'Semi-Smart Pig'. The program will identify and progress technology that can be added to standard internally deployed cleaning tools to detect, measure, and characterize a number of variables that provide data utilized in integrity management decisions. This integrated tool will perform its conventional cleaning function but this 'add on' capability will provide data that can be used to measure and monitor critical parameters.

The addition of 'sensor' technology to cleaning tools already frequently deployed by the industry will allow repeated measurement and parametric data to be recorded providing trends and changes in pipeline network degradation. These tools, deployable at a lower cost and higher frequency, will act as 'alarms' on a pipeline's changing conditions that affect integrity and also allow more accurate planning for the deployment of high resolution inspection tools. It's anticipated that these 'semi smart' tools will also be deployable in other pipelines where geometric configuration does not currently permit the use of In Line Inspection (ILI) tools.

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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 2011 peer reviews was Mr. Robert Smith of PHMSA.

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