



U.S. DEPARTMENT OF TRANSPORTATION
OFFICE OF INSPECTOR GENERAL

**PHMSA Has an Opportunity To Refine Its
Guidance and Performance Reporting for
the Pipeline Safety Research and
Development Program**

PHMSA

Report No. ST2018056

May 30, 2018





PHMSA Has an Opportunity To Refine Its Guidance and Performance Reporting for the Pipeline Safety Research and Development Program

Mandated by the Protecting Our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act of 2016

Pipeline and Hazardous Materials Safety Administration | ST2018056 | May 30, 2018

What We Looked At

The Pipeline and Hazardous Materials Safety Administration (PHMSA) designed its Pipeline Safety Research and Development (R&D) Program to provide safety improvements, reduce environmental impacts, and enhance reliability of the Nation's pipeline transportation system. During fiscal years 2013–2016, PHMSA's Office of Pipeline Safety (OPS), awarded \$38 million in support of 83 pipeline safety R&D projects—covering a variety of topics—conducted by Federal and non-Federal entities. The Protecting Our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act of 2016 mandated that we evaluate PHMSA's pipeline safety R&D program. Accordingly, our objectives were to assess PHMSA's processes for (1) consulting with stakeholders, (2) mitigating selection panel members' conflicts of interest, and (3) measuring the benefits and uses of R&D outcomes.

What We Found

PHMSA consults with stakeholders as required by the Pipeline Safety Improvement Act of 2002 (PSIA), and uses stakeholder input to prepare its 5-year program plan and select project proposals. However, the Agency is missing an opportunity to increase R&D forum attendance and does not have written guidance for using forum results. PHMSA has management controls to manage conflicts of interest (COI) on R&D merit review panels. Although we did not identify any violations in this area, the Agency's written guidance for COIs is incomplete. Finally, the benefits and uses of R&D outcomes are challenging to assess, because they may take years to be fully realized and may not be tangible; increased knowledge is one such intangible benefit. PHMSA staff also lack written guidance for certain follow-up processes, which could lead to inconsistency and a loss of institutional knowledge. While the Agency uses 14 performance metrics to evaluate the overall R&D program, these metrics provide only a tally of program outputs and lack context or analysis for the numerical data.

Our Recommendations

PHMSA concurred with our three recommendations to help the Agency improve its management of the Pipeline Safety R&D Program.

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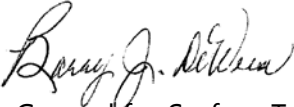
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Memorandum

Date: May 30, 2018

Subject: PHMSA Has an Opportunity To Refine Its Guidance and Performance Reporting for the Pipeline Safety Research and Development Program | Report No. ST2018056

From: Barry J. DeWeese 
Assistant Inspector General for Surface Transportation Audits

To: Pipeline and Hazardous Materials Safety Administrator

The Pipeline and Hazardous Materials Safety Administration (PHMSA) designed its Pipeline Safety Research and Development (R&D) Program to provide safety improvements, reduce environmental impacts, and enhance reliability of the Nation's pipeline transportation system. During fiscal years 2013–2016, the Agency, through its Office of Pipeline Safety, awarded \$38 million in support of 83 pipeline safety R&D projects conducted by Federal and non-Federal entities. Those projects cover several pipeline safety topics—pipe coatings, leak detection, damage prevention, and anomaly detection and characterization.

The Protecting Our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act of 2016¹ mandated that we evaluate PHMSA's pipeline safety R&D program. Accordingly, our objectives were to assess PHMSA's processes for (1) consulting with stakeholders, (2) mitigating selection panel members' conflicts of interest, and (3) measuring the benefits and uses of R&D outcomes.

We conducted this audit in accordance with generally accepted Government auditing standards. We interviewed staff from the Office of the Assistant Secretary for Research and Technology (OST-R), PHMSA Headquarters, Department of Health and Human Services Office of Inspector General (OIG), Department of Commerce's National Institute of Standards and Technology (NIST), and Department of the Interior's Bureau of Safety and Environmental Enforcement (BSEE). We also interviewed representatives from

¹ Public Law 114-183 (June 2016).

several labor, environmental, and safety organizations. We reviewed DOT and PHMSA policy and procedures and analyzed documentation on our statistical sample of 24 out of 47 completed R&D projects, awarded during fiscal years 2013–2016, to analyze benefits and uses of the research. We also surveyed 14 PHMSA Agreement Officer’s Representatives (AOR)² for their perspectives on project benefits, uses, and performance measures. We assessed the R&D program using the Government Accountability Office’s (GAO) *Standards for Internal Control in the Federal Government*.³ Exhibit A details our scope and methodology, exhibit B lists the entities we visited or contacted, and exhibit D presents detailed information about our sample of 24 projects.

We appreciate the courtesies and cooperation of PHMSA representatives during this audit. If you have any questions concerning this report, please call me at (202) 366-5630 or Kerry R. Barras, Program Director, at (817) 978-3318.

cc: The Secretary
DOT Audit Liaison, M-1
PHMSA Audit Liaison, PH-3

² AORs monitor funding recipients’ performance to ensure (1) all technical requirements are met within the grant or cooperative agreement’s period of performance and (2) costs incurred are in accordance with the cost requirements in the agreement.

³ These standards charge management with the responsibility for designing the policies and procedures to fit an entity’s circumstances and building them in as an integral part of the entity’s operations.

Background

PHMSA's R&D program has three objectives: (1) fostering development of new technologies for pipeline operators to improve safety performance and more effectively address regulatory requirements; (2) strengthening consensus standards by targeting and feeding new knowledge into the process of keeping standards relevant to their purpose; and (3) generating and promoting general knowledge to decision makers. The Agency develops 5-year interagency pipeline safety R&D program plans⁴ to describe its research topic areas and performance metrics, and funds others' research through four sub-programs:

Core R&D program (CORE), which uses other transaction agreements and cooperative agreements to fund research by industry groups, individual companies, and other research entities. In fiscal years 2013–2016, PHMSA awarded \$30.2 million for 45 CORE projects.

Competitive Academic Agreement Program (CAAP), which uses cooperative agreements and targets academic research to potentially deliver solutions to further research in another CAAP project or in the CORE program. CAAP also has a goal of increasing students' interest in pipeline safety careers. In fiscal years 2013–2016, PHMSA awarded \$5.4 million for 29 CAAP projects.

Interagency (IA) projects, through which PHMSA funds projects administered by NIST and BSEE, in accordance with its 5-year R&D program plan. In fiscal years 2013–2016, PHMSA awarded \$1 million for five IA projects.

DOT's Small Business Innovative Research (SBIR) program, administered by the John A. Volpe National Transportation Systems Center (Volpe Center), encourages domestic small businesses to engage in R&D, addressing areas that are a high priority for the Department. In fiscal years 2013–2016, PHMSA awarded \$1.4 million for four SBIR projects.

⁴ The Five-Year Interagency Research Development and Demonstration Program Plan for Pipeline Safety and Integrity from 2013 describes program-level areas or strategies where annual coordination and collaborative activities between DOT and the Departments of Commerce and the Interior will be reported primarily for onshore pipelines. Update Reports that describe the success in implementing this plan are to be transmitted to Congress every 2 years.

Results in Brief

PHMSA consults with stakeholders as required, but is missing an opportunity to increase R&D forum attendance and does not have written guidance for using forum results.

By holding biennial R&D Forums and announcing them in the Federal Register,⁵ PHMSA meets a Pipeline Safety Improvement Act of 2002 (PSIA)⁶ requirement to consult with stakeholder groups and use their input to prepare the 5-year program plan and select project proposals. At the 2012, 2014, and 2016 forums, some stakeholder groups (e.g., labor, environmental, and safety) had limited representation in comparison to other stakeholder groups (e.g., pipeline industries and manufacturers). The labor, environmental, and safety organizations we contacted were generally unaware of or uninterested in participating in the forums. PHMSA does not have a process for taking additional steps beyond Federal Register notices, which the Agency considers sufficient to encourage stakeholder participation in such forums, or website notices. As a result, PHMSA is potentially missing an opportunity to benefit from a more diverse set of stakeholder representatives participating in the forums and contributing to the R&D program plan. In addition, PHMSA has draft procedures for conducting the forum; however, the procedures do not address how to incorporate forum results into the 5-year R&D program plan. This is inconsistent with GAO's *Standards for Internal Control in the Federal Government*, which highlights the importance of guidance and documentation.

PHMSA has safeguards in place to manage conflicts of interest (COI) on R&D merit review panels, but has incomplete written guidance for the COI process.

PHMSA has adequate management controls over its processes for identifying and mitigating COI on its merit review panel (MRP) for selecting research proposals for funding, and we did not identify any COI violations. MRP members must complete COI certifications before they can vote on research proposals in the Agency's R&D Management Information System (MIS). The MIS and the certifications identify all entities that submit proposals, which help PHMSA identify potential COI. However, the Agency's procedures do not include specific steps in the COI process. For example, the guidance does not include instructions for an acquisition officer to work with the MIS contractor to grant MRP members

⁵ Federal agencies use the Federal Register to announce public notices of scheduled hearings and meetings.

⁶ Public Law 107-355 (December 2002).

authority to vote or ensure their recusals are consistent with their COI certifications.

Although benefits and uses are difficult to assess, PHMSA's reports to Congress do not include additional context or analysis of performance metrics for the R&D program.

The benefits and uses of R&D outcomes are challenging to assess because they may take years to be fully realized and may not be tangible. Each year, according to PHMSA, staff members reach out to past research partners to determine if net improvements or commercialization can be attributed to previously completed technology projects. However, the Agency does not have written procedures that describe this informal process, its timing, or employee responsibilities—resulting in actions that risk inconsistent performance and a loss of institutional knowledge. According to OST-R officials, PHMSA has excellent interactions with stakeholders before, during, and after research; and the 14 performance metrics the Agency uses to evaluate the overall R&D program serve as a model for other Operating Administrations. However, these metrics provide only a tally of program outputs. As a result, PHMSA's Update Reports to Congress are limited as they do not provide context or analysis for the numerical data presented, such as identifying trends or anomalies in the research program over time. For example, in 2016, PHMSA reported that 6 final reports had been issued to the public in fiscal years 2014–2015 and that 11 technology demonstrations were held, but did not provide additional insights or analysis on the outputs. The Federal Government Performance Improvement Council (PIC)⁷ recommends assessing the success of goals to determine whether outcomes have been met and to inform policy or programmatic decisions. In addition, the PIPES Act of 2016 now requires the Update Reports to Congress to include a summary of each R&D project carried out under the PSIA of 2002 and a review of how the project affects safety.

We are making three recommendations to improve PHMSA's management of the Pipeline Safety R&D Program.

⁷ PIC is a Government-wide body that supports cross-agency collaboration and best practice sharing. It was established under Executive Order 13450, Improving Government Program Performance (November 2007), and is codified in law under the Government Performance and Results Modernization Act of 2010 (Public Law 111-352, January 2011).

PHMSA Consults With Stakeholders as Required, but Is Missing an Opportunity To Increase R&D Forum Attendance and Does Not Have Written Guidance for Using Forum Results

PHMSA meets the PSIA mandate to consult with or seek the advice of stakeholders⁸ by holding biennial R&D forums and publishing advance notices of these forums in the Federal Register and on the Agency’s website events calendar. While PHMSA meets this mandate, its internal guidance does not identify additional notification methods that could encourage a larger cross section of stakeholder representatives to attend the forums. Furthermore, the guidance does not include a description of procedures for incorporating R&D forum results into its 5-year program plan and for selecting project proposals.

PHMSA Is Missing an Opportunity To Increase R&D Forum Attendance

The PSIA requires PHMSA to consult with representatives of 12 stakeholder groups when developing the program plan. The 12 groups are natural gas, crude oil, and petroleum product pipeline industries; utilities; manufacturers; institutions of higher learning; Federal agencies; pipeline research institutions; national laboratories; State pipeline safety officials; labor organizations; environmental organizations; pipeline safety advocates; and professional and technical societies.

PHMSA primarily consults with these representatives through the biennial R&D forums—public meetings that provide opportunities for PHMSA and stakeholder representatives to discuss key pipeline safety research topics and identify research gaps. PHMSA uses the forum results to select and prioritize topics for the program plan and annual solicitations for R&D proposals. At the 2012, 2014, and 2016 forums, some stakeholder groups (e.g., labor, environmental, and safety) had limited representation in comparison to other groups (e.g., pipeline industries and manufacturers)—as illustrated by table 1.

⁸ For the purpose of this report, we are using “consult with” to include “seeking the advice of” stakeholders.

Table 1. Stakeholder Groups Attending or Presenting at Pipeline Safety R&D Forums in Fiscal Years 2012, 2014, or 2016

Stakeholder Group	Number of Attending or Presenting Entities
Pipeline Industries	82
Manufacturers	31
Institutions of Higher Learning	27
Utilities	25
Pipeline Research Institutions	16
Federal Agencies	9
State Pipeline Safety Officials	7
Environmental Organizations	2
National Laboratories	2
Labor Organizations	1
Professional and Technical Societies	1
Pipeline Safety Advocates	0

Source: OIG analysis of PHMSA information

We contacted representatives of several less-represented groups, such as the United Association of Plumbers and Pipefitters, National Wildlife Federation, and Pipeline Safety Trust. Some organizations were not interested in participating in the forums. Others, such as the Environmental Defense Center, were interested in participating but were not aware of the forums. Another group considered itself lacking the necessary expertise to participate. A representative from one organization recommended PHMSA use social media to increase awareness of and participation in future forums.

By including notification of the forums in the Federal Register and its website calendar, PHMSA meets the consultation requirements established in the PSIA of 2002. However, its internal guidance does not identify additional notification methods that could encourage a larger cross section of stakeholder representatives to attend these forums. As a result, PHMSA is potentially missing an opportunity to benefit from a more diverse set of stakeholder representatives participating in the forums and contributing to the R&D program plan.

PHMSA Does Not Have Formal Guidance on Using Forum Results in Program Plans

PHMSA has a formal 5-year R&D Program Plan, and has developed draft procedures for its forums that include forming a steering committee, issuing a Federal Register notice, executing logistics, and coordinating presentations. However, the draft procedures lack complete guidance that details, consolidates, and formalizes the operational elements of the R&D Program. For example, the procedures do not explain how forum results are used to prepare the program plan and to select project proposals.

These incomplete procedures are inconsistent with *Standards for Internal Control in the Federal Government*, which charges management with the responsibility for designing the policies and procedures to fit an entity's circumstances and building them in as an integral part of the entity's operations. Without formal procedures, there is a risk that forum results may not be completely or accurately reflected in upcoming 5-year program plans or selections of proposals, particularly if the program experiences personnel changes.

PHMSA Has Safeguards in Place To Manage COI on R&D Merit Review Panels, but Has Incomplete Written Guidance for the COI Process

PHMSA has adequate safeguards for identifying and mitigating COIs on its MRP⁹ for selecting research proposals for funding, and we did not identify any COI violations. However, PHMSA's guidance does not include procedures to ensure that MRP members' COI certifications and voting records are consistent—even when MRP members recuse themselves for reasons other than COI.

Both Federal and non-Federal PHMSA MRP members are expected to follow specific COI guidance—the Agency's Non-Disclosure and Conflict of Interest Certifications policy and DOT's Financial Assistance Guidance Manual. MRP members submitting COIs certify whether they and/or their spouses, minor children, or business partners have a financial interest or employment

⁹ According to PHMSA, the MRP is synonymous with Technical Evaluation Team, Source Selection Team, and Evaluators. MRP members represent various organizations, including PHMSA, other Federal agencies, State government agencies, the pipeline industry, and other organizations.

commitment with any listed entity. Additionally, they certify whether they hold a trusteeship position with any listed entities.

The Agency has other relevant safeguards for Federal employees. According to PHMSA's Office of Chief Counsel, the Agency requires its employees to take annual ethics training and MRP members who are Federal employees to file annual financial disclosures. Moreover, these additional requirements do not apply to non-Federal MRP members.

According to PHMSA officials, the COI process includes additional steps to prevent MRP members from voting on proposals from entities in which they have a financial interest. MRP members review the list of organizations that submit research proposals and then give their COI self-certifications to a PHMSA acquisition official, who reviews them for recusals. The official submits the self-certifications to the MIS contractor who gives MRP members access to the MIS system so they can vote on the research proposals. MIS' built-in access controls require MRP members to submit signed COI certifications before they can electronically access submitted research proposals and vote on which ones to fund. The same acquisition official compares MRP members' voting records in the MIS with their self-certifications, looking for inconsistencies.

A PHMSA official stated that true conflicts involving a financial or employment stake in a research entity are rare. If a conflict is identified, the acquisition official notifies the MIS contractor, who then tailors controls to restrict that MRP member from voting on the related proposals. Similarly, a PHMSA legal official stated that MRP members tend to over-report their potential conflicts. PHMSA's Office of Chief Counsel is responsible for resolving questionable cases for all MRP members, but no COI cases have been referred in the past 2 years.

We verified that PHMSA and MRP members generally followed Agency COI processes, including those for voting on proposals, and we did not identify any COI violations. Additionally, we confirmed that all MRP members submitted COI certifications in fiscal year 2015. Specifically,

- Each of the 11 CORE MRP members submitted COI certifications; 2 of them reported conflicts and did not vote on related proposals.
- Each of the 4 CAAP MRP members submitted COI certifications; 1 of them reported conflicts and did not vote on related proposals.

However, in some instances, MRP members deviated from Agency COI processes. Two CORE and one CAAP MRP members certified they had no conflicts but then recused themselves—for various reasons—from voting on proposals in the MIS. A PHMSA official stated MRP members sometimes recuse themselves because they did not review a proposal, not because they have a conflict of interest.

PHMSA has taken steps to address this issue. An Agency official issued a statement of work to upgrade the MIS, removing the option for individual MRP members to recuse themselves from voting on proposals. Instead, PHMSA acquisition officials will have the authority to recuse MPR members in the MIS. PHMSA also updated its guidance with steps for acquisition officials to address COI before and while MPR members vote on proposals. While these actions may enhance access controls and resolve the weakness we identified, we cannot at this time confirm their ultimate success.

However, PHMSA's guidance does not include written procedures that document all the action steps in the COI process. For example, the guidance does not include instructions for an acquisition officer to work with the MIS contractor to grant MRP members authority to vote or ensure their recusals are consistent with their COI certifications. As a result, future acquisition officials might not complete all steps contributing to the integrity of the COI process.

The Department's Volpe Center has a similar process for mitigating conflicts of interest among MRP members who review SBIR proposals.¹⁰ We verified all three MRP members submitted COI certifications before they were allowed to vote and did not have conflicts of interest with the research entities submitting proposals.

Although Benefits and Uses Are Difficult To Assess, PHMSA's Reports To Congress Do Not Include Additional Context or Analysis of Performance Metrics for the R&D Program

The benefits and uses of R&D outcomes are challenging to assess, because they may take years to be fully realized and may not be tangible. To measure R&D program effectiveness, PHMSA tracks quantitative performance metrics that provide the number of program outputs for the reporting period to Congress. However, these reported data do not provide context or insights that could inform policy or programmatic decisions.

¹⁰ PHMSA does not administer a COI process for interagency projects, which are handled by NIST or BSEE. As a result, this process was outside the scope of our work.

R&D Benefits and Uses Are Difficult To Assess and May Take Years To Be Fully Realized

DOT has an R&D goal of transferring technology to the public, and PHMSA seeks to foster the development of new technologies, strengthen consensus standards, and generate and promote general knowledge. However, the benefits and uses of R&D outcomes are challenging to assess, because they may take years to be fully realized, may not be tangible, and are project specific.

PHMSA requires that each research project includes a final report (i.e., the project output) that will be made publicly available for download on its R&D website. Neither DOT nor PHMSA can require researchers to achieve specific results and, depending on the research objective, R&D outcomes may not be tangible or immediate. For example, PHMSA tracks the benefits and uses of technology-related projects—such as net improvements, technology demonstrations, and commercialization—but these are typically realized after a project has been completed and closed out, sometimes years after the researcher’s period of performance has ended. As an example, PHMSA noted that improved battery technology has allowed older research ideas to become relevant again.

Net improvements are derived from final project report conclusions and may not be tangible. For example, project results sometimes simply further knowledge; even if a project has a negative result, the research can provide insights on what does not work. To illustrate, one project manager explained that the researchers on his assigned project, “Real-Time Multiple Utility Detection During Pipe Installation Using Horizontal Directional Drilling Systems,” discovered early on that the combination of a “sounding device” coupled with a “radar device” would not work. However, the research team also learned that while the idea has merit, technology in underground sound generation must improve first.

In contrast, technology demonstrations and commercialization can be more tangible. Demonstrations are a means for evaluating the merit of technologies that are reaching the prototype stage, and commercialization means a product has become available for use. However, it can take years to determine the impact of technology outcomes. PHMSA staff stated that they connect annually with researchers from past projects to determine if net improvements or commercialization can be attributed to a technology project.¹¹ If so, staff note

¹¹ PHMSA gathers information about technology demonstrations and similar information only for technology-related projects, and an Agency official stated they do so because they interpret that to be the emphasis in the PSIA of 2002.

this information in the MIS and may highlight a success story on the public PHMSA pipeline safety R&D website. Program office staff carry out this informal process for 2 to 3 years after the research entity has submitted its final report. Therefore, program managers invest effort into this activity well beyond the end of the projects. This process allows PHMSA to collect valuable data on the impact of the R&D program, but an Agency official stated they had no written procedures that describe this process, its timing, or related employee responsibilities. This could result in actions that risk inconsistent performance and a loss of institutional knowledge.

The outcomes of standards- and knowledge-related R&D projects are more difficult, if not impossible, to determine, partly because they do not result in a physical device. According to PHMSA staff, they evaluate the Agency's public website traffic to determine how often project documents are downloaded, indicating how many users seek related knowledge. However, the Agency cannot identify the users or how they used the downloaded information.

According to one PHMSA official, projects are less likely to have an impact in the short term, but have the potential to produce impacts years later; in addition, every time R&D occurs, knowledge is gained, even if the result is negative. Another PHMSA official explained that one of the Office of Pipeline Safety's main goals is to reduce the number of fatalities, but it is impossible to determine how R&D outcomes alone would affect that metric. The official added that many programs and initiatives work together, even with other Operating Administrations, to achieve the goal of reduced fatalities; this is why PHMSA stops evaluating the benefits of the technology research projects at the commercialization level.

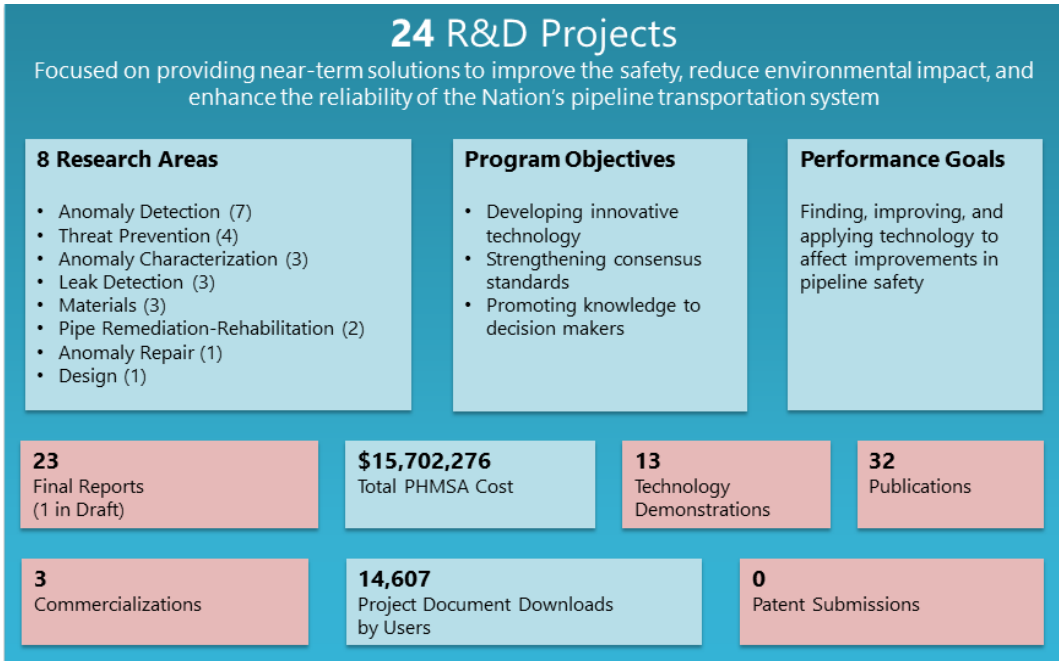
We worked with PHMSA staff to summarize output metrics specific to the sample of 24 completed R&D projects we analyzed. All but 1 of the 24 projects in our sample had resulted in a final report; the absent final report was still being edited by the research entity. Our sample covered 8 research areas, including 7 technology-related projects that resulted in 13 technology demonstrations, 32 publications, and 3 commercializations (see figure 1 on p. 13). Generally, only a small number of technology-related projects achieve commercialization. Exhibit D provides additional details on the sample of projects we analyzed. The data presented in this table are a snapshot and may change over time.

To obtain additional information on benefits and uses for the 24 completed R&D research projects in our sample, the audit team surveyed 14 PHMSA Agreement Officer's Representatives who oversaw these projects. All 14 AORs responded, covering all 24 sampled projects. The survey results from AORs regarding descriptions of benefits and uses were generally positive and not thematic, but rather unique to their managed projects. In sum, AORs reported real, perceived, or future benefits, describing both specific and general results or gained

knowledge stemming from the research work. Despite the varied outcomes suggesting benefits and uses are tied to individual projects, one AOR stated that all R&D projects provide some value and data by explaining what was tested, the lessons learned, and more.

Finally, during our audit we found that PHMSA's R&D website contained outdated information about program processes, such as oversight and output evaluations and assessing program performance. For example, the website stated that PHMSA interacts with the Department's Research and Innovative Technology Administration, which closed in 2014. PHMSA is in the process of updating these web pages.

Figure 1. PHMSA R&D Objectives, Goals, and Metrics for the Sample of 24 Projects



Note: Boxes in red indicate a reported metric included in PHMSA's biennial Update Reports.

Source: OIG's analysis of PHMSA data on sampled R&D projects as of April 24, 2018

PHMSA's Reported Metrics Tally R&D Outputs, but Lack Context and Analysis To Gauge Program Success

The Agency issues biennial reports to update Congress about its progress in implementing the interagency 5-year pipeline safety R&D program plan. PHMSA tracks and reports on the overall performance of the R&D Program using 14 performance metrics and other relevant information. OST-R officials we interviewed highlighted PHMSA's performance metrics as a model for other Operating Administrations to emulate because "PHMSA has excellent interaction with stakeholders before, during, and after research," such as leveraging industry knowledge and tracking results and benefits.

However, while it includes the performance metrics in its biennial Update Reports to Congress, the Agency does not provide additional context based on these metrics, such as analyses to gauge program success over time, trends, or anomalies. Rather, the reports simply provide a tally of the program's quantitative outputs for the reporting period. For example, in 2016 PHMSA reported that 6 final project reports were publicly issued in fiscal years 2014–2015, and 11 technology demonstrations were held. However, it did not include additional insights or analyses of these data to inform policy or programmatic decisions. The report also did not provide analytical data, such as trends, anomalies, or comparisons to previous or expected future outputs. As a result, while they provide a snapshot of outputs for a given time period, PHMSA's Update Reports provide limited context to external stakeholders. Moreover, providing context to Congress and others is especially important, given the difficulty in assessing the benefits and uses of R&D projects.

Best practices outlined by the Performance Improvement Council include assessing the success of goals to determine whether outcomes have been met, inform policy or programmatic decisions, and generate new or rigorous insights by making sense of data and applying those insights to performance questions, trends, anomalies, or issues. For example, PIC suggests key questions to ask, such as, is the entity able to identify trends that show how it tends to perform, or is the entity intentionally assessing its success in achieving its goals. PIC's best practices are complementary to, but different from, the new statutory requirements for the biennial Update Reports to Congress.

Similarly, the PIPES Act of 2016 requires the Update Reports to include a summary of each R&D project carried out under the PSIA of 2002 and a review of how the project affects safety. PHMSA has not yet issued the 2018 Update Report, but a PHMSA official noted that the next 5-Year R&D Program Plan will specifically address this new requirement. The PIC best practices and the new

congressional requirements can guide the collection of comprehensive and reliable data that policymakers need to make policy or programmatic decisions.

Conclusion

PHMSA's Pipeline Safety R&D Program has a variety of components and goals aimed at improving the safety of the Nation's pipeline transportation system, as well as wide-ranging ancillary goals impacting the small business community and institutions of higher learning involved in related research activities. While the R&D Program addresses the Agency's mission and goals, we identified control weaknesses and an opportunity to improve reporting. PHMSA can strengthen the overall program by developing policies and procedures that further support accountability for program activities and enhance reporting to Congress.

Recommendations

To improve the management of the Pipeline Safety Research and Development Program, we recommend that the Pipeline and Hazardous Materials Safety Administrator:

1. Develop and issue comprehensive policy and procedures for the Pipeline Safety Research and Development Program that includes guidance for:
 - a. notifying a wider spectrum of stakeholder representatives about future Research and Development forums, in order to increase their participation;
 - b. addressing how the results of Research and Development forums are incorporated into the program plan;
 - c. conducting all steps in the conflict-of-interest process;
 - d. following up with researchers on benefits and uses.
2. Complete upgrades to the conflict-of-interest portion of the Research and Development Management Information System.
3. Use Performance Improvement Council best practices to update future biennial Update Reports to Congress, to include additional context, such as analyses of current performance metrics and an evaluation of program success, trends, and anomalies.

Agency Comments and OIG Response

We provided PHMSA with our draft report on April 17, 2018, and received its response, included as an appendix to this report, on May 14, 2018. PHMSA concurred with our three recommendations and provided appropriate actions and completion dates. Accordingly, we consider all recommendations resolved but open pending completion of the planned actions.

Actions Required

We consider recommendations 1 through 3 resolved but open pending completion of the planned actions.

Exhibit A. Scope and Methodology

We conducted this performance audit from July 2017 through April 2018 in accordance with generally accepted Government auditing standards as prescribed by the Comptroller General of the United States. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Our objectives were to assess PHMSA's processes for (1) consulting with stakeholders, (2) mitigating selection panel members' COI, and (3) measuring the benefits and uses of R&D outcomes.

To assess PHMSA's processes for consulting with stakeholders, we reviewed legislation; a 2004 memorandum of understanding between DOT, the Department of Energy, and NIST; a draft PHMSA procedure on R&D forums; research solicitations; biennial reports to Congress; Pipeline Safety R&D forum summaries; and Federal Register Notices announcing those forums. To determine stakeholder representation, we worked with PHMSA staff to analyze attendee and presenter lists for the forums held in 2012, 2014, and 2016. We interviewed personnel from PHMSA Headquarters, BSEE, and NIST regarding coordination efforts, and we contacted or interviewed representatives of nine judgmentally selected organizations representing stakeholder groups concerning their knowledge of or participation in forums.

To assess PHMSA processes for mitigating COI, we gathered nondisclosure-COI certifications for each of the 11 MRP members who reviewed CORE proposals, the 4 who reviewed CAAP proposals, and the 3 who reviewed SBIR proposals in fiscal year 2015. We compared their COI certifications to their voting records, looking for discrepancies or inconsistencies in recusals. We interviewed officials at PHMSA and the Volpe Center and reviewed DOT, PHMSA, and Volpe COI policies and guidance. We did not review COI activities related to interagency projects awarded in fiscal year 2015, as they were managed by NIST.

To assess PHMSA's processes for measuring the benefits and uses of R&D outcomes, we reviewed the Agency's public R&D website for relevant information and requested limited access to PHMSA's MIS to review documentation regarding our statistical sample of 24 out of 47 completed R&D projects awarded during fiscal years 2013–2016. We created a sample database to verify the status of project-specific data and documentation, such as project IDs and titles, peer reviews, final reports, commercializations, and submitted patents. We reviewed PHMSA's 5-year R&D program plan and biennial reports, including reported

performance metrics, and compared them to Federal best practices. We also interviewed officials at PHMSA, OST-R, and the Department of Health and Human Services OIG. To collect additional information on R&D benefits and uses, we surveyed 14 AORs and summarized their qualitative responses regarding our sample of projects and their outcomes. Finally, we worked with PHMSA to create a summary of metrics specific to the sample of 24 projects (see exhibit D).

Exhibit B. Organizations Visited or Contacted

PHMSA Facilities

Office of Chief Counsel

Office of Pipeline Safety

Office of the Chief Financial Officer, Acquisition Services Division

Other Organizations

Conservation Law Foundation

Department of Commerce, National Institute of Standards and Technology

Department of Health and Human Services, Office of Inspector General

Department of Interior, Bureau of Safety and Environmental Enforcement

Department of Transportation, Office of the Assistant Secretary for Research and Technology

Department of Transportation, John A. Volpe National Transportation Systems Center

Environmental Defense Center

Environmental Defense Fund

International Brotherhood of Teamsters

International Union of Operating Engineers

Natural Resources Defense Council

National Wildlife Federation

Pipeline Safety Trust

Sierra Club

United Association of Plumbers and Pipefitters

Exhibit C. List of Acronyms

AOR	Agreement Officer’s Representative
BSEE	Bureau of Safety and Environmental Enforcement
CAAP	Competitive Academic Agreement Program
COI	Conflict of interest
DOT	Department of Transportation
IA	Interagency
MIS	Management Information System
NIST	National Institute of Standards and Technology
OIG	Office of Inspector General
OST-R	Office of the Assistant Secretary for Research and Technology
PIC	Performance Improvement Council
PHMSA	Pipeline and Hazardous Materials Safety Administration
R&D	Research and Development
SBIR	Small Business Innovation Research Program

Exhibit D. PHMSA Metrics for OIG Sample of R&D Projects, as of April 24, 2018

#	Project Name	Research Area	Final Report	Downloads 1/1/2017	Patents	Technology Demos	Commercialization	Publication	PHMSA Cost
Note: Shaded cells are technology-related R&D projects.									
1	Radio Frequency Identification (RFID) Smart Corrosion Coupon	Threat Prevention	Yes	401	No	N/A	N/A	0	\$103,258
2	Toward Permanently Installed Pipeline Monitoring Systems	Anomaly Detection	Yes	511	No	N/A	N/A	5	\$102,750
3	Advanced Nondestructive Characterization of Pipeline Materials	Anomaly Detection	Yes	587	No	N/A	N/A	2	\$101,750
4	Subsurface Multi-Utility Asset Location Tool	Threat Prevention	Yes	287	No	2	Yes	1	\$125,998
5	Real-Time Multiple Utility Detection During Pipe Installation Using Horizontal Directional Drilling (HDD) System	Threat Prevention	Yes	732	No	1	TBD	0	\$512,119
6	INO Technologies Assessment of Leak Detection Systems for Hazardous Liquid Pipelines	Leak Detection	Yes	517	No	2	Yes	0	\$551,388
7	Advanced Leak Detection LiDAR	Leak Detection	Yes	559	No	1	TBD	2	\$1,225,028

#	Project Name	Research Area	Final Report	Downloads 1/1/2017	Patents	Technology Demos	Commercialization	Publication	PHMSA Cost
Note: Shaded cells are technology-related R&D projects.									
8	Development, Field Testing and Commercialization of a Crack and Mechanical Damage Sensor for Unpiggable Natural Gas Transmission Pipelines	Anomaly Detection	Yes	491	No	4	TBD	0	\$840,396
9	Improve and Develop ILI Tools to Locate, Size, and Quantify Complex/ Interacting Metal Loss Features	Anomaly Detection	Yes	642	No	1	Yes	2	\$754,000
10	Development of an Industry Test Facility and Qualification Processes for Inline Inspection (ILI) Technology Evaluation and Enhancements	Anomaly Detection	Yes	334	No	N/A	N/A	2	\$1,401,199
11	Above-ground Detection Tools Including Disbondment and Metal Loss for all Metals Including Cast-Iron Graphitization	Anomaly Detection	Yes	359	No	2	TBD	1	\$415,121
12	Evaluation of Structural Liners for the Rehabilitation of Liquid and Natural Gas Piping Systems	Pipe Remediation-Rehabilitation	Yes	439	No	N/A	N/A	1	\$425,650
13	Technology Transfer, Demonstrations and Post-Mortem Testing of Cast Iron and Steel Pipe Lined with Cured-in-Place Pipe Liners	Pipe Remediation-Rehabilitation	Yes	910	No	N/A	N/A	1	\$477,572

Exhibit D. PHMSA Metrics for OIG Sample of R&D Projects

#	Project Name	Research Area	Final Report	Downloads 1/1/2017	Patents	Technology Demos	Commercialization	Publication	PHMSA Cost
Note: Shaded cells are technology-related R&D projects.									
14	Characterization of Modern High Toughness Steels for Fracture Propagation and Arrest Assessment	Materials	No	291	No	N/A	N/A	2	\$300,000
15	The Effect of Pressurized Hydrogen Gas on the Fatigue Properties of the Heat-Affected Zones in X52 and X70 Pipelines	Materials	Yes	296	No	N/A	N/A	1	\$160,000
16	Effects of Hydrocarbon Permeation on Plastic Pipe Strength and Fusion Performance	Materials	Yes	445	No	N/A	N/A	2	\$649,916
17	Consolidated Project Full Scale Testing of Interactive Features for Improved Models	Anomaly Characterization	Yes	1,025	No	N/A	N/A	1	\$3,297,555
18	Strain-Based Design and Assessment of Segments of Pipelines with and without Fittings	Design	Yes	1,383	No	N/A	N/A	2	\$2,035,259
19	Improving Models to Consider Complex Loadings, Operational Considerations, and Interactive Threats	Anomaly Characterization	Yes	1,321	No	N/A	N/A	1	\$470,056
20	Threat/Anomaly Mitigation Decision-Making Process	Anomaly Characterization	Yes	403	No	N/A	N/A	1	\$354,820

#	Project Name	Research Area	Final Report	Downloads 1/1/2017	Patents	Technology Demos	Commercialization	Publication	PHMSA Cost
Note: Shaded cells are technology-related R&D projects.									
21	Improving Leak Detection System Design Redundancy & Accuracy	Leak Detection	Yes	570	No	N/A	N/A	0	\$832,036
22	Definition of Geotechnical and Operational Load Effects on Pipeline Anomalies	Threat Prevention	Yes	464	No	N/A	N/A	3	\$314,500
23	Wall Break-Through in Composite Repaired Defects	Anomaly Repair	Yes	671	No	N/A	N/A	1	\$101,905
24	A Novel Approach to Establishing Remaining Strength of Line Pipe and Fittings with Corrosion Type Defects	Anomaly Detection	Yes	969	No	N/A	N/A	1	\$150,000
Sample Project Totals									
	Projects	Research Areas	Final Reports	Downloads 1/1/2017	Patents	Technology Demos	Commercialization	Publications	PHMSA Cost
	24	8	23	14,607*	0	13	3	32	\$15,702,276

Source: PHMSA. *Document downloads includes all files from the project page: final reports, presentations, publications, etc.

Exhibit E. Major Contributors to This Report

KERRY R. BARRAS	PROGRAM DIRECTOR
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NICHOLAS COATES	SENIOR COUNSEL

Appendix. Agency Comments



U.S. Department
of Transportation

**Pipeline and Hazardous
Materials Safety Administration**

Memorandum

Subject: INFORMATION: Management Response to the Office of
Inspector General (OIG) Draft Report on the Pipeline
Safety Research and Development (R&D) Program

Date: May 10, 2018

From: Howard "Skip" Elliott
PHMSA Administrator

A handwritten signature in blue ink, appearing to read "Howard 'Skip' Elliott".

To: Barry J. DeWeese
Assistant Inspector General for Surface Transportation Audits

The Pipeline and Hazardous Materials Safety Administration (PHMSA) is committed to protecting people and the environment by advancing the safe transportation of energy and other hazardous materials that are essential to our daily lives. Since the enactment of the Pipeline Safety Improvement Act (PSIA) of 2002, PHMSA has awarded more than \$100 million to Federal and non-Federal agencies for R&D projects that support safety improvements, reduce environmental impacts, and enhance pipeline transportation reliability. The more than 250 funded projects had foci ranging from pipeline corrosion to preventing damage to pipelines and allowed PHMSA to conduct 54 technology demonstrations, commercialize 28 technologies, and support 31 projects that applied for patents.

PHMSA continues to enhance its R&D program through multiple initiatives, including the following efforts:

- Identifying options to broaden the spectrum of stakeholder representatives at future R&D forums; and
- Coordinating with PHMSA's procurement staff to update conflict of interest guidance.

The OIG draft report noted that PHMSA met the PSIA mandate to consult with stakeholders, that it has safeguards in place to identify and mitigate conflicts of interest on its merit review panel that selects research proposals for funding, and that it reports to Congress on the results of its research. The OIG made three recommendations on how PHMSA can enhance efforts in these areas, and upon review of OIG's draft report, PHMSA concurs with all three recommendations as written and plans to implement them as follows: Recommendation 1 by June 3, 2019; Recommendation 2 by February 1, 2019; and Recommendation 3 by February 3, 2020.

PHMSA appreciates the opportunity to respond to the OIG draft report. Please contact Kenneth Lee, Director of Engineering and Research, at: (202) 366-2694 with any questions or if you would like additional details.

U.S. DOT IG Fraud & Safety Hotline

hotline@oig.dot.gov | (800) 424-9071

<https://www.oig.dot.gov/hotline>

Our Mission

OIG conducts audits and investigations on behalf of the American public to improve the performance and integrity of DOT's programs to ensure a safe, efficient, and effective national transportation system.

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