INTEGRITY THREATS TO HAZARDOUS LIQUID PIPELINES

Pipeline and Hazardous Materials Safety Administration

Report Number AV-2006-071
Date Issued: September 18, 2006

Memorandum

U.S. Department of Transportation
Office of the Secretary
of Transportation
Office of Inspector General

Subject: ACTION: Report on Integrity Threats to Hazardous Liquid Pipelines Pipeline and Hazardous Materials Safety Administration Report Number AV-2006-071

Date: September 18, 2006

From: David A. Dobbs
Acting Principal Assistant Inspector General for Auditing and Evaluation

Reply to Attn. of: JA-10

To: Administrator, Pipeline and Hazardous Materials Safety Administration

This report presents the results of our review of the Pipeline and Hazardous Materials Safety Administration (PHMSA) Office of Pipeline Safety's (OPS) oversight of hazardous liquid pipeline operators' processes for mitigating and repairing threats to pipeline integrity. The objectives of our audit were to assess: (1) actions taken by pipeline operators to remediate integrity threats and (2) OPS efforts to verify the adequacy of these corrective actions. In March and April 2006, we presented some of our preliminary audit findings at two congressional hearings on pipeline safety.[1] Exhibit A contains details on the scope and methodology we used in conducting this review.

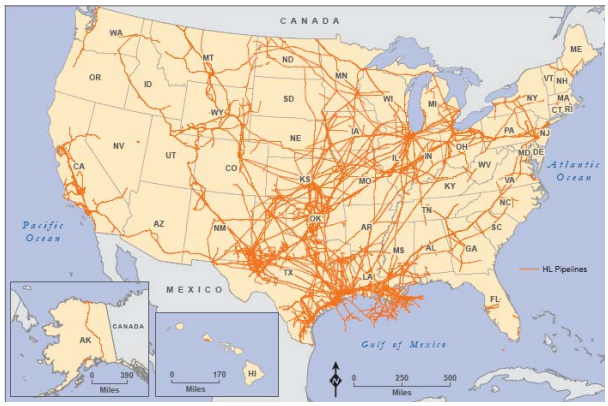
Low-stress transmission pipelines (the type that failed on Alaska's North Slope in March and August 2006) were not included in this audit because they are currently exempt from Federal pipeline safety regulations. PHMSA is working on safety regulations that would address these pipelines and issued a notice of proposed rulemaking on August 31, 2006.

[1] CC-2006-023, "Pipeline Safety: Progress and Remaining Challenges," March 16, 2006; and CC-2006-039, "Pipeline Safety: Progress and Remaining Challenges," April 27, 2006. See OIG reports and testimony on our website: www.oig.dot.gov.

BACKGROUND

Approximately 170,000 miles of pipelines are used to transport crude oil, gasoline, kerosene, diesel fuel, and other hazardous liquids throughout the United States (see Figure 1). These pipelines, comprising 249 systems, are managed by approximately 130 operators.

Figure 1. Hazardous Liquid Pipelines in the United States



Source: OPS

In December 2000, OPS issued the hazardous liquid Integrity Management Program[2] (IMP) rule as a result of several major pipeline accidents, congressional mandates, and concerns over the safety of the Nation's pipelines. Under the IMP rule, OPS requires pipeline operators to develop programs to assess, evaluate, and mitigate (i.e., repair) the risks to their pipelines in areas where a leak or rupture could have significant consequences. This risk-based approach is the backbone of OPS's pipeline safety program. Operator IMPs must include such elements as identifying their pipelines in or potentially affecting high-consequence areas (HCA),[3] conducting baseline assessments, identifying and repairing integrity threats, and measuring program effectiveness.

Figure 2. A Smart Pig

Operators conduct baseline assessments of their pipelines primarily through in-line inspections. In-line inspections employ computerized devices (commonly referred to as smart pigs) that run inside a pipeline (see Figure 2 for a picture of a smart pig). Smart pigs employ magnetic or ultrasound technologies to identify and measure dents, cracks, metal loss from corrosion, and other deformations that may eventually lead to leaks or ruptures. When pigging is impractical, operators use hydrostatic testing or other technology to identify integrity threats. Operators, in turn, use the resulting data to identify

[2] 49 CFR § 195.452 (2001), "Pipeline Integrity Management in High Consequence Areas," went into effect on March 31, 2001. Although initially pertaining to operators with 500 or more miles of hazardous liquid pipelines, the rule was expanded to include operators with less than 500 miles of pipeline starting February 15, 2002.

[3] HCAs include unusually sensitive areas (defined as drinking water or ecological resource areas), urbanized and other populated places, and commercially navigable waterways.

and categorize integrity threats by repair timeframe as established by the IMP rule: immediate, 60-day, 180-day, or other (no specific time period). These threats are included in operator annual reports to OPS, due each June. In addition to using these reports, OPS oversees operator compliance with IMP requirements through a series of integrity management inspections that started in 2002.

RESULTS IN BRIEF

According to OPS, tens of thousands of integrity threats have been identified and repaired since implementing the IMP rule in 2001. IMP success is due in large part to the efforts of hazardous liquid pipeline operators and OPS oversight. Our review found that pipeline operators had repaired all 409 threats we examined, with about 98 percent of the repairs completed within established timeframes. Similarly, OPS and its state partners in overseeing operator compliance with the IMP rule had conducted one or more integrity management inspections[4] of 86 percent (215 of 249) of hazardous liquid pipeline systems as of January 2006. Even more important, those inspected pipeline systems represent approximately 98 percent of all hazardous liquid pipeline miles in or potentially affecting HCAs.

While we acknowledge the progress being made in identifying, repairing, and overseeing integrity threats, several challenges still remain. These include the need to improve the accuracy of operator annual reports submitted to OPS and to ensure the effective use of pipeline inspection technology or smart pigs. The following summarizes our results.

- ✓ **Accuracy of Operator Annual Reports Needs Improvement**. OPS's risk-based approach to safety relies on accurate reporting from operators. Six of the seven hazardous liquid pipeline operators we visited, however, had errors in their annual reports to OPS on integrity threats, in some cases substantial errors. Reporting errors were due to a variety of factors, such as the submission of preliminary numbers, data outside the reporting period, or threats involving non-HCA pipeline segments. In particular, inaccurate reports hamper OPS's ability to analyze threat data, identify important trends, and focus limited inspection resources on areas of greatest concern. OPS has taken steps to improve the accuracy of operator annual reports and to help operators better understand the reporting requirement. For example, as a result of our preliminary audit findings, OPS issued new reporting guidelines to pipeline operators in April 2006. Moreover, in May 2006, OPS updated its integrity management inspection manual to include a requirement to verify the accuracy

[4] During inspections of hazardous liquid pipeline operators, inspectors look at whether operators: (1) perform a thorough and effective review of pig results, (2) identify all integrity threats in a timely manner, (3) remediate integrity threats in a timely manner, and (4) use the appropriate repair or remediation methods.

of operator threat data. OPS, however, still needs to ensure that Federal and state inspectors fully implement the new data verification requirement during future integrity management inspections.

- ✓ **Need To Ensure Smart Pig Results Are Properly Analyzed and Interpreted.** With much of the Nation's pipeline system underground, smart pigs have proven extremely valuable in helping identify tens of thousands of defects before leaks occur. For all the benefits provided by this technology and the industry's extensive use of smart pigs for inspecting pipelines, such devices should not be considered a "silver bullet" for identifying all integrity threats. Our review, for example, found several cases where integrity threats were not correctly identified based on pig inspection data. In one instance, pig data indicated two immediate threats, whereas the operator—after digging up and examining the pipeline—identified 30 threats requiring immediate attention. As a result of limitations in pig technology and incorrect analysis of pig data, some integrity threats can go undetected and pipeline accidents have occurred on pipelines that have been pigged. While OPS, the pipeline industry, and the seven operators we visited have taken a number of corrective actions, continued vigilance will be needed to ensure that operators use the right inspection tool and accurately analyze and interpret pig test results.

In light of these challenges, we recommend that OPS ensure inspectors implement new guidance on verifying operator integrity threat data. We also recommend that OPS identify what actions will be taken over the next year to oversee operators' pig testing and analysis activities and to facilitate the adoption of industry standards and the funding of research and development.

Summary of Management Comments and Office of Inspector General Response

On June 29, 2006, we sent PHMSA a draft of our report. On August 11, 2006, PHMSA provided us with its formal response, which is contained in its entirety in the Appendix.

In its response, PHMSA agreed with both recommendations and believes it has already met the intent of these recommendations. For the first recommendation, PHMSA pointed to its recent revision of annual report guidelines and an update to its inspection protocol. For the second recommendation, PHMSA cited prior year efforts to improve Agency oversight of operator pig testing and analysis and to facilitate both the adoption of industry standards and the funding for research and development activities. However, as PHMSA's response notes, the revised inspection protocol has yet to be implemented. PHMSA also did not indicate what

actions it would take over the next year to further advance smart pig technology and the analysis and interpretation of pig test results.

On September 5, 2006, a PHMSA official confirmed that inspection teams were already using the revised inspection protocol and in the next year the Agency would continue reviewing operators' assessments of pig data, evaluating the adequacy of industry standards on pig processes, and identifying and funding areas in need of further research and development. PHMSA's actions are responsive to our recommendations.

FINDINGS

Accuracy of Operator Annual Reports Needs Improvement

While acknowledging the progress being made in identifying, repairing, and overseeing integrity threats, we have concerns with the accuracy of operator annual reports submitted to OPS. OPS uses the integrity threat data in these reports in a variety of ways, including identifying trends, prioritizing integrity management inspections, and monitoring industry performance and regulatory compliance. Yet, our review found reporting errors in the integrity threat data submitted by six of the seven operators we visited. We asked each of the seven operators to re-examine the 2004 threat data that they reported to OPS. Six of the seven operators acknowledged having made errors, in some cases significant ones, in their annual reports. For example, as indicated by Table 1, the number of

Table 1. Change in Significant Threats Reported to OPS by Seven Operators

Operator	Reported Threats	Revised Numbers	Net # Change	Net % Change
1	53	79	+26	+49%
2	945	1,185	+240	+25%
3	559	622	+63	+11%
4	317	342	+25	+8%
5	26	26	0	0%
6	26	17	-9	-35%
7	186	110	-76	-41%
Total	**2,112**	**2,381**	**+269**	**+13%**

significant threats[5] reported by one operator to OPS had to be increased by

[5] Those threats that must be repaired within set timeframes of immediate, 60 days, or 180 days.

49 percent (i.e., from 53 to 79). In a second example, the operator had to decrease its numbers by 41 percent (i.e., from 186 to 110).

These reporting errors were due to a variety of factors. For example, one operator mistakenly reported preliminary pig data instead of actual numbers obtained from subsequent excavation and repair work. A second operator reported integrity threat data involving non-HCA pipeline segments. Other types of errors included reporting data outside the 2004 reporting period and entering numbers relating to pipeline mileage rather than integrity threats. OPS attributed reporting errors to this being the first annual report submitted by hazardous liquid pipeline operators and the lack of familiarity with the new reporting requirements. Nevertheless, OPS's risk-based approach to safety needs accurate reporting from operators. Our primary concern is that inaccurate reports hamper OPS's ability to analyze threat data, identify important trends, and focus limited inspection resources on areas of greatest concern.

OPS officials are helping operators improve the accuracy of annual reports and to better understand new reporting requirements. Starting in January 2006, OPS began posting operator annual integrity threat reports to its public website as a means of providing transparency and encouraging greater accuracy. In addition, as a result of our preliminary audit findings, OPS has taken three steps to improve the accuracy of operator annual reports. First, in April 2006, OPS issued new reporting guidelines that clarified what threat data should be included in annual reports and requested that operators verify the accuracy of their 2004 threat data. Second, in May 2006, OPS updated its integrity management inspection manual with a requirement for inspection teams to verify integrity threat data included in operator annual reports. Third, in July 2006, OPS updated its inspection protocol, directing inspectors to validate operator processes for reporting integrity threat data. While these actions are positive, OPS needs to ensure that Federal and state inspectors fully implement its new data verification requirements during future inspections.

Continued Vigilance Is Needed To Ensure Smart Pig Results Are Properly Analyzed and Interpreted

Given hazardous liquid pipeline operators' reliance on smart pigs to identify pipeline threats, OPS and the pipeline industry need to ensure the effective use of this technology. Smart pigs have proven extremely valuable in helping identify defects before leaks occur, but the current technology still cannot identify all pipeline integrity threats. As a result, some integrity threats go undetected, and pipeline accidents have occurred on pipelines that have been pigged.

Smart Pigs and How They Are Used

The IMP rule requires operators to assess the integrity of their pipelines using smart pigs or an equally effective method, such as hydrostatic testing or direct assessment. As of March 2006, approximately 95 percent of all hazardous liquid pipeline operators were using smart pigs to identify integrity threats. These devices run inside pipelines to record the location of dents, gouges, cracks, corrosion, and other threats to pipeline safety. With much of the Nation's pipeline system underground, smart pigs can identify defects before leaks occur without the costs and problems associated with excavation. Although operators contract with pig vendors to inspect their pipelines, it is the operator—in verifying and analyzing the vendor data and reports—who decides whether a dent or corrosion is an integrity threat.

The Technology's Limitations

Smart pigs provide valuable insights into a pipeline's integrity, but they do not guarantee that an operator will be able to identify all integrity threats. As the following examples help to illustrate, the correct pig must be used and the data from the pig run must be properly analyzed.

- In the 1999 Bellingham incident,[6] the National Transportation Safety Board determined that one of the probable causes was that the pipeline operator had inaccurately evaluated pig assessment data. As a result, the operator did no further examination or excavation before the pipeline ruptured.

- In a 2003 failure, the pig reported corrosion pits of up to 50 percent, not the 95 percent that was later identified during a post-accident metallurgical analysis of the pipeline.

- In another 2003 example, an operator failed to identify approximately 160 integrity threats due to an error in analyzing pig data. In this case, the operator discovered the threats during a quality control review, rather than after an accident, and made the necessary repairs.

Our audit also found several examples indicating the limitation of smart pigs in identifying integrity threats. In one case, pig data had indicated two immediate threats, whereas the operator—after digging up and examining the pipeline—identified 30 threats requiring immediate attention. In another, 33 of the 409 integrity threats in our sample turned out not to be threats, even though pig data had indicated repairs were needed. Nearly half of the 33 misidentified integrity threats had been classified as requiring repairs within 180 days.

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[6] In June 10, 1999, a 16-inch-diameter hazardous liquid pipeline ruptured near Bellingham, WA, killing three people and injuring eight others, with property damage estimated at $45 million.

Recognizing the value, as well as the limits, of smart pig technology, all seven operators we visited took measures to test the accuracy of pig results. For example, all seven conducted verification digs in which an operator excavates and assesses potential integrity threats identified in a pig vendor report. Additionally, one operator employed an in-house pig analyst and, on one occasion, returned a vendor's final report for recalibration. Two other operators used contract clauses penalizing the pig vendor if an integrity threat's estimated location was not the same as its actual location.

OPS and the pipeline industry have also taken a number of actions to ensure the effective use of smart pig technology and data. Since 1995, OPS has funded research and development activities to enhance this technology. Starting in 2002, OPS integrity management inspections have included steps to determine how well operators review, validate, and analyze pig results.[7] In August 2005, the American Petroleum Institute published its Standard 1163, "In-line Inspection Systems Qualification Standard," in recognition of the need for guidance about smart pigs and their uses. This standard provides guidance to operators and pig vendors on topics such as selecting the right pig, operating it properly, and verifying the results. Also in August, OPS conducted a public meeting to educate operators and pig vendors on the new standard and appropriate ways to apply, interpret, and evaluate pig data.[8]

While OPS, pipeline industry, and operator actions hold promise, additional vigilance is needed. For example, pipeline operators and pig vendors need to continue using industry requirements, standards, and best practices. Likewise, OPS needs to continue its research and development activities with respect to smart pig technology and efforts to educate the industry on the proper use of smart pigs and pig data to identify integrity threats. We also recommend that OPS continue its oversight of operators' use of smart pigs and the interpretation and use of pig data.

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[7] For example, OPS inspectors assess whether operators use data gathered during excavations and repair work to validate the accuracy of pig data.

[8] This is not the first public meeting that OPS has held on pipeline assessment methods. Since 2003, OPS has hosted five other public meetings on the use of smart pigs and other pipeline assessment methods.

RECOMMENDATIONS

We recommend that the PHMSA Administrator:

1. Ensure that integrity management inspection teams have implemented the new guidance on verifying integrity threat data in operator annual reports.

2. Identify what actions will be taken over the next year to (a) oversee operators' pig testing and analysis activities and (b) facilitate the adoption of industry standards and funding of research and development.

AGENCY COMMENTS AND OFFICE OF INSPECTOR GENERAL RESPONSE

On June 29, 2006, we sent PHMSA a draft of our report. On August 11, 2006, PHMSA provided us with its formal response, which is contained in its entirety in the Appendix.

Regarding Recommendation 1, PHMSA agreed with our recommendation and believes it has already met the intent of the recommendation. In July 2006, PHMSA decided to revise its hazardous liquid integrity management inspection protocol to require inspection teams to verify whether operators are following the new reporting guidelines issued in April 2006. The Agency added that inspection teams would begin using the updated inspection protocol in the summer of 2006.

Regarding Recommendation 2, PHMSA agreed with our recommendation and described how it has worked for years to advance smart pig technology and the development of industry standards. In addition, PHMSA pointed out how it has helped to improve smart pig technology through research and development investments. However, the response did not indicate what actions the Agency would take in the coming year to further advance smart pig technology and the analysis and interpretation of pig test results.

On September 5, 2006, a PHMSA official provided additional information on the Agency's response to the draft report. First, he confirmed that inspectors are using the revised inspection protocol. However, PHMSA identified data errors in the operators' June 2006 annual reports. Therefore, the Agency will need to continue working closely with pipeline operators to improve the accuracy of annual reports.

Second, the official stated that over the next year the Agency will continue reviewing operators' assessments of pig data, evaluating the adequacy of industry standards regarding smart pigs, and identifying smart pig technology that needs

further research and development. In addition, PHMSA will further enhance pipeline integrity by awarding research and development contracts on pipeline coatings, welding, and mechanical damage.

PHMSA's actions are responsive to our recommendations, and we consider recommendations 1 and 2 closed, subject to follow-up provisions of Department of Transportation Order 8000.1C.

We appreciate the courtesies and cooperation of OPS representatives during this audit. If you have any questions concerning this report, please call me at (202) 366-0500 or Robin K. Hunt, Deputy Assistant Inspector General for Aviation and Special Program Audits, at (415) 744-3090.

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cc: Assistant Administrator/Chief Safety Officer
Laura Birkhimer, PHA-30
Martin Gertel, M-1

EXHIBIT A. SCOPE AND METHODOLOGY

This review was conducted between August 2005 and May 2006 and included visits to OPS Headquarters and regional offices, seven hazardous liquid pipeline operators, two pipeline associations, and one public interest group (see Exhibit B for a complete list). Nationwide, approximately 130 pipeline operators manage 249 pipeline systems. To conduct our audit, we selected seven operators based on the number of integrity threats they had reported, their location, and when they had undergone an integrity management inspection. We reviewed 13 of the 29 hazardous liquid pipeline systems managed by those 7 operators.

In 2004, hazardous liquid pipeline operators nationwide reported having repaired 18,225 integrity threats, 5,564 of which were time-sensitive (i.e., immediate, 60-day, and 180-day) threats,[9] on their pipeline systems. As depicted in Table 2, the 13 pipeline systems we reviewed reported about 38 percent (2,112 of 5,564) of the nationwide total of significant integrity threats in 2004.

Table 2. Hazardous Liquid Pipeline Systems and Significant Integrity Threats (2004)

Categories	Pipeline Systems	Reported Integrity Threats
Total Universe	249	5,564
Audit Sample	13	2,112
% of Total	**5%**	**38%**

To determine whether operators had repaired integrity threats and made repairs within established time limits, we reviewed operator repair records and pig vendor reports on a statistical sample of 409 integrity threats drawn from the 13 pipeline systems between 2002 and 2004. We discussed integrity threat repairs with OPS, the operators, and the pipeline associations.

To assess the accuracy of the reported integrity threat data from the seven operators, we reviewed OPS's 2004 Hazardous Liquid Annual Report database. We also worked with pipeline operators in re-examining integrity threat data included in their June 2005 annual reports to OPS.

To determine the adequacy of OPS oversight activities, we reviewed OPS's integrity management inspection protocols, inspection reports, and enforcement actions for each of the seven operators we visited. We discussed inspection procedures and results with OPS and pipeline operators.

[9] Operators reported having identified approximately 12,700 other (not time-sensitive) integrity threats in 2004. We focused on the 5,564 time-sensitive integrity threats because they pose a greater risk to pipeline safety.

This performance audit was done in accordance with Generally Accepted Government Auditing Standards prescribed by the Comptroller General of the United States. Our audit included such tests of procedures and records as we considered necessary, including those providing reasonable assurance of detecting abuse and illegal acts. We relied on aggregate integrity threat data provided by OPS and pipeline operators; however, we verified the accuracy of operator data on the individual integrity threats in our sample.

EXHIBIT B. ACTIVITIES VISITED OR CONTACTED

Office of Pipeline Safety

Headquarters, Washington, DC
Central Regional Office, Kansas City, MO
Eastern Regional Office, Washington, DC
Southwest Regional Office, Houston, TX
Trenton District Office, West Trenton, NJ
Western Regional Office, Lakewood, CO

Pipeline Operators and Respective Systems

Buckeye Pipeline Co., Emmaus, PA

- Buckeye Pipeline Company, Limited Partnership
- Everglades Pipeline Company, Limited Partnership
- Laurel Pipeline Company, Limited Partnership
- Norco Pipeline Company, Limited Partnership

Kinder-Morgan Pipeline Co., Wink, TX, and Orange, CA

- Santa Fe Pacific Pipeline, Limited Partnership
- Calnev Pipeline Company
- Kinder Morgan Wink Pipeline, Limited Partnership

Magellan Pipeline Co., Tulsa, OK

- Osage Pipeline Company

Suncor Energy Pipeline Co., Cheyenne, WY

- Suncor Energy (USA) Pipeline Company

TEPPCO, Houston, TX

- TE Products Pipeline Company, Limited Partnership
- TEPPCO Crude Pipeline, Limited Partnership

Valero Logistics, Corpus Christi, TX

- Valero Logistics Operations, Limited Partnership

Wolverine Pipeline Co., Portage, MI

- Wolverine Pipeline Company

Other

Association of Oil Pipelines, Washington, DC
American Pipeline Institute, Washington, DC
Pipeline Safety Trust, Bellingham, WA

Exhibit B. Activities Visited or Contacted

APPENDIX. MANAGEMENT COMMENTS

U.S. Department
of Transportation

**Pipeline and Hazardous
Materials Safety Administration**

AUG 11 2006

400 Seventh Street, S.W.
Washington, D.C. 2059

INFORMATION MEMORANDUM TO THE ASSISTANT INSPECTOR GENERAL FOR AVIATION AND SPECIAL PROGRAM AUDITS

From: Stacey L. Gerard, Assistant Administrator/Chief Safety Officer
x64433

Prepared by: Jeff Wiese, Program Development Director, PHP
x62036

Subject: Draft OIG Report on Integrity Threats to Hazardous Liquid Pipelines

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OIG Finding: *Accuracy of Operator Annual Reports Needs Improvement*

PHMSA agrees that the quality of operator Annual Report submissions (Form PHMSA F 7000-1.1) is important as it reflects progress being made toward the overall goal of pipeline integrity. However, your recommendation is made after reviewing only the first submission ever of hazardous liquid annual reports (CY 2004). As might be expected in the first year for any new reporting requirement, there were some inconsistencies and inaccuracies in the data that was provided. As your team noted, we recognized these issues, modified the report preparation instructions, and notified operators prior to submission of CY 2005 reports. The instructions now clarify more precisely what data should be submitted for several areas where the instructions were ambiguous or operators had difficulty providing the expected information. These include the problem areas identified in the draft report:

- Use of preliminary pig data instead of actual excavation data
- Reporting repairs in pipelines that can not affect High Consequence Areas
- Reporting data outside of the CY 2004 reporting period

Revised Annual Report instructions were issued in April 2006 and are posted on the PHMSA web site where operators obtain the form for preparing their annual submission (http://ops.dot.gov/library/forms/forms.htm).

We have also worked with operators to submit amended 2004 reports to correct errors discovered in our review of operator submissions. Numerous updates to 2004 Annual Reports have been submitted and the revised results posted on our web site at: http://opsweb.rspa.dot.gov/liquidimp/analysis/

In addition to providing operators with better guidance on Annual Report preparation, our inspectors are now reviewing operator Annual Report submissions as part of Integrity Management inspections and confirming that the operator followed instructions in submitting their repair-related data. PHMSA has modified its "Integrity Management Inspection Manual (aka "IM101 Manual") to include guidance for inspectors to review Annual Report data as part of their inspections, and to be sure operators understand the instructions for preparing their report. While limited inspector resources preclude conducting a comprehensive verification of all operator-submitted data, checking selected data elements for conformance with the revised reporting guidance is now being accomplished. For example, inspectors are now checking repair records for all immediate repair conditions and selected other actionable anomalies. When discrepancies or problems are found, operators are now being directed to amend their Annual Report submissions to correct these deficiencies.

Since the beginning of the Integrity Management inspections in late 2002, PHMSA inspectors have taken a systematic, disciplined approach to assuring that operator repairs of potentially injurious pipeline anomalies are being made as required by the Integrity Management rule (49 CFR 195.452). During the course of the OIG's audit, we provided a comprehensive description of our oversight approach. This document describes the approach used to inspect an operator's program and its results for identifying potential pipeline integrity threats, selecting assessment tools to identify these threats, conducting assessments starting with the high risk pipeline segments, analyzing the assessment results, identifying potentially actionable anomalies, scheduling pipeline remediation work, and performing necessary repairs using the appropriate repair methods. Through this comprehensive approach, we provide assurance that operators are identifying and repairing significant pipeline integrity threats in a timely manner.

OIG Recommendation: *Ensure that integrity management inspection teams have implemented the new guidance on verifying integrity threat data in operator annual reports.*

PHMSA believes that we have met the intent of this recommendation already. As mentioned above, our inspection teams currently confirm that operators followed the newly issued reporting guidance and are checking selected field dig and repair records to confirm operators are following that guidance. In July 2006, at its periodic Lessons Learned Meeting/Teleconference (aka "Reset Meeting") for our inspection teams, PHMSA decided to modify the inspection protocol form to provide explicit direction to validate the operator's approach for reporting repair-related data in its Annual Report, and to record on the form any problems or concerns identified with the Annual Report repair information. This modification provides additional assurance that inspectors are following the guidance already provided them in our inspector manual, and provides a

written record of problems with the accuracy of an operator's reported pipeline repair information. The modified protocols are being used by teams starting later this summer.

OIG Finding: *Continued Vigilance Is Needed to Ensure Smart Pig Results Are Properly Analyzed and Interpreted*

PHMSA agrees that there is a need to improve smart pig anomaly characterization and detection capability as well as the methods used to analyze smart pig data and integrate it with other relevant information to diagnose potential pipeline problems. We have aggressively advanced this challenge on several fronts. Our goal is pipeline integrity – not just pipeline testing. As your report notes, smart pigs are not a "silver bullet". Making all of the right repairs is central to pipeline integrity. The systematic approach to pipeline integrity already required by our regulations is essential. Smart pigs – even if properly run and interpreted, only detect and characterize the defects they look for and no pig can look for all defects. For this reason our existing rule requires application of multiple tools based on a thorough risk assessment. A more detailed discussion of these points follows.

First, the requirement for pipeline operators to periodically and repeatedly test their pipelines using smart pigs (and other equally effective technologies) exists in our current integrity management regulations. These requirements are clear and are described in great detail on our expansive and public Integrity Management website (including inspection protocols, frequently asked questions, replies to technical notifications, etc.), are rigorously inspected by our field personnel (see below), have been explained in detail in many public workshops, and operator-specific results from testing are made readily available to the public through our website. The rules require the application of multiple tools, and are framed in ways that allow for innovation and technology growth.

Second, we developed and deployed a rigorous oversight program that focuses heavily on risk identification, selection of appropriate assessment methods for the identified threats, and the operator's evaluation of assessment results to identify anomalies that require remediation. Specific inspection protocol questions and guidance deal with operator analysis of assessment results. These address subjects such as the qualification of individuals evaluating in-line inspection results, tool tolerances and other uncertainties in the analysis, verifying the accuracy of smart pig results, and integrating data from other sources with smart pig results to obtain a more complete understanding of pipe condition. PHMSA has provided its inspectors, and state pipeline inspectors, with training in these areas to enable them to review this highly technical discipline.

PHMSA has also worked on several fronts to promote improved information sharing and industry awareness of the latest technical issues related to in-line inspection capability. We have hosted public workshops on:

- in-line inspection tool capability and the analysis of pigging results;
- direct assessment methods, and
- specific threats such as stress corrosion cracking and mechanical damage.

PHMSA is supportive of three new industry standards that deal with issues critical to in-line inspection testing and results analysis:

- In-Line Inspection of Pipelines (NACE Standard RP 01012)
- In-Line Inspection Personnel Qualification and Certification (ANSI/ANST ILI-PQ)
- In-Line Inspection Systems Qualification Standard (API-1163)

PHMSA has also supported standards activities for other assessment technologies that must be relied upon when smart pigs can not be employed. These standards include:

- Pipeline External Corrosion Direct Assessment Methodology (ANSI/NACE Standard RP 0502)
- Pipeline Internal Corrosion Direct Assessment (ANSI/NACE – RP0104)
- Pipeline Stress Corrosion Cracking Direct Assessment (ANSI/NACE – RP0204)

Finally, PHMSA has supported a robust R&D program focusing on improving in-line inspection technology. In the last few years we have co-funded approximately $5 Million in seven projects to improve smart pig detection capability and $3 Million in five projects to improve anomaly characterization. In addition to improving the detection and characterization of a broader spectrum of pipeline defects, our research has supported technologies that allow smart pigging of pipelines whose designs currently prevent the use of such tools, thereby increasing the percentage of the nation's lines that can be pigged. PHMSA's research has also supported the development and improvement of other assessment technologies for situations where in-line inspection is still not possible.

We have hosted three R&D Forums – public meetings where government agencies, public representatives, research funding organizations, standards organizations, and pipeline operators discuss R&D issues and work toward a consensus on the technical gaps and challenges for future R&D. PHMSA uses this input in selecting future R&D projects to support.

OIG Recommendation: *Identify what actions will be taken over the next year to (a) oversee operators' pig testing and analysis activities and (b) facilitate the adoption of industry standards and funding of research and development.*

As described above, PHMSA believes that it has aggressively advanced the appropriate use of technology, including smart pigs, for many years. We supported the development of standards such as those your report mentions, and others noted above which, to ensure that the technology available is used systematically by qualified personnel.

In equally important ways, we have advanced the technology itself through effective research investments made in concert with the other Federal and state agencies, the pipeline industry, tool vendors, and all pipeline safety research institutions.

Appendix. Management Comments

Please do not hesitate to contact me if I can be of any further assistance in this matter. Specific questions on the report content can also be directed to Mr. Jeff Wiese, on PHMSA's Pipeline Safety Staff. He can be reached by e-mail (jeff.wiese@dot.gov), or by phone (202) 368-5522.

JWiese:Jw:64046:08/09/06

cc: PHP:PH:OfficialFile

Appendix. Management Comments