

DEPARTMENT OF TRANSPORTATION

Pipeline and Hazardous Materials Safety Administration

[Docket No. PHMSA–2024–0176]

Pipeline Safety: Identification and Evaluation of Potential Hard Spots—In-Line Inspection Tools and Analysis

AGENCY: Pipeline and Hazardous Materials Safety Administration (PHMSA), Department of Transportation.

ACTION: Notice; issuance of advisory bulletin.

SUMMARY: PHMSA is issuing this advisory bulletin to notify pipeline owners and operators of the importance of evaluating their pipeline facilities for the existence and potential threat of hard spots in the pipe body. That susceptibility comes from the plate and pipe manufacturing and is broader than previously understood; recent data and incident investigations indicate that hard spots could affect multiple pipelines manufactured prior to 1970. Hard spots, if not identified and mitigated, pose a threat to the integrity of the pipeline from interacting threats such as coating degradation, soil chemistry, and/or increased hydrogen exposure, which can result in hydrogen-induced cracking. Pipeline owners and operators should consider expanding their hard spot threat evaluation to all pipe manufactured prior to 1970, regardless of manufacturer; collecting and analyzing data associated with hard spot magnetic flux leakage in-line inspection tools; and following industry best practices when conducting in-line inspection data analysis.

FOR FURTHER INFORMATION CONTACT: Max Kieba, Director, Engineering & Research Division, at 202–420–9169 or Max.Kieba@dot.gov.

SUPPLEMENTARY INFORMATION:

I. Background

The purpose of this advisory bulletin is to notify owners and operators of gas, hazardous liquid, and carbon dioxide pipelines of the importance of evaluating their pipeline facilities for the existence and potential threat of hard spots in the pipe body. A major tenet of PHMSA's pipeline safety oversight program is that pipeline operators must know and understand their pipeline systems, and use appropriate technologies and procedures to address risks to prevent pipeline failures while considering the inherent limitations of such technology. PHMSA prescribes factors that must be addressed to mitigate risk and conducts

inspections to ensure adequate measures are carried out effectively.

A hard spot is a defect that is created at the time the steel plates are rolled during the pipe manufacturing process. The creation of hard spots in manufacturing is not attached to the in-service product. Even where a pipe may have an intended service at the time of manufacture, the intended service may change after manufacture. A localized increase in hardness produced during the hot rolling of steel plates as a result of localized cooling can form a hard spot. Localized hardening may also occur through the unintentional quenching during the manufacturing process or by cold work. Although hard spots are more prevalent in plate-formed pipe, seamless pipe can also be susceptible to hard spots when poor controls in the manufacturing process result in material property variations, including hardness.¹

Hardness can be measured in any condition, at any time, and is determined by measuring the depth of an indentation made by a calibrated indentation device. There are three industry standards that address hardness testing: (1) ASTM E92 Standard Test Methods for Vickers Hardness of Metallic Materials; (2) ASTM E10–18 Standard Test Methods for Brinell Hardness of Metallic Materials; and (3) ASTM E18–22 Standard Test Methods for Rockwell Hardness of Metallic Materials. Hard spots found by in-line inspection (ILI) analysis can be verified through the use of calibrated devices that press a specific tool into the plate's surface and then measure the resulting width or depth of the indentation.² American Petroleum Institute (API) Specification 5L states that “[a]ny hard spot larger than 50 mm (2.0 in) in any direction shall be classified as a defect if its hardness exceeds 35 HRC, 345 HV10 or 327 HBW, based upon individual indentations.”^{3 4} However, recent

improvements in technology have revealed incidents on hard spots with lower hardness measures.

Hard spots generally form on the surface of pipe and, by themselves, can be considered a stable threat. Unfortunately, hard spots can become unstable when the threat is activated by a change in service conditions such as coating degradation, effects of soil chemistry, and/or influence of the cathodic protection hydrogen film. The presence of hydrogen can result in hydrogen-induced cracking due to hydrogen accumulation at inclusions, impurities, and lattice structure irregularities in the presence of stress on the steel (e.g., from operating pressures). Typically, coatings insulate hard spots from exposure to hydrogen generated by the cathodic protection system, but coatings can deteriorate over time. Recent Pipeline Research Council International (PRCI) research indicates that the level of cathodic protection may also contribute to hydrogen cracking.⁵

PHMSA has previously discussed, in public meetings and workshops, the threat evaluations of pipelines constructed with pipe manufactured by A.O. Smith Corporation (A.O. Smith) from 1948 through 1952 due to the pipe's susceptibility to hard spot related hydrogen cracking.⁶ In the past 20 years, the following five incidents highlight hydrogen-induced cracking of hard spots. All but one of the incidents occurred on pipe manufactured by A.O. Smith.

- On July 18, 2013, a 30-inch natural gas pipeline ruptured in Natchitoches, Louisiana. The pipe was manufactured in 1952 by A.O. Smith. Evidence suggested the failure was caused by hydrogen-induced cracking in a hard spot that was previously reinforced with a Type A sleeve. The leak, in this instance, was repaired with a Type B sleeve.

- On January 14, 2015, a 30-inch natural gas pipeline ruptured in

¹ See Jeremy Faissat et al., “Pipeline Hard Spots: How Hard is Hard?,” Pipeline Technology Conf. 2021 (Apr. 1, 2021), [https://www.pipeline-conference.com/abstracts/pipeline-hard-spots-how-hard-hard; see also Rosen Group, Presentation, ‘Hard Spot Assessment & Integrity Analyses,’ slide 6 \(Dec. 13, 2022\), https://primis-meetings.phmsa.dot.gov/archive/Day_1_AM_1050_Hard_Spot_Assessment_-_Integrity_Analysis.pdf](https://www.pipeline-conference.com/abstracts/pipeline-hard-spots-how-hard-hard; see also Rosen Group, Presentation, ‘Hard Spot Assessment & Integrity Analyses,’ slide 6 (Dec. 13, 2022), https://primis-meetings.phmsa.dot.gov/archive/Day_1_AM_1050_Hard_Spot_Assessment_-_Integrity_Analysis.pdf (National Tube pipe).) (National Tube pipe).

² The three hardness units—HRC, HB and HV₁₀—can be converted using a standard conversion table.

³ API Specification 5L, “Specification for Line Pipe,” section 9.10.6, (46th ed., Apr. 2018) (incorporated by reference under 49 CFR 192.7 and 195.3).

⁴ 49 CFR 192.3 defines a “hard spot” as “an area on steel pipe material with a minimum dimension greater than two inches (50.8 mm) in any direction and hardness greater than or equal to Rockwell 35 HRC (Brinell 327 HB or Vickers 345 HV₁₀).”

⁵ Zoe H. Shall, Presentation, “PRCI Efforts on Hard Spots: Past, Present, and Future,” slide 15 (Dec. 13, 2022), https://primis-meetings.phmsa.dot.gov/archive/Day_1_AM_1020_PRCI_Efforts_on_Hard_Spots_Dec_2022.pdf.

⁶ Gery Bauman & Mary McDaniel, Presentation, “Recent Case Study hard Spots and NTSB Recommendation P–22–3,” slide 20 (Dec. 13, 2022), [https://primis-meetings.phmsa.dot.gov/archive/MtgHome.mtg%2F161.html; see generally, PHMSA, ‘Class Location Special Permits: FAQs,’ FAQ 34 \(June 16, 2010\) \(providing that hard spots are a safety condition that may reduce the toughness of pipe body\), https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.phmsa.dot.gov%2Ffiles%2Ffiles%2Fphmsa.dot.gov%2Ffiles%2Fdocs%2Ftechnical-resources%2Fpipeline%2Fclass-location-special-permits%2F64051%2Ffaq%2Fclass-location-special-permits20180726.docx&wdOrigin=BROWSELINK](https://primis-meetings.phmsa.dot.gov/archive/MtgHome.mtg%2F161.html; see generally, PHMSA, ‘Class Location Special Permits: FAQs,’ FAQ 34 (June 16, 2010) (providing that hard spots are a safety condition that may reduce the toughness of pipe body), https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.phmsa.dot.gov%2Ffiles%2Ffiles%2Fphmsa.dot.gov%2Ffiles%2Fdocs%2Ftechnical-resources%2Fpipeline%2Fclass-location-special-permits%2F64051%2Ffaq%2Fclass-location-special-permits20180726.docx&wdOrigin=BROWSELINK).

Brandon, Mississippi. The pipe was manufactured in 1952 by A.O. Smith. The failure was caused by hydrogen-induced cracking in a hard spot greater than two inches in length, previously reinforced with a Type A sleeve. Hardness testing could not be performed with the sleeve in place.

- On August 1, 2019, a 30-inch natural gas pipeline ruptured in Danville, Kentucky. The pipe was manufactured in 1957 by A.O. Smith. The failure was caused by hydrogen-induced cracking in a hard spot. Hardness testing by the National Transportation Safety Board (NTSB) identified the origin hard spot was 5.85 inches by 3 inches, and had hardness values between 362 and 381 Brinell. Hardness readings extended through the pipe wall.

- On February 13, 2022, an 18-inch natural gas pipeline ruptured in Perry County, Mississippi. The pipe was manufactured in 1950 by A.O. Smith. The failure was caused by hydrogen-induced cracking in a hard spot. Metallurgical testing found hardness values between 35 to 45 Rockwell, and was measured at approximately 0.6-inch by 2.5-inch.

- On March 8, 2023, a 30-inch natural gas pipeline ruptured in Fauquier County, Virginia. The pipe was manufactured in 1957 by Bethlehem Steel. The failure was caused by hydrogen-induced cracking in a hard spot. Post incident ILI identified six hard spot features, and hardness values were confirmed from four features that ranged from 192–208 Brinell, which was slightly harder than base hardness (approximately 170 to 180 Brinell). In this instance, the operator did conduct a re-analysis of its data that resulted in updated results to identify the presence of additional hard spots.

The NTSB conducted an investigation following the August 1, 2019, Danville, Kentucky, incident, and made findings and recommendations regarding identification and evaluation of hard spots.⁷ Specifically, the NTSB issued recommendation P–22–003 to PHMSA to “[a]dvise natural gas transmission pipeline operators of the possible data limitations associated with hard spot magnetic flux leakage in-line inspection tools and analyses used in hard spot management programs and reinforce the need to follow industry best practices

when conducting in-line inspection data analysis.”

Following the NTSB investigation into the Danville incident, PHMSA reviewed accident data and information regarding hard spots and the appropriate methodologies and technologies for detecting hard spots. PHMSA met with industry and technology companies to gather more information regarding hard spot management programs; communicate the results of the data analysis; and discuss appropriate ILI technologies for different anomalies, including hard spot detection. Additionally, PHMSA hosted an informational three-day public meeting in December 2022, in Houston, Texas, to discuss topics relevant to the pipeline industry.⁸ One topic in particular included a discussion of both the NTSB’s findings and hard spot safety concerns. PHMSA presented an overview of the NTSB’s PIR–22/02 report into the Danville incident. During the December 2022 meeting, PHMSA invited stakeholders to present information related to hard spot methodologies/technologies used for detecting hard spots and discussed the circumstances of this incident. PHMSA has continued to meet with technology companies to review hard spot studies and hard spot management programs. As a result of the studies and communications, PHMSA has identified more pipe manufacturers and pipe manufacture vintages that could have issues with hard spots. In addition to A.O. Smith pipe, Bethlehem Steel Corporation, Kaiser Steel Corporation, National Tube Supply, Consolidated Pipe & Supply, Youngstown Sheet and Tube, United States Steel, Claymont Steel, and Republic Steel have been identified as manufacturers with manufacture dates as recent as 1970 whose pipe may experience hard spots.⁹

In addition, new technologies and advancements in ILI have resulted in the ability to learn more using previously obtained ILI data. For example, in the August 2019 Danville, Kentucky, hard spot failure, the NTSB investigation determined that the initial 2011 ILI data analysis had identified 16 hard spots in the relevant line section yet the 2019 re-analysis of the 2011 data identified 441. The NTSB attributed this discrepancy in identifications to

significant improvements in computer hardware, software, and data analysis.¹⁰ PHMSA and researchers have found that older data can be re-analyzed, and previously unidentified hard spots can be identified. It is important when analyzing the possibility of hard spots to verify the capabilities of the tool and verify the data collected. PHMSA believes that data verification should not be limited in scope and should include a thorough review of all relevant data.

PHMSA provides this advisory bulletin to help gas, hazardous liquid, and carbon dioxide pipeline owners and operators and the public understand the threat of hard spots and how to better comply with the existing requirements under federal pipeline safety regulations. Guidance and advisory bulletins are not substantive rules; are not meant to bind the public in any way; and do not assign duties, create legally enforceable rights, or impose new obligations that are not otherwise contained in those regulations.

II. Advisory Bulletin (ADB–2024–01)

To: Owners and Operators of Gas, Hazardous Liquid, and Carbon Dioxide Pipeline Systems.

Subject: Identification and Evaluation of Potential Hard Spots—In-line Inspection Tools and Analysis.

Advisory: PHMSA is issuing this advisory bulletin to advise gas, hazardous liquid, and carbon dioxide pipeline owners and operators of new information regarding the potential for the presence of hard spots in pipelines, and their associated safety and environmental risks of leaks or ruptures. This advisory alerts operators of advancements in knowledge of hard spot susceptibility, most notably that what was once considered to be an issue confined to a single manufacturer (A.O. Smith) of specific, limited manufacturing years, is now understood to include potentially other manufacturers and manufacturing years. Additionally, the presence of hydrogen may result in hydrogen-induced cracking due to hydrogen accumulation at inclusions, impurities, and lattice structure irregularities in the presence of stress on the steel. For pipelines, the stress is typically operational pressure. Typically, coatings isolate hard spots from exposure to hydrogen generated by the cathodic protection system, but coatings can and do deteriorate over time. Recent PRCI research indicates that the level of cathodic protection and the chemistry of the surrounding soil may contribute to hydrogen cracking.

⁸ Information and presentations for this December 2022 public meeting are available at <https://primis-meetings.phmsa.dot.gov/archive/MtgHome.mtg@mtg=161.html>.

⁹ Rosen Group, Presentation, “Hard Spot Assessment & Integrity Analyses” (Dec. 13, 2022), https://primis-meetings.phmsa.dot.gov/archive/Day_1_AM_1050_Hard_Spot_Assessment_-_Integrity_Analysis.pdf.

¹⁰ NTSB, PIR–22/02 at 29.

⁷ NTSB, Pipeline Investigation Report PIR–22/02, “Enbridge Inc. Natural Gas Transmission Pipeline Rupture and Fire, Danville Kentucky, Aug. 1, 2019” (Aug. 15, 2022), <https://www.nts.gov/investigations/AccidentReports/Reports/PIR22002.pdf>.

New technologies and advancements in ILI have resulted in the ability to better identify features associated with hard spots. Additionally, PHMSA and researchers have found that significant improvements in computer hardware, software, and data analysis have enabled the use of older data to be re-analyzed, and previously unknown features identified. It is important to verify the capabilities of the tool and verify the data when analyzing for the possibility of hard spots.

For these reasons, pipeline operators should consider taking the following actions to ensure pipeline safety:

1. Review all design and construction records to ensure they are traceable, verifiable, and complete to determine whether enough information is available to identify the pipe manufacturer, the steel plate manufacturer, and the date of manufacturing.
2. Review and determine whether or not the types of pipes in the system are susceptible to hard spots;
3. Review and determine if known integrity issues have been experienced on those pipelines;
4. Develop and implement an enhanced assessment program to establish the best approach to material hardness anomaly validations;
5. Re-evaluate existing ILI data to support current feature identification; and
6. Continue sharing information used to evaluate the identification of hard spots and the other factors that may contribute to the destabilization of hard spots in industry and public pipeline technical meetings and conferences.

Issued in Washington, DC, on November 1, 2024, under authority delegated in 49 CFR 1.97.

Alan K. Mayberry,

Associate Administrator for Pipeline Safety.

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DEPARTMENT OF TRANSPORTATION

Office of the Secretary

[Docket No. DOT-OST-2024-0003]

Privacy Act of 1974; System of Records

AGENCY: Office of the Departmental Chief Information Officer, Office of the Secretary of Transportation (DOT).

ACTION: Notice of a modified system of records.

SUMMARY: In accordance with the Privacy Act of 1974, the Department of Transportation (DOT), Office of the Secretary (OST), proposes to rename,

update and reissue an existing system of records notice currently titled “DOT/All 11, Integrated Personnel and Payroll System (IPPS).” The name of this system of records notice will be changed to “DOT/ALL 11, Consolidated Automated System for Time and Labor Entry (CASTLE).” The modified system of records notice (hereafter referred to as “Notice”) uses records in this system for fiscal operations related to payroll, attendance, leave, insurance, taxes, retirement, budget, and cost accounting programs. This system is also used to control and facilitate payment of salaries to DOT employees.

DATES: Submit comments on or before December 18, 2024. The Department may publish an amended Systems of Records Notice considering any comments received. This modified system will be effective immediately upon publication. The routine uses will be effective December 18, 2024.

ADDRESSES: You may submit comments, identified by docket number DOT-OST-2024-0003 by one of the following methods:

- *Federal e-Rulemaking Portal:* <https://www.regulations.gov>. Follow the instructions for submitting comments.
- *Mail:* Department of Transportation Docket Management, Room W12-140, 1200 New Jersey Ave. SE, Washington, DC 20590.
- *Hand Delivery or Courier:* West Building Ground Floor, Room W12-140, 1200 New Jersey Ave. SE, between 9 a.m. and 5 p.m. ET, Monday through Friday, except Federal holidays.
- *Instructions:* You must include the agency name and docket number DOT-OST-2024-0003.
- *Instructions:* You must include the agency name and docket number DOT-OST-2024-0003. All comments received will be posted without change to <https://www.regulations.gov>, including any personal information provided. You may review the Department of Transportation’s complete Privacy Act statement in the **Federal Register** published on April 11, 2000 (65 FR 19477-78).

Privacy Act: Anyone is able to search the electronic form of all comments received in any of our dockets by the name of the individual submitting the comment (or signing the comment, if submitted on behalf of an association, business, labor union, etc.).

Docket: For access to the docket to read background documents or comments received, go to <https://www.regulations.gov> or to the street address listed above. Follow the online instructions for accessing the docket.

FOR FURTHER INFORMATION CONTACT: For questions, please contact Karyn Gorman, Departmental Chief Privacy Officer, Privacy Office, Department of Transportation, Washington, DC 20590; email: privacy@dot.gov; or 202-366-3140.

SUPPLEMENTARY INFORMATION:

Notice Updates

This Notice includes both substantive changes and non-substantive changes to the previously published Notice. The substantive changes have been made to the system name, system location, system manager, authority for maintenance of the system, purpose of the system, categories of individuals covered by the system, categories of records in the system, routine uses maintained in the system, policies and practices for storage of record, policies and practices for retrieval, retention and disposal of the records in the system, and administrative, technical, and physical safeguards. Non-substantive changes have been made to record access procedures and contesting record procedures as well as revisions to align with the requirements of Office of Management and Budget Memoranda (OMB) A-108 and to ensure consistency with other Notices issued by the Department of Transportation.

Background

In accordance with the Privacy Act of 1974, the Department of Transportation proposes to modify and re-issue an existing system of records titled “DOT/ALL 11, Integrated Personal and Payroll System, (IPPS)” and change the name to “Consolidated Automated System for Time and Labor Entry, (CASTLE).” This system of records covers records collected and maintained for the purposes of fiscal operations related to payroll, attendance, leave, insurance, taxes, retirement, budget, and cost accounting programs. This system is also used to control and facilitate payment of salaries to DOT employees. The following substantive changes have been made to the Notice:

1. *System Name:* This Notice updates the system name to “Consolidated Automated System for Time and Labor Entry, (CASTLE)” from the previous system name of “DOT/ALL 11, Integrated Personal and Payroll System, (IPPS)”. The update to the system name is to better align with the collection of personally identifiable information in the system and the purpose of the collection. This system is also used to facilitate payment of salaries of DOT employees.

2. *System Location:* This Notice updates the system locations to notify