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### Pipeline and Hazardous Materials Safety Administration Office of Pipeline Safety

2024 DOE HFTO Workshop: Hydrogen Infrastructure Strategies to Enable Deployment in High-Impact Sectors PHMSA Hydrogen Pipeline Safety and Challenges

Vincent Holohan – Senior Engineer US DOT - PHMSA – Office of Pipeline Safety, Engineering and Research Division January 18, 2024



U.S. Department of Transportation

Pipeline and Hazardous Materials Safety Administration



### **PHMSA's Mission**

To protect people and the environment by **advancing the safe transportation of energy and other hazardous materials** that are essential to our daily lives. To do this, the agency establishes national policy, sets and enforces standards, educates, and conducts research to prevent incidents. We also prepare the public and first responders to reduce consequences if an incident does occur.

3.3 Million	1.2 Million	16,700	1.6 Billion	64%
Miles of Regulated Pipelines	Daily Shipments of Hazardous Materials	Underground Natural Gas Storage Wells	Tons of Hazardous Materials Shipped Annually by All Modes	Of U.S. Energy Commodities Transported by Pipeline

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# **Hydrogen Pipelines**

# Hydrogen Pipelines (H<sub>2</sub>)



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### Hydrogen Gas Transmission Pipeline Map



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# **Current Transportation Regulations**

### 49 CFR Part 192 Regulations Unique to Hydrogen Gas Pipelines

- PHMSA has regulated the transportation of Hydrogen gas by pipeline since 1970
- Limited regulatory differences between Hydrogen and Natural Gas pipeline transportation
- Blends are not currently defined or specifically captured in data
- § 192.625(b), when hydrogen gas is intended to be used as feedstock for a manufacturing process, it does not have the requirement to be odorized in Class 3 and 4 locations
- § 192.53 General: "Materials for pipe and components must be:" (...) "(b)
  Chemically compatible with any gas that they transport and with any other material in the pipeline with which they are in contact"



# Assess Gaps In Knowledge: R&D Gaps

### As Identified at PHMSA Pipeline Safety R&D Forum (Oct 31 –Nov 1, 2023)

No.	Research Gap	Infrastructure Type	Main Objective
1	Coating and liners development	Hydrogen, H <sub>2</sub> blends, inside and underground	Develop pipeline surface treatment/coatings/liners for pure and blended hydrogen to prevent hydrogen embrittlement and hydrogen-induced cracking in existing pipelines.
2	Welding standards	Hydrogen pipelines	Update and validate welding standards for transmission and distribution pipelines. API 1104 requirements may not be suitable for hydrogen pipelines (including in- service welds).
3	Evolution of <b>pipeline repair and maintenance</b>	Transmission/distribution of blending and pure hydrogen pipelines	Explore the compatibility of existing pipeline repair and maintenance technologies for hydrogen and H <sub>2</sub> blending in transmission and distribution lines such as welding, joining, hot tapping, stopping, squeeze-off, purging, etc. for pure and blended hydrogen for metallic and non-metallic pipelines.
4	Recommended guidance for hydrogen pipelines	Hydrogen pipeline facilities	Provide a guidance document for <b>engineering assessment of system integrity and</b> <b>performance</b> for pure hydrogen and blending pipelines.
*	Assess and develop <b>material test methodologies for</b> <b>non-metallics</b> such as plastic pipes and elastomers for hydrogen and blending		
*	Develop technologies that would detect and/or quantify leaks on pure hydrogen pipelines		
*	Qualification of premium <b>oil country tubular goods</b> (OCTG) connections for <b>underground hydrogen storage</b>		
*	Evaluate the <b>use of AI and ML efforts to predict</b> <b>integrity failures</b> of assets that are transporting hydrogen		
*	Evaluate odorization of pure and blended hydrogen		
*	Conduct <b>modeling analysis of PIR</b> of hydrogen or H <sub>2</sub> blending releases and provide <b>full-scale field trials</b> for hydrogen blend releases including radiant energy, over- pressure potential, and probability of ignition		
*	Test and evaluate high-pressure and pipeline operational conditions under hydrogen gas blends		

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# Hydrogen R&D Initiative

### BACKGROUND: Hydrogen

**ISSUE:** Pipeline and UGS integrity threats.



### **Previous Research/Findings**

- \$1.6M and four pipeline projects funded
- Heavy focus on materials issues and welding qualifications
- Knowledge Transfer registered to standards bodies
  - American Society of Mechanical Engineering B31.12 Standard on Hydrogen Piping and Pipeline

#### Planned Research FY 2023

- Advancing additional solutions beyond that would be funded in FY 2022 to safely transport hydrogen
- Coordination with government, public, & industry FY 2024
- Exploring the compatibility of existing pipeline repair and maintenance technologies and developing a potential impact radius for hydrogen and hydrogen/natural gas blends.
- Coordination with government, public, & industry

### Outputs

Knowledge/Technology project reporting about hydrogen safely in transporting/storing underground

### Outcomes

Revision of industry standards and PHMSA regulations regarding hydrogen **Impacts on Strategic Goals** Safe transportation and UGS of hydrogen supporting the advancement of climate change timelines



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# **Ongoing Hydrogen Pipeline Research**

Currently 11 active projects related to hydrogen pipelines with a total of \$10.6 million in PHMSA funding and an additional \$2.5 million in cost sharing.

Project	Goals
"Knowledge-guided Automation for Integrity Management of Aging Pipelines (KAI-MAP) for Hydrogen Transport"	Develop an AI-enabled automation framework for pipeline integrity management for emerging fuels, such as hydrogen. Additionally, the researcher will develop decision support tools using AI interfacing with goal-oriented optimization and a context-drive platform to recommend potential pipeline risk mitigation measures.
Category: Threat Prevention	Researcher: Arizona State UniversityPHMSA: \$844,726
"Development of Compatibility Assessment Model for Existing Pipelines for Handling Hydrogen- Containing Natural Gas"	Use data analytics-based modeling techniques to create a compatibility assessment model which determines the capability of existing pipelines with blended and pure hydrogen gas. Develop a publicly available software tool that operators can use to determine suitability of existing pipelines for pure hydrogen or blended gas and identify needed modifications.
Category: Threat Prevention	Researcher: University of Oklahoma PHMSA: \$1,000,000
"Accelerating Transition towards Sustainable, Precise, Reliable Hydrogen Infrastructure (Super- H2): Holistic Risk Assessment, Mitigation Measures, and Decision Support Platforms"	Develop and implement a holistic framework for an AI-powered, platform-forward software tool that will accelerate the transition of existing gas pipelines for hydrogen transport.
Category: Threat Prevention	Researcher: North Dakota State University PHMSA: \$1,000,000
"Investigate Damage Mechanisms for Hydrogen and Hydrogen/Natural Gas Blends to Determine Inspection Intervals for In-Line Inspection Tools"	Analyze failure mechanisms related to hydrogen and hydrogen/natural gas blends, develop knowledge regarding critical flaw sizes and availability and accuracy of ILI tools, and recommend changes to practices for determining reinspection intervals.
Category: Anomaly Detection & Characterization	Researcher: Kiefner and Associates, Inc. PHMSA: \$1,200,000



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# **Ongoing Hydrogen Pipeline Research**

Currently 11 active projects related to hydrogen pipelines with a total of \$10.6 million in PHMSA funding and an additional \$2.5 million in cost sharing.

Project	Goals
<u>"Determining Steel Weld Qualification and</u> Performance for Hydrogen Pipelines"	Review current codes and standards for gaps in qualification requirements for welds in pipelines intended for hydrogen transportation and provide the following: weld qualification requirements for new steel pipeline assets; performance evaluations for varying modern steel grades; and assessment parameters for evaluating the integrity of existing and vintage (pre-Code) assets.
Category: Materials	Researcher: National Institute of Standards and Technology PHMSA: \$2,060,000
"Investigating the Integrity Impacts of Hydrogen Gas on Composite/Multi-Layered Pipe"	Investigate the impact to the integrity of composite pipe when used to transport pressurized hydrogen gas. Identify and address safety hazards to the pipeline facilities, people, and the surrounding environment. Identify required design, material and construction specifications, maintenance procedures, and a roadmap for using alternative-steel and non-steel composite systems for composite pipelines.
Category: Materials	Researcher: Edison Welding Institute, Inc. PHMSA: \$450,078
"Advancing Hydrogen Leak Detection and Quantification Technologies Compatible with Hydrogen Blends"	Investigate the impact of hydrogen on leakage dynamics and existing leak detection equipment. This will inform new approaches for hydrogen sensing and integration into next-generation leak detection equipment.
Category: Leak Detection	Researcher: Gas Technology Institute PHMSA: \$749,446
"Determining the Required Modifications to Safely Repurpose Existing Pipelines to Transport Pure Hydrogen and Hydrogen-Blends"	Determine practical methods for repurposing existing pipeline networks for the safe transport of hydrogen or hydrogen blends; and identify which existing gas transmission pipeline components may need modifications to safely introduce hydrogen gas or natural gas/hydrogen blends.
Category: Climate Change	Researcher: Engineering Mechanics Corporation of Columbus PHMSA: \$800,000



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# **Ongoing Hydrogen Pipeline Research**

Currently 11 active projects related to hydrogen pipelines with a total of \$10.6 million in PHMSA funding and an additional \$2.5 million in cost sharing.

Project	Goals	
"Review of Integrity Threat Characterization Resulting from Hydrogen Gas Pipeline Service"	Identify differences between existing integrity threats and possible new threats resulting from the presence of hydrogen. Define a list of possible changes to the ASME threat assessment process to address hydrogen, or hydrogen blended service-based threats in new or existing pipelines.	
Category: Climate Change	Researcher: Engineering Mechanics Corporation of Columbus PHMSA: \$240,000	
"Expanding Hydrogen Storage to Porous Rock Formations: A Framework for Estimating Feasibility & Operational Considerations"	Develop a framework to expand underground hydrogen storage beyond salt caverns to other formation types. Provide a set of operational considerations for selecting suitable porous rock formations. Establish guidelines for monitoring potential hydrogen movement or loss from geochemical reactions or multiphase hydrogen flow with formation fluids.	
Category: Underground Natural Gas Storage	Researcher: Gas Technology Institute PHMSA: \$298,000	
"Establishing the Technical Basis for Enabling Safe and Reliable Underground Hydrogen Storage Operations"	Identify and understand existing PHMSA regulatory functions and needs as they relate to characterizing, permitting, and assessing underground natural gas storage (UGS) operations within the subsurface in order to define appropriate metrics relevant to UHS. Quantify the suitability of existing UGS facilities (which includes the well and subsurface geologic system) for storing pure and blended hydrogen. Characterize operational expectations with emphasis on quantifying risk for H2 resource loss processes, UGS asset degradation, and estimating transient behavior based on geologic and operational conditions.	
Category: Underground Natural Gas Storage	Researcher: Fossil Energy and Carbon Management PHMSA: \$2,000,000	



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#### Knowledge-guided Automation for Integrity Management of Aging Pipelines (KAI-MAP) for Hydrogen Transport

**Researcher:** Arizona State University **Project Cost:** \$1,055,936 (\$844,726 PHMSA + \$211,210 cost sharing) **Public Page:** <u>https://primis.phmsa.dot.gov/matrix/prjhome.rdm?prj=953</u>

**Project Objective:** The objective of this project is to develop an AI-enabled automation framework for pipeline safety data collection and processing to support the decision making on pipeline integrity management (PIM) for future transport of emerging fuels such as hydrogen.

- Develop automated data entry algorithms to extract hydrogen pipeline safety information from relevant sources
- Propose in-situ inspection automation method for sensible defects for hydrogen, i.e. corrosion and welding.
- Data quality assurance to ensure the data used to inform the decision making on PIM can accurately and effectively represent the pipeline integrity conditions.

Project End Date: 9/30/2024

**Potential Impact on Safety:** AI-enabled automation technologies can be effectively used as a tool to enhance the safety and efficiency of pipeline operation. This project will automate the knowledge transfer from past experiences allowing for the safe conversion and improved integrity management of existing pipelines to the new application of hydrogen transportation.



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#### Development of Compatibility Assessment Model for Existing Pipelines for Handling Hydrogen-Containing Natural Gas

#### **Researcher:** University of Oklahoma **Project Cost:** \$1,250,000 (\$1,000,000 PHMSA + \$250,000 cost sharing)

Public Page: https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=988

#### **Project Objective:**

- Use data analytics-based modeling techniques to create a comprehensive compatibility assessment model for determining the capability of existing pipelines to transport blended and pure hydrogen gas while accounting for hydrogen embrittlement.
- Develop a publicly available software tool that operators can use to determine which existing pipelines are suitable for pure hydrogen or blended gas and what modifications would be needed to make a pipeline suitable for hydrogen transportation.

#### Project End Date: 9/29/2025

**Potential Impact on Safety:** Produced knowledge will reduce the likelihood of existing pipeline failure in blended gas and pure hydrogen transportation.



Picture courtesy University of Oklahoma



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Accelerating Transition Toward Sustainable, Precise, and Reliable Hydrogen Infrastructure (Super-H<sub>2</sub>): Holistic Risk Assessment, Mitigation Measures, and Decision Support Platforms

**Researcher:** North Dakota State University **Project Cost:** \$1,250,000 (\$1,000,000 PHMSA + \$250,000 cost sharing) **Public Page:** <u>https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=991</u>

**Project Objective:** Develop and implement a holistic framework for an AI-powered, platform-forward software tool that will accelerate the transition of existing gas pipelines for hydrogen transport.

• Develop decision support tools using AI interfacing with goal-oriented optimization and a context-driven recommender engine for potential pipeline mitigation measures.

Project End Date: 9/29/2025

**Potential Impact on Safety:** Produced knowledge will reduce the likelihood of existing pipeline failure in blended gas and pure hydrogen transportation.



Pictures courtesy North Dakota State University



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#### Investigate Damage Mechanisms for Hydrogen and Hydrogen/Natural Gas Blends to Determine Inspection Intervals for In-Line Inspection Tools

#### **Researcher:** Kiefner and Associates **Project Cost:** \$1,500,000 (\$1,200,000 PHMSA + \$300,000 cost sharing) **Public Page:** <u>https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=1009</u>

**Project Objective:** The project objectives are to (1) analyze failure mechanisms related to hydrogen and hydrogen/natural gas blends, (2) develop knowledge regarding critical flaw sizes and availability and accuracy of ILI tools, and (3) recommend changes to practices for determining reinspection intervals. This project will develop case studies of engineering critical assessments (ECAs), fitness-for-service (FFS) evaluations, and failure analyses (FAs) using the "what if" method. The research will demonstrate how the presence of H2 gas impacts pipeline threat investigations and in-line inspection (ILI) reinspection intervals. Proposed changes to IM methods should be evaluated for compatibility with different H2-blend percentages, consider prior experience and research, and confirm if threats are indeed affected by hydrogen.

#### Project End Date: 9/19/2026

**Potential Impact on Safety:** Improved integrity threat evaluations for pipelines in hydrogen service will help pipeline integrity professionals reduce the risk for leaks or ruptures, with their associated environmental impact of gas escaping a pipeline, and hazards to the general public.

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Pictures courtesy Kiefner and Associates

Vintage of Hydrogen Pipelines in the U.S. (2019)

Newly

Awarded

Researcher: National Institute of Standards and Technology – Inter-Agency Agreement Project Cost: \$2,060,000 Public Page: https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=976

**Project Objective:** To review current codes and standards for gaps in qualification requirements for welds in pipelines intended for hydrogen transportation and to provide: (1) weld qualification requirements for new steel pipeline assets, including seam, girth, and repair welds; (2) performance evaluations for varying modern steel grades; and (3) assessment parameters for evaluating the integrity of existing and vintage (pre-Code) assets.

Project End Date: 9/29/2024

**Potential Impact on Safety:** An effective weld qualification procedure will support safe operation and design limits for hydrogen pipeline construction and operation.







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#### Investigating the Integrity Impacts of Hydrogen Gas on Composite/Multi-Layered Pipe

#### **Researcher:** Edison Welding Institute **Project Cost:** \$598,078 (\$450,078 PHMSA + \$148,000 cost sharing) **Public Page:** <u>https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=1012</u>

**Project Objective:** Investigate the impact to the integrity of composite pipe when used to transport pressurized hydrogen gas. EWI will identify and address safety hazards to the pipeline facilities, people, and the surrounding environment. EWI will identify required design, material and construction specifications, maintenance procedures, and a roadmap for using alternative-steel and non-steel composite systems for composite pipelines.

#### Project End Date: 3/19/2025

Hydrogen Permeation Test Cell

- Double-cell flux measurement
- One side designed to hold pressurized H2
- One side designed to take cathodic current measurements indicative of through-thickness hydrogen permeation





Newly

Awarded

Pictures courtesy Edison Welding Institute

**Potential Impact on Safety:** The proposed investigation on integrity impacts to composite pipes and their connectors will help ensure that long-term material properties are well understood before commissioning. This includes the transitions where CP meets conventional steel pipeline systems. The deliverables of this project will set forth processes to understanding CP degradation mechanisms, potential damage tolerance limits, and their corresponding kinetics for manufactures, operators, and regulators.



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#### Advancing Hydrogen Leak Detection and Quantification Technologies Compatible with Hydrogen Blends

**Researcher:** Gas Technology Institute **Project Cost:** \$1,499,070 (\$749,446 PHMSA + \$749,624 cost sharing) **Public Page:** <u>https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=979</u>

#### **Project Objective:**

- Investigate impact of hydrogen injection on leakage dynamics.
- Investigate effect of hydrogen on existing leak detection equipment.
- Resulting analysis will inform new approaches for hydrogen sensing and integration into next-generation leak detection equipment.

#### Project End Date: 9/29/2025

**Potential Impact on Safety:** The findings will advance our understanding of hydrogen and natural gas/hydrogen blend leaks, ensuring that any leaks can be detected quickly and efficiently, reducing potential safety impacts caused by undetected leaks, and most importantly minimizing misinterpreted leak detection results causing an underestimation of the size and potential safety hazard of a leak.



Pictures courtesy GTI



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#### Determining the Required Modifications to Safely Repurpose Existing Pipelines to Transport Pure Hydrogen and Hydrogen-Blends

**Researcher:** Engineering Mechanics Corporation of Columbus **Project Cost:** \$1,000,000 (\$800,000 PHMSA + \$200,000 cost sharing) **Public Page:** 

https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=978

**Project Objective:** Will determine practical methods for optimizing or repurposing existing pipeline networks to safely transport pure hydrogen or hydrogen blends. Provide insight into which existing gas transmission pipeline components and facilities may need modifications to safely introduce hydrogen gas or natural gas/hydrogen blends.

**Project End Date:** 9/29/2025

**Potential Impact on Safety:** Improved understanding of pipeline system limitations for hydrogen service will help pipeline integrity professionals reduce the risk for leaks or ruptures, with their associated environmental impact of gas escaping a pipeline, and hazards to the general public.



#### Guidance: Pipeline Flow Reversals, Product Changes and Conversion to Service

#### 2014-22201.pdf (193.88 KB)

PHMSA is issuing this advisory bulletin to alert operators of hazardous liquid and gas transmission pipelines of the potential significant impact flow reversals, product changes and conversion to service may have on the integrity of a pipeline. Failures on natural gas transmission and hazardous liquid pipelines have courced after these operational changes. This advisory bulletin describes specific notification requirements and general operating and maintenance (O&M) and integrity management actions regarding flow reversals, product changes and conversion to service. This advisory bulletin also recommends additional actions operators should take when these operational changes are made including the submission of a comprehensive written plan to the appropriate PHMSA regional office regarding these changes prior to implementation.

DOT is committed to ensuring that information is available in appropriate alternative formats to meet the requirements of persons who have a disability. If you require an alternative version of files provided on this page, please contact <u>PHMSV-AccessIDility@dota.govp</u>.

Effective Date: Saturday, September 18, 2004



Picture courtesy EMCC



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**Researcher:** Engineering Mechanics Corporation of Columbus **Project Cost:** \$300,000 (\$240,000 PHMSA + \$60,000 cost sharing) **Public Page:** <u>https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=985</u>

**Project Objective:** Identify differences between existing integrity threats and potential new threats resulting from the presence of hydrogen.

• Identify possible changes to the American Society of Mechanical Engineers (ASME) Code B31.8S threat assessment process to address hydrogen or hydrogen/natural gas blend service-based threats in new and existing pipelines.

#### Project End Date: 9/29/2024

**Potential Impact on Safety:** An updated threat assessment process for pipelines in hydrogen gas service will allow for a better understanding of risks for pipeline rupture or leaks. Improved leak and burst pressure predictions are essential because over predictions suggest a false sense of low risk, while underpredictions result in excessive conservatism.







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#### Expanding Hydrogen Storage to Porous Rock Formations: A Framework for Estimating Feasibility & Operational Considerations

Researcher: Gas Technology Institute Project Cost: \$598,000 (\$298,000 PHMSA + \$300,000 cost sharing) Public Page: <u>https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=984</u>

#### **Project Objective:**

- Develop a framework that accelerates industry expansion of underground hydrogen storage beyond salt caverns.
- Provide operational considerations for selecting suitable porous rock formations as potential storage sites.
- Establish guidelines for monitoring potential hydrogen movement or hydrogen loss resulting from geochemical reactions.

#### Project End Date: 9/29/2024

**Potential Impact on Safety:** This framework will help industry identify the most viable candidates for storing and recovering hydrogen in these types of formations and will accelerate the safe operation of Underground Hydrogen Storage in the US.



Picture courtesy of cH2ange





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### Establishing the Technical Basis for Enabling Safe and Reliable Underground Hydrogen Storage Operations

Researcher: US Department of Energy, Office of Fossil Energy and Carbon Management & Subsurface Hydrogen Assessment, Storage, and Technology Acceleration (SHASTA) – Inter-Agency Agreement Project Cost: \$2,000,000 Public Page: https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=999

**Project Objective:** The objectives of this work are: 1) Identify and understand existing PHMSA regulatory functions and needs as they relate to characterizing, permitting, and assessing underground natural gas storage (UGS) operations within the subsurface in order to define appropriate metrics relevant to UHS; 2) Quantify the suitability of existing UGS facilities (which includes the well and subsurface geologic system) for storing pure and blended hydrogen; 3) Characterize operational expectations with emphasis on quantifying risk for H2 resource loss processes, UGS asset degradation, and estimating transient behavior based on geologic and operational conditions.

#### Project End Date: 2/28/2025

**Potential Impact on Safety:** Accelerate the safe operation of Underground Hydrogen Storage (UHS) in the US by developing guidance on how to assess the technical suitability for a particular facility to safely store hydrogen or blends, characterize the operational expectations during transition or development of a facility, and scientifically inform any recommended practices or regulatory changes (with related guidance) that may be needed to support UHS.





### Past Hydrogen Pipeline Research

Project	Goals
"Performance Evaluation of High-Strength Steel Pipelines	This project will address the most critical issues related to the safe and efficient transportation of hydrogen using pipelines. The impact of high pressure hydrogen on
for High-Pressure Gaseous Hydrogen Transportation"	by conducting fatigue tests and developing a mechanistic-based analysis model/procedure to correlate and predict the test results.
Category: Alternative Fuels	Researcher: Center for Reliable Energy Systems PHMSA: \$659,500
"Cost-Effective Techniques for Weld Property Measurement and Technologies for Improving Weld	Built upon proven technologies, this proposal research aims at (i) advancing the general knowledge related to fatigue and fracture properties of pipeline steel welds
<u>Hydrogen Embrittlement and Intergranular Stress</u> <u>Corrosion Cracking Resistance for Alternative Fuel</u> <u>Pipelines''</u>	subject to high pressure hydrogen atmosphere (e.g. a pressurized hydrogen transport system) and (ii) developing technologies for weld property improvement.
Category: Alternative Fuels	Researcher: University of Tennessee PHMSA: \$665,211
"The Effect of Pressurized Hydrogen Gas on the Fatigue Properties of the Heat-Affected Zones in X52 and X70 <u>Pipelines</u> "	NIST and PHMSA seek to address concerns over heat-affected zones voiced by American Society of Mechanical Engineers (ASME) B31.12 committee on Hydrogen Piping and Pipelines.
Category: Materials	Researcher: National Institute of Standards and Technology PHMSA: \$160,000
	NIST's Material Measurement Laboratory (MML), Applied Chemicals and Materials
"The Effect of Pressurized Hydrogen Gas on the Fatigue	Division (ACMD) is assisting PHMSA in evaluating emerging technologies and
Properties of Welds in X52 and X70 Pipelines"	standards. NIST will be performing research and standardization activities related to
Catagory: Matarials	Researcher: National Institute of Standards and Technology PHMS4: \$105.187
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### **R&D** Links

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### About Pipeline Research & Development

The mission of PHMSA's Pipeline • Safety Research & Development Program is to sponsor projects focused on providing technical solutions that will improve pipeline• safety, reduce the environmental impact of failures, and enhance the • reliability of the Nation's pipeline transportation system.

### The research program has the following objectives:

- Employ a coordinated and collaborative approach to address mutual pipeline challenges with a wide set of pipeline stakeholders
- Help remove technical and sometimes regulatory barriers on a given challenge
- Tell the research story by measuring our research results, outputs, and impacts
- Promote transparency by posting online R&D program/project actions and products.

R&D Program Website: <u>https://www.phmsa.dot.gov/research-and-development/pipeline/about-pipeline-research-development</u> R&D program awards and sortable features: <u>https://primis.phmsa.dot.gov/matrix/</u>

Submit a research gap suggestion: https://primis.phmsa.dot.gov/rd/gapsuggestions.htm

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R&D Program Email: <u>R&Dteam@dot.gov</u>



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### **Thank You**

### **Questions?**

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