



# Pipeline and Hazardous Materials Safety Administration Office of Pipeline Safety

## Pipeline Safety Research & Development Program

Workgroup#4: Hydrogen Network Components

*Vincent Holohan*

December 1, 2021



# Good Morning & Welcome!

**PHMSA Leader:** Vincent Holohan, Senior Engineer

**Industry Co-Leader:** Mirela Hiti, PhD, P.Eng.

- Manager of Energy Transition Technologies, TC Energy

**Industry Co-Leader:** Tim Harris, PE, Research and Development Senior Engineer, Southern Company Gas

**Industry Co-Leader:** Kevin Woo, Hydrogen Strategy Team Lead, SoCalGas

**Industry Co-Leader:** Danielle Mark, PE, Senior Gas Engineer, PG&E

- Thank you for choosing this Workgroup
- We have an important charge for you:
  - Listening/Learning
  - Assist in developing PHMSA's future research agenda



# Workgroup Objectives

1. Updating the audience on the challenges and funded research to date associated with this workgroup subject
2. Identifying technical gaps that address key challenges
3. Developing a list of important topics for future PHMSA funded research from identified gaps



# Agenda at a Glance



U.S. Department of Transportation  
Pipeline and Hazardous Materials  
Safety Administration

4

**PHMSA: Your Safety is Our Mission**



# Today's Agenda – December 1

<b>Time</b>	<b>Presentation</b>	<b>Speaker</b>
<b>10:00 AM</b>	Introduction to Workgroup	Workgroup Leader PHMSA Workgroup Leader Industry
<b>10:30 AM</b>	Research Funding Organization Presentations	Presenters 1-4
<b>11:30 AM</b>	Q&A	
<b>12:00 PM</b>	Contractor Support Introduction & Description	S&K Facilitate
<b>12:10 PM</b>	Research Gap Brainstorming Session	Workgroup Participants
<b>12:45 PM</b>	Lunch Break & CAAP Poster Presentations During Lunch similar gaps will be combined.	
<b>2:45 PM</b>	Review gaps identified following the combination.	Workgroup Leaders
<b>3:15 PM</b>	Sticky Note Exercise – Round 1 & 2 Workgroup prioritizes R&D Gaps	S&K Facilitate
<b>4:15 PM</b>	Break	
<b>4:30 PM</b>	Workgroup Research Topic Roadmapping	Workgroup Leaders & Participants
<b>6:00 PM</b>	Workgroup Closeout Day 2 closeout	Workgroup Leader



# Tomorrow's Agenda – December 2

10:00 a.m. **PHMSA's Year-Round R&D Solicitation**

10:10 a.m. **Workgroup Readouts**

**The results of this Workgroup will be presented at 10:10 a.m. tomorrow ETZ.**

**Return to the event meeting page to find the entry link to Day 3.**



# PHMSA Funded Research

7



U.S. Department of Transportation  
Pipeline and Hazardous Materials  
Safety Administration

**PHMSA: Your Safety is Our Mission**



# PHMSA Related Research

Project Title	Summary
Performance Evaluation of High-Strength Steel Pipelines for High-Pressure Gaseous Hydrogen Transportation (\$659,500)	The project conducted a fatigue and fracture-toughness property testing and collected data on crack initiation, crack propagation, and final failure.
Cost-Effective Techniques for Weld Property Measurement and Technologies for Improving Weld Hydrogen Embrittlement and Intergranular Stress Corrosion Cracking Resistance for Alternative Fuel Pipelines (\$665,211)	The project conducted destructive material testing to collect data on to better understand the relationship among composition, microstructure, and fatigue resistance. It compared welds to the base metal. This included characterization of the crack tip and the influence of hydrogen on deformation behavior around the crack tip.
The Effect of Pressurized Hydrogen Gas on the Fatigue Properties of the Heat-Affected Zones in X52 and X70 Pipelines (\$160,000)	The project investigated heat-affected zones that may behave differently in a hydrogen gas environment.
The Effect of Pressurized Hydrogen Gas on the Fatigue Properties of Welds in X52 and X70 Pipelines (\$105,187.35)	The project investigated welds that may behave differently in a hydrogen gas environment.
Knowledge-guided Automation for Integrity Management of Aging Pipelines (KAI-MAP) for Hydrogen Transport (\$844,726)	The project is developing an Artificial Intelligence enabled automation framework for pipeline safety data collection and processing to support integrity decision making of pure hydrogen pipelines.





# Notable Research Impacts

- Project final reporting provide very useful information about the issues covered
  - Several papers have been published
- Knowledge Transfer registered to standards bodies
  - American Society of Mechanical Engineering  
B31.12 Standard on Hydrogen Piping and Pipeline



# Related Policy Issues



# Potential Demand for Infrastructure

- PHSMA and State Partners regulate just over 1500 miles of hydrogen transmission pipe operated by around 36 operators. (1500 miles H<sub>2</sub>)/(300,000 miles total gas transmission) ≈ 0.5%
  - H<sub>2</sub> pipelines of shorter, more local nature, concentrated in the TX/Louisiana Gulf Coast region.
- Drivers for future H<sub>2</sub> demand?
- What Infrastructure will be needed to meet that demand:
  - Distribution and/or transmission?
  - New or Repurposed?
  - Separation/Purification facilities?
  - Blends?
  - Storage?
- Data needs to better capture H<sub>2</sub> blends?



# Performance of Existing H<sub>2</sub> Pipelines

- Between 2010 and today, only four reported incidents involved hydrogen gas pipelines:
  - Do not appear to support or refute pipeline integrity concerns specific to hydrogen gas pipelines.
  - No hydrogen assisted cracking.
  - None involved blended gas.



# Part 192 Regulations

Regulatory needs specific to hydrogen or to blends?

Consider solutions:

- Standards for incorporation or development.
- Design requirements/Operational limitations.
- Plastic vs Steel vs Other; Transmission vs Distribution
- Integrity Management (TIMP/DIMP); Risk Analysis; Class Locations/Potential Impact Radius
- Consequence Differences; Leak/Diffusion rates; Flammability; Rupture/Crack arrest;
- For blends: What %'s requires more or less?



# Thank You!

## Research Program Contacts

### **Sentho White**

Director – Engineering & Research  
Department of Transportation  
Pipeline & Hazardous Materials  
Safety Administration  
Office of Pipeline Safety  
(202) 366-2415  
[sentho.white@dot.gov](mailto:sentho.white@dot.gov)

### **Robert Smith**

R&D Program Manager  
Department of Transportation  
Pipeline & Hazardous Materials  
Safety Administration  
Office of Pipeline Safety  
(919) 238-4759  
[robert.w.smith@dot.gov](mailto:robert.w.smith@dot.gov)

### **Kandilarya Barakat**

Operations Supervisor  
Department of Transportation  
Pipeline & Hazardous Materials Safety  
Administration  
Office of Pipeline Safety  
(202) 941-8623  
[kandilarya.barakat@dot.gov](mailto:kandilarya.barakat@dot.gov)

### **Nathan Schoenkin**

Senior Engineer  
Department of Transportation  
Pipeline & Hazardous Materials Safety  
Administration  
Office of Pipeline Safety  
(202) 740-1978  
[nathan.schoenkin@dot.gov](mailto:nathan.schoenkin@dot.gov)

