Working Group #4
Hydrogen Network Components

Working Group Leaders:

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Top 4 Identified R&D Gaps

Gap #1 – Steel weld qualification and performance (Output type: General Knowledge)(Infrastructure type: Pipeline)

Gap #2 – Necessary modifications to repurpose existing pipeline infrastructure to carry pure (100 percent) hydrogen (Output type: General Knowledge)(Infrastructure type: Pipeline (possibly LNG/UNGS))

Gap #3 – Validate existing or new hydrogen leak detection equipment compatible with hydrogen-natural gas blends (Output type: Technology Development/General Knowledge)(Infrastructure type: Pipeline)

Gap #4 – Instrumentation and equipment compatibility (ensuring sensors, analyzers, etc., will properly function) (Output type: Technology Development/General Knowledge)(Infrastructure type: Pipeline)

NOTE: RED Text Means Possible Academic Focus

Gap #1 Associated Details

Title: Steel Weld Qualification and Performance

Main Objective: To provide weld qualification requirements for new and existing assets as well as performance evaluation for existing assets

a. Does the gap address any regulatory, congressional, or NTSB drivers? No
b. Does the gap address related consensus standards or best practices? Yes
c. What technical details or scope items are necessary and recommended? For hydrogen or hydrogen blends from 0 to 100 percent; applicable to gas distribution and transmission systems (at appropriate pressure ranges); applicable to various gas pipeline ages/diameters/grades; applicable to repairs/new construction, as well as vintage or repurposed pipelines
d. What are anticipated targets or timeframes to complete this research (months)? 24 to 36 (possibly 12 for SBIR)
e. What funding level is estimated to support such a topic? $1 to $1.5 million

Gap #2 Associated Details

Title: Necessary modifications to repurpose existing pipeline infrastructure to carry pure (100 percent) hydrogen

Main Objective: To determine the necessary modifications or potential limitations needed for repurposing pipeline infrastructure and components

a. Does the gap address any regulatory, congressional, or NTSB drivers? No
b. Does the gap address related consensus standards or best practices? No
c. What technical details or scope items are necessary and recommended? Determine what anomalies, dents, etc., need to be addressed; applicable to both metallic and nonmetallic pipes; applicable to gas distribution and/or gas transmission, and potentially hazardous liquids (Part 195) pipelines being considered for conversion
d. What are anticipated targets or timeframes to complete this research (months)? 12 for literature search; 24 to 36 for more in-depth data collection and research
e. What funding level is estimated to support such a topic? Literature = $500,000 In depth = $1 million

Gap #3 Associated Details

Title: Validate existing or new hydrogen leak detection equipment compatible with hydrogen-natural gas blends

Main Objective: To validate or identify gaps in leak detection and quantification technologies

a. What operating environment(s) must the technology operate in? Indoor and outdoor pipelines and facilities; above ground and under ground; confined spaces
b. Can any functionality and or performance requirements be identified (must produce what data, must have a certain threshold of detection, etc.)? Yes—quantification based on flammability limits/code requirements
c. Does the gap address any regulatory, congressional, or NTSB drivers? Greenhouse gas initiatives, congressional mandates
d. Does the gap address any related consensus standards or best practices? No
e. What technical or regulatory roadblocks or barriers prevent the technology deployment? To be determined
f. What are anticipated targets or timeframes to complete this research (months)? 12 to 36
g. What funding level is estimated to support such a topic? $700,000 to $1.5 million

Gap #4 Associated Details

Title: Instrumentation and equipment compatibility (ensuring sensors, analyzers, etc. will properly function)

Main Objective: To ensure that sensors, analyzers, etc., will properly function and materials are compatible with hydrogen and hydrogen/natural gas blends

a. What operating environment(s) must the technology operate in? Indoor and outdoor pipelines and facilities; above ground and under ground; confined spaces; inside and outside of pipe and in situ
b. Can any functionality and or performance requirements be identified (must produce what data, must have a certain threshold of detection, etc.)? Yes— accuracy, establishment of correction factors, recalibration of measurement equipment, maintenance requirements
c. Does the gap address any regulatory, congressional, or NTSB drivers? Measurement requirements, custody transfer compliance
d. Does the gap address any related consensus standards or best practices? Yes—ASTM
e. What technical or regulatory roadblocks or barriers prevent the technology deployment? To be determined
f. What are anticipated targets or timeframes to complete this research (months)? 12 to 36
g. What funding level is estimated to support such a topic? $700,000 to $1.5 million (or more for broader overall topic)

Additional Identified Gaps

1. What level of blending of hydrogen is safe under what circumstances?
2. Impact of H2 blends on system joints (welded, fused, threaded, and mechanical)
3. Study Evaluating Part 192 regs for H2 vs. NG
4. Characterization of state of existing networks: materials, existing flaws/crack size, etc.
5. Hydrogen blends - ignition probability, impact radius of ignited blends, and upper/lower explosive limits
6. Compatibility of composite pipe with hydrogen/blends
7. Determine what factors allow/cause the hydrogen to diffuse into the pipe steel and how different natural gas contaminants affect the diffusion
8. Need to study effects of Hydrogen Blends on legacy cast iron pipelines and joints
9. Build a small steel pipeline test loop for H2 testing at scale- various grades and dimensions

NOTE: Highlighted RED Means Possible Academic Focus

Additional Identified Gaps (Cont.)

10. Risks associated with converting vintage crude and natural gas pipelines to blended or pure hydrogen service
11. Real world system studies of H2 blending - lessons learned

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Thank You!/Questions?