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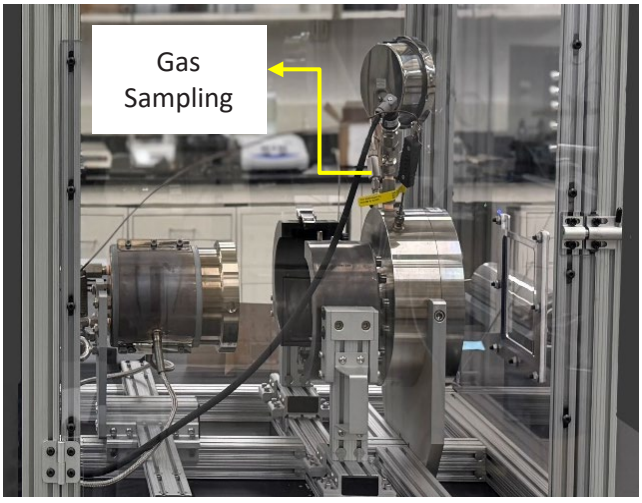
FUNDING DETAILS

Mechanical Characterization of Pipe Steel Materials Exposed to Varying Levels of Hydrogen Concentration

Even though studies on hydrogen embrittlement and the impact of hydrogen-rich environments on pipeline materials have been conducted, there is a clear need for small-scale testing to reduce the uncertainties surrounding the impact of hydrogen on pipeline materials. The University of Alberta (UofA) team will investigate the impact of hydrogen exposure on commonly used pipeline steel grades in Alberta. The research will evaluate how different concentrations of hydrogen affect the mechanical properties of small-scale steel samples and assess the effectiveness of polymer liners in mitigating hydrogen-induced material degradation. Tests are conducted under different temperatures and pressures in a HPHT Parr visual cell to simulate various operating conditions. Insights gained from this study aim to support the conversion of existing natural gas pipelines for hydrogen transport, enhancing infrastructure resilience and sustainability.



RECIPIENT:
UofA – Hassan Dehghanpour

PARTNERS:
C-FER, Enbridge Pipelines, BMT Canada, SANEXEN Ltd

TOTAL BUDGET:
$600,000

AI FUNDING:
$300,000

PROJECT DATES:
NOV 2024 – OCT 2026

PROJECT TRL:
Start: 4
End: 6

APPLICATION

This project will deliver detailed insights into material behavior at small scales, contributing directly to the advancement of safety standards for hydrogen pipelines. It will also build a foundational knowledge base to support Canadian researchers and engineers in the safe and efficient repurposing of existing natural gas infrastructure for hydrogen transport—an essential milestone in the development of a nationwide hydrogen network.

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PROJECT GOALS

The overall objective is to facilitate the transition of Alberta's existing pipeline infrastructure for safe and efficient hydrogen transport. This includes technical, regulatory, business, and educational channels to ensure comprehensive dissemination and application of the research findings across relevant sectors.

The primary objectives are as follows:

- Evaluating how varying hydrogen concentrations affect common pipeline steels used in Alberta.
- Testing the effectiveness of polymer liners in protecting pipes from hydrogen.
- Conducting analysis of the strength and longevity of steel pipes with/without protective liners when exposed to hydrogen.
- Updating CSA Z662 amendment for hydrogen effects on pipeline.

BENEFITS TO ALBERTA

The successful completion of this project will demonstrate the feasibility of repurposing vintage natural gas pipelines for hydrogen transport in Alberta. This approach offers a more sustainable and cost-effective alternative to surface transport via tanks or building entirely new pipeline infrastructure. It represents a critical step toward achieving Canada's net-zero objectives in the region. The project can help for

- Enhancing energy resilience, supporting a greener economy, and contributing to long-term sustainability goals in Alberta.
- Reducing safety risks and GHG emissions associated with hydrogen transportation.
- Creating extensive job opportunities in the new economic sectors of liner manufacturing, laboratory testing, and software development for pipeline assessment.
- Expanding indirect local industries such as natural gas production and transportation (for blue hydrogen feedstock) and hydrogen-utilizing and producing refineries.

7 Publications

3 Students Trained

3 Project Jobs

100+ Future Jobs

2 New Products/Services

1 Spinoff Company

12.3 Mt Project GHGs Reduced

61.8 Mt Future GHGs Reduced

CURRENT STATUS

APR 2025

The project has commenced, with a primary focus on laboratory testing to evaluate the effects of hydrogen on pipeline specimens.