



PIPELINE INTEGRITY  
INSTITUTE  
INSTITUT D'INTÉGRITÉ  
DE PIPELINE



The  
**Competence**  
Club  
*...connects*

UBC Pipeline Integrity Institute collaborates with ROSEN's Competence Club to deliver this short course on March 12-13, 2024, in Calgary at WOOD Centre.

## Introduction to Hydrogen Pipeline Integrity

### Introduction

There are millions of kilometers of high-pressure onshore oil and gas transmission pipelines around the world. As the industry expands and new staff are introduced into it, there is an increasing need for a full appreciation of how to keep pipelines operating safely. Additionally, the pipeline industry is facing new challenges managing emerging fuels. This course provides an introduction to the integrity of hydrogen pipelines.

**Tuesday - Wednesday, March 12 – 13, 2024** (8:30am – 4:30pm MDT)

Subject Matter Expert: Neil Gallon, ROSEN UK Ltd.

### Learning Outcomes:

- Introduce hydrogen in the context of the energy transition.
- Offer a broad overview of the history of hydrogen and its pivotal role in the need for decarbonization, including the different production methods and uses of hydrogen. Specifically, the need for hydrogen pipelines, and the differences between hydrogen and natural gas pipelines. These differences are driven by the different characteristics of hydrogen and natural gas, including the embrittling effects of gaseous hydrogen.
- Compare the operational and risk consequence aspects of hydrogen compared to natural gas.
- Summarize available code guidance on the conversion of natural gas pipelines.
- Present the theory of hydrogen embrittlement and its associated cracking threats and effects on mechanical properties, as well as the relevant testing requirements and protocols.
- Introduce the impact of these differences on defect assessments and fitness for purpose studies.
- Outline the requirements for a holistic hydrogen, and other future fuels' conversion and integrity management process.

## Topics – Day 1:

- Role of hydrogen in the energy transition:
  - History of hydrogen
  - Properties of hydrogen
  - Production of hydrogen (different colours)
  - Hydrogen demand and use
  - Requirement for hydrogen pipelines
- Differences between hydrogen and natural gas pipelines:
  - Code requirements (ASME B31.12, AIGA / EIGA Guidelines, TD1 Supplement, DVGW G409 etc.)
  - Operational requirements (pressure, flow rates etc.)
  - Risk consequences (hazardous radius, likelihood of explosion etc.)
- Conversion of existing natural gas pipelines to hydrogen:
  - Code guidance
  - Operational requirements
  - Repurposing methodology
- Effects of hydrogen on pipeline materials:
  - Theory of hydrogen embrittlement
  - Possibility of cracking (HIC)
  - Effects on strength, ductility, fracture toughness, fatigue
  - Implications for welds (seam and girth)
  - Testing requirements / protocols

## Topics – Day 2:

- Defect assessment:
  - Common defect types (crack-like defects, corrosion, dents, dent-gouges etc.)
  - Data requirements to assess defects
  - Assessment techniques (BS 7910, API 579 etc.) and hydrogen knock-down factors
- Integrity management of hydrogen pipelines:
  - Requirements for an Integrity Management System (IMS) for a hydrogen pipeline
  - Comparison to IMS for a Natural Gas Pipeline
- Introduction to integrity management of future fuels pipelines:
  - Characteristic and threats associated with future fuels pipelines: CO<sub>2</sub>, ammonia, LOHC, biogases
  - Introduction to an Integrity Management System
- Workshop:
  - An interactive session on how to repurpose an existing gas pipeline applying the concepts discussed during the training sessions.
- Presentations/Discussion:

- A brief presentation of workshop results as well as an opportunity for a wrap-up discussion covering the main aspects of the training event.

## Who Should Attend

- All pipeline integrity personnel, including those new to the industry.
- This course is especially suitable for pipeline engineers or managers looking to enhance their wider understanding of integrity management concepts and the implications of the new emerging fuel pipelines.

## Courses Format

The short course will be presented in-person in Calgary at WOOD Centre: Main Floor, 2535 Third Avenue SE, Calgary, AB, Canada T2A 7W5. Start time is 08:30am MDT. Finish time is 16:30pm MDT. Breakfast and lunch will be provided.

### Pre-Course Training (Optional):

Before your training begins, ROSEN's Competence Club, the premier learning and collaboration platform for the pipeline industry, is available for your use at no additional cost. This platform provides four complimentary e-learns that are designed to support you in acquiring the prerequisite knowledge for the course and enhancing your awareness level skillset. The e-learn training lasts a total of 8 hours and can be completed at your own pace and at a time that is convenient for you. The Competence Club training will cover:

- **Introduction to Pipeline Materials CS013A (1 hour):** Gain awareness of pipeline materials properties and selection and the composition and mechanical properties of carbon steel and corrosion-resistant pipeline materials, welds, connectors, flexible pipelines, and non-metallic pipeline materials.
- **Introduction to External Corrosion and Prevention CS017A (1 hour):** This course provides an awareness of external corrosion and related degradation mechanisms on pipelines, of environmental effects, and of relevant mitigation strategies, factory-applied pipeline coating types, and field-applied coating types, including the key reasons behind the use of coatings, and an awareness of the requirements for the success of a coating over the lifecycle of an asset.
- **Introduction to Crack Management CS050A (2 hours):** Gain awareness of the different types of cracks and crack-like defects that can occur in pipelines, their effects and consequences, and how they are detected and mitigated.
- **Introduction to Hydrogen Energy Transition and the Role of Pipelines CS053A (4 hours):** This course outlines the minimum necessary principles, concepts, practices, problems, challenges, and technical parameters involved in the role of these transmission pipelines in the energy transition as well as technical, design, operation, and integrity management issues.

## Short Course Objectives

On completion of the courses, attendees should be able to:

- Review history of hydrogen and its role in the energy transition;
- Explain differences between hydrogen & natural gas pipelines and the process of converting existing pipelines to hydrogen;

- Understand effects of hydrogen on pipelines;
- Discuss defect assessment, and integrity management of hydrogen pipelines & future fuels;
- Workshop: how to re-purpose existing gas pipelines.

**NOTE: A certificate of completion of this short course will be provided on the last day of the course.**

## **COURSE TRAINER**

### **UBC Pipeline Integrity Institute Presents ROSEN's Competence Club Lecturer:**



**Neil Gallon** is a Principal Materials and Welding Engineer working for the ROSEN Integrity Services division in Newcastle upon Tyne, UK. He holds a Master's degree from the University of Cambridge and is a Chartered Engineer, a EUR.ING, a professional Fellow of the Institute of Materials, Minerals and Mining and an International / European Welding Engineer. He has over 20 years' experience in manufacturing and consultancy, including working for companies such as Tata Steel and GE. His current interests include the impact of gaseous hydrogen on materials and welds.



## Correspondence and Information

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## PII Co-Directors & UBC Professors

Dr. Dharma Wijewickreme, Dept. of Civil Engineering

Dr. Edouard Asselin, Dept. Of Materials Engineering

## General Information

The Short Course will be held at WOOD Centre: Main Floor, 2535 Third Avenue SE, Calgary, AB, Canada T2A 7W5. The nearest hotels in the vicinity of the short course venue:

- Hyatt Regency Calgary (downtown)
- Delta Hotels by Marriott Calgary (downtown)
- Best Western Premier Calgary Plaza Hotel & Conference Ctr.
- Holiday Inn Calgary-Airport

The most convenient means of transportation between the Calgary International Airport and downtown Calgary hotels is by taxi or Uber (about \$55-70 CAD) or the option of renting a car at the airport.

If you are traveling from downtown Calgary to the short course venue, take a taxi, Uber or drive to the venue: WOOD Centre, 2535 3 Avenue SE, Calgary. There is free parking available.

If you are taking Rapid Transit from a downtown hotel, for example from Hyatt Regency Calgary, walk 150 metres to board the CTrain Blue Line (departs each 10 minutes), exit train at Barlow/Max Bell stop, and walk to the venue (1000 metres, about 15 minutes). There's a small fee.

An informative guide to Calgary travel and other attractions is found at <https://www.visitcalgary.com/>. Many excellent restaurants are located within easy walking distance of all hotels.

Business casual is typical dress for the course. Breakfast and lunch are provided daily for the duration of the course.

# MAP OF AREA AROUND WOOD CENTRE AND DOWNTOWN CALGARY....

