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ENAGAS H₂ TECHNICAL DAY

**TOWARDS THE NEXT GENERATION
OF INDUSTRY STANDARDS FOR H₂ TRANSPORT**

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presented by

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ROSEN Group



INTRODUCTION

- # HOW **SAFE** IS YOUR STANDARD?
- #HOW **PRACTICAL** IS YOUR STANTARD ?
- #HOW **ECONOMICAL** IS YOUR STANDARD?

INDUSTRY CHALLENGE

Current status

ASME B31.12-2023
(Revision of ASME B31.12-2019)

Hydrogen Piping and Pipelines

ASME Code for Pressure Piping, B31

AN AMERICAN NATIONAL STANDARD



IGEM
The Institution of Gas Engineers and Managers

IGEM/TD/1 Edition 6 Supplement 2
Communication 1849

HIGH PRESSURE HYDROGEN PIPELINES

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Gas- und Wasserfaches e.V.

DVGW
REGELWERK

www.dvgw-regelwerk.de

**Technischer Hinweis – Merkblatt
DVGW G 409 (M)** September 2020

Umstellung von Gashochdruckleitungen aus Stahlrohren für einen Auslegungsdruck von mehr als 16 bar für den Transport von Wasserstoff
Conversion of High Pressure Gas Steel Pipelines for a Design Pressure of more than 16 bar for Transportation of Hydrogen

GAS



CSA Z662:23
National Standard of Canada



Oil and gas pipeline systems



INDUSTRY CHALLENGE



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ASME B31.12-2019
(Revision of ASME B31.12-2014)

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Challenges

- Research moving very quickly... standards are struggling to keep up
- Practical application of ASME B31.12 is challenging for repurposing, particularly accounting for the presence of historic damages
- Gaps & conservatism for demonstrating FFS vs presence of historic defects
- Lack of detailed guidance on integrity management in hydrogen service

REGIONAL INITIATIVES



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EPRG Hydrogen Pipelines Integrity Management and Repurposing Guideline White Paper

Hydrogen Pipeline Systems

A Code of Practice for the Australian Pipeline Industry



Future Fuels Cooperative Research Centre

Document Number: 3.2-10, Revision I

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ASME B31.8 REVIEW – HYDROGEN CHAPTER

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- To match the rapid pace of development in the hydrogen pipeline industry, ASME agreed to enlist the support of the Emerging Fuels Institute (EFI) to develop a **new B31.8 exception chapter**.
- EFI is part of the Pipeline Research Council International (PRCI). Research is geared towards ensuring the **safe transportation & storage of the next generation of energy sources**
 - 21 active member companies
 - 33 active projects
 - 41 projects under review for funding in 2024 and beyond

ASME B31.8 REVIEW – HYDROGEN CHAPTER

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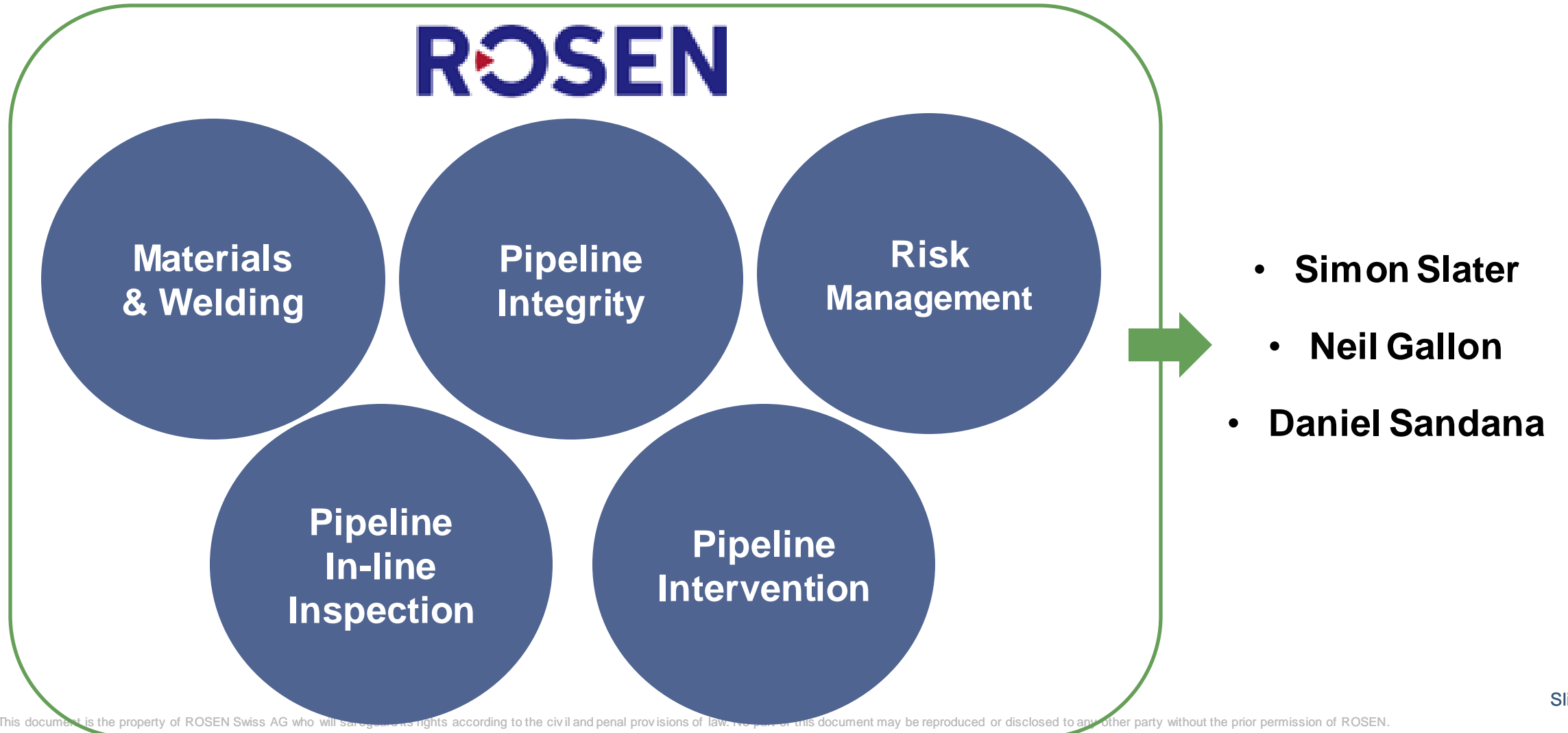
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- The recommended content for B31.8 was established in a new H₂ chapter in the form of **Consensus Engineering Requirements** (CERs).
- New H₂ Chapter CERs aligned to ASME B31.8 structure, clause numbering and style / clause ... Initial B31.8 section clauses are applicable unless **Deviations / exceptions are identified**
- 6 key WPs: **Design, Materials, Operation & Maintenance, Welding, Repurposing, General, and Appendices**
- The primary objective ... disseminate guidance that could be utilized immediately by PRCI members and other stakeholders, **whilst the content under review by ASME for inclusion in the 2026 revision of B31.8.**

ASME B31.8 REVIEW – PROCESS

“ ENSURING CONSENSUS THROUGH COLLABORATION ...”



ASME B31.8 REVIEW – PROCESS



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“ ENSURING CONSENSUS THROUGH COLLABORATION ...”

EFI SMEs



External Stakeholders

- Canadian Standards Association (CSA) Z662
- API 5L
- API 1104

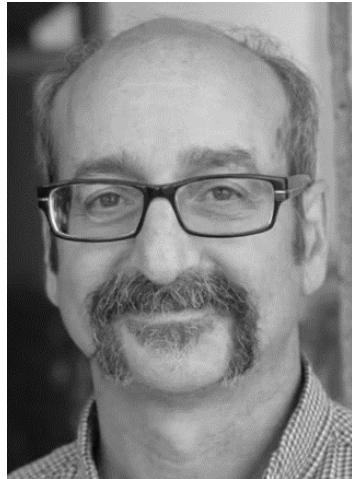


ASME B31.8 REVIEW – PROCESS



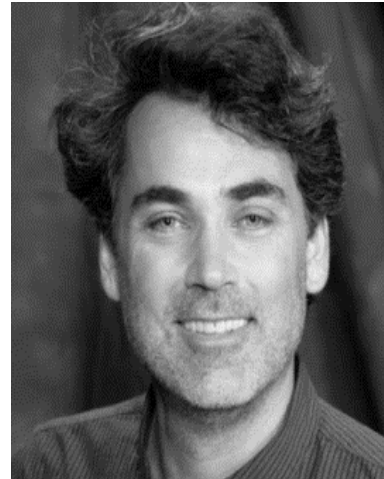
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“ ENSURING CONSENSUS THROUGH COLLABORATION ...”



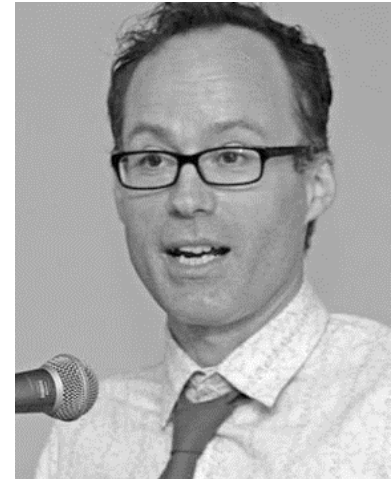
Michael J. Rosenfeld

Vice Chairman of B31.8 Standards
Committee



Chris San Marchi

DoE funded HyBlend initiative team
member



Andrew Cosham

IGEM/TD/1 Edition 6
Supplement 2 High Pressure
Hydrogen Pipelines Lead Author

(SOME) KEY POINTS



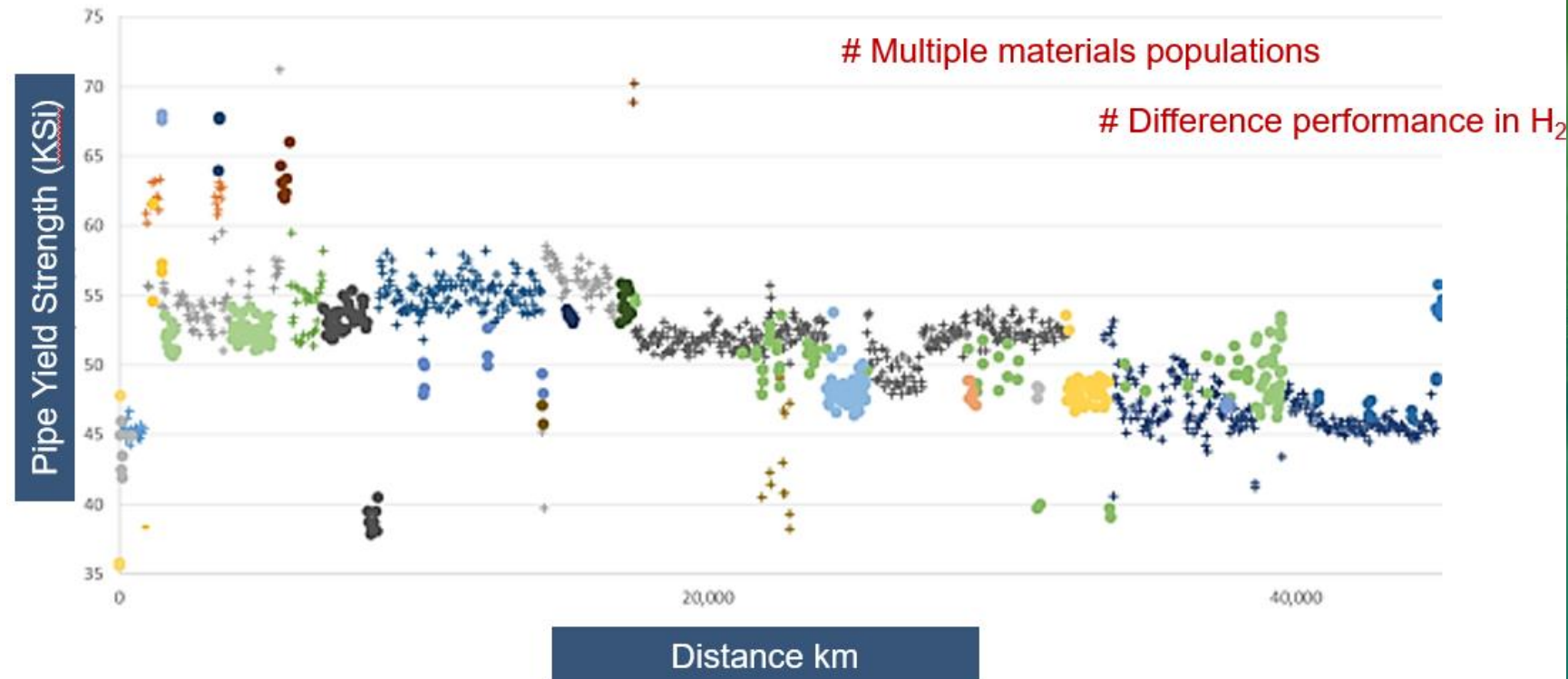
GENERAL - DESIGN & REPURPOSING

Importance of FFS & H₂ Testing

- **FFS process provides the most robust analytical method** to users to methodically qualify pipelines for safe operation in hydrogen commensurately to the asset specificities (e.g. integrity threats, materials, type and size of defects) and operational envelopes
- **Importance of H₂ testing** ... Acknowledges dependency of H₂ 'materials performance' vs variation in line pipe and weld materials (microstructure, chemistry, etc.)... **What is Materials equivalence?**
- Engineering Assessment and H₂ Testing **Requirements modulated by level of principal stresses.... Low versus high stress options**

REPUPOSING WP

- Repurposing to be based on an **FFS for all pipelines**
- **Materials / weld 'populations' across pipeline must be known** and characterised for H₂ performance
- B31.12 - 1 mile sampling criterion -**Practicality??**



POINTS OF ONGOING DISCUSSION

- “**Material equivalence**”? – i.e. if you have test data from Pipe A then can you apply these values to Pipe B – **No agreed industry criterion**
- Susceptibility Screening / testing of **crack growth under static load?** (E1681 KIH-constant displacement not appropriate)
- **FFS assessment criterion**... dents, gouges, hard spots, bending strain, volumetric defects (SAFEH2pipe, PRCI-EFI)
- Requirement to assess **existing dents** against static limits?
- **Design factor relaxation** from current incumbent hydrogen codes.
- **Depth of cover** requirements

CONCLUSIONS - SUMMARY

1. EVERY PIPELINE IS DIFFERENT!

- Different manufacturing, construction, operation, condition, etc.

2. CONVERSION PROCESS AS WELL AS THE FUTURE INTEGRITY, SHOULD BE APPROACHED HOLISTICALLY

- Same philosophy that Natural Gas but fine tuning and accurate with all elements

3. REQUIRES TO DEMONSTRATE THAT THE PIPELINES WILL REMAIN FIT for SERVICE IN H2 (CAPACITY?)

4. THE PROCESS REQUIRES THE DOCUMENTATION OF ENGINEERING INPUTS IN ORDER TO INFORM THE DECISION-MAKING PROCESS FOR:

- Determine the suitability to conversion, or:
- Develop practical economic rehabilitation and mitigation measures to achieve safe conversion

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Thank You for Joining This Presentation

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