ROSEN
empowered by technology

ENAGAS H_2 TECHNICAL DAY

TOWARDS THE NEXT GENERATION OF INDUSTRY STANDARDS FOR H2 TRANSPORT

In cooperation with

Simon Slater (ROSEN)
Neil Gallon (ROSEN)

presented by

Dr. Daniel Sandana

ROSEN Group

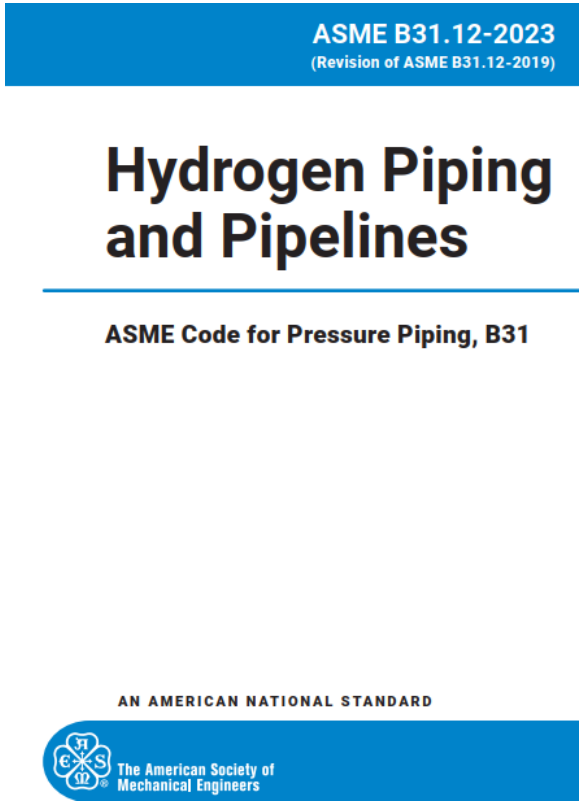
INTRODUCTION

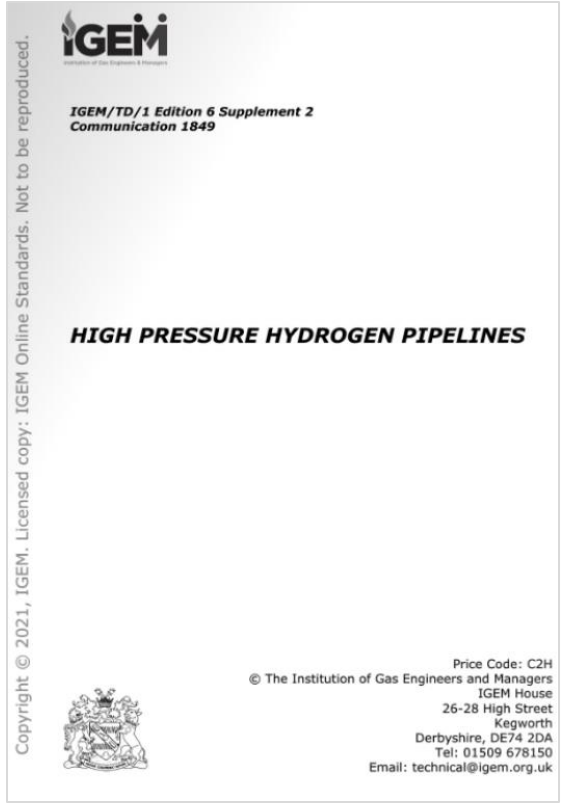
ROSEN
empowered by technology

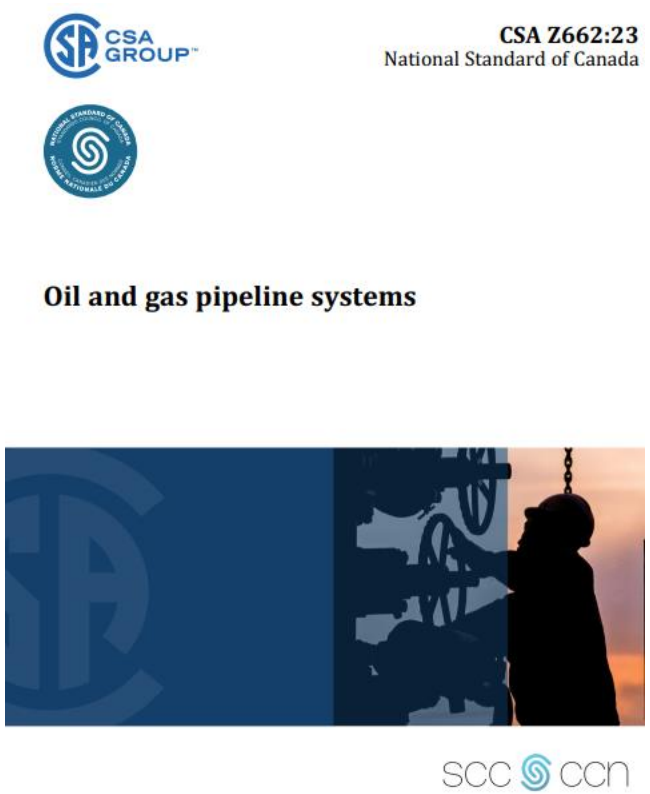
- # HOW **SAFE** IS YOUR STANDARD?
- #HOW **PRACTICAL** IS YOUR STANTARD ?
- #HOW **ECONOMICAL** IS YOUR STANDARD?

INDUSTRY CHALLENGE

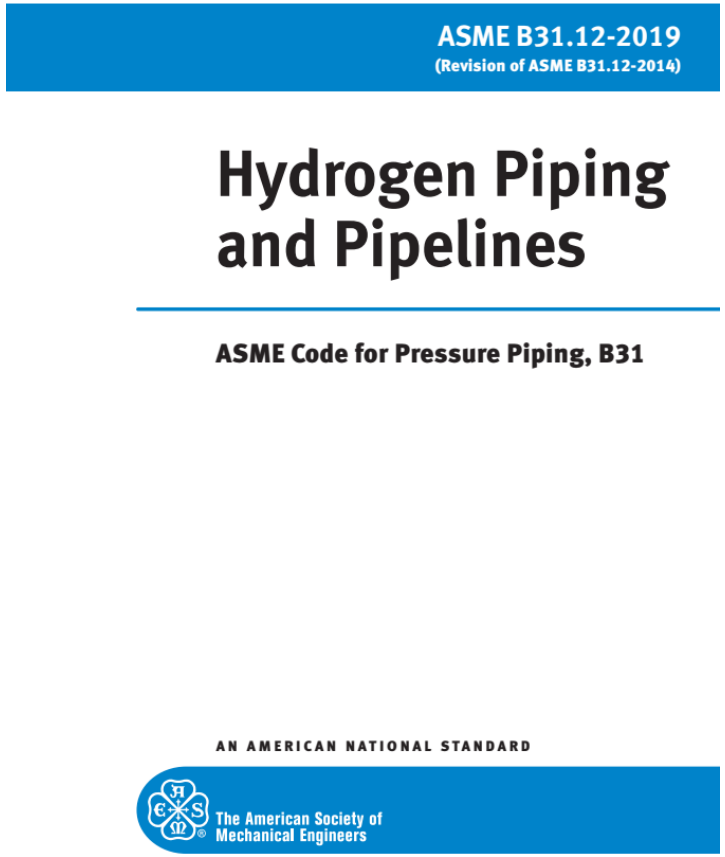
Current status







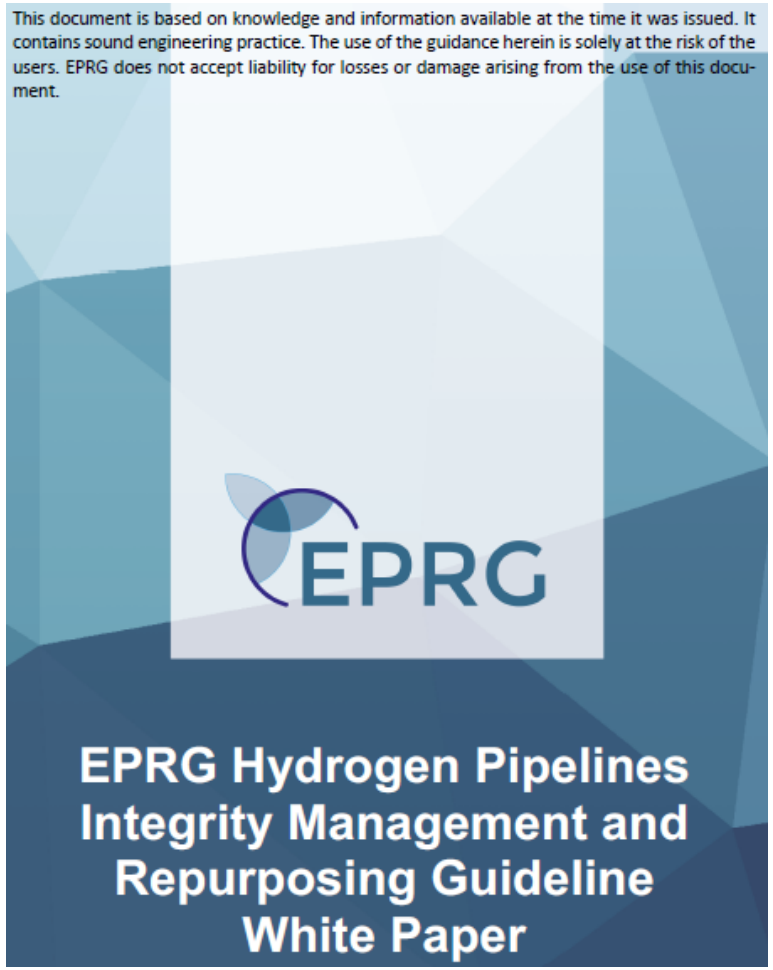
INDUSTRY CHALLENGE

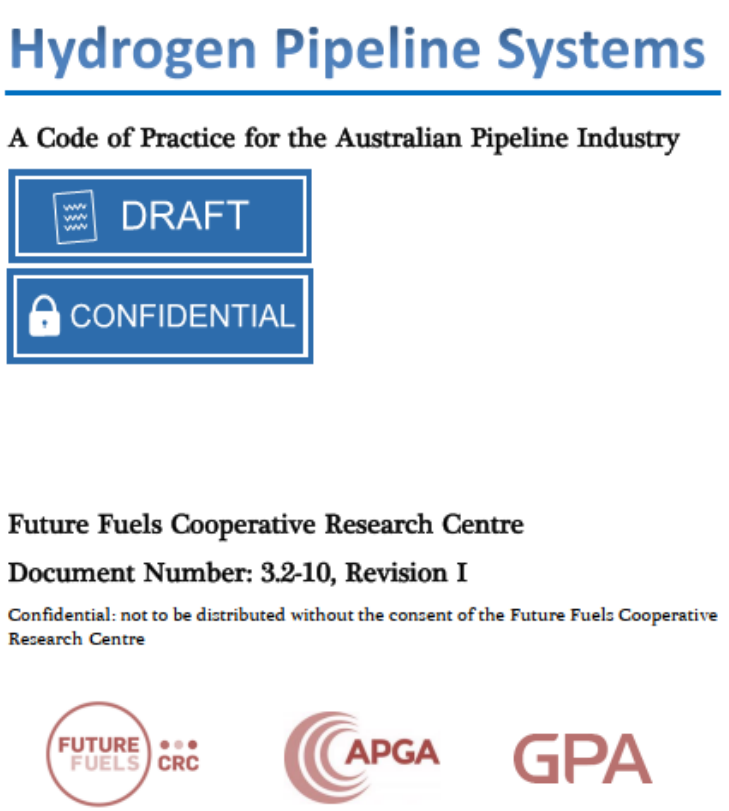


Challenges

- **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





ASME B31.8 REVIEW – HYDROGEN CHAPTER

- 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

ROSEN
empowered by technology

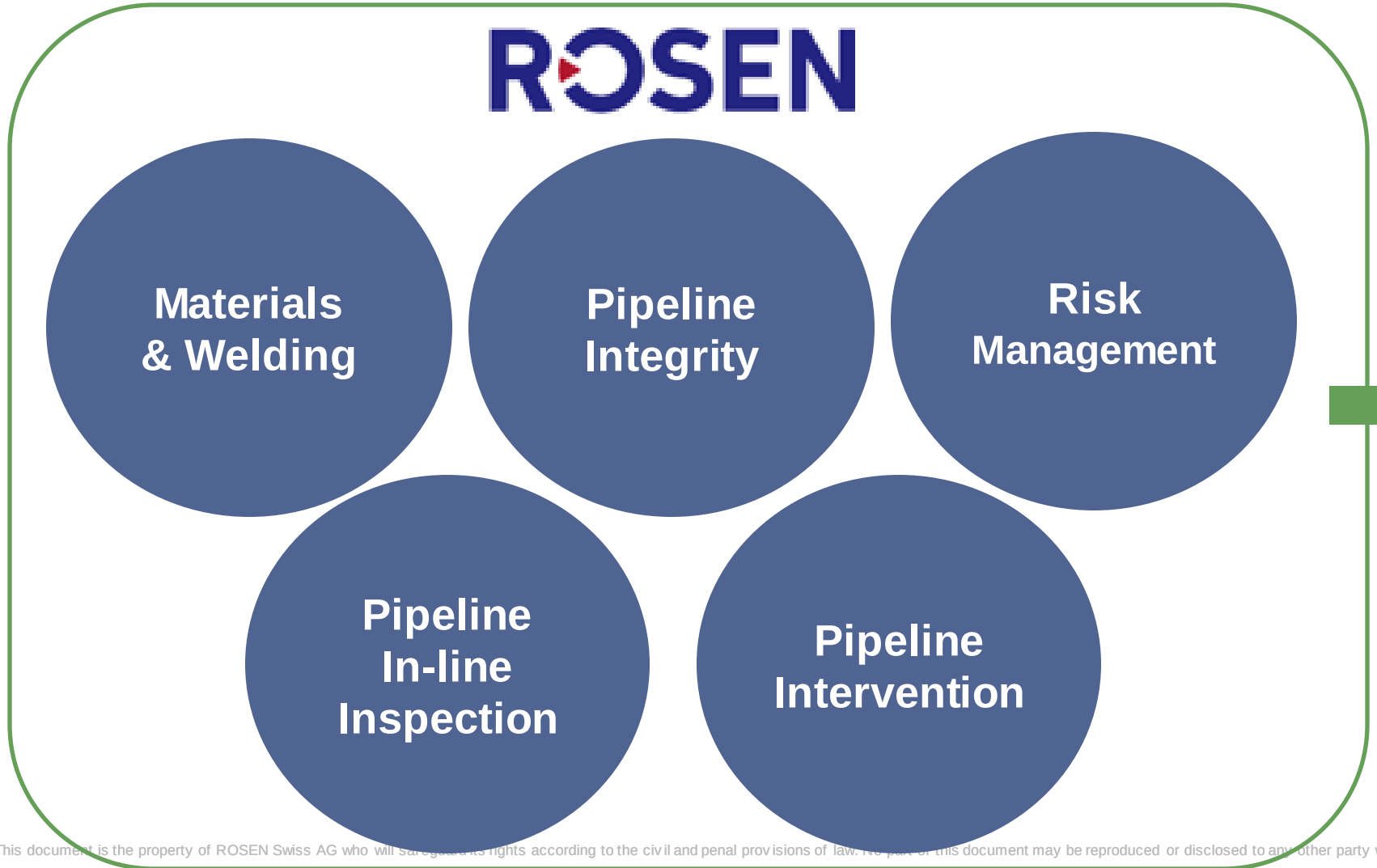
ROSEN
empowered by technology

- The recommended content for B31.8 was established in a new H_2 chapter in the form of **Consensus Engineering Requirements** (CERs).
- New H_2 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

ROSEN
empowered by technology

" ENSURING CONSENSUS THROUGH COLLABORATION …"



- Simon Slater
- Neil Gallon
- Daniel Sandana

ASME B31.8 REVIEW – PROCESS

ROSEN
empowered by technology

“ ENSURING CONSENSUS THROUGH COLLABORATION …”

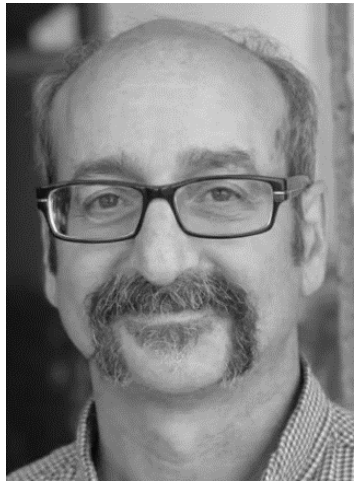
EFI SMEs

External Stakeholders

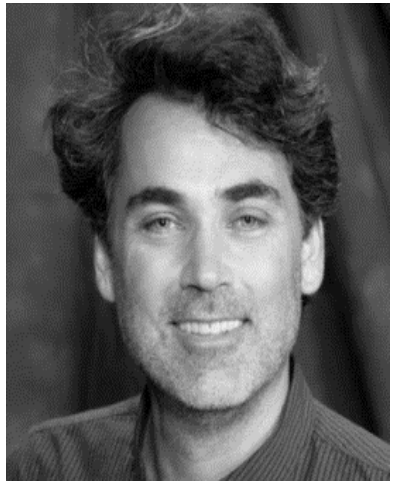
- Canadian Standards Association (CSA) Z662
- API 5L
- API 1104

ASME B31.8 REVIEW – PROCESS

“ 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 & H_2 Testing

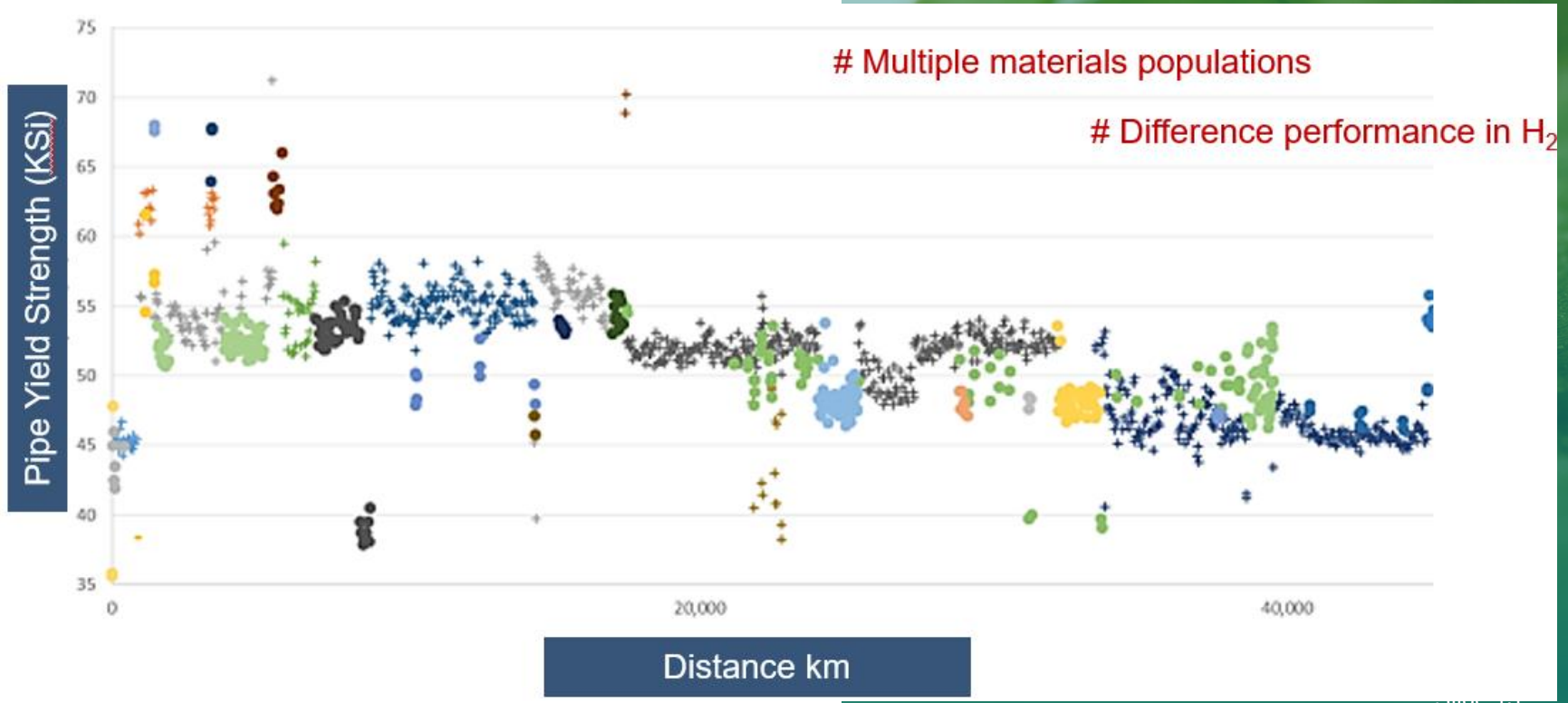
- **FFS process provides the most robust analytical method** to users to methodically qualify pipelines for safe operation in hydrogen commensurately to the asset specificities (e.g. integrity threats, materials, type and size of defects) and operational envelopes

- **Importance of H_2 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 H_2 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 H_2 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

ROSEN
empowered by technology

Thank You for Joining This Presentation

Daniel Sandana
Dsandana@rosen-group.com