

# An Outlook of Latest Solutions for CML Ports and Moisture Gateways in CUI Management Programs

## **Presenter:**

Ahmad Raza Khan Rana MASc, PMP, P.Eng.

Technical Director

Integrity Products & Supplies Inc.



# PRESENTER BIOS

- Ahmad Raza Khan Rana
- Integrity Products Supplies Inc.
- Technical Director (R&D)
- 14 Years in the Asset Integrity roles (R&D, Field Inspections) – Both owner operator & service provider settings
- Certifications in Damage mechanisms (API 571), RBI (API 580), Project Management Professional (PMP)
- ASTM Emerging Professional 2024
- Engineers Nova Scotia Engineering Award 2024
- MP Innovation of the year award (2023) – by AMPP
- Most Impactful Publication of the year award (2021) – by AMPP
- NACE Graduate Student Book Award (2019) – by NACE (now AMPP)



# INTRODUCTION

- CUI – Localized corrosion under thermal Insulations
  - Caused by moisture saturated Insulations
  - Aggravated by chemistry (leachate/ moisture)
- 40 – 60% of piping failures (up to 81%)
- 10% of overall maintenance \$\$\$
- Moisture Infiltration & Condensation
- Field Perspective for moisture infiltrations
  - Gateways
  - CML Ports
- Best practices
  - Solutions
  - Workmanship





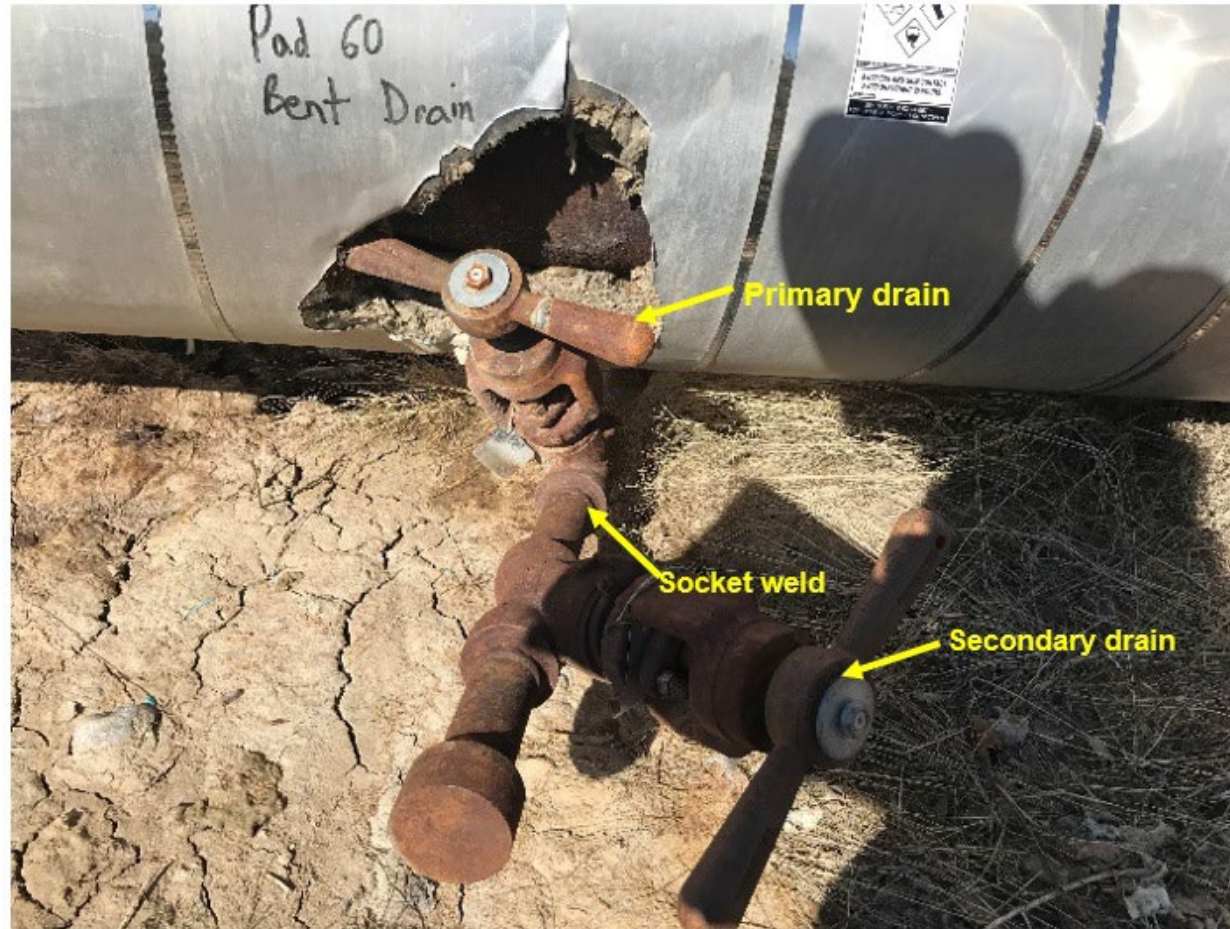
# TYPICAL MOISTURE GATEWAYS



Short-laps



# TYPICAL MOISTURE GATEWAYS



**Image Source:** Rana et. al., "Case Studies – Learnings from CUI Failures and Inspection Challenges," CORROSION 2024 New Orleans, LA, Paper No. 21070 (Houston, TX: AMPP, 2024).

**Un-sealed Insulation Terminations**



# NATURE'S LOVE FOR MOISTURE GATEWAYS 😊



**Image Source:** Rana et. al., “Case Studies – Learnings from CUI Failures and Inspection Challenges,” CORROSION 2024 New Orleans, LA, Paper No. 21070 (Houston, TX: AMPP, 2024).

# CML PORTS NEED & CHALLENGES

## API 581 – Risk-Based inspection Methodology 4.5.3 Corrosion Rate confidence level

- **Low confidence** - Published data, expert opinion, CR tables
- **Medium confidence** - Lab test, simulation, corrosion coupons
- **High confidence** - Field data via thorough inspections, coupons data (for 5+ years of inspection)

## API 581 – Risk-Based inspection Methodology

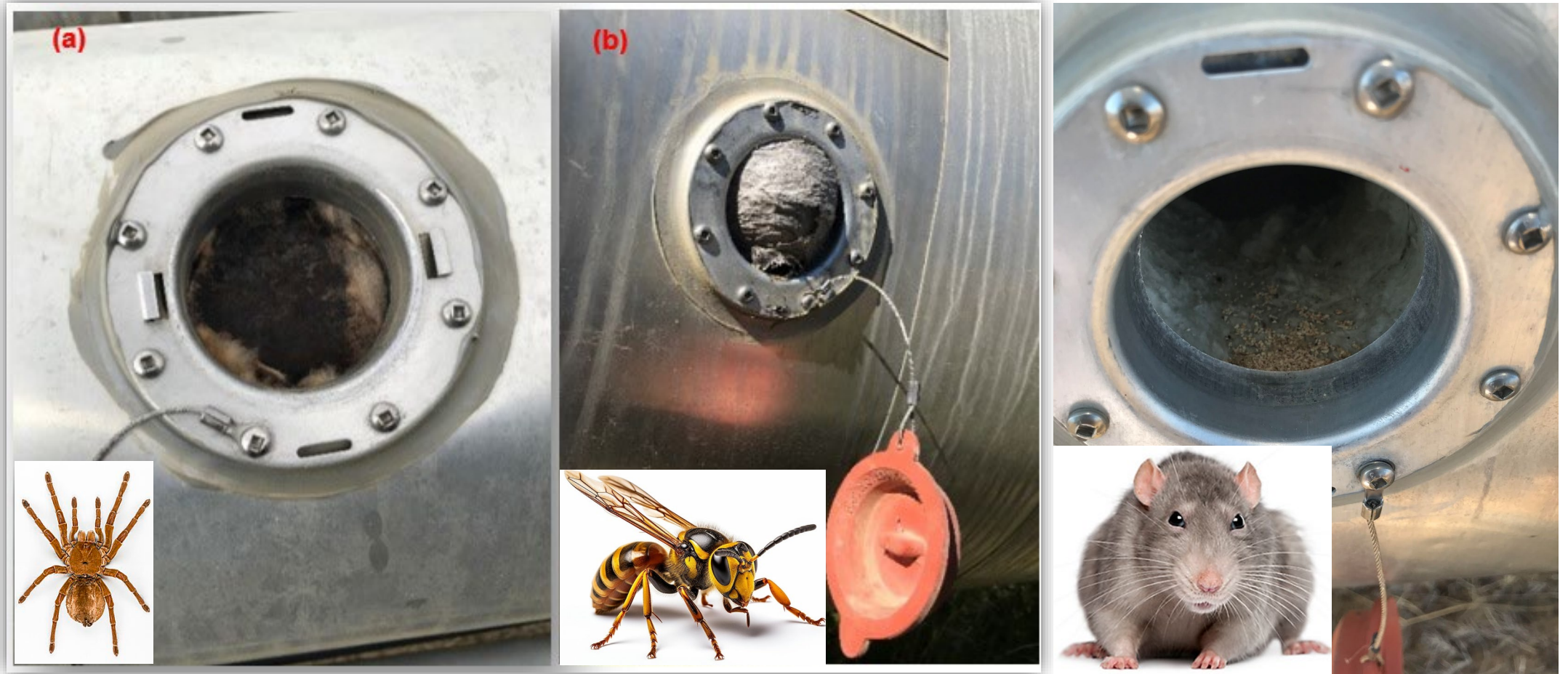
*16.3 m Inspection ports or plugs which are removed to permit thickness measurements on insulated systems represent a major contributor to possible leaks in insulated systems. Special attention should be paid to these locations. **Promptly replacing and resealing of these plugs is imperative.***





# CML PORTS

## CHALLENGES & NATURE'S DWELLINGS ☺



**Image Source:** Rana et. al., “Case Studies – Learnings from CUI Failures and Inspection Challenges,” CORROSION 2024 New Orleans, LA, Paper No. 21070 (Houston, TX: AMPP, 2024).



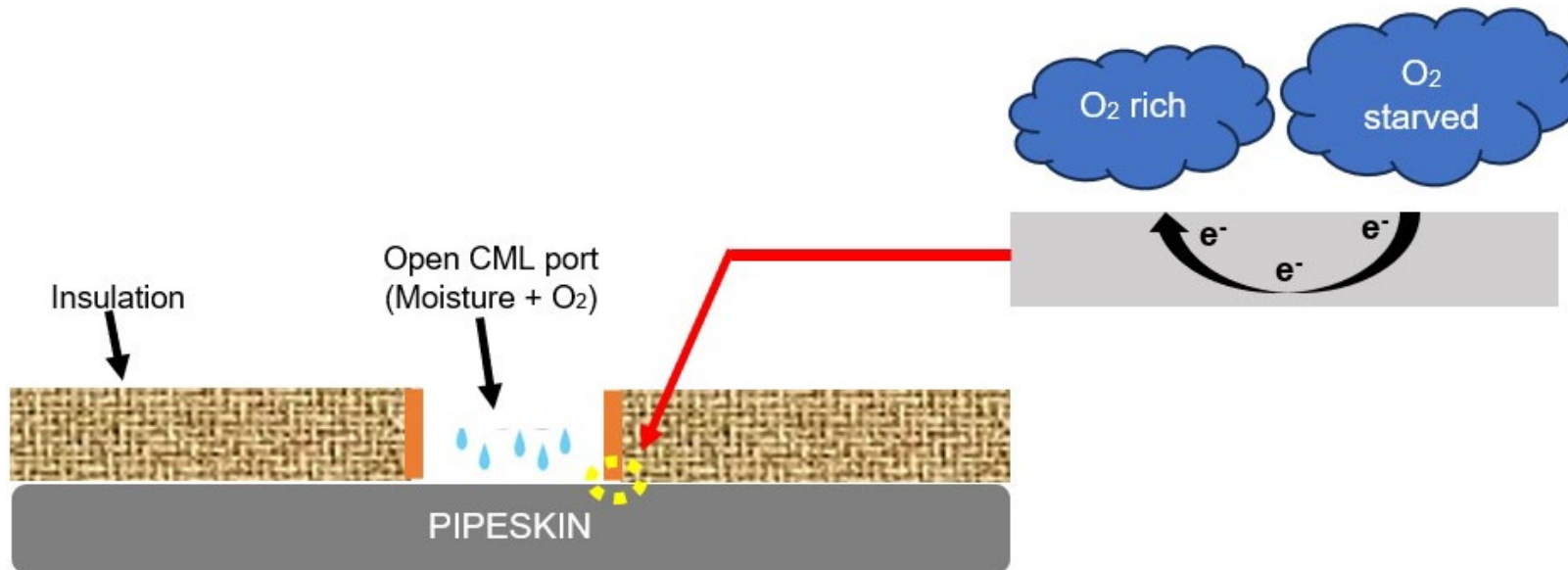
# CML PORTS CHALLENGES



**Image Source:** Rana et. al., "Case Studies – Learnings from CUI Failures and Inspection Challenges," CORROSION 2024 New Orleans, LA, Paper No. 21070 (Houston, TX: AMPP, 2024).

# CML PORTS CHALLENGES

- API 581 classification – CML ports as a high confidence data collection point
- Area around the CML point – Susceptible to localized corrosion
- Likely highest thickness loss point – yet goes un-inspected (as it's not scannable)
- Sealed covers – Crucial for CMLs in the first place

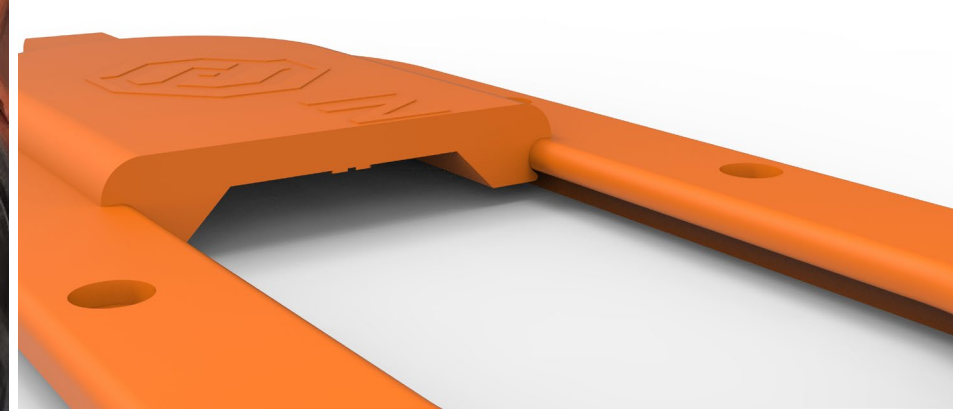


**Image Source:** Rana et. al., “Case Studies – Learnings from CUI Failures and Inspection Challenges,” CORROSION 2024 New Orleans, LA, Paper No. 21070 (Houston, TX: AMPP, 2024).



# CML PORTS DESIGN – FLEXIBLE METAL

## SOME BEST PRACTICE





# THERMAL LOSSES VIA CML PORTS

## SOME BEST PRACTICE ON TRADEMANSHIP

**API RP 583** clause 7.1 Insulation Removal evaluation

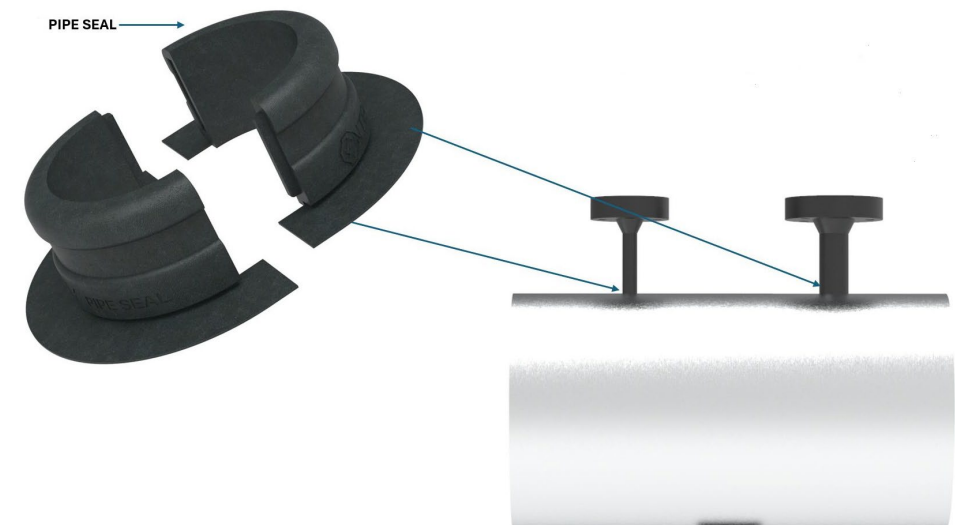
**"Can the insulation be removed for CUI inspection and remediation while the equipment/piping is in service without adversely affecting process control, product quality, and safety?"**





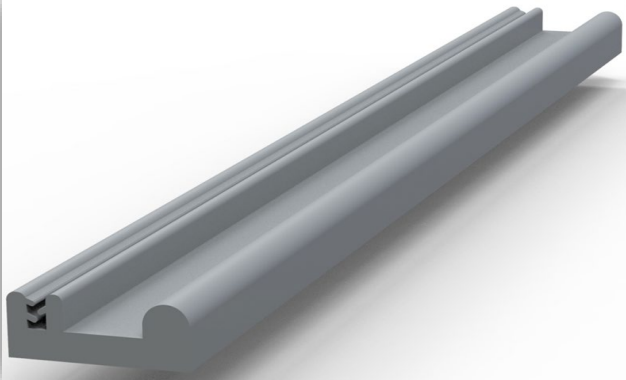
# AN ALTERNATIVE APPROACH PROTRUSIONS

- Avoidance of insulation (where possible) – Avoidance of CUI
  - Thermal losses
  - Process in-efficiencies
- Sealing around protrusions via Pipe seals
- Overcomes challenges – Otherwise with degradation of mere caulking sealants

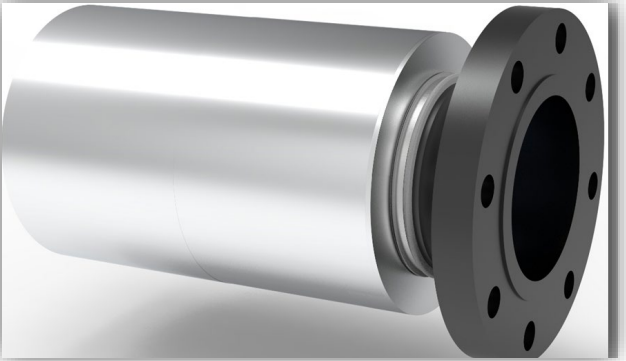


# SUMMARY - BEST PRACTICE

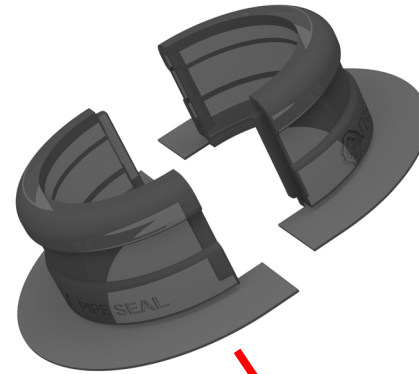
## MOISURE GATEWAY SOLUTION



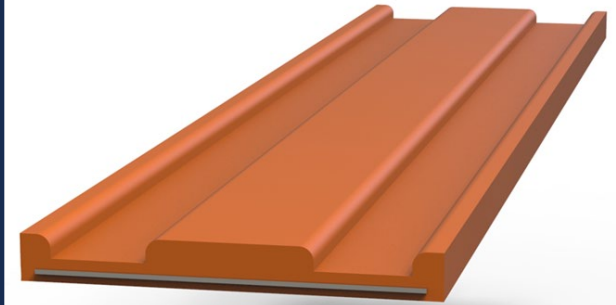
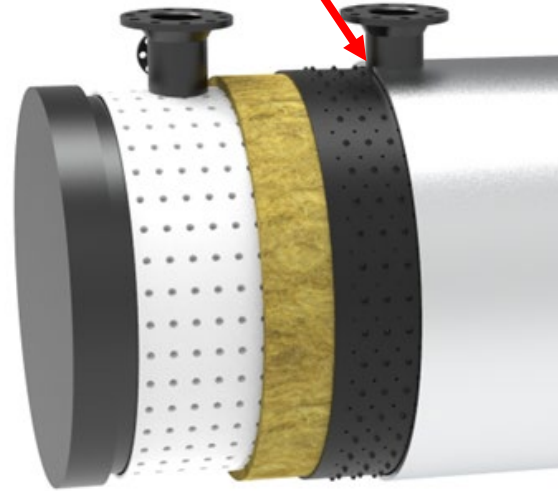
**Termination seal**



**Clamp Cover**



**Pipe Seal**

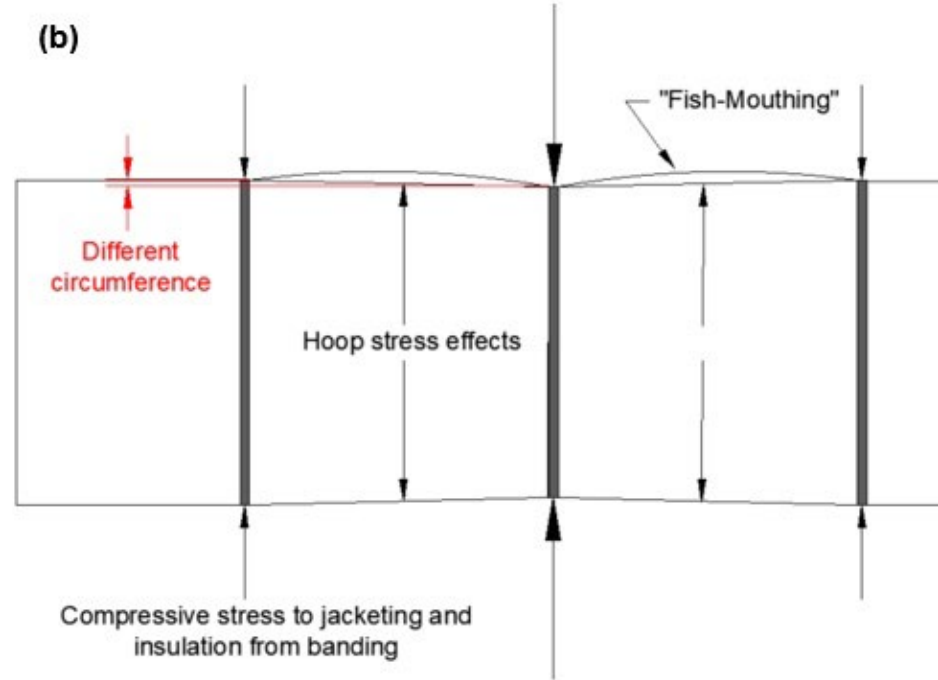
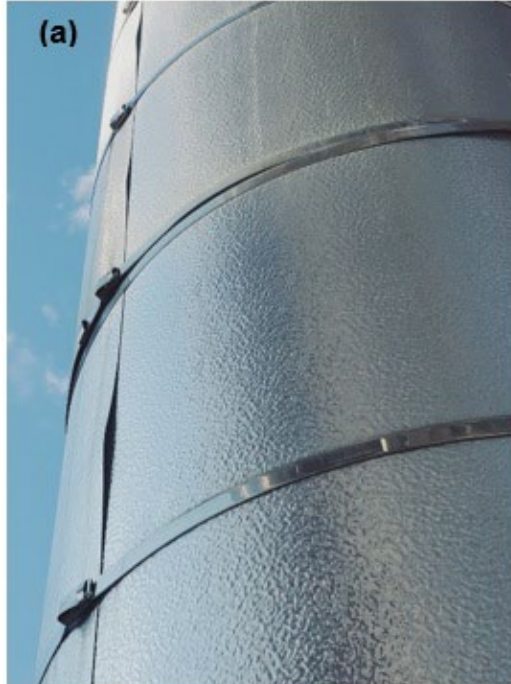


**Flange belt**

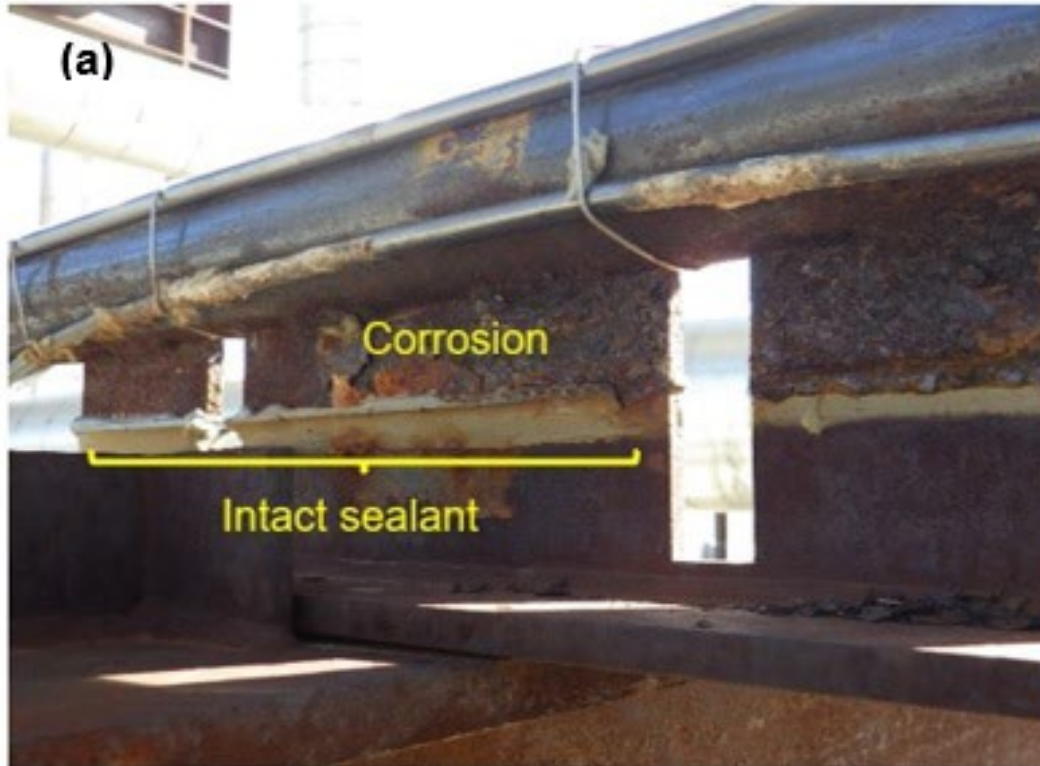




# SOME BEST PRACTICE FISH-MOUTHING/ KINKING AVOIDANCE



# SOME BEST PRACTICE SEAL vs NO SEAL @ LOW POINTS





# CLOSING THOUGHTS

## Moisture Gateways – CUI Triggers

- Workmanship
- Process conditions (Thermal Expansion/ contraction)
- Nature's Interaction (Falling trees, wildlife)
- Eventful loading
- Field retrofitting/ maintenance
- Deliberate (e.g., CML)

## Avoidable via proper design

## CML Port selection & management – Crucial to success of RBI Programs (High Confidence data source)

## Solutions and best practices in place

**THANK YOU!**