

Trial Structure to Evaluate Inspection of External Corrosion Under Insulation (CUI)

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Key Design Factors for Trial Programme

- Why field trial versus lab trial?
 - Drivers for field trial need to be clarified and included such as
 - Age and state of cladding, density of insulation, challenging geometries and access, variation in severity and morphology of wall loss
- Scope
 - Direct or indirect methods of detection
 - Quantitative or qualitative wall loss?
 - Range of insulation and cladding types and age, pipe sizes, geometries
 - Too broad – large trial size, too narrow – not widely applicable
 - Complementary to other trial programs
- Demonstration trial or independent validation (blind trial)?
 - Fully blind trials require:
 - Careful control of factors affecting probability of detection
 - Selection of sufficient test locations with range of moisture/wall loss to assess detection threshold and sensitivity
 - Accurate 3rd party benchmarking of test components for comparison with reported results
 - Independent third party analysis of reported results

NDT methods for CUI

Two main approaches - would require different trial structures

1. **Indirect methods** – find moisture in insulation which may be associated with CUI

- Can be faster than direct NDT methods
- But wet insulation doesn't mean there is CUI – coating breakdown is needed before CUI will start to develop
- Dry insulation may hide CUI - may have dried out at the time of the inspection

2. **Direct methods** – identify CUI through the insulation and cladding

- Several different NDT methods available
- Each method has pros and cons and is not universally applicable
- “Tool kit” of methods needed to cover range of components requiring inspection

NDT methods for CUI

Two main approaches - would require different trial structures

1. Indirect methods – find moisture in insulation which may be associated with CUI

- Visual examination
- Water collectors
- Moisture detectors
- Infra-red thermography
- Neutron backscatter

2. Direct methods – identify CUI through the insulation and cladding

- Strip and visual inspection
- Guided wave testing (inspection and monitoring)
- PEC
- Radiography (incl. real-time imaging)
- Advanced electromagnetic sensors
- Monitoring using permanently installed sensors

Factors Affecting Probability of Detection

HOIS trials, some in conjunction with NZTC, have demonstrated POD of corrosion under insulation using direct methods depends on different factors for different NDT methods.

Factors include:

- Pipe diameter and wall thickness
- Geometry changes (e.g. elbows)
- Insulation type and thickness
- Cladding type (ferromagnetic/stainless steel, aluminium)
- Corrosion morphology (localised pitting/extended corrosion, circumferential/axial extent)
- Maximum wall loss and cross sectional profile

Valid to draw comparisons between results from trials on these same components - but cannot generalise to areas of wall loss with different morphologies

HOIS/NZTC Guidelines for in-situ inspection of corrosion under insulation HOIS-G-023

Publicly Available HOIS Documents

Selection of relevant publicly available HOIS documents

- Available through the BINDT shop [HOIS Documents \(bindt.org\)](https://www.bindt.org)
- NII of pressure vessels
 - HOIS Recommended Practice for Non Intrusive Inspection of Pressure Vessels HOIS-RP-103
 - HOIS/NZTC Guidance Notes for HOIS-RP-103 HOIS G-103
- CUI
 - HOIS/NZTC Guidelines for In-Situ Inspection of Corrosion Under Insulation CUI HOIS-G-02
 - Update will be issued in Q3
- Hard to Reach
 - HOIS/NZTC Guidance for Trunnion Pipe Support Management and Inspection HOIS-G-033
 - HOIS Guidance on Image Quality for UAV/UAS based External RVI in the Oil and Gas Industry HOIS-G-005
 - HOIS Guidance on In Service Inspection and Integrity Management of Caissons HOIS(13)R6

Other HOIS work remain confidential to JIP members

Current projects include Remote Internal Inspection (RII)

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<p>HOIS Good Practice Guide on ISI of Offshore Composite Components – HOIS GP1 Issue 2</p> <p>£100.00</p> <p>View Details</p>	<p>HOIS Guidance for More Effective Pipework Inspection – HOIS-G-010 Issue 1</p> <p>£200.00</p> <p>View Details</p>	<p>HOIS Guidance on Image Quality for UAV/UAS-based External RVI in the Oil and Gas Industry – HOIS-G-005 Issue 1</p> <p>£200.00</p> <p>View Details</p>
<p>HOIS Guidance on In-Service Inspection and Integrity Management of Caissons – HOIS(13)R6 Issue 2</p> <p>£100.00</p> <p>View Details</p>	<p>HOIS Recommended Practice for Non-Intrusive Inspection of Pressure Vessels – HOIS-RP-103</p> <p>£200.00</p> <p>View Details</p>	<p>HOIS Recommended Practice for Statistical Analysis of Inspection Data – HOIS(12)R8 Issue 1</p> <p>£100.00</p> <p>View Details</p>
<p>HOIS Recommended Practice for the Non-Destructive Inspection of Weld Corrosion – HOIS RP2 Issue 2</p> <p>£100.00</p> <p>View Details</p>	<p>HOIS/NZTC Guidance on Inspection of Uninsulated External Corrosion Scabs – HOIS-G-028 Issue 2</p> <p>£100.00</p> <p>View Details</p>	<p>HOIS/OGTC Guidance for Trunnion Pipe Support Management and Inspection – HOIS-G-033 Issue 1</p> <p>£0.00</p> <p>View Details</p>
<p>HOIS/OGTC Guidance Notes for HOIS-RP-103 – HOIS-G-103</p> <p>£0.00</p> <p>View Details</p>	<p>HOIS/OGTC Guidelines for In-Situ Inspection of Corrosion Under Insulation (CUI) – HOIS-G-023 Issue 2</p> <p>£0.00</p> <p>View Details</p>	<p>Recommended Practice for ISI of Wall Loss in Pipes by Digital Radiography – HOIS RP1 Issue 3.1</p> <p>£100.00</p> <p>View Details</p>