

TLB Technology Managers' Network Meeting RSRUK Adoption of Non Invasive Inspection

10th May 2022

RSRUK Adoption of Non Invasive Inspection



Agenda

- 1) RSRUK Vision & Goals
- 2) RSRUK NII Adoption Road Map
- 3) NII Medium Term Planning
- 4) Detailed Inspection Planning
- 5) Inspection Effectiveness
- 6) RSRUK Next Steps
- 7) Concluding Remarks

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Applicable RSRUK Vision & Corporate Goals

- ▶ Greater adoption of Digital and Technology based solutions that bring value to Company
- ▶ Utilise technology to be more efficient by;
 - Improving effectiveness of inspection practices
 - Increasing our Probability of Detection (POD) for critical defects
 - Working safely – remove / reduce Confined Space Entry
 - Supporting Production Efficiency (PE)– through reducing Shutdown scopes (plant downtime)
- ▶ Adopting and Implementing Non-Intrusive Inspection supports these goals

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RSRUK NII Adoption Road Map (2019)



- ▶ Build visibility of forward plans to enable earlier identity of NII opportunities
- ▶ Build Competence & Capability of Company Resource
- ▶ Standardise the Assessment of NII Suitability and Evaluation of Results

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Risk Based Inspection Assessment Database (ARIA) – Overview & NII Assessment



V1620 - Slug Catcher (15-03 Gas Processing) Export Edit

Summary | General Details | Components | Documents | Condition | Consequence | Confidence | Likelihood of Failure | Risk Summary | **Future Workpack** | Notes

Change Log | Peer Review

Future Workpack Input

Internal Inspections Internal Risk **M** Confidence Grade 3 Inspection Frequency 72

NII Suitability Intrinsically Suitable and Appropriate Details Clear

Threat	Degradation Mode	Location / Vulnerable Features	% Coverage	Detection Method	Last Inspection	Next Inspection	Deferral
CO2 Corrosion	General Wall Loss	Internal	100	IVI	13/06/2016	13/06/2022	N
Erosion	General Wall Loss	Internal	100	IVI	12/06/2016	13/06/2022	N
Preferential Weld Root Corrosion	Weld Defects	Weld	100	IVI	12/06/2016	13/06/2022	N

Effective inspection depends on the planning process:

- Ensure a high probability that degradation concern is identified;
- Information on the state of equipment;
- Knowledge of the degradation mechanisms;
- Information on corrosion conditions in planning future activity.

Output:

- When to inspect (intervals)
- Where to inspect (coverage and locations)
- How to inspect (techniques and procedures)

No general NII approach always “equivalent” to IVI performance. Each vessel has to be treated individually

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Alignment with Work Management System (Maximo)



CMMS Alignment

Asset	System	Assessment	INT Maximo PM	INT Maximo Location	INT Maximo	INT RBI	INT Next Inspection	RAD Maximo PM
Montrose	15-02 Oil Processing	P-3190/3750/3210/3200	15-QM-060011-035	15-AC-SP3750	60	60	20/07/2024	
Montrose	15-02 Oil Processing	V1010	15-QM-801100-001	15-AB-V1010	48	48	25/06/2025	15-QM-060012-028
Montrose	15-02 Oil Processing	V1020	15-QM-802100-001	15-AB-V1020	24	24	03/06/2023	15-QM-060012-029
Montrose	15-02 Oil Processing	V1030	15-QM-801100-002	15-AB-V1030	48	48	13/06/2025	15-QM-060012-030
Montrose	15-02 Oil Processing	V1040	15-QM-802100-002	15-AB-V1040	48	36	30/06/2019	15-QM-060012-031
Montrose	15-02 Oil Processing	V1050	15-QM-801100-003	15-AB-V1050	120	120		15-QM-060012-032
Montrose	15-02 Oil Processing	V1090	15-QM-801100-004	15-AB-V1090	48	48	12/06/2023	15-QM-060012-033
Montrose	15-02 Oil Processing	V1100	15-QM-801100-005	15-AB-V1100	24	24	26/06/2023	15-QM-060012-034
Montrose	15-02 Oil Processing	V1510	15-QM-840100-001	15-AP-V1510	12	60	26/12/2021	
Montrose	15-02 Oil Processing	V2020	15-QM-801100-008	15-AD-V2020	60	60	25/08/2026	15-QM-060012-035
Montrose	15-03 Gas Processing	E2960	15-QM-821100-035	15-AD-E2960	N/A	N/A		
Montrose	15-03 Gas Processing	E-3020			N/A	N/A		
Montrose	15-03 Gas Processing	F-68110	15-QM-830100-001	15-CF-F68110	N/A	N/A		
Montrose	15-03 Gas Processing	H-68110			N/A	N/A		
Montrose	15-03 Gas Processing	S-6810			N/A	N/A		
Montrose	15-03 Gas Processing	V1070			N/A	N/A		
Montrose	15-03 Gas Processing	V-1470			N/A	N/A		
Montrose	15-03 Gas Processing	V-1500	15-QM-804100-007	15-CF-V1500	48	72		
Montrose	15-03 Gas Processing	V1610	15-QM-840100-003	15-AP-V1610	12	12	02/08/2022	
Montrose	15-03 Gas Processing	V1620	15-QM-802100-005	15-AG-V1620	72	72	13/06/2022	
Montrose	15-03 Gas Processing	V1630			N/A	N/A		
Montrose	15-03 Gas Processing	V1640			N/A	N/A		

ARIA © 2018-2022

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Inspection Workscope Development & Detailed Planning #1



Material	Carbon Steel		
Lining	None		
Operating Pressure	5.65barg	Operating Temperature	13 deg C
Design Pressure	17.2barg	Design Temperature	93 deg C
P-ID Number	MAPG-L-0040-010-D-AD00		
GA Number	A21653		
Details of defects	No internal defects noted from 2016 IVI (MON02149) and 2010 IVI (MON00937).		
Details of Historical defects	Saddle supports with Cat B corrosion, likewise to bolting. WO2990314 raised for corrective FM. Internal in an acceptable condition. Externally Cat B corrosion noted on nozzles K1AB along with 12mm blister @ 10 o'clock position of shell west side which was descaled with UT revealing no concerns.		
Access requirements	No specific access requirements other than working at height, rope access required		
CRA Type	Type 3		
RBA Grade	Grade 2		
RBA PoF	Low		
RBA CoF	High		
Inspection effectiveness requirement	High		
NII Suitable	Yes		
Inspection Requirement			
Zone	Damage Mechanism	Technique	Priority Areas
Domed Ends	CO2 & MIC	Corrosion Mapping	1. Vessel bottom half 2. Vessel top half
Shell	CO2 & MIC	Corrosion Mapping	1. Vessel bottom half 2. Vessel top half
Boot	CO2 & MIC	Corrosion Mapping	
Parent Material	CO2 & MIC	M-Skip	
Longitudinal Welds	CO2	TOFD	
Circumferential Welds	CO2	TOFD	
Nozzle Welds	CO2	Corrosion Mapping/RAD/Line Scan & Manual UT	
Parent Material	CO2	Phased Array UT	
Sign Off			
Asset Integrity Engineer			
Corrosion Engineer			
Lead Integrity Engineer			

NII Suitability	
Question	Justification
Is the vessel suitable for NII	Vessel operates at 13 degC. Vessel is not insulated. Material is Carbon Steel. Thickness is sufficient for NII techniques. External access is suitable for NII. Internal fixtures don't require to be inspected.
Yes	
Has the vessel been inspected previously	Last external CVI on 12/06/2019, last internal UT on 07/08/2016, last intrusive inspection 12/06/16
Yes	
Is the operating History still relevant	Yes, maximum operating pressure is 5.65 barg and maximum operating temperature is 93 degC
Yes	
Was the vessel specifically designed for NII	
No	
Is the vessel the same as other for which history exists?	
No	
Is entry scheduled for other reasons	No entry scheduled
No	
Confidence in ability to predict type and location of degradation	does not meet Type 4, Thorough assessment of damage mechanisms carried out in ARIA, however cannot rule out any additional mechanisms.
Medium	
Previous inspection Effectiveness	IVI supplemented by RAD and UT on nozzles. All flange faces inspected.
High	
Severity and Rate of Degradation	Negligible internal wall loss noted at last IVI. Minor pitting, <0.5mm deep, noted to flange faces.
Medium	
NII Possible	
Yes	

Provide clear instructions on how to inspect the vessel to meet the requirements of the NII:

- Techniques to be used
- Detection requirements of the techniques
- Locations to inspect

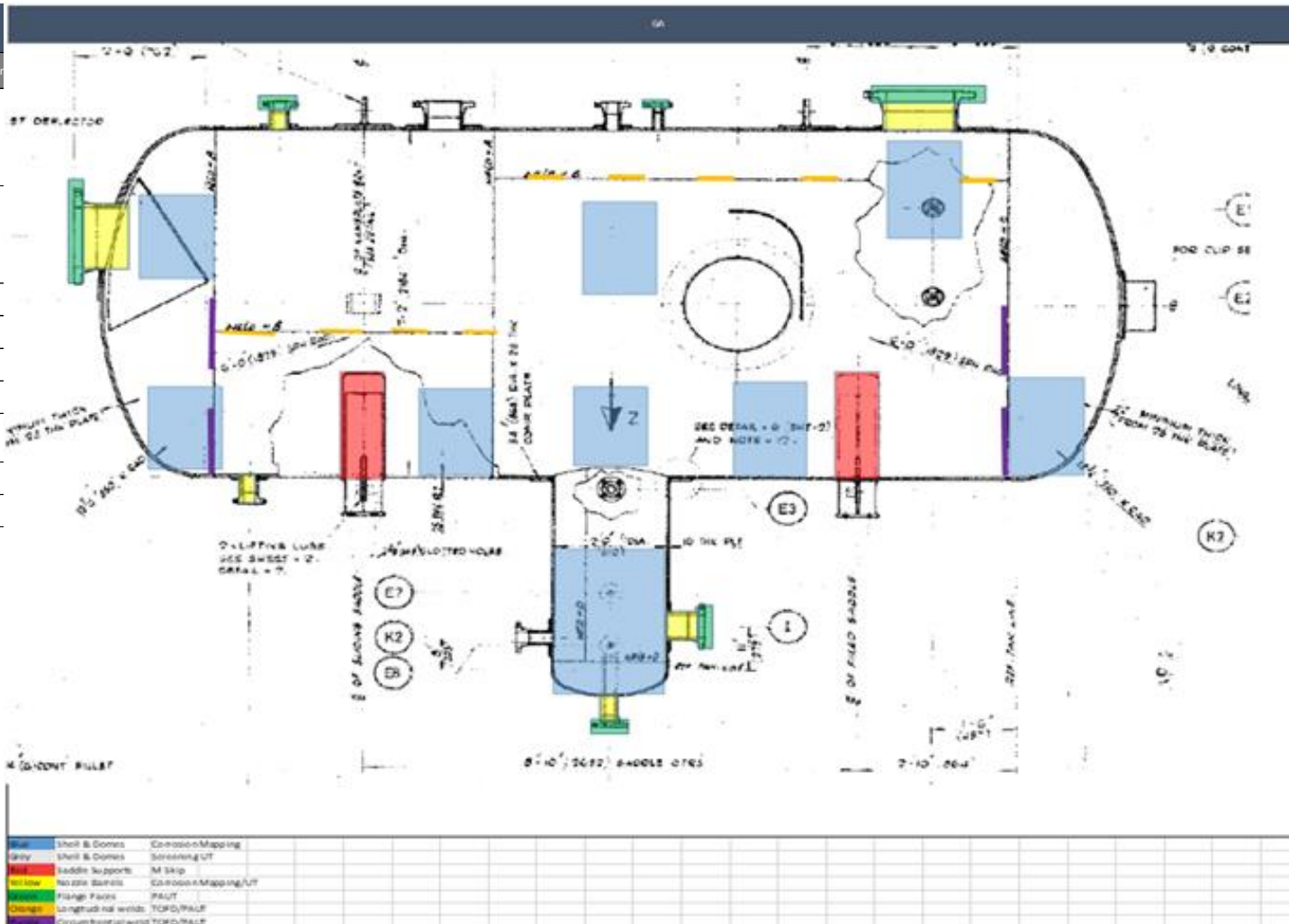
Developed by team responsible for RBIA, NII screening and inspection execution

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Inspection Workpack Development & Detailed Planning #2



Location	Description	Zone type	Damage Mechanism
Zone 1	Domed Ends	Parent Material	CO2 & MIC
Zone 2	Shell	Parent Material	CO2 & MIC
Zone 3	Boot	Parent Material <td>CO2 & MIC</td>	CO2 & MIC
Zone 4	saddle Supports	Parent Material	CO2 & MIC
Zone 5	Longitudinal welds	Longitudinal Welds	CO2
Zone 6	Circumferential Welds	Circumferential Welds	CO2
Zone 7	Nozzle welds (all sizes)	Nozzle Welds	CO2
Zone 8	Nozzle Flange Faces (all sizes)	Parent Material	CO2
Zone 9	Nozzle Barrels (all sizes)	Parent Material	CO2



Priority Areas	Comments
1. Vessel bottom half 2. Vessel top half	Round up to 10% coverage of the vessel shell and domes 3.5m2 in total with 14 x 500mmx500mm squares 7 squares on one side and 7 squares on the other side
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Accuracy and clarity essential.

Important that work specified can be achieved.

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Inspection Effectiveness Evaluation & Close Out

- ▶ NII provides basis for understanding condition, **but is only completed through analysis of the results**
 - Coverage achieved
 - Inspection method suitability
 - Coverage and location suitable
 - Conformance level & Result

<u>Zone</u>	<u>Description</u>	<u>Zone Type</u>	<u>%coverage required</u>	<u>%coverage achieved</u>	<u>inspection method (POD) suitable*</u>	<u>coverage and location suitable*</u>	<u>Conformance level</u>	<u>Result</u>	<u>Action</u>
1	Shell	C	90-100%	95%	Yes	Yes	1	Full replacement of IVI for Zone	Update RBI
2	Dome 1	C	90-100%	98%	Yes	Yes	1	Full replacement of IVI for Zone	Update RBI
3	Dome 2	C	90-100%	98%	Yes	Yes	1	Full replacement of IVI for Zone	Update RBI
4	Saddles	C	90-100%	100%	Yes	Yes	1	Full replacement of IVI for Zone	Update RBI
5	Long Welds	C	90-100%	98%	Yes	Yes	1	Full replacement of IVI for Zone	Update RBI
6	Circ Welds	C	90-100%	98%	Yes	Yes	1	Full replacement of IVI for Zone	Update RBI
7	Nozzle Barrels	C	90-100%	90%	Yes	Yes	2	Full replacement of IVI for Zone	Update RBI
8	Flange Faces	C	90-100%	100%	Yes	Yes	1	Full replacement of IVI for Zone	Update RBI

- ▶ Update the Risk Based Inspection Assessment with NII findings
 - Confirm damage mechanisms correctly assigned
 - Confirm damage locations as expected
 - Degradation rates correctly assigned
 - Next scheduled inspection type (NII / IVI)

Non Invasive Inspection

Concluding Message



- ▶ Robust Risk Based Inspection Assessment is essential to support NII
- ▶ Robust implementation can support reduced shutdowns leading to longer term asset sustainability
- ▶ NII will continue to play a key part in RSRUK integrity assurance program
 - It provides high POD when using advanced techniques – particularly when looking for specific types of degradation, acknowledging;
- ▶ Enhance NII delivery through use of 3D Digital models

- ▶ Internal visual inspection will continue to be utilised (**but must be thorough, carried out by competent personnel and effectively recorded**)