Leveraging Acquisition Of Thickness Measurement Using Wireless And Non-destructive (WAND) System For Sustaining Flowline Integrity

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Speaker Biography

- Name: Ariff Mohd Abdul Wahid
- Company : PETRONAS Carigali Sdn Bhd
- Position in company : Manager Material Corrosion & Inspection
- Years in the Industry : 14 years of professional experience in Material, Corrosion and Inspection in Oil and Gas Industry in Malaysia Asset.
- Experienced Material and Inspection specialized in a range of fields of upstream development covering Engineering, Procurement, Construction, Installation, Hook up & Commissioning with operational. Ensure holistic asset integrity inspection and corrosion monitoring for ageing facilities in Malaysia Asset.

WAND System

Presentation Outline

01 Objective & Case For Change

02 Methodology , Conclusion & Recommendation

03 Results & Value Creation

WAND System

bjective

To sustain proactive inspection efforts and compliment regular inspection inadequacy to further reduce risks of Loss Of Primary Containment (LOPC)

To ensure inspection can be executed in timely manner and reduce dependency to logistic and manpower requirement

To strengthen current inspection efforts with higher frequency and accuracy for better proactive analysis and mitigation implementation

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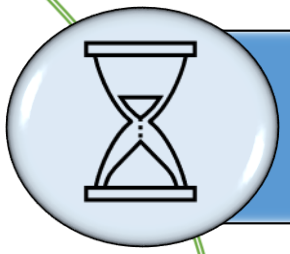
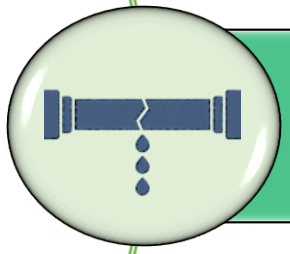
Case For *Change*



Sand production is an inevitable by-product in oil and gas industry especially for matured facilities.



Transportation of the sand particles from the wellbore to the surface impose erosion threats towards the flowline piping which requires quick verification for integrity analysis.

Constraint of conventional corrosion monitoring i.e logistics, manpower and technical capability. It is not cost effective for frequent mobilization of inspection equipment and competent personnel is required.

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Case For *Change*

Manual UT *Challenges*

Skilled inspectors are required

Time consuming processes

Inaccurate thickness trending

WAND *System*

Easy To Use

Reduces sources of human error

Zero Maintenance

Battery free sensors that are activated only when needed

Wireless Activation

Measurement can be taken in seconds, from sensors underneath insulation, coating and composite repair

Digitized Data

Measurements are logged digitally and managed remotely

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Methodology

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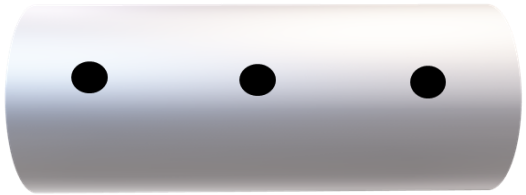
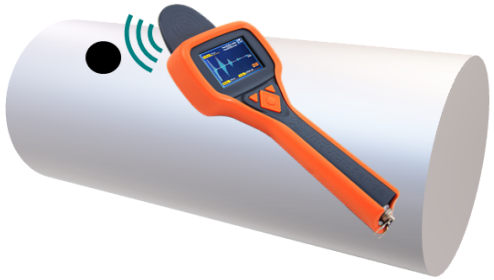
Methodology

1

Install passive **WAND sensors** at corrosion monitoring locations



2 Collect thickness data from the sensors using **Handheld Data Collector (HDC)** or **Remote Data Collector (RDC)**



3 Upload your thickness data to the **Service provider Data Analysis and Reporting)** cloud **Toolkit**

4 Manage and analyse your thickness data by using **service provider browser-based software**

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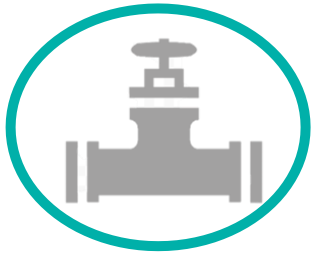
Methodology

Sensors Installation

APPLICATION

Monitoring flowlines suffering from sand erosion



LOCATION

Long radius elbows & area of turbulence after end caps

DATA GATHERING

For identification sensor location

- Well sand risk candidates from Surveillance team
- Verification with UT/CR screening method prior installation

HISTORICAL DATA

Identification of piping hotspot location through historical UT data trending

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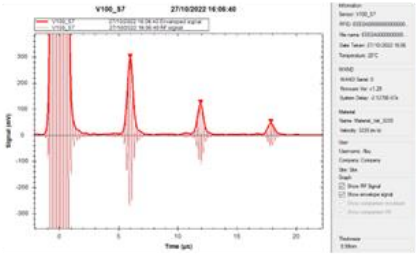
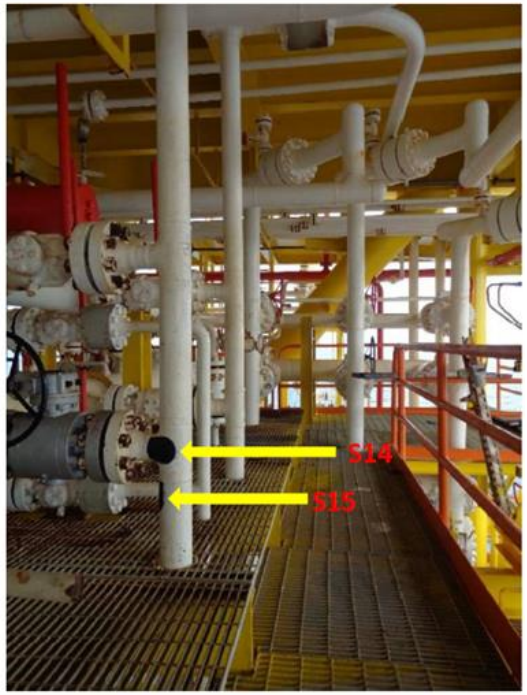
Methodology

Location of WAND Sensors



Field A



Field B

WAND System

Methodology

- WAND sensors are installed at **corrosion monitoring location (CML)** of sand erosion prone area. Additional sensors was installed adjacent to the identified critical locations to provide higher inspection confidence
- As of September 2023, **169 sensors** have been deployed across PCSB SBA platforms
- Based on data trending from 2021 to 2023, **100% sensors showed no fluctuations** of thickness data (within acceptable tolerance limit of 0.05mm/yr)
- Maximum erosion rate ever detected from the WAND sensor is **1.02 mm/yr**

WAND Data Trending

		Nov-21	Apr-22	May/June-23
WELL	Component	WAND Reading, mm	WAND Reading, mm	WAND Reading, mm
A	Tee	10.81	10.8	10.82
	Equal Tee	8.31	7.79	7.79
	Tee	15.74	15.73	15.75
	Equal Tee	8.5	7.95	n/a
	Tee	n/a	7.76	7.76
B	Center Tee	15.08	15.05	15.00
	Equal Tee	14.72	14.67	14.63
	Equal Tee	15.08	15.04	n/a
	Equal Tee	15.24	15.21	15.16
	Equal Tee	16.44	14.91	n/a
C	Elbow	8.69	8.1	8.1
	Elbow	6.09	5.55	4.53
	Tee	9.34	8.74	8.74
	Tee	11.23	10.65	10.68
D	Reducer	12.73	12.18	12.20
	Center Tee	12.35	11.76	11.74
	Straight pipe	8.68	8.28	8.22
	Center Tee	10.29	9.73	9.74
E	Reducer	12.14	11.6	11.6
	Tee	8.11	7.55	7.56
	Equal Tee	7.73	7.17	7.16
	Equal Tee	8.61	8.08	8.11

Field A

cation	ading (29/10/2022)	ading (01/02/2023)	ading (20/04/2023)	ading (18/5/2023)	(mm/yr)
Before desander	10.52	10.50	10.50	10.47	0.091
Before desander	13.92	13.92	13.92	13.92	0.000
Before desander	13.77	13.77	13.77	13.77	0.000
Before desander	13.50	13.50	13.50	13.46	0.073
Before desander	10.89	10.89	10.89	N/A	0.000
Before desander	10.09	10.09	10.08	10.08	0.018
Before desander	13.06	13.05	13.05	13.04	0.036
Before desander	12.79	12.79	12.79	12.79	0.000
Before desander	12.59	12.57	12.57	12.56	0.054
Before desander	13.00	12.98	12.98	12.95	0.091
Before desander	12.68	12.68	12.68	12.67	0.018
Before desander	10.87	10.87	10.87	10.87	0.000
Before desander	13.66	13.66	N/A	13.66	0.000
After desander	13.67	13.62	13.62	13.58	0.163
After desander	12.76	12.76	12.76	12.76	0.000
After desander					

Field B

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Conclusion

1. **WAND** system has successfully provided an accurate and reliable thickness data trending.

2. The acquisition of thickness measurement has become much easier, efficient and cost effective.

3. The **WAND** system allow fast response time for instant UT verification in the event of sand count spike which can be performed by Offshore regular crew without the need of mobilizing skilled inspectors.

4. Sustaining oil production of high sand wells through sustained flowline integrity via operationalization of **WAND t**echnology

WAND System

Recommendation

1. **Define** the best use cases by looking at areas where costs are high (e.g. Offshore manpower, CML's requiring scaffolding, locations requiring frequent inspection)

2. **Sand erosion** is highly dependent on the flow pattern and process condition; any process upset or any changes in the directional flow may also changes the location point of sand attack. Hence, it is recommended to not limit the number of sensors installed as this will give a higher inspection confidence.

3. For wells equipped with **desander unit**, it is worth to also add CML locations for WAND sensors at the downstream of desander unit

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Acknowlegement

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- Afizza Izzma Bt Mustapa Senior Manager Asset Integrity Management (IVA)
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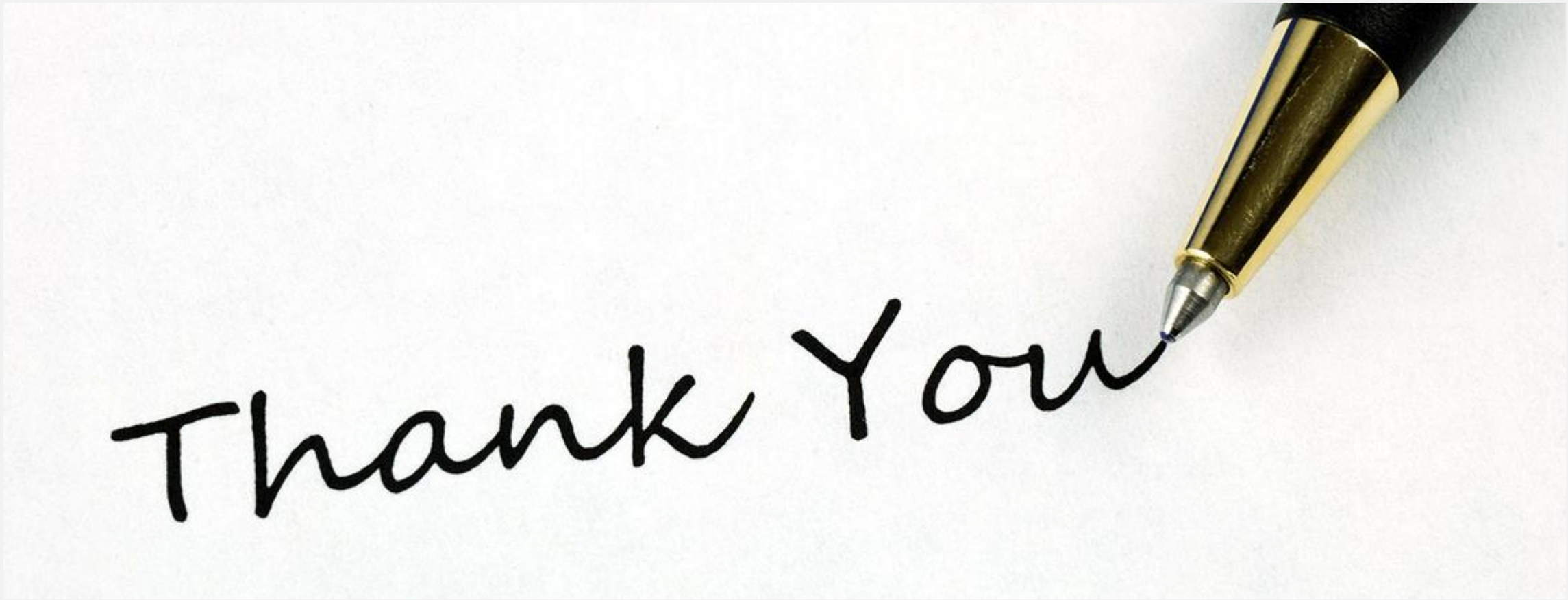

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