

INSPECTION OF DEPROPANIZER REBOILER TUBES

Industry: LNG | Country: Trinidad

INTRODUCTION & PROBLEM STATEMENT

Trinidad is the leading exporter of oil & gas on the global scale. A major natural gas processing and fractionating company was facing challenges on their aging heat exchangers. Since conventional technologies require higher degree of cleaning and longer duration of inspection, end user was in stalemate position due to the following:

#1: 20% of tubes are only inspected on each time of shutdown.

#2: Uncertainty on continuous operation of the heat exchanger as 80% left uninspected.

#3: Lack of precision on results to take corrective action and to predict the remaining lifetime of heat exchangers that are 20+ years in operation already.



This photograph is for illustration purposes only.

SOLUTION

APRIS was introduced by our customer in Trinidad. On looking into the advantages such as

1. Ultra-fast inspection (10 seconds per tube)
2. Any tube material (ferrous/non-ferrous/graphite/composite) shall be tested
3. Different tube configuration (straight/bend/multiple bend/fins)
4. Quick report generation support

The maintenance and operations team decided to perform a trial inspection on a reboiler tubes using APRIS and get the results compared with ECT (Eddy Current Testing) performed on it erstwhile. The details are as follows:

DATE OF INSPECTION	17 Oct 2020	TOTAL NO. OF TUBES	1,401
EQUIPMENT TAG NUMBER	E2700	TOTAL NO. OF TUBES INSPECTED	45
INSPECTION SITE	Trinidad	CONFIGURATION OF TUBES	Straight
END CUSTOMER		TUBE OUTER DIAMETER	19.05mm
COMPANY PERFORMING INSPECTION	Onsite Services Limited	TUBE THICKNESS	2.11mm
DESCRIPTION OF INSPECTION	DePropanizer Reboiler	TUBE LENGTH	15.1m
INSPECTION TECHNICIANS	Kirby & Jason	INSPECTION STANDARD	ASTM E2906/E2906 M-13/ASME BPVC 2019

The inspection was started at 10:30 am (Trinidad Time) on 17 Oct 2020. It took less than 30 minutes to complete the inspection of 45 tubes.

The data was analyzed, and preliminary report was issued at 1:00 pm (Trinidad time) to maintenance supervisor of the LNG plant.

Summary of the inspection results in comparison with ECT:

APRIS FINDINGS				ECT FINDINGS		
ROW	COLUMN	POSITION (m)	WALL REDUCTION (%)	WALL REDUCTION (%)	ROW	COLUMN
1	1	0.61	25	(0-19%)	1	21
1	2	1.03	25	(0-19%)	1	20
1	3	0.71	20	(0-19%)	1	19
1	4	0.39	15	(0-19%)	1	18
1	5	0.57	20	(0-19%)	1	17
1	6	0.66	20	(0-19%)	1	16
1	7	0.49	28.6	Block	1	15
1	8	0.41	25	Block	1	14
1	9	0.42	23.5	(0-19%)	1	13
1	10	0.73	20	(0-19%)	1	12
1	11	0.44	25	(0-19%)	1	11
1	12	0.96	25	(0-19%)	1	10
1	13	0.80	30	(0-19%)	1	9
1	14	0.70	20	(0-19%)	1	8
1	15	0.85	25	(0-19%)	1	7
1	16	0.73	25	(0-19%)	1	6
1	17	1.06	20	(0-19%)	1	5
1	18	0.62	25	(0-19%)	1	4
1	19	0.87	20	(0-19%)	1	3
1	20	0.87	10	(0-19%)	1	2
1	21	0.70	5% (Blockage)	Block	1	1
21	1	0.59	15	(0-19%)	21	39
21	11	1	25	(0-19%)	21	30
21	20	0.74	15	(0-19%)	21	20
21	30	0.81	30	(0-19%)	21	11
21	39	0.86	20	(0-19%)	21	1
42	1	1.1	20	(0-19%)	41	19
42	2	0.85	15	(0-19%)	41	18
42	3	0.74	10	(0-19%)	41	17
42	4	0.51	26.8	(0-19%)	41	16
42	5	0.83	20	(0-19%)	41	15
42	6	0.58	15	(0-19%)	41	14
42	7	0.6	20	(0-19%)	41	13
42	8	1.25	35	(0-19%)	41	12
42	9	0.61	30	(0-19%)	41	11
42	10	0.59	5% (Blockage)	(0-19%)	41	10
42	11	0.58	15	(0-19%)	41	9
42	12	1.03	20	(0-19%)	41	8
42	13	0.58	20	(0-19%)	41	7
42	14	0.86	20	(0-19%)	41	6
42	15	0.58	20	(0-19%)	41	5
42	16	1.32	5% (Blockage)	(0-19%)	41	4
42	17	0.52	15	(0-19%)	41	3
42	18	0.17	28.5	Block	41	2

Table 1: Comparison of APRIS vs ECT.

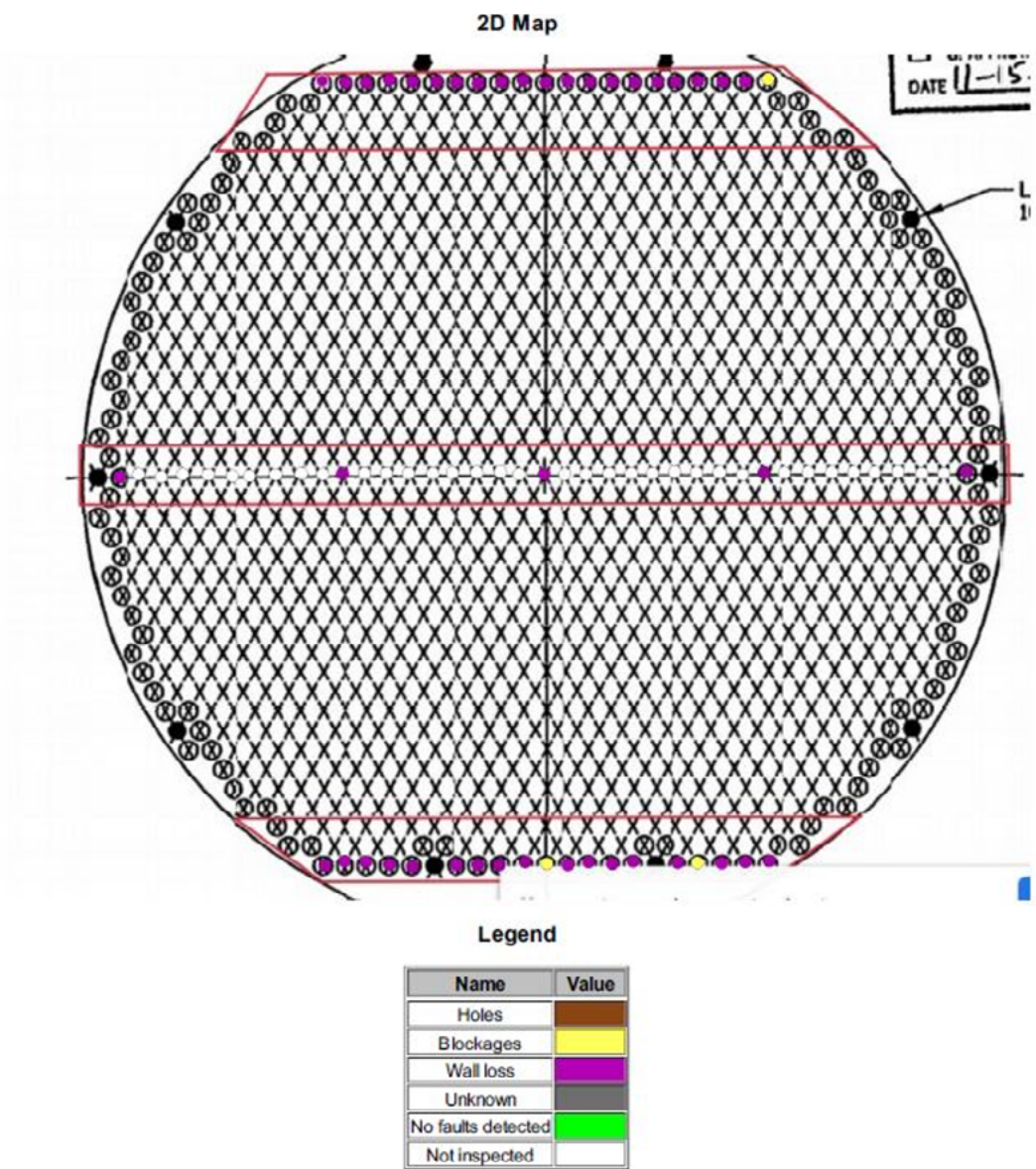
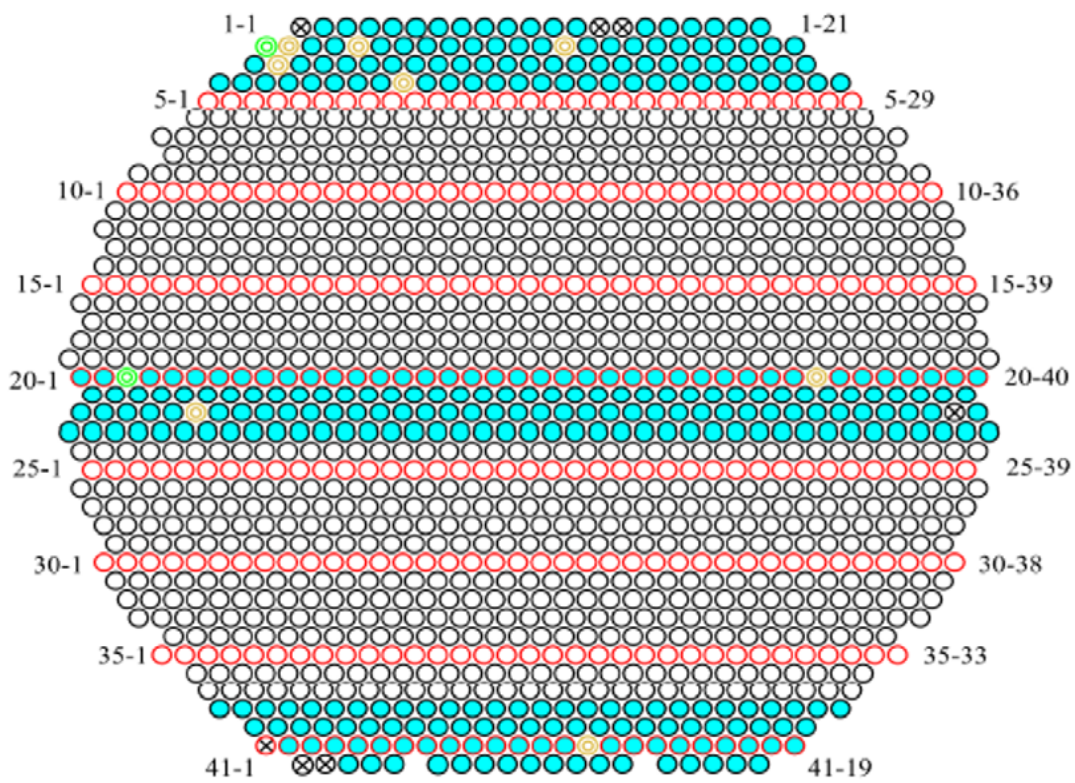


Figure 1: APRIS - Defect Map



Every fifth row highlighted in red

Legend (% Wall Loss)			
0-19 (337 Tubes, 24%)	40-49 (0 Tubes, 0%)	60-69 OD (0 Tubes, 0%)	Block (7 Tubes, 0%)
20-29 (0 Tubes, 0%)	40-49 OD (0 Tubes, 0%)	>70 (0 Tubes, 0%)	Inaccessible (6 Tubes, 0%)
20-29 OD (2 Tubes, 0%)	50-59 (0 Tubes, 0%)	>70 OD (0 Tubes, 0%)	
30-39 (0 Tubes, 0%)	50-59 OD (0 Tubes, 0%)	Not Tested (1047 Tubes, 75%)	
30-39 OD (8 Tubes, 1%)	60-69 (0 Tubes, 0%)	Plug (0 Tubes, 0%)	

Figure 2: ECT - Defect Map

CONCLUSION

Tubes that were inspected by ECT shows wall loss under the category 0-19%. So, as per end user, it's quite skeptical to understand ECT result, if the tube is with 0% wall reduction or 19% wall reduction. Such results trouble the end user in taking decision on corrective action. Hence, end user is convinced to use APRIS in-order to perform 100% inspection in a short duration and to provide precise result indicating location and size. This help them in taking corrective action and predicting the remaining lifetime of their heat exchangers.