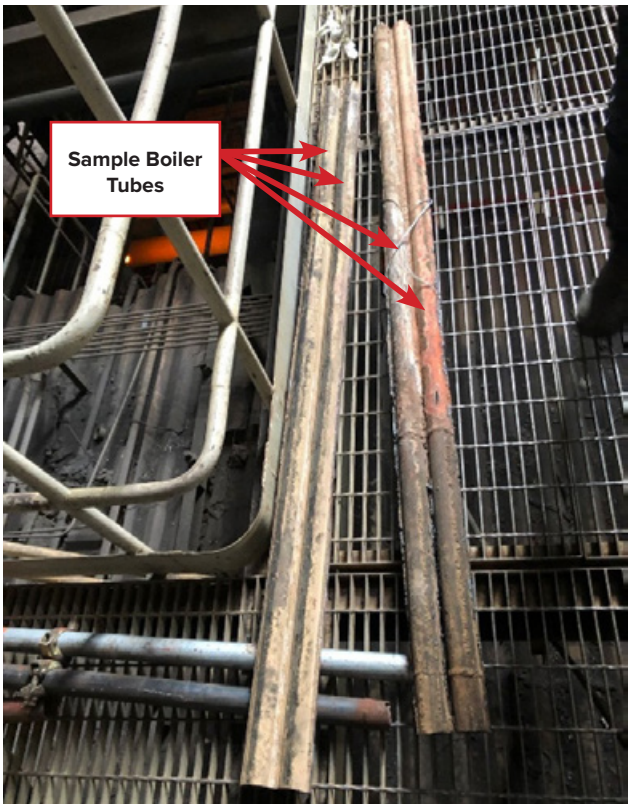
INSPECTION OF WATER BOILER TUBES

LOCATION	Indonesia

CONFIGURATION OF TUBES	Water Boiler Tubes

THE CHALLENGE

A client in the power sector wanted to validate a new technology that would increase their efficiency in tube inspection. Four cut boiler tubes were prepared for an APRIS trial as a test.



Four 2m sample boiler tubes.

Tube Specification of Sample Tubes

DATE OF INSPECTION	6 September 2021
DATE OF REPORT ISSUED	6 September 2021
TOTAL NO. OF TUBES INSPECTED	4
TUBE OUTER DIAMETER	51mm
TUBE THICKNESS	6mm
TUBE LENGTH	2m

THE SOLUTION

Acoustic Pulse Reflectometry Technology Inspection System (APRIS) can identify holes, blockages, and wall loss in a tube regardless of tube configuration and material. It is quick as it takes only **10 seconds per tube** for measurement and can give the **location and size** of the defects. APRIS can measure tubes up to 4 inches.

Tube Specification of Water Boiler

DATE OF INSPECTION	8 September 2021
DATE OF REPORT ISSUED	9 September 2021
TOTAL NO. OF TUBES INSPECTED	255
TUBE OUTER DIAMETER	51mm
TUBE THICKNESS	6mm
TUBE LENGTH	25m

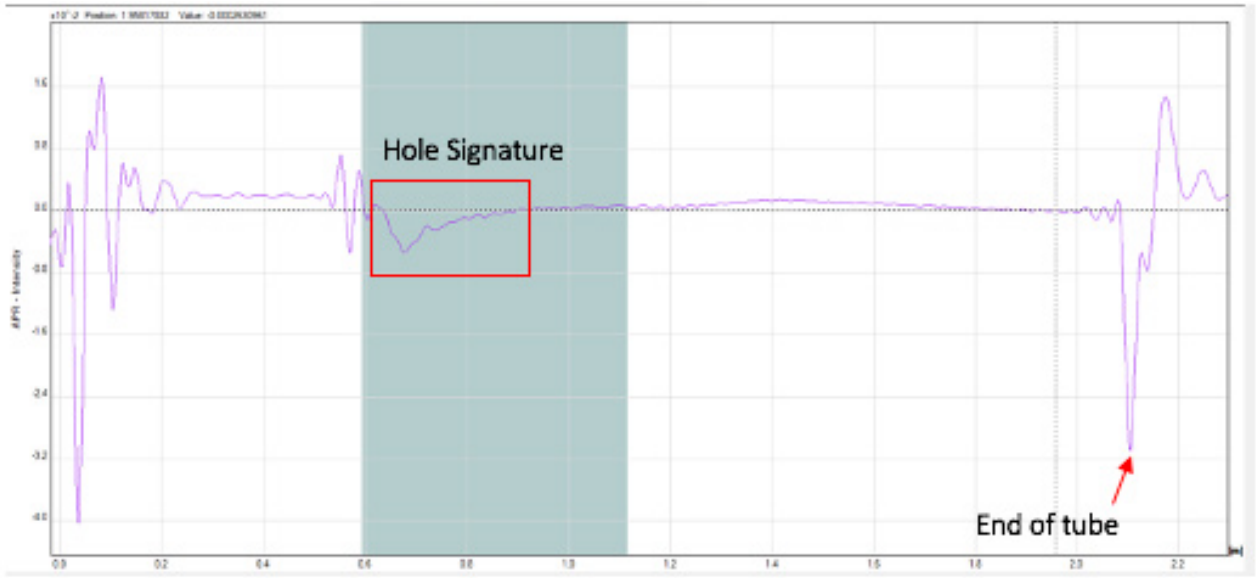
THE RESULT ON SAMPLE TUBES

After measurements were taken by APRIS on the sample tubes, a report was submitted within an hour. One boiler tube sample was found with a 5mm hole at 0.85m from the opening of the tube. Another sample tube was found with blockage and two sample tubes with wall loss as shown in Table 1.

Defect table by tubes

Fault ID	Tube ID	Pos[m]	Type	Size	Comments	Graph
4	R[1]C[1]	1.33	Wall loss	30 %		Link
7	R[1]C[2]	1.37	Wall loss	25 %		Link
9	R[2]C[1]	0.85	Hole	5 mm		Link
11	R[2]C[2]	0.55	Blockage	10 %		Link

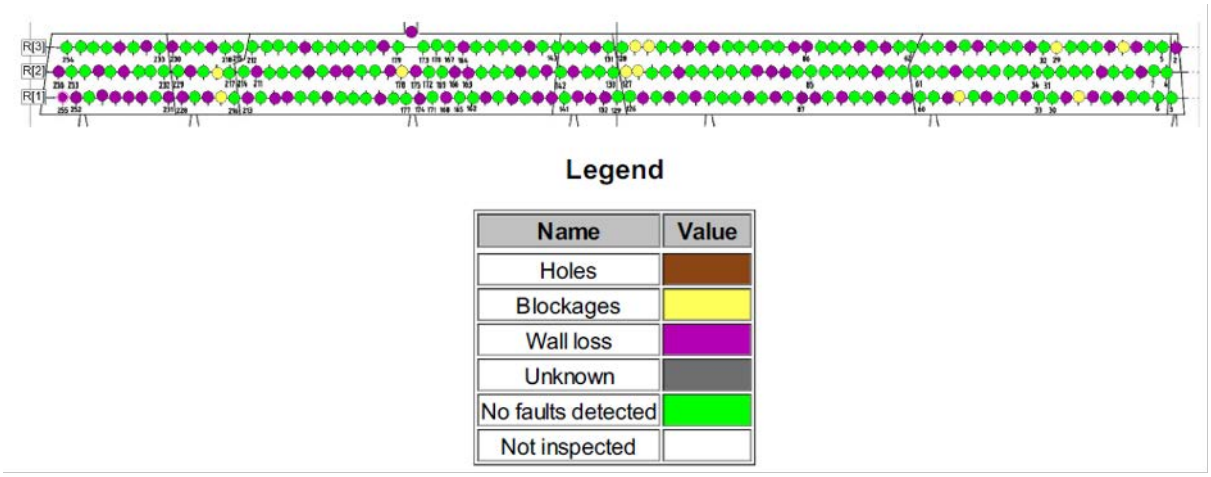
Table 1: *Defect summary table of sample boiler tube.*



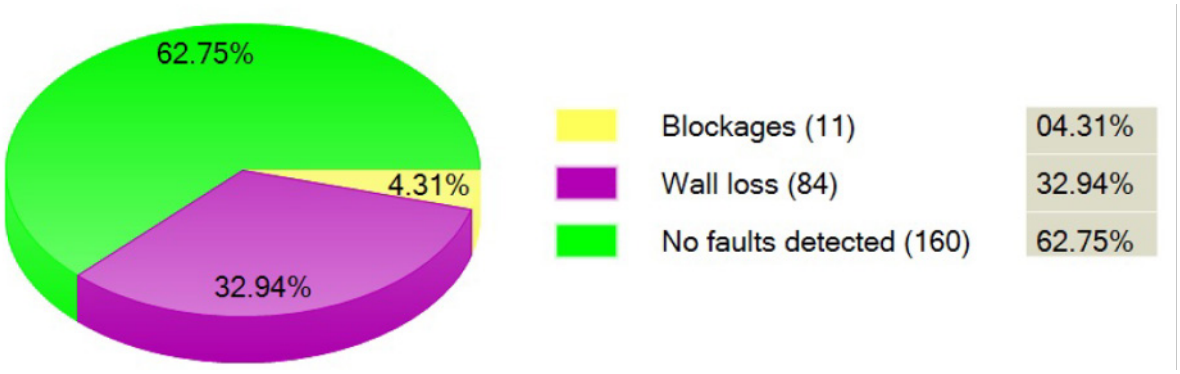
Software screen shot of hole signature of sample boiler tube.

THE RESULT ON WATER BOILER TUBES

After reading the insightful report of APRIS, the client made a quick decision to use APRIS to immediately screen the water boiler tubes. The APRIS software generates insightful information on the condition of the tubes using professional formats such as charts, tables, and images.



Water Boiler Map with defects indication.

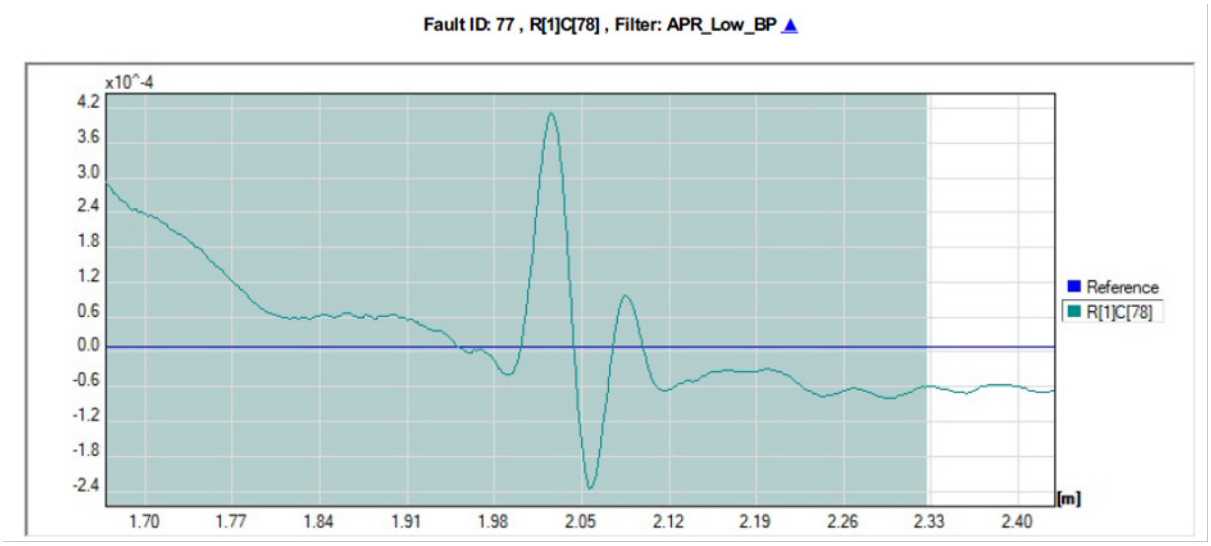


Fault distribution Chart

Blockages

Fault ID	Tube ID	Pos[m]	Cross Section Reduction[%]	Cross Section Reduction[mm]	Comments	Graph
19	R[1]C[13]	14.94	10	3.9		Link
69	R[1]C[69]	8.75	5	1.95		Link
77	R[1]C[78]	2.05	5	1.95		Link
91	R[2]C[13]	15	5	1.95		Link
105	R[2]C[28]	3.43	5	1.95		Link
109	R[2]C[27]	15.81	5	1.95		Link
123	R[2]C[45]	13.95	5	1.95		Link
125	R[2]C[44]	14.98	5	1.95		Link
161	R[3]C[44]	14.66	5	1.95		Link
163	R[3]C[43]	15.49	5	1.95		Link
183	R[3]C[75]	5.59	5	1.95		Link
187	R[3]C[80]	15.14	5	1.95		Link

Table 2: *Blockages table.*



Blockage signature.

Wall loss

Fault ID	Tube ID	Pos[m]	Wall Reduction[%]	Wall Reduction[mm]	Comments	Graph
1	R[1]C[5]	6.58	25	1.5		Link
3	R[1]C[2]	19.03	30	1.8		Link
5	R[1]C[1]	12.45	20	1.2		Link
7	R[1]C[4]	13.26	30	1.8		Link
9	R[1]C[7]	13.91	35	2.1		Link
11	R[1]C[6]	18.38	20	1.2		Link
13	R[1]C[9]	11.17	35	2.1		Link
15	R[1]C[10]	9.81	25	1.5		Link
17	R[1]C[12]	12.05	35	2.1		Link
21	R[1]C[15]	16.73	25	1.5		Link
23	R[1]C[18]	13.85	25	1.5		Link
25	R[1]C[17]	8.57	25	1.5		Link
27	R[1]C[21]	6.8	30	1.8		Link
29	R[1]C[25]	6.56	35	2.1		Link
31	R[1]C[30]	7.67	25	1.5		Link
33	R[1]C[28]	8.01	40	2.4		Link
35	R[1]C[33]	8.46	30	1.8		Link
37	R[1]C[35]	16	35	2.1		Link
39	R[1]C[37]	16.58	30	1.8		Link
41	R[1]C[38]	16.68	25	1.5		Link
43	R[1]C[40]	6.35	25	1.5		Link
45	R[1]C[42]	10.09	35	2.1		Link
47	R[1]C[41]	6.12	25	1.5		Link
49	R[1]C[45]	6.48	25	1.5		Link
51	R[1]C[47]	8.44	35	2.1		Link
53	R[1]C[49]	6.47	25	1.5		Link
55	R[1]C[53]	9.57	35	2.1		Link
57	R[1]C[55]	5.66	35	2.1		Link
59	R[1]C[57]	7.23	45	2.7		Link

Table 3: *Wall loss table.*

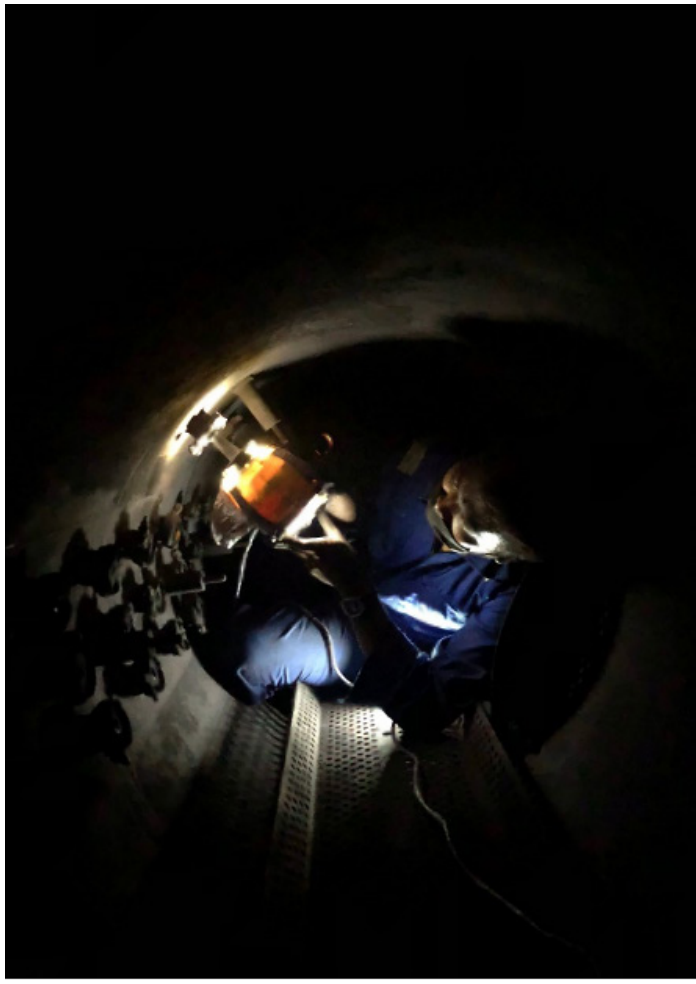
CONCLUSION

The advantages of APRIS were demonstrated by the following:

1. **Speed of measurement**:
   APRIS was able to quickly assess the condition of the tubes in a fraction of the time as compared to other technologies.
2. **U-bend defect detection**:
   APRIS was able to detect holes, blockages and wall loss.
3. **Sizing and location indicated**:
   APRIS indicated the size and location of the defects.

APRIS is recommended as the **initial non-destructive testing method** for applications such as condensers, reboilers and heat exchangers, which have defects originating from the inner diameter of the tubes.

APRIS was proven to be useful in quickly detecting inner diameter surface defects.



APRIS
ACOUSTIC PULSE REFLECTOMETRY INSPECTION SYSTEM