



Chemical Refinery (Italy)

Waste Heat Boiler Tube Inspection

OVERVIEW

Waste Heat Boilers utilize the heat in flue gases from combustion processes or hot waste air flows from industrial processes, to generate hot water or saturated steam. An increased use of waste-heat recovery by refinery/chemical/ petrochemical plants would also serve to mitigate greenhouse gas (GHG) emissions. The primary sources of waste heat in industrial facilities include exhaust gases from fossil fuel-fired furnaces, boilers, and process heating equipment.

Typically, waste heat boilers fail due to three primary factors; excessive temperature, excessive

mass flux rate and excessive water side fouling. Such fouling is a significant factor contributing to reduced reliability. Increased temperatures also affect the reliability of the Waster Heat Boiler because of its effect on the metal parts, which can cause corrosion. It also increases the heat flux through the tubes, which can result in creep and end of tube erosion.

Inspection activities are critical to information gathering for reliability considerations and failure analysis. The sulfur recovery unit of a refinery in Italy underwent an un-scheduled unit shutdown which incurred a production loss of a few

million dollars. The plant decided to conduct an inspection immediately.

Considering the factors such as the hard removal of fouling and the ferrule at the entry of the boiler, the use of tube testing techniques such as eddy current and ultrasonic, were not feasible.

The Technology

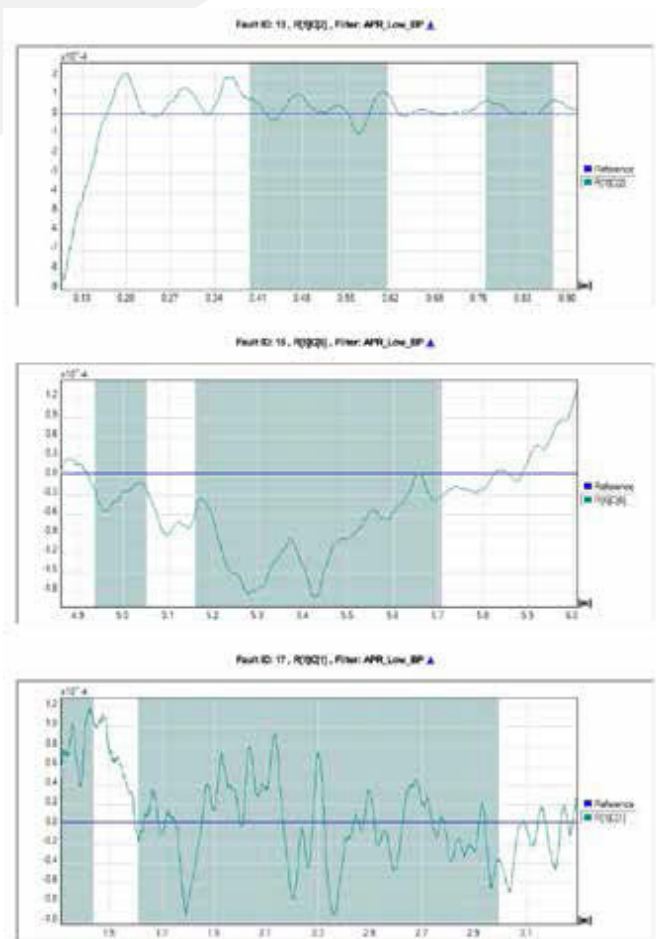
DETECTING THE FAULTS

The maintenance team selected APRIS for this inspection as it uses sound waves which is a non invasive method and its ability to detect precise locations of leaks in the Waste Heat Boiler.

A total number of 356 tubes were inspected.

The tubes that were reported to have leaks were then hydro tested to confirm the fault.

ø: 48.1mm T: 2.11mm L: 6.5m



Sample of Signals with Fault Signatures

OUTCOME RESULTS

It took only 1 hour and 15 minutes to inspect all the tubes.

Hard scales were reflected as blockages. However, leak(s) on 3 tubes were detected because scales didn't mask those. In addition to those, end of tube erosion was reported which shows ferrules didn't helped waste boiler in preventing end of tube erosion.

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Using APRIS, it was possible to have 100% of the tubes inspected for a precise understanding of their inner diameter condition.
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13% of tubes were plugged due to having a wall loss greater than 40%. A periodic inspection would be done every 6 months. It took 2 weeks to reach the same efficiency as before.