

## HRSG TUBE FAILURE DIAGNOSTIC GUIDE

### 6.3 LP Feedwater Tube #2 Case Study

#### 6.3.1 Background

A series of leaks developed in the last row of feedwater heater tubes in a HRSG. The unit consists of a GE 7FA combustion turbine and a HRSG supplying a total of 250 MW. At the time of the tube sample removal, the unit had 16,500 hours of operation and 560 starts. The unit had operated in a cycling mode, with shutdowns at night 5 to 6 times per week. Fuel was natural gas with reported 2 to 4 ppm sulfur content. Duct burners were operated approximately 2085 hours, also using natural gas for fuel.

Condensate water treatment utilized the combination of Morpholine and Cyclohexylamine for pH control and Carbohydrazide for oxygen scavenging. The condensate pH control band was 9.4 to 9.8. Target dissolved oxygen level was <5 ppb.

The tubes in the LP Feedwater section are finned, seamed SA-178 Gr. A, 2 inch OD, with 0.105 inch wall. The removed sample is from the last row of the LP feedwater heater harp. The tubes in this section showed evidence of extensive corrosion of the tube exterior and fins in short spans at various locations along the length of the tubes. The corroded areas appeared wet, with evidence of weeping leaks at static head pressure.

Prior to the discovery of the weeping leaks in the last row of feedwater heater tubes, the unit had operated with tube leaks upstream. The cause of the upstream leaks was not associated with this failure mechanism. The unit may have operated with upstream leaks for periods of several weeks or more prior to the leaks being fixed.

#### 6.3.2 As-Received Condition

Figure 6-22 shows an exterior view of the specimen as-received. The leak region is identified immediately below an area of white deposits on the fins. The fins in the leak region are heavily corroded. Figure 6-23 shows a close up of the leak region. Extensive fin corrosion can be clearly seen.

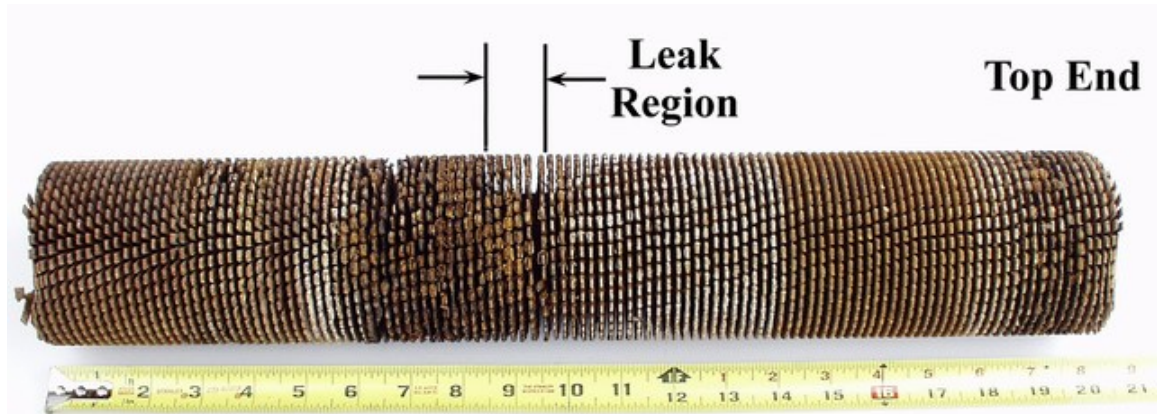
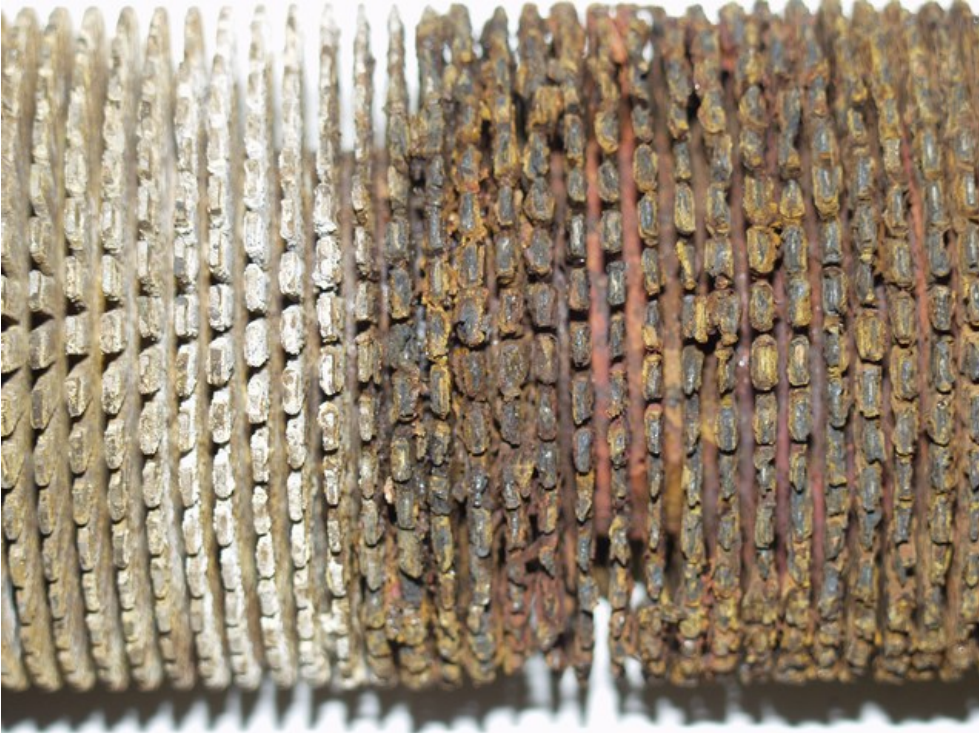


Figure 6-22 Exterior Surface of Tube

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**Figure 6-23** Close up of leak region



**Figure 6-24** ID Surface of Specimen Viewed from End