



Geothermal Plant (Turkey)

Isopentane Condenser Tube Inspection

OVERVIEW

The main purpose of the condenser is to maximize turbine efficiency by maintaining a proper vacuum by condensing steam, removing dissolved non condensable gases from the condensate and conserving the condensate for re-injection or as feed water for the cooling tower. The maintenance of a geothermal plant is very dependent on local factors, namely, the geothermal system, location, weather, and climate. The predominant problems with condensers are corrosion, stress corrosion cracking, scaling, erosion, and slug flow.

A geothermal plant in Turkey uses an Isopentane Condenser Tube (straight with fins over the tube) as part of a binary cycle with a production capacity of 60MW. A leak in the condenser will cause mishaps for the plant which poses a hefty penalty from the local government for the production loss and impact on the environment due to isopentane.

Hence, this plant adopted preventive maintenance approach to maintain the operating efficiency, reliability and safety.

Though preventive maintenance at the plant was in place, they could not afford a longer downtime. They were facing some leaks that resulted in loss of almost half a million dollars everyday. Before, it was too difficult for the plant to inspect 100% of tubes because of various factors such as higher end cleaning, longer inspection duration due to ultrasonic technique.

The Technology

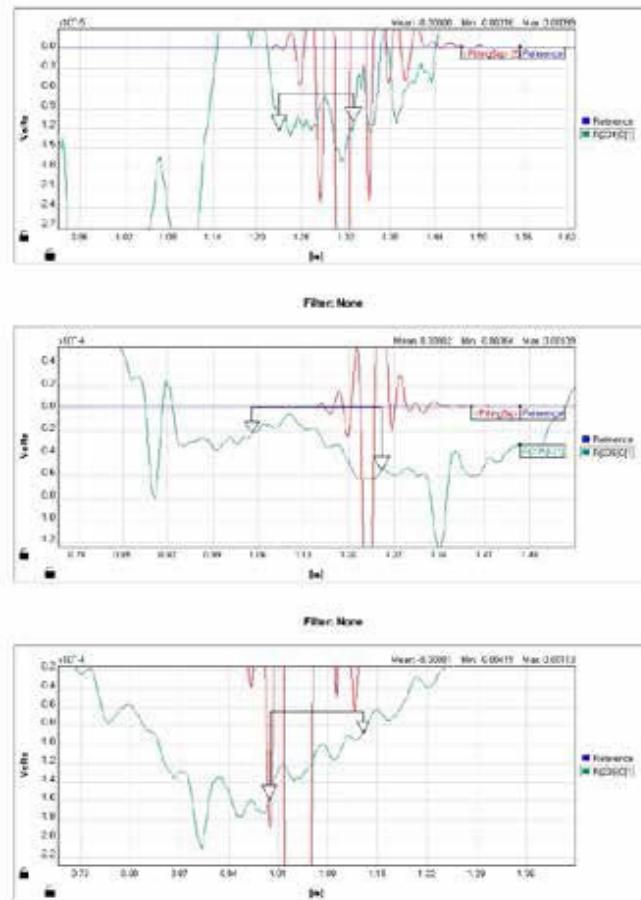
DETECTING THE FAULTS

APRIS was selected as it takes only 10 seconds per tube for an inspection and has a capability to detect wall loss which is the root cause of leaks in such condenser.

A total number of 512 tubes were inspected (256 tubes per bank).

The tubes were inspected using a customised extension because this isopentane condenser had a header and fins over the tube.

ø: 19.05mm T: 2.11mm L: 13.1m



Sample of Signals with Fault Signatures

OUTCOME RESULTS

It took only 2 hours to complete the inspection. The customer expressed their satisfaction on the faster inspection and precise indication of defective tubes and its location. This shall aid them to calculate the corrosion growth rate and remaining life time of such condenser.

1

Using APRIS, it was possible to have 100% of the tubes inspected for a precise understanding of their inner diameter condition.

2

23% of the tubes had corrosion. 4% had 50 - 60% wall loss and had to be plugged.

The rest of the tubes were to be monitored periodically every 24 months.