Steam corrosion in CCGT power plant

High- temperature, high-precision corrosion monitoring of steam piping circuit in CCGT power plant

Key deliverables

- The asset integrity and process control teams are able to operate the asset with the confidence of knowing that it is within safe operating limits. The risk of requiring future unplanned outages has been reduced.
- HotSense probes operate at temperatures up to 600°C, under insulation – this is a revolutionary achievement for asset integrity monitoring in the energy industry.
- Wireless, automated ultrasonic CALIPERAY nodes provide high precision wall thickness measurements to the operator at high-frequency, without needing to remove lagging or access the asset – saving indirect inspection costs.
- As well as detecting the wall loss, the system also identified a leaking valve on one of the lines.
- The cost of inspecting the asset was reduced and the safety of the inspectors has been increased.

Overview

A power plant, with a combined 800 MW cycle gas turbine (CCGT), sought to implement on-stream corrosion and erosion monitoring to gain insights into the impact of varying process conditions on the asset integrity of critical high-pressure steam lines.

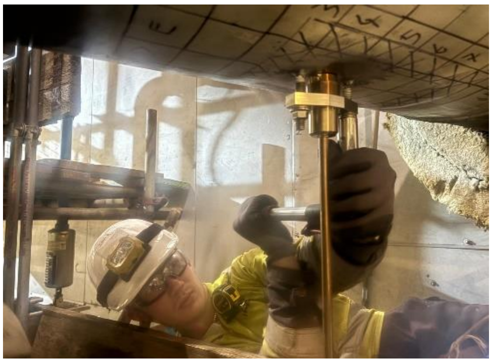

Figure 1, HotSense UHT probe and welded deployment during installation

The site has two steam turbines experiencing accelerated wall loss in the injection circuits of both turbines. With surface temperatures approaching 600 ° C, access to inspection personnel is limited whilst operational, meaning remaining wall thickness inspections were only feasible during shutdown periods, thus introducing an undesirable level of uncertainty and risk. With IRISNDT and Ionix providing data to the client in monthly reports as part of the Systems and Data Health Check package, the customer can safely operate the plant, maximise availability and production all without increasing budget spent on inspections and access. This gives assurance that the plant is operating safely and enables the impact of varying process conditions to be evaluated against asset integrity whilst minimising operational disruption.

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The Challenge

The areas under inspection consisted of an NPS3” line leading to an injection valve into a 24” steam line. All lines cycle from ambient to >560 °C in a number of hours. All lines have between 50-75mm of insulation and lagging. Due to the temperature and access limitations, the line could previously only be inspected during an outage. For a monitoring system, the extreme cycling temperatures presents a challenge with regard to sensor survivability, coupling and installation robustness, and precise, temperature-compensated measurements.

The Solution

- Fixed point HotSense™ sensors with a solid couplant were chosen to provide a sensor that could provide stable and reliable thickness measurements with a detectable wall loss across the wide operating temperature range up to 600 °C.
- The HotSense™ welded stud deployment system was utilised to deploy opposite the injection point on the NPS 24” line. Straps were used to install on the NPS 3” lines.
- The sensors were connected to CALIPERAY WirelessHART devices and all measurements sent back to the FDLK data collection server. The FDLK was installed in one of the turbine halls and linked to the neighbouring hall using fibreoptic lines.
- Remote access to the data was provided via the Ionix secure remote access gateway.

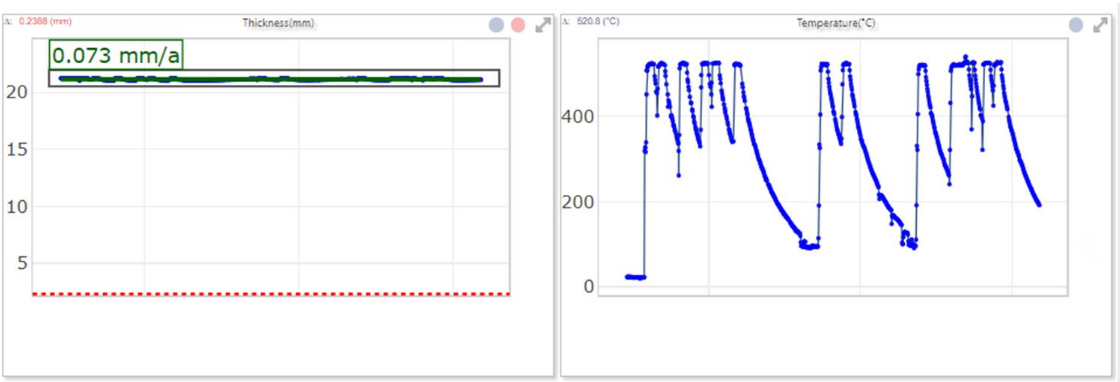

Figure2, Example temperature compensated thickness measurements with calculated wall loss and measured temperature

Execution

- The complete solution was successfully deployed by IRISNDT in the 3-day turnaround period.
- Sensors with thermocouples for accurate compensation were installed under insulation to enable temperature compensation as the plant cycles. The CALIPERAY temperature scaling functionality was utilised to further enhance the precision of the temperature-compensated measurements.
- Data is available to the service provider, IRISNDT, remotely and presented to the customer in quarterly reports as part of the SDHC package from Ionix.
- Measurements are made every hour to capture not only the wall loss but also the thermal cycling of the plant – this lead to the identification of a leaky valve on one of the lines, contributing to the accelerated wall loss.