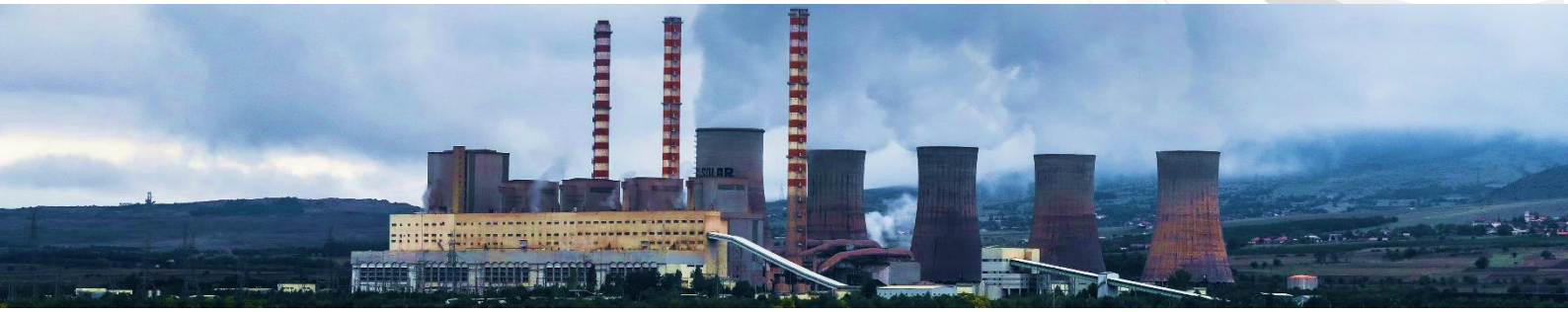
High-precision wall thickness monitoring in nuclear power plant

In-service, high-temperature, high-precision wall loss monitoring of steam piping circuit in a nuclear power plant



Overview

A solution was sought by a European nuclear power plant (NPP) to monitor high-pressure steam lines in proximity to the electricity generating turbines. Previous assets had been experiencing wall loss due to steam condensate causing erosion at piping T-junctions and as such had been replaced. The operator suspected that the wall loss rate and location was accelerated due to process conditions and so sought to collect data at increased frequency to allow wall loss rate to be correlated with specific process parameters. The operator was also advised that the greatest wall loss may occur during the first year of operation of the new piping and so a solution which could be installed immediately was required.

The non-standard steel 21" and 25" NPS diameter steam lines, with surface temperatures above 230 °C, were located across several levels up to 30 m high in an area that is restricted to personnel during operation.

The Challenge

There were a number of challenges around the deployment which required a flexible monitoring solution.

- A high-temperature wall thickness monitoring solution was required which could operate over 230°C continuously.
- The pipe geometry was non-standard and the monitoring locations were distributed around two T-sections.
- The piping is lagged, and the location is inaccessible during normal operation.
- The wall loss was thought to be process dependent, requiring a high-frequency of measurements.
- Wireless/RF systems are restricted in proximity to sensitive electricity generating plant.
- The equipment needed to be installed very short notice before the end of a shutdown as subsequent access would not be possible.

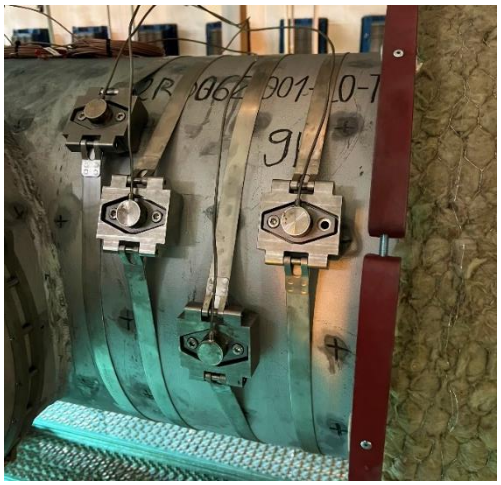
+44 (0) 1484 505 859
contact@ionix.at
ionixadvancedtechnologies.co.uk

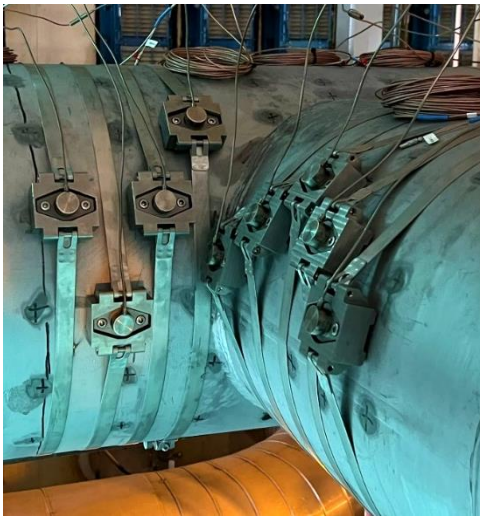
The Solution

- 16 x HotSense 380 sensors were deployed around each T-junction to provide a sensor which could operate continuously above 230 °C and provide a stable and reliable thickness measurement.
- The HotSense strap deployment system allowed for fast installation during the limited shutdown and offered flexibility to place sensors in the expected pattern to detect wall loss.
- Initially, all sensors were connected to Measurement Hubs for manual data collection from a lower platform using a GE flaw detector.
- The CALIPERAY automated monitoring system was inspected by the local electrical engineering team and the radio output found to be of no concern to the safe operation of the site.
- The Measurement Hub was subsequently upgraded to a fully automated CALIPERAY WirelssHART node with Field Deployment Logging Kit (FDLK) for simple implementation and data collection.

Execution

- The full system solution was successfully deployed within 2 months from initial enquiry to meet the scheduled turnaround.
- All sensors were successfully installed within the first day. The NPP inspection team had live, continuous, reliable wall thickness data within 24 hours of the equipment being delivered on site.
- Transferring from a rapid deployment, non-wireless, Measurement Hub solution to the fully WirelessHART CALIPERAY system provided a path to monitoring that met the clients time scales and security and





Key deliverables

- High frequency, high quality data from inaccessible locations allows maintenance teams to optimise repair and replacement programs to **increase safety, maximise productivity and reduce costs**.
- Frequent, consistent and high-quality wall thickness data collection now enables the customer to **minimise unplanned shutdowns and maximise plant up-time – ROI with hours**
- **Plant and personal safety was increased** by increasing inspection frequency whilst removing personal from hazardous environments.