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Nuclear power plant inspection using WAND sensors

Overview

Piping systems on a nuclear power plant are subject to aggressive corrosion, which cause thinning of the pipe wall. It is necessary to take thousands of thickness measurement from specific locations on this pipework manually during the outage of the plant. Much of the pipework is covered in a layer of insulation which needs to first be removed (and then replaced afterwards) which can be expensive. This process takes time and thus increases the exposure of the inspector to radiation. Radiation can also adversely affect electronic devices over prolonged periods.

For nuclear power plant inspection, there is a need for efficient measurement techniques that minimize costs, as well as man hours spent on the asset. Inductosense WAND thickness monitoring sensors have a low-profile design which means they can be embedded underneath insulation. They are wirelessly activated by the WAND handheld data collector, which means thickness readings can still be acquired without removing the insulation itself. The WAND sensors are battery-free, which means prolonged exposure to radiation would not impact their functionality.

In partnership with Hitachi, Inductosense carried out a trial to test the performance of the WAND sensors in a simulated nuclear power plant environment.

The results from the tests show that:

- ✓ **The WAND sensors have the capability to monitor different thickness of pipe walls under insulation (used in nuclear power plants), without needing to remove the insulation itself thanks to the wireless WAND handheld data collector**
- ✓ **The data collection process is quick, taking a matter of seconds, thus helping to minimize inspection time**
- ✓ **The WAND sensors can be exposed to radiation levels present in nuclear power plants**

HITACHI

The testing, at a glance…

1 Comparison against conventional ultrasonic testing

Thickness measurements were performed on sample carbon steel plates representative of pipe sample thicknesses used in nuclear power plants (3.6, 7.7, 9.5, 19.7 and 49.5mm) using the sensors. Good agreement was found with conventional ultrasonic measurements

2 Performance under insulation

Silicate calcium (commonly used as insulation in nuclear power plants) was placed between the probe and the sensor and it was shown that there was no change in the thickness measurements from the sensors with or without the insulation in place

3 Tolerance to radiation

The sensors were exposed to radiation (gamma rays from Co-60 – 18kGy) corresponding to the total exposure for 10 years in a primary containment vessel. There was no deterioration in the signal from the sensors following exposure.

4 Liquid droplet impingement (LDI) defect detection

LDI wastage defects are narrow and deep (compared to flow assisted corrosion). The sensors were tested on a range of machined defects (0.3, 0.6, 0.9, 1.2 and 1.5mm deep) and showed good agreement with the simulation.

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