HIGH TEMPERATURE CORROSION MAPPING

INTRODUCTION

Oil refineries are very industrial environments with extensive piping running throughout and carrying streams of fluids between large chemical processing units, such as heat exchangers.

Non-Intrusive Inspection (NII) and Non-Destructive Testing (NDT) play a major role in keeping the processing units and site assets in a safe operating condition. This can be challenging as surface temperature can be elevated to extreme levels.

For example, a heat exchanger can be designed to heat hydrogen sulphide (H2S) and the process generates surface temperatures up to 200 °C. A failure in the heat exchanger could potentially cost thousands of dollars, or even worse, loss of lives due to the toxicity of H2S.

Heat exchanger, in-service corrosion mapping

CHALLENGE

Create an easy to understand ultrasonic corrosion map of the inlet end of a heat exchanger, detailing wall thickness changes that will allow engineers to determine remaining life assessment (RLA), risk-based inspection (RBI) maintenance programs, and optimum repair strategies.

In order to perform the inspection while the assets are still in operation, the solution must be able to operate on temperature elevated up to 200 °C, be cost-effective, reliable and accurate.

NDT technicians have previously carried our spot reading but due to the low Probability Of Detection (POD), engineers were not satisfied as they didn't get a true picture of the assets' condition which could affect their risk-based inspection program.

Elevated surface temperature

SOLUTION

Silverwing's RMS2 ultrasonic corrosion mapping solution. Why?

- Remote access capabilities with extended umbilical removes operators from hazardous areas and therefore, helps reduce safety concerns.
- High-temperature components enable the system to operate on surface temperatures up to 392 °F (200 °C).
- Also, narrow Narrow water column, meaning water can be recycled at a rate that prevents it from boiling at the test surface and before the ultrasound has propagated into the test subject.

SILVERWING RMS2

High temperature, up to 200 °C

Remote access for increased safety

Repeatable, reliable & recordable results

RESULTS

The inlet end of the heat exchanger was between 2-3 m in diameter with a nominal thickness of 35 mm. The distance between the flanges was around 810 mm.

The inspection was conducted using the standard RMS water column probes with the 25 mm and 75 mm probe holders; both worked well and provided reasonable A-Scan echoes and a corresponding C-Scan.

Notice in the C-Scan image there are several dark blue areas. These relate to weld of internal supports, scattering the sound thus reducing the amplitude of the reflected signal.

A variety of scans with different resolutions were conducted, all with virtually the same results. The scanner speed is slowed down to around 300 mm per second, as it allowed the water column to stabilise.

To maintain a reasonable water seal, a high tension on the probe holder was required. Several scans were conducted during a 3-hour period, with a maximum duration of the RMS2 on the surface for 30 minutes.

Once removed, the temperature of the RMS was measured with a typical body temperature of approximately 50 °C and a peak temperature of approximately 90 °C on the wheels. The magnets were around 80 °C (well within the acceptable range).

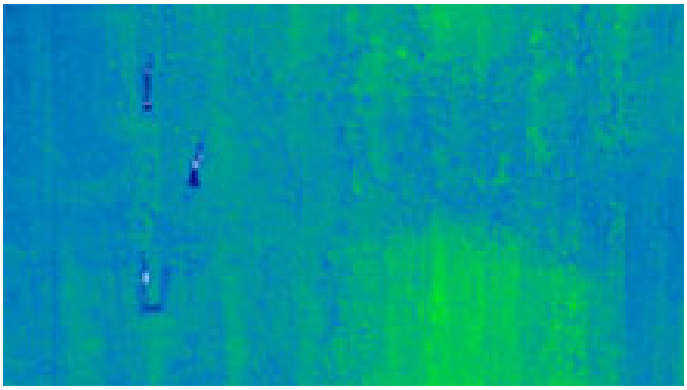
A cooldown period of around 5 minutes is recommended between each 30-minute inspection duration. Being sealed, the water supply could also be used to further cool down the wheels and body of the scanner.

FEEDBACK

The robotic RMS2 performed consistently throughout the inspection and its ability to be controlled from a remote location are major benefits and reduce safety concerns.

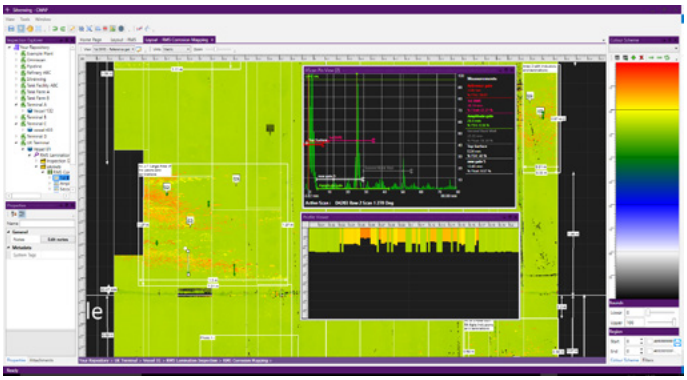
Our client and the asset owners were extremely satisfied with the results. They were particularly impressed with the easy to understand inspection data, which allowed them to make confident maintenance decisions.

Post-processing and analysis of the data gave us extra confidence, and most importantly, having a recordable data set will allow us to periodically monitor defects over time.



C-Scan image, dark blue areas relate to internal support welds

RMS2 In-action



CMAP, Inspection Analysis and Reporting Software

OTHER SUCCESSFUL APPLICATION

- Tank shells
- Horizontal tanks
- Dome ends
- Pressure vessels
- Pipelines
- Ship hulls
- Submarines

DETECTION CAPABILITIES

- Localized / generalized pitting
- General corrosion
- Laminations
- Hydrogen blistering
- Hydrogen-induced cracking (HIC)
- Stress-corrosion cracking (SCC)
- De-bonding of internal liners

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