CASE STUDY

CHOOSING THE RIGHT SMART PIGGING TECHNOLOGY: LESSONS LEARNED

Knowing your provider's technical capabilities is vitally important for long-term fired heater optimization.

There are several ultrasonic smart pigging companies that provide fired heater tubing inspection services to the refining and chemical industries. Although they all claim the ability to detect wall thinning and tube deformations, the inspection surface coverage, resolution, minimum wall thickness detection and reporting capabilities may vary drastically from one service provider to the next. Knowing your provider's capabilities is crucial in ensuring the integrity of your assets, as one refinery recently discovered.

OVERVIEW

PBF Energy's Delaware City Refinery contacted Quest Integrity in May of 2016 to provide an emergency inspection on tubing coils in a reboiler heater using Quest Integrity's Furnace Tube Inspection System (FTIS™). A week prior, the unit had a small fire in the convection section from a tube that leaked. An examination of the failed tube identified localized sulfidation corrosion, which was not expected. To assess the condition of the remaining tubes in the convection section, PBF reached out to a global smart pigging company to perform an inspection. During the planning phase, the chief inspector for the refinery provided a tube replacement reporting threshold of 0.075 inches remaining wall thickness. The inspection was completed and the findings showed that no tubes were below 0.118 inch remaining wall, indicating that the coils were fit for service. During a subsequent coil hydrotest prior to returning the heater to service, another tube failed. An examination showed the same localized sulfidation corrosion as the cause.

Figure 1. Smart Pig Navigating Piping

Figure 3. Tube with sulfidation corrosion (cut open)

Figure 2. Extremely thin wall from sulfidation corrosion

CHALLENGE

During an investigation immediately following the second tube failure, PBF discovered that the original smart pigging service provider's inspection tool could not detect wall thickness readings below 0.118 inches and, therefore, could not accurately identify if tube replacements were necessary or if any tubes were approaching a through-wall condition, which was the main purpose of the inspection.

PBF contacted Quest Integrity to perform an emergency follow up examination of the convection coils. Over the course of the next 24 hours, crews and inspection tools were mobilized to the Delaware City Refinery.

Given PBF's understandable skepticism with smart pigging based on the prior inspection, a technology validation test was requested from Quest Integrity before proceeding with the inspection to demonstrate its smart pigging detection capabilities. The test was performed on a section of the convection tubing that had recently failed. The outcome of the testing clearly showed the ability of the FTIS technology to accurately identify anomalies by detecting and quantifying numerous readings well below PBF's minimum acceptable wall thickness, as well as a 19% bulge at the leak location.

INSPECTION & RESULTS

Having satisfied all of PBF's requirements, Quest Integrity proceeded with the inspection that evening on all four coils (104 pipes and bends) within the heater. Data collection was completed the following morning and preliminary findings were provided to PBF, which showed that eleven tubes fell below the minimum wall thickness threshold of 0.075 inches.

Later that afternoon, PBF invited Quest Integrity to a meeting to discuss the inspection findings and establish a tube replacement plan. During that time, Quest Integrity's lead inspector provided additional insights on each area of extensive wall loss including several bulges, which helped guide PBF toward a final tube replacement plan.

BENEFITS

Although the original inspection was unable to determine the full extent of the tube damage, Quest Integrity's subsequent FTIS inspection and assessment provided PBF with accurate and comprehensive results, enabling the refinery to return the heater to service with assured reliable operation until a future planned outage to replace the heater coil. The detailed data provided by the FTIS inspection also revealed additional insight into the unexpected corrosion mechanism, such that a metallurgy upgrade could be confidently recommended for the replacement coil.

When it comes to high performance assets, knowing your provider's capabilities is critically important in making empowered long-term decisions about asset integrity, avoiding catastrophic operational outages, and ensuring the safe, reliable and cost effective operation of your facility.

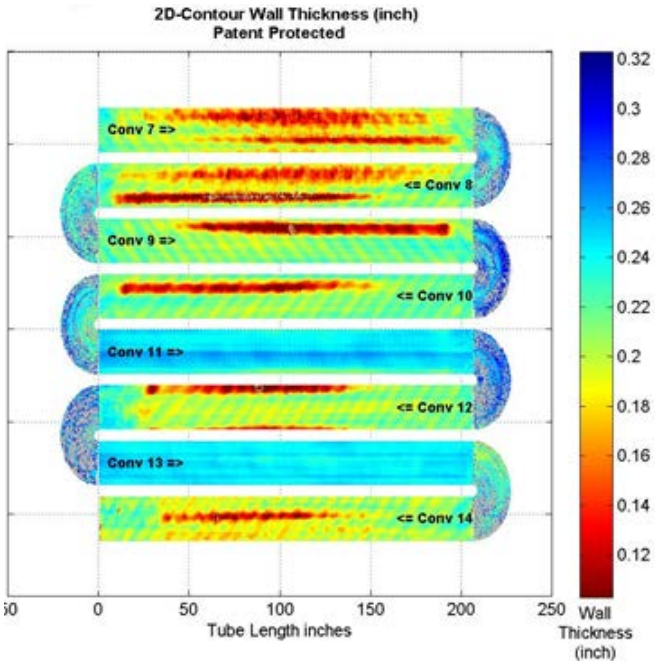

Figure 4. Wall thinning as seen in Quest Integrity data