CASE STUDY

CONTINUAL FIRED HEATER INSPECTIONS REVEAL MYSTERY DAMAGE MECHANISM

OVERVIEW

Continual fired heater asset health is crucial for long-term facility optimization. The use of ultrasonic (UT) intelligent pigging technology to quickly and accurately inspect the convection and radiant coil sections of fired heaters allows operators to mitigate many of the risks associated with loss of containment and unanticipated operational delays.

Although inspections are vitally important for continued asset integrity, the regularity of these inspections is one of the most critical factors in avoiding a catastrophic failure. For assets operating above normal design conditions or with unknown damage mechanisms, it is important to inspect the furnace piping with systematic frequency in order to better monitor the changing condition of anomalies that have the potential to worsen at an unknown rate.

Quest Integrity was requested to perform consecutive inspections on a single atmospheric furnace unit. In 2014, the asset was inspected utilizing Quest Integrity's Furnace Tube Inspection System (FTIS™). Due to the severe extent and unknown cause of the damage, the findings were further verified visually using Remote Digital Video Inspection (RDVI™). After the damaged piping was replaced, early indications of the same damage mechanism were detected in a subsequent inspection one year later.

INSPECTION PROCEDURE AND RESULTS

Using its Furnace Tube Inspection System (FTIS™), Quest Integrity performed an inspection and assessment on 100% overlapping coverage of the tubing in both the radiant and convection sections of the fired heater. The results of the 2014 inspection revealed an unknown damage mechanism causing

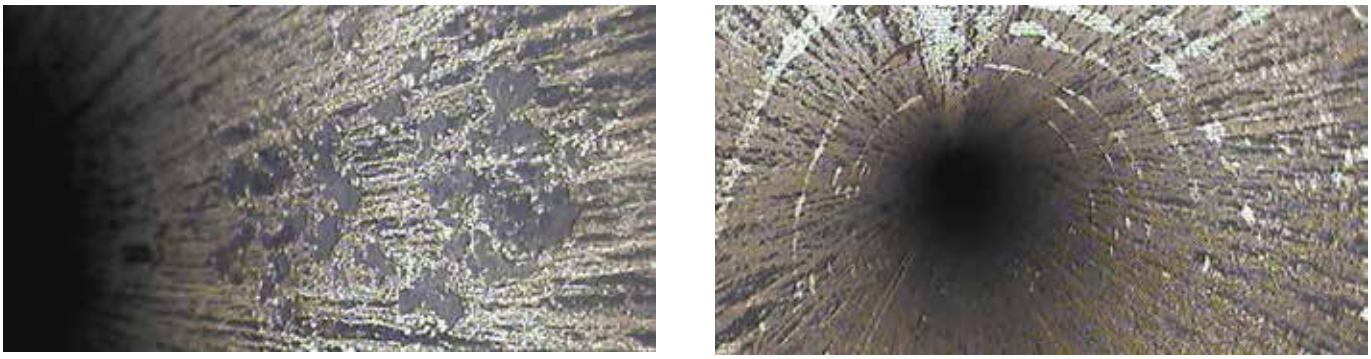

Figure 1. RDVI visual images show the extent of the damage within the convection section of the piping.

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significant wall loss in the convection section of the piping. After the initial FTIS™ inspection, the client utilized Quest Integrity's Remote Digital Video Inspection (RDVI™) in order to visually verify the furnace tubes with the most severe internal wall loss. The Convection box was opened and return bend elbows were removed to allow boroscope access to the damaged areas of piping. This visual inspection provided additional imaging of the unknown damage mechanism as shown in Figure 1. The use of the RDVI™ and FTIS™ inspection methodologies ultimately allowed the client to have both visual and UT radius and wall thickness data of the damaged unit.

Based upon the 2014 inspection findings, the client replaced the damaged tubes within the convection section of the heater. A follow-up FTIS™ inspection in 2015 revealed internal wall loss with the identical pattern and location, as seen in the 2014 inspection.

Considering the rapid acceleration of the wall loss within only a few months of operation, the damage was considered extensive. Based upon the inspection findings in 2014 and 2015, the client ultimately replaced the entire convection box with tubes of a different metallurgy in order to avoid encountering the same accelerated metal loss in the future.

CONCLUSION

The variety of inspection methods utilized on this fired heater ultimately provided the client with 100% inspection coverage for a complete understanding of the condition of the piping system, allowing for the most confident and accurate repair plan for the damaged unit. The benefit of this detailed inspection is not only financially significant but also allows asset operators to respond proactively to asset health rather than reactively to untimely asset failures.

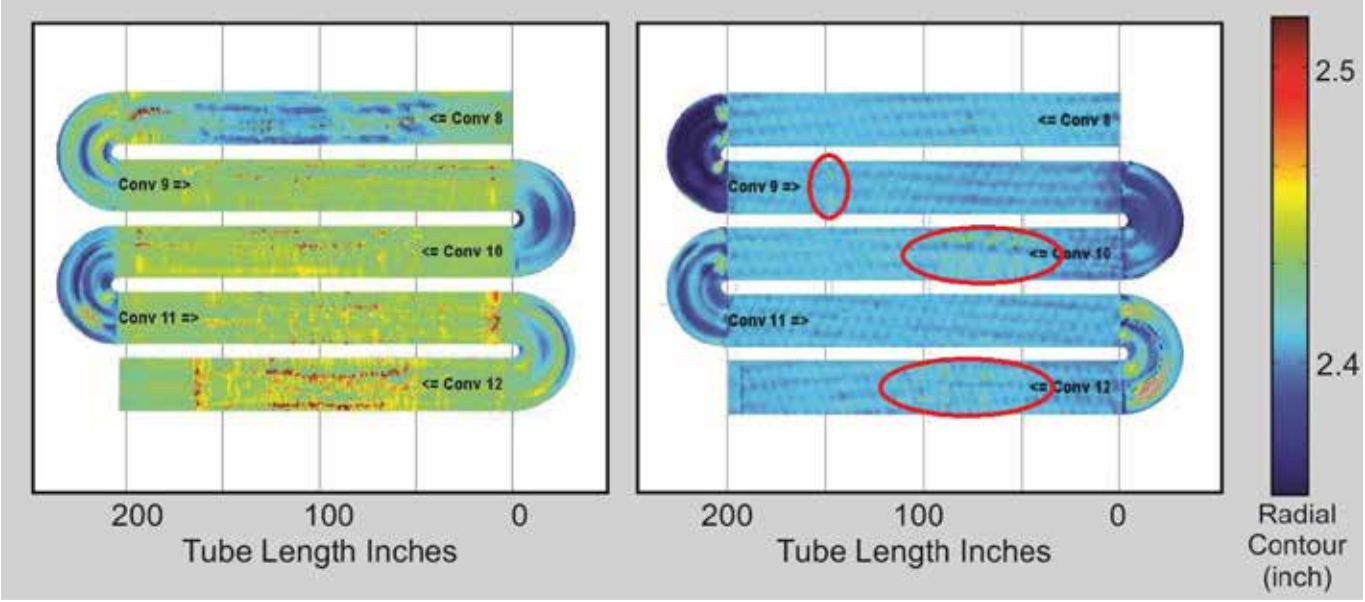

Figure 2: Internal Radius reading from the 2014 (left) and 2015 (right) inspections show different values (due to tube replacement after 2014 inspection), but with identical emerging patterns of damage within this section of convection piping.