

Non-Destructive Testing + Destructive Testing → Failure Analysis

If you work in non-destructive testing (NDT), you probably remember that weld defect that got you addicted to looking for defects. That thirst stays with you as you work in the NDT industry. Have you ever wondered what happens after NDT finds a flaw or defect? Failure analysts are often involved when the customer needs to know more after our field personnel identify flaws - not all flaws are created equally. This article shows damage found by our hard-working NDT personnel and it showcases what happens after the flaws are found.

Hooked on Testing I – Phased Array Ultrasonic Testing Minimizes Shutdown Time

This customer has above ground steam lines vital to their operation - and one of the steam lines leaked near a weld (see Figure 1). This leak can cause costly shutdowns and stop production. IRISNDT personnel found more than one ID root defect with phased array ultrasonic testing (PAUT) near the failure. PAUT on other line welds did not identify further damage. The pipe and weld were cut out and sent to the Edmonton Lab to determine the failure cause.



Figure 1 – Steam Leak in Above Ground Steam Pipeline

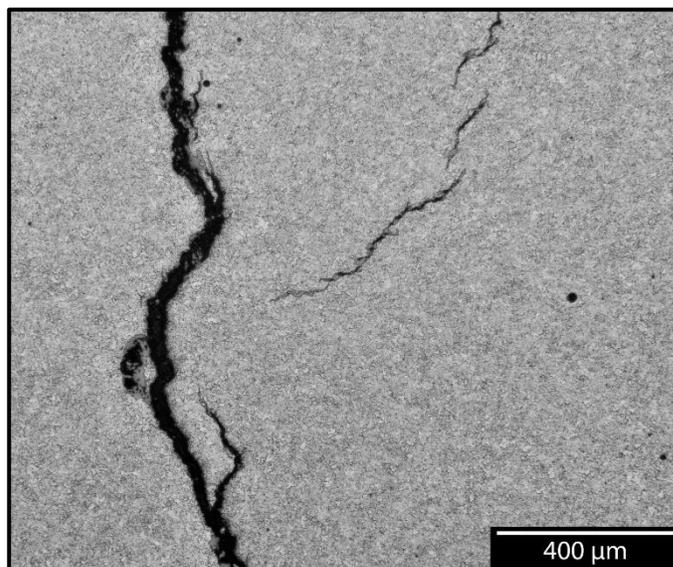


Figure 2 – Caustic Stress Corrosion Cracks in carbon steel, 2% Nital Etch

A metallographic cross section cut through one of the PAUT indications shows the rest of the story (see Figure 2). The root defects are in-service cracks called Caustic Stress Corrosion Cracks. The cracks can form in service because the process carries chemicals that can cause cracking if they collect and concentrate. This damage is difficult to find in service since the pipeline is insulated. Damage happened at this weld because of its unique geometry and arrangement - this weld is near a repaired section, had high bending stresses, and was close to the caustic feed. Before the failure, the customer had had malfunctions with variable amounts of caustic addition. After replacing the pipe, the lines did not experience more of the leaks.

Find more information about this type of failure in API RP 571, “Damage Mechanisms Affecting Fixed Equipment in the Refining Industry”; the standard has information about diagnosing damage like Caustic Stress Corrosion Cracking, and it has good images of this kind of damage.