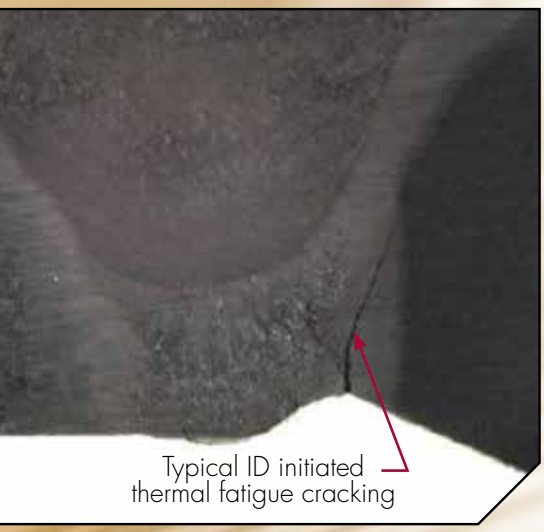
Structural Integrity Associates, Inc.®

Combined Cycle Attemperator Piping Cracking

Improper design, operation, maintenance and control logic for interstage attemperators in the High Pressure Superheat (HPSH) and Hot Reheat (HRH) piping of Combined Cycle plants has resulted in significant cracking and in several cases through wall leaks. As this piping is external to the HRSG, these leaks represent a serious personnel safety risk and can have a significant adverse effect on the overall plant reliability. Not only do these attemperator issues affect the downstream piping, they can also have a major negative impact on the associated headers and tubing.

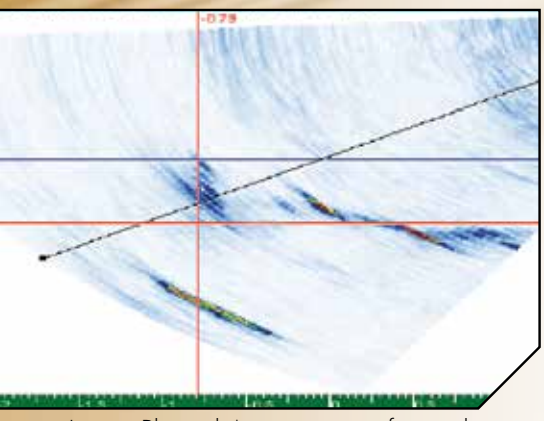


Typical ID initiated thermal fatigue cracking

Structural Integrity has developed the technology and has the technical expertise and experience to identify these problems before they occur and to help manage this condition once it occurs. More importantly, we can help minimize the chance that it happens again.

Why does this cracking occur?

Structural Integrity has conducted thermal transient assessments of over 40 HRSGs worldwide and has typically found that the damage mechanism associated with attemperation is internal diameter (ID) initiated thermal fatigue or cracking at connected components that experience high stresses due to temperature differentials in the attemperator piping system. The root cause of the thermal fatigue is often inadequate attemperator performance or inappropriate activation of the attemperator spraywater, which produces repeated thermal quenching of the ID surfaces, or large temperature differentials across the piping resulting in high tensile stresses. These thermal stresses can often be extremely high and have resulted in cracking in less than five years of operation. Given the severity of these stresses, it is certain that cracking will initiate again without appropriate modification to the attemperator configuration or control logic.



Linear Phased Array image of actual cracking

The Structural Integrity Solution:

We recommend a phased approach.

Phase 1 - Risk Assessment

We perform an overall HRSG risk assessment of the plant to determine if it is susceptible to this condition. This includes a review of operational data, piping configuration and evaluation maintenance history. This characterizes the various aspects of location, configuration, operation and control which lead to attemperation problems.

Phase 2 - Existing Condition

We perform site evaluations using advanced NDE techniques to determine if damage exists and the extent of any existing damage. As a premier provider of NDE, we have access to NDE equipment that no one else in the world offers.

Phase 3 - Flaw Evaluation

Fitness-for-Service analysis is executed in order to develop run/repair/replace decisions if any cracking or damage is identified through Phases 1 and 2. Our extensive expertise in mechanical integrity assessments allows us to perform crack growth and remaining life predictions for various "what if" scenarios.

Phase 4 - Root Cause Investigation

Perform a Root Cause Investigation to identify the source(s) of the thermal stresses and develop recommendations for corrective action. Our preferred approach is to identify the root cause drivers as early in life as possible.

Phase 5 - Implementation and Follow-up

We implement the corrective action and perform follow-up monitoring to ensure it has resulted in the desired effect. The same tools used in Phases 1 and 4 can be used to determine the efficacy of any solution suggested and applied. If repairs are necessary we can provide a turn key solution in conjunction with our strategic partner Wachs Energy Services Company.

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