Failed waterwall tube (short-term overheating)

Failed superheater tube (long-term overheating)

OD wastage on an economizer tube.

For additional information:

Call Toll Free:
877-474-7693
877-4SI-POWER

Visit our website at:
www.structint.com

info@structint.com

Structural Integrity Associates, Inc.®

Root Out the Cause of Boiler Tube Failures

Boiler tube failures remain the leading cause of lost boiler availability and forced outages.

The good news? Nearly all boiler tube failures are preventable. The bad news? Unless the root cause of a failure is accurately identified, there's a good chance that history will repeat itself.

When accuracy is everything, plant owners turn to Structural Integrity.

Why Structural Integrity?

As a global leader in failure prevention, Structural Integrity offers proven solutions to reduce and prevent boiler tube failures. Our approach starts with accurately identifying the damage mechanism so the root cause can be properly addressed.

Our full menu of multidisciplinary boiler tube services includes:

- Metallurgical analyses
- Deposit and scale analyses
- Nondestructive examination
- Life assessment
- Root cause analysis
- Root cause analysis training

Defining The Damage

Boiler tubes can fail for many reasons. In fact, more than 30 different damage mechanisms can affect boiler tubes. Many of these mechanisms can lead to failures that appear visually similar, but have very different underlying characteristics.

Before you can get at the underlying root cause, you first have to understand the damage mechanism that caused a failure. Only then can appropriate corrective actions be taken that target the true cause of failure.

Using a multidisciplinary approach, our world-class team of materials, metallurgical, and mechanical engineers and specialists, cycle chemistry and corrosion experts, and technical staff will define the damage and deliver the answers you need on boiler tube failures.

Metallurgical Evaluation

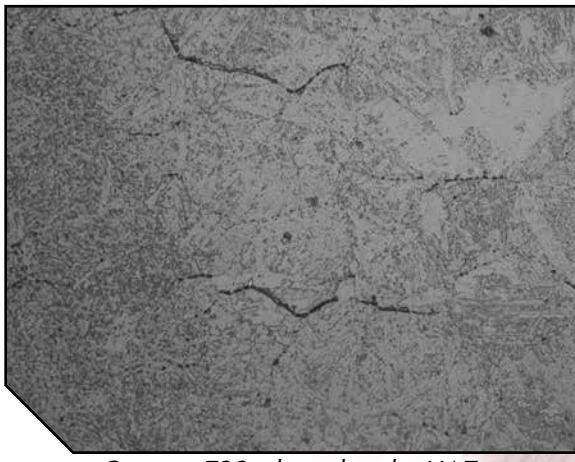
We rely heavily on accurate metallurgical analysis of tube samples to properly identify the root cause of failure.

Our experts can offer guidance on selecting, removing, marking, and shipping tube samples; a checklist of needed failure background information, such as tube location and specifications, design and operating parameters, operating hours, total starts, and cycle chemistry; plus precautions on how to distinguish between look-alike failure mechanisms.

Once the tube sample and background information are in hand, the metallurgical analysis can proceed. While the procedure can be tailored to your unique needs, we generally follow these steps to ensure a thorough evaluation:

- Visual examination and photo documentation
- NDE (if appropriate) using phased array ultrasonics and other advanced techniques
- Chemical analysis
- Dimensional measurements
- Hardness evaluation and/or mechanical property testing
- Metallography
- Fractography
- Characterization of internal and/or external oxide/deposits
- Stress/temperature calculations (if needed)

This systematic approach allows our experts to definitively identify the damage mechanism that caused the tube to fail.



Creep in T22 tube to header HAZ.

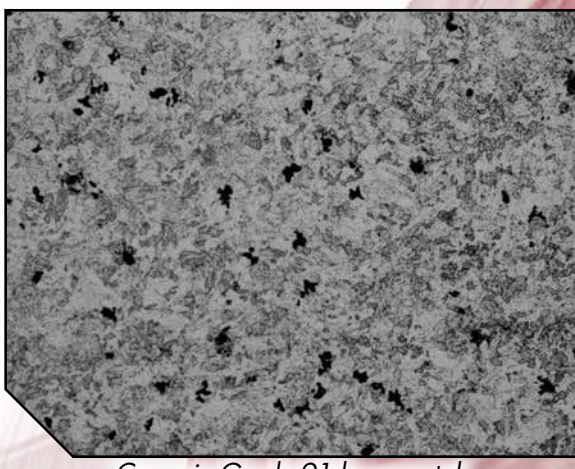
From Damage Mechanism to Root Cause

Once the damage mechanism is identified, it may be tempting to jump directly to corrective actions. However, further work is often needed to identify the root cause of that damage mechanism and then clearly define the suitable corrective action.

This latter phase of root cause identification often requires a broader engineering evaluation that encompasses the metallurgical work, additional engineering evaluations and an understanding of boiler operation — expertise that we bring to the table.

Once the true root cause is identified, we can help you define an appropriate set of corrective actions. Strategies may include operational adjustments to burner systems, cycle chemistry, steam temperatures and steam pressures; pre-emptive nondestructive examination to identify other "at risk" tubes; or defining an appropriate repair strategy.

Omitting the step of root cause identification can lead to misdiagnosis of the underlying reason for failures. That in turn can lead to ineffective corrective actions that misdirect time and money.



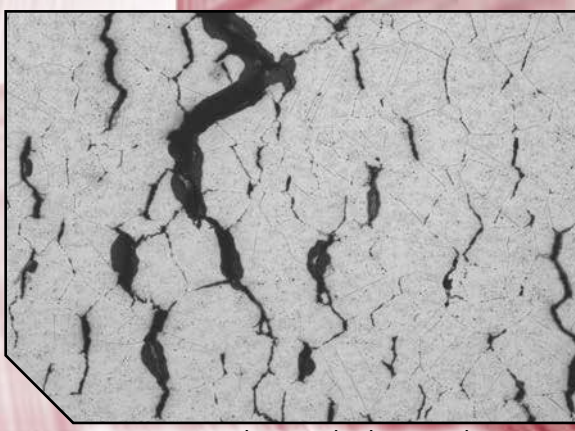
Creep in Grade 91 base metal.

Proactive Life Management

As part of a proactive approach to life management of boiler tubing, Structural Integrity recommends periodic sampling of "typical" tubes. This provides insight into tube condition (remaining life) that can only be gained through a destructive, metallurgical evaluation of the tube.

The evaluation of remaining useful life of a boiler tubing section is a useful way to identify problematic tubing prior to failure. SI's integrated approach predicts boiler tube life based on stress and operating conditions, nondestructive examination, materials evaluations, data from instrumentation and monitoring, and historical data on the component.

When performed correctly, boiler tube lifing provides data to support future outage planning and scheduling, including planning for tube replacement. Few consultants can offer our team's broad multidisciplinary understanding of metallurgy, engineering, operations, and nondestructive testing. Our unmatched quality and unique expertise will shed light on tube failures — so you can prevent them in the future.



Creep in stainless steel reheater tube.

For additional information:

Call Toll Free:
877-474-7693
877-4SI-POWER

Visit our website at:
www.structint.com

info@structint.com