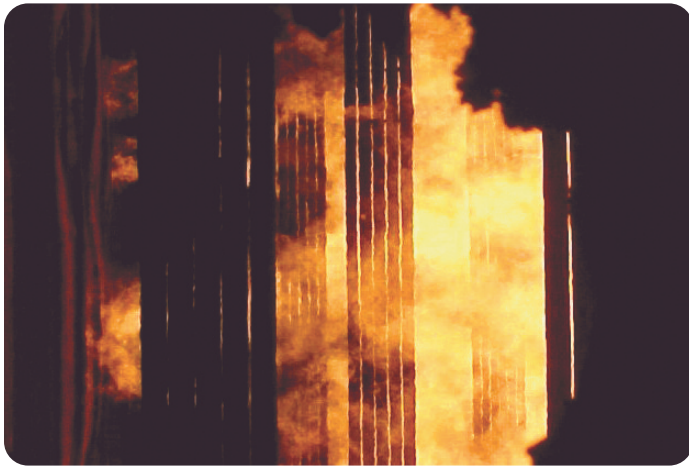


Power Plant Fitness-For-Service

Tubing

Reliability of high temperature tubing is clearly key for boiler availability. Access for adequate inspection is difficult or impossible, and inferences have to be made from all available information, including design and performance data. These notes indicate some methods and results.



Tubing Risk Management

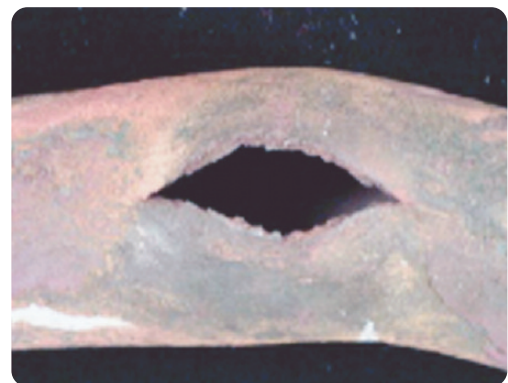
A systematic approach to tubing risk management and replacement needs inspection and analysis techniques which reflect the likely failure mechanisms. These may be grouped into:

- Internal and external wastage (corrosion and wear) mechanisms
- Fouling and barriers to heat transfer
- High temperature creep rupture
- Metal weld failures

Guidance From API 579-1/ASME FFS-1

The new API/ ASME post-construction standard provides data and a framework for pressure part risk assessment. The combination of wastage, fouling and heat transfer makes tubing more complex than traditional pressure parts. These factors may be taken into account while maintaining the overall philosophy in terms of risk and factors of safety.

From the point of view of estimating tube risk, the exact mechanisms of wastage are less important than the data, and knowing if the mechanism is likely to continue. (Clearly if there are intentions of reducing wastage other than by installing shields, then understanding the mechanisms of wastage is important. That is not the objective of this document).



Assessment & Remaining Life Prediction

Given reasonable data, tube risk and minimum remaining life may be estimated, and recommendations made for partial or complete replacement the section. In addition, if the current risk of failure is unacceptable and a replacement is not available, a recommendation for a temperature derate may be made which effectively reduces risk to zero. Experience has shown that this temperature reduction may not be unacceptable in terms of generation performance.

Typical information requirements necessary to make an assessment include:

- Schedule of current tube materials, dimensions, length of service and design conditions
- Unit maximum continuous rating (MCR) temperature and pressure
- Distributed Control System (DCS) and/or thermocouple data for outlet of section in question

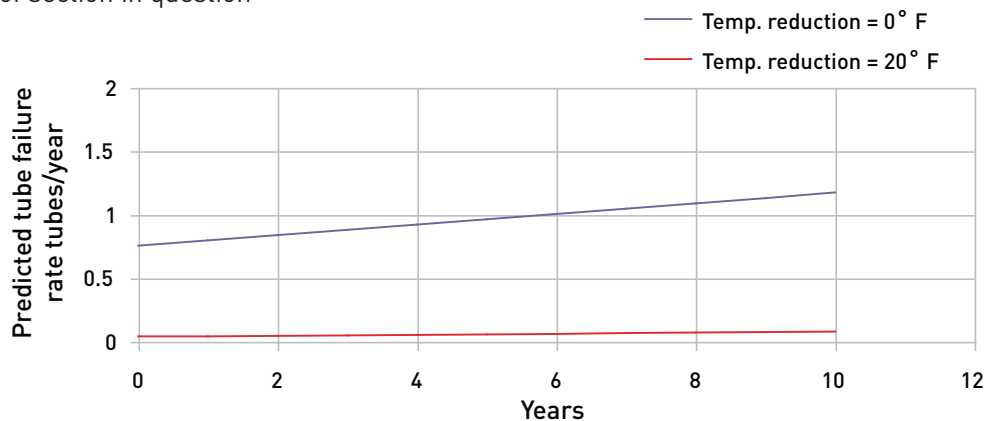
- Dissimilar metal welds.
- Thickness surveys and any evidence of wastage rates
- History (inspection reports, tube replacements, material changes, failure analyses)
- Basic steam flow and thermal performance data for the heat exchanger section

Decisions & Options

Recommendations follow from tube assessments based on data and realistic assumptions. Metallurgical as well as quantitative factors must be taken into account.

SES can provide a defensible basis for decisions such as:

- Inspection interval, inspection techniques
- Time to schedule replacements
- De-rating to reduce risks until next outage



For More Information About
Tubing Risk Management
Call SES Today

Houston
281-955-2900

Cincinnati
513-336-6701

New Orleans
504-889-8440

Baton Rouge
225-769-9772

ON THE WEB AT WWW.STRESS.COM