

## BOILER TUBE ASSESSMENT

- **Use metallurgical analysis to understand the root cause of failure**
- **Recommend strategies to prevent boiler tube failures**
- **Predict boiler tubing remaining useful life**

Boiler tube failures are the leading cause of steam plant non-reliability. A tube failure may cause a forced outage, usually at the most inopportune time. The outage results in loss of production and revenue.

A reduction in the frequency of tube failures can be achieved by understanding the root cause of the failure and taking steps to eliminate the problem. How can you focus these efforts?

The first step in preventing tube failures is understanding why a tube failure occurred. With this information, you can perform preemptive repair, replacement, or alter the tube environment.

In the past several years, NML Madras Centre has conducted several boiler tube analyses.

To address problems directly related to boiler tubes, NML Madras Centre offers:

- Microstructural Analysis
- Scale and Deposit Analysis
- Internal Deposit Loading Measurement
- Chemical Composition Analysis
- Condition Assessment
- Failure Mode Determination
- Remaining Useful Life Estimation

## **Failure Mode Determination**

When boiler tubes fail, replacing them and returning to operation is your first priority. But why did the tubes fail? Will they fail again? Are there operational problems you should know about?

Failure mode determination can distinguish the mechanisms of tube failure. Metallographic analysis can identify creep, corrosion, erosion and fatigue damage to establish the cause of the failure.

A thorough failure analysis of boiler tubes might include scale and deposit analysis, microstructural analysis and chemical analysis. Our failure analysis services can help prevent the loss of additional tubing and other components by directing maintenance and operational efforts.

## **Microstructural Analysis**

Perhaps you haven't experienced a recent failure, but you aren't sure about the tubing's condition. Examining the boiler tube microstructure can reveal deterioration resulting from corrosion, cracking, thermal aging, or mechanical deformation. Accurate tubing assessment provides important data for determining your boiler's overall condition.

Tube samples are also analyzed for metallurgical and manufacturing defects and internal and external surface discontinuities. We use optical and electron microscopes to evaluate tube sections. Hardness and dimensional measurements are made to further assess the tube's condition.

## **Scale Deposit Analysis**

Internal scaling and external deposit buildup on boiler tubes reduce efficiency by acting as barriers to heat corrosion. Scale and deposit

analysis provides information about the amount and source of deposits. This analysis employs energy dispersive X-ray spectroscopy and powder X-ray diffraction to identify constituents in the deposits. We then suggest sources of the tube deposits and steps you can take to remove them and mitigate their return.

## **Chemical Composition Analysis**

Equipment operates best when all the parts are made of the correct material. NML quantitatively analyzes alloying and trace elements in tube base and weld metals, compares the results with the appropriate alloy specification requirements, and brings any discrepancies to your attention.

## **Condition Assessment/Remaining Life Estimation**

Using industry codes as guidelines, we can provide information about future tubing reliability. Condition assessment considers operating conditions, microstructural features and dimensions to predict reliability. We can also estimate your tubing's remaining useful life by evaluating the microstructure and operating conditions. We present data with stress, temperature and time as possible variables.