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## Case studies of failures in thermal power plant boilers

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**Abstract :** *Remaining life assessment study has become an inseparable part of conditioning monitoring and corrective/preventive maintenance in thermal power plant boilers primarily due to the growing awareness and concern in the Indian Power utilities.*

*This paper discusses some of the case studies of the failures noted in boilers, the analysis of the failures and the recommendations / corrective actions taken.*

*The paper thus emphasizes the need for awareness on all the possible modes of failures in the boilers. Based on this awareness and history of a particular Boiler, the scope / extent and methodology of RLA study should be devised.*

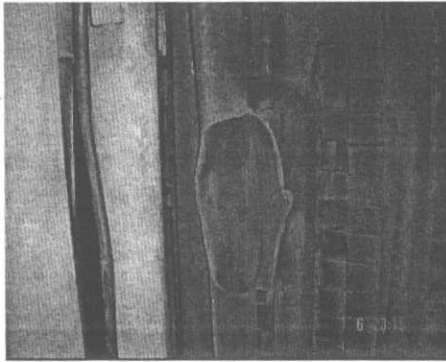
**Keywords :** Failure in thermal power boilers; Remaining life assessment; Steam cooled wall tube; Wall thinning of stub joints.

### CASE STUDY 1

SHORT TERM OVERHEATING OF STEAM COOLED WALL TUBE

## Observation

Steam cooled wall tube had failed in a boiler causing unit shutdown. This tube was at the farthest end of the steam cooled junction header. Failure was due to short term overheating. The failed sample photo is as under



## Analysis

Microstructure study at the zone of failure revealed spheroidal carbides in ferrite matrix suggesting overheating. Study of operational parameters and history revealed that uneven steam flow led to "starvation" and subsequent tube failure.



## Action taken

The tube ends were blanked at both the header ends. This was done for the failed tube as well as adjacent tube.

Thermocouples were attached along the entire length of the header for closer monitoring of tube metal temperatures.

## **CASE STUDY 2**

### **SENSITIZATION OF AUSTENITIC STAINLESS STEEL TUBING USED IN SUPERHEATER TUBES**

#### **Observation**

The austenitic stainless steels of grade AISI 304 and AISI 347 are used in boiler for super heater tubes. These steels are sensitized during service. This phenomenon is noted in the case of all boilers studied.

#### **Analysis**

Sensitization is revealed by metallography of tube samples. The sensitized stainless steel samples collected from outermost coil of Divisional panels, Platen super heater and Final super heater did not show any loss of strength and ductility properties at room temperature.

#### **Recommendations**

As the sensitized grades of stainless steels are always susceptible to intergranular cracking, it is recommended to closely inspect these grades during each overhaul and take extreme precautions during any acid cleaning.

## **CASE STUDY -3**

### **WALL THINNING OF STUB JOINTS OF ECONOMIZER INLET HEADER**

#### **Observation**

One nos. economizer tube failed causing unit shutdown.

#### **Analysis**

Failure was due to internal erosion of tube leading to wall thinning and subsequent failure.



### **Action taken**

100% stub inspection was conducted in the subsequent RLA study and it was found out that 91 stubs out of 182 stub joints were showing thickness less than the allowable limit. The thinned out tubes were cut and replaced.

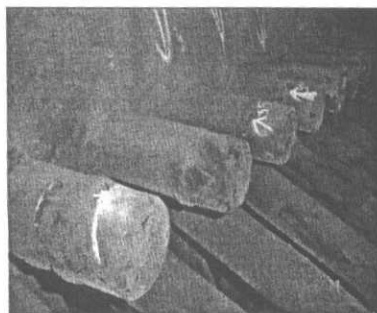
New technology of LFET (LOW FREQUENCY ELECTRO-MAGNETIC TECHNIQUE) was adopted for assessment of thickness reduction.

### **CASE STUDY - 4**

#### **FAILURE OF CAPPED ENDS OF THE REHEATER HEADER**

### **Observation**

Selected tubes of a reheater header were capped to maintain the reheat outlet temperature. During RLA study, it was noted that 13 nos. of capped ends were showing visible ruptured holes



### **Analysis**

Steam impingement at the capped ends caused turbulence and led to subsequent failure of the capped ends.

### **Action taken**

Failed capped ends were replaced. Close monitoring of the unfailed capped ends during every outage.

### **Future RLA scope**

- Hence, in order to conduct a more meaningful and comprehensive RLA study, it is imperative that all the possible modes of failures from live cases are recorded.
- RLA study must include extensive study of the operational and maintenance parameters.
- The RLA scope and extent should be devised to conduct tests over and above the statutory requirements.
- State - of - art and accurate NDT needs to be done ONLY BY EXPERTS.
- Standardization of accurate life prediction techniques.