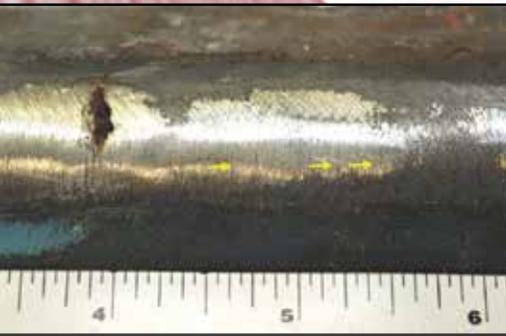


Great River Energy -
Coal Creek Station

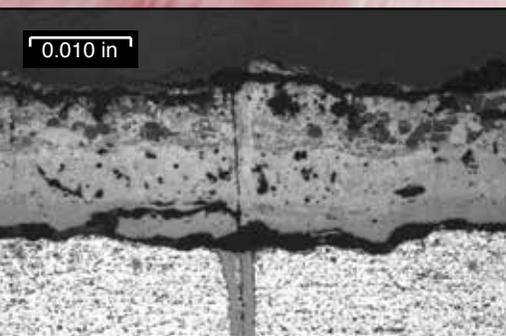
Evaluation of Circumferential Cracking in a Sub-Critical Coal Fired Boiler Waterwall Tubing- Great River Energy Project



Close-up of
Circumferential Cracking



Leak



Typical Crack Morphology

- Reduce “Down Time” due to boiler tube failures
- Quickly establish water wall replacement areas
- Rapid inspection technique for evaluation of circumferential cracking in water wall tubes (all four walls of each firebox in less than five days)
- ET/LPA inspection protocol rapidly identifies areas of greatest concern
- Structural Integrity Associates, Inc., (SI) inspection protocol gives management the tools to quickly make replacement decisions

BACKGROUND

In 2007, to respond to changing environmental regulations, Great River Energy made modifications to the Unit 2 firing system. These modifications consisted of changes in the SOFA and auxiliary air openings, which required burner panel replacements. In August 2008, the unit experienced a water wall tube failure which was followed by multiple tube failures in February 2009 and May 2009. The failures occurred in both fire boxes, and the common features of the failures were that they all occurred on the front wall just above the closed-coupled over fire air ports (CCOFA) and all resulted from circumferential cracking. The timing, location and appearance of the cracking suggest that the failures are related to the firing system changes. Circumferential cracking of water wall tubes typically develops multiple cracks per inch over large areas of the furnace wall, and as a result has proven to be difficult to manage without resorting to widespread panel replacement projects.

Great River Energy has a proactive boiler tube failure reduction program, and to address these water wall tube failures, a short outage was planned for May 2009. The purposes of the outage were to bound the area of circumferential cracking, and identify areas requiring wall panel replacement. The challenge with evaluating circumferential cracking is that there are numerous cracks per inch and visually there is no way to distinguish the shallow cracks that do not represent near term problems from the deeper cracks which will cause near term failures. For this short outage, the traditional inspection approach for circumferential cracking of visual examination in combination with magnetic particle testing followed by exploratory grinding was not viable because that process is very time intensive and only provides qualitative results.

PROJECT

Given these challenges, Great River Energy approached Structural Integrity Associates, Inc. to develop a rapid inspection technique that could provide quantitative crack density and crack depth results. In response, an innovative inspection protocol consisting of an eddy current (ET) testing and linear phased array (LPA) ultrasonic testing inspection protocol which could quickly scan long lengths of tubing and provide quantitative inspection results was developed.

During the five day scheduled outage, Structural Integrity Associates, Inc. established the boundaries of the circumferential damage, and quantitatively assessed the cracking in both fireboxes of Unit 2 (all four walls of each fireboxes) and the front wall of the Unit 1. The results of the quantitative assessments were then used to establish areas for wall panel replacement.

CONCLUSIONS

The ET/LPA protocol developed by Structural Integrity Associates along with Great River Energy’s commitment to eliminating boiler tube failures has resulted in no water wall tube failures occurring in Unit 2 since the protocol was implemented. Cracking was rapidly identified and characterized by the ET/LPA protocol, allowing for sufficient time to identify the areas of greatest concern and allow for the installation of small replacement panels.

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