Plant Service Bulletin

Stress-Assisted Corrosion: Boiler Waterside

Purpose

This Plant Service Bulletin provides customers with information and recommendations concerning waterside corrosion of boiler tubing with emphasis on recovery boilers due to the potential hazards associated with tube leaks.

Problem

Waterside corrosion in the form of pits, rather than general metal wastage, has been discovered in several process recovery boilers. Corrosion may occur anywhere on the tube surface. Stress-assisted corrosion is more pronounced in the areas of the boiler that are depicted in Figure 1. These include lower side wall tubes at the floor seal, windbox attachments, buckstay attachments, and riser tube bends. Figures 2 and 3 are macroscopic and microscopic representations of the corrosion that has been observed at windbox attachments.

The corrosion may be oriented in a variety of directions depending on location in the boiler and has penetrated to depths ranging from several mils to over half of the original tube thickness. To date, the most severe damage in membraned boilers has been oriented longitudinally in sidewall tubes at the floor seals.

Cause

The corrosion is believed to be caused by a less than ideal aqueous environment, with damage intensifying at preferential sites due to the simultaneous action of stress and chemical reactions. Less than ideal environments may include chemical cleaning excursions and high dissolved oxygen or pH excursions in the boiler water. Contributing stresses may be residual or thermal. Environmental upsets may be further aggravated by thermal transients, such as rapid drains, forced coolings or quick start-ups.

Because of the number of contributing factors involved, the rates of corrosion initiation and propagation have not yet been quantified.

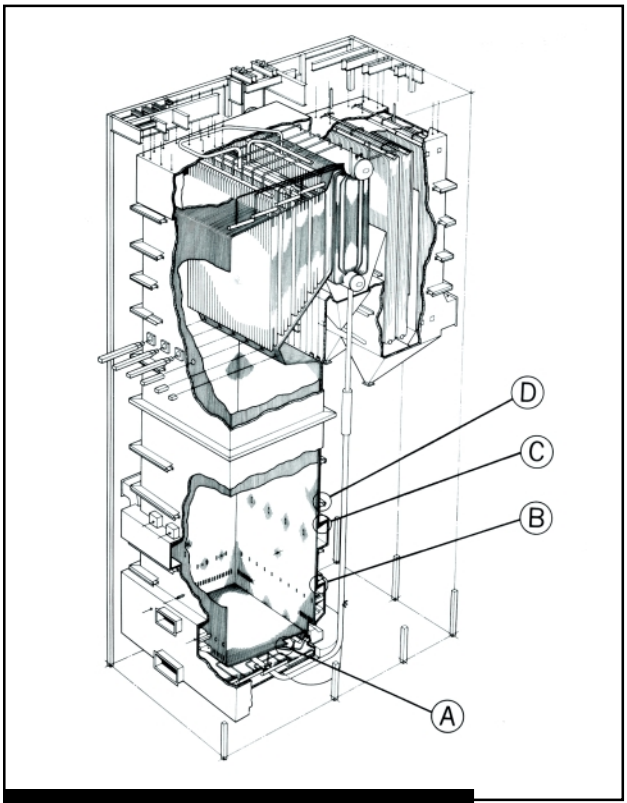

Figure 1: Welded locations where damage has been found.

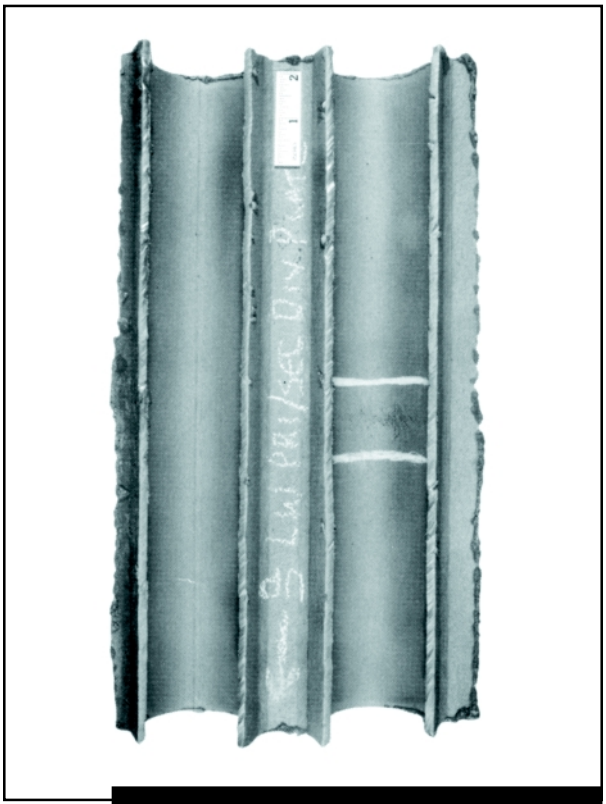

Figure 2: Left sidewall primary/secondary division plate – waterside surface corrosion.

(Continued on reverse side)

Inspection

To date, x-ray examination is the only proven non-destructive technique that affords positive detection of corrosion damage. Other non-destructive examination methods are under investigation for characterizing the extent and depth of corrosion damage.

Recommendations

1. Review waterside operating history to determine if oxygen, pH, and / or chemical cleaning excursions have occurred. Such excursions would increase the probability that corrosion has occurred.
2. Review the pressure part failure history which may indicate through-wall propagation due to corrosive action. Possible suspect failure locations include sidewall tubes at the floor seal, attachment welds and riser tubes.
3. Boiler drums should be inspected for corrosion indications at locations that typically reflect damage from acid cleaning excursions. Such locations include roll tube ends, attachment welds, hold down nuts and belly plate bends.
4. During the next scheduled outage, carry out x-ray examination of attachment weld locations in the lower furnace. While the potential for corrosion is not believed to be isolated to recovery boilers or to a specific boiler manufacturer, examination of recovery boilers should have a higher priority over other boilers because of the potential for catastrophic damage due to tube failure in recovery boilers.
5. Visually inspect any tubing removed from the suspected locations.

Support

Contact B&W Field Engineering Services through your local district service office to coordinate your research and inspection efforts to identify and locate potential corrosion damage.

B&W is continuing its investigation of this problem and will keep customers apprised of further developments.

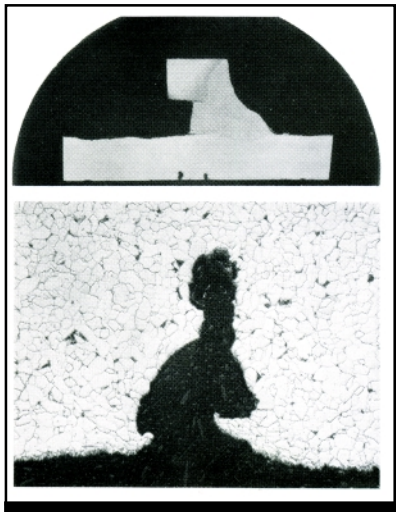

Figure 3: Left sidewall top of secondary windbox – metallography of waterside surface corrosion penetration to a maximum depth of 0.030 inches (3X and 100X).

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