



PO Box 1037 TCAS, Blountville, TN 37617  
P: 423.323.4195, 800.999.4195  
f: 423.323.4908

PO Box 30731, Knoxville, TN 37930  
P: 865.984.3430, 800.999.4195  
f: 865.983.9686

PO Box 2820, Greenville, SC 29602  
P: 864.295.9500, 800.358.9981  
f: 864.295.1360

PO Box 1839, Skyland, NC 28776-1839  
P: 828.251.2420, 800.999.4195  
f: 423.323.4908

Date: November 21, 2010  
To: Water Solutions Engineering Customer  
Subject: Boiler Inspection on November 17, 2010

## **Background**

Two (2) gas fired boilers are used to produce steam. The older boiler is a water tube type capable of producing approximately 35,000 lbs. of steam per hour and is typically only used for back up situations. The new boiler which was installed in 2008 is a fire tube capable of producing 23,500 lbs. of steam per hour and is the primary boiler for the plant. Until August 2010, the boiler chemicals used to treat this boiler was EDTA, Sulfite, and Amine. During the July 2010 boiler inspection of the new boiler, large amounts of iron scale were discovered inside the bottom of this boiler which was of great concern. In August of 2010, the treatment program was changed to a polymer/phosphate blend, liquid sulfite, and amine. The previous EDTA treatment program was premixed with softened water and fed to the feed tank; however, the new chemical program was recently changed to direct feed of the three chemicals using independent chemical pumps. A boiler blowdown controller has also been installed but is not operational at this time. Two very critical items should be noted:

1. Pictures from the July 2010 boiler inspection are not available.
2. An entire drum of the polymer/phosphate was accidently pumped into the new boiler over the period of a few hours just a week prior to the inspection.

## **Inspection**

On Wednesday November 16, 2010 the new boiler was cooled, drained, and two ports (front left and rear) were removed to view the water side of the boiler. In addition, the fire side door was opened to view this section of the boiler. Upon arrival, the top water side port was also removed for better inspection of the top section of the tubes.

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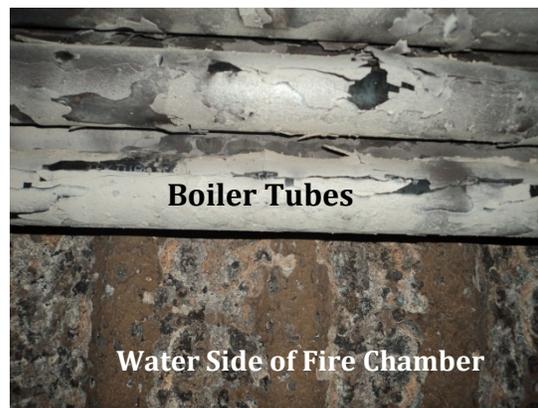
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### **Front Left Port—Boiler Tubes and Water Side of Fire Chamber**

Pictures were taken through the left front port (see below). As you can see, the tubes have a very thin and flaky scale covering approximately 75% of the water side. Since we do not have pictures from the July 2010 inspection for comparison, we are assuming this is the result of the entire chemical treatment drum (polymer/phosphate) being fed just a week prior to this inspection. If that is the case, this scale will be primarily phosphate scale. However, if the tubes showed significant scale buildup in the July 2010, this could be the result of the softening and removing the previously deposited scale. Lab results from the scale analysis should provide some clarification. The water side of the fire chamber shows evidence of pitting most likely caused by the EDTA treatment program.



### **Rear Port—Bottom Section of Tube Sheet (Water Side) and Belly**

Pictures were taken through the rear port (see below) and, as you can see, the flakes which can be seen on the tubes are also present on the belly of the boiler. It is recommended but not necessary that these flakes be removed from the boiler before start-up. Again, scale analysis will provide more answers to the origin of this scale. However, it is not iron scale which was present during the July 2010 inspection.



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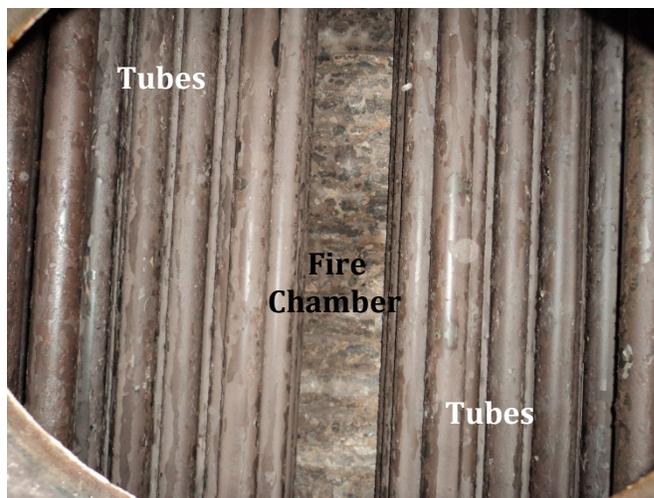
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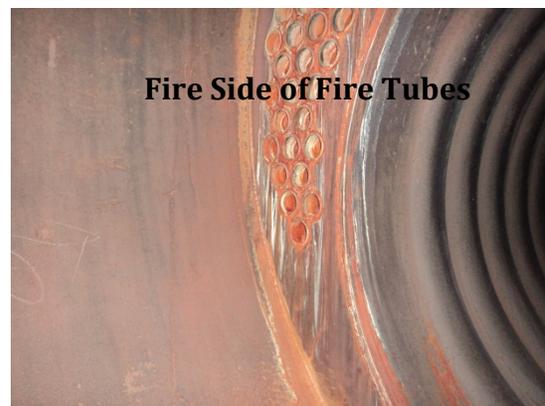
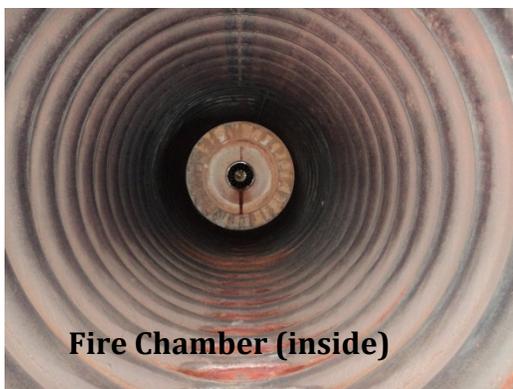
### **Top Port---Top Section of Tubes**

Pictures were taken through the top port (water side) and you can see the same thin, soft and flaky scale on this section of tubes as well. It is a little more difficult to see as the section was still wet as the port was opened just prior to taking these pictures and moisture was present. We do try to achieve a very thin and non flaky coating on the water side of the tubes to prevent corrosion; however, the coating present during this inspection was too thick and too flaky. Again, the lab analysis of the scale will provide more insight.



### **Fire Side of the Fire Tubes and the Open End of the Fire Section**

The fire section of the boiler was inspected and there were not any evidence of fire side or fuel deposits.





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## **Conclusion**

It is evident that the recently implemented change from EDTA treatment chemical program to a polymer/phosphate chemical program has greatly reduced the iron scale inside this boiler in a matter of a few months. However, the thin flaky scale on the water side of the tubes is of some concern. Since pictures from the July 2010 inspection are not available, we must wait on the lab analysis from the scale to determine whether the scale is from the drum of chemical which was accidentally fed a week prior to this inspection or the result of a clean-up of previously deposited scale. In either case, we recommend continuing with the present treatment program and heavily blowing down the boiler (both bottom and surface) upon start-up. The chemical feed pumps should be closely monitored in an effort to prevent another chemical overfeed and the implementation of the boiler controller will greatly improve overall boiler chemicals and parameter control.

Thank you for your business and please let us know if you have any questions about this report.

Water Solutions Engineering