



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: July 15, 2009
To: Water Solutions Engineering Customer
Subject: Fulton Boilers Inspections on July 14, 2009

Background

Two (2) Fulton Boilers are utilized at to heat parts in a humid environment using seven (7) steam boxes. A twin column softener is used to soften city water make up to each electric boiler. A water meter which is located on the make up line between the softener and the boilers is used to provide a signal to a chemical pump. This chemical pump injects boiler chemical for unsoftened make up into the softened water. Boiler chemicals for unsoftened make up are used due to the unreliability of the existing softener. There is not any type of blow down controller on either boiler nor is either boiler manually blown down during normal operation. The steam exits the boilers and travels to the seven (7) steam boxes all of which are electronically controlled with a temperature set point. However, due to the bent doors and lack of door seals on the steam boxes, none of the steam boxes reach the temperature set point. Thus, the two Fulton boilers continuously produce steam whenever these boxes are in operation. It should also be noted that this system has zero condensate return and salt usage is extremely high at approximately 40-80 lbs. per day. The Boiler Inspection Certificate on each boiler listed 10/03/08 as the last inspection.

Inspections

On Tuesday July 14, 2009, both Fulton Boilers (#1 and #2) were cooled, drained, and both hand hole covers (upper and lower) were removed to view the internals of each boiler. These hand holes are approximately 6" oval and are located approximately 10" from the top and bottom of each boiler. The hand holes are placed to allow easy viewing of all four (4) electrical heating elements as well as the inside wall of the outside shell and inside wall of center chamber. Only the internal portions of the boilers were inspected and below details what was viewed during the inspections.

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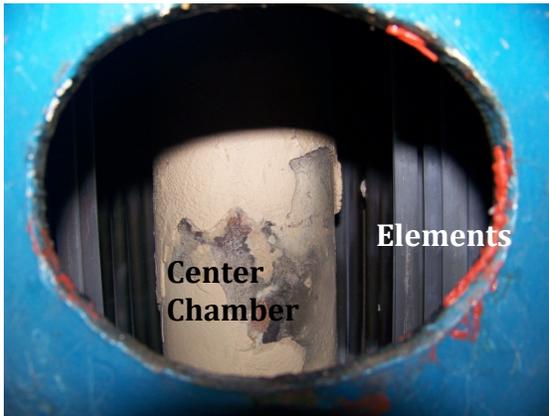
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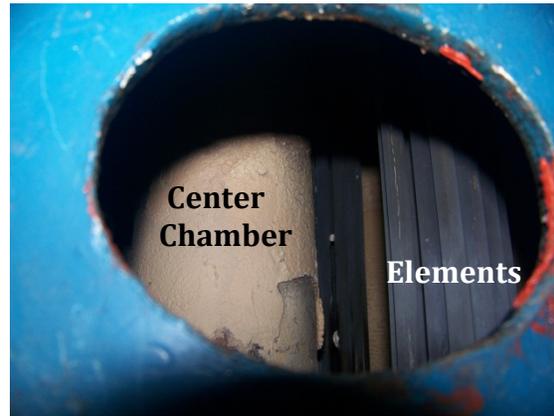
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Boiler #1

This boiler contained the greater amounts of scale which appeared to be calcium carbonate. The bottom of this boiler contained scale in excess of 1/2" in thickness around the shell and center chamber. The surfaces of the electric heating elements showed little to no scale buildup on the top and bottom portions. The pictures below are from the Boiler #1 inspection.



Boiler #1: Top Handhole



Boiler #1: Top Handhole



**Boiler #1: Bottom Hand Hole
before Scale Removal**



**Boiler #1: Bottom Hand Hole
after Scale Removal**

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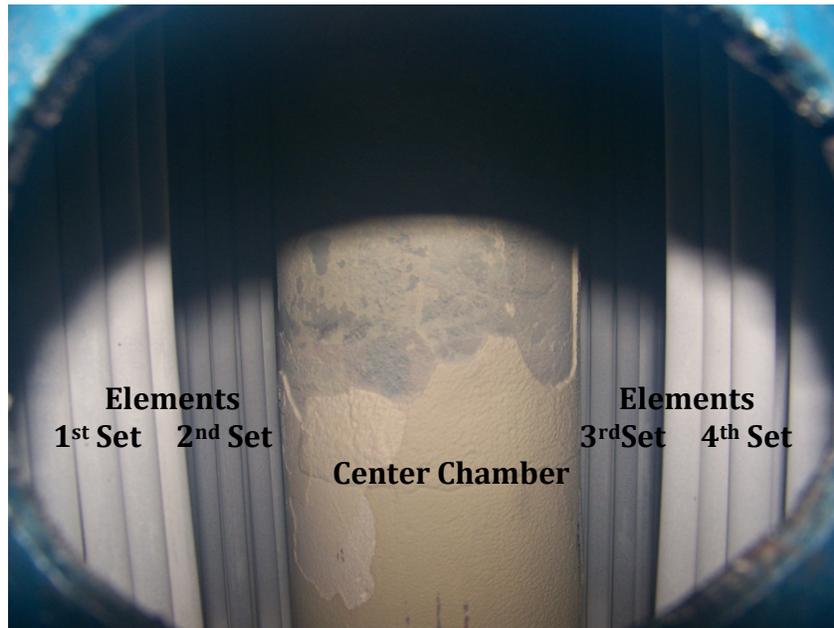
Boiler #1: Scale from Bottom Hand Hole



Boiler #1: 1/2" Thick Scale from Bottom Hand Hole

Boiler #2

This boiler did not contain as much scales as Boiler #1; however, the scale on the shell and center chamber is significant. Also, this boiler had more scale build up on the electric element rods. The shell and center chamber had scale thickness between 1/16" thick at the top and 1/2" at the bottom in some areas. The scale on the elements appeared to be very little at the top but approximately 1/16" thick in some areas on the bottom section. The pictures below are from the Boiler #2 inspection.



Boiler #2: Top Hand Hole



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Scale layer can be seen on the center chamber and the four (4) elements are shown with the white scale layer more noticeable on the forward most sets (1st and 4th).



Boiler #2: Bottom Hand Hole

From the picture above, increase scale buildup can be seen on the elements in the bottom section of Boiler #2. Also, scale and corrosion is noticeable on the center chamber.

Conclusion

The lack of proper maintenance, softened make up water, chemical treatment, and blow down control has led to substantial scale build up in both of the Fulton boilers especially #1. The elements in Boiler #2 showed scale build up and both boilers had almost 1/2" thick scale on the inside of the shell. The inside wall of the center chambers also showed significant scale build up with Boiler #2 also showing some evidence of corrosion. In addition to the lack of attention to the areas listed above, the high steam demand placed on both boilers due to the lack of adequate sealing on the steam boxes increases the likeliness of scale and corrosion inside each boiler.



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Recommendations

1. Replace existing softener with more reliable unit.--- **Online within 2 weeks**
2. Replace existing older pump with more reliable Stenner---**Complete**
3. Install Stenner Pump Control Module (PCM) to interface between water meter and Stenner pump for precise chemical injection----**Complete**
4. Physically remove as much scale as possible from each boiler prior to putting back in service.
5. Replace broken level sight tube on Boiler #1.
6. Repair doors and seals on all steam boxes.
7. Install blow down controller on each boiler or manually check and blow down each boiler daily.
8. Evaluate returning condensed steam (condensate) from the steam boxes back to the boilers. This will save on energy, chemical, and water.
9. Inspect all other areas of each boiler system during next shutdown.
10. Evaluate required set point temperatures of steam boxes and lower if possible without causing quality issues.
11. Conduct economic feasibility study to determine if RO system between softener and boiler can be justified with energy, chemical, and water savings.
12. Introduce boiler cleanup chemical until next inspection to determine if on line cleanup is possible before pursuing acid cleaning.
13. Implement preventative maintenance program as specified in Fulton Boiler Operations Manual.

Thank you for your business and please let us know if you have any questions about this report. We look forward to working with you to complete these recommendations and get these Fulton boilers back to the condition we both desire.

Water Solutions Engineering