Top 10 for Boiler Water Treatment

Western Regional Boiler Association

March 11, 2015
Ultra Low Range Hardness Testing

#11
Continued Increase in Boiler Feedwater Hardness

275 PPB (0.275 PPM) Average hardness
Nexguard dosage recommendation: 9.5 PPM

<table>
<thead>
<tr>
<th>Feedwater Hardness (ppm)</th>
<th>Feedwater Hardness (PPB)</th>
<th>NexGuard (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>0.05</td>
<td>50</td>
<td>1.8</td>
</tr>
<tr>
<td>0.10</td>
<td>100</td>
<td>3.5</td>
</tr>
<tr>
<td>0.15</td>
<td>150</td>
<td>5.3</td>
</tr>
<tr>
<td>0.20</td>
<td>200</td>
<td>7.0</td>
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<tr>
<td>0.25</td>
<td>250</td>
<td>8.8</td>
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<tr>
<td>0.30</td>
<td>300</td>
<td>10.5</td>
</tr>
<tr>
<td>0.35</td>
<td>350</td>
<td>12.3</td>
</tr>
<tr>
<td>0.40</td>
<td>400</td>
<td>14.0</td>
</tr>
</tbody>
</table>
Temperature Correction for “High Purity” pH Testing

#10
Condensate Testing

- Dedicate IRON test glassware. False high iron. Expect <0.025 ppm
- Do not adjust sample flow
- Replace pH meter as required, once/6 months
- Adjust for temperature

<table>
<thead>
<tr>
<th>Total Iron (ppm)</th>
<th>Klin Cond.</th>
<th>HB Cond.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductivity</td>
<td>28</td>
<td>6.2</td>
</tr>
<tr>
<td>pH</td>
<td>9.61</td>
<td>9.2</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Deg F</th>
<th>Deg C</th>
<th>+/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>113</td>
<td>45</td>
<td>0.6</td>
</tr>
<tr>
<td>111</td>
<td>44</td>
<td>0.57</td>
</tr>
<tr>
<td>109</td>
<td>43</td>
<td>0.54</td>
</tr>
<tr>
<td>108</td>
<td>42</td>
<td>0.51</td>
</tr>
<tr>
<td>106</td>
<td>41</td>
<td>0.48</td>
</tr>
<tr>
<td>104</td>
<td>40</td>
<td>0.45</td>
</tr>
<tr>
<td>102</td>
<td>39</td>
<td>0.42</td>
</tr>
<tr>
<td>100</td>
<td>38</td>
<td>0.39</td>
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<td>99</td>
<td>37</td>
<td>0.36</td>
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<td>97</td>
<td>36</td>
<td>0.33</td>
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<td>95</td>
<td>35</td>
<td>0.3</td>
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<td>93</td>
<td>34</td>
<td>0.27</td>
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<tr>
<td>91</td>
<td>33</td>
<td>0.24</td>
</tr>
<tr>
<td>90</td>
<td>32</td>
<td>0.21</td>
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<tr>
<td>88</td>
<td>31</td>
<td>0.18</td>
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<tr>
<td>86</td>
<td>30</td>
<td>0.15</td>
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<tr>
<td>84</td>
<td>29</td>
<td>0.12</td>
</tr>
<tr>
<td>82</td>
<td>28</td>
<td>0.09</td>
</tr>
<tr>
<td>81</td>
<td>27</td>
<td>0.06</td>
</tr>
<tr>
<td>79</td>
<td>26</td>
<td>0.03</td>
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<tr>
<td>77</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>75</td>
<td>24</td>
<td>-0.03</td>
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<tr>
<td>73</td>
<td>23</td>
<td>-0.06</td>
</tr>
<tr>
<td>72</td>
<td>22</td>
<td>-0.09</td>
</tr>
<tr>
<td>70</td>
<td>21</td>
<td>-0.12</td>
</tr>
</tbody>
</table>
### Table 3 - Purge Times Required for Representative Sampling of Water

<table>
<thead>
<tr>
<th>Line Size (inch)</th>
<th>Wall Thickness (inch)</th>
<th>ID (inch)</th>
<th>For Soluble Components</th>
<th>For Particulate Components</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Time at 500 ml/min</td>
<td>Flow Required to Achieve 5 min</td>
</tr>
<tr>
<td>1/8 tubing</td>
<td>0.025</td>
<td>0.180</td>
<td>1.8</td>
<td>1.501</td>
</tr>
<tr>
<td></td>
<td>0.040</td>
<td>0.166</td>
<td>1.3</td>
<td>1.277</td>
</tr>
<tr>
<td></td>
<td>0.049</td>
<td>0.152</td>
<td>1.3</td>
<td>1.070</td>
</tr>
<tr>
<td></td>
<td>0.058</td>
<td>0.134</td>
<td>1.0</td>
<td>0.832</td>
</tr>
<tr>
<td></td>
<td>0.065</td>
<td>0.120</td>
<td>0.8</td>
<td>0.667</td>
</tr>
<tr>
<td>3/8 tubing</td>
<td>0.025</td>
<td>0.300</td>
<td>5.2</td>
<td>4.310</td>
</tr>
<tr>
<td></td>
<td>0.040</td>
<td>0.291</td>
<td>4.7</td>
<td>3.924</td>
</tr>
<tr>
<td></td>
<td>0.049</td>
<td>0.277</td>
<td>4.3</td>
<td>3.555</td>
</tr>
<tr>
<td></td>
<td>0.058</td>
<td>0.259</td>
<td>3.7</td>
<td>3.188</td>
</tr>
<tr>
<td></td>
<td>0.065</td>
<td>0.254</td>
<td>3.4</td>
<td>2.849</td>
</tr>
<tr>
<td>1/2 tubing</td>
<td>0.025</td>
<td>0.430</td>
<td>10.3</td>
<td>8.547</td>
</tr>
<tr>
<td></td>
<td>0.042</td>
<td>0.426</td>
<td>9.6</td>
<td>8.018</td>
</tr>
<tr>
<td></td>
<td>0.049</td>
<td>0.402</td>
<td>9.0</td>
<td>7.488</td>
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<tr>
<td></td>
<td>0.058</td>
<td>0.384</td>
<td>8.2</td>
<td>6.832</td>
</tr>
<tr>
<td></td>
<td>0.065</td>
<td>0.370</td>
<td>7.6</td>
<td>6.343</td>
</tr>
<tr>
<td></td>
<td>0.072</td>
<td>0.356</td>
<td>7.0</td>
<td>5.872</td>
</tr>
<tr>
<td></td>
<td>0.083</td>
<td>0.348</td>
<td>6.2</td>
<td>5.169</td>
</tr>
<tr>
<td>1/4 pipe</td>
<td>Schedule 40</td>
<td>0.622</td>
<td>21.5</td>
<td>17.925</td>
</tr>
<tr>
<td>3/4 pipe</td>
<td>Schedule 40</td>
<td>0.824</td>
<td>37.8</td>
<td>31.459</td>
</tr>
</tbody>
</table>

Notes:
- Soluble Components: Chemical contaminants that are dissolved in the water.
- Particulate Components: Solid or semi-solid materials that are suspended in the water.
Myron 6P – Reliable pH and Conductivity Measurement

# 9
Replacement pH Probe
Know Your Boiler Mass Balance – Diagnostic Study

#8
Boiler Diagnostic Study
4/11/2013

- Emergency Make-up
  (City Water)

- City Make-up
  Water

- Duplex Softeners

- Softened Water

- 22310 m/min
  NexGuard PPM
  22310 NexGuard

- 1720 Sulfite
  8735 Caustic

- Feedwater
  Pumps

- Sample

- Wellons #1
- Condensate

- Wellons #2

- Dry Kilns

- 1820 Amine

- Sample

- 61
  Cycles

- 47
  Cycles

- 0.53
  BD gpm

- 1.04
  BD gpm

- Boiler #1 Blowdown Sump

- Combined Waste Sump

- NexGuard ppm
  104
  1.57
  1.10
  2.66
  Total gpm

- Boiler NexGuard ppm
  - Boiler No. 1:
    208
    36%
    1.6%
    2.0%
    -0.61
  - Boiler No. 2:
    159
    64%
    2.1%
    2.0%
    0.41
  - Total:
    -0.20

Stimson Lumber
Tillamook, OR

Boiler System

NALCO
Deposit Weight Differential - How Clean are your Boiler tubes?

#7
Deposit Weight Density

Sample Dimensions As-Received:
- Length of Received Tube (inches): 8.5
- Outside Diameter of Tube (inches): 2.0

Results From Hot Side:
- Surface Area Examined: 7.7 in²
- Wall Thickness (dirty): 0.096 inches
- Wall Thickness (clean): 0.089 inches
- Deepest Pit: 0 mils (0.001")
- Deposit Weight Density: 83 g/ft²

Results From Cold Side:
- Surface Area Examined: 7.6 in²
- Wall Thickness (dirty): 0.094 inches
- Wall Thickness (clean): 0.092 inches
- Deepest Pit: 0 mils (0.001")
- Deposit Weight Density: 28 g/ft²
Monitor Flue Gas Temperature

An indirect indicator of scale or deposit formation is flue gas temperature. If the flue gas temperature rises (with boiler load and excess air held constant), the effect is possibly due to the presence of scale.

Perform Visual Inspections

Visually inspect boiler tubes when the unit is shut down for maintenance. Scale removal can be achieved by mechanical means, or acid cleaning. If scale is present, consult with your local water treatment specialist and consider modifying your feedwater treatment or chemical additives schedule.

Clean Boiler Water-side Heat Transfer Surfaces

Even on small boilers, the prevention of scale formation can produce substantial energy savings. Scale deposits occur when calcium, magnesium, and silica, commonly found in most water supplies, react to form a continuous layer of material on the waterside of the boiler heat exchange tubes.

Scale creates a problem because it typically possesses a thermal conductivity an order of magnitude less than the corresponding value for bare steel. Even thin layers of scale serve as an effective insulator and retard heat transfer. The result is overheating of boiler tube metal, tube failures, and loss of energy efficiency. Fuel wastage due to boiler scale may be 2% for water-tube boilers and up to 5% in fire-tube boilers. Energy losses as a function of scale thickness and composition are given in the table below.

<table>
<thead>
<tr>
<th>Energy Loss Due to Scale Deposits*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale Thickness, inches</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>1/64</td>
</tr>
<tr>
<td>1/32</td>
</tr>
<tr>
<td>3/64</td>
</tr>
<tr>
<td>1/16</td>
</tr>
</tbody>
</table>

Note: "Normal" scale is usually encountered in low-pressure applications. The high iron and iron plus silica scale composition results from high-pressure service conditions.

Operator Procedures

#6
# RFP Dillard

## Boiler Testing Summary

<table>
<thead>
<tr>
<th>Titration Chemistry</th>
<th>Sample Size</th>
<th>Reagent 1</th>
<th>Reagent 2</th>
<th>Titrant</th>
<th>Multiplier</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Level Total Hardness</td>
<td>100 mL in casodure dish</td>
<td>2 mL H-2 Buffer</td>
<td>Two shakes H-3 Indicator</td>
<td>Titrate with LH-3 until Pink/Purple to Blue</td>
<td>mL's of LH-3 used = ppm of hardness</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Trasar</th>
<th>TRASAR</th>
<th>Product</th>
<th>Product Factor</th>
<th>TRA Value</th>
<th>Calibration Value</th>
<th>Calibration Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TRASAR 3</td>
<td>22300</td>
<td>PF = 40</td>
<td>TRA = 0.0 %</td>
<td>C. Value = 1.0</td>
<td>460-9090</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DR 2800 Chemistry</th>
<th>AP Procedure</th>
<th>Step 1</th>
<th>Step 2</th>
<th>Step 3</th>
<th>Step 4</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silica Low Range</td>
<td>Program 651 Silica LR</td>
<td>Mix 10 mL sample w/ 40 mL DI water</td>
<td>Prepared = 10 mL Blank = 10 mL</td>
<td>Add 14 drops of SIL-1 to EACH cell Press &quot;TIMER&quot; 4-minutes</td>
<td>Add SIL-3 pillow to ONE cell (prepared) Press &quot;TIMER&quot; 2-minute</td>
<td>0.01 to 1.00 ppm as SiO2 (Multiply reading x5)</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silica Ultra Low Range</td>
<td>Program 651 Silica LR</td>
<td>Prepared = 10 mL Blank = 10 mL</td>
<td>Add 14 drops of SIL-1 to EACH cell Press &quot;TIMER&quot; 4-minutes</td>
<td>Add SIL-3 pillow to ONE cell (prepared) Press &quot;TIMER&quot; 2-minute</td>
<td>0.01 to 1.00 ppm as SiO2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron</td>
<td>Program 265 Iron, HL</td>
<td>Prepared = 10 mL Blank = 10 mL</td>
<td>Add Fe-HL pillow to ONE cell (prepared)</td>
<td>Press &quot;TIMER&quot; 3-minute</td>
<td>Insert Blank Press &quot;ZERO&quot; Insert Prepared Press &quot;READ&quot;</td>
<td>0.1 to 3.0 ppm as Fe (iron)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEHA</td>
<td>Program 181 DEHA</td>
<td>Prepared = 25 mL of feedwater sample Blank = 25 mL of DI water</td>
<td>Add Reagent 1 pillow to EACH cell Add 0.5 mL of Reagent 2 to EACH cell</td>
<td>Press &quot;TIMER&quot; 10-minute keep sample cells in the dark</td>
<td>Insert Blank Press &quot;ZERO&quot; Insert Prepared Press &quot;READ&quot;</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test</th>
<th>To Order Call Nalco @ 800.286.0879 (use RFP Dillard sold to #500967777)</th>
<th>Nalco Part #</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Round Glass Sample Cells w/ caps 10-20-25 mL (6 pack)</td>
<td>500-P2555</td>
</tr>
<tr>
<td>Silica LR</td>
<td>SIL-1 (50 mL)</td>
<td>460-S9626</td>
</tr>
<tr>
<td></td>
<td>SH-2/ SIL-2 (100 pillows)</td>
<td>460-S9623</td>
</tr>
<tr>
<td></td>
<td>SIL-3 (100 pillows)</td>
<td>460-S6171P</td>
</tr>
<tr>
<td>Silica ULR</td>
<td>Same reagents as Silica LR</td>
<td></td>
</tr>
<tr>
<td>DEHA</td>
<td>ELMIN-OX Reagent 1 (100 pillows)</td>
<td>460-S9195</td>
</tr>
<tr>
<td></td>
<td>ELMIN-OX Reagent 2 (100 mL)</td>
<td>460-S9196</td>
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<tr>
<td></td>
<td>UH-3 total (1 L) *same as total hardness</td>
<td>460-S9447.75</td>
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<tr>
<td></td>
<td>H-2 buffer (1 L) *same as total hardness</td>
<td>460-S9276.75</td>
</tr>
<tr>
<td></td>
<td>H-3 indicator (100 grams) *same as total hardness</td>
<td>460-S9277.82</td>
</tr>
<tr>
<td>Iron</td>
<td>Fe-HL (100 pillows)</td>
<td>460-S3466</td>
</tr>
</tbody>
</table>
**BOILER CONTROL**

**CONDUCTIVITY 2500 - 3500 μmhos**

- IN RANGE
- OUT OF RANGE
  - LOW
  - HIGH

1. Leaking blowdown valve
2. Manual blowdowns are too long/often
3. Decrease surface blowdown setting
4. Reduced steam production
5. Change in feedwater quality

**SOFT WATER**

- Hardness < 1.0 ppm
  - IN RANGE
  - OUT OF RANGE
  - HIGH

1. Conduct manual blowdown daily
2. Increase surface blowdown setting
3. Change in feedwater quality
4. Increased steam production

**CONDENSATE**

- Amine 1820
  - IN RANGE
  - OUT OF RANGE
  - HIGH

1. Conduct manual blowdown daily
2. Increase surface blowdown setting
3. Change in feedwater quality
4. Increased steam production

**Conductivity**

- < 25 μmhos
  - IN RANGE
  - OUT OF RANGE
  - HIGH

1. Regenerate softener
2. Check brine level
3. Check valve setting
4. Have resin analyzed
5. Run elution study

**pH 8.2 - 9.0**

- IN RANGE
- OUT OF RANGE
- IN RANGE
- OUT OF RANGE
- HIGH

1. Chemical pump malfunction or lost prime
2. Feed tank empty
3. Increase the chemical pump setting and record on log sheet
4. Process contamination

**Soft Water**

- Hardness < 1.0 ppm
  - IN RANGE
  - OUT OF RANGE
  - HIGH

1. Chemical pump malfunction or lost prime
2. Feed tank empty
3. Decrease the chemical pump setting and record on log sheet
4. Process contamination

**Conductivity**

- < 25 μmhos
  - IN RANGE
  - OUT OF RANGE
  - HIGH

1. Boiler water carryover
2. Process contamination

* Consult your Program Administration Manual for further guidance *
Automated Amine Feed

#5
Before Auto
pH variation: 7.2-10.3

Start Auto Amine control
Continuous Feedwater Corrosion Monitoring

#4
Two New Technologies:

- **3D TRASAR Technology for Boilers™**
  - Measures and controls scale inhibitor chemistry

- **Nalco Corrosion Stress Monitor™**
  - Measures and controls pre-boiler corrosion environment
How to Measure Corrosion Processes Faster and More Accurately

Daniel C. Sampson and Peter D. Hicks, Nalco

Case Study #1: A Small Problem with Reductant Feed?

The following example concerns a common occurrence at many power plants: a relatively small increase in DO concentration. Most plants might consider this a minor "blip" that can be ignored, but the corrosion environment at temperature tells a different story.

In this system (Figure 6), scavenger chemical feed rate was slaved to steam flow off a primary boiler. A
Stimson Start-up
Feedwater (DA) Temp vs. ORP

1. Low DA temp - Inadequate Pegging Steam
   High $O_2 > 100$ ppb

2. Corrosive feedwater - High ORP

3. Oxygen Scavenger INCREASED

4. DA Pegging Steam ON, Set Point increased to 6 psi

5. At-Temp ORP in range, $O_2 < 20$ ppb
New Boiler Automation Technology

Directly measures
Automatically responds
Maintain optimum treatment levels

Baseline Monitoring LP #3 AT-T ORP
Phase 1: AEPCO Controlled Feed Of Eliminox
Phase 2: LP #3 AT-T ORP Controlled

Direct control of scale
Inhibitor chemistry

TRASAR Automation
Direct control of preboiler corrosion
NCSM Automation

Direct control of scale
Inhibitor chemistry

Figure 1: LP #3 AT-T ORP Results During Phase 1 and 2 of AEPCO Trial

LP #3 AT-T ORP Set Point = -350 mV

Optimum Operation

Maintain optimum treatment levels

TRASAR Automation
TRASAR Automation
TRASAR Automation
TRASAR Automation
TRASAR Automation
TRASAR Automation

NCSM Automation
NCSM Automation
NCSM Automation
NCSM Automation
NCSM Automation
NCSM Automation

Optimum Operation
Optimum Operation
Optimum Operation
Optimum Operation
Optimum Operation
Optimum Operation

Direct control of preboiler corrosion
Automated Chemical Inventory

#3
Tank Level Monitoring
### Dashboard Customer - Last 30 Days

**DARIGOLD INC - PORTLAND, OR - DAF Chemical Inventories**

<table>
<thead>
<tr>
<th>Inventory</th>
<th>Product Usage</th>
<th>Tank Name</th>
<th>Tank Serial</th>
<th>Last Update</th>
<th>Current Inventory (Gals)</th>
<th>Usage Ave 30 (GPD)</th>
<th>Usage Ave 7 (GPD)</th>
<th>Usage Ave 2 (GPD)</th>
<th>Days To Reorder Point</th>
<th>Days To Empty</th>
</tr>
</thead>
<tbody>
<tr>
<td>8187</td>
<td></td>
<td></td>
<td>120076</td>
<td>2/3/2015 3:53:00 AM</td>
<td>187.8</td>
<td>8.8</td>
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<td>6.3</td>
<td>15.3</td>
<td>28</td>
</tr>
<tr>
<td>8100</td>
<td></td>
<td></td>
<td></td>
<td>2/3/2015 3:53:00 AM</td>
<td>185.9</td>
<td>40.8</td>
<td>35.7</td>
<td>35.6</td>
<td>2.4</td>
<td>5.1</td>
</tr>
</tbody>
</table>

### Usage - Volume (gal/day) - 8187- Last 30 Days

![Graph showing daily usage volume for 8187 over 30 days.]

### Amount Full - Volume (gal) - 8187- Last 30 Days

![Graph showing daily amount full volume for 8187 over 30 days.]

### Usage - Volume (gal/day) - 8100- Last 30 Days

![Graph showing daily usage volume for 8100 over 30 days.]

### Amount Full - Volume (gal) - 8100- Last 30 Days

![Graph showing daily amount full volume for 8100 over 30 days.]

An Ecolab Company
Blowdown Heat Recovery

#2
2. Blowdown heat exchanger
Matt and I confirmed the efficiency of the blowdown heat exchanger. Blowdown Inlet temperature was 343 F, while the temperature of the blowdown outlet was 95 F. These results are excellent and show good heat recovery.
Boiler Energy & Water Savings

Company: Neil Jones Food Company
Plant: Northwest Packing/Cleaver Brooks Boiler
City: Vancouver
State: Washington
Attention: Erich Biancaflor
Prepared by: Bob Reller
NALCO Copy to: John Zora
Date: 3-Oct-07

Input Values

<table>
<thead>
<tr>
<th>Input</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sewer Cost</td>
<td>$/1000 gal</td>
<td>$2.00</td>
</tr>
<tr>
<td>Make Up Water Cost</td>
<td>$/1000 gal</td>
<td>$3.00</td>
</tr>
<tr>
<td>Makeup Water Temp.</td>
<td>°F</td>
<td>85.0</td>
</tr>
<tr>
<td>Return Condensate Temp.</td>
<td>°F</td>
<td>200.0</td>
</tr>
<tr>
<td>Fuel Cost</td>
<td>natural gas</td>
<td>$7.00</td>
</tr>
<tr>
<td>Boiler Efficiency</td>
<td>%</td>
<td>80.0%</td>
</tr>
<tr>
<td>Operating Days per Year</td>
<td>Days</td>
<td>180</td>
</tr>
</tbody>
</table>

Boiler System Operation

<table>
<thead>
<tr>
<th>BD Heat Recovery</th>
<th>Value</th>
<th>&quot;What if&quot; Analysis</th>
<th>Savings from Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat Recovery %</td>
<td>Yes or No</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>% Condensate Return</td>
<td>%</td>
<td>20.0%</td>
<td>20.0%</td>
</tr>
<tr>
<td>Boiler Cycles</td>
<td>Cycles</td>
<td>7.0</td>
<td>7.0</td>
</tr>
<tr>
<td>Steam Pressure</td>
<td>psig</td>
<td>142</td>
<td>142</td>
</tr>
<tr>
<td>Steam Temperature</td>
<td>sstd 362 °F</td>
<td>362</td>
<td>362</td>
</tr>
<tr>
<td>Steam Enthalpy</td>
<td>BTU/lb</td>
<td>1,195</td>
<td>1,195</td>
</tr>
<tr>
<td>Blowdown Enthalpy</td>
<td>BTU/lb</td>
<td>334</td>
<td>334</td>
</tr>
<tr>
<td>Makeup Flow</td>
<td>lb/hr</td>
<td>23,333</td>
<td>23,333</td>
</tr>
<tr>
<td>Return Condensate Flow</td>
<td>lb/hr</td>
<td>5,833</td>
<td>5,833</td>
</tr>
<tr>
<td>Feedwater Flow</td>
<td>lb/hr</td>
<td>28,167</td>
<td>28,167</td>
</tr>
<tr>
<td>Blowdown Flow</td>
<td>lb/hr</td>
<td>4,167</td>
<td>4,167</td>
</tr>
</tbody>
</table>

Energy & Water Costs and Credits

| Blowdown Energy Cost | $/year | $40,886 | $16,342 | $24,543 |
| Blowdown Sewer Cost  | $/year | $3,597  | $3,597  | $-
| Makeup Water Cost    | $/year | $30,216 | $30,216 | $-
| Sub Total (Costs)    | $/year | $74,698 | $60,166 | $24,532 |
| Returned Condensate Fuel Credit | | $(28,644) | $(28,644) | $
| NET SAVINGS or COSTS  | $/year | $-
| Calculated Cost of Steam | S/1000 lbs | 10.79 | 10.52 | $0.272 |
| NET CO2 EMISSION SAVINGS (INCR) | fuel is natural gas | Tons CO2 / yr | 203 |
Boiler Blowdown at 150 psig
1,000 lb/hr at 364°F
$H_f = 336 \text{ BTU/lb}$
Heat Flow = 336M BTU/hr
Useable Heat Flow = 308M BTU/hr

Make-Up water picks up
Heat Flow = 278M BTU/hr

Clean BD HX efficiency gives 90% removal of heat

Make-Up at 60°F
27.4M BTU/lb

To Sewer Waste at 86°F
$H_{fg} = 58.2 \text{ BTU/lb}$
Heat Flow = 58.2M BTU/hr
Useable Heat Loss = 30.8M BTU/hr

90% Energy Saved!
Managing your data

#1
3D Trasar – Stimson Forest Grove

- Scale Control
  - NexGuard Trasar
- Corrosion control
  - At-Temp ORP
- BFW pH
- BFW Conductivity
- Boiler Blowdown
- Turbidity
- Temperature
- Tank Level
- Amine Conductivity
- Softener Hardness
### System Details

**ROSEBURG FOREST PRODUCTS, DILLARD, OR (500067777/500067777) BOILER [11026]**

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Status</th>
<th>Date/Time</th>
<th>Latest Value</th>
<th>Avg.</th>
<th>Min.</th>
<th>Max.</th>
<th>St. Dev.</th>
<th>Low Critical Limit</th>
<th>Low Limit</th>
<th>High Limit</th>
<th>High Critical Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRASAR (ppm)</td>
<td><img src="image" alt="Green" /></td>
<td>3/10/2015 1:00:00 AM</td>
<td>2.16</td>
<td>2.53</td>
<td>1.86</td>
<td>3.3</td>
<td>0.25</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>30</td>
</tr>
<tr>
<td>AT ORP1 (mV)</td>
<td><img src="image" alt="Green" /></td>
<td>3/10/2015 1:00:00 AM</td>
<td>-199</td>
<td>-191.53</td>
<td>-228</td>
<td>-144</td>
<td>12.2</td>
<td>-900</td>
<td>-500</td>
<td>-50</td>
<td>0</td>
</tr>
<tr>
<td>pH 2</td>
<td><img src="image" alt="Green" /></td>
<td>3/10/2015 1:00:00 AM</td>
<td>8.64</td>
<td>8.76</td>
<td>8.54</td>
<td>8.91</td>
<td>0.07</td>
<td>7</td>
<td>8</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Conductivity 1</td>
<td><img src="image" alt="Green" /></td>
<td>3/10/2015 1:00:00 AM</td>
<td>7</td>
<td>6.91</td>
<td>6</td>
<td>8</td>
<td>0.3</td>
<td>0</td>
<td>2</td>
<td>14</td>
<td>25</td>
</tr>
<tr>
<td>Temp 2 (°F)</td>
<td><img src="image" alt="Green" /></td>
<td>3/10/2015 1:00:00 AM</td>
<td>213.11</td>
<td>211.08</td>
<td>204.04</td>
<td>215.79</td>
<td>1.99</td>
<td>50</td>
<td>150</td>
<td>300</td>
<td>400</td>
</tr>
</tbody>
</table>

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NALCO
An Ecolab Company
Possible root cause: Low inventory, blocked feed

Description: Relay has been under failsafe condition for a while. But even with 30% relay duty concentration is still dropping. This indicates either the product container may be empty or a leak or blockage may exist in the feed line. Prior to this during normal operation (auto) concentration decreased less in 1400 minutes indicating reduced feed rate (conductivity is not dropping that much). Please check the above issues.

Graph attached
Basic Boiler Training Seminar

How to run a successful boiler water treatment program

Key Topics
In addition to Nalco, Nick Westerberg, president of Westerberg and Associates, will present on optimization of steam and condensate systems. Nick is a motivational speaker and author of Doc’s Steam Journal and Doc’s Pump Journal.

McMenamin’s Kennedy School
5736 NE 33rd Ave.
Portland, OR 97211
Basic Cooling Water Training

How to run a successful cooling water treatment program

Presented by
NALCO
An Ecolab Company

Thursday, April 23, 2015
9:00 AM - 3:30 PM

McMenamin’s Kennedy School
5736 NE 33rd Ave.
Portland, OR 97211
Top 10 for Boiler Water Treatment

Western Regional Boiler Association

March 11, 2015
LION CAM-3 SECURITY ALERT

ALERT LEVEL: 1A

ACTION: IMMEDIATE

THREAT LEVEL: HIGH

AUTOMATED REPORT SUMMARY
LION CAM-3 SECURITY ALERT

ALERT LEVEL: 1A

ACTION: IMMEDIATE

THREAT LEVEL: HIGH

AUTOMATED REPORT SUMMARY