Institute of Energy Professionals

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Energy Issues

IEP Newsletter –

INSIDE THIS ISSUE:

Cleaver-Brooks Package Boiler

Ten Methods for Saving Thousands in the Boiler Room (Part 1) –

(The following is the first part in a series provided courtesy of the American Society of Power Engineers - ASOPE)

Nearly everyone involved in the operation of boilers, from the operator to the owner, realizes the considerable expense of operating steam generators and associated auxiliary equipment. What many do not realize, however, is that there are seemingly small and insignificant changes and/or modifications that can be implemented and result in considerable savings.

In this issue we highlight the first two (2) of ten (10) recommendations:

Method 1 – Evaluating Boiler Performance – Calculating Efficiency

To optimize boiler performance we must understand how efficiency savings or losses are calculated. The formula for realized savings/losses can be expressed as follows:

Saving/Loss = (New Efficiency – Old Efficiency)/New Efficiency

Example: An existing boiler had an efficiency of 80%. As a result of improper operation and maintenance boiler efficiency has dropped to 73%, directly corresponding to a fuel efficiency loss of:

Loss = (73% -80%)/73% = -9.59%

With an annual fuel bill of $1 million US the additional fuel cost would be $95,900 US.

Method 2 – Waterside Scale Prevention

Water treatment in boilers today remains one of the most important items of energy conversation and savings. Boiler waterside scale is mostly composed of the minerals calcium and magnesium. These are insoluble salts in water; meaning that they don't like to be in solution and will drop *(plate)* out as temperatures rise. This is what you often see in the bottom of hot water *(tea/coffee)* kettles at home.

Deposition or the "plating out" of the calcium and magnesium on the waterside of the boiler tubes reduces heat, resulting in an increase in tube metal temperature.

Tube overheating, along with potential tube failure, will eventually be the result of prolonged scale deposition. Note that there can be other (extensive) damage that can result from the same scale build-up.

The following chart illustrated the efficiency loss as scale thickness increases.

Scale Thickness	*Efficiency Reduction*
0	*0%*
1/64	*4%*
1/32	*7%*
1/16	*11%*
1/8	*18%*
3/16	*27%*
1/4	*38%*
3/8	*48%*

Example: A boiler's original efficiency was 80%. Deposits have subsequently formed a 3/16" scale layer on the tubes. The resulting efficiency change would be:

New Efficiency = 80% - 27% = 53%

Ten Methods for Saving Thousands in the Boiler Room (Part 1) – *(cont.)*

With the typical annual fuel bill of $30,000 US, a 3/16" layer of scale would increase fuel expenses by *$8,100 US*.

Fuel Cost with Scale Formation = $30,000 + ($30,000 x 27%) = $38,100 US

Chemical Treatment and Control – *(Boilers & Chillers)*

Feedwater Hardness *(Calcium & Magnesium)* prior to entering the boiler should typically be less than 1 ppm Total Hardness. Hardness reduction is achieved by using RO units, Ion Exchange systems, and most importantly by maximizing condensate recovery. Typically, the more condensate that is recovered the fewer chemicals that are required for the boiler, along with decreased fuel costs from preheating.

Water chemistry testing should be performed at least daily in order to ensure and maintain proper levels. Calibration of all water chemistry meters is extremely important to ensure correct readings.

Proper chemistry levels in boilers under 300 psi include:

- TDS <3500ppm after neutralization
- Silica <150ppm
- Phosphate 20-40ppm
- Sulfite 30-60ppm
- Hydroxide 300-600ppm

Scale forming conditions in a boiler can also be a significant contributing factor, resulting in Carryover (*moisture in the steam)*. Carryover can result in downstream scaling.

Cooling system scaling is a little different than boiler scaling in that hot areas do not need to be present for scale deposition to occur. Cooling system scale typically occurs when the solubility of the water is exceeded *(concentration cycles are too high).*

As in boilers, heat transference is inhibited along with proper flow. Unlike boilers, microbiological growth can cause the same problems.

Cooling systems are ideal for microscopic life due to the temperatures, as well as food sources in the air.

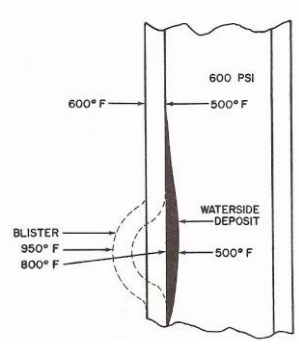
Bacteria:
- Can attack both once-through systems and recirculating systems.
- Can be aerobic *(air breathing)* or anaerobic *(non-air breathing).*

Algae:
- There are many types of algae. Algae are plants that require sunlight for growth.
- Like bacteria, different types of algae will live in different ph's and temperatures.

Fungi:
- Have two (2) forms – Mold and Yeast.
- Yeast will form slime in abundance.

Biofilms formed by microbiological growth are 25 to 200 times more resistant to conduction than many metals. 1 mm of Biofilm on mild carbon steel is equivalent to a wall thickness of 80 mm.

(Look for Methods 3 & 4 in the Winter - 2014 Newsletter.)



Effects of Waterside Deposits on Boiler Tubes

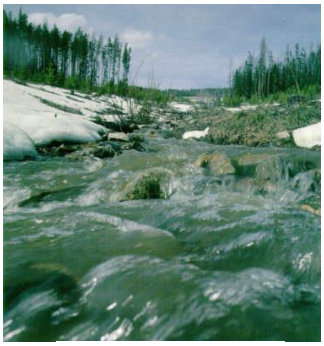
Natural Gas-Fired Boilers Serving a Healthcare Facility

Utility Power Plant – Coal-Fired Boilers

Water: The Next Looming Threat

(Depending upon your location the availability of water may or may not be an issue at this time. However, there are few of us that have not experienced drought conditions on a limited or extended basis. There are a number of reasons for this. Physical location and climate obviously play a major role. However the increased number of people in major urban centers and the cyclic influx of large labor pools for seasonal crop planting and harvesting have placed an increased demand on the need for potable water.

The availability of water supplies for domestic, agricultural and industrial needs has always been a problem for thousands of years in parts of the world. It is, however, becoming a major point of concern for more industrialized countries. The continued availability of adequate supplies of water has taken on a new emphasis much like energy did in the 1970s. Following is an article from William H. Mashburn, Sr. PE, PEM, emphasizing the need for a well thought-out systematic approach to resolving our pending water issues. Dan Mull, PE, PEM – Editor)



Melting Snow Feeds Water Supplies

Brooks Lake Outlet – Wyoming, USA

With the recent increase in *known* energy reserves in the United States and other locations, the future availability of energy is somewhat more secure – compared to the emerging threat of water scarcity. The diversity of this scarcity ranges from local, to national, to international. Following are a few examples of water supply concerns within the USA.

- In the western part of the United States the snowpack and rainfall are the major contributors to the water supply. This year the snowpack has been low. So, the Colorado River will give up its supply as it traverses the country until only a trickle reaches the border with Mexico.
- People in the state of Arizona are currently pulling from aquifers that may take thousands of years to replenish.
- For portions of the eastern United States 2013 has been one of the wettest summers on record. In North Carolina this summer was the first time in recent memory that all 100 counties were no longer under water shortfall conditions. Just a few years ago, however, many of these same areas were experiencing severe water rationing, with the availability of water in local reservoirs down to less than 30 days.
- Another example of a current water shortage is in eastern Virginia. The cities of Virginia Beach and Chesapeake are aggressively pursuing a pipeline over 120 miles to Lake Gaston in North Carolina. The pipeline is projected to provide 60 million gallons of water per day.

On an international basis, this diversity is much greater from severe drought to oversupply. Because of this diversity and other factors, it is difficult to develop a water management program.

A recent article by the *Worldwide Institute* states: “Some 1.2 billion people – almost a fifth of the world’s population - lives in areas of physical water scarcity, while another 1.6 billion face what can be called economic water shortage. The situation is only expected to worsen with population growth, climate change, investment and management shortfalls, and inefficient use of existing resources that restrict the amount of water available to people. It is estimated that by 2025, 1.8 million people will live in countries or regions with absolute water scarcity, and almost half of the world living in conditions of water stress.”

The *Institute of Energy Professionals* has become an international organization with members in more than twenty (20) countries including Mexico, Canada, the United Kingdom, Netherlands, Spain,

Water: The Next Looming Threat (cont.)

France, Germany, Italy, Serbia, the Russian Federation, United Arab Emirates, Lebanon, Saudi Arabia, India, Malaysia, Australia, China, and Brazil. Each *Professional Energy Manager* has received training in organization, economics and technology with respect to energy. This training is directly transferrable and can be utilized in the management of water.

Dr. Wayne Turner, Editor of *Energy Engineering* made a statement in the recent issue: "You and I will spend more of our time in water management/ conservation." This is true statement as we investigate the water needs worldwide.

Because of this impending threat, The *Institute of Energy Professionals* would like to begin to incorporate water management into our training program. In order to effectively do this we would like to have input from our members, both domestically and internationally. We may incorporate some of your experiences into the future issues of the Newsletter, or possibly devote a whole issue to water management. Let us hear from you.

William H. Mashburn Sr. is Professor Emeritus Mechanical Engineering VPI&SU and Executive Director of the Institute of Energy Professionals. Mr. Mashburn is also the founder of the Energy Management Diploma Program.

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Reservoir

PEM Update

IEP has partnered with Virginia Polytechnic Institute & State University (Virginia Tech) to offer a new *Professional Energy Manager Certification Program*. This three-week offering will be held that the Hotel Roanoke & Conference Center in Roanoke, Virginia and include many of the same instructors in the highly regarded *NC State University Energy Management Diploma Program*. Starting the week of March 31, 2014 and concluding in September, this program is specifically structured to provide the necessary skills for PEM certification and to prepare participants for a successful career in Energy Management. For more information on this program contact:

Continuing and Professional Education
Virginia Tech, Mail Code 0272
702 University City Blvd., Blacksburg, VA 24061
Phone: 540-231–5182

PEM Program Display

Be a Contributor

The goal of the IEP Newsletter is to provide PEMs with timely useful information to help them better manage energy resources and control utility expenditures. To that end we would like your input. Let us know what type of information, articles or updates you would like to see in future Newsletters. Also, if you would like to contribute an article about a recent project or application of technology, all submittals used *will apply towards PEM renewal accreditation*. For additional information on being a contributor or recommending future topics contact Dan Mull with your suggestions.

PEM
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