ENVIRONMENTAL WATER, LTD.
WATER TREATMENT SPECIALISTS

Technical Data Sheet

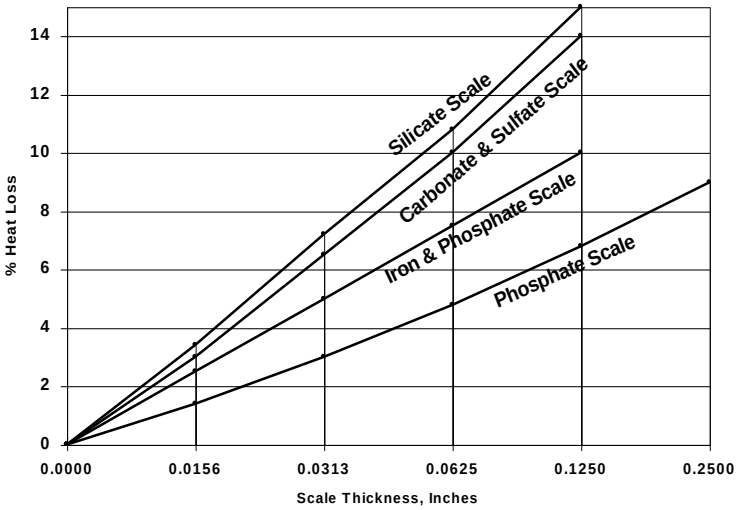
BOILER EFFICIENCY

A clean boiler performs more efficiently saving operation and maintenance expenses as well as costly downtime.

While this document will focus on boiler cleanliness and its impact on boiler efficiency, it is recognized that several other factors can greatly impact boiler system efficiency. These include: 1) optimizing/minimizing energy & water loss from boiler blowdown, 2) minimizing energy and water loss from steam/condensate leaks, poor insulation, and faulty steam traps and 3) optimizing combustion efficiency.

Boiler scale reduces efficiency of operation by inhibiting the transfer of heat into the boiler water. The presence of scale is like spreading a thin film of insulation across the path of heat transfer. Lack of heat transfer in the boiler translates to increased stack temperature (i.e., an increase in stack temperature, all else being equal, would suggest the presence of deposits).

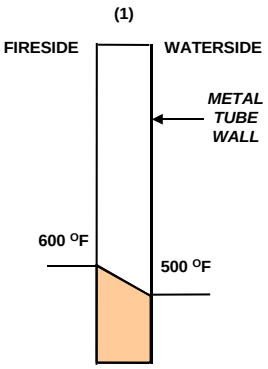
Energy Loss from Scale Deposits



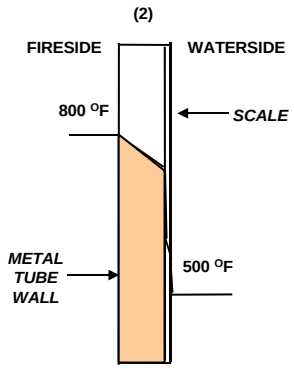
The rate of heat transfer may be reduced as much as 15% by the presence of scale. In a 200 hp. boiler, a 15% loss in heat transfer increases fuel costs by as much as $120,000 a year based on a 10-hour day, 260-day year. The graph below illustrates efficiency loss for various scale types and scale thickness.

In addition to heat loss is the effect scale has in causing boiler metal to overheat. This condition can result in tube failure. If sufficient scale is formed, the insulating qualities of the scale can cause the tubes to heat to more than 800°F/427°C. This is usually the maximum temperature that is considered safe for boiler tubes. Costly repairs and boiler downtime are the result of such a condition.

Clean tube heat transfer is unimpeded. Metal temperature remains well below critical.



Dirty tube heat transfer is impeded causing the fireside metal temp. to rise. Metal exceeds critical temp..



The illustration above visually depicts how scale deposit can cause tube overheat. As the boiler pressure and heat flux (rate of heat transferred per square foot of boiler tube) increases, the tolerance for deposit is reduced. This explains the need for improved feedwater quality and control of boiler water conditions as boiler pressure increases.

There are three key requirements to maintaining boiler cleanliness: 1) proper feedwater quality, 2) proper blowdown control and 3) proper boiler treatment. Good feedwater quality is achieved by properly treating the condensate and maximizing condensate return. Makeup use should be minimized and properly pretreated to minimize hardness and alkalinity, if necessary. Continuous or surface blowdown is the preferred method of blowdown. Intermittent or bottom blowdown is ideally used to remove suspended solids. ASME and ABMA both provide guidelines for feedwater and boiler chemistry control targets. Proper boiler treatment should consider oxygen control, boiler deposition control and condensate corrosion control. Where deposits do exist, the boiler operator should consider off-line or on-line cleaning options.