

### What If I Don't Treat the Boiler? Part 3

This is the third (and last) in the series dedicated to the question: If you don't chemically treat steam boiler systems, what will fail first?

We have already discussed how oxygen corrosion, a "pitting-type" of corrosion, can be the most aggressive agent in causing equipment failure. We also addressed the negative affect untreated steam and condensate can have on a boiler. The final "poison" to the boiler system is hardness in the feedwater.

Hardness, which enters the boiler through the feedwater, will form scale on the boiler tubes. The scale then impedes heat transfer from the fireside to the boiler water, causing the boiler tube to eventually overheat until the metal's yield strength decreases to the point of failure. The timing of this process, however, is dependent on the amount of hardness in the feedwater.

You may say, "My pretreatment system has a softener or RO on the make-up water, so I don't have any hardness entering the system." Even though your pretreatment looks like it measures 0 ppm (parts per million) hardness, there actually is some hardness getting through on a parts-per-billion level. When testing low-level hardness on any water, you should never report a level of 0 ppm  $\text{CaCO}_3$ . Since there is always some hardness in the water, a more correct way of reporting the hardness level is  $<0.1$  ppm as  $\text{CaCO}_3$ .<sup>\*</sup> Without internal chemical treatment (like phosphates and polymers), it is this very low level of hardness that will accumulate on the boiler tubes, eventually causing failures.

So, if we only treat a system for oxygen and condensate corrosion, eventually the boiler will fail from scale. If we have a properly operating pretreatment system, this last failure may take a long time. However, if the pretreatment is prone to periodic upsets, then this failure could happen much earlier than expected. Keep in mind that contamination of hardness into the condensate system will also accelerate this process.

<sup>\*</sup>NOTE: All test methods have their low detection limits. For hardness tests, it is generally  $<0.1$  ppm. A proper service report should never contain "0" for a test result; it should instead list the method's lowest detection limit as provided by the test kit manufacturer.