

What If I Don't Treat the Boiler? Part 2

The ramifications of not chemically treating steam boiler systems are many. In Part 1, we discussed how oxygen corrosion, a "pitting-type" of corrosion, can be the most aggressive agent in causing equipment failure. The next problem most likely to affect our boiler system is untreated steam and condensate. Corrosion in this system will lead to condensate system equipment failures, but more importantly, the transport of those corrosion products into the boiler will eventually cause even bigger concerns.

Corrosion in the condensate system is caused by carbon dioxide absorbing into the pure condensate, forming carbonic acid. The carbonic acid lowers the condensate pH, causing acid gouging. The metal loss eventually causes leaks in the system, requiring replacement of equipment. The condensate equipment loss is tolerable, but what is not tolerable is the subsequent corrosion product getting back into the boiler system. This iron corrosion product enters the boiler where it prefers to deposit in heat flux areas. These heat flux areas are where we are looking for the heat from the combusted fuel to heat the boiler water. The iron corrosion product is about 20 times less dense than the original iron on the piping. This lower-density deposit works as an insulator, impeding heat transfer and causing the boiler tube temperature to increase in order to create the same amount of steam required. As the boiler tubes increase in temperature, their yield strengths decrease. Eventually, with enough insulating deposit, the boiler tube's yield strength will become so low that the boiler tube fails.

With copper corrosion product, the copper can also deposit on boiler tube surfaces; however, the chances for galvanic corrosion on the boiler tube can be worse than the insulating factor of the copper deposit. Metal loss of the boiler tube around the deposit will progress until the tube fails due to pitting corrosion. According to reference documents I have read, galvanic corrosion from copper deposits is rare in well-passivated boilers.

For these reasons, you can see why it is essential to properly treat the condensate, checking to be sure it is properly neutralized and the corrosion product is low. In systems where neutralizing amines are ineffective, filming amines should be considered to protect the systems. The filming amines also must be monitored to avoid overfeed.