Off-Line Boiler Protection Options

**Technical Bulletin 1-019**

**Boiler Systems**

**Background**
Dissolved oxygen in boiler water can cause rapid pitting attack and metal failure. The potential for oxygen corrosion is particularly high in multiple boiler systems where the boilers are rotated or left off-line for extended periods of time. When a boiler is shut down and removed from service, oxygen intrusion occurs as the boiler cools. Unless very high levels of oxygen scavenger are present and the boiler water remains well mixed while off-line, severe corrosion can occur.

**Options for Off-line Boiler Protection**

There are several options available for protecting an off-line boiler from corrosion:

1. **Configure a separate feed system for supplemental feed of sulfite oxygen scavenger and alkalinity chemicals to the off-line boilers.** This is a manual operation, requiring frequent testing and the ability to turn the pump on and off to maintain boiler water sulfite of 100-200 ppm and p-Alkalinity at a minimum of 400 ppm. In plants with limited maintenance personnel, this can be a cumbersome process.

2. **Frequent boiler rotation.** Before a boiler is taken off-line, increase the sulfite levels to 125 ppm minimum. If the boilers are rotated frequently enough, the sulfite residual may not decrease to minimal levels. In this scenario, boiler sulfite levels must not be allowed to drop below normal minimum limits or pitting can occur. This method also requires frequent testing and the ability to change over equipment. If boilers are on standby for extended periods, then rotation can no longer be effective.

3. **Off-line boilers are put into wet storage.** Wet storage involves installing a supplemental feed system for the manual addition of sulfite and alkalinity builder. The boiler should be completely filled with treated water until water level is higher than the top of the sight glass with blowdown lines closed. The steam header valve on stored boilers should also be closed to prevent boiler water from entering the steam header and to prevent condensation from leaking non-return valves from entering the boiler and diluting the chemical levels. In plants that need a rapid response in the event that the main boiler shuts down, wet storage has advantages. The stored boiler must be drained to the normal water level and steam header opened before firing.

4. **Off-line boilers are stored dry.** Boilers are opened and desiccant added on trays setting on the rows of boiler tubes to maintain dry conditions throughout the boiler. In addition, the fireside has to be kept dry as well. This technique can be done when the boiler is seasonally shut down or left off-line for periods of one year or more. It also has obvious disadvantages if the boiler needs to be put online quickly. Vapor phase corrosion inhibitors, such as Cortec® Boiler Lizard™, can also be used for protection during dry storage: simply place the package inside the cooled, drained boiler and slit the package open. It will vaporize inside the boiler and coat the tubes. The bag is water-soluble so it does not need to be removed. Another option is to put a nitrogen blanket on the boiler by adding nitrogen gas from a pressurized gas cylinder. By maintaining a positive pressure of nitrogen, air is prevented from entering the boiler.

5. **Configure boilers with a cascading blowdown.** This technique uses treated boiler water from the firing boiler to help provide needed corrosion protection in the off-line boilers. Since the water from the operating boiler is already treated, there is little or no need (or additional treatment cost) for supplemental feed systems required to accomplish this. For cascading blowdown to work properly, there must be enough heated and treated blowdown available to keep the off-line boilers flooded with hot blowdown. The surface blowdown line from each boiler is piped so it enters the bottom blowdown lines or a side entry point located in the bottom half of the boiler shell on each boiler. Ideally, one wants the hot blowdown water to enter near the bottom at one end of the boiler and exit at the top at the opposite end for best distribution of the sulfite and other treatment chemicals. Usually, the best way to tie all the surface blowdown lines together is through a manifold piping arrangement. In systems where blowdown is intermittent, activated by an automatic conductivity controller, treated boiler water will only enter the off-line boilers when the controller has the blowdown valve opened.

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