Low sulfite residual in a boiler can have many causes. Each boiler system is unique. You should gain an understanding of how your system relates to the possible causes outlined in this article.

**Possible Causes**

- Undercycled boilers
- Low deaerator (DA) temperature and pressure
- Improper DA venting
- Changing steam loads
- Malfunctioning DA
- Bad Iodide/Iodate reagent
- No sulfite being fed to DA
- Bad product blend
- Other oxygen sources

**Undercycled Boilers**

If the boiler conductivity is below setpoint, the sulfite level is expected to be proportionally below setpoint too. (Conversely, if the boiler conductivity is above setpoint, the sulfite level is expected to be proportionally above setpoint too.)

**Low Deaerator Temperature & Pressure**

The deaerator temperature and pressure go hand in hand. The higher the temperature, the higher the pressure, and vice versa. As the temperature increases, oxygen becomes less soluble in water (see graph below) and is vented out of the DA. A typical DA operating temperature is at least 220°F. Remember, the more oxygen that is left in the deaerated water, the more sulfite there will be required to reduce it. Always ensure the DA is operating at a normal temperature and pressure.
Improper DA Venting

If the DA vent is closed or not venting properly, the DA will not be able to vent off the oxygen and other gases from the boiler feedwater. Once again, the more oxygen that is left in the deaerated water, the more sulfite there will be required to reduce it.

How big should the vent plume be? That depends upon which reference you read. The range I've seen in literature is from 15 to 33 inches of actively moving plume. The average of these two numbers is 24 inches.

What do I mean by actively moving plume? This does not include the wisp of steam that forms as the vented gases escape to the atmosphere. It includes the vented gases leaving the vent piping up to the point that the wind starts to bend the flow. You may have to look at the steam plume for a minute before you get an accurate feel for where this point is. Also, remember that the height of the steam plume will fluctuate a little as the system takes on makeup water and the load changes.
The ultimate determining factor of how big the plume needs to be is whether of not oxygen is being properly removed from the water. A dissolved oxygen study with the sulfite feed turned off will help you determine this.

**Changing Steam Loads**

Changing steam loads can affect the sulfite residual by affecting the amount of DA venting required or the amount of sulfite feed required. Unless your sulfite feed pump is controlled based upon feedwater flowrate, steam load, etc., it is probably functioning in an "always on" mode. During weekend production slowdowns, the pump will need to be turned down because of the lower demand for feedwater. Likewise, when production increases again Monday, the pump will need to be increased. If the operator forgets to turn the pump down on Friday night, the Monday morning sulfite readings will be high. If the operator forgets to turn the pump back up Monday morning, the sulfite readings will be low.

**Malfunctioning DA**

Dearators are spray-type or tray-type. If the trays get knocked out of place or the spray nozzles are clogged or damaged, the feedwater will not be broken up into the fine droplets for efficient oxygen removal. If the deaerator is not able to mechanically remove the oxygen properly, more sulfite will have to be consumed to chemically remove it.

**Bad Iodide/Iodate Reagent**

Never, ever, ever let your Iodide/Iodate reagent freeze!!! You will get drastically different results if you do! If your Iodide/Iodate reagent freezes, dispose of it and replace with fresh reagent before running any tests with it.

**No Sulfite Being Fed to DA**

You may have a low sulfite residual for the simple fact that no sulfite is getting to the DA in the first place. The sulfite pump may be broken or turned off. The chemical feed line may be leaking. The sulfite injection quill may be clogged. The sulfite drum/tank may be empty. The operators may have forgotten to add sulfite to the day tank.

**Bad Product Blend**

It should be a rare occurrence, but it does happen. If you have a blended product with sulfite as a component, you may have gotten a bad blend. Doing a dilution to test the sulfite concentration in the product is a bit harder because some of your sulfite will be consumed by the oxygen in the dilution water. Remember, it takes 10 ppm of sodium sulfite to reduce 1 ppm of oxygen.
Other Oxygen Sources

With the deaerator system operating at above atmospheric pressure, any holes or leaks are more likely to leak water or steam than to suck in air. There are exceptions to this rule though. One example is a customer that used to have a steam turbine pump that sent its lower pressure steam to the deaerator. When the pump was removed, the low pressure steam line to the deaerator was left in place. This line had a nonreturn check valve on it so steam would not backup through the line, but the way the pipe was plumbed into the deaerator created a venturi-like vacuum on the line at times. This was sucking air into the deaerator and consuming more sulfite than it should have.