DREWPLEX AT AND OX

LOW PRESSURE BOILER WATER TREATMENT

CORRECTING OUT-OF-CONTROL SCENARIO

Out-of-Control Scenario

We have noted that a number of ship's boiler treatment program are out of control.
The symptoms may include one or more of the following:

- Low Hydrate Alkalinity reserve, regardless of Drewplex AT dosage (H Alkalinity below 20 ppm, Drewplex AT dosage above 1.5 liters/day)
- High Phosphate readings combined with low Hydrate Alkalinity readings (PO4 in excess of 40 ppm and H Alkalinity below 20 ppm)
- High Drewplex OX dosages to maintain 0.4 ppm DEHA reserve (Drewplex OX dosage above 1 liter/day)

We have isolated the causes for these out-of-control scenarios:

- Low hotwell temperatures (below 80C/180F)
- High dosages of Drewplex OX (above 1 liter per day)
- High initial dosage of Drewplex OX at start up
- No regular blowdown

The Chemistry of Out-of-Control Scenario

Drewplex OX contains DEHA, an oxygen scavenger that is very reactive with oxygen. It undergoes chemical changes during the oxygen reaction process and during the thermal process in the boiler. The reaction byproducts include the production of acetates and amines, some of which interfere with hydrate alkalinity.

High oxygen content of the feedwater (due to low hotwell temperatures) causes the chemical reaction to accelerate. Overdosing Drewplex OX to manage the high oxygen content of the feedwater adds more DEHA, which produces more interference with hydrate alkalinity. It's a vicious cycle.

Unlike hydrazine, DEHA travels out with the steam in great quantities, essentially carrying DEHA byproducts throughout the steam and water system. A high dosage of Drewplex OX will generate high DEHA byproduct levels in the condensate, further depressing the H Alkalinity as the DEHA byproducts undergo thermal breakdown in the boiler, along with any new Drewplex OX that is added. Since we control the Drewplex OX dosage with the DEHA test (a measure of the oxygen reducing capacity of the sampled water, not the actual DEHA in the sample), a significant amount of DEHA byproducts can exist undetected.

Correcting Out-of-Control Scenario

We have developed a correction program that had worked in most instances to bring the Drewplex AT and Drewplex OX program back into balance:

- Stop dosing Drewplex OX for 5-7 days. This will allow for removal of the excess DEHA and DEHA byproducts from the system.

- Increase hotwell temperature to at least 75C/170F. (Up to the level of tolerance of the feed pump suction)
- Increase bottom and surface blowdown rate to at least daily until the system clears, then twice weekly thereafter– this removes the bulk of DEHA byproducts and reaction products
- Test condensate pH – if it takes more than 3 drops to neutralize, there is too much DEHA still in the system. Continue blowdown.
- Begin Drewplex AT dosage at 1.5 liters/day – establish H Alkalinity baseline. It may take 5-7 days to see a significant increase in hydrate alkalinity Test condensate pH - If it takes less than 1 drop to neutralize, increase Drewplex AT dosage to make sure that Drewplex AT's amines are controlling condensate pH. If this is so, you can assume that Drewplex OX is no longer present in enough quantity to depress the hydrate alkalinity.
- Restore Hydrate Alkalinity to 40 ppm minimum level by increasing/decreasing Drewplex AT dosage as warranted by the H Alkalinity test. It may be necessary to have slightly lower hydrate alkalinities during an interim period of time while the system is being balanced. A 30-40 ppm reading is acceptable short-term. It is more important to have a positive hydrate alkalinity reserve than DEHA readings.
- When the H Alkalinity reaches 40-45 ppm, restart Drewplex OX dosage at 50 ml/day, increasing until DEHA reading reaches 0.4 ppm or H Alkalinity is affected. There may be a short-term initial drop hydrate alkalinity reserve, but it should stabilize with time.
- A balanced system should have an H Alkalinity of 40-65 ppm, phosphate 10-20 ppm, and DEHA 0.4-0.8 ppm. All else being equal, a higher than normal phosphate reserve on an otherwise stabilized program is not a problem. Distilled water make-up plants sometimes do not have enough hardness to challenge the phosphates contained in Drewplex AT. Reserve levels of 80-100 are not desired, but will not harm the plant provided the hydrate alkalinity is restored to the normal range.