EVAPORATOR SCALE CONTROL PROGRAM IMPROVES EFFICIENCY/INCREASES PRODUCTION CAPACITY

Scale formation in black liquor evaporators results in wasted energy, excess costs, and loss of evaporator production. Tube surfaces coated with scale lower the heat-transfer coefficient, which lowers the production capacity of the evaporator and causes downtime for cleaning.

Scale is formed by crystals that develop on evaporator heat transfer surfaces. As the scale thickness increases, the steam efficiency, or rate of heat conductivity through the tubes, decreases. Initially this can be compensated for by increasing the temperature drop over the evaporator, but eventually a point is reached where evaporation rates begin to fall off. This will continue until production rates fall below the minimum tolerable levels, at which time the evaporators must be cleaned. Severe scaling problems can cause some mills to shut down every 3 to 4 days for cleaning.

Losses in production capacity are of two types: the direct loss of heat transfer rate during operation and the downtime for cleaning. In a mill where evaporator capacity is a bottleneck, scaling can be a serious problem.

ANALYSIS OF A SCALE PROBLEM

A deposit analysis performed by Nalco's Analytical Laboratory will show the composition of the scale. Calcium scales are a serious operating problem in many Kraft liquor evaporators. Crystalline deposits of sodium sulfate, sodium carbonate, aluminum, and magnesium silicate are also frequently encountered. Fiber and organic materials can also deposit.
Soft scales consist primarily of organic materials that are water soluble and can sometimes be easily removed using high-pressure water washing.

Sodium sulfate and sodium carbonate deposits are referred to as soluble scales because they can be dissolved by washing with water or weak liquor. These substances tend to come out of solution as a double salt called burkeite (\(2Na_2SO_4\cdot Na_2CO_3\)).

Calcium carbonate scales are the most common of the hard or insoluble scales. These generally require hydroblasting and/or boilout for removal.

**SCALE-GUARD PLUS TECHNOLOGY EVAPORATOR SCALE CONTROL PROGRAM**

A complete evaporator scale control program includes both a continuous scale treatment and rapid boilout procedure.

**CONTINUOUS SCALE TREATMENT**

Continuous chemical addition to the evaporators can help reduce the buildup of scale on heat transfer surfaces. Nalco’s SCALE-GUARD PLUS Technology includes a complete line of evaporator anti-scalants that are specially formulated blends of surfactants, dispersants, and crystal modifiers that reduce crystal growth. Scale control products are added to the suction side of the liquor pump upstream of the scaling problem. Usually 25 to 100 ppm is sufficient, depending on the type and severity of the scale. The chemical dosage is based on the liquor flow at the point of chemical addition. The program can be implemented without shutting down the system, but it is best to start on a clean piece of equipment. Continuous treatment will not completely eliminate downtime for cleaning, but it will extend the period of time between boilouts.

**RAPID BOILOUT**

Water or weak liquor boilouts do not always restore the heat transfer rate to its prescaling value. When the “clean” tube heat transfer coefficient decays with time, acid boilouts are usually used to restore it. If the scaled evaporator body can be isolated from the rest of the evaporator train, it can be cleaned without shutting down the entire evaporator train.

Nalco’s rapid boilout programs can shorten the cleaning time and provide more thorough cleaning of the evaporators. These special detergents help scrub and loosen existing scale. Some mills have reduced the length of time between boilouts by as much as 50%. With cleaner tubes to start with, deposits take longer to build up.

**BENEFITS**

Nalco’s SCALE-GUARD PLUS Technology reduces downtime to clean out the evaporators, and also allows for longer running time at higher flows, thus providing greater throughput and evaporator efficiency. By inhibiting the development of scale deposits on evaporator tubes, heat transfer improves while increasing the evaporator running time between acid cleanings, hydroblasting, or...
water washing. Reducing evaporator scale can result in significant energy savings and increased production capacity.

The proper implementation of a continuous scale control and rapid boilout program can:

• Reduce downtime
• Provide better heat transfer for extended periods
• Decrease steam consumption
• Improve production rates
• Eliminate recovery system bottlenecks

SCALE-GUARD PLUS TECHNOLOGY

Management of inorganic contaminants begins at the digester and plays a critical role in controlling the problems such contaminants can create throughout the pulp mill. Water optimization and process changes can result in the accumulation of tenacious scale deposits in critical areas. In addition, many pulp mills have modified their washing and bleaching processes due to changing environmental regulations. All of these changes have created an ideal environment for increased scaling problems, reduced brightness ceilings, escalating energy costs, imbalances in organic levels, and increased operating costs.

Nalco’s SCALE-GUARD PLUS Technology programs combine tailor made chemical programs, new monitoring and control technology, and most importantly mechanical, operational and chemical best practices. Nalco’s analytical capabilities and extensive resources enable us to accurately assess your scaling problem and develop cost-effective solutions. With over 80 years of water treatment expertise, we have developed successful scale control programs for every application in your pulp mill, including digesters, bleach plants, evaporators, and refiners.