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BOILER WATER CONDITIONING AND ITS APPLICATION TO DRY KILN OPERATION

(Summary of talk given to United Kiln Clubs, Corvallis, Oregon, May, 12, 1950, by Vern Stiers, Oregon Representative, DEARBORN CHEMICAL COMPANY. ) Seattle, Wash.

The following are the general purposes of boiler feedwater conditioning:

Scale prevention; corrosion control of boiler heating surfaces; prevention of caustic embrittlement; blowdown control for operating efficiency; steam purity control; prevention of corrosion of steam lines; prevention of corrosion in condensate lines.

Of these, the last three are important to dry kiln operation. On each, I will try to state why it is important, what causes the condition, and what can be done about it.

Corrosion control is important because dry-kiln operation is more efficient if replacement of pipes and fittings is cut to a minimum. Corrosion in steam lines is mainly caused by oxygen in the steam. Many surface waters are high in dissolved oxygen; and since oxygen is less soluble in hot water, it comes out of solution in the boiler and comes over with the steam. Oxygen attacks the iron pipe in the steam lines, forming iron oxide which is rust. The rust spots drop out, leaving pits which are generally distributed over the entire pipe.

Corrosion in condensate lines is usually caused by dissolved carbon dioxide gas in the condensate. This carbon dioxide gas is formed from the breakdown of carbonates in the raw water by the high temperature in the boiler. All natural raw waters have some carbonate in them. The carbon dioxide gas dissolves in the condensate, after coming over with the steam, and forms the weak carbonic acid. This tends to dissolve the iron of the condensate line along the stream of condensate in the bottom of the pipe. This cuts a groove in the pipes and they generally groove out at the fitting threads.

What can be done? Until recently, nothing except try to remove oxygen by efficient deaeration of the feedwater and carbonates by chemical pre-treatment. Some years ago volatile amines were developed which could go over with the steam and, because they were alkaline in nature, dissolve in condensate, neutralizing the carbonic acid. This was very effective in many systems, but did nothing about the oxygen corrosion of steam lines. Recently Dearborn Research Laboratories developed a new kind of volatile amine which works by putting a protective film on steam and condensate lines. This film is monomolecular in thickness and does not interfere with heat transfer. This filming amine can effect better than 99% elimination of corrosion in both steam and condensate lines.

Steam purity control is important to dry-kiln operation for two reasons:

- 1) Wet impure steam has much lower heat content. The heat transfer value of steam drops off rapidly as the moisture content of the steam rises.
- 2) Carryover of boiler solids can cause mud and scale deposits in kiln lines which lowers efficiency and may plug them up.

Steam is a colorless, invisible gas--and steam with water in it, or water and solids, is said to be wet and impure. If you can see steam, generally speaking, it is impure. The primary cause of wet steam is carryover and carryover is caused by foaming. Nearly all boilers foam to some extent.

Technically, foaming results directly from the high surface-tension of the boiler water. High surface tension results from concentration of natural minerals in the water by boiling. Oil, coming into the boiler in condensate, greatly aggravates this condition. High surface tension pinches the steam bubbles off when they are small and keeps them small by preventing coalescing. Steam, tearing out of these many small tight bubbles naturally drags water and other impurities with it.

The way to prevent this, then, and produce pure steam is to lower the surface tension of the boiler water. This can be done by chemicals similar in nature to the recent detergents which make water wetter. Dearborn Research Laboratories has developed surface active agents of this type which will stand up under boiler temperatures and pressures. These have been called Polyamide Anti-Foams. The motion pictures illustrate this problem of foaming, and how the anti-foams can be used to produce pure steam.

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