AALBORG INDUSTRIES

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Corrosion and sludge from boiler water

Daily maintenance of a boiler plant must address the potential of scaling, corrosion and sludge in the boiler plant and include preventative measures. This newsletter deals with the corrosion and sludge.

Corrosion control

Corrosive processes in the entire boiler/feedwater system can never be completely eliminated but can be controlled to very low levels. Particular types of corrosion can also be encouraged to provide a rate controller on other more harmful corrosion processes. Aalborg Industries emphasise four corrosion categories that will damage a boiler/feedwater system if left unchecked and recommend appropriate preventative measures.

Mineral acid corrosion - mostly in the boiler. Low-pressure boiler water should be maintained in an alkaline condition: a "P" alkalinity of 100-150 ppm or pH of around 10.8-11 are values at which the boiler metal is least susceptible to corrosion.

The ingress of seawater, from condenser seepage and/or distiller carry-over, creates mineral acids in the boiler which, without treatment, rapidly corrode metal. The preventative treatment is to feed alkaline chemicals to neutralize the acids and maintain a buffer reserve of alkalinity;

Carbonic acid corrosion - mostly in the condensate and the wet end of steam lines. Prevention is addressed by feeding and recycling a neutralising amine.

Oxygen metal depletion - most severe in the boiler. The first preventative measure is to remove as much oxygen as possible in the feedwater tank by keeping the feedwater hot (as near to 90°C as possible) and by providing the maximum possible venting of the tank. An oxygen scavenging chemical fed to the feedwater reduces the remaining dissolved oxygen. The aim is to decrease the amount of oxygen to a level where it provides an insufficient driving force to perform depolarization.

Differential concentration (crevice corrosion) - most severe in the boiler. It occurs where an ionic species is present in significantly different concentrations at adjacent areas of metal surface. The difference is caused by the depletion of the species within the crevice. A differential electrochemical corrosion cell is thus set up, resulting in rapid pitting attack.
A common type of crevice corrosion is "differential aeration" in which oxygen is the differentiated species; other species may be the chloride ion or the sulphate ion. The environment for differential concentration corrosion within the boiler is readily established by the transport of corrosion products from sections outside the boiler. A proportion of these products (oxides of system metals) will deposit on boiler surfaces, particularly on heat transfer surfaces. A multitude of crevices are thus formed, fostering accelerated corrosion.

Sludge deposits in tubes.

Sludge deposits

When the amount of sludge (agglomerated suspended material) exceeds the ability of the boiler

water to carry it in suspension, it will settle on the boiler surfaces. A film of sludge deposited on a heat transfer surface is commonly termed “baked-on sludge”. It acts as a heat insulator and provides the environment for crevice corrosion.

Sludge may be formed from a combination of whatever suspended materials are in the water, including loose corrosion products; insoluble mineral precipitates and oil. A significant proportion of suspended material generated outside the boiler will find its way inside.

Sludge generated within the boiler is routinely handled by the water treatment programme pre-set limits and procedures. The dispersant effect of the treatment chemical will keep the sludge fluid and non-adherent as long as boiler blowdown is performed to maintain the programme limits.

An excessive sludge loading may be imposed, however, by contributions from sections outside the boiler. Such loading distorts the relationship of suspended to soluble constituents of the boiler water. Built-in programme controls are thus rendered less effective.

Most low-pressure boiler systems suffer to some degree from oil contamination, the most common sources being leaking fuel tank coils and fuel oil heaters. Oil is a harmful contaminant, resulting in carbonaceous deposits on heat transfer surfaces. It is also a major contributor to the formation of non-fluid sticky sludges.

Read about scaling problems and preventative measures in Aalborg Solutions No. 6.

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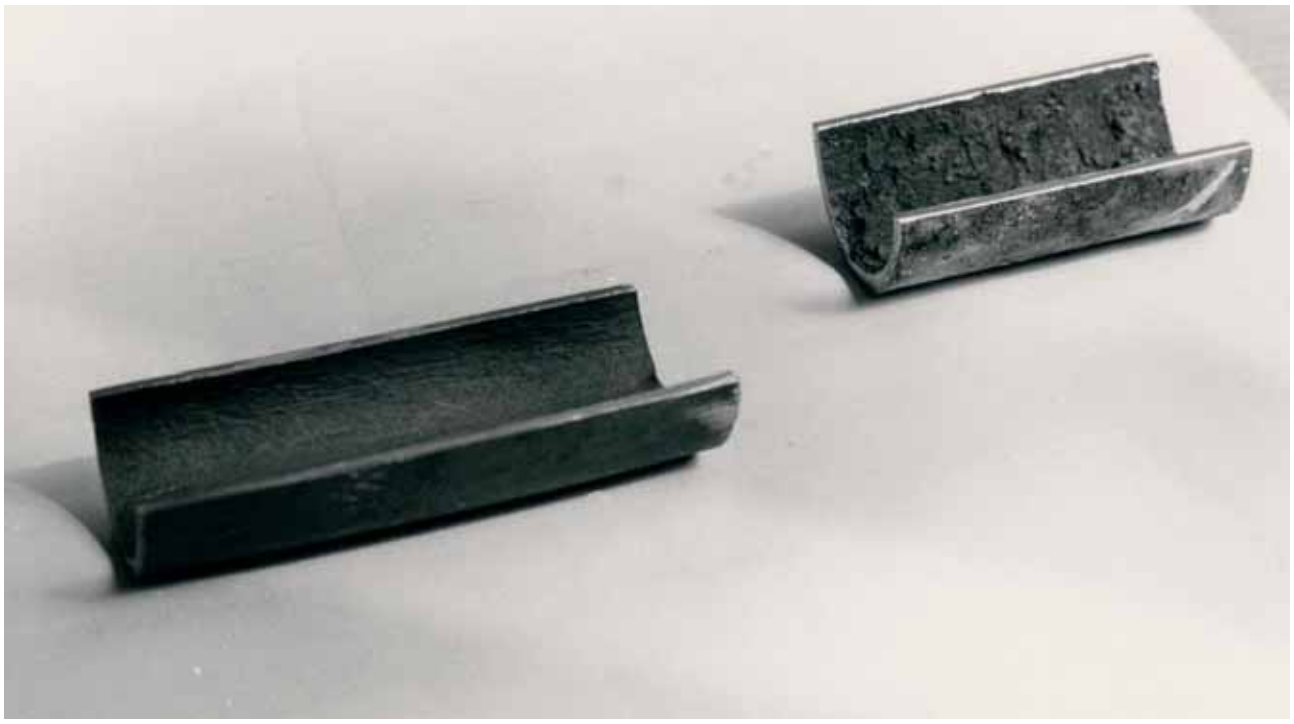

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