ALTRET Industries Private Limited

Overlook Water Chemistry & Concern: -

(This paper discusses the water chemistry and corrosion related problems which are not sufficiently understood.)

There has been a major achievement in corrosion and water chemistry control since there has been awareness among industries for cost cutting. The high cost and loses can minimizes by improved communication among designers, operators, water chemists, and management. The proper transfer and use of knowledge, better instrumentation and sampling practices, better operation of system automatically improves the overall plant efficiency. **As much as 50 % outage time has been attributed to corrosion, with damages to boiler tube, condensers, turbines, feed water heaters, CS piping etc**.

As an Associate with the water treatment chemical business we get to listen many time from clients / proposed clients that there are numbers of suppliers in water treatment business. Why? What's the reason? Is there high profitability? Is manufacturing of water treatment chemicals is very easy?

In my opinion Industries changes the water treatment suppliers/contractor frequently as they do not get desired result or face the problem either water chemistry site engineering site or application site. As per the survey of failure analysis, **50% of True Root causes are never found.**

It is also observed that generally in non-organized segment, small- medium scale industries or some time corporate houses neglected to identify root cause of failures and simply take corrective action that is: Change the supplier or contractor of water treatment.

Hence, Application of existing knowledge needs to be improved and better used in root cause Analysis and problem solving. With the current staffing at utility and industrial companies, the transfer and application of the existing knowledge should be provided by water treatment Supplier Company. The following describe specific problems with knowledge of water chemistry and corrosion in the areas of root cause and failure analysis, operation and maintenance.

Short Term overheating of Boiler: -

Short term overheating of boiler is Thin-lipped, longitudinal rupture of boiler tube, Extensive tube bulging and the appearance is like Large fish-mouth. The typical Causes of short term over heating are Low water level, Partial or complete pluggage of tubes, Rapid start-ups, Excessive load swings and Excessive heat input.

Long Term overheating of Boiler: -

Long overheating is little to moderate bulging and little to moderate reduction in wall thickness. It is typically accompanied by thermal oxidation and mostly found in superheated zones, reheaters, and water walls of boilers. The typical causes of long term over heating are gradual accumulation of deposits or scale, partially restricted steam or water flow, Excessive heat input from burners, Undesired channeling of fireside gases
And steam blanketing in horizontal or inclined tubes. Long term over heating is also observed due to the Operation of boiler slightly above oxidation limits of given tube steel.

Flow Assisted Corrosion (FAC) in Boiler: -

It is localized thinning of pipeline due to the dissolution of protective oxide and base metal. FAC occurs in single or two phase water. FAC is observed in low pressure system
bends, in evaporators, risers and economizer tubes. FAC is affected by temperature, pH, O2 concentration, mass flow rate, and geometry, quality of fluid and alloys of construction. Dissolved oxygen has direct impact on flow assisted corrosion.

Corrosion in Closed Recirculating Systems: -

In a closed recirculating system, water composition remains fairly constant with very little loss of either water or treatment chemical. The need for water treatment in such systems (i.e., water heating, chilled water, combined cooling and heating, and closed loop condenser water systems) is often ignored based on the rationalization that the total amount of scale from the water initially filling the system would be insufficient to interfere significantly with heat transfer, and that corrosion would not be serious. However, leakage losses are common, and corrosion products can accumulate sufficiently to foul heat transfer surfaces.

Therefore, all close systems should be adequately treated to control corrosion. Systems with high makeup rates should be treated to control scale as well. The selection of a treatment program for closed systems should consider the economics, System metallurgy, operating conditions, and Makeup rate and system size. Because of the characteristics of closed

systems and the more than usual problems that corrosion products cause, it is extremely important to eliminate all corrosion from the start of system operation.

High inhibitor levels are required to assure the practical elimination of corrosion resulting from the coupling of dissimilar metals. They also provide back-up protection should be unexpected water loss lower treatment levels.

Fouling in Open Recirculating Cooling Systems: -

Water analysis parameter such as total dissolved solids (TDS), pH, alkalinity, hardness and other chemical aspects of water quality can be predicted and controlled by treatment but, there is one variable that defies easy prediction…the amount of particles **(Total Suspended Solids)** in the water. The air that is drawn through the fill of a cooling tower inevitably contains particles of dust, soil, soot, organic debris and numerous other materials. These particles are effectively scrubbed from the air by the cooling tower and concentrated in the water. Particle concentrations vary and are influenced by constantly changing factors such as wind direction, amount and type of traffic, and the activity of neighbors (Other Plant dust, Boiler ash etc.)

In addition, the system itself produces particles. These include corrosion products, mineral precipitates (e.g. iron oxides, hardness salts), microbiological colonies, aggregates of organic chemicals and many others. Contamination by dissolved and particulate materials leaking from the process side of heat exchange equipment adds to the process by precipitating insoluble chemical products, providing nutrients for accelerated biological growth, and accelerating corrosion and the formation of corrosion products.

The particulates in cooling water are effectively controlled by dispersant treatment as well filtration technique or some time both.

Mechanical, Operational function of Open Recirculating Cooling Systems:

Water treatment performances definitely depend on the design conditions and current operating data, mainly relevant to temperature and flows through system. In low velocity area of system or piping fouling may occur and thereby under deposit corrosion exist. While in high velocity area erosion-corrosion take place. Additionally, these data are also used to identify system stresses that would affect the treatment program. The focus is to look for low flow and high temperatures that increase scale and corrosion potential.

The Operational part of cooling water system takes a statistical view of how well the tower is controlled with respect to pH, cycles (through conductivity), halogen, and program

Product dosing. This section looks at the variation around the stated or desired control points. In multi cycle utility operation it observes frequently that brine ($CaCl_2$ or NaCl or Methanol) mix with circulating water due to poor operational control and disturb cooling water chemistry cycles. Adulteration of CaCl2 or NaCl leads to high halogen in system and may influence corrosion. Methanol act as nutrient for microorganism and disturbs Biocide performance.

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Reference: -

1. On Stress Corrosion - S. P. Rideout (Savannah River Laboratory), 1969 [33]
2. Water chemistry and corrosion –Missing Knowledge-Otakar Jonas,
3. J. Green, Ind Eng. Chem., Vol 42 (8), 1542
4. Cooling Technologies Balcke | Hamon Dry Cooling | Marley
5. Current water treatment practice –Utility & Industrial steam system Otakar Jonas
6. Cibo energy efficiency handbook Edited by Ronald zeitiz.
7. Water Treatment Handbook- Marine chemicals.