

November 17, 2016

Field Report Hydroflux Qualcomm San Diego Condenser Water System

The following was discussed and/or supplements those discussions at job site.

1. My past experiences, both in the field with multiple pulsed electro-magnetic field installations over a 10-year period, and Hydroflux rare-earth magnet laboratory testing result in the formation of a colloidal mixture in the condenser water system.
2. When retro fitting a magnetic field on a condenser water systems, existing scale in the piping or cooling tower fill will be released and will foul/plug-up condenser water system strainers and/or heat exchangers. This was the observed scenario with the lube-oil-cooler shell and tube heat exchanger plugging with the condenser water flowing in the ¼" diameter HX tubes. It would have been out of norm for scale not to be released, unless the system was pure and unscaled prior to magnet installation.
3. Corollary: The heat exchanger fouling was not caused by physical scale removal from the tower fill, when and during tower fan/cell water flow isolation.
4. The magnetic field prevents further accumulation of scale in the system, as is the case now with no problems or higher pressure drop through the lube oil cooler HX.
5. Iron is non-detectable in the City of San Diego water supply Miramar treatment plant so testing if the magnets remove iron is a moot point.
6. I am coordinating for Hydroflux, the field testing at a remote site for magnet effectiveness on algae blooms. A building site with a 100F geothermal well is a once thru system with plate and frame heat exchanger and water is discharged to a sloping, boulder like waterfall where it is ultimately collected by gravity flow to a pond. The operator has been having to clean the algae blooms in this waterfall system for the entire 10 years he has serviced this location. After magnets were installed June 2016 there was and has been zero algae blooms.
7. With regard to the recent algae blooms in the tower cold water basins, my experience is that - the most likely suspect is bird feces with high levels of nitrogen. Air inlet screens would prevent access by birds but the AIS present other maintenance problems for access to cold water basin and louvers.
8. To further study and monitor algae growth in the cooling tower, I propose the removal of 1-hot water basin cover on top of the tower for exposure to maximum sunlight. This would require temporary halt in algaecide applications for definitive results. I do not know if Trident uses both biocide and algaecide in this system, so we need their input in this regard.
9. The Langelier Saturation Index (LSI) is the most widely used indicator of cooling water scale potential. It is purely an equilibrium index and deals only with the thermodynamic driving force for calcium carbonate scale formation and growth. It provides no indication of how much scale or calcium carbonate will actually precipitate to bring water to equilibrium.

10. It simply indicates the driving force for scale formation and growth in terms of pH as a master variable. In order to calculate the LSI, it is necessary to know the alkalinity, the calcium hardness, the total dissolved (TDS), the actual pH, and the temperature of the water.

11. I calculated the Langelier Saturation Index for varying scenarios. That table is attached as part of the report.

12. If the acid feed was discontinued, the result would be that the pH would be the same as from the Miramar water treatment plant: pH = 8.1 vs pH 7.6 as design point.

13. The QC existing system operation with acid feed LSI = 1.36. With no acid feed LSI = 1.86. The science of operation and the effectiveness of the rare-earth magnets, with QC hard-water as make up; to prevent scale at slightly elevated LSI and no acid feed, is beyond the writer's knowledge base. That is, I do not have the background to analyze possible scale formation in this regard other than the LSI calcs.

14. For comparison of results with different tower make-up water, the City of San Francisco water supply is analyzed in the LSI calculations. My experience with the built-environment (The City of San Francisco and University of Berkeley National Laboratory (LLBL) specifically) has seen a majority of electro-magnetic pulsed power, non-chemical installations in successful operation, as stand-alone systems. The colloidal mixture resulting from operation beyond saturation maximizes the effective control of scale, corrosion and microbiological growth. The LSI is over 2 and can reach 3 so is elevated, but TDS, alkalinity and hardness levels are near-to or below the manufacturers' limits. The resulting colloidal mixture solid is removed by a filtration system.

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