

Assessing 'HydroFLOW' Technology and Side-Stream Filtration in High Silica Concentration Groundwater for Prospective Operational Benefits

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(The Following is a Summary of the Above Named Study)



SUMMARY

The Effect of *HydroFLOW* on Evaporative Cooling Towers with High Silica Water

This document summarizes a laboratory test which was performed from May 18 to August 26, 2015. The test was conducted on behalf of *HydroFLOW* Southwest (also known as New Water Innovations) at Los Alamos National Laboratories, Los Alamos, New Mexico, U.S.A. The test's objective was to investigate the effect of *HydroFLOW* on cooling towers. Four portable evaporative cooling towers were utilized to allow realistic equipment to be used in a laboratory setting. The units were tested for 14.5 weeks and their water parameters monitored. A noteworthy aspect of the test was the usage of particularly challenging make-up water which was high in silica content (approx. 155 mg/l TDS, 35 mg/l Total Silicon). The full 34 page report is available upon request.



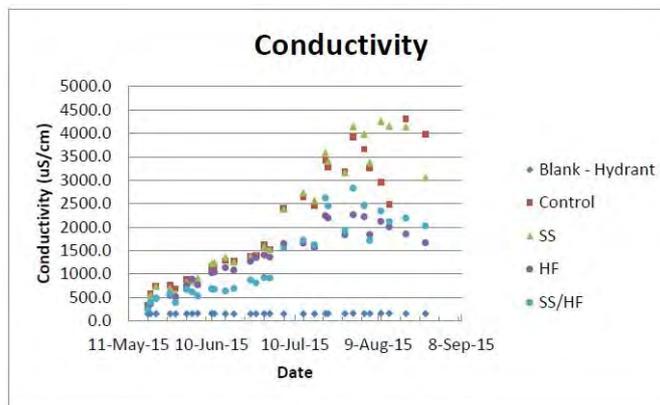
The four units used were set up as follows:

1. Unprotected (control)
2. Treated with a side-stream filter
3. Treated with *HydroFLOW* alone
4. Treated with *HydroFLOW* and a side stream filter

Results

Conductivity and TDS

Conductivity was measured by electronic probe and TDS by the method ASTM D5907-10. The conductivity and TDS of the water in the towers followed similar trends (conductivity plotted below). The units without *HydroFLOW* experienced increasing concentrations throughout the testing; in contrast the TDS of the units protected with *HydroFLOW* stopped increasing and "levelled-out". The units utilizing *HydroFLOW*/Hydropath technology showed a total reduction in TDS of approximately 56% for the unit treated with *HydroFLOW* and 75% for the unit treated with both *HydroFLOW* and side stream filtration.



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Total silicon levels

The levels of silicon in the tower water were measured by Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES). It was found that the levels of silicon for the units treated with *HydroFLOW* were significantly lower than the levels of the other units.

- At the end of the test period the control unit had a concentration of 119 mg/l
- The units protected by *HydroFLOW* had a concentration of 78 and 76 mg/l
- This is a reduction of 35%

Toxicity

Toxicity levels were determined using a method based on bioluminescent bacteria (Microtox).

According to LANL's NPDES permit, samples with a toxicity percent effect higher than 50 are not acceptable into the Sanitary Waste Water System (SWWS).

At the conclusion of the test, the toxicity percent effect in the units unprotected by *HydroFLOW* was significantly higher; approaching or above the permitted percent effect of 50 (44.37% and 55.15%). The units treated with *HydroFLOW* had an average toxicity which was 59% lower than the untreated units (15.83% and 25.01%).

Conclusion

The testing by LANL shows that protection with *HydroFLOW* (with or without an additional side stream filter) can:

- Lower the TDS by 56% - 76%
- Lower the conductivity by 58%
- Reduce the amount of silicon in the water by 35%
- Reduce the water toxicity by 59%

These results indicate that cooling towers can be operated smoothly and more effectively when treated by *HydroFLOW*, even in areas with high silica content water. This allows towers to run at higher efficiency, at higher cycles of concentration and with a significant reduction in water usage.

Quote from the Los Alamos National Lab 34 page report (pages 20-21)

"This observation [of lower conductivity] is important, as maintaining lower conductivities in cooling towers allows operation with less frequent blowdown cycles, therefore increasing the overall cycles of concentration that a cooling tower can be operated at."