Demineralization Cost Reduction News™

February, 2009

Reported independently by Demineralization Cost Reduction News, div. Indumark, New York, NY

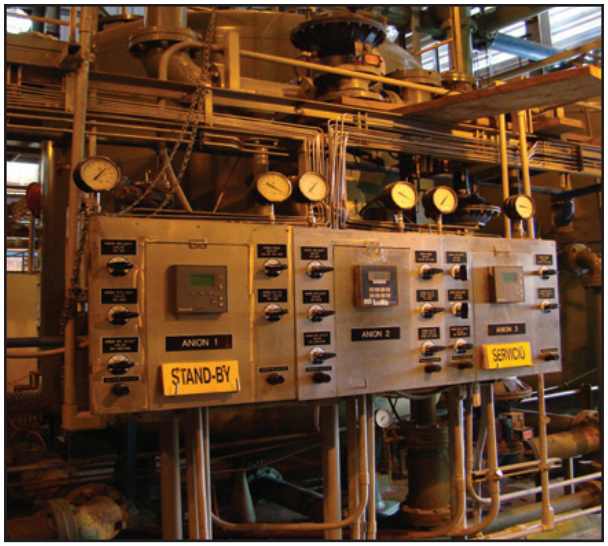
Change to Special IX Resin for Boiler Feedwater DI Cuts Acid Requirement by 50% and Caustic by 40%; Also Reduces Man Hours by 40% for DI, and by 20% for WWT

Dramatically Reduces Cost for Protecting Turbine and Minimizing Steam Pipe Deposits, While High Levels of Hardness Continue from Deep-Well Feed Water Source

An IX DI system serves each of the plant's two 450 MW boilers. Each 1005 deg. F, 2600 psi boiler uses 1950 gal./min. of feed water, and requires 6000 gal./hr. of makeup water. Magnesium and calcium in the deep well feed water are now 420-450 parts per million (ppm), with chloride 80-90 ppm and silica 37 ppm.

Table 1:
Decrease in Acid and Caustic Consumption Following IX Resin Change

	Acid	Caustic
Before:	11 lbs./cu.ft.	10 lbs./cu.ft.
After:	5.5-6 lbs./cu.ft.	6-7 lbs./cu.ft.



Each of three treatment trains contains three 500 cu. ft. cations and three 250 cu. ft. anions. Raw water conductivity has reached over 900 micromhos/cm. Cation conductivity is 1400 micromhos/cm and the anion ranges from 15-40 micromhos/cm.

Salinas, Puerto Rico --- Operations and chemistry management for the Puerto Rico Electric Power Authority (PREPA) Aguirre thermoelectric plant here report dramatic reduction of acid, caustic, and man hours for boiler feedwater deionization/demineralization (DI), as well as man hours for DI wastewater treatment, by changing their ion exchange (IX) resin and regeneration procedure. The move also resulted in performance recognition for the plant and its chemist, including the Manuel A. Perez Government Employees Performance Prize.

The resin change was necessitated by spiraling costs for acid and caustic that derived from increasing hardness in their deep well boiler feedwater source. During the past 30 years, the water table has dropped 20 ft., with magnesium and calcium now reaching 420-450 parts per million (ppm) ; chloride 80-90 ppm; and silica 37 ppm. No new capital investment was available to address the problem.

"Solving the problem by changing the water source was not an option when the condition was detected," said Justo L. Gonzalez, operations manager. "PREPA owns a lake, but there was no capital available at that time for the channel, pipeline, pumps, and probably also ultrafiltration pretreatment that would have been required."

"Changing the ion exchange resin is now being recommended as the best way to improve the performance of the demineralization system at other PREPA plants who have the same problem with their deep well sources."

To protect turbine blades and minimize deposit buildup in steam piping, the plant requires boiler feed water silica (SiO_2) at < 125 parts per billion (ppb), as well as targeting complete removal of chloride (Cl-1), magnesium (Mg), and calcium (Ca). Since the installation of the new resin, SiO_2 is running < 50-60 ppb, and Cl-1, Mg, and Ca are non-detectable.

Results From New Resin

"For regeneration before we changed resins, we needed 11 lbs of acid per cu. ft. of resin, and now we only need 5.5-6 lbs.," said Luis A. Reyes "Tony" Santini, the plant chemist. "Meanwhile, 10 lbs. of caustic in the bath previously is now down to about 6-7 lbs."

"As a result, we have not only saved more than $750,000 in the first year and over $1,000,000 in the second year in chemical costs, but

also due to longer service cycle time we now need 40% less man hours for demineralization and 20% less for DI wastewater treatment. That has allowed me to use my technicians for other analyses to help make the plant run more efficiently, while I have more time for equipment repair and maintenance."

"I have also cut water consumption for regeneration by 25%, or about 100,000 gal.day, helping us to avoid a crisis in water supply for the high pressure boilers."

An IX DI system serves each of the plant's two 450 MW boilers. Each 1005 deg. F, 2600 psi boiler uses 1950 gal./min. of feed water, and requires 6000 gal./hr. of makeup water. The DI systems perform eight to ten 12,000-gal. regenerations per month, generating about 6 million gal. of wastewater that derives from DI and some polishing inside the system.

Each of three treatment trains contains three 500 cu. ft. cations and three 250 cu. ft. anions. Raw water conductivity has reached over 900 micromhos/cm. Cation conductivity is 1400 micromhos/cm and the anion ranges from 15-40 micromhos/cm. Conductivity of water out of the final step mixed-bed is 0.056 micromhos.

Santini recalled that when shipments of acid and caustic to the plant had reached 16 truckloads per month, he was asked to investigate if it needed to be that much.

"I started consulting with our distributor, Manuel Bismarck, who had experience as a plant chemist," he said. "After he had been visited by Fabio Sousa from Purolite resins, he advised that a resin change might help. I then looked at a variety of different resins, and found them all to be the same, except for Purolite, who had a shallow shell technology."

"We took about six months to test their resin on the cation in one of the vessels, and proved we could gain 37-38% savings on chemical costs. We provided a comprehensive presentation for plant management, and then took a year and a half to changeover to Purolite, who also helped us change regen times and flows. We have found that the higher price for their resin has been more than made up for by the savings we have realized, and we have much appreciated their high level of technical support."

New Resin

The combination of Purolite's SST60H and PFA300 resins that was installed here is recommended by the vendor as an innovative approach for coping with jumps in prices for acid and caustic.

Purolite describes its SST™ family of high-efficiency ion exchange resins as based on Shallow Shell Technology. The resins have inert centers. Only the outer shell is functional¬ized, which shortens the ion exchange diffusion path. This is said to lead to more complete ion exchange and regeneration, which provides for higher capacities, lower leakages, better handling of iron and organic fouling, and more resistance to oxidation than standard grade resins.

More complete regeneration in turn allows for a higher, more efficient utilization of the regenerant. The company estimates that when compared to conventional softening or demineralization resins, regenerant cost reductions of 20 to 50% are often possi¬ble without sacrificing capacity or increasing leakages.

Fabio Sousa, the regional director for Latin America for Purolite resins, noted that payback periods are very short for ion exchange resin (IER) replacements like the one at PREPA's Aguirre plant, while their potential applications are very diverse.

"The return on investment (ROI) in the higher priced IER is realized in only a few months," he said. "After that short period, all chemical savings due to the new IER are directly reducing plant operating costs, while the impact of IER cost continues to be very low."

"And the benefits realized at PREPA, through a combination of the unique IER technology and its vendor's technical support, are available to most users of demineralization plants, regardless of the type of industry they are serving, or their site location."

For further information, contact The Purolite Company, 150 Monument Road, Bala Cynwyd, PA 19004, Tel. 800-343-1500, www.purolite.com, info@puroliteusa.com.

Luis A. Reyes Santini, plant chemist, received the Manuel A. Perez Government Employees Performance Prize in recognition of major improvements in plant operating efficiency.