Floc and Drop vs. Shock and Drop: Two Treatment Approaches to Spent Brine Management from Ion Exchange Systems

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Coachella Valley Water District (CVWD) retained Hazen and Sawyer Consultants to design hexavalent chromium treatment systems for 30 of their 96 wells expected to exceed the new California Division of Drinking Water Maximum Contaminant Level (MCL) of 0.01 milligrams per liter (10 parts per billion). The proposed total treatment capacity is approximately 78 Million Gallons per Day (MGD). The project consists of two centralized Weak Base Anion (WBA) treatment systems to treat 7 wells for a total of 11.5 MGD with 7,200 cubic feet of resin. Resin from the WBA system is predicted to last approximately 1-2 years before it disposed of as a hazardous waste and replaced with fresh resin. Strong Base Anion (SBA) resin treatment systems for the remaining 23 wells with lower sulfate levels will each have two parallel treatment trains with 600 cubic feet of resin in each pressure vessel for a composite resin quantity of 27,600 cubic feet. The resin will require regeneration every 1 to 3 months of operation depending variable water quality at each of the individual wells. Instead of the traditional regeneration occurring in the same pressure vessel as service flow treatment, the spent resin will be transported using custom designed truck trailers to a Centralized Resin Regeneration Facility (CRRF) where it is regenerated with a 10-12% brine (sodium chloride) solution. After regeneration at the CRRF, the resin is returned to a pressure vessel for another operating cycle. Among the significant benefits for this concept is optimized management and treatment of the spent brine from the regeneration process at a centralized location.

The CRRF is designed to regenerate up to two 600 cubic foot regenerations per day. The regeneration process at the CRRF consists of several major unit processes such as: 1.) Spent resin transfer; 2.) Backwash / backwash recovery; 3.) Brine / brine recycle / brine treatment; 4.) Slow rinse / slow rinse recycle; 5.) Fast rinse / fast rinse recycle; and 6.) Fresh resin transfer. The process design optimizes flexibility, redundancy and brine recycling to minimize treatment residuals. The water recovery efficiency for the SBA/CRRF process is greater than 99.9%, with potential for zero liquid discharge with further optimization of the spent brine treatment systems discussed in this presentation. The treated spent brine discharges to dedicated holding tanks that can be shipped off-site for disposal or overflow to 4 acres of evaporation ponds. With over 10 years of experience operating ion exchange and brine treatment systems, CVWD considers brine management to be the key process for managing treatment costs and providing reliable water service and has elected to have both brine treatment and disposal options to optimize this process.

This presentation will focus on the comparison of the more traditional spent brine chemical coagulation (CC) treatment with ferrous iron to the less traditional treatment with electro-coagulation (EC). CC has been successfully used in municipal applications to achieve 99%+ hexavalent chromium removal in the spent brine.

EC also has a long history of achieving 99% + hexavalent chromium removal in industrial wastewater markets such as plating facilities, but not in spent brine treatment associated with anion resin. Over the last decade, improvements in the technology have resulted in higher flow (up to 2,500 gpm), commercially available units.

Both technologies were bench tested in the early stages of design, and both technologies offer distinct advantages and disadvantages. The 20 year lifecycle costs for CC and EC are similar and CVWD elected to design both a CC system and an EC system to integrate operational flexibility into the design. Several solids disposal factors discovered during pilot testing required further evaluation including the concentration of uranium and selenium. Another consideration is the recovery of constituents in the liquid and solid for beneficial use. Variable economic conditions including chemical, fuel and energy costs are expected to impact the efficiencies of these two processes. Having two technologies provides redundant systems for reliability and provides CVWD the opportunity to optimize operating costs by varying the technology selected based on existing economic drivers.

The attendees will have the opportunity to learn about the following: 1) CC and EC treatment train configurations; 2) removal efficiencies and solids characteristics with the various treatability testing; 3) potential for brine recycle after treatment; 4) water and resource recovery opportunities in the various regeneration unit processes; and 5) lessons learned.