RESINTECH

TECHNICAL DATA SHEET

URANIUM

Low levels of uranium in the water in the order of a few ppm can be removed effectively with ResinTech SBG1-HP or SBG2-HP. Both resins are strong base anion resins operated in the chloride form. The uranium is present as an anionic complex U_3O_8 or the tetravalent carbonate anionic complex $UO_2 (CO_3)_3$. The anion resin should be regenerated with 15 pounds per cubic foot of sodium chloride, and the capacity will be about 18 kilograins per cubic foot. The uranium is held more strongly than the sulfate and the specific capacity of the resin for just uranium is approximately 5 kilograins per cubic foot. During service, the sulfate in the water will not displace the uranium.

At pH above 6, uranium exists in potable water primarily as a carbonate complex which is an anion and has a tremendous affinity for strongly basic anion exchange resins. The process has been tested and found to be very effective at pH of 6 to 8.2. Higher pH could result in uranium precipitation which make the problem one of physical removal. Lower pH change the nature of uranium to non-ionic and/or cationic which would prevent the exchange reactions from operating effectively. Tests have shown effective removal (over 95%) of uranium at pH as low as 5.6. But after the pH was reduced to 4.3, the removal rate dropped to 50% and the run lengths (throughput capacities) were reduced by over 90%. Therefore, it is advisable to control the inlet water pH above 6 at all times. It has also been shown that sudden changes in pH of the influent water to values below 5.6 can result in dumping of previously removed uranium. In situations where the pH cannot be maintained above pH of 5.6, other treatment methods should be considered.

Regeneration: In order to regenerate the uranyl carbonate it is important that the concentration of the regenerant at the resin bed be sufficiently high to reverse or reduce the relative affinities to acceptable levels and to use enough regenerant and contact time. Sodium chloride is the most common regenerant.
Concentration above 10% NaCl, at regenerant levels of 14 to 15 lbs. per cu. ft. is sufficient to insure better than 90% uranium removal through the operating cycle. Leakage will remain low through the service cycles even without complete regeneration because of the very high selectivity during the service cycle. Leakages are essentially nil for regeneration levels of 15 lbs. of sodium chloride per cu. ft. at concentrations of 10% or higher with minimum contact time of at least 10 minutes during regeneration.

Other Regenerants: The chloride ion is the most effective ion for regeneration of uranium of those commonly found in potable water. Neutral salts are usually preferred because of environmental and materials of construction considerations. Regeneration with pure hydrochloric acid, though not recommended because of the nature of hydrochloric acid and the added expense for corrosion resistant equipment, shows an even better efficiency than sodium chloride. This is mentioned to point out that lower pH is acceptable in terms of regeneration efficiency. Higher pH, such as through the addition or use of alkalis such as sodium hydroxide or sodium bicarbonate or sodium carbonate, will result in severely decreased uranium regeneration. At high pH, uranium tends to form $Na_2U_2O_7$ a non-ionized precipitate.

In a paper from Diamond Shamrock, Duolite A-101D was used to reduce uranium from 2 ppm to an effluent level of 10 ppb. Three columns were used in series and regenerated countercurrently with an acid-brine treatment: 1.5 M sodium chloride followed by 1.5 M sodium chloride mixed with 0.1 capital N hydrochloric acid. The paper was entitled "Recovery of Low Level Dissolved Uranium Values From Treated Mine Waters" and was based on work done at the Schwartzwalder Mine, Cotter Corporation, Golden, CO.

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