

Episode 22 When You're Hot You're Not!

Uranium, radium, are radiologicals which are not gaseous. Radon is gaseous. Uranium and radium are very easily removed from water because they're ionically sticky. They will adhere and accumulate on anion and cation resins during the treatment process. If the system isn't properly operated and maintained the radiologicals can accumulate resulting in harmful levels of radioactivity.

Uranium is commonly found in North Carolina. We encounter Radium, which comes from rock formations, in New Jersey. These contaminants are found throughout the US. (The Urbans Aqua customer base is east of the Mississippi River. We only discuss problems which we commonly encounter.)

Treatment

Uranium Treatment

- Type II anion resin, which is also used for dealkalization and NON-selective nitrate removal.
 - Static or non-regenerable
 - Regenerable
 - Brine waste will have Uranium.
- Titanium dioxide adsorbents such as Graver's HMRG
 - Static, cannot be regenerated
 - Backwashable – radiologicals adhere to the media

Radium 226, 228 Treatment

- Cation resin, which is also used for water softening
 - Static or non-regenerable
 - Regenerable
 - Brine waste will have Radium
- Reverse Osmosis.
 - Waste will contain Radium

Radon Treatment

Radon is considered a daughter or progeny of radium. As radium decays, it also pushes off radon which is gaseous.

- Air stripping followed by activated carbon
 - Very quick half-life and it's very, very easy to bubble out – spray aeration vented to outside the building.
 - Activated carbon can become "hot" radioactive if neglected.

Sizing up the Uranium System – Ion Exchange

- A full cation, anion water analysis is mandatory because there are other contaminant ions which may impact removal efficiency. This enables the resin manufacturer to model the system and estimate life expectancy of the resin.
- Keep the chain of custody clean if you are helping your customer to dispose of the resin.
- The DOT (Department of Transportation) regulates and checks for radioactivity. The limit is 335,000 ppb (parts per billion).
- The landfill will check for radioactivity.
- The MCL (Maximum Contaminant Level) for uranium is 30 pci/l.
- **Formula for sizing a uranium system:**
 - Requires 2.5 minutes EBCT (Empty Bed Contact Time). That is how many minutes the water must pass through your column of treatment. The resin manufacturer will advise EBCT.
 - Determine the customer's gpm (gallons per minute).
 - Multiply the EBCT by the GPM.
 - Divide by 7.481. (Number of gallons in a cubic foot.)
 - Example – customer has 44 ppb of uranium.
 - $2.5 \times 6 \text{ gpm} = 15$
 - $15 \div 7.481 = 2.0005 \text{ cf}^3$
 - This home will require a 2 cubic foot system.
 - Life expectancy of the system – remove no more than 335,000 ppb (per DOT regs).
 - Divide 335,000 ppb by the contaminant level (the amount of uranium in the customer's water) equals the number of BV (Bed Volumes)
 - Multiply the number of BV by 7.481 to determine number of gallons which can be treated.
 - Example continues:
 - $335,000 \div 44 = 7,613 \text{ BV}$
 - $7,613 \text{ BV} \times 7.431 = 57,572 \text{ gallons treated by each tank}$
 - $57,572 \text{ gal.} \times 2 = 113,144 \text{ gallons for 2 tanks.}$
 - New example – customer has 44 ppb uranium and house gpm is 7.
 - System size:
 - $2.5 \times 7 = 17.5$
 - $17.5 \div 7.481 = 2.33$ – round up to 2.5 cf^3
 - This home requires a 2.5 cubic foot system
 - Life Expectancy
 - $335,000 \div 44 = 7,613 \text{ BV}$
 - $7,613 \text{ BV} \times 7.431 = 57,572 \text{ gallons treated by each tank}$
 - $57,572 \times 2.5 \text{ cf}^3 = 143,930 \text{ gallons treated by system}$
- Regenerable system sizing:
 - Increases the amount which can be treated by 5.
 - Check with local municipal authorities before installation.

- Install a water meter with an alarm which will shut off the water to avoid overrunning the system.
- Test the water after 6 months and again after 1 year.
- Do not use potassium chloride (KLife) in a regenerable system as it will hold uranium.
- As with any anion application a shift in pH may occur.

Half-Life

For more information on Half-Life see:

<https://www.britannica.com/science/half-life-radioactivity>

<https://en.wikipedia.org/wiki/Half-life>