
**TECHNICAL
APPLICATION
BULLETIN**

Uranium

**Recognized Treatment Techniques For Meeting
Drinking Water Regulations For The Reduction
Of Uranium From Drinking Water Supplies
Using Point-of-Use/Point-of-Entry Devices And Systems**

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TECHNICAL APPLICATION BULLETIN

Uranium

Recognized treatment techniques for meeting drinking water regulations for the reduction of ammonia using point-of-use and point-of-entry (POU/POE) devices and systems.

Occurrence

Uranium is a common naturally occurring and radioactive substance. It is a normal part of rocks, soil, air, and water, and it occurs in nature in the form of minerals - but never as a metal. Natural uranium is a mixture of three types or isotopes called U-234 (^{234}U), U-235 (^{235}U), and U-238 (^{238}U). All three are the same chemical, but they have different radioactive properties. The isotope ^{235}U is useful as a fuel in power plants and weapons.

Uranium enters water by leaching from soil and rocks, or in releases from processing plants. Release of uranium from human activities are due accidents of different nature. Larger particles settle into the bottom of lakes, rivers, and ponds and join uranium that is there naturally. Uranium is present in water supplies as anionic complexes, $\text{UO}_2(\text{CO}_3)_2^{-2}$ and $\text{UO}_2(\text{CO}_3)_3^{-4}$.

Health Effects

Uranium has demonstrated toxic effects on human kidneys leading to kidney inflammation and changes in urine composition. Uranium can decay into other radioactive substances, such as radium, which can cause cancer with extensive exposures over a long enough period of time.

The U.S. EPA has issued a Maximum Contaminant Level Goal of zero and a Maximum Contaminant Level (MCL) of 0.030 micrograms per liter for uranium. The 0.030 $\mu\text{g/L}$ is based on increased risk of kidney toxicity and is equivalent to about 27 picocuries per liter (pCi/L) of radioactivity, which also presents an increased risk of cancer from uranium. The U.S. EPA feels the 0.030 $\mu\text{g/L}$ MCL will protect against both cancer risk and risk of kidney damage.

Treatment Alternatives

Strong base anion exchange resins, both Type I and Type II, have a strong affinity for the uranium complexes and can remove them effectively to meet the MCL requirement. Cation exchange resins are not effective for the removal of uranium.

Reverse osmosis and distillation are also potentially effective techniques for reducing uranium levels.

There are presently no protocols in any of the NSF/ANSI Standards for reducing the uranium levels from water. Thus, the treatment methods listed below are generally recognized as techniques that can effectively reduce uranium sufficiently to meet or exceed the MCL. However, this list does not reflect the fact that POU/POE devices and systems currently on the market may differ widely in their effectiveness in treating specific contaminants and performance may vary from application to application. Therefore, selection of a particular device or system for uranium reduction should be made only after a careful investigation of its performance capabilities based on results from competent equipment validation testing for the specific contaminant to be reduced.

As part of the installation procedure, system performance characteristics should be verified by tests conducted under established test procedures and water analysis. Thereafter, the resulting water should be monitored periodically to verify continued performance. The application of the water treatment equipment must be controlled diligently to ensure that acceptable feedwater conditions and equipment capacity are not exceeded.

<u>Contaminant</u>	<u>MCL, mg/L</u>	<u>Treatment Method</u>
$\text{UO}_2(\text{CO}_3)_2^{-2}$	0.030 $\mu\text{g/L}$	Strong Base Anion Exchange Resins (Cl ⁻ form), Reverse Osmosis, Distillation.
$\text{UO}_2(\text{CO}_3)_3^{-4}$		

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