



Radionuclides in Well Water

Radionuclides in Private Wells

Radionuclides, either naturally present or man-made, can be transported into your well water. Radon, radium and uranium are the most common radioactive elements in the environment. These radionuclides are soluble in water, which means they can be drawn into private well water. If the soil and rocks surrounding a well have high enough concentrations, the well water may radiologically contaminate.

According to the U.S. Environmental Protection Agency (EPA), about 15 percent of Americans use private wells as their main source of drinking water. Unlike community water systems, private wells are not regulated or routinely inspected for radionuclides. Owners should get their well water tested on a regular schedule to make sure their drinking water is safe.

Standards for Radionuclides in Drinking Water

The EPA sets standards for public drinking water supplies (Table 1). The same standards are recommended for private well water.

Table 1: Standards for Radioactive Substances in Drinking Water		
Contaminant	Primary Type of Radiation	EPA Standard ¹
Gross Alpha	Alpha Particles	15 pCi/L (not including uranium)
Gross Beta	Beta Particles	4 mrem/yr ²
Radium-226 (Ra-226)	Alpha Particles	5 pCi/L (combined Ra-226/228)
Radium-228 (Ra-228)	Beta Particles	5 pCi/L (combined Ra-226/228)
Total Uranium (U)	Alpha Particles	30 micrograms/L ³

¹ Source: EPA 40 Code of Federal Regulations 142.65

² The standard for gross beta is expressed as an annual dose in millirems per year (mrem/yr). According to the EPA, 4 mrem/yr is roughly equal to a gross beta of 50 pCi/L minus the naturally occurring potassium-40 activity.

³ The standard for total uranium is expressed in micrograms per liter (µg/L). According to EPA's Implementation Guidance for Radionuclides, (pg. I-16), 1 µg/L uranium is equal 0.67 pCi/L.



Guidelines for Radiological Tests

Whenever a concern occurs, the first thing tested should be the activity of gross alpha and gross beta. This screening test is fast and cost efficient. The gross alpha/beta test results in Table 2 could be used to assess if treatment or additional testing is needed.

Table 2: Radiological Tests Guidelines		
Gross Alpha/Beta	Remarks	Other Tests
Gross Alpha/Beta < 5 pCi/L	No Radiological Contamination	No Additional Tests Required
Gross Alpha/Beta 5-15 pCi/L	Possible Radium Contamination	Radium-226/228
Gross Alpha > 15 pCi/L	Possible Radium-226/228 and Uranium Contamination	Radium-226/228 and Uranium
Treatment will be required if ...		
Ra-226 + Ra-228 > 5 pCi/L, or Gross Alpha- Uranium >15 pCi/L, or Uranium > 30 ug/L		

Radiological Tests for Radionuclides in Water at EMSL

EMSL Analytical, Inc.'s Radiochemistry Laboratory provides the analytical services for radionuclides in drinking water. **There are two options for radionuclides analysis:**

Option 1: The analyses will be conducted according to the initial screening results in Table 3.

Table 3: Radionuclides Analysis for Drinking Water				
Step	Condition	Radionuclides Analysis	Detection Limit	Method
Step 1	Screening	Gross Alpha Gross Beta	< 3 pCi/L < 4 pCi/L	EPA 900
Step 2	Alpha 3-15 pCi/L	+ Ra-228 + Ra-226	< 3 pCi/L < 4 pCi/L	EPA 903.0 EPA 904.0
Step 3	Alpha > 15 pCi/L	+ Total Uranium	<1 pCi/L	EPA 908
Step 4	Beta > 50 pCi/L	+ Gamma	Cs-137 < 10	EPA 901.1
Information Only Homeowners Kit / 4-Week TAT				

Option 2: Client selects the plan(s) for the tests in Table 4.

Table 4: Radionuclides Analysis in Drinking Water at EMSL	
Step	Radionuclides
Plan A	Gross Alpha / Beta
Plan B	Ra-228, Ra-226
Plan C	Total Uranium
Plan D	Gamma
All	Gross Alpha / Beta, Ra-228, Ra-226, Total Uranium and Gamma
Information Only Homeowners Kit / 4-Week TAT	





Sample Collection, Preservation and Shipment

A representative sample must be collected from a free-flowing source of drinking water and should be large enough so that adequate aliquots can be taken to obtain the required sensitivity. It is recommended that samples be preserved at the time of collection by adding 15 mL of 1M Nitric Acid to the sample collection bottle. If samples are to be collected without preservation, they should be brought to the laboratory within five days. Then, the samples should be preserved using 5 mL of concentrated Nitric Acid, and held in the original container for a minimum of 16 hours before analyzing or transferring the sample. The maximum hold time for drinking water samples is six months.

Product Items Numbers

Test	Bottle Description	EMSL Product ID
Gamma Alpha Gamma Beta	500 ML Bottle w/Preservative	8714205
226/228	2L Bottle w/Preservative	8714201
Uranium	500 ML Bottle w/Preservative	8714205

Plastic containers should be chosen over glass containers in order to prevent loss due to breakage during transporting and handling. To purchase sampling kits, please visit www.EMSL.com or call 1-800-220-3675.

Additional and Cited Information

Federal: USEPA Safe Drinking Water Hotline: 1-800-426-4791

Radionuclides in Drinking Water: <https://www.epa.gov/dwreginfo/radionuclides-rule>

Natural Radionuclides in Private Wells: <https://www3.epa.gov/radtown/private-wells.html>

Radon in Drinking Water (Q&A): <http://www.cdc.gov/healthywater/drinking/private/wells/disease/radon.html>

Ionizing Radiation Fact Sheets Series: No. 1: <http://www.rst2.edu/ties/radon/ramfordu/pdffiles/whatif1.pdf>

A Homeowner's Guide Radionuclides in Well Water: <https://sosradon.org/files/sosradon/resources/Maryland%20Radion%20in%20water.pdf>

For more information, please contact EMSL at info@emsl.com.

