

Gross alpha radiation is a type of energy released when certain radioactive elements decay or break down. For example, uranium and thorium are two radioactive elements found naturally in the Earth's crust. Over billions of years, these elements slowly change form and produce "decay products" such as radium and polonium. During this change process, energy is released. Gross alpha radiation is one form of the energy released.

Health Effects

Gross alpha radiation may cause health effects over time. Because gross alpha radiation loses energy rapidly and within a short distance, it does not pass through skin. It is not a hazard outside of the body. However, the radiation can be harmful if you eat, drink or breathe in something containing gross alpha radiation.

Over a long period of time and at elevated levels, radium increases the risk of bone cancer and uranium increases the risk of kidney damage. There are no immediate health risks or symptoms from drinking water that contains gross alpha radiation.

Exposure

The amount of gross alpha radiation in water varies because the Earth's bedrock contains varying amounts of radioactive elements. As radioactive elements decay, gross alpha radiation continues to be released into groundwater as positive ions called cations (e.g. radium 226 and 228), negative ions called anions (e.g. uranium), or as radiation with no charge.

Drinking Water Standards

Levels of uranium and radium in drinking water are regulated by the Environmental Protection

Agency (EPA) and the State of Vermont. To account for the remaining radioactivity, the general gross alpha level is also regulated. Public water systems in Vermont must keep the gross alpha radiation at or below the following maximum contaminant levels (MCLs) at each entry point of their distribution system:

- Adjusted Gross Alpha = 15 pCi/L (picoCuries per liter)
- Combined radium 226/228 = 5 pCi/L
- Uranium = 0.020 mg/L (milligrams per liter)

Adjusted Gross Alpha (AGA) is a calculated value based on the gross alpha and uranium result. If the AGA is above the MCL, the water system is notified, and a plan is made to find the source of the radiation and lower its level in the water.

You can estimate the AGA, if you have the results for gross alpha and uranium, by using the AGA Calculator on this web page:

healthvermont.gov/water/radioactive-elements.

The Vermont Department of Health recommends that **private well owners test for gross alpha radiation and uranium every five years** and follow these recommendations:

- If the AGA result is **less than 5 pCi/L** and the uranium result is **less than 0.02 mg/L**, no more testing or treatment is necessary. Retest again in five years.
- If the uranium result is **above 0.02 mg/L**, but the AGA result is **less than 5 pCi/L**, consider treating for uranium. Retest again in five years.
- If the AGA result is **above 5 pCi/L**, but the uranium result is **less than 0.02 mg/L**, the high AGA level is likely caused by radium. Consider treating for radium, or testing for

radium-226/228 to confirm the AGA level is due to radium and not other radioactive particles. Retest again in five years.

- If the AGA result is **above 5 pCi/L**, and the uranium result is **above 0.02 mg/L**, consider treating for uranium and radium, or testing for radium-226/228 to confirm the AGA level is due to radium and not other radioactive particles. Retest again in five years.

The radium-226/228 test is not offered at the Health Department Laboratory. Go to healthvermont.gov/drinkingwaterlab for a list of certified labs.

Because gross alpha radiation causes cancer, any exposure to it will increase your risk of getting cancer. If you would like to lower or eliminate your exposure, consider treating your water for gross alpha radiation, even if it is under the MCL.

Reducing Gross Alpha Radiation Levels in Your Water

Radioactive elements can be effectively removed from drinking water. There are different treatments for different elements.

Reverse Osmosis

Reverse osmosis treatment addresses *all* gross alpha radiation contaminants. It uses a synthetic membrane that allows water to go through but leaves radium, uranium and other

gross alpha radiation contaminants behind. The membrane is continually rinsed. It is usually installed under the kitchen sink (point-of-use, POU), but can also be installed as a whole house system (point-of-entry, POE).

Cation Exchange Treatment

A conventional water softener (also called a cation exchange softener) can be used to reduce the level of radioactive ions with a positive charge, like *radium*. This treatment exchanges radium for sodium or potassium, which remains in the water. The radium is flushed away with the wastewater when the softener is cleaned. This type of treatment is typically installed as a POE system.

Anion Exchange Treatment

Anion exchange is a treatment like water softening, but uses a different media that exchanges the negatively charge radioactive ions, like *uranium* for chloride. This is also typically a POE system.

Your water may need to be treated for other water quality issues—such as hardness, iron, manganese and pH level—before it's treated for radium or uranium. A water treatment professional will be able to determine which water treatment system is best for your water.

Re-test for gross alpha radiation after any treatment system is installed to make sure levels are below the MCL.

For More Information

Vermont Department of Health: healthvermont.gov/water

- For **health or treatment questions**, call: 802-863-7220 or 800-439-8550 (toll-free in Vermont)
- To **order a water test kit**, call: 802-338-4736 or 800-660-9997 (toll-free in Vermont)
- For a **list of certified labs that test for radium 226/228**, visit: healthvermont.gov/drinkingwaterlab

For questions related to **public water supplies**, call the Drinking Water and Groundwater Protection Division (Vermont Department of Environmental Conservation) at: 802-828-1535 or visit: dec.vermont.gov/water