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Phone 630 505 0160

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RADIUM FACT SHEET

Contaminant	In Water As	Maximum Contaminant Level
Radium (Ra)	Ra^{2+}	**US EPA (Radium 226 and 228 combined):** MCL* = 5.0 pCi/L MCLG** = zero pCi/L **WHO† Guideline:** Radium 226 = 1 Bq/l Radium 228 = 0.1 Bq/l **Health Canada (Radium 226 only):** MAC*** = 0.5 Bq/L (13.5 pCi/L)
Sources of Contaminant	Radioactive decay of uranium and thorium in rocks and soil	
Potential Health Effects	Increased risk of cancer	
Treatment Methods	Cation Exchange Softening Reverse Osmosis Distillation Electrochemical deionization†† Lime Softening	

*Maximum Contaminant Level (MCL) — The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLGs as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards.

**Maximum Contaminant Level Goal (MCLG) - The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals.

***Maximum Acceptable Concentration (MAC) - established for parameters which when present above a certain concentration, have known or suspected adverse health effects.

†WHO - World Health Organization

††Check with unit manufacturer to confirm percent reduction in concentration

Radium is formed when uranium and thorium undergo radioactive decay in the environment. Uranium and thorium are found in small amounts in most rocks and soil. Radium is constantly being produced by the radioactive decay of uranium and thorium. Two of the main radium isotopes found in the environment are radium-226 and radium-228 with an atomic weight of 226 and 228. Radium has been used as a radiation source for treating cancer, in radiography of metals, and combined with other metals as a neutron source for research and radiation instrument calibration.

Surface water sources and shallow wells will typically have lower levels of radium while deeper wells may at times have higher concentrations, depending on several natural factors.

HEALTH EFFECTS

Radium emits energy in the form of alpha particles and gamma rays, and will also decay to form radon. Radium in drinking water is of primary concern because this radiation may cause cancer, kidney damage, and birth defects. Additionally, the decay of radium into radon presents another contaminant of health concern in drinking water as well as in the air. The National Academy of Sciences reported that exposure to radon in the air is the second cause of lung cancer next to cigarette smoking.

TREATMENT METHODS

Residential **Point-of-Entry** **Point-of-Use**	Cation Exchange Softening Electrochemical deionization Reverse Osmosis Distillation
Municipal	Lime softening
Visit WQA.org or NSF.org to search for products certified to NSF/ANSI 44, 58, 62, and WQA S-300 for radium reduction.	

When proper regeneration procedures are employed in ion exchange treatment methodologies (e.g., conventional water softeners), radium along with barium, calcium, and magnesium are effectively reduced. Radium removal has been shown to continue well after the hardness breakthrough point on both new and old cation resin beds, while barium breakthrough occurs shortly after hardness. Reverse osmosis and distillation are also effective at reducing radium.

There are established standards for reducing radium by cation exchange softeners, reverse osmosis systems, and distillers. These standards actually utilize barium (Ba^{2+}) as a conservative surrogate to demonstrate radium reduction. There are many softeners, RO devices, and distillers tested and certified for the reduction of radium by independent testing and certifying organizations.

Discharge regulations for wastewater containing radium may vary from area to area. Consult the local health department, Environmental Protection Agency (EPA), or Department of Environmental Protection Agency (DEP) when there are waste products of potential concern.

The treatment methods listed herein are generally recognized as techniques that can effectively reduce the listed contaminants sufficiently to meet or exceed the relevant MCL. However, this list does not reflect the fact that point-of-use/point-of-entry (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 health contaminant reduction should be made only after 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 of POE products, the performance characteristics should be verified by tests conducted under established test procedures and water analysis. Thereafter, the treated water should be monitored periodically to verify continued performance. The water treatment equipment must be controlled diligently to ensure that acceptable feedwater conditions and equipment capacity are not exceeded.

Visit WQA.org to find water professionals in your area. Note that Certified Water Specialists have passed the water treatment educational program with the Water Quality Association and continue their education with recertification every 3 years.

REGULATIONS

In the United States the EPA, under the authority of the Safe Drinking Water Act (SDWA), has set the Maximum Contaminant Level Goal (MCLG) for radium at zero pCi/L (Ra 226 and 228 combined). This is the health-based goal at which no known or anticipated adverse effects on human health occur and for which an adequate margin of safety exists. The US EPA has set this level of protection based on the best available science to prevent potential health problems. Based on the MCLG, EPA has set an enforceable regulation for Radium, the Maximum Contaminant Level (MCL), at 5 pCi/L. MCLs are set as close to the MCLG as possible, considering cost, benefits and the ability of public water systems to detect and remove contaminants using suitable treatment technologies.

REFERENCES/SOURCES

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Mark Brotman, CWS-VI	Pauli Undesser, M.S., CWS-VI
P. Regunathan, Ph.D.	Kimberly Redden, CWS-VI
Rebecca Tallon, P.E.	

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National Headquarters & Laboratory

4151 Naperville Road • Lisle, Illinois 60532
Tel: 630 505 0160 • Fax: 630 505 9637