

RADIONUCLIDES

All About Radionuclides

Where Do Radionuclides Occur?

Radionuclides are naturally-occurring elements in rocks and soils resulting from the radioactive decay of uranium-238 and thorium-232. The decay process results in the release of ionizing radiation, which may be in the form of alpha particles, beta particles, or gamma rays.

The most common radionuclides found in groundwater are radon, radium-226, radium-228, uranium-238, and uranium-234. Additional radionuclides may occur in groundwater, but have less mobility or shorter half lives and are less likely to be found in significant quantities.

What are the Health Effects?

Radiation is a health concern due to the potential for ionizing radiation to injure cells in living organisms, potentially causing cancer.

What are Some of the Best Available Technologies for Eliminating Radionuclides in Drinking Water?

1. Gross alpha emitters: Reverse Osmosis
2. Radium 226 and 228: ion Exchange, Lime Softening, and Reverse Osmosis
3. Beta/photon emitters: Ion Exchange and Reverse Osmosis
4. Uranium: Ion Exchange, Enhanced Coagulation/Filtration, Reverse Osmosis, and Lime Softening

IMPORTANT DATES

Proposal Date: 1991

Rule Finalized: December 7, 2000

Effective Date: December 8, 2003

End of First Reporting Period: December 31, 2007
(All systems must complete initial monitoring)

Insight Into the Regulation:

Drinking water standards for radionuclides were first promulgated in 1976 under the authority of the Safe Drinking Water Act (SDWA) of 1974. These standards, which addressed beta and photon emitters, radium-226 and radium-228, gross alpha particle radioactivity, and beta particle and photon radioactivity, became effective in 1977.

The 1986 Amendments to the SDWA required the USEPA to promulgate a revised Radionuclide Rule by June 1989, and added radon and uranium to the list of contaminants required for regulation. The USEPA failed to meet this deadline, and a court order was subsequently issued to require promulgation of a radionuclides regulation by November 21, 2000.

In 1991, the USEPA proposed new regulations for uranium and radon and revisions to the existing maximum contaminant levels (MCLs) promulgated in 1976. The 1996 Amendments to the SDWA required the USEPA to withdraw the drinking water standards proposed for radon in 1991, to arrange for the National Academy of Sciences to conduct a risk assessment for radon in drinking water, and to finalize a national primary drinking water regulation for radon by August 2000. The Radon Rule, proposed in November 1999, is anticipated to be promulgated in December 2006.

The Radionuclides Rule, which is effective for all Community Water Systems, finalizes the 1991 proposal. The new rule contains several changes from the 1991 proposal, primarily the implementation of an MCL for uranium, the requirement for compliance monitoring to occur at all entry points to the distribution system, rather than at "representative" points throughout the system, and separate monitoring for radium-226 and radium-228. Because the USEPA recognizes that many systems will have to re-establish monitoring baselines unless data grandfathering is allowed, primacy entities will be allowed to develop data grandfathering plans that are suited to individual situations.



Think Big. Go Beyond.

If you have any questions on the information provided in this handout or additional questions concerning USEPA drinking water regulations, contact Wayne Gerszewski, PE at 701-746-8087 (Grand Forks), Russ Sorenson, PE at 701-221-0530 (Bismarck), Grant Meyer, PE at 763-463-5036 (Minneapolis), Nate Weisenburger, PE at 406-268-0626 (Great Falls), or Brian Bergantine, PE at 218-299-5610 (Moorhead).

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USEPA IMPLEMENTATION PLAN FOR THE RADIONUCLIDES RULE:

Rule Proposed: 1991

Final Rule: December 7, 2000

Effective Date: December 8, 2003 (Systems to begin initial monitoring under State-specified monitoring plan unless State permits use of grandfathered data)

End of First Reporting Period: December 31, 2007 (All systems must complete initial monitoring)

National Primary Drinking Water Regulations for Radionuclides (Excluding Radon)				
Radionuclide	MCL (Year)	MCLG	Source	Health Effects
Radium 226/228	5 pCi/L (1976)	Zero	Naturally occurs in some drinking water sources.	May increase the risk of cancer if drinking water containing concentrations greater than the MCL is consumed over a period of many years.
Beta and Photon Emitters	4 mrem/year (1976)	Zero	May occur due to contamination from facilities using or producing radioactive materials.	May increase the risk of cancer if drinking water containing concentrations greater than the MCL is consumed over a period of many years.
(Adjusted) Gross Alpha Emitters	15 pCi/L (1976)	Zero	Naturally occurs in some drinking water sources.	May increase the risk of cancer if drinking water containing concentrations greater than the MCL is consumed over a period of many years.
Uranium	30 ug/L (2000)	Zero	Naturally occurs in some drinking water sources.	Exposure may result in toxic effects to the kidneys, and may increase the risk of cancer if drinking water containing concentrations greater than the MCL is consumed over a period of many years.

mrem/yr = measurement of the amount of energy absorbed by the body or any internal organ per year.

Source: USEPA Office of Ground Water and Drinking Water