

Radiation and Public Health

Human beings are constantly exposed to radiation from natural and manmade sources. On average, 80 percent of that exposure comes from natural sources, including terrestrial radiation from radioactive elements such as uranium, radium, and radon that occur naturally in rocks, soil and minerals. Radiation exposures vary according to factors such as an individual's location, lifestyle, occupation and daily activities.

Radionuclides in Drinking Water

Uranium and radium naturally present in underground rocks that serve as aquifers may dissolve and enter groundwater used for drinking water.



Most drinking water sources have very low levels of radioactive contaminants (“radionuclides”), and are not considered to

be a public health concern. Of the small percentage of drinking water systems with radioactive contaminant levels high enough to be of concern, most of the radioactivity is naturally occurring.

If source water comes from a geographic area where radiation releases are documented or likely to occur due to the presence of natural radionuclides in rocks or soil, a Community Water System (CWS) should test both source water and water treatment residuals to determine their radionuclide contents.

Radionuclide Rule

To protect public health, EPA has established drinking water standards for the following radioactive contaminants:

- ▶ Combined radium 226/228 (5 pCi/L);
- ▶ Man-made beta particles and photon emitters (4 millirems per year);
- ▶ Gross alpha activity (15 pCi/L); and
- ▶ Uranium (30 µg/L).

Reducing the exposure to radionuclides in drinking water and filtration equipment or wastes containing radionuclides will reduce the risk of cancer. (For details see EPA's Radionuclide Rule; 66 FR 76708, December 7, 2000.)

Treatment of Water for Human Consumption

Water treatment practices purify water for human consumption by removing levels of naturally occurring radioactive materials found in raw water supplies. As large quantities of water are treated using a filtration process, these contaminants become concentrated in various filtration media and wastes. Typical activities during the water treatment process can potentially bring the worker within close proximity to these concentrated waste contaminants.

Disposal of Liquid and Solid Waste

Treating water for naturally occurring radionuclides will result in residual streams requiring disposal which is regulated by EPA and/or States. Radionuclide concentrations in waste may determine the disposal options(s) available. These include:

Liquid waste disposal

- ▶ Direct discharge to surface water
- ▶ Discharge to Publicly Owned Treatment Works

Solid waste disposal

- ▶ Solid waste landfills*
- ▶ Hazardous waste landfills
- ▶ Low-level radioactive waste landfills

* Note that landfill owners can refuse to accept any waste.

States may have additional requirements or restrictions on the disposal of these residuals containing radionuclides. The practice of land spreading, as an alternative to landfill disposal of waste treatment residuals, is under review by EPA.

Additional Resources

- ▶ Drinking Water Standards: 40 CFR Parts 8, 141, and 142.
- ▶ A Regulator's Guide to Management of Radioactive Residuals from Drinking Water Treatment Technologies. U.S. EPA Office of Water, July 2005 (EPA Publication No. 816-R-05-004).
- ▶ Narasimhan, R., J.D. Lowry, J. Culley, and N. Young-Pong, 2005. Management of the Disposal of Radioactive Residuals in Drinking Water Treatment. American Water Works Association (AWWA) Research Foundation.
- ▶ www.epa.gov/radiation/tenorm/water-treatment.html



Radiation Health and Safety Practices for Community Water Systems

Minimizing Worker Exposure to Radon and Radiation at Community Water Systems (CWSs)

Provided by:

Office of Radiation and Indoor Air (ORIA)
Office of Ground Water & Drinking Water (OGWDW)

What Can a CWS Do to Reduce Worker Exposure?

Contact your State radiation program for guidance on conducting radiation surveys at the facility.

Changes to Facility:

- ▶ Ventilate all buildings to remove radon gas, especially those buildings where waste with radium is stored.
- ▶ Locate treatment units and waste storage areas as far away from common areas (e.g., offices) as possible.
- ▶ Survey the system's ambient radiation levels annually in areas where treatment takes place or material can accumulate.



Changes in Personal Hygiene Practices:

- ▶ At home, wash work clothing separately.
- ▶ Avoid wearing contaminated clothing into the home.
- ▶ Keep work boots or shoes clean; after potential contamination, do not bring them home.

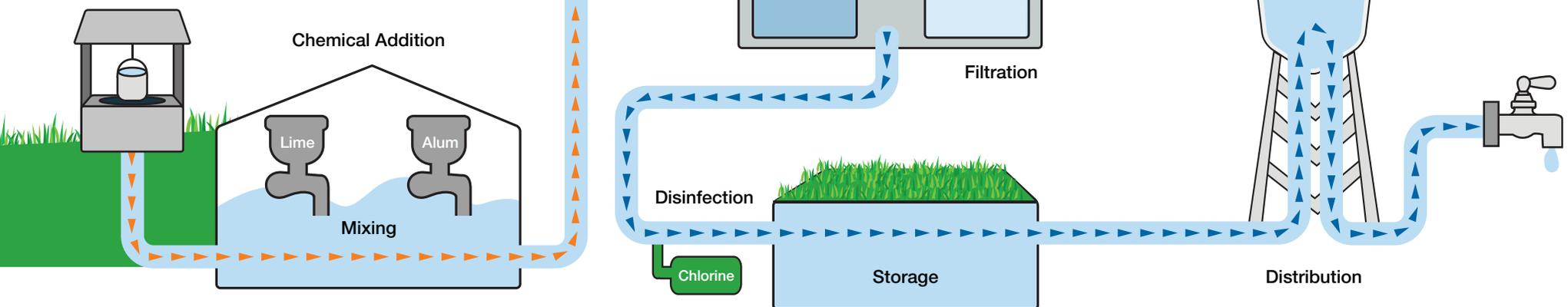
Changes in Work Practices:

- ▶ Limit time spent near filtration and aeration equipment, backwash spray, waste sludges and scales, waste lagoons, pits and ponds.
- ▶ Follow OSHA measures to limit the potential ingestion of heavy metals and biological pathogens present in filters.
- ▶ Use protective gloves and frequently wash hands.
- ▶ Avoid plunging hands/arms in filtration tanks.
- ▶ Avoid eating and drinking in the work area.
- ▶ Shower after exposure to potentially radioactive materials.
- ▶ Launder work clothing at the system if possible.



- ▶ Monitor levels of radiation to which staff is exposed.
- ▶ Provide workers OSHA-approved respirators (not dust masks) when handling media to minimize inhalation of radioactive particulates. Note that respirators are not effective against radon gas.
- ▶ Provide workers with dosimeters to monitor radon levels around the facility.

Drinking Water Well



Water Contaminated with Radionuclides

- ▶ Untreated
- ▶ Partially Treated
- ▶ Meets EPA Standards