3745-81-15 **Maximum contaminant levels and best available technologies for radionuclide contaminants.**

(A) Combined radium-226 and radium-228: the maximum contaminant level (MCL) for combined radium-226 and radium-228 is five picocuries per liter (pCi/L). The combined radium-226 and radium-228 value is determined by the addition of the results of the analysis for radium-226 and the analysis for radium-228.

(B) Gross alpha particle activity: the MCL for gross alpha particle activity (including radium-226 but excluding radon and uranium) is fifteen pCi/L. The gross alpha particle activity value may be adjusted by subtracting the result of the analysis for uranium. If the result for uranium is reported as a mass measurement in micrograms per liter (µg/L), the activity value in pCi/L shall be obtained by multiplying the result with a conversion factor of 0.67 pCi/µg.

(C) Beta particle and photon radioactivity:

(1) The MCL for beta particle and photon radioactivity from man-made radionuclides is an annual dose equivalent of four millirem/year (mrem/yr) to the total body or any internal organ. The annual dose equivalent is determined by converting the running annual average concentration for the radionuclide from pCi/L to mrem/yr (running annual average concentration divided by the dose equivalent for the radionuclide). If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed four mrem/yr.

(2) The annual dose equivalent for radionuclides may be determined using the conversion table below. For radionuclides not listed, the concentration causing four mrem/yr total body or organ dose equivalents may be obtained from appendix I of the "Implementation Guidance for Radionuclides" dated March 2002 and designated EPA 816-F-00-002.

[Comment: This rule references the U.S. EPA "Implementation Guidance for Radionuclides" and "Implementation Guidance for Radionuclides Appendices A - J," issued March 2002. This document is available from the "U.S. EPA Office of Ground Water and Drinking Water, Ariel Rios Building, 1200 Pennsylvania Ave., N.W., Washington, D.C. 20460-0003, (202) 564-3750, www.epa.gov/safewater." A copy may also be obtained by contacting "Ohio EPA, Lazarus Government Center, 50 West Town Street, Suite 700, Columbus, OH, 43215."]

Dose Equivalents Assumed to Produce a Total Body or Organ Dose of four mrem/yr

Radionuclide	Critical Organ	pCi/L
Tritium	Total body	20,000
Strontium-89	Bone marrow	20
Strontium-90	Bone marrow	8
Iodine-131	Thyroid	3
Cesium-134	Total body	80

(D) Uranium: the MCL for uranium is thirty µg/L (activity level of twenty pCi/L). If the result for uranium is reported as an activity measurement in pCi/L, the mass in µg/L shall be obtained by multiplying the result with a conversion factor of 1.49 µg/pCi.

(E) The director may determine that a public water system shall apply best available technology in order to reduce the level of a contaminant to below its MCL. The director hereby identifies the following technologies, treatment techniques, or other means as the best available technologies (BATs) for removal of the following radionuclide contaminants from water.

Contaminant	BATs
Combined radium-226 and radium-228	1[a], 2[b], 3[c], 4[d], 5[e], 6, 7[f]
Gross alpha particle activity (excluding Radon and Uranium)	2[b]
Beta particle and photon radioactivity	1[a], 2[b]
Uranium	1[a], 2[b], 3[c], 8[a,g], 9[h]

Key to BATs in table:

1 = Ion exchange

2 = Reverse Osmosis

3 = Lime softening

4 = Green sand filtration

5 = Co-precipitation with barium sulfate

6 = Electrodialysis/electrodialysis reversal

7 = Pre-formed hydrous manganese oxide filtration

8 = Activated alumina

9 = Enhanced coagulation/filtration

Limitations footnotes:

a) The regeneration solution contains high concentrations of the contaminant ions. Disposal options should be carefully considered before choosing this technology.

b) Reject water disposal options and other reverse osmosis limitations should be carefully considered before choosing this technology.

c) This technology should not be used for public water systems serving a population of five hundred or less.

d) Removal efficiencies can vary depending on water quality.

e) This technology may be very limited in application to small systems. Since the process requires static mixing, detention basins, and filtration, it is most applicable to the systems with sufficiently high sulfate levels that already have a suitable filtration treatment train in place.

f) This technology is most applicable to small systems that already have filtration in place.

g) Competing anion concentrations may affect regeneration frequency. Handling of chemicals required during regeneration and pH adjustment may be too difficult for small systems without an adequately trained operator.

h) Assumes modification to a coagulation/filtration process already in place.

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