UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OSWER No. 9355.01-83A

MEMORANDUM

SUBJECT: Distribution of OSWER of Radionuclide Preliminary Remediation Goals (PRGs) for Superfund Electronic Calculator

FROM: Elaine F. Davies, Acting Director
Office of Emergency and Remedial Response (OERR)
Office of Solid Waste and Emergency Response

Stephen D. Page, Director
Office of Radiation and Indoor Air (ORIA)
Office of Air and Radiation

TO: Addressees

PURPOSE

The purpose of this memorandum is to transmit to you a final electronic calculator entitled: "Radionuclide Preliminary Remediation Goals (PRGs) for Superfund." The Radionuclide PRG calculator may be found at the following website http://epa-prgs.ornl.gov/radionuclides. The electronic calculator provides guidance for establishing PRGs at radioactively contaminated Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) sites.[1]

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[1]The electronic calculator transmitted by this memorandum provides guidance on preliminary remediation goal issues involved at CERCLA sites and is consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). It does not alter the NCP expectations regarding treatment of principal threat waste and the use of containment and institutional controls for low level threat waste. Consistent with CERCLA and the NCP, response actions must attain or waive applicable or relevant and appropriate requirements (ARARs). CERCLA response actions for contaminated ground water at radiation sites must attain (or waive as appropriate) the Maximum Contaminant Levels (MCLs) or non-zero Maximum Contaminant Level Goals (MCLGs) established under the Safe Drinking Water Act, where the MCLs or MCLGs are relevant and appropriate for the site.

BACKGROUND

The U.S. Environmental Protection Agency (EPA) issued guidance entitled "Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination" (OSWER No. 9200.4-18, August 22, 1997). This 1997 guidance provided clarification for establishing protective cleanup levels for radioactive contamination at CERCLA sites. The guidance reiterated that cleanups of radionuclides are governed by the risk range for all carcinogens established in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) when Applicable or Relevant and Appropriate Requirements (ARARs) are not available or are not sufficiently protective. Cleanup should generally achieve a level of risk within the 10^{-4} to 10^{-6} carcinogenic risk range based on the reasonable maximum exposure for an individual. In calculating cleanup levels, one should include exposures from all potential pathways, and through all media (e.g., soil, ground water, surface water, sediment, air, structures, etc.) The guidance also provides a listing of radiation standards that are likely to be used as ARARs to establish cleanup levels or to conduct remedial actions.

This Radionuclide PRG calculator is part of a continuing effort between the Office of Emergency and Remedial Response (OERR) and the Office of Radiation and Indoor Air (ORIA) to provide updated guidance for addressing radioactively contaminated sites consistent with our guidance for addressing chemically contaminated sites, except to account for the technical differences between radionuclides and chemicals. This effort is intended to facilitate compliance with the NCP at radioactively contaminated sites while incorporating the improvements to the Superfund program that have been implemented through Administrative Reforms.

Today's Radionuclide PRG calculator provides updated guidance to the equations that are found in a previous guidance document issued by EPA entitled "Risk Assessment Guidance for Superfund: Volume I, Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals)" (EPA/540/R-92/003, December 1991). Much of the basis for this updated guidance is found in two other guidance documents issued by EPA entitled "Soil Screening Guidance for Radionuclides: User's Guide" (OSWER No. 9355.4-16A, October 2000), and "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (Peer Review Draft)" (OSWER No. 9355.4-24, March 2001).

IMPLEMENTATION

For questions regarding radiation site policy and guidance for CERCLA cleanup actions, readers are referred to the RCRA/Superfund Hotline at 1-800-424-9346 or the Superfund Radiation Webpage at http://www.epa.gov/superfund/resources/radiation/index.htm. The subject matter specialists for this electronic calculator are Phil Newkirk and Ron Wilhelm of ORIA and Stuart Walker of OERR.

Addressees:

National Superfund Policy Managers

Superfund Branch Chiefs (Regions I-X)
Superfund Branch Chiefs, Office of Regional Counsel (Regions I-X)
Radiation Program Managers (Regions I, IV, V, VI, VII, X)
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Radionuclide Toxicity and Preliminary Remediation Goals for Superfund

Element (Atomic Number)	Isotope	Toxicity: Soil Ingestion Slope Factor (risk/pCi)	Toxicity: Soil Ingestion Slope Factor-Adult (risk/pCi)	Toxicity: Water Ingestion Slope Factor (risk/pCi)	Toxicity: Food Ingestion Slope Factor (risk/pCi)	Toxicity: Inhalation Slope Factor (risk/pCi)	Toxicity: External Exposure Slope Factor (risk/y per pCi/g)	Preliminary Remediation Goals (PRG): Residential Soil (pCi/g)	Preliminary Remediation Goals (PRG): Agricultural Soil (pCi/g)	Preliminary Remediation Goals (PRG): Outdoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Indoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Tap Water (pCi/L)	Preliminary Remediation Goals (PRG): Fish Ingestion (pCi/g)	Soil to Groundwater: DAF=20 (pCi/g)	Soil to Groundwater: DAF=1 (pCi/g)
Actinium (89)	Ac-223						1.55E-08	3.58E+07	3.58E+07	5.78E+07	1.30E+08				
Actinium (89)	Ac-224	1.53E-11		5.59E-12	8.03E-12	4.07E-10	6.06E-07	1.15E+04	4.14E+03	1.87E+04	4.20E+04	8.52E+00	2.20E-01		
Actinium (89)	Ac-225	5.18E-10		1.89E-10	2.71E-10	2.86E-08	4.50E-08	3.66E+02	2.30E+00	3.03E+03	6.81E+03	2.52E-01	6.51E-03		
Actinium (89)	Ac-226	2.00E-10		6.92E-11	1.01E-10	4.33E-09	4.46E-07	1.36E+03	4.96E+01	2.54E+03	5.71E+03	6.88E-01	1.75E-02		
Actinium (89)	Ac-227	3.81E-10	2.01E-10	2.01E-10	2.45E-10	1.49E-07	3.48E-10	1.10E+00	4.45E-03	1.22E+01	2.22E+01	2.37E-01	7.20E-03		
Actinium (89)	Ac-227+D	1.16E-09	3.45E-10	4.86E-10	6.53E-10	2.09E-07	1.47E-06	9.08E-02	1.64E-03	2.07E-01	4.63E-01	9.80E-02	2.70E-03		
Actinium (89)	Ac-228	5.55E-12		1.99E-12	2.89E-12	4.92E-11	4.53E-06	7.31E+02	6.73E+02	1.18E+03	2.66E+03	2.39E+01	6.10E-01		
Aluminum (13)	Al-26	4.70E-11		1.73E-11	2.49E-11	6.92E-11	1.33E-05	8.37E-03	5.01E-03	1.63E-02	3.66E-02	2.75E+00	7.08E-02		
Aluminum (13)	Al-28						9.32E-06	5.84E+04	5.84E+04	9.43E+04	2.12E+05				
Americium (95)	Am-237	1.24E-13		5.07E-14	7.18E-14	5.77E-14	1.35E-06	1.24E+04	1.23E+04	2.00E+04	4.50E+04	9.39E+02	2.46E+01	3.54E+12	1.77E+11
Americium (95)	Am-238	2.28E-13		9.62E-14	1.35E-13	9.51E-14	4.02E-06	3.09E+03	3.08E+03	5.00E+03	1.12E+04	4.95E+02	1.31E+01	1.03E+12	5.17E+10
Americium (95)	Am-239	3.89E-12		1.38E-12	2.01E-12	8.40E-13	6.91E-07	2.47E+03	1.78E+03	3.99E+03	8.98E+03	3.45E+01	8.77E-01	1.36E+09	6.79E+07
Americium (95)	Am-240	6.81E-12		2.59E-12	3.70E-12	1.41E-12	4.69E-06	8.53E+01	7.71E+01	1.38E+02	3.10E+02	1.84E+01	4.77E-01	3.97E+07	1.98E+06
Americium (95)	Am-241	2.17E-10	9.10E-11	1.04E-10	1.34E-10	2.81E-08	2.76E-08	1.42E+00	4.78E-03	5.68E+00	1.19E+01	4.58E-01	1.32E-02	2.58E+00	1.29E-01
Americium (95)	Am-242	5.14E-12		1.79E-12	2.62E-12	5.03E-11	3.48E-08	3.53E+04	3.28E+03	5.90E+04	1.33E+05	2.66E+01	6.73E-01	5.79E+08	2.90E+07
Americium (95)	Am-242m	1.29E-10		7.07E-11	8.77E-11	1.56E-08	1.05E-09	3.52E+00	7.76E-03	2.00E+02	4.50E+02	6.74E-01	2.01E-02	1.30E-01	6.48E-03
Americium (95)	Am-242m+D	2.21E-10		1.04E-10	1.36E-10	2.81E-08	4.83E-08	1.17E+00	4.99E-03	4.72E+00	1.06E+01	4.58E-01	1.30E-02	8.81E-02	4.40E-03
Americium (95)	Am-243	2.17E-10		1.03E-10	1.34E-10	2.70E-08	9.47E-08	7.56E-01	4.63E-03	2.28E+00	5.14E+00	4.62E-01	1.32E-02	2.52E+00	1.26E-01
Americium (95)	Am-243+D	2.32E-10		1.08E-10	1.42E-10	2.70E-08	6.36E-07	1.61E-01	4.25E-03	3.40E-01	7.66E-01	4.41E-01	1.24E-02	2.52E+00	1.26E-01
Americium (95)	Am-244	7.03E-12		2.52E-12	3.66E-12	3.09E-12	3.58E-06	5.62E+02	4.94E+02	9.08E+02	2.04E+03	1.89E+01	4.82E-01	1.03E+09	5.16E+07
Americium (95)	Am-244m	1.18E-13		5.11E-14	7.10E-14	1.02E-13	5.09E-09	9.16E+06	3.20E+06	1.49E+07	3.35E+07	9.32E+02	2.48E+01	2.77E+13	1.38E+12
Americium (95)	Am-245	6.11E-13		2.22E-13	3.22E-13	1.56E-13	1.04E-07	9.52E+04	6.73E+04	1.54E+05	3.46E+05	2.15E+02	5.48E+00	2.84E+11	1.42E+10
Americium (95)	Am-246	2.93E-13		1.23E-13	1.73E-13	1.31E-13	2.93E-06	1.07E+04	1.06E+04	1.72E+04	3.88E+04	3.87E+02	1.02E+01	5.11E+12	2.55E+11
Americium (95)	Am-246m	1.48E-13		6.59E-14	9.10E-14	3.96E-14	4.83E-06	1.01E+04	1.01E+04	1.63E+04	3.67E+04	7.23E+02	1.94E+01	2.32E+13	1.16E+12
Antimony (51)	Sb-115	1.16E-13		5.14E-14	7.10E-14	2.33E-14	3.92E-06	9.78E+03	9.75E+03	1.58E+04	3.56E+04	9.26E+02	2.48E+01		
Antimony (51)	Sb-116	1.07E-13		4.96E-14	6.81E-14	1.88E-14	1.05E-05	7.35E+03	7.34E+03	1.19E+04	2.67E+04	9.60E+02	2.59E+01		
Antimony (51)	Sb-116m	4.00E-13		1.76E-13	2.45E-13	8.81E-14	1.47E-05	1.38E+03	1.37E+03	2.22E+03	5.00E+03	2.71E+02	7.20E+00		
Antimony (51)	Sb-117	1.70E-13		6.59E-14	9.44E-14	4.07E-14	5.78E-07	1.26E+04	1.23E+04	2.03E+04	4.56E+04	7.23E+02	1.87E+01		
Antimony (51)	Sb-118m	1.67E-12		6.99E-13	9.81E-13	2.64E-13	1.21E-05	3.36E+02	3.32E+02	5.43E+02	1.22E+03	6.81E+01	1.80E+00		
Antimony (51)	Sb-119	1.35E-12		4.77E-13	6.96E-13	1.74E-13	2.58E-09	1.36E+05	5.30E+03	3.34E+05	7.51E+05	9.98E+01	2.53E+00		
Antimony (51)	Sb-120a	5.44E-14		2.48E-14	3.42E-14	1.12E-14	1.94E-06	3.95E+04	3.94E+04	6.39E+04	1.44E+05	1.92E+03	5.16E+01		
Antimony (51)	Sb-120b	1.08E-11		4.44E-12	6.22E-12	3.30E-12	1.15E-05	1.28E+01	1.19E+01	2.06E+01	4.65E+01	1.07E+01	2.84E-01		
Antimony (51)	Sb-122	3.03E-11		1.06E-11	1.55E-11	5.48E-12	1.97E-06	1.57E+02	7.55E+01	2.57E+02	5.79E+02	4.49E+00	1.14E-01		
Antimony (51)	Sb-124	3.50E-11		1.29E-11	1.85E-11	2.43E-11	8.89E-06	1.58E+00	1.22E+00	2.56E+00	5.75E+00	3.69E+00	9.53E-02		
Antimony (51)	Sb-124m						1.56E-06	5.04E+05	5.04E+05	8.15E+05	1.83E+06				
Antimony (51)	Sb-124n	3.81E-14		1.67E-14	2.32E-14	1.15E-14	7.76E-12	1.16E+09	1.84E+07	1.26E+10	2.83E+10	2.85E+03	7.60E+01		
Antimony (51)	Sb-125	1.12E-11		4.37E-12	6.14E-12	1.66E-11	1.81E-06	4.60E-01	3.13E-01	7.49E-01	1.68E+00	1.09E+01	2.87E-01		
Antimony (51)	Sb-125+D	1.32E-11		5.13E-12	7.21E-12	1.93E-11	1.81E-06	4.59E-01	2.96E-01	7.49E-01	1.68E+00	9.28E+00	2.45E-01		
Antimony (51)	Sb-126	2.93E-11		1.11E-11	1.59E-11	1.15E-11	1.28E-05	5.32E+00	4.54E+00	8.62E+00	1.94E+01	4.29E+00	1.11E-01		
Antimony (51)	Sb-126m	1.48E-13		6.66E-14	9.21E-14	3.16E-14	6.94E-06	9.25E+03	9.23E+03	1.49E+04	3.36E+04	7.15E+02	1.91E+01		
Antimony (51)	Sb-127	2.85E-11		1.01E-11	1.47E-11	7.51E-12	3.07E-06	7.10E+01	4.28E+01	1.16E+02	2.60E+02	4.71E+00	1.20E-01		
Antimony (51)	Sb-128a	1.19E-13		5.51E-14	7.55E-14	2.12E-14	9.03E-06	1.30E+04	1.30E+04	2.10E+04	4.72E+04	8.64E+02	2.34E+01		
Antimony (51)	Sb-128b	9.21E-12		3.45E-12	4.96E-12	1.44E-12	1.40E-05	1.61E+02	1.53E+02	2.60E+02	5.86E+02	1.38E+01	3.56E-01		
Antimony (51)	Sb-129	6.11E-12		2.19E-12	3.19E-12	9.62E-13	6.85E-06	6.86E+02	6.44E+02	1.11E+03	2.50E+03	2.17E+01	5.53E-01		
Antimony (51)	Sb-130	4.77E-13		2.07E-13	2.88E-13	9.73E-14	1.51E-05	2.02E+03	2.01E+03	3.26E+03	7.34E+03	2.30E+02	6.12E+00		
Antimony (51)	Sb-131	6.48E-13		2.56E-13	3.59E-13	9.73E-14	9.08E-06	5.84E+03	5.81E+03	9.43E+03	2.12E+04	1.86E+02	4.91E+00		
Argon (18)	Ar-37						0.00E+00								
Argon (18)	Ar-39						5.94E-10	1.95E+02	1.48E+02	3.76E+02	8.46E+02				
Argon (18)	Ar-41						6.39E-06	1.74E+03	1.74E+03	2.81E+03	6.32E+03				
Arsenic (33)	As-69	2.39E-13		1.05E-13	1.46E-13	4.29E-14	4.43E-06	1.81E+04	1.80E+04	2.93E+04	6.58E+04	4.54E+02	1.21E+01		
Arsenic (33)	As-70	7.40E-13		3.20E-13	4.48E-13	1.37E-13	1.96E-05	1.18E+03	1.18E+03	1.91E+03	4.30E+03	1.49E+02	3.94E+00		

Radionuclide Toxicity and Preliminary Remediation Goals for Superfund

Element (Atomic Number)	Isotope	Toxicity: Soil Ingestion Slope Factor (risk/pCi)	Toxicity: Soil Ingestion Slope Factor-Adult (risk/pCi)	Toxicity: Water Ingestion Slope Factor (risk/pCi)	Toxicity: Food Ingestion Slope Factor (risk/pCi)	Toxicity: Inhalation Slope Factor (risk/pCi)	Toxicity: External Exposure Slope Factor (risk/y per pCi/g)	Preliminary Remediation Goals (PRG): Residential Soil (pCi/g)	Preliminary Remediation Goals (PRG): Agricultural Soil (pCi/g)	Preliminary Remediation Goals (PRG): Outdoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Indoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Tap Water (pCi/L)	Preliminary Remediation Goals (PRG): Fish Ingestion (pCi/g)	Soil to Groundwater: DAF=20 (pCi/g)	Soil to Groundwater: DAF=1 (pCi/g)
Arsenic (33)	As-71	6.07E-12		2.28E-12	3.29E-12	1.52E-12	2.37E-06	1.30E+02	1.05E+02	2.14E+02	4.81E+02	2.09E+01	5.36E-01		
Arsenic (33)	As-72	2.79E-11		1.02E-11	1.48E-11	4.29E-12	8.21E-06	9.29E+01	7.10E+01	1.54E+02	3.46E+02	4.67E+00	1.19E-01		
Arsenic (33)	As-73	4.40E-12		1.56E-12	2.28E-12	3.88E-12	5.78E-09	2.86E+02	2.41E+01	2.95E+03	6.63E+03	3.05E+01	7.74E-01		
Arsenic (33)	As-74	1.82E-11		6.70E-12	9.69E-12	8.44E-12	3.35E-06	1.37E+01	9.17E+00	2.29E+01	5.16E+01	7.11E+00	1.82E-01		
Arsenic (33)	As-76	2.70E-11		9.66E-12	1.42E-11	4.14E-12	2.01E-06	3.51E+02	1.64E+02	6.21E+02	1.40E+03	4.93E+00	1.24E-01		
Arsenic (33)	As-77	7.03E-12		2.50E-12	3.67E-12	1.76E-12	3.58E-08	6.10E+03	7.16E+02	2.36E+04	5.32E+04	1.90E+01	4.81E-01		
Arsenic (33)	As-78	1.61E-12		6.33E-13	9.03E-13	2.69E-13	6.11E-06	2.20E+03	2.14E+03	3.55E+03	8.00E+03	7.52E+01	1.95E+00		
Astatine (85)	At-207	1.66E-12		6.96E-13	9.51E-13	7.77E-12	6.11E-06	1.85E+03	1.81E+03	2.98E+03	6.72E+03	6.84E+01	1.85E+00		
Astatine (85)	At-211	8.21E-11		3.37E-11	4.63E-11	3.58E-10	7.94E-08	3.10E+04	4.49E+02	5.73E+04	1.29E+05	1.41E+00	3.81E-02		
Astatine (85)	At-215						8.09E-10	9.04E+14	9.04E+14	1.46E+15	3.29E+15				
Astatine (85)	At-216						3.08E-09	7.92E+13	7.92E+13	1.28E+14	2.88E+14				
Astatine (85)	At-217						1.32E-09	1.72E+12	1.72E+12	2.77E+12	6.24E+12				
Astatine (85)	At-218						3.57E-09	1.02E+10	1.02E+10	1.66E+10	3.72E+10				
Barium (56)	Ba-126	2.24E-12		8.51E-13	1.22E-12	3.49E-13	5.83E-07	2.16E+04	1.68E+04	3.50E+04	7.88E+04	5.60E+01	1.45E+00		
Barium (56)	Ba-128	4.33E-11		1.52E-11	2.23E-11	7.22E-12	2.10E-07	1.48E+03	1.07E+02	2.68E+03	6.03E+03	3.13E+00	7.91E-02		
Barium (56)	Ba-131	5.25E-12		2.00E-12	2.87E-12	2.91E-12	1.77E-06	4.05E+01	3.32E+01	6.55E+01	1.47E+02	2.38E+01	6.15E-01		
Barium (56)	Ba-131m	2.11E-14		9.25E-15	1.29E-14	1.69E-14	1.67E-07	5.00E+05	4.95E+05	8.08E+05	1.82E+06	5.15E+03	1.37E+02		
Barium (56)	Ba-133	1.39E-11		6.81E-12	9.44E-12	1.16E-11	1.44E-06	1.75E-01	8.57E-02	3.03E-01	6.82E-01	6.99E+00	1.87E-01		
Barium (56)	Ba-133m	9.07E-12		3.19E-12	4.66E-12	2.04E-12	1.96E-07	2.60E+03	6.25E+02	4.31E+03	9.69E+03	1.49E+01	3.78E-01		
Barium (56)	Ba-135m	7.29E-12		2.56E-12	3.74E-12	1.61E-12	1.70E-07	4.07E+03	1.04E+03	6.73E+03	1.51E+04	1.86E+01	4.72E-01		
Barium (56)	Ba-137m						2.69E-06	1.78E+05	1.78E+05	2.87E+05	6.46E+05				
Barium (56)	Ba-139	9.73E-13		3.70E-13	5.33E-13	1.79E-13	1.65E-07	8.90E+04	6.19E+04	1.44E+05	3.25E+05	1.29E+02	3.31E+00		
Barium (56)	Ba-140	4.18E-11		1.49E-11	2.17E-11	2.03E-11	7.61E-07	8.49E+01	1.78E+01	1.42E+02	3.18E+02	3.20E+00	8.13E-02		
Barium (56)	Ba-141	5.59E-13		2.14E-13	3.07E-13	9.69E-14	3.79E-06	1.76E+04	1.74E+04	2.84E+04	6.39E+04	2.23E+02	5.74E+00		
Barium (56)	Ba-142	2.27E-13		9.29E-14	1.31E-13	4.55E-14	4.85E-06	2.37E+04	2.36E+04	3.83E+04	8.62E+04	5.13E+02	1.35E+01		
Berkelium (97)	Bk-245	9.73E-12		3.43E-12	5.00E-12	7.22E-12	7.09E-07	2.41E+02	1.24E+02	3.91E+02	8.79E+02	1.39E+01	3.53E-01		
Berkelium (97)	Bk-246	5.25E-12		2.01E-12	2.88E-12	9.25E-13	4.25E-06	1.09E+02	9.98E+01	1.76E+02	3.96E+02	2.37E+01	6.12E-01		
Berkelium (97)	Bk-247	2.49E-10		1.24E-10	1.60E-10	3.26E-08	3.09E-07	3.27E-01	3.89E-03	7.04E-01	1.58E+00	3.84E-01	1.10E-02		
Berkelium (97)	Bk-249	2.95E-12		1.11E-12	1.57E-12	5.14E-11	2.63E-12	6.34E+03	1.26E+01	1.46E+06	3.27E+06	4.29E+01	1.12E+00		
Berkelium (97)	Bk-250	1.54E-12		5.66E-13	8.18E-13	1.03E-12	4.23E-06	1.49E+03	1.45E+03	2.41E+03	5.42E+03	8.41E+01	2.16E+00		
Beryllium (4)	Be-10	2.02E-11		7.03E-12	1.02E-11	9.40E-11	7.43E-10	1.07E+01	6.00E-02	2.91E+02	6.55E+02	6.77E+00	1.73E-01		
Beryllium (4)	Be-7	2.02E-13		8.66E-14	1.20E-13	2.13E-13	2.13E-07	7.45E+01	6.92E+01	1.20E+02	2.71E+02	5.50E+02	1.47E+01		
Bismuth (83)	Bi-200	3.65E-13		1.52E-13	2.13E-13	7.55E-14	1.06E-05	3.16E+03	3.15E+03	5.10E+03	1.15E+04	3.13E+02	8.28E+00		
Bismuth (83)	Bi-201	1.09E-12		4.22E-13	6.03E-13	1.90E-13	6.05E-06	1.86E+03	1.83E+03	3.01E+03	6.78E+03	1.13E+02	2.92E+00		
Bismuth (83)	Bi-202	6.18E-13		2.65E-13	3.69E-13	1.12E-13	1.24E-05	9.81E+02	9.75E+02	1.59E+03	3.57E+03	1.80E+02	4.78E+00		
Bismuth (83)	Bi-203	4.85E-12		1.92E-12	2.73E-12	8.21E-13	1.16E-05	1.48E+02	1.42E+02	2.40E+02	5.40E+02	2.48E+01	6.46E-01		
Bismuth (83)	Bi-205	8.18E-12		3.32E-12	4.66E-12	3.24E-12	8.19E-06	6.69E+00	6.06E+00	1.09E+01	2.46E+01	1.43E+01	3.78E-01		
Bismuth (83)	Bi-206	1.98E-11		7.73E-12	1.10E-11	5.85E-12	1.52E-05	8.82E+00	7.78E+00	1.44E+01	3.24E+01	6.16E+00	1.60E-01		
Bismuth (83)	Bi-207	1.49E-11		5.66E-12	8.14E-12	2.10E-11	7.08E-06	2.01E-02	1.35E-02	3.80E-02	8.56E-02	8.41E+00	2.17E-01		
Bismuth (83)	Bi-210	2.55E-11		8.92E-12	1.30E-11	3.17E-10	2.76E-09	7.55E+02	6.38E+01	9.88E+04	2.22E+05	5.34E+00	1.36E-01		
Bismuth (83)	Bi-210m	1.45E-10		5.51E-11	7.77E-11	1.17E-08	1.01E-06	4.79E-02	4.98E-03	2.14E-01	4.82E-01	8.64E-01	2.27E-02		
Bismuth (83)	Bi-211						1.88E-07	3.03E+06	3.03E+06	4.90E+06	1.10E+07				
Bismuth (83)	Bi-212	1.78E-12		7.10E-13	9.99E-13	7.77E-11	8.87E-07	2.23E+04	1.85E+04	3.66E+04	8.24E+04	6.71E+01	1.77E+00		
Bismuth (83)	Bi-213	1.28E-12		5.11E-13	7.18E-13	6.85E-11	5.65E-07	4.62E+04	3.75E+04	7.63E+04	1.72E+05	9.32E+01	2.46E+00		
Bismuth (83)	Bi-214	4.33E-13		1.92E-13	2.65E-13	2.90E-11	7.48E-06	8.19E+03	8.13E+03	1.32E+04	2.98E+04	2.48E+02	6.66E+00		
Bromine (35)	Br-74	3.19E-13		1.50E-13	2.05E-13	6.44E-14	2.32E-05	2.07E+03	2.06E+03	3.36E+03	7.55E+03	3.17E+02	8.60E+00		
Bromine (35)	Br-74m	5.29E-13		2.46E-13	3.36E-13	1.15E-13	2.00E-05	1.47E+03	1.45E+03	2.37E+03	5.34E+03	1.94E+02	5.25E+00		
Bromine (35)	Br-75	3.42E-13		1.57E-13	2.13E-13	1.13E-13	5.21E-06	2.38E+03	2.32E+03	3.86E+03	8.68E+03	3.03E+02	8.28E+00		
Bromine (35)	Br-76	3.34E-12		1.45E-12	1.97E-12	1.10E-12	1.30E-05	9.47E+01	8.77E+01	1.56E+02	3.51E+02	3.28E+01	8.95E-01		
Bromine (35)	Br-77	6.51E-13		3.01E-13	4.03E-13	2.06E-13	1.34E-06	2.61E+02	2.26E+02	4.37E+02	9.84E+02	1.58E+02	4.38E+00		
Bromine (35)	Br-80	1.03E-13		4.70E-14	6.48E-14	1.80E-14	3.55E-07	1.93E+05	1.76E+05	3.19E+05	7.17E+05	1.01E+03	2.72E+01		

Radionuclide Toxicity and Preliminary Remediation Goals for Superfund

Element (Atomic Number)	Isotope	Toxicity: Soil Ingestion Slope Factor (risk/pCi)	Toxicity: Soil Ingestion Slope Factor-Adult (risk/pCi)	Toxicity: Water Ingestion Slope Factor (risk/pCi)	Toxicity: Food Ingestion Slope Factor (risk/pCi)	Toxicity: Inhalation Slope Factor (risk/pCi)	Toxicity: External Exposure Slope Factor (risk/y per pCi/g)	Preliminary Remediation Goals (PRG): Residential Soil (pCi/g)	Preliminary Remediation Goals (PRG): Agricultural Soil (pCi/g)	Preliminary Remediation Goals (PRG): Outdoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Indoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Tap Water (pCi/L)	Preliminary Remediation Goals (PRG): Fish Ingestion (pCi/g)	Soil to Groundwater: DAF=20 (pCi/g)	Soil to Groundwater: DAF=1 (pCi/g)
Bromine (35)	Br-80m	6.70E-13		2.82E-13	3.89E-13	2.43E-13	5.95E-09	8.29E+04	1.74E+04	1.25E+06	2.81E+06	1.69E+02	4.53E+00		
Bromine (35)	Br-82	3.70E-12		1.71E-12	2.30E-12	1.66E-12	1.24E-05	4.53E+01	4.13E+01	7.50E+01	1.69E+02	2.78E+01	7.67E-01		
Bromine (35)	Br-83	1.94E-13		8.44E-14	1.16E-13	1.21E-13	3.46E-08	1.72E+05	7.62E+04	3.97E+05	8.93E+05	5.64E+02	1.52E+01		
Bromine (35)	Br-84	3.21E-13		1.48E-13	2.02E-13	7.18E-14	9.35E-06	4.09E+03	4.04E+03	6.62E+03	1.49E+04	3.22E+02	8.73E+00		
Cadmium (48)	Cd-104	4.14E-13		1.72E-13	2.41E-13	7.66E-14	9.70E-07	2.15E+04	1.99E+04	3.52E+04	7.92E+04	2.77E+02	7.32E+00	5.76E+11	2.88E+10
Cadmium (48)	Cd-107	9.99E-13		3.50E-13	5.11E-13	3.10E-13	3.48E-08	5.17E+04	1.40E+04	1.45E+05	3.27E+05	1.36E+02	3.45E+00	6.21E+09	3.11E+08
Cadmium (48)	Cd-109	1.14E-11		5.00E-12	6.70E-12	2.19E-11	8.73E-09	5.27E+00	7.32E-01	3.38E+02	7.60E+02	9.52E+00	2.63E-01	5.69E+02	2.85E+01
Cadmium (48)	Cd-113	3.85E-11		2.28E-11	2.90E-11	1.12E-10	7.36E-11	7.69E-02	7.75E-03	2.87E+03	6.47E+03	2.09E+00	6.08E-02	1.23E-01	6.14E-03
Cadmium (48)	Cd-113m	5.11E-11		2.87E-11	3.64E-11	1.30E-10	4.45E-10	1.19E-01	1.45E-02	8.58E+02	1.93E+03	1.66E+00	4.85E-02	3.67E-01	1.83E-02
Cadmium (48)	Cd-115	2.47E-11		8.66E-12	1.27E-11	5.14E-12	1.01E-06	2.30E+02	6.64E+01	6.08E+02	1.37E+03	5.50E+00	1.39E-01	3.70E+06	1.85E+05
Cadmium (48)	Cd-115m	4.74E-11		1.70E-11	2.46E-11	2.92E-11	1.13E-07	1.40E+01	2.06E+00	2.71E+02	6.11E+02	2.80E+00	7.17E-02	4.70E+03	2.35E+02
Cadmium (48)	Cd-117	3.81E-12		1.37E-12	1.99E-12	6.51E-13	5.23E-06	1.53E+03	1.37E+03	2.52E+03	5.67E+03	3.48E+01	8.86E-01	1.08E+10	5.39E+08
Cadmium (48)	Cd-117m	3.26E-12		1.22E-12	1.76E-12	6.55E-13	1.03E-05	5.82E+02	5.52E+02	9.49E+02	2.13E+03	3.90E+01	1.00E+00	6.65E+09	3.33E+08
Calcium (20)	Ca-41	5.74E-13		3.53E-13	4.37E-13	2.09E-13	0.00E+00	3.05E+00	3.97E-01	1.73E+08	3.90E+08	1.35E+02	4.04E+00		
Calcium (20)	Ca-45	6.07E-12	1.52E-12	2.47E-12	3.37E-12	9.40E-12	3.96E-11	1.84E+01	3.20E+00	3.74E+04	6.97E+04	1.93E+01	5.23E-01		
Calcium (20)	Ca-47	2.02E-11		7.55E-12	1.08E-11	7.88E-12	5.24E-06	3.04E+01	1.79E+01	5.76E+01	1.30E+02	6.31E+00	1.63E-01		
Calcium (20)	Ca-49						1.75E-05	7.99E+03	7.99E+03	1.29E+04	2.90E+04				
Californium (98)	Cf-244	2.93E-13		1.25E-13	1.74E-13	2.96E-11	6.83E-11	4.53E+08	2.68E+06	1.48E+09	3.34E+09	3.81E+02	1.01E+01		
Californium (98)	Cf-246	6.11E-11		2.11E-11	3.09E-11	1.47E-09	9.25E-11	4.11E+04	1.37E+02	9.08E+06	2.04E+07	2.26E+00	5.71E-02		
Californium (98)	Cf-248	1.18E-10		4.44E-11	6.22E-11	1.81E-08	4.73E-11	9.34E+01	3.03E-01	2.64E+04	5.93E+04	1.07E+00	2.84E-02		
Californium (98)	Cf-249	2.54E-10		1.27E-10	1.63E-10	3.40E-08	1.37E-06	8.02E-02	3.74E-03	1.62E-01	3.64E-01	3.75E-01	1.08E-02		
Californium (98)	Cf-250	1.85E-10		8.62E-11	1.12E-10	2.66E-08	4.48E-11	4.96E+00	1.34E-02	1.92E+03	4.31E+03	5.52E-01	1.57E-02		
Californium (98)	Cf-251	2.67E-10		1.32E-10	1.70E-10	3.40E-08	3.76E-07	2.55E-01	3.66E-03	5.81E-01	1.31E+00	3.61E-01	1.04E-02		
Californium (98)	Cf-252						8.66E-11	1.01E+04	1.01E+04	1.64E+04	3.69E+04				
Californium (98)	Cf-253	1.20E-11		4.26E-12	6.11E-12	4.22E-09	4.86E-11	1.71E+04	5.79E+01	1.04E+06	2.34E+06	1.12E+01	2.89E-01		
Californium (98)	Cf-254						1.46E-13	9.58E+07	9.58E+07	1.55E+08	3.48E+08				
Carbon (6)	C-11	8.70E-14		4.07E-14	5.59E-14	2.78E-14	4.45E-06	1.33E+04	1.24E+04	2.17E+04	4.88E+04	1.17E+03	3.16E+01	6.71E+12	3.36E+11
Carbon (6)	C-14	2.79E-12	1.38E-12	1.55E-12	2.00E-12	7.07E-12	7.83E-12	6.08E-02	6.46E-03	1.23E+03	2.24E+03	1.29E+00	8.82E-01	4.01E+01	2.00E+00
Cerium (58)	Ce-134	4.59E-11		1.59E-11	2.33E-11	6.96E-12	8.24E-09	1.26E+04	8.93E+01	5.53E+04	1.24E+05	2.99E+00	7.57E-02	1.35E+07	6.74E+05
Cerium (58)	Ce-135	1.02E-11		3.81E-12	5.48E-12	1.75E-12	7.74E-06	1.49E+02	1.36E+02	2.41E+02	5.42E+02	1.25E+01	3.22E-01	9.42E+08	4.71E+07
Cerium (58)	Ce-137	3.64E-13		1.31E-13	1.91E-13	4.11E-14	4.46E-08	5.05E+04	3.21E+04	8.18E+04	1.84E+05	3.64E+02	9.23E+00	1.05E+11	5.24E+09
Cerium (58)	Ce-137m	9.99E-12		3.47E-12	5.07E-12	1.94E-12	1.38E-07	4.19E+03	7.17E+02	6.91E+03	1.56E+04	1.37E+01	3.48E-01	2.71E+08	1.35E+07
Cerium (58)	Ce-139	3.70E-12		1.35E-12	1.95E-12	5.66E-12	4.54E-07	1.35E+01	8.55E+00	2.18E+01	4.91E+01	3.53E+01	9.04E-01	7.51E+04	3.75E+03
Cerium (58)	Ce-141	1.34E-11		4.63E-12	6.77E-12	1.14E-11	2.27E-07	1.13E+02	2.28E+01	1.85E+02	4.17E+02	1.03E+01	2.61E-01	3.95E+05	1.97E+04
Cerium (58)	Ce-143	2.04E-11		7.10E-12	1.04E-11	3.74E-12	1.09E-06	5.62E+02	2.47E+02	9.13E+02	2.05E+03	6.71E+00	1.70E-01	1.44E+08	7.19E+06
Cerium (58)	Ce-144	1.02E-10		3.52E-11	5.18E-11	1.10E-10	5.02E-08	3.64E+01	4.22E-01	9.59E+01	2.16E+02	1.35E+00	3.40E-02	5.64E+02	2.82E+01
Cerium (58)	Ce-144+D	1.02E-10		3.53E-11	5.19E-11	1.10E-10	2.44E-07	1.08E+01	4.10E-01	1.97E+01	4.44E+01	1.35E+00	3.40E-02	5.64E+02	2.82E+01
Cesium (55)	Cs-125	1.29E-13		5.96E-14	8.18E-14	1.64E-14	2.92E-06	9.28E+03	9.21E+03	1.50E+04	3.37E+04	7.99E+02	2.16E+01	9.61E+12	4.81E+11
Cesium (55)	Cs-126						4.74E-06	1.57E+05	1.57E+05	2.53E+05	5.70E+05				
Cesium (55)	Cs-127	1.38E-13		6.51E-14	8.73E-14	2.47E-14	1.68E-06	1.93E+03	1.91E+03	3.13E+03	7.03E+03	7.31E+02	2.02E+01	1.27E+11	6.34E+09
Cesium (55)	Cs-128						3.92E-06	7.97E+04	7.97E+04	1.29E+05	2.90E+05				
Cesium (55)	Cs-129	4.00E-13		1.85E-13	2.48E-13	7.44E-14	1.05E-06	6.02E+02	5.68E+02	9.74E+02	2.19E+03	2.57E+02	7.11E+00	1.69E+09	8.45E+07
Cesium (55)	Cs-130	1.02E-13		4.74E-14	6.48E-14	1.24E-14	2.22E-06	1.84E+04	1.82E+04	2.97E+04	6.68E+04	1.00E+03	2.72E+01	2.74E+13	1.37E+12
Cesium (55)	Cs-131	4.11E-13		1.86E-13	2.49E-13	7.51E-14	4.90E-09	1.32E+04	1.25E+03	2.88E+04	6.48E+04	2.56E+02	7.08E+00	3.20E+07	1.60E+06
Cesium (55)	Cs-132	2.89E-12		1.46E-12	1.91E-12	5.92E-13	3.11E-06	4.18E+01	3.62E+01	6.79E+01	1.53E+02	3.26E+01	9.23E-01	9.12E+06	4.56E+05
Cesium (55)	Cs-134	5.81E-11	4.48E-11	4.22E-11	5.14E-11	1.65E-11	7.10E-06	1.51E-01	5.48E-02	2.56E-01	5.76E-01	1.13E+00	3.43E-02	1.65E+02	8.24E+00
Cesium (55)	Cs-134m	8.84E-14		4.14E-14	5.55E-14	1.99E-14	5.02E-08	1.39E+05	1.08E+05	2.25E+05	5.07E+05	1.15E+03	3.18E+01	9.25E+11	4.63E+10
Cesium (55)	Cs-135	7.18E-12		4.74E-12	5.88E-12	1.86E-12	2.36E-11	2.76E+00	5.44E-02	9.16E+03	2.06E+04	1.00E+01	3.00E-01	1.84E+02	9.18E+00
Cesium (55)	Cs-135m	9.10E-14		4.51E-14	6.07E-14	1.32E-14	7.37E-06	3.12E+03	3.11E+03	5.04E+03	1.13E+04	1.06E+03	2.91E+01	9.16E+12	4.58E+11
Cesium (55)	Cs-136	1.65E-11		8.66E-12	1.12E-11	3.49E-12	1.00E-05	6.41E+00	5.00E+00	1.04E+01	2.35E+01	5.50E+00	1.57E-01	3.76E+05	1.88E+04
Cesium (55)	Cs-137	4.33E-11		3.04E-11	3.74E-11	1.19E-11	5.32E-10	6.02E-01	1.31E-02	5.35E+02	1.20E+03	1.57E+00	4.72E-02	5.66E+01	2.83E+00

Radionuclide Toxicity and Preliminary Remediation Goals for Superfund

Element (Atomic Number)	Isotope	Toxicity: Soil Ingestion Slope Factor (risk/pCi)	Toxicity: Soil Ingestion Slope Factor-Adult (risk/pCi)	Toxicity: Water Ingestion Slope Factor (risk/pCi)	Toxicity: Food Ingestion Slope Factor (risk/pCi)	Toxicity: Inhalation Slope Factor (risk/pCi)	Toxicity: External Exposure Slope Factor (risk/y per pCi/g)	Preliminary Remediation Goals (PRG): Residential Soil (pCi/g)	Preliminary Remediation Goals (PRG): Agricultural Soil (pCi/g)	Preliminary Remediation Goals (PRG): Outdoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Indoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Tap Water (pCi/L)	Preliminary Remediation Goals (PRG): Fish Ingestion (pCi/g)	Soil to Groundwater: DAF=20 (pCi/g)	Soil to Groundwater: DAF=1 (pCi/g)
Cesium (55)	Cs-137+D	4.33E-11	3.17E-11	3.04E-11	3.74E-11	1.19E-11	2.55E-06	5.51E-02	1.04E-02	1.11E-01	2.51E-01	1.57E+00	4.72E-02	5.66E+01	2.83E+00
Cesium (55)	Cs-138	3.40E-13		1.58E-13	2.16E-13	4.00E-14	1.19E-05	3.18E+03	3.17E+03	5.14E+03	1.16E+04	3.01E+02	8.17E+00	7.08E+12	3.54E+11
Chlorine (17)	Cl-36	7.66E-12	2.29E-12	3.30E-12	4.44E-12	2.50E-11	1.74E-09	7.51E-03	1.34E-03	1.07E+02	2.33E+02	1.44E+01	3.97E-01		
Chlorine (17)	Cl-38	4.22E-13		1.93E-13	2.64E-13	9.40E-14	7.93E-06	3.72E+03	2.82E+03	6.68E+03	1.50E+04	2.47E+02	6.68E+00		
Chlorine (17)	Cl-39	3.31E-13		1.52E-13	2.08E-13	9.36E-14	7.09E-06	2.82E+03	2.19E+03	5.00E+03	1.12E+04	3.13E+02	8.48E+00		
Chromium (24)	Cr-48	1.84E-12		7.44E-13	1.05E-12	7.51E-13	1.62E-06	5.45E+02	5.02E+02	8.81E+02	1.98E+03	6.40E+01	1.68E+00		
Chromium (24)	Cr-49	3.20E-13		1.35E-13	1.89E-13	7.36E-14	4.43E-06	6.54E+03	6.50E+03	1.06E+04	2.38E+04	3.53E+02	9.33E+00		
Chromium (24)	Cr-51	4.96E-13		1.85E-13	2.66E-13	1.67E-13	1.27E-07	2.41E+02	1.88E+02	3.89E+02	8.75E+02	2.57E+02	6.63E+00		
Cobalt (27)	Co-55	1.23E-11		4.63E-12	6.70E-12	2.07E-12	9.21E-06	1.25E+02	4.94E+01	2.04E+02	4.58E+02	1.03E+01	2.63E-01	6.68E+06	3.34E+05
Cobalt (27)	Co-56	2.56E-11		1.01E-11	1.43E-11	1.85E-11	1.80E-05	5.90E-01	2.21E-01	9.64E-01	2.17E+00	4.71E+00	1.23E-01	2.62E+02	1.31E+01
Cobalt (27)	Co-57	2.78E-12	4.85E-13	1.04E-12	1.49E-12	2.09E-12	3.55E-07	8.32E+00	8.84E-01	1.42E+01	3.20E+01	4.58E+01	1.18E+00	1.68E+02	8.40E+00
Cobalt (27)	Co-58	7.44E-12		2.95E-12	4.18E-12	5.99E-12	4.48E-06	2.64E+00	8.92E-01	4.31E+00	9.70E+00	1.61E+01	4.22E-01	1.11E+03	5.56E+01
Cobalt (27)	Co-58m	3.47E-13		1.26E-13	1.83E-13	6.88E-14	1.00E-12	8.89E+05	5.68E+03	3.59E+09	8.07E+09	3.78E+02	9.64E+00	8.98E+08	4.49E+07
Cobalt (27)	Co-60	4.03E-11	7.33E-12	1.57E-11	2.23E-11	3.58E-11	1.24E-05	3.53E-02	7.37E-03	5.96E-02	1.34E-01	3.03E+00	7.91E-02	2.41E+00	1.21E-01
Cobalt (27)	Co-60m	5.88E-15		2.66E-15	3.66E-15	3.96E-15	1.86E-08	6.23E+06	4.40E+06	1.01E+07	2.27E+07	1.79E+04	4.82E+02	1.16E+14	5.82E+12
Cobalt (27)	Co-61	6.40E-13		2.43E-13	3.49E-13	1.43E-13	2.48E-07	4.87E+04	1.24E+04	8.02E+04	1.80E+05	1.96E+02	5.05E+00	1.43E+10	7.16E+08
Cobalt (27)	Co-62m	1.79E-13		8.25E-14	1.13E-13	3.17E-14	1.35E-05	6.50E+03	6.38E+03	1.05E+04	2.36E+04	5.77E+02	1.56E+01	2.14E+12	1.07E+11
Copper (29)	Cu-60	3.00E-13		1.37E-13	1.89E-13	5.77E-14	1.93E-05	2.72E+03	2.72E+03	4.40E+03	9.90E+03	3.48E+02	9.33E+00		
Copper (29)	Cu-61	1.20E-12		4.63E-13	6.70E-13	2.41E-13	3.63E-06	1.63E+03	1.58E+03	2.65E+03	5.97E+03	1.03E+02	2.63E+00		
Copper (29)	Cu-62						4.43E-06	2.83E+04	2.83E+04	4.56E+04	1.03E+05				
Copper (29)	Cu-64	1.72E-12		6.40E-13	9.32E-13	4.33E-13	8.30E-07	1.88E+03	1.54E+03	3.11E+03	7.01E+03	7.44E+01	1.89E+00		
Copper (29)	Cu-66						4.32E-07	5.53E+05	5.53E+05	8.94E+05	2.01E+06				
Copper (29)	Cu-67	5.29E-12		1.94E-12	2.83E-12	2.35E-12	3.83E-07	7.37E+02	3.23E+02	1.38E+03	3.12E+03	2.45E+01	6.23E-01		
Curium (96)	Cm-238	8.70E-13		3.28E-13	4.70E-13	1.35E-11	1.90E-07	4.45E+04	3.34E+04	7.20E+04	1.62E+05	1.45E+02	3.75E+00	1.44E+12	7.21E+10
Curium (96)	Cm-240	9.88E-11		3.49E-11	5.07E-11	9.51E-09	6.19E-11	1.39E+03	4.60E+00	4.27E+05	9.61E+05	1.36E+00	3.48E-02	1.86E+05	9.29E+03
Curium (96)	Cm-241	1.35E-11		4.85E-12	7.03E-12	1.01E-10	1.94E-06	1.33E+01	8.95E+00	2.15E+01	4.84E+01	9.82E+00	2.51E-01	9.06E+05	4.53E+04
Curium (96)	Cm-242	1.05E-10	1.87E-11	3.85E-11	5.48E-11	1.51E-08	7.73E-11	2.16E+02	7.05E-01	3.44E+03	6.27E+03	1.24E+00	3.22E-02	4.62E+03	2.31E+02
Curium (96)	Cm-243	2.05E-10	7.84E-11	9.47E-11	1.23E-10	2.69E-08	4.19E-07	3.35E-01	7.72E-03	6.73E-01	1.51E+00	5.03E-01	1.43E-02	3.64E+01	1.82E+00
Curium (96)	Cm-244	1.81E-10		8.36E-11	1.08E-10	2.53E-08	4.85E-11	4.30E+00	1.13E-02	1.68E+03	3.79E+03	5.70E-01	1.63E-02	4.35E+01	2.17E+00
Curium (96)	Cm-245	2.18E-10		1.04E-10	1.35E-10	2.77E-08	2.38E-07	3.83E-01	4.56E-03	9.09E-01	2.05E+00	4.58E-01	1.31E-02	7.91E-01	3.96E-02
Curium (96)	Cm-246	2.12E-10		1.02E-10	1.31E-10	2.77E-08	4.57E-11	2.15E+00	4.77E-03	1.03E+03	2.31E+03	4.67E-01	1.35E-02	8.08E-01	4.04E-02
Curium (96)	Cm-247	2.11E-10		9.95E-11	1.30E-10	2.50E-08	1.31E-06	8.19E-02	4.45E-03	1.65E-01	3.71E-01	4.79E-01	1.36E-02	8.25E-01	4.13E-02
Curium (96)	Cm-248						3.42E-11	3.26E+03	2.45E+03	6.32E+03	1.42E+04			2.59E+01	1.29E+00
Curium (96)	Cm-249	2.18E-13		8.40E-14	1.20E-13	7.25E-14	8.51E-08	2.23E+05	1.88E+05	3.61E+05	8.11E+05	5.67E+02	1.47E+01	2.83E+13	1.42E+12
Dysprosium (66)	Dy-155	1.35E-12		5.25E-13	7.47E-13	2.45E-13	2.44E-06	8.33E+02	8.00E+02	1.35E+03	3.03E+03	9.07E+01	2.36E+00		
Dysprosium (66)	Dy-157	5.62E-13		2.26E-13	3.20E-13	8.33E-14	1.32E-06	1.90E+03	1.84E+03	3.07E+03	6.91E+03	2.11E+02	5.51E+00		
Dysprosium (66)	Dy-159	1.47E-12		5.29E-13	7.70E-13	1.28E-12	3.19E-08	1.83E+02	4.36E+01	2.98E+02	6.70E+02	9.00E+01	2.29E+00		
Dysprosium (66)	Dy-165	1.15E-12		4.14E-13	6.03E-13	2.10E-13	9.49E-08	9.17E+04	4.97E+04	1.48E+05	3.34E+05	1.15E+02	2.92E+00		
Dysprosium (66)	Dy-166	3.22E-11		1.11E-11	1.63E-11	8.36E-12	6.02E-08	3.85E+03	1.11E+02	6.68E+03	1.50E+04	4.29E+00	1.08E-01		
Einsteinium (99)	Es-250	1.44E-13		5.96E-14	8.36E-14	5.07E-13	1.69E-06	5.73E+03	5.69E+03	9.25E+03	2.08E+04	7.99E+02	2.11E+01		
Einsteinium (99)	Es-251	2.89E-12		1.02E-12	1.49E-12	6.40E-12	2.55E-07	2.41E+03	1.36E+03	3.90E+03	8.78E+03	4.67E+01	1.18E+00		
Einsteinium (99)	Es-253	1.01E-10		3.49E-11	5.11E-11	8.84E-09	1.25E-09	2.67E+03	6.04E+00	5.12E+04	1.15E+05	1.36E+00	3.45E-02		
Einsteinium (99)	Es-254	1.50E-10		5.51E-11	7.81E-11	1.85E-08	8.55E-09	1.03E+02	2.93E-01	5.72E+02	1.29E+03	8.64E-01	2.26E-02		
Einsteinium (99)	Es-254m	7.88E-11		2.73E-11	4.00E-11	1.53E-09	2.10E-06	2.45E+02	6.94E+01	3.98E+02	8.95E+02	1.74E+00	4.41E-02		
Erbium (68)	Er-161	8.10E-13		3.15E-13	4.51E-13	1.34E-13	4.09E-06	1.53E+03	1.51E+03	2.48E+03	5.57E+03	1.51E+02	3.91E+00		
Erbium (68)	Er-165	2.42E-13		8.95E-14	1.30E-13	3.13E-14	3.05E-08	6.40E+04	4.08E+04	1.03E+05	2.33E+05	5.32E+02	1.36E+01		
Erbium (68)	Er-169	7.36E-12		2.53E-12	3.70E-12	3.85E-12	9.10E-11	8.09E+04	1.84E+02	1.62E+06	3.64E+06	1.88E+01	4.77E-01		
Erbium (68)	Er-171	5.74E-12		2.02E-12	2.96E-12	9.40E-13	1.42E-06	1.90E+03	1.49E+03	3.07E+03	6.92E+03	2.36E+01	5.96E-01		
Erbium (68)	Er-172	1.70E-11		5.99E-12	8.77E-12	4.74E-12	2.20E-06	1.87E+02	1.22E+02	3.03E+02	6.81E+02	7.95E+00	2.01E-01		
Europium (63)	Eu-145	6.77E-12		2.73E-12	3.85E-12	1.81E-12	6.95E-06	2.05E+01	1.91E+01	3.31E+01	7.45E+01	1.74E+01	4.58E-01		
Europium (63)	Eu-146	1.12E-11		4.55E-12	6.40E-12	2.59E-12	1.16E-05	1.58E+01	1.47E+01	2.56E+01	5.75E+01	1.05E+01	2.76E-01		

Radionuclide Toxicity and Preliminary Remediation Goals for Superfund

Element (Atomic Number)	Isotope	Toxicity: Soil Ingestion Slope Factor (risk/pCi)	Toxicity: Soil Ingestion Slope Factor-Adult (risk/pCi)	Toxicity: Water Ingestion Slope Factor (risk/pCi)	Toxicity: Food Ingestion Slope Factor (risk/pCi)	Toxicity: Inhalation Slope Factor (risk/pCi)	Toxicity: External Exposure Slope Factor (risk/y per pCi/g)	Preliminary Remediation Goals (PRG): Residential Soil (pCi/g)	Preliminary Remediation Goals (PRG): Agricultural Soil (pCi/g)	Preliminary Remediation Goals (PRG): Outdoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Indoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Tap Water (pCi/L)	Preliminary Remediation Goals (PRG): Fish Ingestion (pCi/g)	Soil to Groundwater: DAF=20 (pCi/g)	Soil to Groundwater: DAF=1 (pCi/g)
Europium (63)	Eu-147	5.37E-12		2.02E-12	2.90E-12	3.85E-12	2.04E-06	1.73E+01	1.45E+01	2.79E+01	6.29E+01	2.36E+01	6.08E-01		
Europium (63)	Eu-148	1.04E-11		4.29E-12	6.03E-12	9.92E-12	9.84E-06	1.58E+00	1.46E+00	2.55E+00	5.74E+00	1.11E+01	2.92E-01		
Europium (63)	Eu-149	1.40E-12		5.14E-13	7.40E-13	1.07E-12	1.42E-07	6.38E+01	3.75E+01	1.03E+02	2.33E+02	9.26E+01	2.38E+00		
Europium (63)	Eu-150a	6.88E-12		2.38E-12	3.50E-12	1.03E-12	1.95E-07	8.17E+03	2.41E+03	1.34E+04	3.01E+04	2.00E+01	5.04E-01		
Europium (63)	Eu-150b	1.08E-11		4.33E-12	6.07E-12	1.12E-10	6.49E-06	2.29E-02	1.67E-02	4.25E-02	9.56E-02	1.10E+01	2.91E-01		
Europium (63)	Eu-152	1.62E-11	2.96E-12	6.07E-12	8.70E-12	9.10E-11	5.30E-06	4.16E-02	3.07E-02	7.30E-02	1.64E-01	7.84E+00	2.03E-01		
Europium (63)	Eu-152m	8.51E-12		2.98E-12	4.37E-12	1.12E-12	1.33E-06	1.64E+03	1.13E+03	2.65E+03	5.96E+03	1.60E+01	4.04E-01		
Europium (63)	Eu-154	2.85E-11	4.74E-12	1.03E-11	1.49E-11	1.15E-10	5.83E-06	4.98E-02	3.51E-02	8.49E-02	1.91E-01	4.62E+00	1.18E-01		
Europium (63)	Eu-155	5.40E-12		1.90E-12	2.77E-12	1.48E-11	1.24E-07	3.77E+00	9.40E-01	6.28E+00	1.41E+01	2.51E+01	6.37E-01		
Europium (63)	Eu-156	3.56E-11		1.27E-11	1.84E-11	1.37E-11	6.62E-06	8.40E+00	6.11E+00	1.36E+01	3.06E+01	3.75E+00	9.59E-02		
Europium (63)	Eu-157	1.06E-11		3.70E-12	5.40E-12	1.57E-12	9.60E-07	1.39E+03	7.90E+02	2.25E+03	5.06E+03	1.29E+01	3.27E-01		
Europium (63)	Eu-158	5.22E-13		2.14E-13	3.01E-13	1.10E-13	5.06E-06	5.25E+03	5.21E+03	8.48E+03	1.91E+04	2.23E+02	5.86E+00		
Fermium (100)	Fm-252	4.92E-11		1.69E-11	2.48E-11	1.03E-09	5.09E-11	1.28E+05	2.70E+02	2.53E+07	5.70E+07	2.82E+00	7.11E-02		
Fermium (100)	Fm-253	1.48E-11		5.14E-12	7.51E-12	1.28E-09	2.24E-07	1.25E+03	2.30E+02	2.04E+03	4.58E+03	9.26E+00	2.35E-01		
Fermium (100)	Fm-254	6.07E-12		2.15E-12	3.13E-12	1.98E-10	1.23E-10	6.42E+06	1.50E+04	8.16E+07	1.84E+08	2.21E+01	5.63E-01		
Fermium (100)	Fm-255	4.77E-11		1.65E-11	2.42E-11	8.84E-10	3.85E-09	9.57E+04	3.12E+02	4.24E+05	9.53E+05	2.89E+00	7.29E-02		
Fermium (100)	Fm-257	1.23E-10		4.40E-11	6.29E-11	2.04E-08	3.06E-07	2.59E+01	9.61E-01	4.42E+01	9.95E+01	1.08E+00	2.80E-02		
Fluorine (9)	F-18	2.00E-13		9.73E-14	1.30E-13	1.21E-13	4.45E-06	2.49E+03	2.48E+03	4.02E+03	9.05E+03	4.89E+02	1.36E+01		
Francium (87)	Fr-219						1.44E-08	2.42E+11	2.42E+11	3.91E+11	8.79E+11				
Francium (87)	Fr-220						3.25E-08	8.21E+07	8.21E+07	1.33E+08	2.99E+08				
Francium (87)	Fr-221						1.11E-07	2.29E+06	2.29E+06	3.70E+06	8.32E+06				
Francium (87)	Fr-222	3.43E-12		1.48E-12	2.02E-12	2.42E-11	1.14E-08	7.12E+06	3.01E+05	1.20E+07	2.70E+07	3.22E+01	8.73E-01		
Francium (87)	Fr-223	1.78E-11		7.29E-12	1.00E-11	3.06E-12	1.40E-07	3.92E+05	3.78E+04	6.45E+05	1.45E+06	6.53E+00	1.76E-01		
Gadolinium (64)	Gd-145	1.99E-13		8.92E-14	1.23E-13	3.63E-14	1.13E-05	4.71E+03	4.70E+03	7.61E+03	1.71E+04	5.34E+02	1.43E+01		
Gadolinium (64)	Gd-146	1.39E-11		5.03E-12	7.29E-12	2.27E-11	5.56E-07	3.12E+01	1.14E+01	5.09E+01	1.15E+02	9.47E+00	2.42E-01		
Gadolinium (64)	Gd-147	6.33E-12		2.46E-12	3.50E-12	1.34E-12	5.87E-06	9.08E+01	8.41E+01	1.47E+02	3.30E+02	1.94E+01	5.04E-01		
Gadolinium (64)	Gd-148	9.07E-11		4.22E-11	5.51E-11	1.26E-08	0.00E+00	3.47E+00	1.30E-02	3.15E+03	7.09E+03	1.13E+00	3.20E-02		
Gadolinium (64)	Gd-149	6.03E-12		2.23E-12	3.22E-12	2.76E-12	1.59E-06	5.66E+01	4.44E+01	9.15E+01	2.06E+02	2.14E+01	5.48E-01		
Gadolinium (64)	Gd-151	3.20E-12		1.14E-12	1.65E-12	2.92E-12	1.20E-07	5.82E+01	2.05E+01	9.50E+01	2.14E+02	4.18E+01	1.07E+00		
Gadolinium (64)	Gd-152	6.29E-11		2.97E-11	3.85E-11	9.10E-09	0.00E+00	4.47E+00	1.60E-02	3.98E+03	8.96E+03	1.60E+00	4.58E-02		
Gadolinium (64)	Gd-153	4.26E-12		1.52E-12	2.22E-12	6.55E-12	1.62E-07	2.14E+01	7.56E+00	3.49E+01	7.85E+01	3.13E+01	7.94E-01		
Gadolinium (64)	Gd-159	9.21E-12		3.19E-12	4.66E-12	1.46E-12	1.74E-07	6.16E+03	1.36E+03	1.01E+04	2.28E+04	1.49E+01	3.78E-01		
Gallium (31)	Ga-65	1.39E-13		6.33E-14	8.73E-14	2.84E-14	5.04E-06	1.59E+04	1.59E+04	2.57E+04	5.78E+04	7.52E+02	2.02E+01		
Gallium (31)	Ga-66	1.80E-11		6.40E-12	9.32E-12	2.18E-12	1.26E-05	1.72E+02	1.56E+02	2.77E+02	6.24E+02	7.44E+00	1.89E-01		
Gallium (31)	Ga-67	2.89E-12		1.04E-12	1.51E-12	9.55E-13	5.36E-07	4.84E+02	3.52E+02	7.82E+02	1.76E+03	4.58E+01	1.17E+00		
Gallium (31)	Ga-68	7.18E-13		2.83E-13	4.03E-13	1.28E-13	4.17E-06	4.30E+03	4.24E+03	6.95E+03	1.56E+04	1.68E+02	4.38E+00		
Gallium (31)	Ga-70	1.19E-13		5.22E-14	7.22E-14	2.92E-14	4.39E-08	1.31E+06	1.07E+06	2.12E+06	4.76E+06	9.12E+02	2.44E+01		
Gallium (31)	Ga-72	1.53E-11		5.59E-12	8.07E-12	2.17E-12	1.37E-05	1.05E+02	9.75E+01	1.70E+02	3.82E+02	8.52E+00	2.19E-01		
Gallium (31)	Ga-73	3.92E-12		1.39E-12	2.03E-12	6.14E-13	1.25E-06	3.31E+03	2.72E+03	5.35E+03	1.20E+04	3.43E+01	8.69E-01		
Germanium (32)	Ge-66	7.99E-13		3.70E-13	4.88E-13	2.50E-13	2.86E-06	3.09E+03	2.92E+03	5.06E+03	1.14E+04	1.29E+02	3.61E+00		
Germanium (32)	Ge-67	2.28E-13		1.06E-13	1.45E-13	4.59E-14	6.24E-06	1.04E+04	1.03E+04	1.69E+04	3.80E+04	4.49E+02	1.22E+01		
Germanium (32)	Ge-68	1.85E-11		6.96E-12	9.88E-12	4.88E-11	4.69E-13	4.43E+00	7.22E-01	6.25E+06	1.41E+07	6.84E+00	1.79E-01		
Germanium (32)	Ge-69	2.35E-12		9.84E-13	1.35E-12	8.81E-13	4.02E-06	1.26E+02	1.14E+02	2.09E+02	4.70E+02	4.84E+01	1.31E+00		
Germanium (32)	Ge-71	1.73E-13		6.48E-14	9.18E-14	5.18E-14	4.74E-13	1.16E+04	1.90E+03	2.44E+08	5.50E+08	7.35E+02	1.92E+01		
Germanium (32)	Ge-75	1.85E-13		8.66E-14	1.17E-13	8.44E-14	1.38E-07	1.01E+05	7.91E+04	1.72E+05	3.88E+05	5.50E+02	1.51E+01		
Germanium (32)	Ge-77	2.81E-12		1.22E-12	1.65E-12	1.15E-12	4.82E-06	3.65E+02	3.27E+02	6.03E+02	1.36E+03	3.90E+01	1.07E+00		
Germanium (32)	Ge-78	6.22E-13		3.09E-13	4.03E-13	2.48E-13	1.10E-06	1.24E+04	1.11E+04	2.06E+04	4.63E+04	1.54E+02	4.38E+00		
Gold (79)	Au-193	2.05E-12		7.36E-13	1.07E-12	4.55E-13	4.30E-07	2.56E+03	1.77E+03	4.31E+03	9.70E+03	6.47E+01	1.65E+00		
Gold (79)	Au-194	4.22E-12		1.66E-12	2.36E-12	7.92E-13	4.93E-06	1.03E+02	9.51E+01	1.69E+02	3.79E+02	2.87E+01	7.47E-01		
Gold (79)	Au-195	4.22E-12		1.50E-12	2.19E-12	6.48E-12	1.38E-07	2.64E+01	7.93E+00	5.42E+01	1.22E+02	3.17E+01	8.05E-01		
Gold (79)	Au-195m						7.37E-07	3.25E+06	3.25E+06	5.26E+06	1.18E+07				

Element (Atomic Number)	Isotope	Toxicity: Soil Ingestion Slope Factor (risk/pCi)	Toxicity: Soil Ingestion Slope Factor-Adult (risk/pCi)	Toxicity: Water Ingestion Slope Factor (risk/pCi)	Toxicity: Food Ingestion Slope Factor (risk/pCi)	Toxicity: Inhalation Slope Factor (risk/pCi)	Toxicity: External Exposure Slope Factor (risk/y per pCi/g)	Preliminary Remediation Goals (PRG): Residential Soil (pCi/g)	Preliminary Remediation Goals (PRG): Agricultural Soil (pCi/g)	Preliminary Remediation Goals (PRG): Outdoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Indoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Tap Water (pCi/L)	Preliminary Remediation Goals (PRG): Fish Ingestion (pCi/g)	Soil to Groundwater: DAF=20 (pCi/g)	Soil to Groundwater: DAF=1 (pCi/g)
Gold (79)	Au-198	1.78E-11		6.29E-12	9.18E-12	4.00E-12	1.70E-06	1.69E+02	8.79E+01	2.98E+02	6.70E+02	7.57E+00	1.92E-01		
Gold (79)	Au-198m	2.09E-11		7.44E-12	1.08E-11	7.77E-12	1.89E-06	1.78E+02	9.01E+01	3.15E+02	7.08E+02	6.40E+00	1.63E-01		
Gold (79)	Au-199	7.92E-12		2.78E-12	4.07E-12	3.12E-12	2.79E-07	7.74E+02	2.44E+02	1.56E+03	3.51E+03	1.71E+01	4.33E-01		
Gold (79)	Au-200	3.85E-13		1.55E-13	2.20E-13	8.55E-14	1.30E-06	1.93E+04	1.87E+04	3.13E+04	7.04E+04	3.07E+02	8.02E+00		
Gold (79)	Au-200m	1.48E-11		5.44E-12	7.88E-12	2.81E-12	9.04E-06	1.18E+02	1.02E+02	1.94E+02	4.37E+02	8.75E+00	2.24E-01		
Gold (79)	Au-201	1.01E-13		4.33E-14	6.03E-14	3.30E-14	2.29E-07	2.01E+05	1.91E+05	3.26E+05	7.33E+05	1.10E+03	2.92E+01		
Hafnium (72)	Hf-170	5.81E-12		2.19E-12	3.14E-12	1.20E-12	2.04E-06	6.22E+02	5.16E+02	1.01E+03	2.26E+03	2.17E+01	5.62E-01		
Hafnium (72)	Hf-172	1.37E-11		4.96E-12	7.14E-12	6.92E-11	1.62E-07	7.57E+00	1.11E+00	1.24E+01	2.78E+01	9.60E+00	2.47E-01		
Hafnium (72)	Hf-173	2.85E-12		1.06E-12	1.52E-12	5.92E-13	1.34E-06	6.32E+02	5.49E+02	1.02E+03	2.30E+03	4.49E+01	1.16E+00		
Hafnium (72)	Hf-175	5.29E-12		1.96E-12	2.83E-12	4.29E-12	1.35E-06	8.95E+00	7.00E+00	1.45E+01	3.26E+01	2.43E+01	6.23E-01		
Hafnium (72)	Hf-177m	4.74E-13		2.01E-13	2.81E-13	1.81E-13	8.58E-06	2.76E+03	2.75E+03	4.47E+03	1.00E+04	2.37E+02	6.28E+00		
Hafnium (72)	Hf-178m	3.89E-11		1.51E-11	2.13E-11	3.70E-10	9.57E-06	1.60E-02	1.02E-02	2.95E-02	6.64E-02	3.15E+00	8.28E-02		
Hafnium (72)	Hf-179m	1.81E-11		6.55E-12	9.51E-12	1.38E-11	3.42E-06	9.86E+00	7.19E+00	1.59E+01	3.59E+01	7.27E+00	1.85E-01		
Hafnium (72)	Hf-180m	1.89E-12		7.18E-13	1.03E-12	4.14E-13	3.93E-06	9.40E+02	9.08E+02	1.52E+03	3.42E+03	6.63E+01	1.71E+00		
Hafnium (72)	Hf-181	1.79E-11		6.36E-12	9.25E-12	1.76E-11	2.24E-06	8.90E+00	5.74E+00	1.44E+01	3.24E+01	7.49E+00	1.91E-01		
Hafnium (72)	Hf-182	1.27E-11		5.37E-12	7.25E-12	3.41E-10	9.10E-07	1.22E-01	4.45E-02	2.38E-01	5.35E-01	8.87E+00	2.43E-01		
Hafnium (72)	Hf-182m	2.70E-13		1.11E-13	1.57E-13	1.04E-13	3.83E-06	5.18E+03	5.15E+03	8.36E+03	1.88E+04	4.29E+02	1.12E+01		
Hafnium (72)	Hf-183	6.25E-13		2.39E-13	3.42E-13	1.65E-13	3.30E-06	5.77E+03	5.69E+03	9.33E+03	2.10E+04	1.99E+02	5.16E+00		
Hafnium (72)	Hf-184	8.18E-12		2.91E-12	4.26E-12	1.38E-12	8.64E-07	5.70E+03	3.44E+03	9.22E+03	2.07E+04	1.64E+01	4.14E-01		
Holmium (67)	Ho-155	2.63E-13		1.05E-13	1.49E-13	5.29E-14	1.52E-06	1.67E+04	1.65E+04	2.70E+04	6.07E+04	4.54E+02	1.18E+01		
Holmium (67)	Ho-157	3.49E-14		1.54E-14	2.13E-14	7.36E-15	1.84E-06	5.26E+04	5.25E+04	8.50E+04	1.91E+05	3.09E+03	8.28E+01		
Holmium (67)	Ho-159	3.96E-14		1.78E-14	2.46E-14	1.22E-14	1.16E-06	3.18E+04	3.18E+04	5.15E+04	1.16E+05	2.68E+03	7.17E+01		
Holmium (67)	Ho-161	1.33E-13		4.96E-14	7.14E-14	1.98E-14	5.52E-08	1.47E+05	1.25E+05	2.38E+05	5.35E+05	9.60E+02	2.47E+01		
Holmium (67)	Ho-162	1.29E-14		5.96E-15	8.18E-15	5.40E-15	6.02E-07	1.35E+05	1.35E+05	2.18E+05	4.91E+05	7.99E+03	2.16E+02		
Holmium (67)	Ho-162m	1.81E-13		7.47E-14	1.05E-13	5.18E-14	2.46E-06	7.29E+03	7.25E+03	1.18E+04	2.65E+04	6.37E+02	1.68E+01		
Holmium (67)	Ho-164	4.11E-14		1.75E-14	2.45E-14	1.65E-14	2.78E-08	1.51E+06	1.35E+06	2.44E+06	5.50E+06	2.72E+03	7.20E+01		
Holmium (67)	Ho-164m	1.05E-13		4.14E-14	5.88E-14	3.48E-14	3.63E-08	8.95E+05	7.34E+05	1.45E+06	3.26E+06	1.15E+03	3.00E+01		
Holmium (67)	Ho-166	2.67E-11		9.21E-12	1.35E-11	3.85E-12	1.18E-07	5.94E+03	3.89E+02	1.04E+04	2.34E+04	5.17E+00	1.31E-01		
Holmium (67)	Ho-166m	2.10E-11		8.03E-12	1.14E-11	3.09E-10	7.69E-06	1.46E-02	9.17E-03	2.83E-02	6.37E-02	5.93E+00	1.55E-01		
Holmium (67)	Ho-167	9.95E-13		3.64E-13	5.25E-13	2.25E-13	1.45E-06	4.52E+03	4.31E+03	7.30E+03	1.64E+04	1.31E+02	3.36E+00		
Hydrogen (1)	H-3	2.20E-13	4.51E-14	1.12E-13	1.44E-13	1.99E-13		1.99E+00	1.22E-01	7.32E+04	1.32E+05	4.30E+01	1.22E+01	1.65E+02	8.25E+00
Indium (49)	In-109	6.25E-13		2.46E-13	3.50E-13	1.11E-13	2.90E-06	1.67E+03	1.64E+03	2.70E+03	6.06E+03	1.94E+02	5.04E+00		
Indium (49)	In-110a	7.03E-13		2.81E-13	4.00E-13	1.17E-13	7.13E-06	2.47E+03	2.46E+03	4.00E+03	8.99E+03	1.69E+02	4.41E+00		
Indium (49)	In-110b	1.77E-12		7.59E-13	1.05E-12	2.65E-13	1.41E-05	2.94E+02	2.91E+02	4.75E+02	1.07E+03	6.27E+01	1.68E+00		
Indium (49)	In-111	3.40E-12		1.29E-12	1.85E-12	8.03E-13	1.42E-06	2.10E+02	1.79E+02	3.40E+02	7.66E+02	3.69E+01	9.53E-01		
Indium (49)	In-112	3.70E-14		1.68E-14	2.32E-14	1.10E-14	1.15E-06	7.36E+04	7.34E+04	1.19E+05	2.68E+05	2.83E+03	7.60E+01		
Indium (49)	In-113m	2.47E-13		9.47E-14	1.35E-13	5.18E-14	1.05E-06	1.17E+04	1.15E+04	1.88E+04	4.24E+04	5.03E+02	1.31E+01		
Indium (49)	In-114						1.35E-08	7.54E+07	7.54E+07	1.22E+08	2.74E+08				
Indium (49)	In-114m	7.03E-11		2.48E-11	3.60E-11	3.00E-11	3.57E-07	4.44E+01	3.26E+00	7.74E+01	1.74E+02	1.92E+00	4.90E-02		
Indium (49)	In-115	5.85E-11		3.38E-11	4.33E-11	4.03E-10	2.70E-10	3.66E+00	1.42E-02	7.84E+02	1.76E+03	1.41E+00	4.07E-02		
Indium (49)	In-115m	1.24E-12		4.40E-13	6.40E-13	2.15E-13	6.27E-07	7.21E+03	6.34E+03	1.17E+04	2.62E+04	1.08E+02	2.76E+00		
Indium (49)	In-116m	3.77E-13		1.62E-13	2.26E-13	8.77E-14	1.23E-05	1.83E+03	1.82E+03	2.95E+03	6.65E+03	2.94E+02	7.80E+00		
Indium (49)	In-117	1.67E-13		7.03E-14	9.84E-14	5.59E-14	2.90E-06	9.60E+03	9.55E+03	1.55E+04	3.49E+04	6.77E+02	1.79E+01		
Indium (49)	In-117m	1.22E-12		4.44E-13	6.44E-13	2.33E-13	3.35E-07	3.11E+04	2.47E+04	5.03E+04	1.13E+05	1.07E+02	2.74E+00		
Indium (49)	In-119						3.54E-06	1.43E+05	1.43E+05	2.32E+05	5.22E+05				
Indium (49)	In-119m	1.70E-13		7.55E-14	1.04E-13	3.34E-14	5.63E-08	1.20E+06	9.62E+05	1.94E+06	4.37E+06	6.31E+02	1.70E+01		
Iodine (53)	I-120	2.33E-12		9.03E-13	2.46E-12	3.89E-13	1.33E-05	1.13E+03	5.57E+02	1.83E+03	4.11E+03	5.27E+01	7.17E-01	4.41E+09	2.21E+08
Iodine (53)	I-120m	1.20E-12		5.03E-13	1.30E-12	1.98E-13	2.55E-05	9.02E+02	7.02E+02	1.46E+03	3.28E+03	9.47E+01	1.36E+00	1.85E+10	9.26E+08
Iodine (53)	I-121	5.59E-13		2.27E-13	6.03E-13	9.81E-14	1.63E-06	5.87E+03	1.92E+03	9.50E+03	2.14E+04	2.10E+02	2.92E+00	7.12E+09	3.56E+08
Iodine (53)	I-122						4.17E-06	8.08E+04	8.08E+04	1.30E+05	2.94E+05				
Iodine (53)	I-123	1.96E-12		6.96E-13	2.05E-12	3.03E-13	5.10E-07	2.98E+03	1.29E+02	4.88E+03	1.10E+04	6.84E+01	8.60E-01	5.99E+07	3.00E+06

Radionuclide Toxicity and Preliminary Remediation Goals for Superfund

Element (Atomic Number)	Isotope	Toxicity: Soil Ingestion Slope Factor (risk/pCi)	Toxicity: Soil Ingestion Slope Factor-Adult (risk/pCi)	Toxicity: Water Ingestion Slope Factor (risk/pCi)	Toxicity: Food Ingestion Slope Factor (risk/pCi)	Toxicity: Inhalation Slope Factor (risk/pCi)	Toxicity: External Exposure Slope Factor (risk/y per pCi/g)	Preliminary Remediation Goals (PRG): Residential Soil (pCi/g)	Preliminary Remediation Goals (PRG): Agricultural Soil (pCi/g)	Preliminary Remediation Goals (PRG): Outdoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Indoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Tap Water (pCi/L)	Preliminary Remediation Goals (PRG): Fish Ingestion (pCi/g)	Soil to Groundwater: DAF=20 (pCi/g)	Soil to Groundwater: DAF=1 (pCi/g)
Iodine (53)	I-124	1.16E-10		4.14E-11	1.22E-10	1.76E-11	5.10E-06	3.67E+01	2.95E-01	6.42E+01	1.44E+02	1.15E+00	1.45E-02	1.74E+04	8.72E+02
Iodine (53)	I-125	5.55E-11		2.54E-11	6.29E-11	1.06E-11	7.24E-09	6.25E+01	4.01E-02	3.14E+03	7.07E+03	1.87E+00	2.80E-02	1.37E+02	6.87E+00
Iodine (53)	I-126	2.31E-10		8.73E-11	2.48E-10	3.70E-11	1.96E-06	2.31E+01	4.69E-02	5.37E+01	1.21E+02	5.45E-01	7.11E-03	8.55E+02	4.27E+01
Iodine (53)	I-128	1.89E-13		8.14E-14	2.06E-13	3.04E-14	3.74E-07	1.30E+05	3.20E+04	2.11E+05	4.74E+05	5.85E+02	8.56E+00	5.14E+11	2.57E+10
Iodine (53)	I-129	2.71E-10	1.14E-10	1.48E-10	3.22E-10	6.07E-11	6.10E-09	9.95E-02	4.65E-05	1.08E+01	2.08E+01	3.22E-01	5.48E-03	4.60E-03	2.30E-04
Iodine (53)	I-130	1.80E-11		6.36E-12	1.88E-11	2.76E-12	9.67E-06	1.68E+02	1.43E+01	2.74E+02	6.16E+02	7.49E+00	9.38E-02	7.43E+06	3.71E+05
Iodine (53)	I-131	1.26E-10		4.55E-11	1.34E-10	1.95E-11	1.59E-06	5.12E+01	1.40E-01	1.07E+02	2.41E+02	1.05E+00	1.32E-02	4.29E+03	2.14E+02
Iodine (53)	I-132	2.22E-12		8.44E-13	2.34E-12	3.74E-13	1.06E-05	8.33E+02	3.73E+02	1.35E+03	3.03E+03	5.64E+01	7.54E-01	1.63E+09	8.14E+07
Iodine (53)	I-132m	1.70E-12		6.11E-13	1.78E-12	2.70E-13	1.40E-06	1.04E+04	1.29E+03	1.68E+04	3.79E+04	7.79E+01	9.91E-01	6.12E+09	3.06E+08
Iodine (53)	I-133	4.26E-11		1.44E-11	4.40E-11	6.25E-12	2.72E-06	3.40E+02	3.93E+00	5.80E+02	1.31E+03	3.31E+00	4.01E-02	1.17E+06	5.83E+04
Iodine (53)	I-134	5.96E-13		2.50E-13	6.44E-13	1.02E-13	1.24E-05	1.87E+03	1.45E+03	3.02E+03	6.79E+03	1.90E+02	2.74E+00	3.78E+10	1.89E+09
Iodine (53)	I-135	8.62E-12		3.05E-12	8.99E-12	1.34E-12	7.83E-06	3.91E+02	5.29E+01	6.34E+02	1.43E+03	1.56E+01	1.96E-01	5.45E+07	2.73E+06
Iridium (77)	Ir-182	2.33E-13		9.95E-14	1.39E-13	5.03E-14	5.85E-06	1.39E+04	1.38E+04	2.24E+04	5.05E+04	4.79E+02	1.27E+01		
Iridium (77)	Ir-184	1.67E-12		6.44E-13	9.21E-13	3.30E-13	8.66E-06	7.76E+02	7.64E+02	1.26E+03	2.82E+03	7.39E+01	1.91E+00		
Iridium (77)	Ir-185	3.61E-12		1.32E-12	1.91E-12	7.25E-13	2.69E-06	5.38E+02	4.86E+02	8.72E+02	1.96E+03	3.61E+01	9.23E-01		
Iridium (77)	Ir-186a	5.44E-12		2.08E-12	2.98E-12	1.06E-12	7.40E-06	1.73E+02	1.64E+02	2.81E+02	6.32E+02	2.29E+01	5.92E-01		
Iridium (77)	Ir-186b	5.07E-13		2.00E-13	2.84E-13	1.11E-13	4.22E-06	2.75E+03	2.72E+03	4.45E+03	1.00E+04	2.38E+02	6.21E+00		
Iridium (77)	Ir-187	1.57E-12		5.77E-13	8.33E-13	2.87E-13	1.42E-06	1.36E+03	1.25E+03	2.20E+03	4.95E+03	8.25E+01	2.12E+00		
Iridium (77)	Ir-188	6.40E-12		2.52E-12	3.58E-12	1.38E-12	7.68E-06	6.36E+01	5.95E+01	1.03E+02	2.32E+02	1.89E+01	4.93E-01		
Iridium (77)	Ir-189	4.29E-12		1.51E-12	2.21E-12	2.33E-12	1.69E-07	3.52E+02	1.25E+02	6.09E+02	1.37E+03	3.15E+01	7.98E-01		
Iridium (77)	Ir-190	1.50E-11		5.66E-12	8.10E-12	8.81E-12	5.99E-06	1.16E+01	9.66E+00	1.89E+01	4.25E+01	8.41E+00	2.18E-01		
Iridium (77)	Ir-190m	8.44E-14		3.17E-14	4.55E-14	3.89E-14	8.69E-13	7.03E+07	2.41E+06	3.15E+10	7.08E+10	1.50E+03	3.88E+01		
Iridium (77)	Ir-190n	1.07E-12		4.26E-13	6.03E-13	2.14E-13	6.48E-06	1.01E+03	9.97E+02	1.63E+03	3.68E+03	1.12E+02	2.92E+00		
Iridium (77)	Ir-191m						1.58E-07	9.37E+07	9.37E+07	1.51E+08	3.41E+08				
Iridium (77)	Ir-192	2.04E-11	3.30E-12	7.36E-12	1.07E-11	2.41E-11	3.40E-06	3.31E+00	2.26E+00	5.44E+00	1.22E+01	6.47E+00	1.65E-01		
Iridium (77)	Ir-192m	2.16E-12		9.81E-13	1.32E-12	1.02E-10	5.39E-07	2.13E-01	1.19E-01	4.16E-01	9.36E-01	4.85E+01	1.34E+00		
Iridium (77)	Ir-194	2.49E-11		8.62E-12	1.26E-11	3.40E-12	4.09E-07	2.22E+03	4.49E+02	4.18E+03	9.41E+03	5.52E+00	1.40E-01		
Iridium (77)	Ir-194m	2.29E-11		8.88E-12	1.26E-11	4.59E-11	1.01E-05	4.87E-01	4.11E-01	7.92E-01	1.78E+00	5.36E+00	1.40E-01		
Iridium (77)	Ir-195	1.10E-12		3.96E-13	5.77E-13	2.39E-13	1.12E-07	7.06E+04	4.04E+04	1.17E+05	2.64E+05	1.20E+02	3.06E+00		
Iridium (77)	Ir-195m	2.89E-12		1.03E-12	1.50E-12	5.96E-13	1.58E-06	3.37E+03	2.95E+03	5.47E+03	1.23E+04	4.62E+01	1.18E+00		
Iron (26)	Fe-52	1.94E-11		7.07E-12	1.03E-11	2.73E-12	3.07E-06	7.98E+02	4.56E+02	1.29E+03	2.91E+03	6.74E+00	1.71E-01	2.15E+08	1.08E+07
Iron (26)	Fe-55	2.09E-12	5.18E-13	8.62E-13	1.16E-12	7.99E-13	0.00E+00	1.76E+03	3.29E+00	2.21E+04	3.97E+04	5.52E+01	1.52E+00	1.02E+03	5.08E+01
Iron (26)	Fe-59	2.07E-11		7.88E-12	1.11E-11	1.33E-11	5.83E-06	3.26E+00	2.28E+00	5.27E+00	1.19E+01	6.04E+00	1.59E-01	1.16E+04	5.80E+02
Iron (26)	Fe-60	3.53E-10		1.80E-10	2.39E-10	1.84E-10	6.38E-12	1.25E+00	1.56E-03	2.89E+04	6.51E+04	2.65E-01	7.38E-03	1.75E-02	8.73E-04
Krypton (36)	Kr-74						4.90E-06	2.16E+04	2.16E+04	3.50E+04	7.86E+04				
Krypton (36)	Kr-76						1.73E-06	7.94E+02	7.94E+02	1.28E+03	2.88E+03				
Krypton (36)	Kr-77						4.22E-06	3.87E+03	3.87E+03	6.25E+03	1.41E+04				
Krypton (36)	Kr-79						1.08E-06	5.38E+02	5.38E+02	8.68E+02	1.95E+03				
Krypton (36)	Kr-81						2.18E-08	5.12E+00	3.84E+00	9.92E+00	2.23E+01				
Krypton (36)	Kr-81m						4.60E-07	1.22E+07	1.22E+07	1.98E+07	4.45E+07				
Krypton (36)	Kr-83m						1.34E-11	8.29E+08	8.29E+08	1.34E+09	3.01E+09				
Krypton (36)	Kr-85						1.05E-08	2.41E+01	2.23E+01	4.16E+01	9.36E+01				
Krypton (36)	Kr-85m						5.46E-07	8.31E+03	8.31E+03	1.34E+04	3.02E+04				
Krypton (36)	Kr-87						4.00E-06	3.99E+03	3.99E+03	6.45E+03	1.45E+04				
Krypton (36)	Kr-88						1.02E-05	7.01E+02	7.01E+02	1.13E+03	2.55E+03				
Lanthanum (57)	La-131	2.28E-13		9.32E-14	1.31E-13	5.48E-14	2.76E-06	7.49E+03	7.44E+03	1.21E+04	2.72E+04	5.11E+02	1.35E+01		
Lanthanum (57)	La-132	4.85E-12		1.78E-12	2.58E-12	6.25E-13	9.52E-06	4.45E+02	4.29E+02	7.18E+02	1.62E+03	2.68E+01	6.84E-01		
Lanthanum (57)	La-134						3.05E-06	5.99E+04	5.99E+04	9.68E+04	2.18E+05				
Lanthanum (57)	La-135	3.96E-13		1.46E-13	2.11E-13	5.03E-14	5.21E-08	1.99E+04	1.29E+04	3.23E+04	7.27E+04	3.26E+02	8.36E+00		
Lanthanum (57)	La-137	9.44E-13		3.48E-13	5.00E-13	1.39E-11	6.75E-09	1.57E+01	1.12E+00	3.20E+01	7.21E+01	1.37E+02	3.53E+00		
Lanthanum (57)	La-138	8.81E-12		3.53E-12	4.96E-12	3.05E-10	6.07E-06	1.84E-02	1.24E-02	3.56E-02	8.02E-02	1.35E+01	3.56E-01		

Radionuclide Toxicity and Preliminary Remediation Goals for Superfund

Element (Atomic Number)	Isotope	Toxicity: Soil Ingestion Slope Factor (risk/pCi)	Toxicity: Soil Ingestion Slope Factor-Adult (risk/pCi)	Toxicity: Water Ingestion Slope Factor (risk/pCi)	Toxicity: Food Ingestion Slope Factor (risk/pCi)	Toxicity: Inhalation Slope Factor (risk/pCi)	Toxicity: External Exposure Slope Factor (risk/y per pCi/g)	Preliminary Remediation Goals (PRG): Residential Soil (pCi/g)	Preliminary Remediation Goals (PRG): Agricultural Soil (pCi/g)	Preliminary Remediation Goals (PRG): Outdoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Indoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Tap Water (pCi/L)	Preliminary Remediation Goals (PRG): Fish Ingestion (pCi/g)	Soil to Groundwater: DAF=20 (pCi/g)	Soil to Groundwater: DAF=1 (pCi/g)
Lanthanum (57)	La-140	3.05E-11		1.10E-11	1.59E-11	4.77E-12	1.15E-05	4.38E+01	3.69E+01	7.08E+01	1.59E+02	4.33E+00	1.11E-01		
Lanthanum (57)	La-141	5.37E-12		1.88E-12	2.74E-12	7.44E-13	2.37E-07	2.16E+04	8.50E+03	3.52E+04	7.93E+04	2.53E+01	6.44E-01		
Lanthanum (57)	La-142	1.48E-12		5.77E-13	8.21E-13	2.42E-13	1.44E-05	9.15E+02	9.08E+02	1.48E+03	3.33E+03	8.25E+01	2.15E+00		
Lanthanum (57)	La-143	3.14E-13		1.26E-13	1.78E-13	5.66E-14	5.11E-07	1.68E+05	1.60E+05	2.71E+05	6.11E+05	3.78E+02	9.91E+00		
Lead (82)	Pb-195m	1.20E-13		5.48E-14	7.55E-14	4.37E-14	6.90E-06	1.12E+04	1.12E+04	1.81E+04	4.06E+04	8.69E+02	2.34E+01	5.15E+13	2.58E+12
Lead (82)	Pb-198	6.18E-13		2.60E-13	3.63E-13	1.43E-13	1.62E-06	5.22E+03	5.06E+03	8.44E+03	1.90E+04	1.83E+02	4.86E+00	1.31E+11	6.54E+09
Lead (82)	Pb-199	3.28E-13		1.42E-13	1.97E-13	7.44E-14	6.87E-06	1.97E+03	1.96E+03	3.19E+03	7.17E+03	3.35E+02	8.95E+00	6.13E+11	3.06E+10
Lead (82)	Pb-200	4.03E-12		1.58E-12	2.24E-12	1.16E-12	5.97E-07	1.57E+03	1.02E+03	2.56E+03	5.75E+03	3.01E+01	7.87E-01	2.68E+08	1.34E+07
Lead (82)	Pb-201	1.47E-12		5.92E-13	8.36E-13	3.50E-13	3.18E-06	6.79E+02	6.55E+02	1.10E+03	2.47E+03	8.04E+01	2.11E+00	3.74E+09	1.87E+08
Lead (82)	Pb-202	3.74E-11		2.22E-11	2.93E-11	1.43E-11	3.09E-12	2.06E+00	1.96E-02	6.81E+04	1.53E+05	2.15E+00	6.02E-02	2.66E-01	1.33E-02
Lead (82)	Pb-202m	9.84E-13		4.18E-13	5.85E-13	2.25E-13	9.32E-06	6.02E+02	5.97E+02	9.73E+02	2.19E+03	1.14E+02	3.01E+00	3.58E+10	1.79E+09
Lead (82)	Pb-203	2.65E-12		1.02E-12	1.46E-12	7.55E-13	1.09E-06	3.57E+02	2.99E+02	5.78E+02	1.30E+03	4.67E+01	1.21E+00	7.07E+07	3.54E+06
Lead (82)	Pb-205	1.26E-12		6.33E-13	8.25E-13	6.44E-13	3.50E-12	7.15E+01	6.96E-01	6.17E+04	1.39E+05	7.52E+01	2.14E+00	9.33E+00	4.66E-01
Lead (82)	Pb-209	6.55E-13		2.41E-13	3.49E-13	1.90E-13	5.37E-10	5.16E+06	1.22E+05	1.88E+07	4.23E+07	1.98E+02	5.05E+00	7.69E+10	3.85E+09
Lead (82)	Pb-210	1.84E-09		8.81E-10	1.18E-09	2.77E-09	1.41E-09	7.68E-02	8.51E-04	2.18E+02	4.91E+02	5.41E-02	1.49E-03	1.58E-02	7.92E-04
Lead (82)	Pb-210+D	2.66E-09	2.04E-09	1.27E-09	3.44E-09	1.39E-08	4.21E-09	2.80E-02	2.92E-04	1.23E+00	2.23E+00	3.75E-02	5.13E-04	1.10E-02	5.50E-04
Lead (82)	Pb-211	1.04E-12		4.11E-13	5.81E-13	3.70E-11	2.29E-07	1.47E+05	1.08E+05	2.38E+05	5.36E+05	1.16E+02	3.04E+00	1.32E+12	6.58E+10
Lead (82)	Pb-212	6.70E-11		2.50E-11	3.54E-11	5.77E-10	5.09E-07	3.32E+03	3.38E+02	6.08E+03	1.37E+04	1.90E+00	4.98E-02	6.97E+07	3.49E+06
Lead (82)	Pb-214	8.51E-13		3.44E-13	4.85E-13	3.63E-11	9.82E-07	4.63E+04	4.32E+04	7.48E+04	1.68E+05	1.38E+02	3.64E+00	2.85E+12	1.43E+11
Lutetium (71)	Lu-169	5.03E-12		1.94E-12	2.77E-12	1.33E-12	4.73E-06	1.26E+02	1.17E+02	2.04E+02	4.58E+02	2.45E+01	6.37E-01		
Lutetium (71)	Lu-170	1.06E-11		4.14E-12	5.88E-12	2.25E-12	1.26E-05	3.36E+01	3.16E+01	5.43E+01	1.22E+02	1.15E+01	3.00E-01		
Lutetium (71)	Lu-171	8.84E-12		3.27E-12	4.70E-12	3.50E-12	2.90E-06	3.55E+01	2.92E+01	5.74E+01	1.29E+02	1.46E+01	3.75E-01		
Lutetium (71)	Lu-172	1.47E-11		5.59E-12	8.03E-12	6.03E-12	8.70E-06	1.45E+01	1.29E+01	2.35E+01	5.28E+01	8.52E+00	2.20E-01		
Lutetium (71)	Lu-173	3.74E-12		1.35E-12	1.96E-12	8.70E-12	2.92E-07	5.79E+00	3.06E+00	9.37E+00	2.11E+01	3.53E+01	9.00E-01		
Lutetium (71)	Lu-174	4.11E-12		1.46E-12	2.12E-12	1.42E-11	4.26E-07	1.65E+00	9.88E-01	2.67E+00	6.01E+00	3.26E+01	8.32E-01		
Lutetium (71)	Lu-174m	9.73E-12		3.38E-12	4.96E-12	1.51E-11	9.88E-08	5.95E+01	7.82E+00	9.75E+01	2.19E+02	1.41E+01	3.56E-01		
Lutetium (71)	Lu-176	2.60E-11		9.29E-12	1.35E-11	1.41E-10	1.83E-06	6.08E-02	2.30E-02	1.18E-01	2.66E-01	5.13E+00	1.31E-01		
Lutetium (71)	Lu-176m	2.43E-12		8.55E-13	1.25E-12	4.55E-13	2.78E-08	1.96E+05	2.83E+04	3.21E+05	7.22E+05	5.57E+01	1.41E+00		
Lutetium (71)	Lu-177	1.02E-11		3.53E-12	5.18E-12	4.66E-12	1.14E-07	1.09E+03	1.56E+02	1.79E+03	4.02E+03	1.35E+01	3.40E-01		
Lutetium (71)	Lu-177m	2.60E-11		9.36E-12	1.36E-11	5.70E-11	3.63E-06	1.45E+00	9.65E-01	2.34E+00	5.27E+00	5.09E+00	1.30E-01		
Lutetium (71)	Lu-178	2.02E-13		8.62E-14	1.20E-13	5.29E-14	6.76E-07	6.35E+04	6.20E+04	1.03E+05	2.31E+05	5.52E+02	1.47E+01		
Lutetium (71)	Lu-178m	1.59E-13		7.10E-14	9.84E-14	5.85E-14	4.26E-06	1.26E+04	1.26E+04	2.04E+04	4.58E+04	6.71E+02	1.79E+01		
Lutetium (71)	Lu-179	3.21E-12		1.12E-12	1.64E-12	5.14E-13	1.19E-07	3.71E+04	1.31E+04	6.01E+04	1.35E+05	4.25E+01	1.08E+00		
Magnesium (12)	Mg-28	3.06E-11		1.14E-11	1.65E-11	5.14E-12	6.56E-06	1.48E+02	1.11E+02	2.39E+02	5.39E+02	4.18E+00	1.07E-01		
Manganese (25)	Mn-51	5.11E-13		2.09E-13	2.95E-13	9.55E-14	4.37E-06	6.02E+03	5.90E+03	9.76E+03	2.20E+04	2.28E+02	5.98E+00	1.30E+12	6.50E+10
Manganese (25)	Mn-52	1.58E-11		6.44E-12	9.07E-12	4.40E-12	1.67E-05	8.83E+00	7.62E+00	1.47E+01	3.30E+01	7.39E+00	1.94E-01	1.39E+06	6.95E+04
Manganese (25)	Mn-52m	2.82E-13		1.27E-13	1.75E-13	5.07E-14	1.15E-05	5.02E+03	5.00E+03	8.12E+03	1.83E+04	3.75E+02	1.01E+01	1.03E+13	5.13E+11
Manganese (25)	Mn-53	4.37E-13		1.56E-13	2.25E-13	2.17E-13	0.00E+00	9.83E+00	1.06E+00	1.67E+08	3.76E+08	3.05E+02	7.84E+00	3.11E+01	1.56E+00
Manganese (25)	Mn-54	5.14E-12	1.48E-12	2.28E-12	3.11E-12	5.88E-12	3.89E-06	6.68E-01	5.44E-01	1.12E+00	2.53E+00	2.09E+01	5.67E-01	7.42E+02	3.71E+01
Manganese (25)	Mn-56	2.78E-12		1.03E-12	1.48E-12	4.14E-13	8.44E-06	9.25E+02	8.79E+02	1.51E+03	3.39E+03	4.62E+01	1.19E+00	2.35E+10	1.17E+09
Mendelevium (101)	Md-257	1.67E-12		5.88E-13	8.58E-13	7.70E-11	3.62E-07	1.08E+04	8.20E+03	1.74E+04	3.92E+04	8.10E+01	2.06E+00		
Mendelevium (101)	Md-258	1.23E-10		4.33E-11	6.25E-11	1.68E-08	1.31E-09	8.24E+02	1.84E+00	1.76E+04	3.97E+04	1.10E+00	2.82E-02		
Mercury (80)	Hg-193	1.14E-12		4.11E-13	5.99E-13	2.53E-13	5.55E-07	9.79E+03	7.32E+03	1.69E+04	3.80E+04	1.16E+02	2.94E+00		
Mercury (80)	Hg-193m	5.37E-12		1.97E-12	2.84E-12	9.40E-13	4.54E-06	3.88E+02	3.23E+02	6.51E+02	1.47E+03	2.42E+01	6.21E-01		
Mercury (80)	Hg-194	1.55E-10		8.07E-11	1.06E-10	2.88E-11	5.04E-12	1.72E-02	2.09E-03	4.29E+04	9.65E+04	5.90E-01	1.66E-02		
Mercury (80)	Hg-195	1.41E-12		5.07E-13	7.36E-13	2.84E-13	7.34E-07	2.63E+03	2.00E+03	4.52E+03	1.02E+04	9.39E+01	2.40E+00		
Mercury (80)	Hg-195m	9.55E-12		3.36E-12	4.92E-12	2.33E-12	7.68E-07	4.51E+02	1.79E+02	1.03E+03	2.31E+03	1.42E+01	3.58E-01		
Mercury (80)	Hg-197	4.07E-12		1.43E-12	2.09E-12	1.25E-12	1.14E-07	1.28E+03	3.35E+02	4.49E+03	1.01E+04	3.33E+01	8.44E-01		
Mercury (80)	Hg-197m	8.62E-12		3.00E-12	4.40E-12	2.28E-12	2.50E-07	1.61E+03	4.26E+02	5.52E+03	1.24E+04	1.59E+01	4.01E-01		
Mercury (80)	Hg-199m	1.63E-13		6.70E-14	9.44E-14	6.33E-14	5.77E-07	4.91E+04	4.66E+04	8.01E+04	1.80E+05	7.11E+02	1.87E+01		
Mercury (80)	Hg-203	1.27E-11		5.70E-12	7.62E-12	8.95E-12	9.21E-07	1.29E+01	4.59E+00	3.19E+01	7.17E+01	8.35E+00	2.31E-01		

Radionuclide Toxicity and Preliminary Remediation Goals for Superfund

Element (Atomic Number)	Isotope	Toxicity: Soil Ingestion Slope Factor (risk/pCi)	Toxicity: Soil Ingestion Slope Factor-Adult (risk/pCi)	Toxicity: Water Ingestion Slope Factor (risk/pCi)	Toxicity: Food Ingestion Slope Factor (risk/pCi)	Toxicity: Inhalation Slope Factor (risk/pCi)	Toxicity: External Exposure Slope Factor (risk/y per pCi/g)	Preliminary Remediation Goals (PRG): Residential Soil (pCi/g)	Preliminary Remediation Goals (PRG): Agricultural Soil (pCi/g)	Preliminary Remediation Goals (PRG): Outdoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Indoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Tap Water (pCi/L)	Preliminary Remediation Goals (PRG): Fish Ingestion (pCi/g)	Soil to Groundwater: DAF=20 (pCi/g)	Soil to Groundwater: DAF=1 (pCi/g)
Molybdenum (42)	Mo-101	1.48E-13		6.88E-14	9.44E-14	4.33E-14	6.62E-06	1.26E+04	1.26E+04	2.04E+04	4.59E+04	6.92E+02	1.87E+01		
Molybdenum (42)	Mo-90	1.39E-12		6.59E-13	8.73E-13	1.24E-12	3.41E-06	1.05E+03	9.94E+02	1.70E+03	3.82E+03	7.23E+01	2.02E+00		
Molybdenum (42)	Mo-93	5.29E-12		3.35E-12	4.18E-12	1.27E-12	2.17E-10	1.22E+00	8.96E-02	9.99E+02	2.25E+03	1.42E+01	4.22E-01		
Molybdenum (42)	Mo-93m	6.62E-13		3.20E-13	4.26E-13	4.33E-13	1.09E-05	2.72E+02	2.70E+02	4.40E+02	9.89E+02	1.49E+02	4.14E+00		
Molybdenum (42)	Mo-99	3.50E-12		1.60E-12	2.11E-12	4.29E-12	6.64E-07	4.33E+02	2.71E+02	7.49E+02	1.69E+03	2.98E+01	8.36E-01		
Neodymium (60)	Nd-136	6.70E-13		2.70E-13	3.81E-13	1.34E-13	1.01E-06	2.38E+04	2.27E+04	3.85E+04	8.65E+04	1.76E+02	4.63E+00		
Neodymium (60)	Nd-138	9.69E-12		3.42E-12	5.00E-12	1.24E-12	6.73E-08	5.70E+04	5.41E+03	9.68E+04	2.18E+05	1.39E+01	3.53E-01		
Neodymium (60)	Nd-139	1.21E-13		4.96E-14	6.96E-14	2.37E-14	1.72E-06	2.39E+04	2.37E+04	3.86E+04	8.68E+04	9.60E+02	2.53E+01		
Neodymium (60)	Nd-139m	2.86E-12		1.08E-12	1.56E-12	4.96E-13	7.13E-06	5.18E+02	5.03E+02	8.37E+02	1.88E+03	4.41E+01	1.13E+00		
Neodymium (60)	Nd-141	8.07E-14		3.09E-14	4.40E-14	1.34E-14	2.28E-07	3.58E+04	3.49E+04	5.78E+04	1.30E+05	1.54E+03	4.01E+01		
Neodymium (60)	Nd-141m						3.48E-06	3.37E+05	3.37E+05	5.44E+05	1.22E+06				
Neodymium (60)	Nd-147	2.01E-11		6.96E-12	1.02E-11	9.36E-12	4.87E-07	1.56E+02	4.12E+01	2.55E+02	5.74E+02	6.84E+00	1.73E-01		
Neodymium (60)	Nd-149	1.51E-12		5.44E-13	7.92E-13	3.19E-13	1.49E-06	7.88E+03	7.35E+03	1.27E+04	2.87E+04	8.75E+01	2.23E+00		
Neodymium (60)	Nd-151	1.83E-13		7.36E-14	1.04E-13	3.92E-14	4.10E-06	2.40E+04	2.39E+04	3.87E+04	8.72E+04	6.47E+02	1.70E+01		
Neon (10)	Ne-19						4.47E-06	9.51E+05	9.51E+05	1.54E+06	3.46E+06				
Neptunium (93)	Np-232	4.14E-14		1.97E-14	2.70E-14	3.17E-14	5.25E-06	1.58E+04	1.58E+04	2.55E+04	5.74E+04	2.42E+03	6.53E+01	8.01E+12	4.01E+11
Neptunium (93)	Np-233	1.14E-14		5.03E-15	6.99E-15	2.49E-15	2.29E-07	1.47E+05	1.46E+05	2.38E+05	5.35E+05	9.47E+03	2.52E+02	5.18E+12	2.59E+11
Neptunium (93)	Np-234	8.77E-12		3.40E-12	4.85E-12	1.86E-12	7.06E-06	2.72E+01	2.37E+01	4.40E+01	9.91E+01	1.40E+01	3.64E-01	2.50E+05	1.25E+04
Neptunium (93)	Np-235	9.99E-13		3.46E-13	5.07E-13	1.15E-12	2.13E-09	5.39E+02	1.92E+01	1.62E+03	3.65E+03	1.38E+02	3.48E+00	3.03E+02	1.52E+01
Neptunium (93)	Np-236a	2.56E-11		1.05E-11	1.44E-11	9.77E-10	3.25E-07	2.96E-01	2.44E-02	6.66E-01	1.50E+00	4.54E+00	1.22E-01	2.72E-02	1.36E-03
Neptunium (93)	Np-236b	3.19E-12		1.11E-12	1.63E-12	8.07E-12	1.34E-07	6.46E+03	1.86E+03	1.09E+04	2.45E+04	4.29E+01	1.08E+00	1.69E+07	8.43E+05
Neptunium (93)	Np-237	1.46E-10		6.18E-11	8.29E-11	1.77E-08	5.36E-08	3.17E-01	4.67E-03	4.03E+00	9.06E+00	7.71E-01	2.13E-02	9.00E-02	4.50E-03
Neptunium (93)	Np-237+D	1.62E-10		6.74E-11	9.10E-11	1.77E-08	7.97E-07	9.92E-02	4.10E-03	2.71E-01	6.11E-01	7.07E-01	1.94E-02	9.00E-02	4.50E-03
Neptunium (93)	Np-238	1.52E-11		5.40E-12	7.88E-12	4.18E-12	2.62E-06	1.51E+02	9.25E+01	2.46E+02	5.54E+02	8.82E+00	2.24E-01	6.78E+05	3.39E+04
Neptunium (93)	Np-239	1.47E-11		5.14E-12	7.51E-12	4.00E-12	5.41E-07	6.31E+02	1.66E+02	1.07E+03	2.41E+03	9.26E+00	2.35E-01	5.75E+05	2.87E+04
Neptunium (93)	Np-240	5.55E-13		2.23E-13	3.16E-13	1.95E-13	5.80E-06	3.23E+03	3.20E+03	5.22E+03	1.18E+04	2.14E+02	5.58E+00	3.62E+10	1.81E+09
Neptunium (93)	Np-240m						1.51E-06	1.09E+05	1.09E+05	1.76E+05	3.97E+05				
Nickel (28)	Ni-56	6.70E-12		2.83E-12	3.96E-12	2.88E-12	7.74E-06	1.79E+01	1.61E+01	2.90E+01	6.52E+01	1.68E+01	4.45E-01	1.78E+07	8.91E+05
Nickel (28)	Ni-57	1.02E-11		3.89E-12	5.55E-12	1.78E-12	9.43E-06	5.94E+01	5.27E+01	9.64E+01	2.17E+02	1.22E+01	3.18E-01	2.13E+08	1.07E+07
Nickel (28)	Ni-59	7.33E-13	1.44E-13	2.74E-13	3.89E-13	4.66E-13	0.00E+00	3.33E+01	9.58E-01	1.23E+04	2.22E+04	1.74E+02	4.53E+00	2.05E+02	1.03E+01
Nickel (28)	Ni-63	1.79E-12	3.50E-13	6.70E-13	9.51E-13	1.64E-12	0.00E+00	1.51E+01	4.51E-01	5.55E+03	9.99E+03	7.11E+01	1.85E+00	3.80E+01	1.90E+00
Nickel (28)	Ni-65	1.92E-12		6.96E-13	1.01E-12	3.03E-13	2.74E-06	2.93E+03	2.72E+03	4.75E+03	1.07E+04	6.84E+01	1.75E+00	2.44E+11	1.22E+10
Nickel (28)	Ni-66	5.77E-11		2.00E-11	2.94E-11	8.99E-12	2.67E-11	1.47E+03	5.64E+01	2.25E+07	5.06E+07	2.38E+00	6.00E-02	1.81E+07	9.06E+05
Niobium (41)	Nb-88	2.45E-13		1.13E-13	1.55E-13	4.51E-14	1.89E-05	4.51E+03	4.51E+03	7.29E+03	1.64E+04	4.21E+02	1.14E+01		
Niobium (41)	Nb-89a	1.01E-12		4.00E-13	5.66E-13	1.74E-13	8.48E-06	2.18E+03	2.16E+03	3.52E+03	7.92E+03	1.19E+02	3.12E+00		
Niobium (41)	Nb-89b	2.82E-12		1.04E-12	1.51E-12	4.07E-13	6.64E-06	1.50E+03	1.46E+03	2.43E+03	5.47E+03	4.58E+01	1.17E+00		
Niobium (41)	Nb-90	1.52E-11		5.70E-12	8.21E-12	2.27E-12	2.13E-05	6.53E+01	6.20E+01	1.06E+02	2.38E+02	8.35E+00	2.15E-01		
Niobium (41)	Nb-93m	2.31E-12		8.03E-13	1.17E-12	1.90E-12	3.83E-11	9.39E+01	1.19E+00	9.99E+03	2.25E+04	5.93E+01	1.51E+00		
Niobium (41)	Nb-94	2.05E-11	3.89E-12	7.77E-12	1.11E-11	3.77E-11	7.29E-06	1.53E-02	9.46E-03	2.97E-02	6.68E-02	6.13E+00	1.59E-01		
Niobium (41)	Nb-95	6.36E-12		2.45E-12	3.50E-12	5.44E-12	3.53E-06	6.80E+00	5.98E+00	1.10E+01	2.48E+01	1.94E+01	5.04E-01		
Niobium (41)	Nb-95m	1.05E-11		3.66E-12	5.37E-12	3.27E-12	2.32E-07	9.68E+02	2.38E+02	1.63E+03	3.68E+03	1.30E+01	3.28E-01		
Niobium (41)	Nb-96	1.35E-11		5.03E-12	7.25E-12	2.28E-12	1.15E-05	7.54E+01	6.94E+01	1.22E+02	2.74E+02	9.47E+00	2.43E-01		
Niobium (41)	Nb-97	5.00E-13		1.96E-13	2.79E-13	1.07E-13	2.97E-06	5.69E+03	5.62E+03	9.20E+03	2.07E+04	2.43E+02	6.32E+00		
Niobium (41)	Nb-97m						3.34E-06	3.65E+05	3.65E+05	5.90E+05	1.33E+06				
Niobium (41)	Nb-98	6.73E-13		2.80E-13	3.92E-13	1.23E-13	1.16E-05	2.04E+03	2.03E+03	3.30E+03	7.42E+03	1.70E+02	4.50E+00		
Nitrogen (7)	N-13						4.45E-06	2.75E+04	2.75E+04	4.44E+04	9.99E+04				
Osmium (76)	Os-180	7.92E-14		3.63E-14	5.00E-14	2.62E-14	1.08E-07	5.13E+05	4.83E+05	8.29E+05	1.87E+06	1.31E+03	3.53E+01		
Osmium (76)	Os-181	9.21E-13		3.54E-13	5.07E-13	1.95E-13	5.41E-06	2.15E+03	2.12E+03	3.47E+03	7.80E+03	1.35E+02	3.48E+00		
Osmium (76)	Os-182	6.92E-12		2.59E-12	3.74E-12	1.45E-12	1.63E-06	5.66E+02	4.34E+02	9.15E+02	2.06E+03	1.84E+01	4.72E-01		
Osmium (76)	Os-185	4.77E-12		1.92E-12	2.70E-12	6.14E-12	3.11E-06	2.90E+00	2.59E+00	4.68E+00	1.05E+01	2.48E+01	6.53E-01		
Osmium (76)	Os-189m	2.94E-13		1.02E-13	1.50E-13	3.44E-14	7.20E-13	8.05E+07	1.69E+05	7.60E+09	1.71E+10	4.67E+02	1.18E+01		

Radionuclide Toxicity and Preliminary Remediation Goals for Superfund

Element (Atomic Number)	Isotope	Toxicity: Soil Ingestion Slope Factor (risk/pCi)	Toxicity: Soil Ingestion Slope Factor-Adult (risk/pCi)	Toxicity: Water Ingestion Slope Factor (risk/pCi)	Toxicity: Food Ingestion Slope Factor (risk/pCi)	Toxicity: Inhalation Slope Factor (risk/pCi)	Toxicity: External Exposure Slope Factor (risk/y per pCi/g)	Preliminary Remediation Goals (PRG): Residential Soil (pCi/g)	Preliminary Remediation Goals (PRG): Agricultural Soil (pCi/g)	Preliminary Remediation Goals (PRG): Outdoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Indoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Tap Water (pCi/L)	Preliminary Remediation Goals (PRG): Fish Ingestion (pCi/g)	Soil to Groundwater: DAF=20 (pCi/g)	Soil to Groundwater: DAF=1 (pCi/g)
Osmium (76)	Os-190m						6.76E-06	1.82E+04	1.82E+04	2.94E+04	6.62E+04				
Osmium (76)	Os-191	1.05E-11		3.64E-12	5.33E-12	7.10E-12	1.66E-07	3.28E+02	6.25E+01	5.35E+02	1.20E+03	1.31E+01	3.31E-01		
Osmium (76)	Os-191m	1.76E-12		6.11E-13	8.95E-13	6.36E-13	1.05E-08	1.45E+05	1.20E+04	2.40E+05	5.41E+05	7.79E+01	1.97E+00		
Osmium (76)	Os-193	1.53E-11		5.29E-12	7.77E-12	2.71E-12	2.69E-07	2.50E+03	5.18E+02	4.07E+03	9.15E+03	9.00E+00	2.27E-01		
Osmium (76)	Os-194	4.37E-11		1.53E-11	2.23E-11	2.55E-10	6.57E-10	5.87E+01	1.31E-01	1.00E+03	2.26E+03	3.11E+00	7.91E-02		
Oxygen (8)	O-15						4.46E-06	1.34E+05	1.34E+05	2.17E+05	4.89E+05				
Palladium (46)	Pd-100	1.05E-11		4.03E-12	5.77E-12	3.10E-12	2.22E-07	7.29E+02	1.67E+02	1.70E+03	3.82E+03	1.18E+01	3.06E-01		
Palladium (46)	Pd-101	1.12E-12		4.22E-13	6.07E-13	1.97E-13	1.38E-06	1.77E+03	1.63E+03	2.88E+03	6.47E+03	1.13E+02	2.91E+00		
Palladium (46)	Pd-103	3.61E-12		1.25E-12	1.84E-12	1.77E-12	1.15E-09	1.54E+03	1.33E+02	7.00E+04	1.57E+05	3.81E+01	9.59E-01		
Palladium (46)	Pd-107	7.25E-13		2.50E-13	3.67E-13	1.69E-12	0.00E+00	1.79E+01	1.12E+00	2.14E+07	4.83E+07	1.90E+02	4.81E+00		
Palladium (46)	Pd-109	1.01E-11		3.50E-12	5.14E-12	1.85E-12	1.27E-08	1.52E+04	1.43E+03	1.93E+05	4.34E+05	1.36E+01	3.43E-01		
Phosphorus (15)	P-30						4.50E-06	1.08E+05	1.08E+05	1.75E+05	3.94E+05				
Phosphorus (15)	P-32	2.21E-11		8.95E-12	1.23E-11	1.22E-11	9.41E-09	2.86E+01	5.79E+00	1.02E+04	2.29E+04	5.32E+00	1.43E-01		
Phosphorus (15)	P-33	2.47E-12		9.81E-13	1.36E-12	5.11E-12	3.72E-11	1.46E+02	2.95E+01	1.45E+06	3.25E+06	4.85E+01	1.30E+00		
Platinum (78)	Pt-186	1.03E-12		3.92E-13	5.62E-13	8.25E-14	3.20E-06	3.17E+03	3.10E+03	5.13E+03	1.15E+04	1.21E+02	3.14E+00		
Platinum (78)	Pt-188	1.03E-11		3.77E-12	5.44E-12	1.88E-12	6.02E-07	1.38E+02	6.24E+01	2.23E+02	5.01E+02	1.26E+01	3.24E-01		
Platinum (78)	Pt-189	1.61E-12		5.92E-13	8.55E-13	1.32E-13	1.17E-06	1.59E+03	1.45E+03	2.57E+03	5.79E+03	8.04E+01	2.06E+00		
Platinum (78)	Pt-191	4.85E-12		1.76E-12	2.55E-12	4.63E-13	9.78E-07	3.09E+02	2.29E+02	4.99E+02	1.12E+03	2.71E+01	6.92E-01		
Platinum (78)	Pt-193	6.14E-13		2.11E-13	3.09E-13	1.11E-13	2.78E-12	1.53E+03	2.64E+00	9.20E+04	2.07E+05	2.26E+02	5.71E+00		
Platinum (78)	Pt-193m	8.81E-12		3.03E-12	4.44E-12	7.73E-13	1.68E-08	1.08E+04	3.20E+02	1.88E+04	4.23E+04	1.57E+01	3.97E-01		
Platinum (78)	Pt-195m	1.19E-11		4.11E-12	6.03E-12	1.05E-12	1.26E-07	1.65E+03	2.26E+02	2.70E+03	6.08E+03	1.16E+01	2.92E-01		
Platinum (78)	Pt-197	7.59E-12		2.62E-12	3.85E-12	5.22E-13	5.63E-08	1.94E+04	1.94E+03	3.19E+04	7.17E+04	1.82E+01	4.58E-01		
Platinum (78)	Pt-197m	1.12E-12		4.00E-13	5.81E-13	8.66E-14	2.38E-07	5.42E+04	4.09E+04	8.77E+04	1.97E+05	1.19E+02	3.04E+00		
Platinum (78)	Pt-199	2.18E-13		8.84E-14	1.25E-13	2.48E-14	8.69E-07	4.55E+04	4.47E+04	7.36E+04	1.66E+05	5.39E+02	1.41E+01		
Platinum (78)	Pt-200	2.23E-11		7.73E-12	1.13E-11	1.48E-12	1.58E-07	1.01E+04	9.74E+02	1.66E+04	3.74E+04	6.16E+00	1.56E-01		
Plutonium (94)	Pu-234	2.39E-12		8.58E-13	1.25E-12	6.85E-11	1.61E-07	1.43E+04	7.01E+03	2.32E+04	5.21E+04	5.55E+01	1.41E+00	2.47E+09	1.24E+08
Plutonium (94)	Pu-235	9.73E-15		4.37E-15	6.03E-15	2.39E-15	2.37E-07	2.03E+05	2.03E+05	3.28E+05	7.39E+05	1.09E+04	2.92E+02	2.11E+14	1.06E+13
Plutonium (94)	Pu-236	1.74E-10		7.47E-11	9.92E-11	2.28E-08	1.19E-10	1.97E+01	6.09E-02	5.17E+03	1.16E+04	6.37E-01	1.78E-02	3.53E+00	1.77E-01
Plutonium (94)	Pu-237	1.62E-12		5.77E-13	8.40E-13	1.27E-12	1.12E-07	1.66E+02	8.30E+01	2.70E+02	6.07E+02	8.25E+01	2.10E+00	2.41E+05	1.20E+04
Plutonium (94)	Pu-238	2.72E-10	1.17E-10	1.31E-10	1.69E-10	3.36E-08	7.22E-11	1.88E+00	4.29E-03	1.64E+01	2.97E+01	3.64E-01	1.04E-02	1.75E+00	8.76E-02
Plutonium (94)	Pu-239	2.76E-10	1.21E-10	1.35E-10	1.74E-10	3.33E-08	2.00E-10	1.63E+00	3.57E-03	1.43E+01	2.59E+01	3.53E-01	1.01E-02	1.56E+00	7.80E-02
Plutonium (94)	Pu-240	2.77E-10		1.35E-10	1.74E-10	3.33E-08	6.98E-11	1.64E+00	3.58E-03	8.07E+02	1.81E+03	3.53E-01	1.01E-02	1.56E+00	7.81E-02
Plutonium (94)	Pu-241	3.29E-12	1.73E-12	1.76E-12	2.28E-12	3.34E-10	4.11E-12	2.48E+02	6.14E-01	1.72E+03	3.11E+03	2.71E+01	7.74E-01	1.00E+01	5.02E-01
Plutonium (94)	Pu-242	2.63E-10		1.28E-10	1.65E-10	3.13E-08	6.25E-11	1.72E+00	3.76E-03	8.68E+02	1.95E+03	3.72E-01	1.07E-02	1.56E+00	7.80E-02
Plutonium (94)	Pu-243	1.34E-12		4.74E-13	6.92E-13	2.94E-13	5.50E-08	7.41E+04	2.76E+04	1.20E+05	2.71E+05	1.00E+02	2.55E+00	1.41E+10	7.04E+08
Plutonium (94)	Pu-244	2.94E-10		1.37E-10	1.80E-10	2.93E-08	3.01E-11	1.56E+00	3.45E-03	1.06E+03	2.37E+03	3.48E-01	9.80E-03	1.56E+00	7.80E-02
Plutonium (94)	Pu-244+D	3.14E-10		1.44E-10	1.90E-10	2.93E-08	1.51E-06	7.03E-02	3.09E-03	1.43E-01	3.22E-01	3.31E-01	9.28E-03	1.56E+00	7.80E-02
Plutonium (94)	Pu-245	1.28E-11		4.48E-12	6.55E-12	2.07E-12	1.77E-06	1.09E+03	7.30E+02	1.77E+03	3.97E+03	1.06E+01	2.69E-01	3.33E+08	1.66E+07
Plutonium (94)	Pu-246	4.92E-11		1.73E-11	2.53E-11	1.73E-11	4.04E-07	1.87E+02	2.04E+01	3.11E+02	6.99E+02	2.75E+00	6.97E-02	1.39E+05	6.94E+03
Polonium (84)	Po-203	3.92E-13		1.63E-13	1.88E-13	7.73E-14	7.65E-06	4.34E+03	4.33E+03	7.02E+03	1.58E+04	2.92E+02	9.38E+00		
Polonium (84)	Po-205	4.26E-13		1.81E-13	2.41E-13	1.72E-13	7.36E-06	1.53E+03	1.53E+03	2.48E+03	5.58E+03	2.63E+02	7.32E+00		
Polonium (84)	Po-207	1.28E-12		5.18E-13	5.55E-13	1.99E-13	6.08E-06	5.73E+02	5.66E+02	9.26E+02	2.08E+03	9.19E+01	3.18E+00		
Polonium (84)	Po-210	7.96E-10		3.77E-10	2.25E-09	1.08E-08	3.95E-11	1.26E+01	2.03E-02	9.54E+04	2.15E+05	1.26E-01	7.84E-04		
Polonium (84)	Po-211						3.58E-08	3.96E+09	3.96E+09	6.40E+09	1.44E+10				
Polonium (84)	Po-212						0.00E+00								
Polonium (84)	Po-213						0.00E+00								
Polonium (84)	Po-214						3.86E-10	1.16E+15	1.16E+15	1.87E+15	4.20E+15				
Polonium (84)	Po-215						7.48E-10	5.49E+13	5.49E+13	8.88E+13	2.00E+14				
Polonium (84)	Po-216						7.87E-11	6.20E+12	6.20E+12	1.00E+13	2.25E+13				
Polonium (84)	Po-218						4.26E-11	9.38E+09	9.38E+09	1.52E+10	3.41E+10				
Potassium (19)	K-38						1.61E-05	9.91E+03	9.91E+03	1.60E+04	3.60E+04				

Radionuclide Toxicity and Preliminary Remediation Goals for Superfund

Element (Atomic Number)	Isotope	Toxicity: Soil Ingestion Slope Factor (risk/pCi)	Toxicity: Soil Ingestion Slope Factor-Adult (risk/pCi)	Toxicity: Water Ingestion Slope Factor (risk/pCi)	Toxicity: Food Ingestion Slope Factor (risk/pCi)	Toxicity: Inhalation Slope Factor (risk/pCi)	Toxicity: External Exposure Slope Factor (risk/y per pCi/g)	Preliminary Remediation Goals (PRG): Residential Soil (pCi/g)	Preliminary Remediation Goals (PRG): Agricultural Soil (pCi/g)	Preliminary Remediation Goals (PRG): Outdoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Indoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Tap Water (pCi/L)	Preliminary Remediation Goals (PRG): Fish Ingestion (pCi/g)	Soil to Groundwater: DAF=20 (pCi/g)	Soil to Groundwater: DAF=1 (pCi/g)
Potassium (19)	K-40	6.18E-11		2.47E-11	3.43E-11	1.03E-11	7.97E-07	4.42E-02	6.67E-03	2.71E-01	6.11E-01	1.93E+00	5.14E-02		
Potassium (19)	K-42	3.06E-12		1.26E-12	1.74E-12	4.33E-13	1.46E-06	1.06E+03	7.97E+02	1.81E+03	4.08E+03	3.78E+01	1.01E+00		
Potassium (19)	K-43	1.81E-12		7.88E-13	1.07E-12	3.09E-13	4.23E-06	2.10E+02	1.96E+02	3.43E+02	7.73E+02	6.04E+01	1.65E+00		
Potassium (19)	K-44	3.00E-13		1.39E-13	1.91E-13	3.39E-14	1.19E-05	4.63E+03	4.61E+03	7.49E+03	1.69E+04	3.43E+02	9.23E+00		
Potassium (19)	K-45	1.93E-13		8.95E-14	1.22E-13	2.33E-14	9.53E-06	6.39E+03	6.37E+03	1.03E+04	2.33E+04	5.32E+02	1.45E+01		
Praseodymium (59)	Pr-136	1.27E-13		5.88E-14	8.07E-14	2.15E-14	9.74E-06	9.55E+03	9.54E+03	1.54E+04	3.47E+04	8.10E+02	2.19E+01		
Praseodymium (59)	Pr-137	3.22E-13		1.25E-13	1.78E-13	5.55E-14	2.14E-06	7.44E+03	7.35E+03	1.20E+04	2.70E+04	3.81E+02	9.91E+00		
Praseodymium (59)	Pr-138						3.57E-06	2.36E+05	2.36E+05	3.80E+05	8.56E+05				
Praseodymium (59)	Pr-138m	1.03E-12		4.18E-13	5.92E-13	1.76E-13	1.13E-05	8.56E+02	8.50E+02	1.38E+03	3.11E+03	1.14E+02	2.98E+00		
Praseodymium (59)	Pr-139	4.03E-13		1.47E-13	2.12E-13	6.96E-14	4.41E-07	1.02E+04	9.59E+03	1.65E+04	3.71E+04	3.24E+02	8.32E+00		
Praseodymium (59)	Pr-142	2.49E-11		8.58E-12	1.26E-11	3.38E-12	3.14E-07	3.30E+03	5.26E+02	5.47E+03	1.23E+04	5.55E+00	1.40E-01		
Praseodymium (59)	Pr-142m	3.20E-13		1.10E-13	1.62E-13	4.33E-14	0.00E+00	7.41E+08	3.80E+06	5.22E+14	1.17E+15	4.33E+02	1.09E+01		
Praseodymium (59)	Pr-143	2.29E-11		7.92E-12	1.16E-11	9.73E-12	1.63E-09	6.42E+03	3.96E+01	6.17E+04	1.39E+05	6.01E+00	1.52E-01		
Praseodymium (59)	Pr-144	1.82E-13		8.10E-14	1.12E-13	3.58E-14	1.94E-07	3.63E+05	3.37E+05	5.87E+05	1.32E+06	5.88E+02	1.57E+01		
Praseodymium (59)	Pr-144m						8.73E-09	1.94E+07	1.94E+07	3.13E+07	7.05E+07				
Praseodymium (59)	Pr-145	6.59E-12		2.29E-12	3.36E-12	9.25E-13	6.95E-08	4.73E+04	6.47E+03	7.90E+04	1.78E+05	2.08E+01	5.25E-01		
Praseodymium (59)	Pr-147	1.32E-13		5.85E-14	8.10E-14	3.59E-14	3.78E-06	2.37E+04	2.36E+04	3.83E+04	8.62E+04	8.14E+02	2.18E+01		
Promethium (61)	Pm-141	1.52E-13		6.66E-14	9.25E-14	2.85E-14	3.33E-06	1.75E+04	1.75E+04	2.83E+04	6.37E+04	7.15E+02	1.91E+01		
Promethium (61)	Pm-142						3.86E-06	4.68E+05	4.68E+05	7.56E+05	1.70E+06				
Promethium (61)	Pm-143	2.20E-12		8.73E-13	1.24E-12	5.37E-12	1.33E-06	2.40E+00	2.13E+00	3.88E+00	8.73E+00	5.45E+01	1.42E+00		
Promethium (61)	Pm-144	8.10E-12		3.34E-12	4.66E-12	2.76E-11	6.90E-06	3.38E-01	3.10E-01	5.46E-01	1.23E+00	1.43E+01	3.78E-01		
Promethium (61)	Pm-145	1.54E-12		5.59E-13	8.07E-13	6.59E-12	1.61E-08	1.14E+01	1.32E+00	2.11E+01	4.74E+01	8.52E+01	2.19E+00		
Promethium (61)	Pm-146	1.12E-11		4.18E-12	5.99E-12	5.40E-11	3.29E-06	1.30E-01	1.03E-01	2.15E-01	4.84E-01	1.14E+01	2.94E-01		
Promethium (61)	Pm-147	4.88E-12		1.69E-12	2.48E-12	1.61E-11	3.21E-11	5.05E+02	2.63E+00	4.45E+04	1.00E+05	2.82E+01	7.11E-01		
Promethium (61)	Pm-148	4.96E-11		1.72E-11	2.52E-11	1.05E-11	2.80E-06	5.60E+01	2.54E+01	9.10E+01	2.05E+02	2.77E+00	7.00E-02		
Promethium (61)	Pm-148m	2.13E-11		7.99E-12	1.15E-11	2.12E-11	8.98E-06	2.28E+00	1.95E+00	3.69E+00	8.30E+00	5.96E+00	1.53E-01		
Promethium (61)	Pm-149	1.93E-11		6.66E-12	9.77E-12	3.66E-12	4.60E-08	7.25E+03	2.79E+02	1.34E+04	3.02E+04	7.15E+00	1.81E-01		
Promethium (61)	Pm-150	2.94E-12		1.08E-12	1.56E-12	4.63E-13	6.87E-06	1.10E+03	1.07E+03	1.78E+03	4.01E+03	4.41E+01	1.13E+00		
Promethium (61)	Pm-151	1.28E-11		4.51E-12	6.59E-12	2.36E-12	1.27E-06	5.61E+02	3.31E+02	9.10E+02	2.05E+03	1.06E+01	2.68E-01		
Protactinium (91)	Pa-227	2.38E-12		9.69E-13	1.37E-12	2.12E-10	4.37E-08	6.87E+05	1.35E+05	1.18E+06	2.65E+06	4.91E+01	1.29E+00		
Protactinium (91)	Pa-228	9.84E-12		3.60E-12	5.18E-12	2.33E-10	5.10E-06	1.81E+02	1.58E+02	2.93E+02	6.58E+02	1.32E+01	3.40E-01		
Protactinium (91)	Pa-230	1.02E-11		3.77E-12	5.40E-12	2.58E-09	2.86E-06	1.70E+01	1.34E+01	2.75E+01	6.18E+01	1.26E+01	3.27E-01		
Protactinium (91)	Pa-231	3.74E-10	1.54E-10	1.73E-10	2.26E-10	4.55E-08	1.39E-07	1.96E-01	2.62E-03	1.37E+00	2.99E+00	2.75E-01	7.80E-03		
Protactinium (91)	Pa-232	9.55E-12		3.48E-12	5.03E-12	6.81E-12	4.29E-06	1.50E+02	1.29E+02	2.43E+02	5.48E+02	1.37E+01	3.51E-01		
Protactinium (91)	Pa-233	1.59E-11		5.55E-12	8.14E-12	1.42E-11	7.43E-07	4.13E+01	1.66E+01	6.82E+01	1.53E+02	8.58E+00	2.17E-01		
Protactinium (91)	Pa-234	7.03E-12		2.56E-12	3.70E-12	1.46E-12	8.71E-06	3.48E+02	3.29E+02	5.63E+02	1.27E+03	1.86E+01	4.77E-01		
Protactinium (91)	Pa-234m						6.87E-08	1.52E+07	1.52E+07	2.45E+07	5.51E+07				
Radium (88)	Ra-222						3.71E-08	5.19E+07	5.19E+07	8.38E+07	1.89E+08				
Radium (88)	Ra-223	6.44E-10		2.38E-10	3.39E-10	2.50E-08	4.34E-07	2.66E+01	1.17E+00	2.76E+02	6.22E+02	2.00E-01	5.20E-03	5.67E+03	2.84E+02
Radium (88)	Ra-224	4.51E-10		1.67E-10	2.38E-10	9.99E-09	3.72E-08	1.37E+02	5.20E+00	1.00E+04	2.26E+04	9.50E-04	7.41E-03	7.84E+04	3.92E+03
Radium (88)	Ra-225	2.72E-10		1.14E-10	1.54E-10	2.10E-08	5.91E-09	5.33E+01	1.99E+00	1.53E+04	3.45E+04	4.18E-01	1.15E-02	7.03E+03	3.51E+02
Radium (88)	Ra-226	7.29E-10	2.95E-10	3.85E-10	5.14E-10	1.15E-08	2.29E-08	3.15E-02	8.80E-04	3.69E+00	7.21E+00	8.23E-04	3.43E-03	3.22E-01	1.61E-02
Radium (88)	Ra-226+D	7.30E-10	2.34E-09	3.86E-10	5.15E-10	1.16E-08	8.49E-06	9.33E-03	8.07E-04	2.48E-02	5.53E-02	8.16E-04	3.42E-03	3.22E-01	1.61E-02
Radium (88)	Ra-227	2.48E-13		1.05E-13	1.46E-13	3.13E-13	6.22E-07	4.64E+04	4.45E+04	7.50E+04	1.69E+05	4.54E+02	1.21E+01	1.95E+12	9.73E+10
Radium (88)	Ra-228	2.28E-09		1.04E-09	1.43E-09	5.18E-09	0.00E+00	4.19E-02	1.52E-03	2.22E+04	4.99E+04	4.58E-02	1.23E-03	1.19E+00	5.94E-02
Radium (88)	Ra-228+D	2.29E-09		1.04E-09	1.43E-09	5.23E-09	4.53E-06	2.88E-02	1.50E-03	1.51E-01	3.40E-01	4.58E-02	1.23E-03	1.19E+00	5.94E-02
Radon (86)	Rn-218						3.39E-09	6.16E+11	6.16E+11	9.96E+11	2.24E+12				
Radon (86)	Rn-219						2.25E-07	8.21E+07	8.21E+07	1.33E+08	2.98E+08				
Radon (86)	Rn-220						1.70E-09	7.74E+08	7.74E+08	1.25E+09	2.81E+09				
Radon (86)	Rn-222						1.74E-09	1.27E+05	1.27E+05	2.06E+05	4.63E+05			2.38E+03	1.19E+02
Radon (86)	Rn-222+D					7.57E-12		5.45E+09	5.30E+09	7.93E+09	1.78E+10	1.26E+00		2.38E+03	1.19E+02

Element (Atomic Number)	Isotope	Toxicity: Soil Ingestion Slope Factor (risk/pCi)	Toxicity: Soil Ingestion Slope Factor-Adult (risk/pCi)	Toxicity: Water Ingestion Slope Factor (risk/pCi)	Toxicity: Food Ingestion Slope Factor (risk/pCi)	Toxicity: Inhalation Slope Factor (risk/pCi)	Toxicity: External Exposure Slope Factor (risk/y per pCi/g)	Preliminary Remediation Goals (PRG): Residential Soil (pCi/g)	Preliminary Remediation Goals (PRG): Agricultural Soil (pCi/g)	Preliminary Remediation Goals (PRG): Outdoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Indoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Tap Water (pCi/L)	Preliminary Remediation Goals (PRG): Fish Ingestion (pCi/g)	Soil to Groundwater: DAF=20 (pCi/g)	Soil to Groundwater: DAF=1 (pCi/g)
Rhenium (75)	Re-177	1.05E-13		4.55E-14	6.33E-14	2.97E-14	2.62E-06	3.32E+04	3.31E+04	5.37E+04	1.21E+05	1.05E+03	2.79E+01		
Rhenium (75)	Re-178	9.32E-14		4.26E-14	5.85E-14	2.33E-14	5.65E-06	1.63E+04	1.63E+04	2.64E+04	5.94E+04	1.12E+03	3.01E+01		
Rhenium (75)	Re-180						5.29E-06	9.48E+04	9.48E+04	1.53E+05	3.45E+05				
Rhenium (75)	Re-181	3.64E-12		1.41E-12	2.00E-12	7.96E-13	3.18E-06	3.19E+02	2.95E+02	5.16E+02	1.16E+03	3.38E+01	8.82E-01		
Rhenium (75)	Re-182a	2.16E-12		8.70E-13	1.22E-12	5.51E-13	5.37E-06	2.98E+02	2.89E+02	4.81E+02	1.08E+03	5.47E+01	1.45E+00		
Rhenium (75)	Re-182b	1.26E-11		4.96E-12	6.99E-12	4.44E-12	8.22E-06	3.86E+01	3.47E+01	6.24E+01	1.40E+02	9.60E+00	2.52E-01		
Rhenium (75)	Re-184	7.66E-12		3.16E-12	4.40E-12	6.73E-12	3.93E-06	5.67E+00	4.93E+00	9.16E+00	2.06E+01	1.51E+01	4.01E-01		
Rhenium (75)	Re-184m	1.27E-11		4.88E-12	6.96E-12	2.26E-11	1.52E-06	3.37E+00	2.09E+00	5.45E+00	1.23E+01	9.76E+00	2.53E-01		
Rhenium (75)	Re-186	1.53E-11		5.59E-12	8.03E-12	4.26E-12	5.49E-08	3.93E+03	1.99E+02	6.60E+03	1.48E+04	8.52E+00	2.20E-01		
Rhenium (75)	Re-186m	1.95E-11		7.33E-12	1.05E-11	4.18E-11	1.75E-08	5.51E+00	5.88E-02	1.24E+01	2.78E+01	6.50E+00	1.68E-01		
Rhenium (75)	Re-187	4.81E-14		1.79E-14	2.56E-14	2.51E-14	0.00E+00	1.65E+04	2.44E+01	1.44E+09	3.25E+09	2.66E+03	6.89E+01		
Rhenium (75)	Re-188	1.35E-11		4.88E-12	7.07E-12	2.22E-12	2.38E-07	4.98E+03	1.01E+03	8.11E+03	1.83E+04	9.76E+00	2.49E-01		
Rhenium (75)	Re-188m	2.69E-13		9.92E-14	1.42E-13	5.07E-14	1.28E-07	5.12E+05	4.46E+05	8.27E+05	1.86E+06	4.80E+02	1.24E+01		
Rhenium (75)	Re-189	7.84E-12		2.86E-12	4.11E-12	1.73E-12	2.42E-07	3.44E+03	1.06E+03	5.58E+03	1.26E+04	1.67E+01	4.29E-01		
Rhodium (45)	Rh-100	6.62E-12		2.65E-12	3.74E-12	1.04E-12	1.38E-05	7.04E+01	6.67E+01	1.14E+02	2.57E+02	1.80E+01	4.72E-01		
Rhodium (45)	Rh-101	5.37E-12		2.15E-12	3.01E-12	1.81E-11	8.84E-07	7.64E-01	4.65E-01	1.33E+00	2.99E+00	2.21E+01	5.86E-01		
Rhodium (45)	Rh-101m	2.46E-12		9.40E-13	1.34E-12	7.14E-13	1.19E-06	1.60E+02	1.31E+02	2.65E+02	5.96E+02	5.07E+01	1.32E+00		
Rhodium (45)	Rh-102	1.71E-11		7.70E-12	1.04E-11	5.99E-11	9.73E-06	8.04E-02	6.63E-02	1.33E-01	3.00E-01	6.18E+00	1.70E-01		
Rhodium (45)	Rh-102m	1.66E-11		6.07E-12	8.73E-12	2.56E-11	2.11E-06	1.78E+00	1.01E+00	3.13E+00	7.05E+00	7.84E+00	2.02E-01		
Rhodium (45)	Rh-103m	2.40E-14		9.40E-15	1.34E-14	9.14E-15	9.31E-11	5.61E+07	7.01E+06	3.77E+08	8.48E+08	5.07E+03	1.32E+02		
Rhodium (45)	Rh-105	6.73E-12		2.34E-12	3.43E-12	1.59E-12	3.15E-07	1.47E+03	5.29E+02	2.94E+03	6.62E+03	2.04E+01	5.14E-01		
Rhodium (45)	Rh-106						9.66E-07	2.53E+06	2.53E+06	4.09E+06	9.21E+06				
Rhodium (45)	Rh-106m	1.37E-12		5.48E-13	7.73E-13	2.71E-13	1.37E-05	6.73E+02	6.66E+02	1.09E+03	2.45E+03	8.69E+01	2.28E+00		
Rhodium (45)	Rh-107	9.51E-14		4.18E-14	5.81E-14	2.88E-14	1.28E-06	4.38E+04	4.34E+04	7.09E+04	1.60E+05	1.14E+03	3.04E+01		
Rhodium (45)	Rh-99	5.77E-12		2.21E-12	3.15E-12	3.33E-12	2.50E-06	2.06E+01	1.65E+01	3.42E+01	7.69E+01	2.15E+01	5.60E-01		
Rhodium (45)	Rh-99m	6.03E-13		2.42E-13	3.42E-13	9.99E-14	3.02E-06	1.43E+03	1.40E+03	2.31E+03	5.20E+03	1.97E+02	5.16E+00		
Rubidium (37)	Rb-79	1.79E-13		8.36E-14	1.14E-13	2.37E-14	5.85E-06	9.10E+03	9.06E+03	1.47E+04	3.31E+04	5.70E+02	1.55E+01		
Rubidium (37)	Rb-80						5.56E-06	3.87E+05	3.87E+05	6.25E+05	1.41E+06				
Rubidium (37)	Rb-81	2.83E-13		1.28E-13	1.74E-13	4.63E-14	2.59E-06	1.71E+03	1.69E+03	2.77E+03	6.23E+03	3.72E+02	1.01E+01		
Rubidium (37)	Rb-81m	4.55E-14		2.05E-14	2.80E-14	1.10E-14	9.08E-09	3.93E+06	2.48E+06	6.78E+06	1.53E+07	2.32E+03	6.30E+01		
Rubidium (37)	Rb-82						4.85E-06	1.93E+05	1.93E+05	3.12E+05	7.03E+05				
Rubidium (37)	Rb-82m	7.25E-13		3.51E-13	4.70E-13	1.35E-13	1.35E-05	2.43E+02	2.41E+02	3.92E+02	8.82E+02	1.36E+02	3.75E+00		
Rubidium (37)	Rb-83	1.18E-11		5.70E-12	7.51E-12	2.32E-12	2.18E-06	4.19E+00	2.54E+00	7.28E+00	1.64E+01	8.35E+00	2.35E-01		
Rubidium (37)	Rb-84	1.91E-11		8.81E-12	1.17E-11	3.59E-12	4.22E-06	5.77E+00	3.77E+00	9.88E+00	2.22E+01	5.41E+00	1.51E-01		
Rubidium (37)	Rb-86	2.37E-11		9.88E-12	1.34E-11	4.00E-12	4.67E-07	5.94E+01	1.30E+01	1.57E+02	3.52E+02	4.82E+00	1.32E-01		
Rubidium (37)	Rb-87	1.25E-11		5.22E-12	7.07E-12	2.14E-12	9.11E-11	7.17E-01	5.28E-02	2.37E+03	5.34E+03	9.12E+00	2.49E-01		
Rubidium (37)	Rb-88	3.06E-13		1.40E-13	1.92E-13	3.17E-14	3.36E-06	2.04E+04	2.01E+04	3.29E+04	7.41E+04	3.40E+02	9.19E+00		
Rubidium (37)	Rb-89	1.70E-13		7.88E-14	1.08E-13	2.09E-14	1.05E-05	7.64E+03	7.62E+03	1.23E+04	2.78E+04	6.04E+02	1.63E+01		
Ruthenium (44)	Ru-103	1.05E-11		3.85E-12	5.55E-12	8.92E-12	2.04E-06	1.04E+01	7.35E+00	1.71E+01	3.84E+01	1.24E+01	3.18E-01	4.80E+04	2.40E+03
Ruthenium (44)	Ru-105	3.77E-12		1.35E-12	1.96E-12	6.48E-13	3.51E-06	1.30E+03	1.20E+03	2.11E+03	4.74E+03	3.53E+01	9.00E-01	6.17E+09	3.09E+08
Ruthenium (44)	Ru-106	1.19E-10		4.22E-11	6.11E-11	1.02E-10	0.00E+00	7.12E+00	2.35E-01	6.11E+06	1.37E+07	1.13E+00	2.89E-02	6.43E+01	3.22E+00
Ruthenium (44)	Ru-106+D	1.19E-10		4.22E-11	6.11E-11	1.02E-10	9.66E-07	1.78E+00	2.14E-01	3.85E+00	8.66E+00	1.13E+00	2.89E-02	6.43E+01	3.22E+00
Ruthenium (44)	Ru-94	8.03E-13		3.06E-13	4.37E-13	1.23E-13	2.31E-06	1.02E+04	9.89E+03	1.65E+04	3.70E+04	1.56E+02	4.04E+00	7.20E+11	3.60E+10
Ruthenium (44)	Ru-97	1.65E-12		6.36E-13	9.07E-13	3.36E-13	8.63E-07	3.36E+02	2.90E+02	5.47E+02	1.23E+03	7.49E+01	1.94E+00	5.33E+07	2.67E+06
Samarium (62)	Sm-141	1.59E-13		7.10E-14	9.81E-14	2.79E-14	6.39E-06	1.87E+04	1.87E+04	3.02E+04	6.80E+04	6.71E+02	1.80E+01		
Samarium (62)	Sm-141m	3.26E-13		1.40E-13	1.95E-13	6.29E-14	9.04E-06	5.97E+03	5.95E+03	9.64E+03	2.17E+04	3.40E+02	9.04E+00		
Samarium (62)	Sm-142	1.40E-12		5.37E-13	7.70E-13	2.13E-13	2.99E-07	5.61E+04	4.17E+04	9.09E+04	2.04E+05	8.87E+01	2.29E+00		
Samarium (62)	Sm-145	3.27E-12		1.17E-12	1.70E-12	4.51E-12	3.83E-08	6.31E+01	9.27E+00	1.05E+02	2.36E+02	4.07E+01	1.04E+00		
Samarium (62)	Sm-146	8.36E-11		4.11E-11	5.25E-11	7.88E-09	0.00E+00	3.31E+00	1.18E-02	4.60E+03	1.03E+04	1.16E+00	3.36E-02		
Samarium (62)	Sm-147	7.59E-11		3.74E-11	4.77E-11	6.88E-09	0.00E+00	3.64E+00	1.29E-02	5.27E+03	1.19E+04	1.27E+00	3.70E-02		
Samarium (62)	Sm-151	1.59E-12		5.55E-13	8.07E-13	4.88E-12	3.60E-13	2.23E+02	8.89E-01	6.11E+05	1.37E+06	8.58E+01	2.19E+00		

Radionuclide Toxicity and Preliminary Remediation Goals for Superfund

Element (Atomic Number)	Isotope	Toxicity: Soil Ingestion Slope Factor (risk/pCi)	Toxicity: Soil Ingestion Slope Factor-Adult (risk/pCi)	Toxicity: Water Ingestion Slope Factor (risk/pCi)	Toxicity: Food Ingestion Slope Factor (risk/pCi)	Toxicity: Inhalation Slope Factor (risk/pCi)	Toxicity: External Exposure Slope Factor (risk/y per pCi/g)	Preliminary Remediation Goals (PRG): Residential Soil (pCi/g)	Preliminary Remediation Goals (PRG): Agricultural Soil (pCi/g)	Preliminary Remediation Goals (PRG): Outdoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Indoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Tap Water (pCi/L)	Preliminary Remediation Goals (PRG): Fish Ingestion (pCi/g)	Soil to Groundwater: DAF=20 (pCi/g)	Soil to Groundwater: DAF=1 (pCi/g)
Samarium (62)	Sm-153	1.40E-11		4.85E-12	7.10E-12	2.95E-12	1.06E-07	3.92E+03	4.07E+02	6.63E+03	1.49E+04	9.82E+00	2.48E-01		
Samarium (62)	Sm-155	1.13E-13		4.96E-14	6.88E-14	3.15E-14	2.81E-07	1.96E+05	1.90E+05	3.17E+05	7.14E+05	9.60E+02	2.56E+01		
Samarium (62)	Sm-156	4.26E-12		1.49E-12	2.18E-12	9.69E-13	3.79E-07	5.68E+03	3.21E+03	9.21E+03	2.07E+04	3.20E+01	8.09E-01		
Scandium (21)	Sc-43	2.21E-12		8.18E-13	1.18E-12	3.81E-13	4.73E-06	1.10E+03	1.07E+03	1.78E+03	4.01E+03	5.82E+01	1.49E+00		
Scandium (21)	Sc-44	4.22E-12		1.56E-12	2.25E-12	6.44E-13	9.95E-06	5.20E+02	5.04E+02	8.39E+02	1.89E+03	3.05E+01	7.84E-01		
Scandium (21)	Sc-44m	3.89E-11		1.38E-11	2.01E-11	6.96E-12	1.15E-06	2.98E+02	8.97E+01	4.87E+02	1.10E+03	3.45E+00	8.77E-02		
Scandium (21)	Sc-46	1.62E-11	3.07E-12	6.22E-12	8.88E-12	2.47E-11	9.63E-06	1.05E+00	9.33E-01	1.69E+00	3.81E+00	7.66E+00	1.99E-01		
Scandium (21)	Sc-47	1.00E-11		3.49E-12	5.11E-12	3.05E-12	3.62E-07	6.92E+02	2.40E+02	1.13E+03	2.54E+03	1.36E+01	3.45E-01		
Scandium (21)	Sc-48	1.93E-11		7.33E-12	1.05E-11	3.96E-12	1.62E-05	2.87E+01	2.64E+01	4.64E+01	1.04E+02	6.50E+00	1.68E-01		
Scandium (21)	Sc-49	5.25E-13		2.05E-13	2.92E-13	1.07E-13	1.90E-08	1.11E+06	3.63E+05	1.81E+06	4.06E+06	2.32E+02	6.04E+00		
Selenium (34)	Se-70	6.92E-13		2.95E-13	4.11E-13	7.36E-14	4.22E-06	7.03E+03	6.91E+03	1.14E+04	2.56E+04	1.61E+02	4.29E+00		
Selenium (34)	Se-73	1.99E-12		7.96E-13	1.13E-12	1.99E-13	4.52E-06	6.26E+02	5.98E+02	1.02E+03	2.29E+03	5.98E+01	1.56E+00		
Selenium (34)	Se-73m	2.02E-13		8.29E-14	1.17E-13	2.06E-14	1.06E-06	2.94E+04	2.88E+04	4.76E+04	1.07E+05	5.74E+02	1.51E+01		
Selenium (34)	Se-75	1.67E-11		8.14E-12	1.08E-11	3.77E-12	1.45E-06	4.32E+00	1.93E+00	7.86E+00	1.77E+01	5.85E+00	1.63E-01		
Selenium (34)	Se-77m						2.85E-07	1.47E+07	1.47E+07	2.37E+07	5.33E+07				
Selenium (34)	Se-79	1.60E-11		7.29E-12	9.69E-12	3.33E-12	1.10E-11	6.79E-01	4.25E-02	1.96E+04	4.42E+04	6.53E+00	1.82E-01		
Selenium (34)	Se-81	9.58E-14		4.29E-14	5.92E-14	1.27E-14	4.68E-08	1.38E+06	1.12E+06	2.27E+06	5.12E+06	1.11E+03	2.98E+01		
Selenium (34)	Se-81m	3.24E-13		1.30E-13	1.85E-13	3.54E-14	3.56E-08	5.49E+05	2.91E+05	9.66E+05	2.17E+06	3.66E+02	9.53E+00		
Selenium (34)	Se-83	2.33E-13		1.02E-13	1.43E-13	2.72E-14	1.15E-05	4.71E+03	4.70E+03	7.61E+03	1.71E+04	4.67E+02	1.23E+01		
Silicon (14)	Si-31	1.81E-12		6.48E-13	9.40E-13	3.05E-13	1.11E-08	6.84E+05	5.67E+04	1.13E+06	2.54E+06	7.35E+01	1.88E+00		
Silicon (14)	Si-32	9.81E-12		3.44E-12	5.00E-12	2.93E-10	2.18E-11	8.14E+01	1.29E-01	9.36E+03	2.11E+04	1.38E+01	3.53E-01		
Silver (47)	Ag-102	1.56E-13		7.25E-14	9.95E-14	2.56E-14	1.60E-05	5.91E+03	5.88E+03	9.54E+03	2.15E+04	6.57E+02	1.77E+01	2.73E+13	1.37E+12
Silver (47)	Ag-103	2.96E-13		1.20E-13	1.69E-13	6.07E-14	3.33E-06	5.57E+03	5.34E+03	9.00E+03	2.03E+04	3.97E+02	1.04E+01	6.37E+11	3.18E+10
Silver (47)	Ag-104	3.77E-13		1.65E-13	2.29E-13	6.25E-14	1.25E-05	1.41E+03	1.39E+03	2.28E+03	5.12E+03	2.89E+02	7.70E+00	4.17E+11	2.09E+10
Silver (47)	Ag-104m	2.81E-13		1.21E-13	1.68E-13	4.92E-14	5.50E-06	6.61E+03	6.45E+03	1.07E+04	2.41E+04	3.94E+02	1.05E+01	2.43E+12	1.21E+11
Silver (47)	Ag-105	4.40E-12		1.77E-12	2.49E-12	2.83E-12	2.15E-06	9.33E+00	4.84E+00	1.55E+01	3.49E+01	2.69E+01	7.08E-01	5.35E+04	2.67E+03
Silver (47)	Ag-106	1.34E-13		5.92E-14	8.21E-14	2.72E-14	3.08E-06	1.65E+04	1.61E+04	2.66E+04	6.00E+04	8.04E+02	2.15E+01	9.67E+12	4.84E+11
Silver (47)	Ag-106m	1.14E-11		4.81E-12	6.73E-12	3.54E-12	1.31E-05	7.59E+00	5.35E+00	1.24E+01	2.79E+01	9.90E+00	2.62E-01	4.67E+05	2.34E+04
Silver (47)	Ag-108						8.56E-08	6.01E+06	6.01E+06	9.71E+06	2.18E+07				
Silver (47)	Ag-108m	1.92E-11		8.14E-12	1.12E-11	2.67E-11	7.18E-06	1.62E-02	5.57E-03	3.22E-02	7.25E-02	5.85E+00	1.57E-01	3.99E-01	1.99E-02
Silver (47)	Ag-109m						7.66E-09	2.41E+08	2.41E+08	3.90E+08	8.77E+08				
Silver (47)	Ag-110						1.69E-07	1.76E+07	1.76E+07	2.84E+07	6.40E+07				
Silver (47)	Ag-110m	2.37E-11		9.88E-12	1.37E-11	2.83E-11	1.30E-05	2.54E-01	1.37E-01	4.21E-01	9.47E-01	4.82E+00	1.29E-01	1.58E+02	7.92E+00
Silver (47)	Ag-111	2.37E-11		8.21E-12	1.21E-11	6.66E-12	1.09E-07	2.73E+02	1.09E+01	1.68E+03	3.79E+03	5.80E+00	1.46E-01	3.49E+05	1.75E+04
Silver (47)	Ag-112	5.59E-12		1.99E-12	2.90E-12	7.25E-13	3.23E-06	1.97E+03	1.14E+03	3.26E+03	7.33E+03	2.39E+01	6.08E-01	4.73E+09	2.36E+08
Silver (47)	Ag-115	3.46E-13		1.40E-13	1.98E-13	6.81E-14	3.44E-06	1.77E+04	1.69E+04	2.86E+04	6.44E+04	3.40E+02	8.91E+00	5.89E+12	2.94E+11
Sodium (11)	Na-22	1.97E-11	7.47E-12	9.62E-12	1.26E-11	3.89E-12	1.03E-05	8.57E-02	7.18E-02	1.40E-01	3.15E-01	4.95E+00	1.40E-01		
Sodium (11)	Na-24	2.64E-12		1.23E-12	1.65E-12	4.74E-13	2.20E-05	6.15E+01	6.08E+01	9.95E+01	2.24E+02	3.87E+01	1.07E+00		
Strontium (38)	Sr-80	2.83E-12		1.09E-12	1.55E-12	4.51E-13	5.08E-11	1.56E+05	1.39E+04	3.88E+08	8.72E+08	4.37E+01	1.14E+00	1.25E+10	6.26E+08
Strontium (38)	Sr-81	4.03E-13		1.71E-13	2.39E-13	8.07E-14	5.97E-06	7.99E+03	7.83E+03	1.29E+04	2.91E+04	2.78E+02	7.38E+00	1.23E+12	6.14E+10
Strontium (38)	Sr-82	8.47E-11		3.13E-11	4.48E-11	3.69E-11	5.00E-11	1.50E+01	1.34E+00	1.09E+06	2.45E+06	1.52E+00	3.94E-02	3.36E+03	1.68E+02
Strontium (38)	Sr-83	5.85E-12		2.21E-12	3.17E-12	1.26E-12	3.60E-06	1.67E+02	1.16E+02	2.81E+02	6.33E+02	2.15E+01	5.56E-01	1.63E+07	8.17E+05
Strontium (38)	Sr-85	5.03E-12		2.26E-12	3.11E-12	2.56E-12	2.20E-06	5.54E+00	3.30E+00	9.59E+00	2.16E+01	2.11E+01	5.67E-01	6.93E+03	3.47E+02
Strontium (38)	Sr-85m	3.74E-14		1.67E-14	2.31E-14	8.32E-15	8.21E-07	2.13E+04	2.10E+04	3.45E+04	7.77E+04	2.85E+03	7.63E+01	1.69E+12	8.46E+10
Strontium (38)	Sr-87m	2.69E-13		1.07E-13	1.51E-13	5.62E-14	1.33E-06	5.41E+03	5.11E+03	8.78E+03	1.98E+04	4.45E+02	1.17E+01	4.49E+10	2.24E+09
Strontium (38)	Sr-89	3.47E-11		1.28E-11	1.84E-11	2.34E-11	7.19E-09	1.79E+01	1.61E+00	3.77E+03	8.48E+03	3.72E+00	9.59E-02	2.02E+03	1.01E+02
Strontium (38)	Sr-90	9.18E-11		5.59E-11	6.88E-11	1.05E-10	4.82E-10	4.51E-02	3.34E-03	5.95E+02	1.34E+03	8.52E-01	2.56E-02	2.69E-01	1.34E-02
Strontium (38)	Sr-90+D	1.44E-10	5.92E-11	7.40E-11	9.53E-11	1.13E-10	1.96E-08	3.24E-02	2.41E-03	1.07E+01	2.26E+01	6.44E-01	1.85E-02	2.69E-01	1.34E-02
Strontium (38)	Sr-91	8.81E-12		3.22E-12	4.66E-12	1.70E-12	3.30E-06	6.05E+02	3.60E+02	1.05E+03	2.36E+03	1.48E+01	3.78E-01	1.30E+08	6.52E+06
Strontium (38)	Sr-92	6.18E-12		2.25E-12	3.26E-12	1.03E-12	6.69E-06	1.09E+03	8.79E+02	1.81E+03	4.07E+03	2.12E+01	5.41E-01	2.29E+09	1.15E+08
Sulfur (16)	S-35	1.24E-12	3.27E-13	5.14E-13	3.70E-12	5.03E-12	8.77E-12	2.61E+01	4.75E+00	3.22E+05	6.02E+05	9.26E+01	4.77E-01		

Element (Atomic Number)	Isotope	Toxicity: Soil Ingestion Slope Factor (risk/pCi)	Toxicity: Soil Ingestion Slope Factor-Adult (risk/pCi)	Toxicity: Water Ingestion Slope Factor (risk/pCi)	Toxicity: Food Ingestion Slope Factor (risk/pCi)	Toxicity: Inhalation Slope Factor (risk/pCi)	Toxicity: External Exposure Slope Factor (risk/y per pCi/g)	Preliminary Remediation Goals (PRG): Residential Soil (pCi/g)	PRG: Agricultural Soil (pCi/g)	PRG: Outdoor Worker Soil (pCi/g)	PRG: Indoor Worker Soil (pCi/g)	PRG: Tap Water (pCi/L)	PRG: Fish Ingestion (pCi/g)	Soil to Groundwater: DAF=20 (pCi/g)	Soil to Groundwater: DAF=1 (pCi/g)
Tantalum (73)	Ta-172	2.64E-13		1.14E-13	1.59E-13	7.22E-14	7.04E-06	4.71E+03	4.69E+03	7.60E+03	1.71E+04	4.18E+02	1.11E+01		
Tantalum (73)	Ta-173	2.49E-12		9.03E-13	1.31E-12	4.44E-13	2.38E-06	2.33E+03	2.16E+03	3.78E+03	8.50E+03	5.27E+01	1.35E+00		
Tantalum (73)	Ta-174	4.11E-13		1.62E-13	2.30E-13	1.11E-13	2.55E-06	6.64E+03	6.55E+03	1.07E+04	2.41E+04	2.94E+02	7.67E+00		
Tantalum (73)	Ta-175	2.25E-12		8.70E-13	1.24E-12	4.37E-13	4.16E-06	4.65E+02	4.46E+02	7.52E+02	1.69E+03	5.47E+01	1.42E+00		
Tantalum (73)	Ta-176	3.18E-12		1.25E-12	1.78E-12	5.96E-13	1.06E-05	2.37E+02	2.31E+02	3.83E+02	8.62E+02	3.81E+01	9.91E-01		
Tantalum (73)	Ta-177	1.65E-12		5.88E-13	8.58E-13	4.44E-13	1.20E-07	2.92E+03	1.46E+03	4.83E+03	1.09E+04	8.10E+01	2.06E+00		
Tantalum (73)	Ta-178a						3.29E-07	3.98E+05	3.98E+05	6.43E+05	1.45E+06				
Tantalum (73)	Ta-178b	6.29E-13		2.49E-13	3.53E-13	1.79E-13	3.78E-06	2.44E+03	2.41E+03	3.95E+03	8.88E+03	1.91E+02	5.00E+00		
Tantalum (73)	Ta-179	9.51E-13		3.44E-13	5.00E-13	2.05E-12	3.62E-08	3.35E+01	1.16E+01	5.68E+01	1.28E+02	1.38E+02	3.53E+00		
Tantalum (73)	Ta-180	1.23E-11		4.44E-12	6.44E-12	7.25E-11	2.03E-06	5.43E-02	2.81E-02	1.07E-01	2.40E-01	1.07E+01	2.74E-01		
Tantalum (73)	Ta-180m	8.58E-13		3.03E-13	4.40E-13	1.86E-13	6.13E-08	3.99E+04	1.99E+04	6.61E+04	1.49E+05	1.57E+02	4.01E+00		
Tantalum (73)	Ta-182	2.19E-11		7.96E-12	1.15E-11	3.74E-11	6.04E-06	1.21E+00	9.51E-01	1.97E+00	4.43E+00	5.98E+00	1.53E-01		
Tantalum (73)	Ta-182m	4.44E-14		1.99E-14	2.76E-14	3.41E-14	7.38E-07	1.05E+05	1.04E+05	1.69E+05	3.80E+05	2.39E+03	6.39E+01		
Tantalum (73)	Ta-183	2.38E-11		8.33E-12	1.22E-11	8.81E-12	9.40E-07	1.69E+02	6.05E+01	2.85E+02	6.42E+02	5.72E+00	1.45E-01		
Tantalum (73)	Ta-184	9.81E-12		3.53E-12	5.11E-12	1.73E-12	7.02E-06	3.32E+02	3.00E+02	5.37E+02	1.21E+03	1.35E+01	3.45E-01		
Tantalum (73)	Ta-185	3.92E-13		1.57E-13	2.22E-13	1.18E-13	6.24E-07	3.98E+04	3.79E+04	6.44E+04	1.45E+05	3.03E+02	7.94E+00		
Tantalum (73)	Ta-186	1.19E-13		5.51E-14	7.55E-14	2.69E-14	6.69E-06	1.74E+04	1.73E+04	2.80E+04	6.31E+04	8.64E+02	2.34E+01		
Technetium (43)	Tc-101	6.81E-14		3.06E-14	4.22E-14	1.85E-14	1.37E-06	6.11E+04	5.54E+04	1.01E+05	2.28E+05	1.56E+03	4.18E+01	3.82E+12	1.91E+11
Technetium (43)	Tc-104	3.09E-13		1.38E-13	1.90E-13	5.33E-14	9.75E-06	6.76E+03	6.34E+03	1.11E+04	2.50E+04	3.45E+02	9.28E+00	5.15E+11	2.57E+10
Technetium (43)	Tc-93	3.55E-13		1.59E-13	2.20E-13	6.36E-14	7.31E-06	9.86E+02	8.96E+02	1.63E+03	3.67E+03	2.99E+02	8.02E+00	5.44E+09	2.72E+08
Technetium (43)	Tc-93m	1.55E-13		6.81E-14	9.44E-14	3.17E-14	3.62E-06	7.58E+03	6.97E+03	1.25E+04	2.81E+04	6.99E+02	1.87E+01	1.83E+11	9.13E+09
Technetium (43)	Tc-94	1.48E-12		6.36E-13	8.88E-13	2.80E-13	1.24E-05	3.17E+02	2.57E+02	5.42E+02	1.22E+03	7.49E+01	1.99E+00	4.31E+08	2.16E+07
Technetium (43)	Tc-94m	5.74E-13		2.36E-13	3.32E-13	1.03E-13	8.70E-06	2.61E+03	2.32E+03	4.35E+03	9.80E+03	2.02E+02	5.31E+00	3.69E+10	1.84E+09
Technetium (43)	Tc-95	1.35E-12		5.77E-13	8.03E-13	2.63E-13	3.63E-06	2.36E+02	1.44E+02	4.52E+02	1.02E+03	8.25E+01	2.20E+00	2.83E+07	1.42E+06
Technetium (43)	Tc-95m	4.29E-12		1.80E-12	2.51E-12	3.40E-12	2.93E-06	2.76E+00	1.02E+00	7.65E+00	1.72E+01	2.65E+01	7.03E-01	1.69E+03	8.47E+01
Technetium (43)	Tc-96	7.81E-12		3.42E-12	4.74E-12	2.00E-12	1.16E-05	1.27E+01	6.22E+00	2.75E+01	6.20E+01	1.39E+01	3.72E-01	1.81E+05	9.06E+03
Technetium (43)	Tc-96m	8.36E-14		3.59E-14	5.00E-14	2.05E-14	2.13E-07	9.29E+04	5.56E+04	1.80E+05	4.04E+05	1.33E+03	3.53E+01	2.47E+11	1.24E+10
Technetium (43)	Tc-97	7.40E-13		2.70E-13	3.89E-13	8.51E-13	2.94E-10	3.43E-01	5.05E-02	7.36E+02	1.66E+03	1.76E+02	4.53E+00	7.30E-01	3.65E-02
Technetium (43)	Tc-97m	6.62E-12		2.38E-12	3.44E-12	1.12E-11	1.04E-09	3.38E+00	6.64E-01	1.51E+04	3.40E+04	2.00E+01	5.13E-01	6.30E+02	3.15E+01
Technetium (43)	Tc-98	1.83E-11		7.10E-12	1.01E-11	3.01E-11	6.45E-06	7.49E-03	1.69E-03	3.35E-02	7.55E-02	6.71E+00	1.75E-01	2.78E-02	1.39E-03
Technetium (43)	Tc-99	7.66E-12	1.32E-12	2.75E-12	4.00E-12	1.41E-11	8.14E-11	3.34E-02	4.91E-03	8.94E+02	1.72E+03	1.73E+01	4.41E-01	3.73E+00	1.86E-01
Technetium (43)	Tc-99m	2.03E-13		7.96E-14	1.14E-13	5.70E-14	3.93E-07	6.91E+03	3.84E+03	1.39E+04	3.12E+04	5.98E+02	1.55E+01	2.27E+09	1.13E+08
Tellurium (52)	Te-116	1.75E-12		6.73E-13	9.62E-13	3.20E-13	1.34E-07	3.54E+04	1.23E+04	9.84E+04	2.21E+05	7.08E+01	1.83E+00		
Tellurium (52)	Te-121	3.40E-12		1.46E-12	2.01E-12	1.30E-12	2.46E-06	1.87E+01	1.40E+01	3.27E+01	7.36E+01	3.26E+01	8.77E-01		
Tellurium (52)	Te-121m	1.42E-11		6.40E-12	8.51E-12	1.44E-11	7.83E-07	3.35E+00	1.00E+00	1.13E+01	2.55E+01	7.44E+00	2.07E-01		
Tellurium (52)	Te-123	6.77E-12		4.11E-12	5.11E-12	2.50E-12	2.73E-09	2.16E-01	2.97E-02	7.92E+01	1.78E+02	1.16E+01	3.45E-01		
Tellurium (52)	Te-123m	1.02E-11		4.14E-12	5.66E-12	1.36E-11	4.48E-07	6.94E+00	1.98E+00	2.54E+01	5.72E+01	1.15E+01	3.12E-01		
Tellurium (52)	Te-125m	8.92E-12		3.33E-12	4.70E-12	1.17E-11	6.95E-09	3.04E+01	5.62E+00	3.39E+03	7.63E+03	1.43E+01	3.75E-01		
Tellurium (52)	Te-127	2.87E-12		1.00E-12	1.48E-12	6.11E-13	2.10E-08	1.28E+04	2.60E+03	1.67E+05	3.76E+05	4.76E+01	1.19E+00		
Tellurium (52)	Te-127m	2.25E-11		8.62E-12	1.20E-11	2.58E-11	2.73E-09	6.42E+00	1.17E+00	4.60E+03	1.03E+04	5.52E+00	1.47E-01		
Tellurium (52)	Te-129	4.40E-13		1.71E-13	2.44E-13	9.95E-14	2.45E-07	6.50E+04	4.61E+04	1.16E+05	2.60E+05	2.78E+02	7.23E+00		
Tellurium (52)	Te-129m	4.26E-11		1.53E-11	2.20E-11	2.49E-11	1.38E-07	1.07E+01	2.05E+00	2.95E+02	6.64E+02	3.11E+00	8.02E-02		
Tellurium (52)	Te-131	5.62E-13		2.17E-13	3.05E-13	6.40E-14	1.79E-06	2.68E+04	2.49E+04	4.40E+04	9.90E+04	2.19E+02	5.78E+00		
Tellurium (52)	Te-131m	2.28E-11		8.25E-12	1.19E-11	4.22E-12	6.61E-06	8.68E+01	5.14E+01	1.66E+02	3.72E+02	5.77E+00	1.48E-01		
Tellurium (52)	Te-132	4.77E-11		1.70E-11	2.44E-11	9.32E-12	7.83E-07	8.03E+01	1.82E+01	5.36E+02	1.21E+03	2.80E+00	7.23E-02		
Tellurium (52)	Te-133	5.29E-13		1.92E-13	2.73E-13	4.92E-14	4.29E-06	2.26E+04	2.20E+04	3.67E+04	8.26E+04	2.48E+02	6.46E+00		
Tellurium (52)	Te-133m	2.42E-12		8.73E-13	1.24E-12	2.64E-13	1.09E-05	2.00E+03	1.90E+03	3.26E+03	7.34E+03	5.45E+01	1.42E+00		
Tellurium (52)	Te-134	7.51E-13		3.01E-13	4.18E-13	1.60E-13	3.78E-06	7.63E+03	7.27E+03	1.25E+04	2.80E+04	1.58E+02	4.22E+00		
Terbium (65)	Tb-147	1.37E-12		5.33E-13	7.59E-13	2.26E-13	7.30E-06	1.69E+03	1.66E+03	2.73E+03	6.13E+03	8.93E+01	2.32E+00		
Terbium (65)	Tb-149	2.90E-12		1.08E-12	1.56E-12	1.65E-11	7.60E-06	6.44E+02	6.27E+02	1.04E+03	2.34E+03	4.41E+01	1.13E+00		
Terbium (65)	Tb-150	2.92E-12		1.08E-12	1.56E-12	3.88E-13	7.79E-06	7.98E+02	7.77E+02	1.29E+03	2.90E+03	4.41E+01	1.13E+00		

Element (Atomic Number)	Isotope	Toxicity: Soil Ingestion Slope Factor (risk/pCi)	Toxicity: Soil Ingestion Slope Factor-Adult (risk/pCi)	Toxicity: Water Ingestion Slope Factor (risk/pCi)	Toxicity: Food Ingestion Slope Factor (risk/pCi)	Toxicity: Inhalation Slope Factor (risk/pCi)	Toxicity: External Exposure Slope Factor (risk/y per pCi/g)	Preliminary Remediation Goals (PRG): Residential Soil (pCi/g)	Preliminary Remediation Goals (PRG): Agricultural Soil (pCi/g)	Preliminary Remediation Goals (PRG): Outdoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Indoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Tap Water (pCi/L)	Preliminary Remediation Goals (PRG): Fish Ingestion (pCi/g)	Soil to Groundwater: DAF=20 (pCi/g)	Soil to Groundwater: DAF=1 (pCi/g)
Terbium (65)	Tb-151	3.92E-12		1.49E-12	2.13E-12	7.73E-13	3.65E-06	3.16E+02	2.93E+02	5.11E+02	1.15E+03	3.20E+01	8.28E-01		
Terbium (65)	Tb-153	3.54E-12		1.28E-12	1.86E-12	8.18E-13	7.24E-07	4.99E+02	3.71E+02	8.07E+02	1.82E+03	3.72E+01	9.48E-01		
Terbium (65)	Tb-154	6.51E-12		2.57E-12	3.64E-12	1.14E-12	1.18E-05	8.04E+01	7.72E+01	1.30E+02	2.92E+02	1.85E+01	4.85E-01		
Terbium (65)	Tb-155	2.97E-12		1.08E-12	1.56E-12	8.99E-13	3.26E-07	4.87E+02	2.96E+02	7.89E+02	1.77E+03	4.41E+01	1.13E+00		
Terbium (65)	Tb-156	1.30E-11		4.96E-12	7.10E-12	4.22E-12	8.37E-06	1.89E+01	1.70E+01	3.06E+01	6.89E+01	9.60E+00	2.48E-01		
Terbium (65)	Tb-156m	2.29E-12		8.44E-13	1.22E-12	8.47E-13	2.16E-08	3.71E+04	4.45E+03	6.23E+04	1.40E+05	5.64E+01	1.45E+00		
Terbium (65)	Tb-156n	1.11E-12		4.03E-13	5.85E-13	3.77E-13	4.06E-09	9.09E+05	4.87E+04	1.62E+06	3.64E+06	1.18E+02	3.01E+00		
Terbium (65)	Tb-157	5.29E-13		1.86E-13	2.70E-13	1.46E-12	1.63E-09	6.56E+01	2.40E+00	1.41E+02	3.16E+02	2.56E+02	6.53E+00		
Terbium (65)	Tb-158	1.32E-11		4.88E-12	6.99E-12	8.29E-11	3.57E-06	3.34E-02	2.03E-02	6.42E-02	1.44E-01	9.76E+00	2.52E-01		
Terbium (65)	Tb-160	2.42E-11		8.70E-12	1.27E-11	2.45E-11	5.23E-06	2.24E+00	1.68E+00	3.62E+00	8.14E+00	5.47E+00	1.39E-01		
Terbium (65)	Tb-161	1.38E-11		4.77E-12	7.03E-12	5.03E-12	3.44E-08	3.11E+03	1.24E+02	5.75E+03	1.29E+04	9.98E+00	2.51E-01		
Thallium (81)	Tl-194	3.68E-14		1.81E-14	2.45E-14	5.11E-15	3.25E-06	1.14E+04	1.13E+04	1.84E+04	4.13E+04	2.63E+03	7.20E+01		
Thallium (81)	Tl-194m	1.63E-13		7.81E-14	1.06E-13	2.50E-14	1.01E-05	3.68E+03	3.67E+03	5.95E+03	1.34E+04	6.10E+02	1.66E+01		
Thallium (81)	Tl-195	1.36E-13		6.40E-14	8.70E-14	2.08E-14	6.02E-06	2.91E+03	2.90E+03	4.70E+03	1.06E+04	7.44E+02	2.03E+01		
Thallium (81)	Tl-197	1.41E-13		6.25E-14	8.55E-14	2.39E-14	1.65E-06	4.33E+03	4.28E+03	7.01E+03	1.58E+04	7.62E+02	2.06E+01		
Thallium (81)	Tl-198	4.26E-13		2.06E-13	2.75E-13	7.92E-14	9.67E-06	3.96E+02	3.93E+02	6.41E+02	1.44E+03	2.31E+02	6.41E+00		
Thallium (81)	Tl-198m	2.76E-13		1.30E-13	1.75E-13	4.92E-14	5.04E-06	2.15E+03	2.14E+03	3.48E+03	7.84E+03	3.66E+02	1.01E+01		
Thallium (81)	Tl-199	1.64E-13		7.36E-14	9.99E-14	2.89E-14	8.56E-07	3.19E+03	3.10E+03	5.17E+03	1.16E+04	6.47E+02	1.77E+01		
Thallium (81)	Tl-200	1.31E-12		6.14E-13	8.21E-13	2.52E-13	5.93E-06	1.31E+02	1.26E+02	2.12E+02	4.77E+02	7.76E+01	2.15E+00		
Thallium (81)	Tl-201	8.81E-13		3.61E-13	5.00E-13	1.49E-13	1.88E-07	1.36E+03	8.58E+02	2.39E+03	5.38E+03	1.32E+02	3.53E+00		
Thallium (81)	Tl-202	3.28E-12		1.49E-12	2.01E-12	6.14E-13	1.83E-06	3.66E+01	2.92E+01	6.13E+01	1.38E+02	3.20E+01	8.77E-01		
Thallium (81)	Tl-204	1.54E-11		5.85E-12	8.25E-12	2.45E-12	2.76E-09	2.19E+00	2.72E-01	3.63E+02	8.17E+02	8.14E+00	2.14E-01		
Thallium (81)	Tl-206						6.05E-09	4.80E+07	4.80E+07	7.75E+07	1.74E+08				
Thallium (81)	Tl-207						1.52E-08	1.68E+07	1.68E+07	2.72E+07	6.11E+07				
Thallium (81)	Tl-208						1.76E-05	2.26E+04	2.26E+04	3.65E+04	8.20E+04				
Thallium (81)	Tl-209						9.83E-06	5.64E+04	5.64E+04	9.11E+04	2.05E+05				
Thorium (90)	Th-226	1.58E-12		6.66E-13	9.32E-13	1.56E-10	2.36E-08	1.65E+06	2.65E+05	2.70E+06	6.08E+06	7.15E+01	1.89E+00	3.61E+12	1.81E+11
Thorium (90)	Th-227	1.37E-10		4.74E-11	6.92E-11	3.51E-08	3.78E-07	1.11E+02	4.67E+00	1.93E+02	4.35E+02	1.00E+00	2.55E-02	6.68E+04	3.34E+03
Thorium (90)	Th-228	2.89E-10	6.40E-11	1.07E-10	1.48E-10	1.32E-07	5.59E-09	1.69E+01	6.10E-02	1.39E+02	2.74E+02	4.45E-01	1.19E-02	6.60E+01	3.30E+00
Thorium (90)	Th-228+D	8.09E-10	1.62E-10	3.00E-10	4.22E-10	1.43E-07	7.76E-06	1.53E-01	1.88E-02	2.52E-01	5.67E-01	1.59E-01	4.18E-03	6.60E+01	3.30E+00
Thorium (90)	Th-229	4.96E-10		2.24E-10	2.90E-10	1.75E-07	2.25E-07	3.25E-01	2.14E-03	9.58E-01	2.16E+00	2.13E-01	6.08E-03	6.07E+00	3.03E-01
Thorium (90)	Th-229+D	1.29E-09		5.28E-10	7.16E-10	2.25E-07	1.17E-06	7.59E-02	8.60E-04	1.85E-01	4.16E-01	9.02E-02	2.46E-03	6.07E+00	3.03E-01
Thorium (90)	Th-230	2.02E-10		9.10E-11	1.19E-10	2.85E-08	8.19E-10	2.27E+00	5.23E-03	2.19E+02	4.92E+02	5.23E-01	1.48E-02	6.06E+00	3.03E-01
Thorium (90)	Th-231	6.36E-12		2.21E-12	3.24E-12	1.52E-12	2.45E-08	3.07E+04	1.73E+03	5.25E+04	1.18E+05	2.15E+01	5.44E-01	4.44E+08	2.22E+07
Thorium (90)	Th-232	2.31E-10	8.47E-11	1.01E-10	1.33E-10	4.33E-08	3.42E-10	2.02E+00	4.68E-03	1.98E+01	3.61E+01	4.71E-01	1.33E-02	6.06E+00	3.03E-01
Thorium (90)	Th-234	6.70E-11		2.31E-11	3.40E-11	3.07E-11	1.63E-08	1.12E+03	7.65E+00	3.48E+03	7.83E+03	2.06E+00	5.19E-02	8.26E+04	4.13E+03
Thulium (69)	Tm-162	1.24E-13		5.66E-14	7.77E-14	2.72E-14	8.69E-06	6.46E+03	6.46E+03	1.04E+04	2.35E+04	8.41E+02	2.27E+01		
Thulium (69)	Tm-166	2.86E-12		1.12E-12	1.59E-12	5.14E-13	8.98E-06	2.94E+02	2.87E+02	4.75E+02	1.07E+03	4.25E+01	1.11E+00		
Thulium (69)	Tm-167	9.88E-12		3.46E-12	5.07E-12	4.37E-12	3.97E-07	2.30E+02	8.52E+01	3.73E+02	8.39E+02	1.38E+01	3.48E-01		
Thulium (69)	Tm-170	2.59E-11		8.92E-12	1.31E-11	2.43E-11	1.01E-08	4.78E+02	3.72E+00	1.05E+03	2.36E+03	5.34E+00	1.35E-01		
Thulium (69)	Tm-171	2.02E-12		6.99E-13	1.02E-12	3.33E-12	6.97E-10	1.23E+03	8.81E+00	2.80E+03	6.30E+03	6.81E+01	1.73E+00		
Thulium (69)	Tm-172	3.09E-11		1.08E-11	1.57E-11	5.62E-12	2.35E-06	1.36E+02	7.18E+01	2.20E+02	4.94E+02	4.41E+00	1.12E-01		
Thulium (69)	Tm-173	4.88E-12		1.72E-12	2.52E-12	7.73E-13	1.62E-06	1.52E+03	1.26E+03	2.46E+03	5.53E+03	2.77E+01	7.00E-01		
Thulium (69)	Tm-175	1.19E-13		5.22E-14	7.25E-14	3.26E-14	4.78E-06	1.68E+04	1.67E+04	2.71E+04	6.10E+04	9.12E+02	2.43E+01		
Tin (50)	Sn-110	5.18E-12		1.87E-12	2.71E-12	6.70E-13	1.13E-06	4.49E+03	3.39E+03	7.26E+03	1.63E+04	2.55E+01	6.51E-01		
Tin (50)	Sn-111	1.32E-13		5.51E-14	7.70E-14	2.83E-14	2.29E-06	1.51E+04	1.50E+04	2.44E+04	5.48E+04	8.64E+02	2.29E+01		
Tin (50)	Sn-113	1.22E-11		4.33E-12	6.33E-12	1.00E-11	2.02E-08	3.00E+02	8.38E+00	5.89E+02	1.32E+03	1.10E+01	2.79E-01		
Tin (50)	Sn-117m	1.25E-11		4.37E-12	6.40E-12	8.84E-12	4.69E-07	1.31E+02	4.66E+01	2.14E+02	4.82E+02	1.09E+01	2.76E-01		
Tin (50)	Sn-119m	6.36E-12		2.21E-12	3.24E-12	7.81E-12	1.20E-09	8.38E+02	6.56E+00	3.89E+03	8.75E+03	2.15E+01	5.44E-01		
Tin (50)	Sn-121	4.33E-12		1.50E-12	2.20E-12	1.02E-12	1.30E-10	4.52E+05	2.51E+03	9.32E+06	2.10E+07	3.17E+01	8.02E-01		
Tin (50)	Sn-121m	6.66E-12		2.34E-12	3.41E-12	1.54E-11	8.85E-10	4.13E+01	2.30E-01	2.85E+02	6.41E+02	2.04E+01	5.17E-01		

Element (Atomic Number)	Isotope	Toxicity: Soil Ingestion Slope Factor (risk/pCi)	Toxicity: Soil Ingestion Slope Factor-Adult (risk/pCi)	Toxicity: Water Ingestion Slope Factor (risk/pCi)	Toxicity: Food Ingestion Slope Factor (risk/pCi)	Toxicity: Inhalation Slope Factor (risk/pCi)	Toxicity: External Exposure Slope Factor (risk/y per pCi/g)	Preliminary Remediation Goals (PRG): Residential Soil (pCi/g)	PRG: Agricultural Soil (pCi/g)	PRG: Outdoor Worker Soil (pCi/g)	PRG: Indoor Worker Soil (pCi/g)	PRG: Tap Water (pCi/L)	PRG: Fish Ingestion (pCi/g)	Soil to Groundwater: DAF=20 (pCi/g)	Soil to Groundwater: DAF=1 (pCi/g)
Tin (50)	Sn-123	4.03E-11		1.40E-11	2.05E-11	3.03E-11	3.88E-08	1.24E+02	2.33E+00	2.73E+02	6.15E+02	3.40E+00	8.60E-02		
Tin (50)	Sn-123m	1.94E-13		7.96E-14	1.12E-13	5.62E-14	4.62E-07	6.58E+04	6.37E+04	1.06E+05	2.39E+05	5.98E+02	1.57E+01		
Tin (50)	Sn-125	5.81E-11		2.01E-11	2.95E-11	1.41E-11	1.53E-06	5.66E+01	1.59E+01	9.27E+01	2.09E+02	2.37E+00	5.98E-02		
Tin (50)	Sn-126	7.07E-11		2.56E-11	3.69E-11	9.95E-11	9.96E-08	8.93E-01	1.64E-02	2.17E+00	4.89E+00	1.86E+00	4.78E-02		
Tin (50)	Sn-127	2.22E-12		8.25E-13	1.19E-12	4.40E-13	9.25E-06	1.05E+03	1.03E+03	1.69E+03	3.80E+03	5.77E+01	1.48E+00		
Tin (50)	Sn-128	1.09E-12		4.33E-13	6.14E-13	2.29E-13	2.62E-06	7.87E+03	7.63E+03	1.27E+04	2.86E+04	1.10E+02	2.87E+00		
Titanium (22)	Ti-44	6.73E-11		2.56E-11	3.64E-11	3.41E-10	2.39E-07	5.55E-01	2.16E-02	1.08E+00	2.43E+00	1.86E+00	4.85E-02		
Titanium (22)	Ti-45	1.75E-12		6.44E-13	9.32E-13	3.09E-13	3.79E-06	1.74E+03	1.69E+03	2.81E+03	6.33E+03	7.39E+01	1.89E+00		
Tungsten (74)	W-176	1.05E-12		4.11E-13	5.88E-13	1.24E-13	3.20E-07	2.74E+04	2.18E+04	4.46E+04	1.00E+05	1.16E+02	3.00E+00		
Tungsten (74)	W-177	5.00E-13		2.01E-13	2.84E-13	5.99E-14	3.63E-06	2.49E+03	2.46E+03	4.02E+03	9.04E+03	2.37E+02	6.21E+00		
Tungsten (74)	W-178	3.33E-12		1.21E-12	1.75E-12	3.85E-13	1.59E-08	1.80E+03	1.43E+02	3.96E+03	8.92E+03	3.94E+01	1.01E+00		
Tungsten (74)	W-179	1.68E-14		7.22E-15	1.01E-14	1.83E-15	6.01E-08	5.41E+05	5.28E+05	8.74E+05	1.97E+06	6.60E+03	1.75E+02		
Tungsten (74)	W-181	1.07E-12		3.96E-13	5.70E-13	1.35E-13	4.86E-08	1.39E+02	5.30E+01	2.33E+02	5.23E+02	1.20E+02	3.09E+00		
Tungsten (74)	W-185	8.36E-12		2.93E-12	4.29E-12	9.36E-13	2.92E-10	7.84E+02	1.80E+01	6.24E+04	1.40E+05	1.63E+01	4.11E-01		
Tungsten (74)	W-187	1.03E-11		3.67E-12	5.37E-12	1.11E-12	2.04E-06	4.13E+02	3.01E+02	6.73E+02	1.51E+03	1.30E+01	3.28E-01		
Tungsten (74)	W-188	4.00E-11		1.40E-11	2.05E-11	4.63E-12	7.02E-09	1.64E+02	4.06E+00	2.81E+03	6.32E+03	3.40E+00	8.60E-02		
Uranium (92)	U-230	5.66E-10		2.09E-10	2.98E-10	4.55E-08	3.07E-09	1.96E+02	6.25E-01	1.97E+04	4.43E+04	2.28E-01	5.92E-03	3.58E+12	1.79E+11
Uranium (92)	U-231	5.00E-12		1.75E-12	2.56E-12	1.80E-12	1.60E-07	1.25E+03	2.80E+02	2.04E+03	4.58E+03	2.72E+01	6.89E-01	8.74E+13	4.37E+12
Uranium (92)	U-232	5.74E-10		2.92E-10	3.85E-10	1.95E-08	5.98E-10	5.30E-01	1.20E-03	3.41E+02	7.67E+02	1.63E-01	4.58E-03	8.86E+06	4.43E+05
Uranium (92)	U-233	1.60E-10		7.18E-11	9.69E-11	1.16E-08	9.82E-10	1.74E+00	3.96E-03	2.06E+02	4.63E+02	6.63E-01	1.82E-02	3.47E+03	1.74E+02
Uranium (92)	U-234	1.58E-10	5.11E-11	7.07E-11	9.55E-11	1.14E-08	2.52E-10	1.79E+00	4.01E-03	3.31E+01	6.01E+01	6.74E-01	1.85E-02	2.24E+03	1.12E+02
Uranium (92)	U-235	1.57E-10	4.92E-11	6.96E-11	9.44E-11	1.01E-08	5.18E-07	1.92E-01	3.96E-03	4.13E-01	9.26E-01	6.84E-01	1.87E-02	7.77E-01	3.89E-02
Uranium (92)	U-235+D	1.63E-10	5.49E-10	7.18E-11	9.76E-11	1.01E-08	5.43E-07	1.84E-01	3.83E-03	3.55E-01	7.77E-01	6.63E-01	1.81E-02	7.77E-01	3.89E-02
Uranium (92)	U-236	1.49E-10		6.70E-11	9.03E-11	1.05E-08	1.25E-10	1.90E+00	4.24E-03	1.15E+03	2.59E+03	7.11E-01	1.95E-02	2.33E+01	1.16E+00
Uranium (92)	U-237	1.39E-11		4.88E-12	7.14E-12	6.44E-12	3.76E-07	3.29E+02	6.48E+01	5.39E+02	1.21E+03	9.76E+00	2.47E-01	3.30E+13	1.65E+12
Uranium (92)	U-238	1.43E-10	4.66E-11	6.40E-11	8.66E-11	9.32E-09	4.99E-11	1.98E+00	4.43E-03	3.75E+01	6.77E+01	7.44E-01	2.04E-02	1.21E-01	6.04E-03
Uranium (92)	U-238+D	2.10E-10	2.52E-09	8.71E-11	1.21E-10	9.35E-09	1.14E-07	5.75E-01	3.15E-03	5.14E-01	9.79E-01	5.47E-01	1.46E-02	1.21E-01	6.04E-03
Uranium (92)	U-239	1.90E-13		7.40E-14	1.06E-13	5.70E-14	1.21E-07	4.28E+05	3.60E+05	6.93E+05	1.56E+06	6.44E+02	1.66E+01	5.59E+18	2.80E+17
Uranium (92)	U-240	2.02E-11		7.03E-12	1.03E-11	2.96E-12	7.33E-10	1.83E+05	6.40E+02	3.18E+06	7.15E+06	6.77E+00	1.71E-01	4.30E+15	2.15E+14
Vanadium (23)	V-47	2.92E-13		1.25E-13	1.74E-13	5.96E-14	4.36E-06	8.58E+03	8.53E+03	1.39E+04	3.12E+04	3.81E+02	1.01E+01		
Vanadium (23)	V-48	2.13E-11		8.21E-12	1.17E-11	9.29E-12	1.40E-05	3.73E+00	3.36E+00	6.03E+00	1.36E+01	5.80E+00	1.51E-01		
Vanadium (23)	V-49	3.53E-13		1.22E-13	1.79E-13	1.47E-13	0.00E+00	5.17E+04	1.07E+02	4.73E+09	1.06E+10	3.90E+02	9.85E+00		
Xenon (54)	Xe-120						1.70E-06	1.79E+04	1.79E+04	2.90E+04	6.52E+04				
Xenon (54)	Xe-121						8.73E-06	3.48E+03	3.48E+03	5.63E+03	1.27E+04				
Xenon (54)	Xe-122						1.83E-07	5.52E+03	5.52E+03	8.92E+03	2.01E+04				
Xenon (54)	Xe-123						2.72E-06	3.59E+03	3.59E+03	5.80E+03	1.31E+04				
Xenon (54)	Xe-125						9.38E-07	1.27E+03	1.27E+03	2.06E+03	4.63E+03				
Xenon (54)	Xe-127						9.52E-07	2.44E+01	2.44E+01	3.95E+01	8.88E+01				
Xenon (54)	Xe-129m						4.25E-08	2.49E+03	2.49E+03	4.02E+03	9.05E+03				
Xenon (54)	Xe-131m						1.41E-08	5.05E+03	5.05E+03	8.15E+03	1.83E+04				
Xenon (54)	Xe-133						6.62E-08	2.44E+03	2.44E+03	3.94E+03	8.85E+03				
Xenon (54)	Xe-133m						9.25E-08	4.18E+03	4.18E+03	6.75E+03	1.52E+04				
Xenon (54)	Xe-135						9.70E-07	2.30E+03	2.30E+03	3.72E+03	8.38E+03				
Xenon (54)	Xe-135m						1.86E-06	4.28E+04	4.28E+04	6.92E+04	1.56E+05				
Xenon (54)	Xe-138						5.62E-06	1.53E+04	1.53E+04	2.47E+04	5.55E+04				
Ytterbium (70)	Yb-162	1.21E-13		5.22E-14	7.29E-14	3.00E-14	3.26E-07	1.98E+05	1.92E+05	3.20E+05	7.19E+05	9.12E+02	2.42E+01		
Ytterbium (70)	Yb-166	1.17E-11		4.37E-12	6.29E-12	2.89E-12	9.46E-08	3.72E+03	3.83E+02	6.12E+03	1.38E+04	1.09E+01	2.80E-01		
Ytterbium (70)	Yb-167	3.70E-14		1.56E-14	2.18E-14	1.71E-14	6.21E-07	1.12E+05	1.12E+05	1.81E+05	4.08E+05	3.05E+03	8.09E+01		
Ytterbium (70)	Yb-169	1.12E-11		4.00E-12	5.85E-12	1.08E-11	7.75E-07	3.41E+01	1.70E+01	5.52E+01	1.24E+02	1.19E+01	3.01E-01		
Ytterbium (70)	Yb-175	8.29E-12		2.87E-12	4.22E-12	2.95E-12	1.54E-07	1.30E+03	2.81E+02	2.12E+03	4.77E+03	1.66E+01	4.18E-01		
Ytterbium (70)	Yb-177	9.51E-13		3.46E-13	5.03E-13	2.29E-13	8.35E-07	1.28E+04	1.19E+04	2.07E+04	4.66E+04	1.38E+02	3.51E+00		

Radionuclide Toxicity and Preliminary Remediation Goals for Superfund

Element (Atomic Number)	Isotope	Toxicity: Soil Ingestion Slope Factor (risk/pCi)	Toxicity: Soil Ingestion Slope Factor-Adult (risk/pCi)	Toxicity: Water Ingestion Slope Factor (risk/pCi)	Toxicity: Food Ingestion Slope Factor (risk/pCi)	Toxicity: Inhalation Slope Factor (risk/pCi)	Toxicity: External Exposure Slope Factor (risk/y per pCi/g)	Preliminary Remediation Goals (PRG): Residential Soil (pCi/g)	Preliminary Remediation Goals (PRG): Agricultural Soil (pCi/g)	Preliminary Remediation Goals (PRG): Outdoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Indoor Worker Soil (pCi/g)	Preliminary Remediation Goals (PRG): Tap Water (pCi/L)	Preliminary Remediation Goals (PRG): Fish Ingestion (pCi/g)	Soil to Groundwater: DAF=20 (pCi/g)	Soil to Groundwater: DAF=1 (pCi/g)
Ytterbium (70)	Yb-178	1.06E-12		3.89E-13	5.59E-13	2.38E-13	1.44E-07	1.14E+05	7.53E+04	1.85E+05	4.16E+05	1.22E+02	3.16E+00		
Yttrium (39)	Y-86	1.05E-11		4.07E-12	5.81E-12	1.58E-12	1.73E-05	7.99E+01	7.64E+01	1.29E+02	2.90E+02	1.17E+01	3.04E-01		
Yttrium (39)	Y-86m	6.11E-13		2.35E-13	3.35E-13	9.29E-14	8.35E-07	3.04E+04	2.88E+04	4.91E+04	1.11E+05	2.03E+02	5.26E+00		
Yttrium (39)	Y-87	6.92E-12		2.58E-12	3.70E-12	1.49E-12	1.94E-06	1.30E+02	1.04E+02	2.11E+02	4.74E+02	1.85E+01	4.77E-01		
Yttrium (39)	Y-88	9.92E-12		4.18E-12	5.85E-12	1.70E-11	1.37E-05	5.77E-01	5.46E-01	9.33E-01	2.10E+00	1.14E+01	3.01E-01		
Yttrium (39)	Y-90	5.25E-11		1.81E-11	2.65E-11	8.40E-12	1.91E-08	8.45E+03	8.79E+01	2.69E+04	6.04E+04	2.63E+00	6.66E-02		
Yttrium (39)	Y-90m	2.95E-12		1.04E-12	1.51E-12	4.81E-13	2.58E-06	2.47E+03	2.29E+03	3.99E+03	8.97E+03	4.58E+01	1.17E+00		
Yttrium (39)	Y-91	4.66E-11		1.60E-11	2.35E-11	3.36E-11	2.51E-08	3.49E+02	4.51E+00	9.31E+02	2.10E+03	2.98E+00	7.50E-02		
Yttrium (39)	Y-91m	8.51E-14		3.52E-14	4.96E-14	3.01E-14	2.34E-06	1.05E+04	1.05E+04	1.69E+04	3.81E+04	1.35E+03	3.56E+01		
Yttrium (39)	Y-92	7.03E-12		2.48E-12	3.61E-12	9.32E-13	1.26E-06	4.55E+03	3.28E+03	7.36E+03	1.66E+04	1.92E+01	4.89E-01		
Yttrium (39)	Y-93	2.08E-11		7.18E-12	1.05E-11	2.64E-12	4.60E-07	4.30E+03	1.07E+03	7.07E+03	1.59E+04	6.63E+00	1.68E-01		
Yttrium (39)	Y-94	3.08E-13		1.37E-13	1.90E-13	5.51E-14	5.45E-06	1.17E+04	1.17E+04	1.89E+04	4.26E+04	3.48E+02	9.28E+00		
Yttrium (39)	Y-95	1.59E-13		7.25E-14	9.99E-14	2.92E-14	4.80E-06	2.37E+04	2.37E+04	3.83E+04	8.63E+04	6.57E+02	1.77E+01		
Zinc (30)	Zn-62	1.34E-11		4.96E-12	7.25E-12	2.65E-12	1.87E-06	9.31E+02	2.88E+01	1.90E+03	4.27E+03	9.60E+00	2.43E-01	2.23E+07	1.11E+06
Zinc (30)	Zn-63	3.77E-13		1.61E-13	2.26E-13	7.55E-14	4.87E-06	6.55E+03	4.45E+03	1.06E+04	2.39E+04	2.96E+02	7.80E+00	1.46E+11	7.30E+09
Zinc (30)	Zn-65	2.45E-11		1.17E-11	1.54E-11	5.81E-12	2.81E-06	9.03E-01	2.16E-02	1.99E+00	4.49E+00	4.07E+00	1.15E-01	5.60E+01	2.80E+00
Zinc (30)	Zn-69	1.79E-13		7.22E-14	1.03E-13	6.11E-14	1.67E-09	2.49E+06	2.02E+04	2.07E+07	4.66E+07	6.60E+02	1.71E+01	1.45E+11	7.27E+09
Zinc (30)	Zn-69m	5.07E-12		1.86E-12	2.73E-12	1.28E-12	1.77E-06	7.54E+02	4.94E+01	1.34E+03	3.02E+03	2.56E+01	6.46E-01	2.68E+07	1.34E+06
Zinc (30)	Zn-71m	2.50E-12		9.66E-13	1.39E-12	5.33E-13	6.84E-06	7.48E+02	2.45E+02	1.22E+03	2.75E+03	4.93E+01	1.27E+00	6.38E+08	3.19E+07
Zinc (30)	Zn-72	1.71E-11		6.59E-12	9.44E-12	5.48E-12	4.68E-07	3.97E+02	4.49E+00	1.51E+03	3.39E+03	7.23E+00	1.87E-01	6.65E+05	3.33E+04
Zirconium (40)	Zr-86	1.02E-11		3.85E-12	5.55E-12	1.56E-12	1.04E-06	1.18E+03	6.89E+02	1.91E+03	4.30E+03	1.24E+01	3.18E-01		
Zirconium (40)	Zr-88	3.74E-12		1.58E-12	2.18E-12	8.95E-12	1.65E-06	6.15E+00	5.22E+00	9.94E+00	2.24E+01	3.01E+01	8.09E-01		
Zirconium (40)	Zr-89	9.58E-12		3.60E-12	5.18E-12	1.92E-12	5.38E-06	4.82E+01	4.27E+01	7.78E+01	1.75E+02	1.32E+01	3.40E-01		
Zirconium (40)	Zr-93	2.12E-12		1.11E-12	1.44E-12	7.29E-12	0.00E+00	2.07E+02	4.32E-01	4.97E+06	1.12E+07	4.29E+01	1.22E+00		
Zirconium (40)	Zr-95	1.23E-11		4.59E-12	6.59E-12	1.65E-11	3.40E-06	3.89E+00	3.09E+00	6.29E+00	1.41E+01	1.04E+01	2.68E-01		
Zirconium (40)	Zr-97	3.57E-11		1.25E-11	1.83E-11	4.81E-12	8.62E-07	1.38E+03	3.62E+02	2.25E+03	5.07E+03	3.81E+00	9.64E-02		