

**WAC 246-221-300 Appendix B—Minimum quantities of radioactive material requiring labeling.**

Minimum Quantities<sup>1</sup> of Radioactive Material Requiring Labeling

Radionuclide	Quantity*( $\mu$ Ci)
Actinium-224	1
Actinium-225	0.01
Actinium-226	0.1
Actinium-227	0.001
Actinium-228	1
Aluminum-26	10
Americium-237	1,000
Americium-238	100
Americium-239	1,000
Americium-240	100
Americium-241	0.001
Americium-242	10
Americium-242m	0.001
Americium-243	0.001
Americium-244	10
Americium-244m	100
Americium-245	1,000
Americium-246	1,000
Americium-246m	1,000
Antimony-115	1,000
Antimony-116	1,000
Antimony-116m	1,000
Antimony-117	1,000
Antimony-118m	1,000
Antimony-119	1,000
Antimony-120 (16min)	1,000
Antimony-120 (5.76d)	100
Antimony-122	100
Antimony-124	10
Antimony-124m	1,000
Antimony-125	100
Antimony-126	100
Antimony-126m	1,000
Antimony-127	100
Antimony-128 (9.01h)	100
Antimony-128 (10.4min)	1,000
Antimony-129	100
Antimony-130	1,000
Antimony-131	1,000
Argon-39	1,000
Argon-41	1,000
Arsenic-69	1,000
Arsenic-70	1,000

Radionuclide	Quantity*( $\mu$ Ci)
Arsenic-71	100
Arsenic-72	100
Arsenic-73	100
Arsenic-74	100
Arsenic-76	100
Arsenic-77	100
Arsenic-78	1,000
Astatine-207	100
Astatine-211	10
Barium-126	1,000
Barium-128	100
Barium-131	100
Barium-131m	1,000
Barium-133	100
Barium-133m	100
Barium-135m	100
Barium-139	1,000
Barium-140	100
Barium-141	1,000
Barium-142	1,000
Berkelium-245	100
Berkelium-246	100
Berkelium-247	0.001
Berkelium-249	0.1
Berkelium-250	10
Beryllium-7	1,000
Beryllium-10	1
Bismuth-200	1,000
Bismuth-201	1,000
Bismuth-202	1,000
Bismuth-203	100
Bismuth-205	100
Bismuth-206	100
Bismuth-207	10
Bismuth-210	1
Bismuth-210m	0.1
Bismuth-212	10
Bismuth-213	10
Bismuth-214	100
Bromine-74	1,000
Bromine-74m	1,000
Bromine-75	1,000
Bromine-76	100
Bromine-77	1,000
Bromine-80	1,000
Bromine-80m	1,000
Bromine-82	100

Radionuclide	Quantity*( $\mu$ Ci)
Bromine-83	1,000
Bromine-84	1,000
Cadmium-104	1,000
Cadmium-107	1,000
Cadmium-109	1
Cadmium-113	100
Cadmium-113m	0.1
Cadmium-115	100
Cadmium-115m	10
Cadmium-117	1,000
Cadmium-117m	1,000
Calcium-41	100
Calcium-45	100
Calcium-47	100
Californium-244	100
Californium-246	1
Californium-248	0.01
Californium-249	0.001
Californium-250	0.001
Californium-251	0.001
Californium-252	0.001
Californium-253	0.1
Californium-254	0.001
Carbon-11	1,000
Carbon-14	1,000
Cerium-134	100
Cerium-135	100
Cerium-137	1,000
Cerium-137m	100
Cerium-139	100
Cerium-141	100
Cerium-143	100
Cerium-144	1
Cesium-125	1,000
Cesium-127	1,000
Cesium-129	1,000
Cesium-130	1,000
Cesium-131	1,000
Cesium-132	100
Cesium-134	10
Cesium-134m	1,000
Cesium-135	100
Cesium-135m	1,000
Cesium-136	10
Cesium-137	10
Cesium-138	1,000
Chlorine-36	10

Radionuclide	Quantity*( $\mu$ Ci)
Chlorine-38	1,000
Chlorine-39	1,000
Chromium-48	1,000
Chromium-49	1,000
Chromium-51	1,000
Cobalt-55	100
Cobalt-56	10
Cobalt-57	100
Cobalt-58	100
Cobalt-58m	1,000
Cobalt-60	1
Cobalt-60m	1,000
Cobalt-61	1,000
Cobalt-62m	1,000
Copper-60	1,000
Copper-61	1,000
Copper-64	1,000
Copper-67	1,000
Curium-238	100
Curium-240	0.1
Curium-241	1
Curium-242	0.01
Curium-243	0.001
Curium-244	0.001
Curium-245	0.001
Curium-246	0.001
Curium-247	0.001
Curium-248	0.001
Curium-249	1,000
Dysprosium-155	1,000
Dysprosium-157	1,000
Dysprosium-159	100
Dysprosium-165	1,000
Dysprosium-166	100
Einsteinium-250	100
Einsteinium-251	100
Einsteinium-253	0.1
Einsteinium-254	0.01
Einsteinium-254m	1
Erbium-161	1,000
Erbium-165	1,000
Erbium-169	100
Erbium-171	100
Erbium-172	100
Europium-145	100
Europium-146	100
Europium-147	100

Radionuclide	Quantity*( $\mu$ Ci)
Europium-148	10
Europium-149	100
Europium-150 (12.62h)	100
Europium-150 (34.2y)	1
Europium-152	1
Europium-152m	100
Europium-154	1
Europium-155	10
Europium-156	100
Europium-157	100
Europium-158	1,000
Fermium-252	1
Fermium-253	1
Fermium-254	10
Fermium-255	1
Fermium-257	0.01
Fluorine-18	1,000
Francium-222	100
Francium-223	100
Gadolinium-145	1,000
Gadolinium-146	10
Gadolinium-147	100
Gadolinium-148	0.001
Gadolinium-149	100
Gadolinium-151	10
Gadolinium-152	100
Gadolinium-153	10
Gadolinium-159	100
Gallium-65	1,000
Gallium-66	100
Gallium-67	1,000
Gallium-68	1,000
Gallium-70	1,000
Gallium-72	100
Gallium-73	1,000
Germanium-66	1,000
Germanium-67	1,000
Germanium-68	10
Germanium-69	1,000
Germanium-71	1,000
Germanium-75	1,000
Germanium-77	1,000
Germanium-78	1,000
Gold-193	1,000
Gold-194	100
Gold-195	10
Gold-198	100

Radionuclide	Quantity*( $\mu$ Ci)
Gold-198m	100
Gold-199	100
Gold-200	1,000
Gold-200m	100
Gold-201	1,000
Hafnium-170	100
Hafnium-172	1
Hafnium-173	1,000
Hafnium-175	100
Hafnium-177m	1,000
Hafnium-178m	0.1
Hafnium-179m	10
Hafnium-180m	1,000
Hafnium-181	10
Hafnium-182	0.1
Hafnium-182m	1,000
Hafnium-183	1,000
Hafnium-184	100
Holmium-155	1,000
Holmium-157	1,000
Holmium-159	1,000
Holmium-161	1,000
Holmium-162	1,000
Holmium-162m	1,000
Holmium-164	1,000
Holmium-164m	1,000
Holmium-166	100
Holmium-166m	1
Holmium-167	1,000
Hydrogen-3	1,000
Indium-109	1,000
Indium-110 (4.9h)	1,000
Indium-110m (69.1min)	1,000
Indium-111	100
Indium-112	1,000
Indium-113m	1,000
Indium-114m	10
Indium-115	100
Indium-115m	1,000
Indium-116m	1,000
Indium-117	1,000
Indium-117m	1,000
Indium-119m	1,000
Iodine-120	100
Iodine-120m	1,000
Iodine-121	1,000
Iodine-123	100

Radionuclide	Quantity*( $\mu$ Ci)
Iodine-124	10
Iodine-125	1
Iodine-126	1
Iodine-128	1,000
Iodine-129	1
Iodine-130	10
Iodine-131	1
Iodine-132	100
Iodine-132m	100
Iodine-133	10
Iodine-134	1,000
Iodine-135	100
Iridium-182	1,000
Iridium-184	1,000
Iridium-185	1,000
Iridium-186	100
Iridium-187	1,000
Iridium-188	100
Iridium-189	100
Iridium-190	100
Iridium-190m	1,000
Iridium-192 (73.8d)	1
Iridium-192m (1.4min)	10
Iridium-194	100
Iridium-194m	10
Iridium-195	1,000
Iridium-195m	1,000
Iron-52	100
Iron-55	100
Iron-59	10
Iron-60	1
Krypton-74	1,000
Krypton-76	1,000
Krypton-77	1,000
Krypton-79	1,000
Krypton-81	1,000
Krypton-83m	1,000
Krypton-85	1,000
Krypton-85m	1,000
Krypton-87	1,000
Krypton-88	1,000
Lanthanum-131	1,000
Lanthanum-132	100
Lanthanum-135	1,000
Lanthanum-137	10
Lanthanum-138	100
Lanthanum-140	100

Radionuclide	Quantity*( $\mu$ Ci)
Lanthanum-141	100
Lanthanum-142	1,000
Lanthanum-143	1,000
Lead-195m	1,000
Lead-198	1,000
Lead-199	1,000
Lead-200	100
Lead-201	1,000
Lead-202	10
Lead-202m	1,000
Lead-203	1,000
Lead-205	100
Lead-209	1,000
Lead-210	0.01
Lead-211	100
Lead-212	1
Lead-214	100
Lutetium-169	100
Lutetium-170	100
Lutetium-171	100
Lutetium-172	100
Lutetium-173	10
Lutetium-174	10
Lutetium-174m	10
Lutetium-176	100
Lutetium-176m	1,000
Lutetium-177	100
Lutetium-177m	10
Lutetium-178	1,000
Lutetium-178m	1,000
Lutetium-179	1,000
Magnesium-28	100
Manganese-51	1,000
Manganese-52	100
Manganese-52m	1,000
Manganese-53	1,000
Manganese-54	100
Manganese-56	1,000
Mendelevium-257	10
Mendelevium-258	0.01
Mercury-193	1,000
Mercury-193m	100
Mercury-194	1
Mercury-195	1,000
Mercury-195m	100
Mercury-197	1,000
Mercury-197m	100



Radionuclide	Quantity*( $\mu$ Ci)
Mercury-199m	1,000
Mercury-203	100
Molybdenum-90	100
Molybdenum-93	10
Molybdenum-93m	100
Molybdenum-99	100
Molybdenum-101	1,000
Neodymium-136	1,000
Neodymium-138	100
Neodymium-139	1,000
Neodymium-139m	1,000
Neodymium-141	1,000
Neodymium-147	100
Neodymium-149	1,000
Neodymium-151	1,000
Neptunium-232	100
Neptunium-233	1,000
Neptunium-234	100
Neptunium-235	100
Neptunium-236 (1.15E+5y)	0.001
Neptunium-236 (22.5h)	1
Neptunium-237	0.001
Neptunium-238	10
Neptunium-239	100
Neptunium-240	1,000
Nickel-56	100
Nickel-57	100
Nickel-59	100
Nickel-63	100
Nickel-65	1,000
Nickel-66	10
Niobium-88	1,000
Niobium-89 (122min)	1,000
Niobium-89m (66min)	1,000
Niobium-90	100
Niobium-93m	10
Niobium-94	1
Niobium-95	100
Niobium-95m	100
Niobium-96	100
Niobium-97	1,000
Niobium-98	1,000
Osmium-180	1,000
Osmium-181	1,000
Osmium-182	100
Osmium-185	100
Osmium-189m	1,000

Radionuclide	Quantity*( $\mu$ Ci)
Osmium-191	100
Osmium-191m	1,000
Osmium-193	100
Osmium-194	1
Palladium-100	100
Palladium-101	1,000
Palladium-103	100
Palladium-107	10
Palladium-109	100
Phosphorus-32	10
Phosphorus-33	100
Platinum-186	1,000
Platinum-188	100
Platinum-189	1,000
Platinum-191	100
Platinum-193	1,000
Platinum-193m	100
Platinum-195m	100
Platinum-197	100
Platinum-197m	1,000
Platinum-199	1,000
Platinum-200	100
Plutonium-234	10
Plutonium-235	1,000
Plutonium-236	0.001
Plutonium-237	100
Plutonium-238	0.001
Plutonium-239	0.001
Plutonium-240	0.001
Plutonium-241	0.01
Plutonium-242	0.001
Plutonium-243	1,000
Plutonium-244	0.001
Plutonium-245	100
Polonium-203	1,000
Polonium-205	1,000
Polonium-207	1,000
Polonium-210	0.1
Potassium-40	100
Potassium-42	1,000
Potassium-43	1,000
Potassium-44	1,000
Potassium-45	1,000
Praseodymium-136	1,000
Praseodymium-137	1,000
Praseodymium-138m	1,000
Praseodymium-139	1,000

Radionuclide	Quantity*( $\mu$ Ci)
Praseodymium-142	100
Praseodymium-142m	1,000
Praseodymium-143	100
Praseodymium-144	1,000
Praseodymium-145	100
Praseodymium-147	1,000
Promethium-141	1,000
Promethium-143	100
Promethium-144	10
Promethium-145	10
Promethium-146	1
Promethium-147	10
Promethium-148	10
Promethium-148m	10
Promethium-149	100
Promethium-150	1,000
Promethium-151	100
Protactinium-227	10
Protactinium-228	1
Protactinium-230	0.1
Protactinium-231	0.001
Protactinium-232	1
Protactinium-233	100
Protactinium-234	100
Radium-223	0.1
Radium-224	0.1
Radium-225	0.1
Radium-226	0.1
Radium-227	1,000
Radium-228	0.1
Radon-220	1
Radon-222	1
Rhenium-177	1,000
Rhenium-178	1,000
Rhenium-181	1,000
Rhenium-182 (64.0h)	100
Rhenium-182 (12.7h)	1,000
Rhenium-184	100
Rhenium-184m	10
Rhenium-186	100
Rhenium-186m	10
Rhenium-187	1,000
Rhenium-188	100
Rhenium-188m	1,000
Rhenium-189	100
Rhodium-99	100
Rhodium-99m	1,000

Radionuclide	Quantity*( $\mu$ Ci)
Rhodium-100	100
Rhodium-101	10
Rhodium-101m	1,000
Rhodium-102	10
Rhodium-102m	10
Rhodium-103m	1,000
Rhodium-105	100
Rhodium-106m	1,000
Rhodium-107	1,000
Rubidium-79	1,000
Rubidium-81	1,000
Rubidium-81m	1,000
Rubidium-82m	1,000
Rubidium-83	100
Rubidium-84	100
Rubidium-86	100
Rubidium-87	100
Rubidium-88	1,000
Rubidium-89	1,000
Ruthenium-94	1,000
Ruthenium-97	1,000
Ruthenium-103	100
Ruthenium-105	1,000
Ruthenium-106	1
Samarium-141	1,000
Samarium-141m	1,000
Samarium-142	1,000
Samarium-145	100
Samarium-146	1
Samarium-147	100
Samarium-151	10
Samarium-153	100
Samarium-155	1,000
Samarium-156	1,000
Scandium-43	1,000
Scandium-44	100
Scandium-44m	100
Scandium-46	10
Scandium-47	100
Scandium-48	100
Scandium-49	1,000
Selenium-70	1,000
Selenium-73	100
Selenium-73m	1,000
Selenium-75	100
Selenium-79	100
Selenium-81	1,000

Radionuclide	Quantity*( $\mu$ Ci)
Selenium-81m	1,000
Selenium-83	1,000
Silicon-31	1,000
Silicon-32	1
Silver-102	1,000
Silver-103	1,000
Silver-104	1,000
Silver-104m	1,000
Silver-105	100
Silver-106	1,000
Silver-106m	100
Silver-108m	1
Silver-111	100
Silver-112	100
Silver-115	1,000
Silver-110m	10
Sodium-22	10
Sodium-24	100
Strontium-80	100
Strontium-81	1,000
Strontium-83	100
Strontium-85	100
Strontium-85m	1,000
Strontium-87m	1,000
Strontium-89	10
Strontium-90	0.1
Strontium-91	100
Strontium-92	100
Sulfur-35	100
Tantalum-172	1,000
Tantalum-173	1,000
Tantalum-174	1,000
Tantalum-175	1,000
Tantalum-176	100
Tantalum-177	1,000
Tantalum-178	1,000
Tantalum-179	100
Tantalum-180	100
Tantalum-180m	1,000
Tantalum-182	10
Tantalum-182m	1,000
Tantalum-183	100
Tantalum-184	100
Tantalum-185	1,000
Tantalum-186	1,000
Technetium-93	1,000
Technetium-93m	1,000

Radionuclide	Quantity*( $\mu$ Ci)
Technetium-94	1,000
Technetium-94m	1,000
Technetium-96	100
Technetium-96m	1,000
Technetium-97	1,000
Technetium-97m	100
Technetium-98	10
Technetium-99	100
Technetium-99m	1,000
Technetium-101	1,000
Technetium-104	1,000
Tellurium-116	1,000
Tellurium-121	100
Tellurium-121m	10
Tellurium-123	100
Tellurium-123m	10
Tellurium-125m	10
Tellurium-127	1,000
Tellurium-127m	10
Tellurium-129	1,000
Tellurium-129m	10
Tellurium-131	100
Tellurium-131m	10
Tellurium-132	10
Tellurium-133	1,000
Tellurium-133m	100
Tellurium-134	1,000
Terbium-147	1,000
Terbium-149	100
Terbium-150	1,000
Terbium-151	100
Terbium-153	1,000
Terbium-154	100
Terbium-155	1,000
Terbium-156	100
Terbium-156m (24.4h)	1,000
Terbium-156m (5.0h)	1,000
Terbium-157	10
Terbium-158	1
Terbium-160	10
Terbium-161	100
Thallium-194	1,000
Thallium-194m	1,000
Thallium-195	1,000
Thallium-197	1,000
Thallium-198	1,000
Thallium-198m	1,000

Radionuclide	Quantity*( $\mu$ Ci)
Thallium-199	1,000
Thallium-200	1,000
Thallium-201	1,000
Thallium-202	100
Thallium-204	100
Thorium-226	10
Thorium-227	0.01
Thorium-228	0.001
Thorium-229	0.001
Thorium-230	0.001
Thorium-231	100
Thorium-232	100
Thorium-234	10
Thorium-natural	100
Thulium-162	1,000
Thulium-166	100
Thulium-167	100
Thulium-170	10
Thulium-171	10
Thulium-172	100
Thulium-173	100
Thulium-175	1,000
Tin-110	100
Tin-111	1,000
Tin-113	100
Tin-117m	100
Tin-119m	100
Tin-121	1,000
Tin-121m	100
Tin-123	10
Tin-123m	1,000
Tin-125	10
Tin-126	10
Tin-127	1,000
Tin-128	1,000
Titanium-44	1
Titanium-45	1,000
Tungsten-176	1,000
Tungsten-177	1,000
Tungsten-178	1,000
Tungsten-179	1,000
Tungsten-181	1,000
Tungsten-185	100
Tungsten-187	100
Tungsten-188	10
Uranium-230	0.01
Uranium-231	100

Radionuclide	Quantity*( $\mu$ Ci)
Uranium-232	0.001
Uranium-233	0.001
Uranium-234	0.001
Uranium-235	0.001
Uranium-236	0.001
Uranium-237	100
Uranium-238	100
Uranium-239	1,000
Uranium-240	100
Uranium-natural	100
Vanadium-47	1,000
Vanadium-48	100
Vanadium-49	1,000
Xenon-120	1,000
Xenon-121	1,000
Xenon-122	1,000
Xenon-123	1,000
Xenon-125	1,000
Xenon-127	1,000
Xenon-129m	1,000
Xenon-131m	1,000
Xenon-133	1,000
Xenon-133m	1,000
Xenon-135	1,000
Xenon-135m	1,000
Xenon-138	1,000
Ytterbium-162	1,000
Ytterbium-166	100
Ytterbium-167	1,000
Ytterbium-169	100
Ytterbium-175	100
Ytterbium-177	1,000
Ytterbium-178	1,000
Yttrium-86	100
Yttrium-86m	1,000
Yttrium-87	100
Yttrium-88	10
Yttrium-90	10
Yttrium-90m	1,000
Yttrium-91	10
Yttrium-91m	1,000
Yttrium-92	100
Yttrium-93	100
Yttrium-94	1,000
Yttrium-95	1,000
Zinc-62	100
Zinc-63	1,000



Radionuclide	Quantity*( $\mu$ Ci)
Zinc-65	10
Zinc-69	1,000
Zinc-69m	100
Zinc-71m	1,000
Zinc-72	100
Zirconium-86	100
Zirconium-88	10
Zirconium-89	100
Zirconium-93	1
Zirconium-95	10
Zirconium-97	100
Any alpha-emitting radionuclide not listed above or mixtures of alpha-emitters of unknown composition	0.001
Any radionuclide other than alpha-emitting radionuclides not listed above, or mixtures of beta emitters of unknown composition	0.01

Note: For purposes of WAC 246 221 120(8), 246 221 130 (7)(a), and 246 221 240(1) where there is involved a combination of radionuclides in known amounts, the limit for the combination shall be derived as follows: Determine, for each radionuclide in the combination, the ratio between the quantity present in the combination and the limit otherwise established for the specific radionuclide when not in combination. The sum of such ratios for all radionuclides in the combination may not exceed "1" — that is, unity.

<sup>1</sup> The quantities listed above were derived by taking 1/10th of the most restrictive ALI listed in Table I, Columns 1 and 2, of WAC 246-221-290, rounding to the nearest factor of 10, and constraining the values listed between 37 Bq and 37 MBq (0.001 and 1,000 $\mu$ Ci). Values of 3.7 MBq (100  $\mu$ Ci) have been assigned for radionuclides having a radioactive half-life in excess of E+9 years, except rhenium, 37 MBq (1,000  $\mu$ Ci), to take into account their low specific activity.

\* To convert  $\mu$ Ci to kBq, multiply the  $\mu$ Ci value by 37.

[Statutory Authority: RCW 70.98.050. WSR 94-01-073, § 246-221-300, filed 12/9/93, effective 1/9/94. Statutory Authority: RCW 70.98.050 and 70.98.080. WSR 91-15-112 (Order 184), § 246-221-300, filed 7/24/91, effective 8/24/91. Statutory Authority: RCW 43.70 040. WSR 91-02-049 (Order 121), recodified as § 246-221-300, filed 12/27/90, effective 1/31/91. Statutory Authority: RCW 70.98.080. WSR 83-19-050 (Order 2026), § 402-24-230, filed 9/16/83. Statutory Authority: RCW 70.98.050. WSR 81-01-011 (Order 1570), § 402-24-230, filed 12/8/80; Order 1095, § 402-24-230, filed 2/6/76; Order 708, § 402-24-230, filed 8/24/72; Order 1, § 402-24-230, filed 7/2/71; Order 1, § 402-24-230, filed 1/8/69; Rules (part), filed 10/26/66.]