

**Chapter DHS 157**

**APPENDIX F**

**Quantities of Licensed Material Requiring Labeling  
(in Atomic Order)**

**Note:** To convert uCi to kBq, multiply the uCi value by 37.

| <b>Radionuclide</b> | <b>Quantity (uCi)</b> | <b>Radionuclide</b> | <b>Quantity (uCi)</b> |
|---------------------|-----------------------|---------------------|-----------------------|
| Hydrogen-3          | 1,000                 | Manganese-51        | 1,000                 |
| Beryllium-7         | 1,000                 | Manganese-52m       | 1,000                 |
| Beryllium-10        | 1                     | Manganese-52        | 100                   |
| Carbon-11           | 1,000                 | Manganese-53        | 1,000                 |
| Carbon-14           | 100                   | Manganese-54        | 100                   |
| Fluorine-18         | 1,000                 | Manganese-56        | 1,000                 |
| Sodium-22           | 10                    | Iron-52             | 100                   |
| Sodium-24           | 100                   | Iron-55             | 100                   |
| Magnesium-28        | 100                   | Iron-59             | 10                    |
| Aluminum-26         | 10                    | Iron-60             | 1                     |
| Silicon-31          | 1,000                 | Cobalt-55           | 100                   |
| Silicon-32          | 1                     | Cobalt-56           | 10                    |
| Phosphorus-32       | 10                    | Cobalt-57           | 100                   |
| Phosphorus-33       | 100                   | Cobalt-58m          | 1,000                 |
| Sulfur-35           | 100                   | Cobalt-58           | 100                   |
| Chlorine-36         | 10                    | Cobalt-60m          | 1,000                 |
| Chlorine-38         | 1,000                 | Cobalt-60           | 1                     |
| Chlorine-39         | 1,000                 | Cobalt-61           | 1,000                 |
| Argon-39            | 1,000                 | Cobalt-62m          | 1,000                 |
| Argon-41            | 1,000                 | Nickel-56           | 100                   |
| Potassium-40        | 100                   | Nickel-57           | 100                   |
| Potassium-42        | 1,000                 | Nickel-59           | 100                   |
| Potassium-43        | 1,000                 | Nickel-63           | 100                   |
| Potassium-44        | 1,000                 | Nickel-65           | 1,000                 |
| Potassium-45        | 1,000                 | Nickel-66           | 10                    |
| Calcium-41          | 100                   | Copper-60           | 1,000                 |
| Calcium-45          | 100                   | Copper-61           | 1,000                 |
| Calcium-47          | 100                   | Copper-64           | 1,000                 |
| Scandium-43         | 1,000                 | Copper-67           | 1,000                 |
| Scandium-44m        | 100                   | Zinc-62             | 100                   |
| Scandium-44         | 100                   | Zinc-63             | 1,000                 |
| Scandium-46         | 10                    | Zinc-65             | 10                    |
| Scandium-47         | 100                   | Zinc-69m            | 100                   |
| Scandium-48         | 100                   | Zinc-69             | 1,000                 |
| Scandium-49         | 1,000                 | Zinc-71m            | 1,000                 |
| Titanium-44         | 1                     | Zinc-72             | 100                   |
| Titanium-45         | 1,000                 | Gallium-65          | 1,000                 |
| Vanadium-47         | 1,000                 | Gallium-66          | 100                   |
| Vanadium-48         | 100                   | Gallium-67          | 1,000                 |
| Vanadium-49         | 1,000                 | Gallium-68          | 1,000                 |
| Chromium-48         | 1,000                 | Gallium-70          | 1,000                 |
| Chromium-49         | 1,000                 | Gallium-72          | 100                   |
| Chromium-51         | 1,000                 | Gallium-73          | 1,000                 |

| Radionuclide | Quantity (uCi) | Radionuclide         | Quantity (uCi) |
|--------------|----------------|----------------------|----------------|
| Germanium-66 | 1,000          | Rubidium-87          | 100            |
| Germanium-67 | 1,000          | Rubidium-88          | 1,000          |
| Germanium-68 | 10             | Rubidium-89          | 1,000          |
| Germanium-69 | 1,000          | Strontium-80         | 100            |
| Germanium-71 | 1,000          | Strontium-81         | 1,000          |
| Germanium-75 | 1,000          | Strontium-83         | 100            |
| Germanium-77 | 1,000          | Strontium-85m        | 1,000          |
| Germanium-78 | 1,000          | Strontium-85         | 100            |
| Arsenic-69   | 1,000          | Strontium-87m        | 1,000          |
| Arsenic-70   | 1,000          | Strontium-89         | 10             |
| Arsenic-71   | 100            | Strontium-90         | 0.1            |
| Arsenic-72   | 100            | Strontium-91         | 100            |
| Arsenic-73   | 100            | Strontium-92         | 100            |
| Arsenic-74   | 100            | Yttrium-86m          | 1,000          |
| Arsenic-76   | 100            | Yttrium-86           | 100            |
| Arsenic-77   | 100            | Yttrium-87           | 100            |
| Arsenic-78   | 1,000          | Yttrium-88           | 10             |
| Selenium-70  | 1,000          | Yttrium-90m          | 1,000          |
| Selenium-73m | 1,000          | Yttrium-90           | 10             |
| Selenium-73  | 100            | Yttrium-91m          | 1,000          |
| Selenium-75  | 100            | Yttrium-91           | 10             |
| Selenium-79  | 100            | Yttrium-92           | 100            |
| Selenium-81m | 1,000          | Yttrium-93           | 100            |
| Selenium-81  | 1,000          | Yttrium-94           | 1,000          |
| Selenium-83  | 1,000          | Yttrium-95           | 1,000          |
| Bromine-74m  | 1,000          | Zirconium-86         | 100            |
| Bromine-74   | 1,000          | Zirconium-88         | 10             |
| Bromine-75   | 1,000          | Zirconium-89         | 100            |
| Bromine-76   | 100            | Zirconium-93         | 1              |
| Bromine-77   | 1,000          | Zirconium-95         | 10             |
| Bromine-80m  | 1,000          | Zirconium-97         | 100            |
| Bromine-80   | 1,000          | Niobium-88           | 1,000          |
| Bromine-82   | 100            | Niobium-89m (66 min) | 1,000          |
| Bromine-83   | 1,000          | Niobium-89 (122 min) | 1,000          |
| Bromine-84   | 1,000          | Niobium-90           | 100            |
| Krypton-74   | 1,000          | Niobium-93m          | 10             |
| Krypton-76   | 1,000          | Niobium-94           | 1              |
| Krypton-77   | 1,000          | Niobium-95m          | 100            |
| Krypton-79   | 1,000          | Niobium-95           | 100            |
| Krypton-81   | 1,000          | Niobium-96           | 100            |
| Krypton-83m  | 1,000          | Niobium-97           | 1,000          |
| Krypton-85m  | 1,000          | Niobium-98           | 1,000          |
| Krypton-85   | 1,000          | Molybdenum-90        | 100            |
| Krypton-87   | 1,000          | Molybdenum-93m       | 100            |
| Krypton-88   | 1,000          | Molybdenum-93        | 10             |
| Rubidium-79  | 1,000          | Molybdenum-99        | 100            |
| Rubidium-81m | 1,000          | Molybdenum-101       | 1,000          |
| Rubidium-81  | 1,000          | Technetium-93m       | 1,000          |
| Rubidium-82m | 1,000          | Technetium-93        | 1,000          |
| Rubidium-83  | 100            | Technetium-94m       | 1,000          |
| Rubidium-84  | 100            | Technetium-94        | 1,000          |
| Rubidium-86  | 100            | Technetium-96m       | 1,000          |

| Radionuclide          | Quantity (uCi) | Radionuclide            | Quantity (uCi) |
|-----------------------|----------------|-------------------------|----------------|
| Technetium-96         | 100            | Indium-110 (4.9 h)      | 1,000          |
| Technetium-97m        | 100            | Indium-111              | 100            |
| Technetium-97         | 1,000          | Indium-112              | 1,000          |
| Technetium-98         | 10             | Indium-113m             | 1,000          |
| Technetium-99m        | 1,000          | Indium-114m             | 10             |
| Technetium-99         | 100            | Indium-115m             | 1,000          |
| Technetium-101        | 1,000          | Indium-115              | 100            |
| Technetium-104        | 1,000          | Indium-116m             | 1,000          |
| Ruthenium-94          | 1,000          | Indium-117m             | 1,000          |
| Ruthenium-97          | 1,000          | Indium-117              | 1,000          |
| Ruthenium-103         | 100            | Indium-119m             | 1,000          |
| Ruthenium-105         | 1,000          | Tin-110                 | 100            |
| Ruthenium-106         | 1              | Tin-111                 | 1,000          |
| Rhodium-99m           | 1,000          | Tin-113                 | 100            |
| Rhodium-99            | 100            | Tin-117m                | 100            |
| Rhodium-100           | 100            | Tin-119m                | 100            |
| Rhodium-101m          | 1,000          | Tin-121m                | 100            |
| Rhodium-101           | 10             | Tin-121                 | 1,000          |
| Rhodium-102m          | 10             | Tin-123m                | 1,000          |
| Rhodium-102           | 10             | Tin-123                 | 10             |
| Rhodium-103m          | 1,000          | Tin-125                 | 10             |
| Rhodium-105           | 100            | Tin-126                 | 10             |
| Rhodium-106m          | 1,000          | Tin-127                 | 1,000          |
| Rhodium-107           | 1,000          | Tin-128                 | 1,000          |
| Palladium-100         | 100            | Antimony-115            | 1,000          |
| Palladium-101         | 1,000          | Antimony-116m           | 1,000          |
| Palladium-103         | 100            | Antimony-116            | 1,000          |
| Palladium-107         | 10             | Antimony-117            | 1,000          |
| Palladium-109         | 100            | Antimony-118m           | 1,000          |
| Silver-102            | 1,000          | Antimony-119            | 1,000          |
| Silver-103            | 1,000          | Antimony-120 (16 min)   | 1,000          |
| Silver-104m           | 1,000          | Antimony-120 (5.76 d)   | 100            |
| Silver-104            | 1,000          | Antimony-122            | 100            |
| Silver-105            | 100            | Antimony-124m           | 1,000          |
| Silver-106m           | 100            | Antimony-124            | 10             |
| Silver-106            | 1,000          | Antimony-125            | 100            |
| Silver-108m           | 1              | Antimony-126m           | 1,000          |
| Silver-110m           | 10             | Antimony-126            | 100            |
| Silver-111            | 100            | Antimony-127            | 100            |
| Silver-112            | 100            | Antimony-128 (10.4 min) | 1,000          |
| Silver-115            | 1,000          | Antimony-128 (9.01 h)   | 100            |
| Cadmium-104           | 1,000          | Antimony-129            | 100            |
| Cadmium-107           | 1,000          | Antimony-130            | 1,000          |
| Cadmium-109           | 1              | Antimony-131            | 1,000          |
| Cadmium-113m          | 0.1            | Tellurium-116           | 1,000          |
| Cadmium-113           | 100            | Tellurium-121m          | 10             |
| Cadmium-115m          | 10             | Tellurium-121           | 100            |
| Cadmium-115           | 100            | Tellurium-123m          | 10             |
| Cadmium-117m          | 1,000          | Tellurium-123           | 100            |
| Cadmium-117           | 1,000          | Tellurium-125m          | 10             |
| Indium-109            | 1,000          | Tellurium-127m          | 10             |
| Indium-110 (69.1 min) | 1,000          | Tellurium-127           | 1,000          |

| Radionuclide   | Quantity (uCi) | Radionuclide      | Quantity (uCi) |
|----------------|----------------|-------------------|----------------|
| Tellurium-129m | 10             | Barium-131m       | 1,000          |
| Tellurium-129  | 1,000          | Barium-131        | 100            |
| Tellurium-131m | 10             | Barium-133m       | 100            |
| Tellurium-131  | 100            | Barium-133        | 100            |
| Tellurium-132  | 10             | Barium-135m       | 100            |
| Tellurium-133m | 100            | Barium-139        | 1,000          |
| Tellurium-133  | 1,000          | Barium-140        | 100            |
| Tellurium-134  | 1,000          | Barium-141        | 1,000          |
| Iodine-120m    | 1,000          | Barium-142        | 1,000          |
| Iodine-120     | 100            | Lanthanum-131     | 1,000          |
| Iodine-121     | 1,000          | Lanthanum-132     | 100            |
| Iodine-123     | 100            | Lanthanum-135     | 1,000          |
| Iodine-124     | 10             | Lanthanum-137     | 10             |
| Iodine-125     | 1              | Lanthanum-138     | 100            |
| Iodine-126     | 1              | Lanthanum-140     | 100            |
| Iodine-128     | 1,000          | Lanthanum-141     | 100            |
| Iodine-129     | 1              | Lanthanum-142     | 1,000          |
| Iodine-130     | 10             | Lanthanum-143     | 1,000          |
| Iodine-131     | 1              | Cerium-134        | 100            |
| Iodine-132m    | 100            | Cerium-135        | 100            |
| Iodine-132     | 100            | Cerium-137m       | 100            |
| Iodine-133     | 10             | Cerium-137        | 1,000          |
| Iodine-134     | 1,000          | Cerium-139        | 100            |
| Iodine-135     | 100            | Cerium-141        | 100            |
| Xenon-120      | 1,000          | Cerium-143        | 100            |
| Xenon-121      | 1,000          | Cerium-144        | 1              |
| Xenon-122      | 1,000          | Praseodymium-136  | 1,000          |
| Xenon-123      | 1,000          | Praseodymium-137  | 1,000          |
| Xenon-125      | 1,000          | Praseodymium-138m | 1,000          |
| Xenon-127      | 1,000          | Praseodymium-139  | 1,000          |
| Xenon-129m     | 1,000          | Praseodymium-142m | 1,000          |
| Xenon-131m     | 1,000          | Praseodymium-142  | 100            |
| Xenon-133m     | 1,000          | Praseodymium-143  | 100            |
| Xenon-133      | 1,000          | Praseodymium-144  | 1,000          |
| Xenon-135m     | 1,000          | Praseodymium-145  | 100            |
| Xenon-135      | 1,000          | Praseodymium-147  | 1,000          |
| Xenon-138      | 1,000          | Neodymium-136     | 1,000          |
| Cesium-125     | 1,000          | Neodymium-138     | 100            |
| Cesium-127     | 1,000          | Neodymium-139m    | 1,000          |
| Cesium-129     | 1,000          | Neodymium-139     | 1,000          |
| Cesium-130     | 1,000          | Neodymium-141     | 1,000          |
| Cesium-131     | 1,000          | Neodymium-147     | 100            |
| Cesium-132     | 100            | Neodymium-149     | 1,000          |
| Cesium-134m    | 1,000          | Neodymium-151     | 1,000          |
| Cesium-134     | 10             | Promethium-141    | 1,000          |
| Cesium-135m    | 1,000          | Promethium-143    | 100            |
| Cesium-135     | 100            | Promethium-144    | 10             |
| Cesium-136     | 10             | Promethium-145    | 10             |
| Cesium-137     | 10             | Promethium-146    | 1              |
| Cesium-138     | 1,000          | Promethium-147    | 10             |
| Barium-126     | 1,000          | Promethium-148m   | 10             |
| Barium-128     | 100            | Promethium-148    | 10             |

| Radionuclide           | Quantity (uCi) | Radionuclide   | Quantity (uCi) |
|------------------------|----------------|----------------|----------------|
| Promethium-149         | 100            | Dysprosium-159 | 100            |
| Promethium-150         | 1,000          | Dysprosium-165 | 1,000          |
| Promethium-151         | 100            | Dysprosium-166 | 100            |
| Samarium-141m          | 1,000          | Holmium-155    | 1,000          |
| Samarium-141           | 1,000          | Holmium-157    | 1,000          |
| Samarium-142           | 1,000          | Holmium-159    | 1,000          |
| Samarium-145           | 100            | Holmium-161    | 1,000          |
| Samarium-146           | 1              | Holmium-162m   | 1,000          |
| Samarium-147           | 100            | Holmium-162    | 1,000          |
| Samarium-151           | 10             | Holmium-164m   | 1,000          |
| Samarium-153           | 100            | Holmium-164    | 1,000          |
| Samarium-155           | 1,000          | Holmium-166m   | 1              |
| Samarium-156           | 1,000          | Holmium-166    | 100            |
| Europium-145           | 100            | Holmium-167    | 1,000          |
| Europium-146           | 100            | Erbium-161     | 1,000          |
| Europium-147           | 100            | Erbium-165     | 1,000          |
| Europium-148           | 10             | Erbium-169     | 100            |
| Europium-149           | 100            | Erbium-171     | 100            |
| Europium-150 (12.62 h) | 100            | Erbium-172     | 100            |
| Europium-150 (34.2 y)  | 1              | Thulium-162    | 1,000          |
| Europium-152m          | 100            | Thulium-166    | 100            |
| Europium-152           | 1              | Thulium-167    | 100            |
| Europium-154           | 1              | Thulium-170    | 10             |
| Europium-155           | 10             | Thulium-171    | 10             |
| Europium-156           | 100            | Thulium-172    | 100            |
| Europium-157           | 100            | Thulium-173    | 100            |
| Europium-158           | 1,000          | Thulium-175    | 1,000          |
| Gadolinium-145         | 1,000          | Ytterbium-162  | 1,000          |
| Gadolinium-146         | 10             | Ytterbium-166  | 100            |
| Gadolinium-147         | 100            | Ytterbium-167  | 1,000          |
| Gadolinium-148         | 0.001          | Ytterbium-169  | 100            |
| Gadolinium-149         | 100            | Ytterbium-175  | 100            |
| Gadolinium-151         | 10             | Ytterbium-177  | 1,000          |
| Gadolinium-152         | 100            | Ytterbium-178  | 1,000          |
| Gadolinium-153         | 10             | Lutetium-169   | 100            |
| Gadolinium-159         | 100            | Lutetium-170   | 100            |
| Terbium-147            | 1,000          | Lutetium-171   | 100            |
| Terbium-149            | 100            | Lutetium-172   | 100            |
| Terbium-150            | 1,000          | Lutetium-173   | 10             |
| Terbium-151            | 100            | Lutetium-174m  | 10             |
| Terbium-153            | 1,000          | Lutetium-174   | 10             |
| Terbium-154            | 100            | Lutetium-176m  | 1,000          |
| Terbium-155            | 1,000          | Lutetium-176   | 100            |
| Terbium-156m (5.0 h)   | 1,000          | Lutetium-177m  | 10             |
| Terbium-156m (24.4 h)  | 1,000          | Lutetium-177   | 100            |
| Terbium-156            | 100            | Lutetium-178m  | 1,000          |
| Terbium-157            | 10             | Lutetium-178   | 1,000          |
| Terbium-158            | 1              | Lutetium-179   | 1,000          |
| Terbium-160            | 10             | Hafnium-170    | 100            |
| Terbium-161            | 100            | Hafnium-172    | 1              |
| Dysprosium-155         | 1,000          | Hafnium-173    | 1,000          |
| Dysprosium-157         | 1,000          | Hafnium-175    | 100            |

| Radionuclide           | Quantity (uCi) | Radionuclide  | Quantity (uCi) |
|------------------------|----------------|---------------|----------------|
| Hafnium-177m           | 1,000          | Iridium-195m  | 1,000          |
| Hafnium-178m           | 0.1            | Iridium-195   | 1,000          |
| Hafnium-179m           | 10             | Platinum-186  | 1,000          |
| Hafnium-180m           | 1,000          | Platinum-188  | 100            |
| Hafnium-181            | 10             | Platinum-189  | 1,000          |
| Hafnium-182m           | 1,000          | Platinum-191  | 100            |
| Hafnium-182            | 0.1            | Platinum-193m | 100            |
| Hafnium-183            | 1,000          | Platinum-193  | 1,000          |
| Hafnium-184            | 100            | Platinum-195m | 100            |
| Tantalum-172           | 1,000          | Platinum-197m | 1,000          |
| Tantalum-173           | 1,000          | Platinum-197  | 100            |
| Tantalum-174           | 1,000          | Platinum-199  | 1,000          |
| Tantalum-175           | 1,000          | Platinum-200  | 100            |
| Tantalum-176           | 100            | Gold-193      | 1,000          |
| Tantalum-177           | 1,000          | Gold-194      | 100            |
| Tantalum-178           | 1,000          | Gold-195      | 10             |
| Tungsten-188           | 10             | Gold-198m     | 100            |
| Rhenium-177            | 1,000          | Gold-198      | 100            |
| Rhenium-178            | 1,000          | Gold-199      | 100            |
| Rhenium-181            | 1,000          | Gold-200m     | 100            |
| Rhenium-182 (12.7 h)   | 1,000          | Gold-200      | 1,000          |
| Rhenium-182 (64.0 h)   | 100            | Gold-201      | 1,000          |
| Rhenium-184m           | 10             | Mercury-193m  | 100            |
| Rhenium-184            | 100            | Mercury-193   | 1,000          |
| Rhenium-186m           | 10             | Mercury-194   | 1              |
| Rhenium-186            | 100            | Mercury-195m  | 100            |
| Rhenium-187            | 1,000          | Mercury-195   | 1,000          |
| Rhenium-188m           | 1,000          | Mercury-197m  | 100            |
| Rhenium-188            | 100            | Mercury-197   | 1,000          |
| Rhenium-189            | 100            | Mercury-199m  | 1,000          |
| Osmium-180             | 1,000          | Mercury-203   | 100            |
| Osmium-181             | 1,000          | Thallium-194m | 1,000          |
| Osmium-182             | 100            | Thallium-194  | 1,000          |
| Osmium-185             | 100            | Thallium-195  | 1,000          |
| Osmium-189m            | 1,000          | Thallium-197  | 1,000          |
| Osmium-191m            | 1,000          | Thallium-198m | 1,000          |
| Osmium-191             | 100            | Thallium-198  | 1,000          |
| Osmium-193             | 100            | Thallium-199  | 1,000          |
| Osmium-194             | 1              | Thallium-201  | 1,000          |
| Iridium-182            | 1,000          | Thallium-200  | 1,000          |
| Iridium-184            | 1,000          | Thallium-202  | 100            |
| Iridium-185            | 1,000          | Thallium-204  | 100            |
| Iridium-186            | 100            | Lead-195m     | 1,000          |
| Iridium-187            | 1,000          | Lead-198      | 1,000          |
| Iridium-188            | 100            | Lead-199      | 1,000          |
| Iridium-189            | 100            | Lead-200      | 100            |
| Iridium-190m           | 1,000          | Lead-201      | 1,000          |
| Iridium-190            | 100            | Lead-202m     | 1,000          |
| Iridium-192m (1.4 min) | 10             | Lead-202      | 10             |
| Iridium-192 (73.8 d)   | 1              | Lead-203      | 1,000          |
| Iridium-194m           | 10             | Lead-205      | 100            |
| Iridium-194            | 100            | Lead-209      | 1,000          |

| Radionuclide     | Quantity (uCi) | Radionuclide              | Quantity (uCi) |
|------------------|----------------|---------------------------|----------------|
| Lead-210         | 0.01           | Protactinium-234          | 100            |
| Lead-211         | 100            | Uranium-230               | 0.01           |
| Lead-212         | 1              | Uranium-231               | 100            |
| Lead-214         | 100            | Uranium-232               | 0.001          |
| Bismuth-200      | 1,000          | Uranium-233               | 0.001          |
| Bismuth-201      | 1,000          | Uranium-234               | 0.001          |
| Bismuth-202      | 1,000          | Uranium-235               | 0.001          |
| Bismuth-203      | 100            | Uranium-236               | 0.001          |
| Bismuth-205      | 100            | Uranium-237               | 100            |
| Bismuth-206      | 100            | Uranium-238               | 100            |
| Bismuth-207      | 10             | Uranium-239               | 1,000          |
| Bismuth-210m     | 0.1            | Uranium-240               | 100            |
| Bismuth-210      | 1              | Uranium-natural           | 100            |
| Bismuth-212      | 10             | Neptunium-232             | 100            |
| Bismuth-213      | 10             | Neptunium-233             | 1,000          |
| Bismuth-214      | 100            | Neptunium-234             | 100            |
| Polonium-203     | 1,000          | Neptunium-235             | 100            |
| Polonium-205     | 1,000          | Neptunium-236 (1.15E+5 y) | 0.001          |
| Polonium-207     | 1,000          | Neptunium-236 (22.5 h)    | 1              |
| Polonium-210     | 0.1            | Neptunium-237             | 0.001          |
| Astatine-207     | 100            | Neptunium-238             | 10             |
| Astatine-211     | 10             | Neptunium-239             | 100            |
| Radon-220        | 1              | Neptunium-240             | 1,000          |
| Radon-222        | 1              | Plutonium-234             | 10             |
| Francium-222     | 100            | Plutonium-235             | 1,000          |
| Francium-223     | 100            | Plutonium-236             | 0.001          |
| Radium-223       | 0.1            | Plutonium-237             | 100            |
| Radium-224       | 0.1            | Plutonium-238             | 0.001          |
| Radium-225       | 0.1            | Plutonium-239             | 0.001          |
| Radium-226       | 0.1            | Plutonium-240             | 0.001          |
| Radium-227       | 1,000          | Plutonium-241             | 0.01           |
| Radium-228       | 0.1            | Plutonium-242             | 0.001          |
| Actinium-224     | 1              | Plutonium-243             | 1,000          |
| Actinium-225     | 0.01           | Plutonium-244             | 0.001          |
| Actinium-226     | 0.1            | Plutonium-245             | 100            |
| Actinium-227     | 0.001          | Americium-237             | 1,000          |
| Actinium-228     | 1              | Americium-238             | 100            |
| Thorium-226      | 10             | Americium-239             | 1,000          |
| Thorium-227      | 0.01           | Americium-240             | 100            |
| Thorium-228      | 0.001          | Americium-241             | 0.001          |
| Thorium-229      | 0.001          | Americium-242m            | 0.001          |
| Thorium-230      | 0.001          | Americium-242             | 10             |
| Thorium-231      | 100            | Americium-243             | 0.001          |
| Thorium-232      | 100            | Americium-244m            | 100            |
| Thorium-234      | 10             | Americium-244             | 10             |
| Thorium-natural  | 100            | Americium-245             | 1,000          |
| Protactinium-227 | 10             | Americium-246m            | 1,000          |
| Protactinium-228 | 1              | Americium-246             | 1,000          |
| Protactinium-230 | 0.1            | Curium-238                | 100            |
| Protactinium-231 | 0.001          | Curium-240                | 0.1            |
| Protactinium-232 | 1              | Curium-241                | 1              |
| Protactinium-233 | 100            |                           |                |

| Radionuclide                                                                                                                                  | Quantity (uCi) | Radionuclide     | Quantity (uCi) |
|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------------|----------------|
| Curium-242                                                                                                                                    | 0.01           | Californium-250  | 0.001          |
| Curium-243                                                                                                                                    | 0.001          | Californium-251  | 0.001          |
| Curium-244                                                                                                                                    | 0.001          | Californium-252  | 0.001          |
| Curium-245                                                                                                                                    | 0.001          | Californium-253  | 0.1            |
| Curium-246                                                                                                                                    | 0.001          | Californium-254  | 0.001          |
| Curium-247                                                                                                                                    | 0.001          | Einsteinium-250  | 100            |
| Curium-248                                                                                                                                    | 0.001          | Einsteinium-251  | 100            |
| Curium-249                                                                                                                                    | 1,000          | Einsteinium-253  | 0.1            |
| Berkelium-245                                                                                                                                 | 100            | Einsteinium-254m | 1              |
| Berkelium-246                                                                                                                                 | 100            | Einsteinium-254  | 0.01           |
| Berkelium-247                                                                                                                                 | 0.001          | Fermium-252      | 1              |
| Berkelium-249                                                                                                                                 | 0.1            | Fermium-253      | 1              |
| Berkelium-250                                                                                                                                 | 10             | Fermium-254      | 10             |
| Californium-244                                                                                                                               | 100            | Fermium-255      | 1              |
| Californium-246                                                                                                                               | 1              | Fermium-257      | 0.01           |
| Californium-248                                                                                                                               | 0.01           | Mendelevium-257  | 10             |
| Californium-249                                                                                                                               | 0.001          | Mendelevium-258  | 0.01           |
| 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 s. DHS 157.29 (1) (e), (5) (a) and s. DHS 157.32 (1) (a) 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.

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