# Great Majority of Radionuclides Excluded from Testing

**TABLE 4-2**
**RADIONUCLIDES USED AT HPS**

| Radionuclide | Half-Life | Radiation |
|---|---|---|
| Ac-227 (Actinium) | 21.8 Years | Alpha, beta, and gamma |
| Ag-110m (Silver) | 249.9 Seconds | Beta and gamma |
| Am-241 (Americium) | 432.7 Years | Alpha and gamma |
| Am-243 | 7,370 Years | Alpha gamma |
| As-73 (Arsenic) | 80.3 Days | Beta and gamma |
| As-76 | 26.3 Hours | Beta and gamma |
| Au-195 (Gold) | 186 Days | Gamma |
| Au-198 | 2.7 Days | Beta and gamma |
| Ba-133 (Barium) | 10.5 Years | Beta and gamma |
| Ba-140 | 12.8 Days | Beta and gamma |
| Be-7 (Beryllium) | 52.28 Days | Beta and gamma |
| Bi-207 (Bismuth) | 32 Years | Beta and gamma |
| Bi-210 | 5.08 Days | Beta and gamma |
| Br-82 (Bromine) | 1.47 Days | Beta and gamma |
| C-14 (Carbon) | 5715 Years | Beta |
| Ca-45 (Calcium) | 163.7 Days | Beta and gamma |
| Cd-109 (Cadmium) | 463 Days | Gamma |
| Ce-139 | 1.20 Days | Beta and gamma |
| Ce-141 (Cerium) | 32.5 Days | Beta and gamma |
| Ce-144 | 284.8 Days | Beta and gamma |
| Cf-252 (Californium) | 2.65 Years | Alpha, beta, and gamma |
| Cl-36 (Chlorine) | $3.01 \times 10^{5}$ Years | Beta |
| Cm-242 (Curium) | 162.8 Days | Alpha and gamma |
| Cm-244 | 18.1 Years | Alpha and gamma |
| Co-57 (Cobalt) | 271 Days | Gamma |
| Co-58 | 70.9 Days | Beta and gamma |
| Co-60* | 5.27 Years | Beta and gamma |
| Cr-51 (Chromium) | 27.7 Days | Gamma |
| Cs-134 (Cesium) | 2.07 Years | Beta and gamma |
| Cs-137* | 30.1 Years | Beta and gamma |
| Eu-152 (European) | 13.3 Years | Beta and gamma |
| Eu-154 | 8.6 Years | Beta and gamma |
| Eu-155 | 4.8 Years | Beta and gamma |
| Fe-59 | 44.5 Days | Beta and gamma |
| Ga-67 (Gallium) | 3.25 Days | Gamma |
| Ga-68 | 45.3 Days | Beta and gamma |
| Gd-153 (Gadolinium) | $2.4 \times 10^{5}$ Years | Alpha |
| Ge-68 (Germanium) | 270.8 Days | Beta and gamma |
| H-3 (Tritium) | 12.3 Years | Beta |
| Hg-203 (Mercury) | 46.6 Days | Beta and gamma |

**TABLE 4-2**
**RADIONUCLIDES USED AT HPS**

| Radionuclide | Half-Life | Radiation |
|---|---|---|
| I-125 (Iodine) | 59.4 Days | Beta and gamma |
| I-129 | $1.57 \times 10^{7}$ Years | Beta and gamma |
| I-131 | 8 Days | Beta and gamma |
| In-115 (Indium) | $4.4 \times 10^{14}$ Years | Beta |
| Ir-192* (Iridium) | 73.8 Days | Beta and gamma |
| K-40 (Potassium) | $1.27 \times 10^{9}$ Years | Beta and gamma |
| K-42 | 12.36 Hours | Beta and gamma |
| Kr-85 (Krypton) | 10.76 Years | Beta and gamma |
| La-140 (Lanthanum) | 1.68 Days | Beta and gamma |
| Lu-177 (Lutetium) | 6.72 Days | Beta and gamma |
| Mn-54 (Manganese) | 312.1 Days | Beta and gamma |
| Mo-99 (Molybdenum) | 2.75 Days | Beta and gamma |
| Na-22 (Sodium) | 2.6 Years | Beta* and gamma |
| Na-24 | 14.95 Hours | Beta and gamma |
| Nb-94 (Niobium) | $2 \times 10^{4}$ Years | Beta and gamma |
| Nd-147 (Neodymium) | 10.98 Days | Beta and gamma |
| Ni-63 (Nickel) | 100 Years | Beta |
| Np-237 (Neptunium) | $2.14 \times 10^{6}$ Years | Alpha and gamma |
| P-32 (Phosphorus) | 14.28 Days | Beta |
| Pa-234 (Protactinium) | 6.7 Hours | Beta and gamma |
| Pb-210 (Lead) | 22.6 Years | Beta and gamma |
| Pd-109 (Palladium) | 13.5 Hour | Beta and gamma |
| Pm-147 (Promethium) | 2.62 Years | Beta and gamma |
| Po-210 (Polonium) | 138.4 Days | Alpha and gamma |
| Pr-143 (Praseodymium) | 13.57 Days | Beta and gamma |
| Pt-193 | 50.39 Months | Beta and gamma |
| Pu-232 (Plutonium) | 45.2 Days | Alpha and gamma |
| Pu-238 | 87.7 Years | Alpha and gamma |
| Pu-239* | $2.41 \times 10^{4}$ Years | Alpha and gamma |
| Ra-226* (Radium) | 1,599 Years | Alpha and gamma |
| Ra-228 | 5.75 Days | Alpha and gamma |
| Rb-86 (Rubidium) | 18.65 Days | Beta and gamma |
| Ru-103 (Ruthenium) | 39.27 Days | Beta and gamma |
| Ru-106 | 1.02 Years | Beta |
| S-35 (Sulfur) | 87.2 Days | Beta |
| Sb-125 (Antimony) | 2.76 Years | Beta and gamma |
| Sc-46 (Scandium) | 83.8 Days | Beta and gamma |
| Se-75 (Selenium) | 119.8 Days | Gamma |
| Sm-147 (Samarium) | 340 Days | Gamma |
| Sn-113 | 1.93 Days | Beta and gamma |

**TABLE 4-2**
**RADIONUCLIDES USED AT HPS**

| Radionuclide | Half-Life | Radiation |
|---|---|---|
| Sn-117m (Tin) | 13.61 Days | Beta and gamma |
| Sr-85 (Strontium) | 64.84 Days | Gamma |
| Sr-89 | 50.52 Days | Beta and gamma |
| Sr-90* | 28.78 Years | Beta |
| Ta-182 (Tantalum) | 114.4 Days | Beta and gamma |
| Tb-161 (Terbium) | 6.91 Days | Beta and gamma |
| Tc-97 (Technetium) | $2.6 \times 10^{6}$ Years | Beta and gamma |
| Tc-99 | $2.1 \times 10^{5}$ Years | Beta and gamma |
| Te-127 (Tellurium) | 9.4 Hours | Beta and gamma |
| Te-133 | 12.4 Minutes | Beta and gamma |
| Te-133m | 55.4 Minutes | Beta and gamma |
| Th-228* (Thorium) | 1.91 Years | Alpha and gamma |
| Th-232 | $1.4 \times 10^{10}$ Years | Alpha |
| Tl-44 (Thallium) | 67 Years | Gamma |
| Tl-204 (Thallium) | 3.78 Years | Beta |
| Tm-170 (Thulium) | 128.6 Days | Beta and gamma |
| Tm-171 | 1.92 Years | Beta and gamma |
| U-232 (Uranium) | $1.59 \times 10^{2}$ Years | Alpha and gamma |
| U-235 | $7.04 \times 10^{8}$ Years | Alpha and gamma |
| U-236 | $2.34 \times 10^{7}$ Years | Alpha and gamma |
| U-238 | $4.468 \times 10^{9}$ Years | Alpha and gamma |
| W-185 (Tungsten) | 74.8 Days | Beta and gamma |
| Xe-133 (Xenon) | 5.24 Days | Beta and gamma |
| Y-88 (Yttrium) | 106.7 Days | Beta* and gamma |
| Y-90 | 2.67 Days | Beta and gamma |
| Y-91 | 58.5 Days | Beta and gamma |
| Zn-65 (Zinc) | 243.8 Days | Beta* and gamma |
| Zr-95 (Zirconium) | 64 Days | Beta and gamma |

**Over 100 radionuclides used**

from US Navy, 2004 Historical Radiological Assessment Volume 2, Table 4-2