

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA (FLIP) U OF WI
SNF ID #: 1035
Fuel Units & Descr: 9 - ELEMENT
Heavy Metal Mass: BOL=1.573kg EOL=1.573kg
ROD Storage Site: INEEL

Fuel decay start date: 2035
Estimates as of: 2030
Template: TRIGA-FLIP (LW/U-Zrx SST, 60 to 100%, U)
Template Burnup (MWd): 66.52
Template BOL Heavy Metal Mass (MT): 0.000196
Template Decay Time: 5 years

Estimated
Canister usage
18"x10"
0.08

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|---------------------|------------------------------|
| | m | x _a | x _b | b | y _a | y _b | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Avg MeV | |
| Ac-227 | 2.8488E-10 | 59.32 | 118.64 | 0.00E+00 | 1.69E-08 | 3.38E-08 | 0.0150 | 1.914E+13 |
| Am-241 | 7.5767E-03 | 59.32 | 118.64 | 0.00E+00 | 4.49E-01 | 8.99E-01 | 0.0250 | 4.201E+12 |
| Am-242m | 2.4459E-05 | 59.32 | 118.64 | 0.00E+00 | 1.45E-03 | 2.90E-03 | 0.0375 | 3.716E+12 |
| Am-243 | 3.0983E-05 | 59.32 | 118.64 | 0.00E+00 | 1.84E-03 | 3.68E-03 | 0.0575 | 3.709E+12 |
| C-14 | 1.2590E-04 | 59.32 | 118.64 | 0.00E+00 | 7.47E-03 | 1.49E-02 | 0.0850 | 2.308E+12 |
| Cl-36 | 2.6624E-06 | 59.32 | 118.64 | 0.00E+00 | 1.58E-04 | 3.16E-04 | 0.1250 | 1.853E+12 |
| Cm-243 | 3.8244E-05 | 59.32 | 118.64 | 0.00E+00 | 2.27E-03 | 4.54E-03 | 0.2250 | 1.961E+12 |
| Cm-244 | 4.1010E-03 | 59.32 | 118.64 | 0.00E+00 | 2.43E-01 | 4.87E-01 | 0.3750 | 9.786E+11 |
| Co-60 | 1.2410E+00 | 59.32 | 118.64 | 0.00E+00 | 7.36E+01 | 1.47E+02 | 0.5750 | 1.620E+13 |
| Cs-134 | 6.5454E-01 | 59.32 | 118.64 | 0.00E+00 | 3.88E+01 | 7.77E+01 | 0.8500 | 2.971E+12 |
| Cs-135 | 1.9753E-05 | 59.32 | 118.64 | 0.00E+00 | 1.17E-03 | 2.34E-03 | 1.2500 | 1.141E+13 |
| Cs-137 | 2.7375E+00 | 59.32 | 118.64 | 0.00E+00 | 1.62E+02 | 3.25E+02 | 1.7500 | 1.526E+10 |
| Eu-154 | 1.2324E-01 | 59.32 | 118.64 | 0.00E+00 | 7.31E+00 | 1.46E+01 | 2.2500 | 1.196E+10 |
| Eu-155 | 5.3037E-02 | 59.32 | 118.64 | 0.00E+00 | 3.15E+00 | 6.29E+00 | 2.7500 | 1.085E+08 |
| Fe-55 | 7.9555E-01 | 59.32 | 118.64 | 0.00E+00 | 4.72E+01 | 9.44E+01 | 3.5000 | 1.277E+07 |
| H-3 | 1.0531E-02 | 59.32 | 118.64 | 0.00E+00 | 6.25E-01 | 1.25E+00 | 5.0000 | 3.059E+03 |
| I-129 | 7.1287E-07 | 59.32 | 118.64 | 0.00E+00 | 4.23E-05 | 8.46E-05 | 7.0000 | 3.520E+02 |
| Kr-85 | 2.4955E-01 | 59.32 | 118.64 | 0.00E+00 | 1.48E+01 | 2.96E+01 | 11.0000 | 4.039E+01 |
| Np-237 | 1.2121E-05 | 59.32 | 118.64 | 0.00E+00 | 7.19E-04 | 1.44E-03 | | |
| Pa-231 | 1.1230E-09 | 59.32 | 118.64 | 0.00E+00 | 6.66E-08 | 1.33E-07 | | |
| Pb-210 | 6.1636E-14 | 59.32 | 118.64 | 0.00E+00 | 3.66E-12 | 7.31E-12 | | |
| Pm-147 | 1.1302E+00 | 59.32 | 118.64 | 0.00E+00 | 6.70E+01 | 1.34E+02 | | |
| Pu-238 | 5.4826E-02 | 59.32 | 118.64 | 0.00E+00 | 3.25E+00 | 6.50E+00 | | |
| Pu-239 | 1.4056E-03 | 59.32 | 118.64 | 0.00E+00 | 8.34E-02 | 1.67E-01 | | |
| Pu-240 | 1.1536E-03 | 59.32 | 118.64 | 0.00E+00 | 6.84E-02 | 1.37E-01 | | |
| Pu-241 | 4.2995E-01 | 59.32 | 118.64 | 0.00E+00 | 2.55E+01 | 5.10E+01 | | |
| Pu-242 | 4.9910E-06 | 59.32 | 118.64 | 0.00E+00 | 2.96E-04 | 5.92E-04 | | |
| Ra-226 | 2.4008E-13 | 59.32 | 118.64 | 0.00E+00 | 1.42E-11 | 2.85E-11 | | |
| Ra-228 | 1.8220E-11 | 59.32 | 118.64 | 0.00E+00 | 1.08E-09 | 2.16E-09 | | |
| Ru-106 | 1.0343E-01 | 59.32 | 118.64 | 0.00E+00 | 6.14E+00 | 1.23E+01 | | |
| Se-79 | 1.2832E-05 | 59.32 | 118.64 | 0.00E+00 | 7.61E-04 | 1.52E-03 | | |
| Sn-126 | 1.2090E-05 | 59.32 | 118.64 | 0.00E+00 | 7.17E-04 | 1.43E-03 | | |
| Sr-90 | 2.5646E+00 | 59.32 | 118.64 | 0.00E+00 | 1.52E+02 | 3.04E+02 | | |
| Tc-99 | 4.0319E-04 | 59.32 | 118.64 | 0.00E+00 | 2.39E-02 | 4.78E-02 | | |
| Th-229 | 7.7375E-11 | 59.32 | 118.64 | 0.00E+00 | 4.59E-09 | 9.18E-09 | | |
| Th-230 | 1.2211E-10 | 59.32 | 118.64 | 0.00E+00 | 7.24E-09 | 1.45E-08 | | |
| Th-232 | 2.3842E-11 | 59.32 | 118.64 | 0.00E+00 | 1.41E-09 | 2.83E-09 | | |
| Ti-208 | 1.4313E-07 | 59.32 | 118.64 | 0.00E+00 | 8.49E-06 | 1.70E-05 | | |
| U-232 | 4.1927E-07 | 59.32 | 118.64 | 0.00E+00 | 2.49E-05 | 4.97E-05 | | |
| U-233 | 6.8491E-08 | 59.32 | 118.64 | 0.00E+00 | 4.06E-06 | 8.13E-06 | | |
| U-234 | 2.0189E-06 | 59.32 | 118.64 | 0.00E+00 | 1.20E-04 | 2.40E-04 | | |
| U-235 | -2.6572E-06 | 59.32 | 0.00 | 2.38E-03 | 2.22E-03 | 2.38E-03 | | |
| U-236 | 1.3575E-05 | 59.32 | 118.64 | 0.00E+00 | 8.05E-04 | 1.61E-03 | | |
| U-238 | -2.2698E-08 | 59.32 | 0.00 | 1.59E-04 | 1.58E-04 | 1.59E-04 | | |
| Y-90 | 2.5646E+00 | 59.32 | 118.64 | 0.00E+00 | 1.52E+02 | 3.04E+02 | | |
| Other Radionuclides | | | | | 2.11E+02 | 4.23E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | SST | SST |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 69.93004832 | 60 to 100 |

Basis for Parameter Differences:

Burnup Summary (MWd)⁴

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | 59.32 | |
| Bounding | | 118.64 |

Basis for burnup used in estimate:

Nominal burnup taken directly from SFD (converted to MWd)
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|-----------------------------------|
| Nominal | 0.11 | 0.00 |
| Bounding | 0.22 | |

Estimated EOL HM/Given EOL HM

0.96

¹ Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

² Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA (FLIP) UNIV OF WISCONSIN
 SNF ID #: 242
 Fuel Units & Descr: 92 - ELEMENT
 Heavy Metal Mass: BOL=18 032kg; EOL=15 53kg
 ROD Storage Site: INEEL

Fuel decay start date: 2035
 Estimates as of: 2030
 Template: TRIGA-FLIP (LW/U-Zr, SST, 60 to 100%, U)
 Template Burnup (MWd): 66 52
 Template BOL Heavy Metal Mass (MT): 0 000196
 Template Decay Time: 5 years

Estimated
 Canister usage
 18"x10"
 0 83

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2 848E-10 | 2,378 33 | 4,756 66 | 0 00E+00 | 6 78E-07 | 1 36E-06 | Avg MeV | |
| Am-241 | 7 5767E-03 | 2,378 33 | 4,756 66 | 0 00E+00 | 1 80E+01 | 3 60E+01 | 0 0150 | 7 675E+14 |
| Am-242m | 2 4459E-05 | 2,378 33 | 4,756 66 | 0 00E+00 | 5 82E-02 | 1 16E-01 | 0 0250 | 1 684E+14 |
| Am-243 | 3 0983E-05 | 2,378 33 | 4,756 66 | 0 00E+00 | 7 37E-02 | 1 47E-01 | 0 0375 | 1 490E+14 |
| C-14 | 1 2590E-04 | 2,378 33 | 4,756 66 | 0 00E+00 | 2 99E-01 | 5 99E-01 | 0 0575 | 1 487E+14 |
| Cl-36 | 2 6624E-06 | 2,378 33 | 4,756 66 | 0 00E+00 | 6 33E-03 | 1 27E-02 | 0 0850 | 9 252E+13 |
| Cm-243 | 3 8244E-05 | 2,378 33 | 4,756 66 | 0 00E+00 | 9 10E-02 | 1 82E-01 | 0 1250 | 7 429E+13 |
| Cm-244 | 4 1010E-03 | 2,378 33 | 4,756 66 | 0 00E+00 | 9 75E+00 | 1 95E+01 | 0 2250 | 7 863E+13 |
| Co-60 | 1 2410E+00 | 2,378 33 | 4,756 66 | 0 00E+00 | 2 95E+03 | 5 90E+03 | 0 3750 | 3 923E+13 |
| Cs-134 | 6 5454E-01 | 2,378 33 | 4,756 66 | 0 00E+00 | 1 56E+03 | 3 11E+03 | 0 5750 | 6 493E+14 |
| Cs-135 | 1 9753E-05 | 2,378 33 | 4,756 66 | 0 00E+00 | 4 70E-02 | 9 40E-02 | 0 8500 | 1 191E+14 |
| Cs-137 | 2 7375E+00 | 2,378 33 | 4,756 66 | 0 00E+00 | 6 51E+03 | 1 30E+04 | 1 2500 | 4 575E+14 |
| Eu-154 | 1 2324E-01 | 2,378 33 | 4,756 66 | 0 00E+00 | 2 93E+02 | 5 86E+02 | 1 7500 | 6 120E+11 |
| Eu-155 | 5 3037E-02 | 2,378 33 | 4,756 66 | 0 00E+00 | 1 26E+02 | 2 52E+02 | 2 2500 | 4 797E+11 |
| Fe-55 | 7 9555E-01 | 2,378 33 | 4,756 66 | 0 00E+00 | 1 89E+03 | 3 78E+03 | 2 7500 | 4 349E+09 |
| H-3 | 1 0531E-02 | 2,378 33 | 4,756 66 | 0 00E+00 | 2 50E+01 | 5 01E+01 | 3 5000 | 5 118E+08 |
| I-129 | 7 1287E-07 | 2,378 33 | 4,756 66 | 0 00E+00 | 1 70E-03 | 3 39E-03 | 5 0000 | 1 226E+05 |
| Kr-85 | 2 4955E-01 | 2,378 33 | 4,756 66 | 0 00E+00 | 5 94E+02 | 1 19E+03 | 7 0000 | 1 411E+04 |
| Np-237 | 1 2121E-05 | 2,378 33 | 4,756 66 | 0 00E+00 | 2 88E-02 | 5 77E-02 | 11 0000 | 1 619E+03 |
| Pa-231 | 1 1230E-09 | 2,378 33 | 4,756 66 | 0 00E+00 | 2 67E-06 | 5 34E-06 | | |
| Pb-210 | 6 1636E-14 | 2,378 33 | 4,756 66 | 0 00E+00 | 1 47E-10 | 2 93E-10 | | |
| Pm-147 | 1 1302E+00 | 2,378 33 | 4,756 66 | 0 00E+00 | 2 69E+03 | 5 38E+03 | | |
| Pu-238 | 5 4826E-02 | 2,378 33 | 4,756 66 | 0 00E+00 | 1 30E+02 | 2 61E+02 | | |
| Pu-239 | 1 4056E-03 | 2,378 33 | 4,756 66 | 0 00E+00 | 3 34E+00 | 6 69E+00 | | |
| Pu-240 | 1 1536E-03 | 2,378 33 | 4,756 66 | 0 00E+00 | 2 74E+00 | 5 49E+00 | | |
| Pu-241 | 4 2995E-01 | 2,378 33 | 4,756 66 | 0 00E+00 | 1 02E+03 | 2 05E+03 | | |
| Pu-242 | 4 9910E-06 | 2,378 33 | 4,756 66 | 0 00E+00 | 1 19E-02 | 2 37E-02 | | |
| Ra-226 | 2 4008E-13 | 2,378 33 | 4,756 66 | 0 00E+00 | 5 71E-10 | 1 14E-09 | | |
| Ra-228 | 1 8220E-11 | 2,378 33 | 4,756 66 | 0 00E+00 | 4 33E-08 | 8 67E-08 | | |
| Ru-106 | 1 0343E-01 | 2,378 33 | 4,756 66 | 0 00E+00 | 2 46E+02 | 4 92E+02 | | |
| Se-79 | 1 2832E-05 | 2,378 33 | 4,756 66 | 0 00E+00 | 3 05E-02 | 6 10E-02 | | |
| Sn-126 | 1 2090E-05 | 2,378 33 | 4,756 66 | 0 00E+00 | 2 88E-02 | 5 75E-02 | | |
| Sr-90 | 2 5646E+00 | 2,378 33 | 4,756 66 | 0 00E+00 | 6 10E+03 | 1 22E+04 | | |
| Tc-99 | 4 0319E-04 | 2,378 33 | 4,756 66 | 0 00E+00 | 9 59E-01 | 1 92E+00 | | |
| Th-229 | 7 7375E-11 | 2,378 33 | 4,756 66 | 0 00E+00 | 1 84E-07 | 3 68E-07 | | |
| Th-230 | 1 2211E-10 | 2,378 33 | 4,756 66 | 0 00E+00 | 2 90E-07 | 5 81E-07 | | |
| Th-232 | 2 3842E-11 | 2,378 33 | 4,756 66 | 0 00E+00 | 5 67E-08 | 1 13E-07 | | |
| Th-208 | 1 4313E-07 | 2,378 33 | 4,756 66 | 0 00E+00 | 3 40E-04 | 6 81E-04 | | |
| U-232 | 4 1927E-07 | 2,378 33 | 4,756 66 | 0 00E+00 | 9 97E-04 | 1 99E-03 | | |
| U-233 | 6 8491E-08 | 2,378 33 | 4,756 66 | 0 00E+00 | 1 63E-04 | 3 26E-04 | | |
| U-234 | 2 0189E-06 | 2,378 33 | 4,756 66 | 0 00E+00 | 4 80E-03 | 9 60E-03 | | |
| U-235 | -2 6572E-06 | 2,378 33 | 0 00 | 2 72E-02 | 2 09E-02 | 2 72E-02 | | |
| U-236 | 1 3575E-05 | 2,378 33 | 4,756 66 | 0 00E+00 | 3 23E-02 | 6 46E-02 | | |
| U-238 | -2 2698E-08 | 2,378 33 | 0 00 | 1 82E-03 | 1 77E-03 | 1 82E-03 | | |
| Y-90 | 2 5646E+00 | 2,378 33 | 4,756 66 | 0 00E+00 | 6 10E+03 | 1 22E+04 | | |
| Other Radionuclides | | | | | 8 47E+03 | 1 69E+04 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| | From SFD | Used | |
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 69 89795918 | 60 to 100 | |

| Burnup Summary (MWd) ¹ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 509 96 | 2 378 33 | |
| Bounding | | 4 756 66 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0 39 | 4 66 | |
| Bounding | 0 78 | | 1 00 |

¹Reactor shutdown, core removal, storage shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA (FLIP) WSU
 SNF ID #: 243
 Fuel Units & Descr: 78 - ELEMENT
 Heavy Metal Mass: BOL=15.288kg EOL=13.291kg
 ROD Storage Site: INEEL

¹Fuel decay start date: 2035
 Estimates as of: 2030
 Template: TRIGA-FLIP (LW/U-Zrx, SST, 60 to 100% U)
²Template Burnup (MWd): 66.52
 Template BOL Heavy Metal Mass (MT): 0.000196
 Template Decay Time: 5 years

Estimated
 Canister usage
 18"x10"
 0.70

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|-------------------------------|--------------------------------|-----------------------------|------------------------------|
| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.8488E-10 | 1,897.80 | 3,795.60 | 0.00E+00 | 5.41E-07 | 1.08E-06 | Avg MeV | |
| Am-241 | 7.5767E-03 | 1,897.80 | 3,795.60 | 0.00E+00 | 1.44E+01 | 2.88E+01 | 0.0150 | 6.124E+14 |
| Am-242m | 2.4459E-05 | 1,897.80 | 3,795.60 | 0.00E+00 | 4.64E-02 | 9.28E-02 | 0.0250 | 1.344E+14 |
| Am-243 | 3.0983E-05 | 1,897.80 | 3,795.60 | 0.00E+00 | 5.88E-02 | 1.18E-01 | 0.0375 | 1.189E+14 |
| C-14 | 1.2590E-04 | 1,897.80 | 3,795.60 | 0.00E+00 | 2.39E-01 | 4.78E-01 | 0.0575 | 1.186E+14 |
| Cl-36 | 2.6624E-06 | 1,897.80 | 3,795.60 | 0.00E+00 | 5.05E-03 | 1.01E-02 | 0.0850 | 7.383E+13 |
| Cm-243 | 3.8244E-05 | 1,897.80 | 3,795.60 | 0.00E+00 | 7.26E-02 | 1.45E-01 | 0.1250 | 5.928E+13 |
| Cm-244 | 4.1010E-03 | 1,897.80 | 3,795.60 | 0.00E+00 | 7.78E+00 | 1.56E+01 | 0.2250 | 6.274E+13 |
| Co-60 | 1.2410E+00 | 1,897.80 | 3,795.60 | 0.00E+00 | 2.36E+03 | 4.71E+03 | 0.3750 | 3.131E+13 |
| Cs-134 | 6.5454E-01 | 1,897.80 | 3,795.60 | 0.00E+00 | 1.24E+03 | 2.48E+03 | 0.5750 | 5.181E+14 |
| Cs-135 | 1.9753E-05 | 1,897.80 | 3,795.60 | 0.00E+00 | 3.75E-02 | 7.50E-02 | 0.8500 | 9.505E+13 |
| Cs-137 | 2.7375E+00 | 1,897.80 | 3,795.60 | 0.00E+00 | 5.20E+03 | 1.04E+04 | 1.2500 | 3.651E+14 |
| Eu-154 | 1.2324E-01 | 1,897.80 | 3,795.60 | 0.00E+00 | 2.34E+02 | 4.68E+02 | 1.7500 | 4.883E+11 |
| Eu-155 | 5.3037E-02 | 1,897.80 | 3,795.60 | 0.00E+00 | 1.01E+02 | 2.01E+02 | 2.2500 | 3.828E+11 |
| Fe-55 | 7.9555E-01 | 1,897.80 | 3,795.60 | 0.00E+00 | 1.51E+03 | 3.02E+03 | 2.7500 | 3.470E+09 |
| H-3 | 1.0531E-02 | 1,897.80 | 3,795.60 | 0.00E+00 | 2.00E+01 | 4.00E+01 | 3.5000 | 4.084E+08 |
| I-129 | 7.1287E-07 | 1,897.80 | 3,795.60 | 0.00E+00 | 1.35E-03 | 2.71E-03 | 5.0000 | 9.784E+04 |
| Kr-85 | 2.4955E-01 | 1,897.80 | 3,795.60 | 0.00E+00 | 4.74E+02 | 9.47E+02 | 7.0000 | 1.126E+04 |
| Np-237 | 1.2121E-05 | 1,897.80 | 3,795.60 | 0.00E+00 | 2.30E-02 | 4.60E-02 | 11.0000 | 1.292E+03 |
| Pa-231 | 1.1230E-09 | 1,897.80 | 3,795.60 | 0.00E+00 | 2.13E-06 | 4.26E-06 | | |
| Pb-210 | 6.1636E-14 | 1,897.80 | 3,795.60 | 0.00E+00 | 1.17E-10 | 2.34E-10 | | |
| Pm-147 | 1.1302E+00 | 1,897.80 | 3,795.60 | 0.00E+00 | 2.14E+03 | 4.29E+03 | | |
| Pu-238 | 5.4826E-02 | 1,897.80 | 3,795.60 | 0.00E+00 | 1.04E+02 | 2.08E+02 | | |
| Pu-239 | 1.4056E-03 | 1,897.80 | 3,795.60 | 0.00E+00 | 2.67E+00 | 5.34E+00 | | |
| Pu-240 | 1.1536E-03 | 1,897.80 | 3,795.60 | 0.00E+00 | 2.19E+00 | 4.38E+00 | | |
| Pu-241 | 4.2995E-01 | 1,897.80 | 3,795.60 | 0.00E+00 | 8.16E+02 | 1.63E+03 | | |
| Pu-242 | 4.9910E-06 | 1,897.80 | 3,795.60 | 0.00E+00 | 9.47E-03 | 1.89E-02 | | |
| Ra-226 | 2.4008E-13 | 1,897.80 | 3,795.60 | 0.00E+00 | 4.56E-10 | 9.11E-10 | | |
| Ra-228 | 1.8220E-11 | 1,897.80 | 3,795.60 | 0.00E+00 | 3.46E-08 | 6.92E-08 | | |
| Ru-106 | 1.0343E-01 | 1,897.80 | 3,795.60 | 0.00E+00 | 1.96E+02 | 3.93E+02 | | |
| Se-79 | 1.2832E-05 | 1,897.80 | 3,795.60 | 0.00E+00 | 2.44E-02 | 4.87E-02 | | |
| Sn-126 | 1.2090E-05 | 1,897.80 | 3,795.60 | 0.00E+00 | 2.29E-02 | 4.59E-02 | | |
| Sr-90 | 2.5646E+00 | 1,897.80 | 3,795.60 | 0.00E+00 | 4.87E+03 | 9.73E+03 | | |
| Tc-99 | 4.0319E-04 | 1,897.80 | 3,795.60 | 0.00E+00 | 7.65E-01 | 1.53E+00 | | |
| Th-229 | 7.7375E-11 | 1,897.80 | 3,795.60 | 0.00E+00 | 1.47E-07 | 2.94E-07 | | |
| Th-230 | 1.2211E-10 | 1,897.80 | 3,795.60 | 0.00E+00 | 2.32E-07 | 4.63E-07 | | |
| Th-232 | 2.3842E-11 | 1,897.80 | 3,795.60 | 0.00E+00 | 4.52E-08 | 9.05E-08 | | |
| Ti-208 | 1.4313E-07 | 1,897.80 | 3,795.60 | 0.00E+00 | 2.72E-04 | 5.43E-04 | | |
| U-232 | 4.1927E-07 | 1,897.80 | 3,795.60 | 0.00E+00 | 7.96E-04 | 1.59E-03 | Thermal Power | |
| U-233 | 6.8491E-08 | 1,897.80 | 3,795.60 | 0.00E+00 | 1.30E-04 | 2.60E-04 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 2.0189E-06 | 1,897.80 | 3,795.60 | 0.00E+00 | 3.83E-03 | 7.66E-03 | 1.24E+02 | 2.49E+02 |
| U-235 | -2.6572E-06 | 1,897.80 | 0.00 | 2.31E-02 | 1.81E-02 | 2.31E-02 | Total | Total |
| U-236 | 1.3575E-05 | 1,897.80 | 3,795.60 | 0.00E+00 | 2.58E-02 | 5.15E-02 | | |
| U-238 | -2.2698E-08 | 1,897.80 | 0.00 | 1.54E-03 | 1.50E-03 | 1.54E-03 | | |
| Y-90 | 2.5646E+00 | 1,897.80 | 3,795.60 | 0.00E+00 | 4.87E+03 | 9.73E+03 | | |
| Other Radionuclides | | | | | 6.76E+03 | 1.35E+04 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|---|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator: Fuel Cladding: BOL HM Constituents BOL Enrichment % | From SFD | Used | |
| | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| | SST | SST | |
| | U | U | |
| | 70 | 60 to 100 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate |
|-----------------------------------|----------|-----------|---|
| Nominal Bounding | From SFD | Estimated | |
| | 432.36 | 1,897.80 | |
| | | 3,795.60 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|---------------------|-------------------|-----------------------------------|-------------------------------|
| Nominal Bounding | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| | 0.37 | 4.39 | |
| | 0.73 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA (HIGH POWER) (HEU)
SNF ID #: 998
Fuel Units & Descr: 4 - ELEMENT
Heavy Metal Mass: BOL=0.117kg; EOL=0.117kg
ROD Storage Site: INEEL

¹Fuel decay start date: 1970
Estimates as of: 2030
Template: TRIGA-FLIP (LWU-Zrx, SST, 60 to 100% U)
²Template Burnup(MWd): 66.52
Template BOL Heavy Metal Mass (MT): 0.000196
Template Decay Time: 50 years

Estimated
Canister usage
18"x10"
0.05

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.0776E-09 | 2.22 | 4.44 | 0.00E+00 | 4.61E-09 | 9.23E-09 | Avg MeV | |
| Am-241 | 1.6777E-02 | 2.22 | 4.44 | 0.00E+00 | 3.72E-02 | 7.45E-02 | 0.0150 | 2.150E+11 |
| Am-242m | 1.9919E-05 | 2.22 | 4.44 | 0.00E+00 | 4.42E-05 | 8.84E-05 | 0.0250 | 4.441E+10 |
| Am-243 | 3.0848E-05 | 2.22 | 4.44 | 0.00E+00 | 6.85E-05 | 1.37E-04 | 0.0375 | 3.879E+10 |
| C-14 | 1.2521E-04 | 2.22 | 4.44 | 0.00E+00 | 2.78E-04 | 5.56E-04 | 0.0575 | 4.239E+10 |
| Ci-36 | 2.6624E-06 | 2.22 | 4.44 | 0.00E+00 | 5.91E-06 | 1.18E-05 | 0.0850 | 2.498E+10 |
| Cm-243 | 1.2813E-05 | 2.22 | 4.44 | 0.00E+00 | 2.84E-05 | 5.69E-05 | 0.1250 | 1.640E+10 |
| Cm-244 | 7.3361E-04 | 2.22 | 4.44 | 0.00E+00 | 1.63E-03 | 3.26E-03 | 0.2250 | 2.155E+10 |
| Co-60 | 3.3494E-03 | 2.22 | 4.44 | 0.00E+00 | 7.44E-03 | 1.49E-02 | 0.3750 | 9.379E+09 |
| Cs-134 | 1.7799E-07 | 2.22 | 4.44 | 0.00E+00 | 3.95E-07 | 7.90E-07 | 0.5750 | 1.600E+11 |
| Cs-135 | 1.9738E-05 | 2.22 | 4.44 | 0.00E+00 | 4.38E-05 | 8.76E-05 | 0.8500 | 1.779E+09 |
| Cs-137 | 9.6843E-01 | 2.22 | 4.44 | 0.00E+00 | 2.15E+00 | 4.30E+00 | 1.2500 | 1.889E+09 |
| Eu-154 | 3.2877E-03 | 2.22 | 4.44 | 0.00E+00 | 7.30E-03 | 1.46E-02 | 1.7500 | 4.770E+07 |
| Eu-155 | 9.8812E-05 | 2.22 | 4.44 | 0.00E+00 | 2.19E-04 | 4.39E-04 | 2.2500 | 1.025E+04 |
| Fe-55 | 4.9444E-06 | 2.22 | 4.44 | 0.00E+00 | 1.10E-05 | 2.20E-05 | 2.7500 | 1.727E+04 |
| H-3 | 8.4381E-04 | 2.22 | 4.44 | 0.00E+00 | 1.87E-03 | 3.75E-03 | 3.5000 | 5.549E+01 |
| I-129 | 7.1287E-07 | 2.22 | 4.44 | 0.00E+00 | 1.58E-06 | 3.17E-06 | 5.0000 | 2.353E+01 |
| Kr-85 | 1.3624E-02 | 2.22 | 4.44 | 0.00E+00 | 3.02E-02 | 6.05E-02 | 7.0000 | 2.688E+00 |
| Np-237 | 1.2375E-05 | 2.22 | 4.44 | 0.00E+00 | 2.75E-05 | 5.50E-05 | 11.0000 | 3.073E-01 |
| Pa-231 | 3.2066E-09 | 2.22 | 4.44 | 0.00E+00 | 7.12E-09 | 1.42E-08 | | |
| Pb-210 | 1.0925E-11 | 2.22 | 4.44 | 0.00E+00 | 2.43E-11 | 4.85E-11 | | |
| Pm-147 | 7.8187E-06 | 2.22 | 4.44 | 0.00E+00 | 1.74E-05 | 3.47E-05 | | |
| Pu-238 | 3.8440E-02 | 2.22 | 4.44 | 0.00E+00 | 8.53E-02 | 1.71E-01 | | |
| Pu-239 | 1.4038E-03 | 2.22 | 4.44 | 0.00E+00 | 3.12E-03 | 6.23E-03 | | |
| Pu-240 | 1.1560E-03 | 2.22 | 4.44 | 0.00E+00 | 2.57E-03 | 5.13E-03 | | |
| Pu-241 | 4.9354E-02 | 2.22 | 4.44 | 0.00E+00 | 1.10E-01 | 2.19E-01 | | |
| Pu-242 | 4.9910E-06 | 2.22 | 4.44 | 0.00E+00 | 1.11E-05 | 2.22E-05 | | |
| Ra-226 | 2.9330E-11 | 2.22 | 4.44 | 0.00E+00 | 6.51E-11 | 1.30E-10 | | |
| Ra-228 | 2.3857E-11 | 2.22 | 4.44 | 0.00E+00 | 5.30E-11 | 1.06E-10 | | |
| Ru-106 | 3.8455E-15 | 2.22 | 4.44 | 0.00E+00 | 8.54E-15 | 1.71E-14 | | |
| Se-79 | 1.2826E-05 | 2.22 | 4.44 | 0.00E+00 | 2.85E-05 | 5.70E-05 | | |
| Sn-126 | 1.2087E-05 | 2.22 | 4.44 | 0.00E+00 | 2.68E-05 | 5.37E-05 | | |
| Sr-90 | 8.7913E-01 | 2.22 | 4.44 | 0.00E+00 | 1.95E+00 | 3.90E+00 | | |
| Tc-99 | 4.0304E-04 | 2.22 | 4.44 | 0.00E+00 | 8.95E-04 | 1.79E-03 | | |
| Th-229 | 4.3912E-10 | 2.22 | 4.44 | 0.00E+00 | 9.75E-10 | 1.95E-09 | | |
| Th-230 | 2.8879E-09 | 2.22 | 4.44 | 0.00E+00 | 6.41E-09 | 1.28E-08 | | |
| Th-232 | 2.3888E-11 | 2.22 | 4.44 | 0.00E+00 | 5.30E-11 | 1.06E-10 | | |
| Th-208 | 1.1027E-07 | 2.22 | 4.44 | 0.00E+00 | 2.45E-07 | 4.90E-07 | | |
| U-232 | 2.9871E-07 | 2.22 | 4.44 | 0.00E+00 | 6.63E-07 | 1.33E-06 | | |
| U-233 | 7.1407E-08 | 2.22 | 4.44 | 0.00E+00 | 1.59E-07 | 3.17E-07 | | |
| U-234 | 8.6801E-06 | 2.22 | 4.44 | 0.00E+00 | 1.93E-05 | 3.85E-05 | | |
| U-235 | -2.6572E-06 | 2.22 | 0.00 | 2.35E-04 | 2.29E-04 | 2.35E-04 | | |
| U-236 | 1.3576E-05 | 2.22 | 4.44 | 0.00E+00 | 3.01E-05 | 6.03E-05 | | |
| U-238 | -2.2698E-08 | 2.22 | 0.00 | 2.69E-06 | 2.64E-06 | 2.69E-06 | | |
| Y-90 | 8.7928E-01 | 2.22 | 4.44 | 0.00E+00 | 1.95E+00 | 3.90E+00 | | |
| Other Radionuclides | | | | | 2.15E+00 | 4.30E+00 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences* |
|---------------------|-----------------------|-----------------------|--|
| Reactor Moderator: | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | This Template was used for the following reasons |
| Fuel Cladding: | INCOLOY | SST | This fuel matches on all parameters except cladding (SST is conservative). |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 93.152 | 60 to 100 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|----------|-----------|---|
| Nominal | | 2.22 | Nominal burnup assumed to be 2% of BOL heavy metal mass |
| Bounding | | 4.44 | Bounding burnup assumed to be twice nominal burnup |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0.06 | | 0.98 |
| Bounding | 0.11 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA (HIGH POWER) ROMANIA
SNF ID #: 302
Fuel Units & Descr: 611 - ELEMENT
Heavy Metal Mass BOL=27.067kg EOL=13.992kg
ROD Storage Site INEEL

¹Fuel decay start date: 1978
Estimates as of: 2030
Template: TRIGA-FLIP (LW/U-Zr, SST, 60 to 100%, U)
²Template Burnup(MWd): 66.52
Template BOL Heavy Metal Mass (MT): 0.000196
Template Decay Time: 50 years

Estimated
Canister usage
18"x10"
5.50

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| | m | x _a | x _b | b | y _a | y _b | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Avg MeV | |
| Ac-227 | 2.0776E-09 | 12,427.12 | 24,854.25 | 0.00E+00 | 2.58E-05 | 5.16E-05 | 0.0150 | 1.203E+15 |
| Am-241 | 1.6777E-02 | 12,427.12 | 24,854.25 | 0.00E+00 | 2.08E+02 | 4.17E+02 | 0.0250 | 2.486E+14 |
| Am-242m | 1.9919E-05 | 12,427.12 | 24,854.25 | 0.00E+00 | 2.48E-01 | 4.95E-01 | 0.0375 | 2.171E+14 |
| Am-243 | 3.0848E-05 | 12,427.12 | 24,854.25 | 0.00E+00 | 3.83E-01 | 7.67E-01 | 0.0575 | 2.373E+14 |
| C-14 | 1.2521E-04 | 12,427.12 | 24,854.25 | 0.00E+00 | 1.56E+00 | 3.11E+00 | 0.0850 | 1.398E+14 |
| Cl-36 | 2.6624E-06 | 12,427.12 | 24,854.25 | 0.00E+00 | 3.31E-02 | 6.62E-02 | 0.1250 | 9.179E+13 |
| Cm-243 | 1.2813E-05 | 12,427.12 | 24,854.25 | 0.00E+00 | 1.59E-01 | 3.18E-01 | 0.2250 | 1.206E+14 |
| Cm-244 | 7.3361E-04 | 12,427.12 | 24,854.25 | 0.00E+00 | 9.12E+00 | 1.82E+01 | 0.3750 | 5.250E+13 |
| Co-60 | 3.3494E-03 | 12,427.12 | 24,854.25 | 0.00E+00 | 4.16E+01 | 8.32E+01 | 0.5750 | 8.955E+14 |
| Cs-134 | 1.7799E-07 | 12,427.12 | 24,854.25 | 0.00E+00 | 2.21E-03 | 4.42E-03 | 0.8500 | 9.957E+12 |
| Cs-135 | 1.9738E-05 | 12,427.12 | 24,854.25 | 0.00E+00 | 2.45E-01 | 4.91E-01 | 1.2500 | 1.057E+13 |
| Cs-137 | 9.6843E-01 | 12,427.12 | 24,854.25 | 0.00E+00 | 1.20E+04 | 2.41E+04 | 1.7500 | 2.670E+11 |
| Eu-154 | 3.2877E-03 | 12,427.12 | 24,854.25 | 0.00E+00 | 4.09E+01 | 8.17E+01 | 2.2500 | 5.735E+07 |
| Eu-155 | 9.8812E-05 | 12,427.12 | 24,854.25 | 0.00E+00 | 1.23E+00 | 2.46E+00 | 2.7500 | 9.668E+07 |
| Fe-55 | 4.9444E-06 | 12,427.12 | 24,854.25 | 0.00E+00 | 6.14E-02 | 1.23E-01 | 3.5000 | 3.105E+05 |
| H-3 | 8.4381E-04 | 12,427.12 | 24,854.25 | 0.00E+00 | 1.05E+01 | 2.10E+01 | 5.0000 | 1.317E+05 |
| I-129 | 7.1287E-07 | 12,427.12 | 24,854.25 | 0.00E+00 | 8.86E-03 | 1.77E-02 | 7.0000 | 1.504E+04 |
| Kr-85 | 1.3624E-02 | 12,427.12 | 24,854.25 | 0.00E+00 | 1.69E+02 | 3.39E+02 | 11.0000 | 1.719E+03 |
| Np-237 | 1.2375E-05 | 12,427.12 | 24,854.25 | 0.00E+00 | 1.54E-01 | 3.08E-01 | | |
| Pa-231 | 3.2066E-09 | 12,427.12 | 24,854.25 | 0.00E+00 | 3.98E-05 | 7.97E-05 | | |
| Pb-210 | 1.0925E-11 | 12,427.12 | 24,854.25 | 0.00E+00 | 1.36E-07 | 2.72E-07 | | |
| Pm-147 | 7.8187E-06 | 12,427.12 | 24,854.25 | 0.00E+00 | 9.72E-02 | 1.94E-01 | | |
| Pu-238 | 3.8440E-02 | 12,427.12 | 24,854.25 | 0.00E+00 | 4.78E+02 | 9.55E+02 | | |
| Pu-239 | 1.4038E-03 | 12,427.12 | 24,854.25 | 0.00E+00 | 1.74E+01 | 3.49E+01 | | |
| Pu-240 | 1.1560E-03 | 12,427.12 | 24,854.25 | 0.00E+00 | 1.44E+01 | 2.87E+01 | | |
| Pu-241 | 4.9354E-02 | 12,427.12 | 24,854.25 | 0.00E+00 | 6.13E+02 | 1.23E+03 | | |
| Pu-242 | 4.9910E-06 | 12,427.12 | 24,854.25 | 0.00E+00 | 6.20E-02 | 1.24E-01 | | |
| Ra-226 | 2.9330E-11 | 12,427.12 | 24,854.25 | 0.00E+00 | 3.64E-07 | 7.29E-07 | | |
| Ra-228 | 2.3857E-11 | 12,427.12 | 24,854.25 | 0.00E+00 | 2.96E-07 | 5.93E-07 | | |
| Ru-106 | 3.8455E-15 | 12,427.12 | 24,854.25 | 0.00E+00 | 4.78E-11 | 9.56E-11 | | |
| Se-79 | 1.2826E-05 | 12,427.12 | 24,854.25 | 0.00E+00 | 1.59E-01 | 3.19E-01 | | |
| Sn-126 | 1.2087E-05 | 12,427.12 | 24,854.25 | 0.00E+00 | 1.50E-01 | 3.00E-01 | | |
| Sr-90 | 8.7913E-01 | 12,427.12 | 24,854.25 | 0.00E+00 | 1.09E+04 | 2.19E+04 | | |
| Tc-99 | 4.0304E-04 | 12,427.12 | 24,854.25 | 0.00E+00 | 5.01E+00 | 1.00E+01 | | |
| Th-229 | 4.3912E-10 | 12,427.12 | 24,854.25 | 0.00E+00 | 5.46E-06 | 1.09E-05 | | |
| Th-230 | 2.8879E-09 | 12,427.12 | 24,854.25 | 0.00E+00 | 3.59E-05 | 7.18E-05 | | |
| Th-232 | 2.3888E-11 | 12,427.12 | 24,854.25 | 0.00E+00 | 2.97E-07 | 5.94E-07 | | |
| Tl-208 | 1.1027E-07 | 12,427.12 | 24,854.25 | 0.00E+00 | 1.37E-03 | 2.74E-03 | | |
| U-232 | 2.9871E-07 | 12,427.12 | 24,854.25 | 0.00E+00 | 3.71E-03 | 7.42E-03 | | |
| U-233 | 7.1407E-08 | 12,427.12 | 24,854.25 | 0.00E+00 | 8.87E-04 | 1.77E-03 | | |
| U-234 | 8.6801E-06 | 12,427.12 | 24,854.25 | 0.00E+00 | 1.08E-01 | 2.16E-01 | | |
| U-235 | -2.6572E-06 | 12,427.12 | 0.00 | 5.45E-02 | 2.15E-02 | 5.45E-02 | | |
| U-236 | 1.3576E-05 | 12,427.12 | 24,854.25 | 0.00E+00 | 1.69E-01 | 3.37E-01 | | |
| U-238 | -2.2698E-08 | 12,427.12 | 0.00 | 6.24E-04 | 3.42E-04 | 6.24E-04 | | |
| Y-90 | 8.7928E-01 | 12,427.12 | 24,854.25 | 0.00E+00 | 1.09E+04 | 2.19E+04 | | |
| Other Radionuclides | | | | | 1.20E+04 | 2.40E+04 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | | Basis for Parameter Differences: |
|--|-----------------------|-----------------------------------|--|------------------------------------|
| Reactor Moderator Fuel Cladding BOL HM Constituents BOL Enrichment % | From SFD | Used | | |
| | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | | |
| | INCOLOY | SST | | |
| This Template was used for the following reasons: This fuel matches on all parameters except cladding (SST is conservative) | | | | |
| Burnup Summary (MWd) ² | | | | Basis for burnup used in estimate: |
| Nominal Bounding | From SFD | Estimated | | |
| | | 12,427.12 24,854.25 | | |
| Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup | | | | |
| Checks | | | | Estimated EOL HM/Given EOL HM |
| Nominal Bounding | Burnup Multiplier | Estimated Burnup/ Given Burnup | | |
| | 1.35 2.71 | | | |
| | | | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA (HIGH POWER) ROMANIA
SNF ID #: 930
Fuel Units & Descr: 267 - ELEMENT
Heavy Metal Mass: BOL=11 828kg; EOL=5.58kg
ROD Storage Site: INEEL

Fuel decay start date: 1999
Estimates as of: 2030
Template: TRIGA-FLIP (LW/U-Zrx, SST, 60 to 100%, U)
Template Burnup(MWd): 66 52
Template BOL Heavy Metal Mass (MT): 0 000196
Template Decay Time: 25 years

Estimated
Canister usage
18"x10"
2 41

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Cu/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 1 0386E-09 | 5,938 04 | 11,241 67 | 0 00E+00 | 6.17E-06 | 1 17E-05 | Avg MeV | |
| Am-241 | 1 4973E-02 | 5,938 04 | 11,241 67 | 0 00E+00 | 8 89E+01 | 1 68E+02 | 0 0150 | 9 881E+14 |
| Am-242m | 2 2324E-05 | 5,938 04 | 11,241 67 | 0 00E+00 | 1.33E-01 | 2 51E-01 | 0 0250 | 2 046E+14 |
| Am-243 | 3 0923E-05 | 5,938 04 | 11,241 67 | 0 00E+00 | 1 84E-01 | 3 48E-01 | 0 0375 | 1 798E+14 |
| C-14 | 1 2559E-04 | 5,938 04 | 11,241 67 | 0 00E+00 | 7.46E-01 | 1 41E+00 | 0 0575 | 1 932E+14 |
| Cl-36 | 2 6624E-06 | 5,938 04 | 11,241 67 | 0 00E+00 | 1.58E-02 | 2 99E-02 | 0 0850 | 1 153E+14 |
| Cm-243 | 2 3527E-05 | 5,938 04 | 11,241 67 | 0 00E+00 | 1 40E-01 | 2 64E-01 | 0 1250 | 7 874E+13 |
| Cm-244 | 1 9092E-03 | 5,938 04 | 11,241 67 | 0 00E+00 | 1 13E+01 | 2 15E+01 | 0 2250 | 9 962E+13 |
| Co-60 | 8 9552E-02 | 5,938 04 | 11,241 67 | 0 00E+00 | 5 32E+02 | 1 01E+03 | 0 3750 | 4 324E+13 |
| Cs-134 | 7 9074E-04 | 5,938 04 | 11,241 67 | 0 00E+00 | 4 70E+00 | 8 89E+00 | 0 5750 | 7 229E+14 |
| Cs-135 | 1 9753E-05 | 5,938 04 | 11,241 67 | 0 00E+00 | 1.17E-01 | 2 22E-01 | 0 8500 | 1 215E+13 |
| Cs-137 | 1 7243E+00 | 5,938 04 | 11,241 67 | 0 00E+00 | 1 02E+04 | 1 94E+04 | 1 2500 | 8 223E+13 |
| Eu-154 | 2 4609E-02 | 5,938 04 | 11,241 67 | 0 00E+00 | 1 46E+02 | 2 77E+02 | 1 7500 | 3 414E+11 |
| Eu-155 | 3 2456E-03 | 5,938 04 | 11,241 67 | 0 00E+00 | 1 93E+01 | 3 65E+01 | 2 2500 | 4 153E+08 |
| Fe-55 | 3 8605E-03 | 5,938 04 | 11,241 67 | 0 00E+00 | 2.29E+01 | 4 34E+01 | 2 7500 | 5 679E+07 |
| H-3 | 3 4305E-03 | 5,938 04 | 11,241 67 | 0 00E+00 | 2 04E+01 | 3 86E+01 | 3 5000 | 3 303E+05 |
| I-129 | 7 1287E-07 | 5,938 04 | 11,241 67 | 0 00E+00 | 4.23E-03 | 8 01E-03 | 5 0000 | 1 402E+05 |
| Kr-85 | 6 8536E-02 | 5,938 04 | 11,241 67 | 0 00E+00 | 4 07E+02 | 7 70E+02 | 7 0000 | 1 610E+04 |
| Np-237 | 1 2219E-05 | 5,938 04 | 11,241 67 | 0 00E+00 | 7.26E-02 | 1 37E-01 | 11 0000 | 1 845E+03 |
| Pa-231 | 2 0701E-09 | 5,938 04 | 11,241 67 | 0 00E+00 | 1.23E-05 | 2 33E-05 | | |
| Pb-210 | 1 3279E-12 | 5,938 04 | 11,241 67 | 0 00E+00 | 7 88E-09 | 1 49E-08 | | |
| Pm-147 | 5 7517E-03 | 5,938 04 | 11,241 67 | 0 00E+00 | 3.42E+01 | 6 47E+01 | | |
| Pu-238 | 4 6828E-02 | 5,938 04 | 11,241 67 | 0 00E+00 | 2.78E+02 | 5 26E+02 | | |
| Pu-239 | 1 4048E-03 | 5,938 04 | 11,241 67 | 0 00E+00 | 8.34E+00 | 1 58E+01 | | |
| Pu-240 | 1 1563E-03 | 5,938 04 | 11,241 67 | 0 00E+00 | 6.87E+00 | 1 30E+01 | | |
| Pu-241 | 1 6431E-01 | 5,938 04 | 11,241 67 | 0 00E+00 | 9 76E+02 | 1 85E+03 | | |
| Pu-242 | 4 9910E-06 | 5,938 04 | 11,241 67 | 0 00E+00 | 2.96E-02 | 5 61E-02 | | |
| Ra-226 | 5 4390E-12 | 5,938 04 | 11,241 67 | 0 00E+00 | 3.23E-08 | 6 11E-08 | | |
| Ra-228 | 2 3437E-11 | 5,938 04 | 11,241 67 | 0 00E+00 | 1.39E-07 | 2 63E-07 | | |
| Ru-106 | 1 1115E-07 | 5,938 04 | 11,241 67 | 0 00E+00 | 6 60E-04 | 1 25E-03 | | |
| Se-79 | 1 2829E-05 | 5,938 04 | 11,241 67 | 0 00E+00 | 7 62E-02 | 1 44E-01 | | |
| Sn-126 | 1 2088E-05 | 5,938 04 | 11,241 67 | 0 00E+00 | 7.18E-02 | 1 36E-01 | | |
| Sr-90 | 1 5935E+00 | 5,938 04 | 11,241 67 | 0 00E+00 | 9 46E+03 | 1 79E+04 | | |
| Tc-99 | 4 0319E-04 | 5,938 04 | 11,241 67 | 0 00E+00 | 2 39E+00 | 4 53E+00 | | |
| Th-229 | 2 4023E-10 | 5,938 04 | 11,241 67 | 0 00E+00 | 1 43E-06 | 2 70E-06 | | |
| Th-230 | 9 6948E-10 | 5,938 04 | 11,241 67 | 0 00E+00 | 5 76E-06 | 1 09E-05 | | |
| Th-232 | 2 3857E-11 | 5,938 04 | 11,241 67 | 0 00E+00 | 1.42E-07 | 2 68E-07 | | |
| Th-208 | 1 3982E-07 | 5,938 04 | 11,241 67 | 0 00E+00 | 8.30E-04 | 1 57E-03 | | |
| U-232 | 3 7943E-07 | 5,938 04 | 11,241 67 | 0 00E+00 | 2.25E-03 | 4 27E-03 | | |
| U-233 | 6 9814E-08 | 5,938 04 | 11,241 67 | 0 00E+00 | 4.15E-04 | 7 85E-04 | | |
| U-234 | 5 4059E-06 | 5,938 04 | 11,241 67 | 0 00E+00 | 3.21E-02 | 6 08E-02 | | |
| U-235 | -2 6572E-06 | 5,938 04 | 0 00 | 2.38E-02 | 8 03E-03 | 2 38E-02 | | |
| U-236 | 1 3576E-05 | 5,938 04 | 11,241 67 | 0 00E+00 | 8 06E-02 | 1 53E-01 | | |
| U-238 | -2.2698E-08 | 5,938 04 | 0 00 | 2 72E-04 | 1.38E-04 | 2 72E-04 | | |
| Y-90 | 1 5935E+00 | 5,938 04 | 11,241 67 | 0 00E+00 | 9 46E+03 | 1 79E+04 | | |
| Other Radionuclides | | | | | 1 01E+04 | 1 90E+04 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|--|
| Reactor Moderator | From SFD | Used | |
| Fuel Cladding | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | This Template was used for the following reasons: This fuel matches on all parameters except cladding (SST is conservative) |
| BOL HM Constituents | INCOLOY | SST | |
| BOL Enrichment % | U | U | |
| | 93 14636964 | 60 to 100 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | | 5,938 04 | Nominal burnup calculated from the heavy metal mass destroyed. |
| Bounding | | 11,241 67 | Bounding burnup calculated assuming all BOL heavy metal burned |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 1 48 | | 1 00 |
| Bounding | 2.80 | | |

¹Reactor shutdown, core removal storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT).

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA 2020 FFCR MNRC

SNF ID # 737

Fuel Units & Descr: 6 - ELEMENT

Heavy Metal Mass BOL=2.462kg EOL=2.462kg

ROD Storage Site INEEL

¹Fuel decay start date 2035

Estimates as of: 2030

Template: TRIGA-SS (LW/U-Zr, SST, 10 to 20% U)

²Template Burnup(MWd) 6.65

Template BOL Heavy Metal Mass (MT) 0.000195

Template Decay Time 5 years

Estimated

Canister usage

18"x10"

0.08

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.5173E-10 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | Avg MeV | |
| Am-241 | 1.8331E-03 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0150 | 2.607E+07 |
| Am-242m | 1.4129E-06 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0250 | 0.000E+00 |
| Am-243 | 1.4774E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0375 | 3.553E+04 |
| C-14 | 1.2871E-04 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0575 | 2.174E+04 |
| Cl-36 | 2.8120E-06 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0850 | 3.036E+06 |
| Cm-243 | 1.7940E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.1250 | 5.994E+06 |
| Cm-244 | 1.6962E-06 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.2250 | 2.121E+07 |
| Co-60 | 1.2839E+00 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.3750 | 5.293E+04 |
| Cs-134 | 9.0541E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.5750 | 2.604E+03 |
| Cs-135 | 3.2195E-05 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.8500 | 4.065E+02 |
| Cs-137 | 2.7564E+00 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.2500 | 2.427E+01 |
| Eu-154 | 1.5368E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.7500 | 1.188E+01 |
| Eu-155 | 2.9293E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.2500 | 6.879E+00 |
| Fe-55 | 7.7158E-01 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.7500 | 3.997E+00 |
| H-3 | 1.1111E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 3.5000 | 3.573E+00 |
| I-129 | 7.3684E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 5.0000 | 1.535E+00 |
| Kr-85 | 2.5263E-01 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 7.0000 | 1.767E-01 |
| Np-237 | 1.2427E-06 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 11.0000 | 2.032E-02 |
| Pa-231 | 3.8511E-09 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pb-210 | 7.3880E-15 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pm-147 | 2.1023E+00 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-238 | 1.0383E-03 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-239 | 5.5293E-03 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-240 | 2.1278E-03 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-241 | 1.0195E-01 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-242 | 2.3128E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Ra-226 | 5.2782E-14 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Ra-228 | 1.9338E-10 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Ru-106 | 9.1684E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Se-79 | 1.3018E-05 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Sn-126 | 1.2167E-05 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Sr-90 | 2.6045E+00 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Tc-99 | 4.4241E-04 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Th-229 | 1.3713E-10 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Th-230 | 1.8090E-11 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Th-232 | 2.5278E-10 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Ti-208 | 1.6947E-08 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-232 | 4.8737E-08 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-233 | 1.2203E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-234 | 1.5925E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-235 | -2.6194E-06 | 0.00 | 0.00 | 1.05E-03 | 1.05E-03 | 1.05E-03 | | |
| U-236 | 1.2693E-05 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-238 | -3.6331E-08 | 0.00 | 0.00 | 6.64E-04 | 6.64E-04 | 6.64E-04 | | |
| Y-90 | 2.6060E+00 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Other Radionuclides | | | | | 0.00E+00 | 0.00E+00 | | |

Thermal Power

| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
|-----------------------------|------------------------------|
| 4.44E-05 | 4.44E-05 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | SST | SST |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 19.76779631 | 10 to 20.1 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | 0.00 | |
| Bounding | | |

Basis for burnup used in estimate:

Nominal burnup taken directly from SFD (converted to MWd)
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|--------------------------------|-------------------------------|
| Nominal | 0.00 | | 1.00 |
| Bounding | 0.00 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA 30/20 FFCR MNRC
SNF ID #: 1055
Fuel Units & Descr: 1 - ELEMENT
Heavy Metal Mass: BOL=0.675kg, EOL=0.675kg
ROD Storage Site: INEEL

¹Fuel decay start date: 2035
Estimates as of: 2030

Template: TRIGA-SS (LW/U-Zr, SST, 10 to 20%, U)

²Template Burnup(MWd): 6.65

Template BOL Heavy Metal Mass (MT): 0.000195

Template Decay Time: 5 years

Estimated
Canister usage
18"x10"
0.01

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.5173E-10 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | Avg. MeV | |
| Am-241 | 1.8331E-03 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0150 | 7.138E+06 |
| Am-242m | 1.4129E-06 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0250 | 0.000E+00 |
| Am-243 | 1.4774E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0375 | 9.726E+03 |
| C-14 | 1.2871E-04 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0575 | 5.957E+03 |
| Cl-36 | 2.8120E-06 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0850 | 8.309E+05 |
| Cm-243 | 1.7940E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.1250 | 1.641E+06 |
| Cm-244 | 1.6962E-06 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.2250 | 5.806E+06 |
| Co-60 | 1.2839E+00 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.3750 | 1.449E+04 |
| Cs-134 | 9.0541E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.5750 | 7.127E+02 |
| Cs-135 | 3.2195E-05 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.8500 | 1.113E+02 |
| Cs-137 | 2.7564E+00 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.2500 | 6.652E+00 |
| Eu-154 | 1.5368E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.7500 | 3.255E+00 |
| Eu-155 | 2.9293E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.2500 | 1.885E+00 |
| Fe-55 | 7.7158E-01 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.7500 | 1.095E+00 |
| H-3 | 1.1111E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 3.5000 | 9.793E-01 |
| I-129 | 7.3684E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 5.0000 | 4.207E-01 |
| Kr-85 | 2.5263E-01 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 7.0000 | 4.843E-02 |
| Np-237 | 1.2427E-06 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 11.0000 | 5.568E-03 |
| Pa-231 | 3.8511E-09 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pb-210 | 7.3880E-15 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pm-147 | 2.1023E+00 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-238 | 1.0383E-03 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-239 | 5.5293E-03 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-240 | 2.1278E-03 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-241 | 1.0195E-01 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-242 | 2.3128E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Ra-226 | 5.2782E-14 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Ra-228 | 1.9338E-10 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Ru-106 | 9.1684E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Se-79 | 1.3018E-05 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Sn-126 | 1.2167E-05 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Sr-90 | 2.6045E+00 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Tc-99 | 4.4241E-04 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Th-229 | 1.3713E-10 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Th-230 | 1.8090E-11 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Th-232 | 2.5278E-10 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Ti-208 | 1.6947E-08 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-232 | 4.8737E-08 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-233 | 1.2203E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-234 | 1.5925E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-235 | -2.6194E-06 | 0.00 | 0.00 | 2.88E-04 | 2.88E-04 | 2.88E-04 | | |
| U-236 | 1.2693E-05 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-238 | -3.6331E-08 | 0.00 | 0.00 | 1.82E-04 | 1.82E-04 | 1.82E-04 | | |
| Y-90 | 2.6060E+00 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Other Radionuclides | | | | | 0.00E+00 | 0.00E+00 | | |
| | | | | | | | Thermal Power | |
| | | | | | | | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| | | | | | | | 1.22E-05 | 1.22E-05 |
| | | | | | | | Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------------------|-------------------------------|----------------------------------|
| Reactor Moderator: | From SFD LW AND U ZIRC HYDRIDE | Used LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19.74748006 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal: | 0.00 | | |
| Bounding: | | | Nominal burnup taken directly from SFD (converted to MWd) Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|-----------|-------------------|--------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal: | 0.00 | | |
| Bounding: | 0.00 | | 1.00 |

¹ Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

² Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA 8 5/20 FFCR
SNF ID # 1003
Fuel Units & Descr: 10 - ELEMENT
Heavy Metal Mass BOL=1 604kg EOL=1.541kg
ROD Storage Site INEEL

¹Fuel decay start date 2035
Estimates as of 2030
Template TRIGA-SS (LW/U-Zrx SST, 10 to 20% U)
²Template Burnup(MWd): 6 65
Template BOL Heavy Metal Mass (MT) 0 000195
Template Decay Time 5 years

Estimated
Canister usage
18"x10"
0 14

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 5173E-10 | 60 14 | 120 28 | 0 00E+00 | 5 12E-08 | 1 02E-07 | Avg MeV | |
| Am-241 | 1 8331E-03 | 60 14 | 120 28 | 0 00E+00 | 1 10E-01 | 2 20E-01 | 0 0150 | 1.944E+13 |
| Am-242m | 1 4129E-06 | 60 14 | 120 28 | 0 00E+00 | 8 50E-05 | 1 70E-04 | 0 0250 | 4.278E+12 |
| Am-243 | 1 4774E-07 | 60 14 | 120 28 | 0 00E+00 | 8 89E-06 | 1 78E-05 | 0 0375 | 3.643E+12 |
| C-14 | 1 2871E-04 | 60 14 | 120 28 | 0 00E+00 | 7 74E-03 | 1 55E-02 | 0 0575 | 3.739E+12 |
| Cl-36 | 2 8120E-06 | 60 14 | 120 28 | 0 00E+00 | 1 69E-04 | 3 38E-04 | 0 0850 | 2.316E+12 |
| Cm-243 | 1 7940E-07 | 60 14 | 120 28 | 0 00E+00 | 1 08E-05 | 2 16E-05 | 0 1250 | 1.682E+12 |
| Cm-244 | 1 6962E-06 | 60 14 | 120 28 | 0 00E+00 | 1 02E-04 | 2 04E-04 | 0 2250 | 1.965E+12 |
| Co-60 | 1 2839E+00 | 60 14 | 120 28 | 0 00E+00 | 7 72E+01 | 1 54E+02 | 0 3750 | 9.972E+11 |
| Cs-134 | 9 0541E-02 | 60 14 | 120 28 | 0 00E+00 | 5 45E+00 | 1 09E+01 | 0 5750 | 1.326E+13 |
| Cs-135 | 3 2195E-05 | 60 14 | 120 28 | 0 00E+00 | 1 94E-03 | 3 87E-03 | 0 8500 | 5.690E+11 |
| Cs-137 | 2 7564E+00 | 60 14 | 120 28 | 0 00E+00 | 1 66E+02 | 3 32E+02 | 1 2500 | 1.155E+13 |
| Eu-154 | 1 5368E-02 | 60 14 | 120 28 | 0 00E+00 | 9 24E-01 | 1 85E+00 | 1 7500 | 7.702E+09 |
| Eu-155 | 2 9293E-02 | 60 14 | 120 28 | 0 00E+00 | 1 76E+00 | 3 52E+00 | 2 2500 | 1.241E+10 |
| Fe-55 | 7 7158E-01 | 60 14 | 120 28 | 0 00E+00 | 4 64E+01 | 9 28E+01 | 2 7500 | 9.852E+07 |
| H-3 | 1 1111E-02 | 60 14 | 120 28 | 0 00E+00 | 6 68E-01 | 1 34E+00 | 3 5000 | 1.147E+07 |
| I-129 | 7 3684E-07 | 60 14 | 120 28 | 0 00E+00 | 4 43E-05 | 8 86E-05 | 5 0000 | 6.404E+01 |
| Kr-85 | 2 5263E-01 | 60 14 | 120 28 | 0 00E+00 | 1 52E+01 | 3 04E+01 | 7 0000 | 7.250E+00 |
| Np-237 | 1 2427E-06 | 60 14 | 120 28 | 0 00E+00 | 7 47E-05 | 1 49E-04 | 11 0000 | 8.259E-01 |
| Pa-231 | 3 8511E-09 | 60 14 | 120 28 | 0 00E+00 | 2 32E-07 | 4 63E-07 | | |
| Pb-210 | 7 3880E-15 | 60 14 | 120 28 | 0 00E+00 | 4 44E-13 | 8 89E-13 | | |
| Pm-147 | 2 1023E+00 | 60 14 | 120 28 | 0 00E+00 | 1 26E+02 | 2 53E+02 | | |
| Pu-238 | 1 0383E-03 | 60 14 | 120 28 | 0 00E+00 | 6 24E-02 | 1 25E-01 | | |
| Pu-239 | 5 5293E-03 | 60 14 | 120 28 | 0 00E+00 | 3 33E-01 | 6 65E-01 | | |
| Pu-240 | 2 1278E-03 | 60 14 | 120 28 | 0 00E+00 | 1 28E-01 | 2 56E-01 | | |
| Pu-241 | 1 0195E-01 | 60 14 | 120 28 | 0 00E+00 | 6 13E+00 | 1 23E+01 | | |
| Pu-242 | 2 3128E-07 | 60 14 | 120 28 | 0 00E+00 | 1 39E-05 | 2 78E-05 | | |
| Ra-226 | 5 2782E-14 | 60 14 | 120 28 | 0 00E+00 | 3 17E-12 | 6 35E-12 | | |
| Ra-228 | 1 9338E-10 | 60 14 | 120 28 | 0 00E+00 | 1 16E-08 | 2 33E-08 | | |
| Ru-106 | 9 1684E-02 | 60 14 | 120 28 | 0 00E+00 | 5 51E+00 | 1 10E+01 | | |
| Se-79 | 1 3018E-05 | 60 14 | 120 28 | 0 00E+00 | 7 83E-04 | 1 57E-03 | | |
| Sn-126 | 1 2167E-05 | 60 14 | 120 28 | 0 00E+00 | 7 32E-04 | 1 46E-03 | | |
| Sr-90 | 2 6045E+00 | 60 14 | 120 28 | 0 00E+00 | 1 57E+02 | 3 13E+02 | | |
| Tc-99 | 4 4241E-04 | 60 14 | 120 28 | 0 00E+00 | 2 66E-02 | 5 32E-02 | | |
| Th-229 | 1 3713E-10 | 60 14 | 120 28 | 0 00E+00 | 8 25E-09 | 1 65E-08 | | |
| Th-230 | 1 8090E-11 | 60 14 | 120 28 | 0 00E+00 | 1 09E-09 | 2 18E-09 | | |
| Th-232 | 2 5278E-10 | 60 14 | 120 28 | 0 00E+00 | 1 52E-08 | 3 04E-08 | | |
| Ti-208 | 1 6947E-08 | 60 14 | 120 28 | 0 00E+00 | 1 02E-06 | 2 04E-06 | | |
| U-232 | 4 8737E-08 | 60 14 | 120 28 | 0 00E+00 | 2 93E-06 | 5 86E-06 | | |
| U-233 | 1 2203E-07 | 60 14 | 120 28 | 0 00E+00 | 7 34E-06 | 1 47E-05 | | |
| U-234 | 1 5925E-07 | 60 14 | 120 28 | 0 00E+00 | 9 58E-06 | 1 92E-05 | | |
| U-235 | -2 6194E-06 | 60 14 | 0 00 | 6 68E-04 | 5 10E-04 | 6 68E-04 | | |
| U-236 | 1 2693E-05 | 60 14 | 120 28 | 0 00E+00 | 7 63E-04 | 1 53E-03 | | |
| U-238 | -3 6331E-08 | 60 14 | 0 00 | 4 35E-04 | 4 33E-04 | 4 35E-04 | | |
| Y-90 | 2 6060E+00 | 60 14 | 120 28 | 0 00E+00 | 1 57E+02 | 3 13E+02 | | |
| Other Radionuclides | | | | | 2 17E+02 | 4 34E+02 | | |

Thermal Power
Nominal Heat Output (Watts) 3.50E+00
Bounding Heat Output (Watts) 7.00E+00
Total Total

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| | From SFD | Used | |
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19.26433915 | 10 to 20 1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 54 71 | 60 14 | |
| Bounding | | 120 28 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 1 10 | 1 10 | |
| Bounding | 2 20 | | 1 00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA 8.5/20 FFCR AFRRI
SNF ID #: 969
Fuel Units & Descr: 3 - ELEMENT
Heavy Metal Mass: BOL= , EOL=0.26kg
ROD Storage Site: INEEL

¹Fuel decay start date: 2019
Estimates as of: 2030

Template: TRIGA SS (LW/U-Zr, SST, 10 to 20%, U)

²Template Burnup(MWD): 6.65

Template BOL Heavy Metal Mass (MT) 0.000195

Template Decay Time: 10 years

Estimated
Canister usage
18"x10"
0.04

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 1.3731E-09 | 9.20 | 18.40 | 0.00E+00 | 1.26E-08 | 2.53E-08 | Avg. MeV | |
| Am-241 | 2.3865E-03 | 9.20 | 18.40 | 0.00E+00 | 2.20E-02 | 4.39E-02 | 0.0150 | 2.377E+12 |
| Am-242m | 1.3812E-06 | 9.20 | 18.40 | 0.00E+00 | 1.27E-05 | 2.54E-05 | 0.0250 | 5.036E+11 |
| Am-243 | 1.4767E-07 | 9.20 | 18.40 | 0.00E+00 | 1.36E-06 | 2.72E-06 | 0.0375 | 4.302E+11 |
| C-14 | 1.2863E-04 | 9.20 | 18.40 | 0.00E+00 | 1.18E-03 | 2.37E-03 | 0.0575 | 4.585E+11 |
| Cl-36 | 2.8120E-06 | 9.20 | 18.40 | 0.00E+00 | 2.59E-05 | 5.17E-05 | 0.0850 | 2.782E+11 |
| Cm-243 | 1.5895E-07 | 9.20 | 18.40 | 0.00E+00 | 1.46E-06 | 2.92E-06 | 0.1250 | 1.829E+11 |
| Cm-244 | 1.4008E-06 | 9.20 | 18.40 | 0.00E+00 | 1.29E-05 | 2.58E-05 | 0.2250 | 2.372E+11 |
| Co-60 | 6.6541E-01 | 9.20 | 18.40 | 0.00E+00 | 6.12E+00 | 1.22E+01 | 0.3750 | 1.090E+11 |
| Cs-134 | 1.6887E-02 | 9.20 | 18.40 | 0.00E+00 | 1.55E-01 | 3.11E-01 | 0.5750 | 1.707E+12 |
| Cs-135 | 3.2195E-05 | 9.20 | 18.40 | 0.00E+00 | 2.96E-04 | 5.92E-04 | 0.8500 | 3.048E+10 |
| Cs-137 | 2.4556E+00 | 9.20 | 18.40 | 0.00E+00 | 2.26E+01 | 4.52E+01 | 1.2500 | 9.164E+11 |
| Eu-154 | 1.0268E-02 | 9.20 | 18.40 | 0.00E+00 | 9.45E-02 | 1.89E-01 | 1.7500 | 5.515E+08 |
| Eu-155 | 1.4570E-02 | 9.20 | 18.40 | 0.00E+00 | 1.34E-01 | 2.68E-01 | 2.2500 | 2.880E+07 |
| Fe-55 | 2.0361E-01 | 9.20 | 18.40 | 0.00E+00 | 1.87E+00 | 3.75E+00 | 2.7500 | 4.768E+05 |
| H-3 | 8.3940E-03 | 9.20 | 18.40 | 0.00E+00 | 7.72E-02 | 1.54E-01 | 3.5000 | 5.650E+04 |
| I-129 | 7.3684E-07 | 9.20 | 18.40 | 0.00E+00 | 6.78E-06 | 1.36E-05 | 5.0000 | 9.771E+00 |
| Kr-85 | 1.8286E-01 | 9.20 | 18.40 | 0.00E+00 | 1.68E+00 | 3.36E+00 | 7.0000 | 1.105E+00 |
| Np-237 | 1.2462E-06 | 9.20 | 18.40 | 0.00E+00 | 1.15E-05 | 2.29E-05 | 11.0000 | 1.258E-01 |
| Pa-231 | 4.9143E-09 | 9.20 | 18.40 | 0.00E+00 | 4.52E-08 | 9.04E-08 | | |
| Pb-210 | 1.7173E-14 | 9.20 | 18.40 | 0.00E+00 | 1.58E-13 | 3.16E-13 | | |
| Pm-147 | 5.6165E-01 | 9.20 | 18.40 | 0.00E+00 | 5.17E+00 | 1.03E+01 | | |
| Pu-238 | 9.9820E-04 | 9.20 | 18.40 | 0.00E+00 | 9.18E-03 | 1.84E-02 | | |
| Pu-239 | 5.5293E-03 | 9.20 | 18.40 | 0.00E+00 | 5.09E-02 | 1.02E-01 | | |
| Pu-240 | 2.1263E-03 | 9.20 | 18.40 | 0.00E+00 | 1.96E-02 | 3.91E-02 | | |
| Pu-241 | 8.0165E-02 | 9.20 | 18.40 | 0.00E+00 | 7.38E-01 | 1.48E+00 | | |
| Pu-242 | 2.3128E-07 | 9.20 | 18.40 | 0.00E+00 | 2.13E-06 | 4.26E-06 | | |
| Ra-226 | 9.9774E-14 | 9.20 | 18.40 | 0.00E+00 | 9.18E-13 | 1.84E-12 | | |
| Ra-228 | 2.1729E-10 | 9.20 | 18.40 | 0.00E+00 | 2.00E-09 | 4.00E-09 | | |
| Ru-106 | 2.9519E-03 | 9.20 | 18.40 | 0.00E+00 | 2.72E-02 | 5.43E-02 | | |
| Se-79 | 1.3017E-05 | 9.20 | 18.40 | 0.00E+00 | 1.20E-04 | 2.40E-04 | | |
| Sn-126 | 1.2167E-05 | 9.20 | 18.40 | 0.00E+00 | 1.12E-04 | 2.24E-04 | | |
| Sr-90 | 2.3128E+00 | 9.20 | 18.40 | 0.00E+00 | 2.13E+01 | 4.26E+01 | | |
| Tc-99 | 4.4241E-04 | 9.20 | 18.40 | 0.00E+00 | 4.07E-03 | 8.14E-03 | | |
| Th-229 | 1.9459E-10 | 9.20 | 18.40 | 0.00E+00 | 1.79E-09 | 3.58E-09 | | |
| Th-230 | 2.5564E-11 | 9.20 | 18.40 | 0.00E+00 | 2.35E-10 | 4.70E-10 | | |
| Th-232 | 2.5278E-10 | 9.20 | 18.40 | 0.00E+00 | 2.33E-09 | 4.65E-09 | | |
| Ti-208 | 1.6947E-08 | 9.20 | 18.40 | 0.00E+00 | 1.56E-07 | 3.12E-07 | | |
| U-232 | 4.6812E-08 | 9.20 | 18.40 | 0.00E+00 | 4.31E-07 | 8.61E-07 | | |
| U-233 | 1.2206E-07 | 9.20 | 18.40 | 0.00E+00 | 1.12E-06 | 2.25E-06 | | |
| U-234 | 1.7323E-07 | 9.20 | 18.40 | 0.00E+00 | 1.59E-06 | 3.19E-06 | | |
| U-235 | -2.6194E-06 | 9.20 | 0.00 | 1.17E-04 | 9.25E-05 | 1.17E-04 | | |
| U-236 | 1.2693E-05 | 9.20 | 18.40 | 0.00E+00 | 1.17E-04 | 2.34E-04 | | |
| U-238 | -3.6331E-08 | 9.20 | 0.00 | 7.25E-05 | 7.22E-05 | 7.25E-05 | | |
| Y-90 | 2.3128E+00 | 9.20 | 18.40 | 0.00E+00 | 2.13E+01 | 4.26E+01 | | |
| Other Radionuclides | | | | | 2.26E+01 | 4.51E+01 | | |
| | | | | | | | Thermal Power | |
| | | | | | | | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| | | | | | | | 3.60E-01 | 7.21E-01 |
| | | | | | | | Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|--|
| | From SFD | Used | |
| Reactor Moderator: | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | This Template was used for the following reasons: This fuel matches on all parameters except enrichment (unknown) |
| Fuel Cladding: | SST | SST | |
| BOL HM Constituents: | U | U | |
| BOL Enrichment %: | | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | | 9.20 | Nominal burnup taken from SFD and converted to MWd using BOL=0.27kg Bounding burnup assumed to be twice nominal burnup |
| Bounding | | 18.40 | |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 1.00 | | 1.00 |
| Bounding | 2.00 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA 8 5/20 FFCR ENGLAND
SNF ID # 987
Fuel Units & Descr: 4 - ELEMENT
Heavy Metal Mass: BOL=0.641kg EOL=0.624kg
ROD Storage Site: INEEL

¹Fuel decay start date 2010
Estimates as of 2030
Template TRIGA-SS (LW/U-Zrx, SST, 10 to 20%, U)
²Template Burnup(MWd) 6.65
Template BOL Heavy Metal Mass (MT) 0.000195
Template Decay Time 20 years

Estimated
Canister usage
18"x10"
0.04

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| | m | x _a | x _b | b | y _a | y _b | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Avg MeV | |
| Ac-227 | 2.6436E-09 | 18.75 | 37.49 | 0.00E+00 | 4.96E-08 | 9.91E-08 | 0.0150 | 3.757E+12 |
| Am-241 | 3.1429E-03 | 18.75 | 37.49 | 0.00E+00 | 5.89E-02 | 1.18E-01 | 0.0250 | 7.822E+11 |
| Am-242m | 1.3195E-06 | 18.75 | 37.49 | 0.00E+00 | 2.47E-05 | 4.95E-05 | 0.0375 | 6.776E+11 |
| Am-243 | 1.4753E-07 | 18.75 | 37.49 | 0.00E+00 | 2.77E-06 | 5.53E-06 | 0.0575 | 7.290E+11 |
| C-14 | 1.2847E-04 | 18.75 | 37.49 | 0.00E+00 | 2.41E-03 | 4.82E-03 | 0.0850 | 4.401E+11 |
| Cl-36 | 2.8120E-06 | 18.75 | 37.49 | 0.00E+00 | 5.27E-05 | 1.05E-04 | 0.1250 | 2.876E+11 |
| Cm-243 | 1.2465E-07 | 18.75 | 37.49 | 0.00E+00 | 2.34E-06 | 4.67E-06 | 0.2250 | 3.779E+11 |
| Cm-244 | 9.5564E-07 | 18.75 | 37.49 | 0.00E+00 | 1.79E-05 | 3.58E-05 | 0.3750 | 1.656E+11 |
| Co-60 | 1.7880E-01 | 18.75 | 37.49 | 0.00E+00 | 3.35E+00 | 6.70E+00 | 0.5750 | 2.724E+12 |
| Cs-134 | 5.8692E-04 | 18.75 | 37.49 | 0.00E+00 | 1.10E-02 | 2.20E-02 | 0.8500 | 3.070E+10 |
| Cs-135 | 3.2195E-05 | 18.75 | 37.49 | 0.00E+00 | 6.04E-04 | 1.21E-03 | 1.2500 | 5.088E+11 |
| Cs-137 | 1.9489E+00 | 18.75 | 37.49 | 0.00E+00 | 3.65E+01 | 7.31E+01 | 1.7500 | 7.888E+08 |
| Eu-154 | 4.5895E-03 | 18.75 | 37.49 | 0.00E+00 | 8.60E-02 | 1.72E-01 | 2.2500 | 2.717E+06 |
| Eu-155 | 3.6045E-03 | 18.75 | 37.49 | 0.00E+00 | 6.76E-02 | 1.35E-01 | 2.7500 | 2.993E+04 |
| Fe-55 | 1.4185E-02 | 18.75 | 37.49 | 0.00E+00 | 2.66E-01 | 5.32E-01 | 3.5000 | 1.664E+02 |
| H-3 | 4.7895E-03 | 18.75 | 37.49 | 0.00E+00 | 8.98E-02 | 1.80E-01 | 5.0000 | 1.988E+01 |
| I-129 | 7.3684E-07 | 18.75 | 37.49 | 0.00E+00 | 1.38E-05 | 2.76E-05 | 7.0000 | 2.246E+00 |
| Kr-85 | 9.5820E-02 | 18.75 | 37.49 | 0.00E+00 | 1.80E+00 | 3.59E+00 | 11.0000 | 2.555E-01 |
| Np-237 | 1.2552E-06 | 18.75 | 37.49 | 0.00E+00 | 2.35E-05 | 4.71E-05 | | |
| Pa-231 | 7.0406E-09 | 18.75 | 37.49 | 0.00E+00 | 1.32E-07 | 2.64E-07 | | |
| Pb-210 | 5.8000E-14 | 18.75 | 37.49 | 0.00E+00 | 1.09E-12 | 2.17E-12 | | |
| Pm-147 | 4.0075E-02 | 18.75 | 37.49 | 0.00E+00 | 7.51E-01 | 1.50E+00 | | |
| Pu-238 | 9.2256E-04 | 18.75 | 37.49 | 0.00E+00 | 1.73E-02 | 3.46E-02 | | |
| Pu-239 | 5.5278E-03 | 18.75 | 37.49 | 0.00E+00 | 1.04E-01 | 2.07E-01 | | |
| Pu-240 | 2.1248E-03 | 18.75 | 37.49 | 0.00E+00 | 3.98E-02 | 7.97E-02 | | |
| Pu-241 | 4.9549E-02 | 18.75 | 37.49 | 0.00E+00 | 9.29E-01 | 1.86E+00 | | |
| Pu-242 | 2.3128E-07 | 18.75 | 37.49 | 0.00E+00 | 4.34E-06 | 8.67E-06 | | |
| Ra-226 | 2.4526E-13 | 18.75 | 37.49 | 0.00E+00 | 4.60E-12 | 9.20E-12 | | |
| Ra-228 | 2.4015E-10 | 18.75 | 37.49 | 0.00E+00 | 4.50E-09 | 9.00E-09 | | |
| Ru-106 | 3.0602E-06 | 18.75 | 37.49 | 0.00E+00 | 5.74E-05 | 1.15E-04 | | |
| Se-79 | 1.3015E-05 | 18.75 | 37.49 | 0.00E+00 | 2.44E-04 | 4.88E-04 | | |
| Sn-126 | 1.2165E-05 | 18.75 | 37.49 | 0.00E+00 | 2.28E-04 | 4.56E-04 | | |
| Sr-90 | 1.8226E+00 | 18.75 | 37.49 | 0.00E+00 | 3.42E+01 | 6.83E+01 | | |
| Tc-99 | 4.4241E-04 | 18.75 | 37.49 | 0.00E+00 | 8.29E-03 | 1.66E-02 | | |
| Th-229 | 3.0962E-10 | 18.75 | 37.49 | 0.00E+00 | 5.80E-09 | 1.16E-08 | | |
| Th-230 | 4.2346E-11 | 18.75 | 37.49 | 0.00E+00 | 7.94E-10 | 1.59E-09 | | |
| Th-232 | 2.5278E-10 | 18.75 | 37.49 | 0.00E+00 | 4.74E-09 | 9.48E-09 | | |
| Ti-208 | 1.5820E-08 | 18.75 | 37.49 | 0.00E+00 | 2.97E-07 | 5.93E-07 | | |
| U-232 | 4.2647E-08 | 18.75 | 37.49 | 0.00E+00 | 8.00E-07 | 1.60E-06 | | |
| U-233 | 1.2211E-07 | 18.75 | 37.49 | 0.00E+00 | 2.29E-06 | 4.58E-06 | | |
| U-234 | 1.9955E-07 | 18.75 | 37.49 | 0.00E+00 | 3.74E-06 | 7.48E-06 | | |
| U-235 | -2.6194E-06 | 18.75 | 0.00 | 2.77E-04 | 2.28E-04 | 2.77E-04 | | |
| U-236 | 1.2693E-05 | 18.75 | 37.49 | 0.00E+00 | 2.38E-04 | 4.76E-04 | | |
| U-238 | -3.6331E-08 | 18.75 | 0.00 | 1.72E-04 | 1.72E-04 | 1.72E-04 | | |
| Y-90 | 1.8241E+00 | 18.75 | 37.49 | 0.00E+00 | 3.42E+01 | 6.84E+01 | | |
| Other Radionuclides | | | | | 3.61E+01 | 7.22E+01 | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 4.69E-01 | 9.38E-01 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| | From SFD | Used | |
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19.96879875 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 18.75 | 16.80 | |
| Bounding | | 37.49 | Nominal burnup taken directly from SFD (converted to MWd) Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 0.86 | 0.90 | |
| Bounding | 1.71 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA 8 5/20 FFCR HEIDELBERG
SNF ID # 1045
Fuel Units & Descr. 5 - ELEMENT
Heavy Metal Mass BOL=0.801kg EOL=0.79kg
ROD Storage Site INEEL

¹Fuel decay start date: 2010
Estimates as of: 2030
Template* TRIGA-SS (LW/U-Zr, SST, 10 to 20%, U)
²Template Burnup(MWd): 6.65
Template BOL Heavy Metal Mass (MT)* 0.000195
Template Decay Time 20 years

Estimated
Canister usage:
18"x10"
0.05

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-----------------------------|------------------------------|-----------------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventones(Ci) | Bounding Fuel Inventones(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.6436E-09 | 15.61 | 31.23 | 0.00E+00 | 4.13E-08 | 8.25E-08 | Avg MeV | |
| Am-241 | 3.1429E-03 | 15.61 | 31.23 | 0.00E+00 | 4.91E-02 | 9.81E-02 | 0.0150 | 3.129E+12 |
| Am-242m | 1.3195E-06 | 15.61 | 31.23 | 0.00E+00 | 2.06E-05 | 4.12E-05 | 0.0250 | 6.514E+11 |
| Am-243 | 1.4753E-07 | 15.61 | 31.23 | 0.00E+00 | 2.30E-06 | 4.61E-06 | 0.0375 | 5.643E+11 |
| C-14 | 1.2847E-04 | 15.61 | 31.23 | 0.00E+00 | 2.01E-03 | 4.01E-03 | 0.0575 | 6.071E+11 |
| Cl-36 | 2.8120E-06 | 15.61 | 31.23 | 0.00E+00 | 4.39E-05 | 8.78E-05 | 0.0850 | 3.665E+11 |
| Cm-243 | 1.2465E-07 | 15.61 | 31.23 | 0.00E+00 | 1.95E-06 | 3.89E-06 | 0.1250 | 2.395E+11 |
| Cm-244 | 9.5564E-07 | 15.61 | 31.23 | 0.00E+00 | 1.49E-05 | 2.98E-05 | 0.2250 | 3.147E+11 |
| Co-60 | 1.7880E-01 | 15.61 | 31.23 | 0.00E+00 | 2.79E+00 | 5.58E+00 | 0.3750 | 1.379E+11 |
| Cs-134 | 5.8692E-04 | 15.61 | 31.23 | 0.00E+00 | 9.16E-03 | 1.83E-02 | 0.5750 | 2.268E+12 |
| Cs-135 | 3.2195E-05 | 15.61 | 31.23 | 0.00E+00 | 5.03E-04 | 1.01E-03 | 0.8500 | 2.557E+10 |
| Cs-137 | 1.9489E+00 | 15.61 | 31.23 | 0.00E+00 | 3.04E+01 | 6.09E+01 | 1.2500 | 4.237E+11 |
| Eu-154 | 4.5895E-03 | 15.61 | 31.23 | 0.00E+00 | 7.17E-02 | 1.43E-01 | 1.7500 | 6.569E+08 |
| Eu-155 | 3.6045E-03 | 15.61 | 31.23 | 0.00E+00 | 5.63E-02 | 1.13E-01 | 2.2500 | 2.263E+06 |
| Fe-55 | 1.4185E-02 | 15.61 | 31.23 | 0.00E+00 | 2.21E-01 | 4.43E-01 | 2.7500 | 2.493E+04 |
| H-3 | 4.7895E-03 | 15.61 | 31.23 | 0.00E+00 | 7.48E-02 | 1.50E-01 | 3.5000 | 1.390E+02 |
| I-129 | 7.3684E-07 | 15.61 | 31.23 | 0.00E+00 | 1.15E-05 | 2.30E-05 | 5.0000 | 1.672E+01 |
| Kr-85 | 9.5820E-02 | 15.61 | 31.23 | 0.00E+00 | 1.50E+00 | 2.99E+00 | 7.0000 | 1.889E+00 |
| Np-237 | 1.2552E-06 | 15.61 | 31.23 | 0.00E+00 | 1.96E-05 | 3.92E-05 | 11.0000 | 2.150E-01 |
| Pa-231 | 7.0406E-09 | 15.61 | 31.23 | 0.00E+00 | 1.10E-07 | 2.20E-07 | | |
| Pb-210 | 5.8000E-14 | 15.61 | 31.23 | 0.00E+00 | 9.06E-13 | 1.81E-12 | | |
| Pm-147 | 4.0075E-02 | 15.61 | 31.23 | 0.00E+00 | 6.26E-01 | 1.25E+00 | | |
| Pu-238 | 9.2256E-04 | 15.61 | 31.23 | 0.00E+00 | 1.44E-02 | 2.88E-02 | | |
| Pu-239 | 5.5278E-03 | 15.61 | 31.23 | 0.00E+00 | 8.63E-02 | 1.73E-01 | | |
| Pu-240 | 2.1248E-03 | 15.61 | 31.23 | 0.00E+00 | 3.32E-02 | 6.63E-02 | | |
| Pu-241 | 4.9549E-02 | 15.61 | 31.23 | 0.00E+00 | 7.74E-01 | 1.55E+00 | | |
| Pu-242 | 2.3128E-07 | 15.61 | 31.23 | 0.00E+00 | 3.61E-06 | 7.22E-06 | | |
| Ra-226 | 2.4526E-13 | 15.61 | 31.23 | 0.00E+00 | 3.83E-12 | 7.66E-12 | | |
| Ra-228 | 2.4015E-10 | 15.61 | 31.23 | 0.00E+00 | 3.75E-09 | 7.50E-09 | | |
| Ru-106 | 3.0602E-06 | 15.61 | 31.23 | 0.00E+00 | 4.78E-05 | 9.56E-05 | | |
| Se-79 | 1.3015E-05 | 15.61 | 31.23 | 0.00E+00 | 2.03E-04 | 4.06E-04 | | |
| Sn-126 | 1.2165E-05 | 15.61 | 31.23 | 0.00E+00 | 1.90E-04 | 3.80E-04 | | |
| Sr-90 | 1.8226E+00 | 15.61 | 31.23 | 0.00E+00 | 2.85E+01 | 5.69E+01 | | |
| Tc-99 | 4.4241E-04 | 15.61 | 31.23 | 0.00E+00 | 6.91E-03 | 1.38E-02 | | |
| Th-229 | 3.0962E-10 | 15.61 | 31.23 | 0.00E+00 | 4.83E-09 | 9.67E-09 | | |
| Th-230 | 4.2346E-11 | 15.61 | 31.23 | 0.00E+00 | 6.61E-10 | 1.32E-09 | | |
| Th-232 | 2.5278E-10 | 15.61 | 31.23 | 0.00E+00 | 3.95E-09 | 7.89E-09 | | |
| Ti-208 | 1.5820E-08 | 15.61 | 31.23 | 0.00E+00 | 2.47E-07 | 4.94E-07 | | |
| U-232 | 4.2647E-08 | 15.61 | 31.23 | 0.00E+00 | 6.66E-07 | 1.33E-06 | Thermal Power | |
| U-233 | 1.2211E-07 | 15.61 | 31.23 | 0.00E+00 | 1.91E-06 | 3.81E-06 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 1.9955E-07 | 15.61 | 31.23 | 0.00E+00 | 3.12E-06 | 6.23E-06 | 3.91E-01 | 7.81E-01 |
| U-235 | -2.6194E-06 | 15.61 | 0.00 | 3.44E-04 | 3.03E-04 | 3.44E-04 | Total | Total |
| U-236 | 1.2693E-05 | 15.61 | 31.23 | 0.00E+00 | 1.98E-04 | 3.96E-04 | | |
| U-238 | -3.6331E-08 | 15.61 | 0.00 | 2.16E-04 | 2.15E-04 | 2.16E-04 | | |
| Y-90 | 1.8241E+00 | 15.61 | 31.23 | 0.00E+00 | 2.85E+01 | 5.70E+01 | | |
| Other Radionuclides | | | | | 3.01E+01 | 6.01E+01 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------------------|-------------------------------|----------------------------------|
| Reactor Moderator: | From SFD LW AND U ZIRC HYDRIDE | Used LW AND U ZIRC HYDRIDE | |
| Fuel Cladding: | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19.85018727 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 15.61 | 10.02 | |
| Bounding | | 31.23 | Nominal burnup taken directly from SFD (converted to MWd) Bounding burnup assumed to be twice nominal burnup |

| Checks | | | |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
| Nominal | 0.57 | 0.64 | |
| Bounding | 1.14 | | |
| | | | 0.99 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA 8.5/20 FFCR ITALY
SNF ID # 730

Fuel Units & Descr 3 - ELEMENT
Heavy Metal Mass BOL=0.484kg EOL=0.458kg
ROD Storage Site INEEL

¹Fuel decay start date 1959
Estimates as of 2030
Template TRIGA-SS (LW/U-Zrx SST, 10 to 20%, U)
²Template Burnup(MWd) 6.65
Template BOL Heavy Metal Mass (MT) 0.000195
Template Decay Time 65 years

Estimated
Canister usage
18"x10"
0.04

| II. Estimates | m | X _a | X _b | b | Y _a | Y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | Cu/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 1.2442E-08 | 24.34 | 48.68 | 0.00E+00 | 3.03E-07 | 6.06E-07 | Avg MeV | |
| Am-241 | 4.0120E-03 | 24.34 | 48.68 | 0.00E+00 | 9.77E-02 | 1.95E-01 | 0.0150 | 1.665E+12 |
| Am-242m | 1.0749E-06 | 24.34 | 48.68 | 0.00E+00 | 2.62E-05 | 5.23E-05 | 0.0250 | 3.456E+11 |
| Am-243 | 1.4692E-07 | 24.34 | 48.68 | 0.00E+00 | 3.58E-06 | 7.15E-06 | 0.0375 | 3.015E+11 |
| C-14 | 1.2777E-04 | 24.34 | 48.68 | 0.00E+00 | 3.11E-03 | 6.22E-03 | 0.0575 | 3.248E+11 |
| Cl-36 | 2.8120E-06 | 24.34 | 48.68 | 0.00E+00 | 6.85E-05 | 1.37E-04 | 0.0850 | 1.946E+11 |
| Cm-243 | 4.1759E-08 | 24.34 | 48.68 | 0.00E+00 | 1.02E-06 | 2.03E-06 | 0.1250 | 1.262E+11 |
| Cm-244 | 1.7098E-07 | 24.34 | 48.68 | 0.00E+00 | 4.16E-06 | 8.32E-06 | 0.2250 | 1.676E+11 |
| Co-60 | 4.8241E-04 | 24.34 | 48.68 | 0.00E+00 | 1.17E-02 | 2.35E-02 | 0.3750 | 7.311E+10 |
| Cs-134 | 1.5970E-10 | 24.34 | 48.68 | 0.00E+00 | 3.89E-09 | 7.77E-09 | 0.5750 | 1.249E+12 |
| Cs-135 | 3.2195E-05 | 24.34 | 48.68 | 0.00E+00 | 7.84E-04 | 1.57E-03 | 0.8500 | 1.201E+10 |
| Cs-137 | 6.8977E-01 | 24.34 | 48.68 | 0.00E+00 | 1.68E+01 | 3.36E+01 | 1.2500 | 5.826E+09 |
| Eu-154 | 1.2238E-04 | 24.34 | 48.68 | 0.00E+00 | 2.98E-03 | 5.96E-03 | 1.7500 | 3.091E+08 |
| Eu-155 | 6.7158E-06 | 24.34 | 48.68 | 0.00E+00 | 1.63E-04 | 3.27E-04 | 2.2500 | 4.290E+04 |
| Fe-55 | 8.8165E-08 | 24.34 | 48.68 | 0.00E+00 | 2.15E-06 | 4.29E-06 | 2.7500 | 1.771E+04 |
| H-3 | 3.8376E-04 | 24.34 | 48.68 | 0.00E+00 | 9.34E-03 | 1.87E-02 | 3.5000 | 5.983E+01 |
| I-129 | 7.3684E-07 | 24.34 | 48.68 | 0.00E+00 | 1.79E-05 | 3.59E-05 | 5.0000 | 2.519E+01 |
| Kr-85 | 5.2316E-03 | 24.34 | 48.68 | 0.00E+00 | 1.27E-01 | 2.55E-01 | 7.0000 | 2.842E+00 |
| Np-237 | 1.3232E-06 | 24.34 | 48.68 | 0.00E+00 | 3.22E-05 | 6.44E-05 | 11.0000 | 3.231E-01 |
| Pa-231 | 1.8722E-08 | 24.34 | 48.68 | 0.00E+00 | 4.56E-07 | 9.11E-07 | | |
| Pb-210 | 1.2620E-12 | 24.34 | 48.68 | 0.00E+00 | 3.07E-11 | 6.14E-11 | | |
| Pm-147 | 2.7714E-07 | 24.34 | 48.68 | 0.00E+00 | 6.75E-06 | 1.35E-05 | | |
| Pu-238 | 6.4707E-04 | 24.34 | 48.68 | 0.00E+00 | 1.58E-02 | 3.15E-02 | | |
| Pu-239 | 5.5203E-03 | 24.34 | 48.68 | 0.00E+00 | 1.34E-01 | 2.69E-01 | | |
| Pu-240 | 2.1143E-03 | 24.34 | 48.68 | 0.00E+00 | 5.15E-02 | 1.03E-01 | | |
| Pu-241 | 5.6872E-03 | 24.34 | 48.68 | 0.00E+00 | 1.38E-01 | 2.77E-01 | | |
| Pu-242 | 2.3128E-07 | 24.34 | 48.68 | 0.00E+00 | 5.63E-06 | 1.13E-05 | | |
| Ra-226 | 2.6466E-12 | 24.34 | 48.68 | 0.00E+00 | 6.44E-11 | 1.29E-10 | | |
| Ra-228 | 2.5278E-10 | 24.34 | 48.68 | 0.00E+00 | 6.15E-09 | 1.23E-08 | | |
| Ru-106 | 1.1377E-19 | 24.34 | 48.68 | 0.00E+00 | 2.77E-18 | 5.54E-18 | | |
| Se-79 | 1.3009E-05 | 24.34 | 48.68 | 0.00E+00 | 3.17E-04 | 6.33E-04 | | |
| Sn-126 | 1.2162E-05 | 24.34 | 48.68 | 0.00E+00 | 2.96E-04 | 5.92E-04 | | |
| Sr-90 | 6.2511E-01 | 24.34 | 48.68 | 0.00E+00 | 1.52E+01 | 3.04E+01 | | |
| Tc-99 | 4.4241E-04 | 24.34 | 48.68 | 0.00E+00 | 1.08E-02 | 2.15E-02 | | |
| Th-229 | 9.4105E-10 | 24.34 | 48.68 | 0.00E+00 | 2.29E-08 | 4.58E-08 | | |
| Th-230 | 1.7098E-10 | 24.34 | 48.68 | 0.00E+00 | 4.16E-09 | 8.32E-09 | | |
| Th-232 | 2.5278E-10 | 24.34 | 48.68 | 0.00E+00 | 6.15E-09 | 1.23E-08 | | |
| Ti-208 | 1.0305E-08 | 24.34 | 48.68 | 0.00E+00 | 2.51E-07 | 5.02E-07 | | |
| U-232 | 2.7669E-08 | 24.34 | 48.68 | 0.00E+00 | 6.74E-07 | 1.35E-06 | Thermal Power | |
| U-233 | 1.2239E-07 | 24.34 | 48.68 | 0.00E+00 | 2.98E-06 | 5.96E-06 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 3.1278E-07 | 24.34 | 48.68 | 0.00E+00 | 7.61E-06 | 1.52E-05 | 1.93E-01 | 3.87E-01 |
| U-235 | -2.6179E-06 | 24.34 | 0.00 | 2.10E-04 | 1.46E-04 | 2.10E-04 | Total | Total |
| U-236 | 1.2696E-05 | 24.34 | 48.68 | 0.00E+00 | 3.09E-04 | 6.18E-04 | | |
| U-238 | -3.6331E-08 | 24.34 | 0.00 | 1.30E-04 | 1.29E-04 | 1.30E-04 | | |
| Y-90 | 6.2541E-01 | 24.34 | 48.68 | 0.00E+00 | 1.52E+01 | 3.04E+01 | | |
| Other Radionuclides | | | | | 1.73E+01 | 3.45E+01 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences* |
|---------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment %: | 20.04130579 | 10 to 20.1 | |

Burnup Summary (MWd)³

| | From SFD | Estimated | Basis for burnup used in estimate* |
|----------|----------|-----------|------------------------------------|
| Nominal | 16.51 | 24.34 | |
| Bounding | | 48.68 | |

Nominal burnup calculated from the heavy metal mass destroyed
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 1.48 | 1.47 | |
| Bounding | 2.95 | | |

Estimated EOL HM/Given EOL HM
1.00

*Reactor shutdown, core removal, storage, shipping or other data confirming that irradiation ceased for fuel

³Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA 8.520 FFCR MNRC
SNF ID #: 703
Fuel Units & Descr: 5 - ELEMENT
Heavy Metal Mass: BOL=0.801kg EOL=0.761kg
ROD Storage Site: INEEL

¹Fuel decay start date: 2035
Estimates as of: 2030
Template: TRIGA-SS (LW/U-Zrx SST, 10 to 20% U)
²Template Burnup(MWd): 6.65
Template BOL Heavy Metal Mass (MT): 0.000195
Template Decay Time: 5 years

Estimated
Canister usage:
18"x10"
0.07

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Cu/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.5173E-10 | 39.14 | 78.28 | 0.00E+00 | 3.33E-08 | 6.67E-08 | Avg MeV | |
| Am-241 | 1.8331E-03 | 39.14 | 78.28 | 0.00E+00 | 7.17E-02 | 1.43E-01 | 0.0150 | 1.265E+13 |
| Am-242m | 1.4129E-06 | 39.14 | 78.28 | 0.00E+00 | 5.53E-05 | 1.11E-04 | 0.0250 | 2.784E+12 |
| Am-243 | 1.4774E-07 | 39.14 | 78.28 | 0.00E+00 | 5.78E-06 | 1.16E-05 | 0.0375 | 2.371E+12 |
| C-14 | 1.2871E-04 | 39.14 | 78.28 | 0.00E+00 | 5.04E-03 | 1.01E-02 | 0.0575 | 2.433E+12 |
| Cl-36 | 2.8120E-06 | 39.14 | 78.28 | 0.00E+00 | 1.10E-04 | 2.20E-04 | 0.0850 | 1.508E+12 |
| Cm-243 | 1.7940E-07 | 39.14 | 78.28 | 0.00E+00 | 7.02E-06 | 1.40E-05 | 0.1250 | 1.095E+12 |
| Cm-244 | 1.6962E-06 | 39.14 | 78.28 | 0.00E+00 | 6.64E-05 | 1.33E-04 | 0.2250 | 1.279E+12 |
| Co-60 | 1.2839E+00 | 39.14 | 78.28 | 0.00E+00 | 5.03E+01 | 1.01E+02 | 0.3750 | 6.490E+11 |
| Cs-134 | 9.0541E-02 | 39.14 | 78.28 | 0.00E+00 | 3.54E+00 | 7.09E+00 | 0.5750 | 8.628E+12 |
| Cs-135 | 3.2195E-05 | 39.14 | 78.28 | 0.00E+00 | 1.26E-03 | 2.52E-03 | 0.8500 | 3.703E+11 |
| Cs-137 | 2.7564E+00 | 39.14 | 78.28 | 0.00E+00 | 1.08E+02 | 2.16E+02 | 1.2500 | 7.520E+12 |
| Eu-154 | 1.5368E-02 | 39.14 | 78.28 | 0.00E+00 | 6.02E-01 | 1.20E+00 | 1.7500 | 5.013E+09 |
| Eu-155 | 2.9293E-02 | 39.14 | 78.28 | 0.00E+00 | 1.15E+00 | 2.29E+00 | 2.2500 | 8.080E+09 |
| Fe-55 | 7.7158E-01 | 39.14 | 78.28 | 0.00E+00 | 3.02E+01 | 6.04E+01 | 2.7500 | 6.412E+07 |
| H-3 | 1.1111E-02 | 39.14 | 78.28 | 0.00E+00 | 4.35E-01 | 8.70E-01 | 3.5000 | 7.462E+06 |
| I-129 | 7.3684E-07 | 39.14 | 78.28 | 0.00E+00 | 2.88E-05 | 5.77E-05 | 5.0000 | 4.153E+01 |
| Kr-85 | 2.5263E-01 | 39.14 | 78.28 | 0.00E+00 | 9.89E+00 | 1.98E+01 | 7.0000 | 4.701E+00 |
| Np-237 | 1.2427E-06 | 39.14 | 78.28 | 0.00E+00 | 4.86E-05 | 9.73E-05 | 11.0000 | 5.355E-01 |
| Pa-231 | 3.8511E-09 | 39.14 | 78.28 | 0.00E+00 | 1.51E-07 | 3.01E-07 | | |
| Pb-210 | 7.3880E-15 | 39.14 | 78.28 | 0.00E+00 | 2.89E-13 | 5.78E-13 | | |
| Pm-147 | 2.1023E+00 | 39.14 | 78.28 | 0.00E+00 | 8.23E+01 | 1.65E+02 | | |
| Pu-238 | 1.0383E-03 | 39.14 | 78.28 | 0.00E+00 | 4.06E-02 | 8.13E-02 | | |
| Pu-239 | 5.5293E-03 | 39.14 | 78.28 | 0.00E+00 | 2.16E-01 | 4.33E-01 | | |
| Pu-240 | 2.1278E-03 | 39.14 | 78.28 | 0.00E+00 | 8.33E-02 | 1.67E-01 | | |
| Pu-241 | 1.0195E-01 | 39.14 | 78.28 | 0.00E+00 | 3.99E+00 | 7.98E+00 | | |
| Pu-242 | 2.3128E-07 | 39.14 | 78.28 | 0.00E+00 | 9.05E-06 | 1.81E-05 | | |
| Ra-226 | 5.2782E-14 | 39.14 | 78.28 | 0.00E+00 | 2.07E-12 | 4.13E-12 | | |
| Ra-228 | 1.9338E-10 | 39.14 | 78.28 | 0.00E+00 | 7.57E-09 | 1.51E-08 | | |
| Ru-106 | 9.1684E-02 | 39.14 | 78.28 | 0.00E+00 | 3.59E+00 | 7.18E+00 | | |
| Se-79 | 1.3018E-05 | 39.14 | 78.28 | 0.00E+00 | 5.10E-04 | 1.02E-03 | | |
| Sn-126 | 1.2167E-05 | 39.14 | 78.28 | 0.00E+00 | 4.76E-04 | 9.52E-04 | | |
| Sr-90 | 2.6045E+00 | 39.14 | 78.28 | 0.00E+00 | 1.02E+02 | 2.04E+02 | | |
| Tc-99 | 4.4241E-04 | 39.14 | 78.28 | 0.00E+00 | 1.73E-02 | 3.46E-02 | | |
| Th-229 | 1.3713E-10 | 39.14 | 78.28 | 0.00E+00 | 5.37E-09 | 1.07E-08 | | |
| Th-230 | 1.8090E-11 | 39.14 | 78.28 | 0.00E+00 | 7.08E-10 | 1.42E-09 | | |
| Th-232 | 2.5278E-10 | 39.14 | 78.28 | 0.00E+00 | 9.89E-09 | 1.98E-08 | | |
| Ti-208 | 1.6947E-08 | 39.14 | 78.28 | 0.00E+00 | 6.63E-07 | 1.33E-06 | | |
| U-232 | 4.8737E-08 | 39.14 | 78.28 | 0.00E+00 | 1.91E-06 | 3.82E-06 | | |
| U-233 | 1.2203E-07 | 39.14 | 78.28 | 0.00E+00 | 4.78E-06 | 9.55E-06 | | |
| U-234 | 1.5925E-07 | 39.14 | 78.28 | 0.00E+00 | 6.23E-06 | 1.25E-05 | | |
| U-235 | -2.6194E-06 | 39.14 | 0.00 | 3.35E-04 | 2.32E-04 | 3.35E-04 | | |
| U-236 | 1.2693E-05 | 39.14 | 78.28 | 0.00E+00 | 4.97E-04 | 9.94E-04 | | |
| U-238 | -3.6331E-08 | 39.14 | 0.00 | 2.17E-04 | 2.16E-04 | 2.17E-04 | | |
| Y-90 | 2.6060E+00 | 39.14 | 78.28 | 0.00E+00 | 1.02E+02 | 2.04E+02 | | |
| Other Radionuclides | | | | | 1.41E+02 | 2.82E+02 | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 2.28E+00 | 4.56E+00 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|------------|----------------------------------|
| Reactor Moderator: | LW AND U ZIRC HYDRIDE | Used | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19.34235977 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | 27.34 | 39.14 | |
| Bounding | | 78.28 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 1.43 | 1.43 | |
| Bounding | 2.86 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA 8.5/20 FCR OSU
SNF ID # 1041
Fuel Units & Descr 2 - ELEMENT
Heavy Metal Mass BOL=0.392kg, EOL=0.37kg
ROD Storage Site INEEL
Fuel decay start date 2025
Estimates as of 2030
Template TRIGA-FLIP (LW/U-Zrx, SST 60 to 100%, U)
Template Burnup(MWd) 66.52
Template BOL Heavy Metal Mass (MT) 0.000196
Template Decay Time 5 years

Estimated
Canister usage:
18"x10"
0.02

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.8488E-10 | 20.91 | 41.82 | 0.00E+00 | 5.96E-09 | 1.19E-08 | Avg MeV | |
| Am-241 | 7.5767E-03 | 20.91 | 41.82 | 0.00E+00 | 1.58E-01 | 3.17E-01 | 0.0150 | 6.747E+12 |
| Am-242m | 2.4459E-05 | 20.91 | 41.82 | 0.00E+00 | 5.11E-04 | 1.02E-03 | 0.0250 | 1.481E+12 |
| Am-243 | 3.0983E-05 | 20.91 | 41.82 | 0.00E+00 | 6.48E-04 | 1.30E-03 | 0.0375 | 1.310E+12 |
| C-14 | 1.2590E-04 | 20.91 | 41.82 | 0.00E+00 | 2.63E-03 | 5.27E-03 | 0.0575 | 1.307E+12 |
| Cl-36 | 2.6624E-06 | 20.91 | 41.82 | 0.00E+00 | 5.57E-05 | 1.11E-04 | 0.0850 | 8.134E+11 |
| Cm-243 | 3.8244E-05 | 20.91 | 41.82 | 0.00E+00 | 8.00E-04 | 1.60E-03 | 0.1250 | 6.531E+11 |
| Cm-244 | 4.1010E-03 | 20.91 | 41.82 | 0.00E+00 | 8.57E-02 | 1.71E-01 | 0.2250 | 6.913E+11 |
| Co-60 | 1.2410E+00 | 20.91 | 41.82 | 0.00E+00 | 2.59E+01 | 5.19E+01 | 0.3750 | 3.449E+11 |
| Cs-134 | 6.5454E-01 | 20.91 | 41.82 | 0.00E+00 | 1.37E+01 | 2.74E+01 | 0.5750 | 5.709E+12 |
| Cs-135 | 1.9753E-05 | 20.91 | 41.82 | 0.00E+00 | 4.13E-04 | 8.26E-04 | 0.8500 | 1.047E+12 |
| Cs-137 | 2.7375E+00 | 20.91 | 41.82 | 0.00E+00 | 5.72E+01 | 1.14E+02 | 1.2500 | 4.023E+12 |
| Eu-154 | 1.2324E-01 | 20.91 | 41.82 | 0.00E+00 | 2.58E+00 | 5.15E+00 | 1.7500 | 5.380E+09 |
| Eu-155 | 5.3037E-02 | 20.91 | 41.82 | 0.00E+00 | 1.11E+00 | 2.22E+00 | 2.2500 | 4.217E+09 |
| Fe-55 | 7.9555E-01 | 20.91 | 41.82 | 0.00E+00 | 1.66E+01 | 3.33E+01 | 2.7500 | 3.823E+07 |
| H-3 | 1.0531E-02 | 20.91 | 41.82 | 0.00E+00 | 2.20E-01 | 4.40E-01 | 3.5000 | 4.499E+06 |
| I-129 | 7.1287E-07 | 20.91 | 41.82 | 0.00E+00 | 1.49E-05 | 2.98E-05 | 5.0000 | 1.078E+03 |
| Kr-85 | 2.4955E-01 | 20.91 | 41.82 | 0.00E+00 | 5.22E+00 | 1.04E+01 | 7.0000 | 1.241E+02 |
| Np-237 | 1.2121E-05 | 20.91 | 41.82 | 0.00E+00 | 2.53E-04 | 5.07E-04 | 11.0000 | 1.424E+01 |
| Pa-231 | 1.1230E-09 | 20.91 | 41.82 | 0.00E+00 | 2.35E-08 | 4.70E-08 | | |
| Pb-210 | 6.1636E-14 | 20.91 | 41.82 | 0.00E+00 | 1.29E-12 | 2.58E-12 | | |
| Pm-147 | 1.1302E+00 | 20.91 | 41.82 | 0.00E+00 | 2.36E+01 | 4.73E+01 | | |
| Pu-238 | 5.4826E-02 | 20.91 | 41.82 | 0.00E+00 | 1.15E+00 | 2.29E+00 | | |
| Pu-239 | 1.4056E-03 | 20.91 | 41.82 | 0.00E+00 | 2.94E-02 | 5.88E-02 | | |
| Pu-240 | 1.1536E-03 | 20.91 | 41.82 | 0.00E+00 | 2.41E-02 | 4.82E-02 | | |
| Pu-241 | 4.2995E-01 | 20.91 | 41.82 | 0.00E+00 | 8.99E+00 | 1.80E+01 | | |
| Pu-242 | 4.9910E-06 | 20.91 | 41.82 | 0.00E+00 | 1.04E-04 | 2.09E-04 | | |
| Ra-226 | 2.4008E-13 | 20.91 | 41.82 | 0.00E+00 | 5.02E-12 | 1.00E-11 | | |
| Ra-228 | 1.8220E-11 | 20.91 | 41.82 | 0.00E+00 | 3.81E-10 | 7.62E-10 | | |
| Ru-106 | 1.0343E-01 | 20.91 | 41.82 | 0.00E+00 | 2.16E+00 | 4.33E+00 | | |
| Se-79 | 1.2832E-05 | 20.91 | 41.82 | 0.00E+00 | 2.68E-04 | 5.37E-04 | | |
| Sn-126 | 1.2090E-05 | 20.91 | 41.82 | 0.00E+00 | 2.53E-04 | 5.06E-04 | | |
| Sr-90 | 2.5646E+00 | 20.91 | 41.82 | 0.00E+00 | 5.36E+01 | 1.07E+02 | | |
| Tc-99 | 4.0319E-04 | 20.91 | 41.82 | 0.00E+00 | 8.43E-03 | 1.69E-02 | | |
| Th-229 | 7.7375E-11 | 20.91 | 41.82 | 0.00E+00 | 1.62E-09 | 3.24E-09 | | |
| Th-230 | 1.2211E-10 | 20.91 | 41.82 | 0.00E+00 | 2.55E-09 | 5.11E-09 | | |
| Th-232 | 2.3842E-11 | 20.91 | 41.82 | 0.00E+00 | 4.99E-10 | 9.97E-10 | | |
| Ti-208 | 1.4313E-07 | 20.91 | 41.82 | 0.00E+00 | 2.99E-06 | 5.99E-06 | | |
| U-232 | 4.1927E-07 | 20.91 | 41.82 | 0.00E+00 | 8.77E-06 | 1.75E-05 | | |
| U-233 | 6.8491E-08 | 20.91 | 41.82 | 0.00E+00 | 1.43E-06 | 2.86E-06 | | |
| U-234 | 2.0189E-06 | 20.91 | 41.82 | 0.00E+00 | 4.22E-05 | 8.44E-05 | | |
| U-235 | -2.6572E-06 | 20.91 | 0.00 | 5.92E-04 | 5.37E-04 | 5.92E-04 | | |
| U-236 | 1.3575E-05 | 20.91 | 41.82 | 0.00E+00 | 2.84E-04 | 5.68E-04 | | |
| U-238 | -2.2698E-08 | 20.91 | 0.00 | 3.97E-05 | 3.92E-05 | 3.97E-05 | | |
| Y-90 | 2.5646E+00 | 20.91 | 41.82 | 0.00E+00 | 5.36E+01 | 1.07E+02 | | |
| Other Radionuclides | | | | | 7.45E+01 | 1.49E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator | From SFD | Used | |
| | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 69.89795918 | 60 to 100 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | 5.73 | 20.91 | |
| Bounding | | 41.82 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 0.16 | 3.65 | |
| Bounding | 0.31 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA 8.520 FFCR PENN STATE UNIV
 SNF ID #: 815
 Fuel Units & Descr: 7 - ELEMENT
 Heavy Metal Mass BOL=1.379kg; EOL=1.316kg
 ROD Storage Site INEEL

Fuel decay start date. 2035
 Estimates as of: 2030
 Template: TRIGA SS (LW/U-Zr, SST, 10 to 20%, U)
 Template Burnup(MWd): 6.65
 Template BOL Heavy Metal Mass (MT): 0.000195
 Template Decay Time 5 years

Estimated
 Canister usage:
 18"x10"
 0.09

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.5173E-10 | 60.14 | 120.28 | 0.00E+00 | 5.12E-08 | 1.02E-07 | Avg MeV | |
| Am-241 | 1.8331E-03 | 60.14 | 120.28 | 0.00E+00 | 1.10E-01 | 2.20E-01 | 0.0150 | 1.944E+13 |
| Am-242m | 1.4129E-06 | 60.14 | 120.28 | 0.00E+00 | 8.50E-05 | 1.70E-04 | 0.0250 | 4.278E+12 |
| Am-243 | 1.4774E-07 | 60.14 | 120.28 | 0.00E+00 | 8.89E-06 | 1.78E-05 | 0.0375 | 3.643E+12 |
| C-14 | 1.2871E-04 | 60.14 | 120.28 | 0.00E+00 | 7.74E-03 | 1.55E-02 | 0.0575 | 3.739E+12 |
| Cl-36 | 2.8120E-06 | 60.14 | 120.28 | 0.00E+00 | 1.69E-04 | 3.38E-04 | 0.0850 | 2.316E+12 |
| Cm-243 | 1.7940E-07 | 60.14 | 120.28 | 0.00E+00 | 1.08E-05 | 2.16E-05 | 0.1250 | 1.682E+12 |
| Cm-244 | 1.6962E-06 | 60.14 | 120.28 | 0.00E+00 | 1.02E-04 | 2.04E-04 | 0.2250 | 1.965E+12 |
| Co-60 | 1.2839E+00 | 60.14 | 120.28 | 0.00E+00 | 7.72E+01 | 1.54E+02 | 0.3750 | 9.972E+11 |
| Cs-134 | 9.0541E-02 | 60.14 | 120.28 | 0.00E+00 | 5.45E+00 | 1.09E+01 | 0.5750 | 1.326E+13 |
| Cs-135 | 3.2195E-05 | 60.14 | 120.28 | 0.00E+00 | 1.94E-03 | 3.87E-03 | 0.8500 | 5.690E+11 |
| Cs-137 | 2.7564E+00 | 60.14 | 120.28 | 0.00E+00 | 1.66E+02 | 3.32E+02 | 1.2500 | 1.155E+13 |
| Eu-154 | 1.5368E-02 | 60.14 | 120.28 | 0.00E+00 | 9.24E-01 | 1.85E+00 | 1.7500 | 7.702E+09 |
| Eu-155 | 2.9293E-02 | 60.14 | 120.28 | 0.00E+00 | 1.76E+00 | 3.52E+00 | 2.2500 | 1.241E+10 |
| Fe-55 | 7.7158E-01 | 60.14 | 120.28 | 0.00E+00 | 4.64E+01 | 9.28E+01 | 2.7500 | 9.852E+07 |
| H-3 | 1.1111E-02 | 60.14 | 120.28 | 0.00E+00 | 6.68E-01 | 1.34E+00 | 3.5000 | 1.147E+07 |
| I-129 | 7.3684E-07 | 60.14 | 120.28 | 0.00E+00 | 4.43E-05 | 8.86E-05 | 5.0000 | 6.389E+01 |
| Kr-85 | 2.5263E-01 | 60.14 | 120.28 | 0.00E+00 | 1.52E+01 | 3.04E+01 | 7.0000 | 7.233E+00 |
| Np-237 | 1.2427E-06 | 60.14 | 120.28 | 0.00E+00 | 7.47E-05 | 1.49E-04 | 11.0000 | 8.239E-01 |
| Pa-231 | 3.8511E-09 | 60.14 | 120.28 | 0.00E+00 | 2.32E-07 | 4.63E-07 | | |
| Pb-210 | 7.3880E-15 | 60.14 | 120.28 | 0.00E+00 | 4.44E-13 | 8.89E-13 | | |
| Pm-147 | 2.1023E+00 | 60.14 | 120.28 | 0.00E+00 | 1.26E+02 | 2.53E+02 | | |
| Pu-238 | 1.0383E-03 | 60.14 | 120.28 | 0.00E+00 | 6.24E-02 | 1.25E-01 | | |
| Pu-239 | 5.5293E-03 | 60.14 | 120.28 | 0.00E+00 | 3.33E-01 | 6.65E-01 | | |
| Pu-240 | 2.1278E-03 | 60.14 | 120.28 | 0.00E+00 | 1.28E-01 | 2.56E-01 | | |
| Pu-241 | 1.0195E-01 | 60.14 | 120.28 | 0.00E+00 | 6.13E+00 | 1.23E+01 | | |
| Pu-242 | 2.3128E-07 | 60.14 | 120.28 | 0.00E+00 | 1.39E-05 | 2.78E-05 | | |
| Ra-226 | 5.2782E-14 | 60.14 | 120.28 | 0.00E+00 | 3.17E-12 | 6.35E-12 | | |
| Ra-228 | 1.9338E-10 | 60.14 | 120.28 | 0.00E+00 | 1.16E-08 | 2.33E-08 | | |
| Ru-106 | 9.1684E-02 | 60.14 | 120.28 | 0.00E+00 | 5.51E+00 | 1.10E+01 | | |
| Se-79 | 1.3018E-05 | 60.14 | 120.28 | 0.00E+00 | 7.83E-04 | 1.57E-03 | | |
| Sn-126 | 1.2167E-05 | 60.14 | 120.28 | 0.00E+00 | 7.32E-04 | 1.46E-03 | | |
| Sr-90 | 2.6045E+00 | 60.14 | 120.28 | 0.00E+00 | 1.57E+02 | 3.13E+02 | | |
| Tc-99 | 4.4241E-04 | 60.14 | 120.28 | 0.00E+00 | 2.66E-02 | 5.32E-02 | | |
| Th-229 | 1.3713E-10 | 60.14 | 120.28 | 0.00E+00 | 8.25E-09 | 1.65E-08 | | |
| Th-230 | 1.8090E-11 | 60.14 | 120.28 | 0.00E+00 | 1.09E-09 | 2.18E-09 | | |
| Th-232 | 2.5278E-10 | 60.14 | 120.28 | 0.00E+00 | 1.52E-08 | 3.04E-08 | | |
| Th-208 | 1.6947E-08 | 60.14 | 120.28 | 0.00E+00 | 1.02E-06 | 2.04E-06 | | |
| U-232 | 4.8737E-08 | 60.14 | 120.28 | 0.00E+00 | 2.93E-06 | 5.86E-06 | | |
| U-233 | 1.2203E-07 | 60.14 | 120.28 | 0.00E+00 | 7.34E-06 | 1.47E-05 | | |
| U-234 | 1.5925E-07 | 60.14 | 120.28 | 0.00E+00 | 9.58E-06 | 1.92E-05 | | |
| U-235 | -2.6194E-06 | 60.14 | 0.00 | 5.90E-04 | 4.32E-04 | 5.90E-04 | | |
| U-236 | 1.2693E-05 | 60.14 | 120.28 | 0.00E+00 | 7.63E-04 | 1.53E-03 | | |
| U-238 | -3.6331E-08 | 60.14 | 0.00 | 3.72E-04 | 3.70E-04 | 3.72E-04 | | |
| Y-90 | 2.6060E+00 | 60.14 | 120.28 | 0.00E+00 | 1.57E+02 | 3.13E+02 | | |
| Other Radionuclides | | | | | 2.17E+02 | 4.34E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| | From SFD | Used | |
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19.79695431 | 10 to 20.1 | |

| Burnup Summary (MWd) ¹ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 40.32 | 60.14 | |
| Bounding | | 120.28 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 1.28 | 1.49 | |
| Bounding | 2.56 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA 8 S/20 FFCR SLOVENIA
SNF ID #: 941
Fuel Units & Descr: 3 - ELEMENT
Heavy Metal Mass BOL=0.473kg EOL=0.457kg
ROD Storage Site INEEL

¹Fuel decay start date 1959
Estimates as of 2030
Template TRIGA-SS (LW/U-Zr, SST, 10 to 20% U)
²Template Burnup(MWd) 6.65
Template BOL Heavy Metal Mass (MT) 0.000195
Template Decay Time 65 years

Estimated
Canister usage:
18"x10"
0.04

| II. Estimates | m | X _n | X _b | b | Y _n | Y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 1.2442E-08 | 16.14 | 32.28 | 0.00E+00 | 2.01E-07 | 4.02E-07 | Avg MeV | |
| Am-241 | 4.0120E-03 | 16.14 | 32.28 | 0.00E+00 | 6.47E-02 | 1.29E-01 | 0.0150 | 1.104E+12 |
| Am-242m | 1.0749E-06 | 16.14 | 32.28 | 0.00E+00 | 1.73E-05 | 3.47E-05 | 0.0250 | 2.291E+11 |
| Am-243 | 1.4692E-07 | 16.14 | 32.28 | 0.00E+00 | 2.37E-06 | 4.74E-06 | 0.0375 | 1.999E+11 |
| C-14 | 1.2777E-04 | 16.14 | 32.28 | 0.00E+00 | 2.06E-03 | 4.12E-03 | 0.0575 | 2.153E+11 |
| Cl-36 | 2.8120E-06 | 16.14 | 32.28 | 0.00E+00 | 4.54E-05 | 9.08E-05 | 0.0850 | 1.290E+11 |
| Cm-243 | 4.1759E-08 | 16.14 | 32.28 | 0.00E+00 | 6.74E-07 | 1.35E-06 | 0.1250 | 8.366E+10 |
| Cm-244 | 1.7098E-07 | 16.14 | 32.28 | 0.00E+00 | 2.76E-06 | 5.52E-06 | 0.2250 | 1.111E+11 |
| Co-60 | 4.8241E-04 | 16.14 | 32.28 | 0.00E+00 | 7.79E-03 | 1.56E-02 | 0.3750 | 4.847E+10 |
| Cs-134 | 1.5970E-10 | 16.14 | 32.28 | 0.00E+00 | 2.58E-09 | 5.15E-09 | 0.5750 | 8.280E+11 |
| Cs-135 | 3.2195E-05 | 16.14 | 32.28 | 0.00E+00 | 5.20E-04 | 1.04E-03 | 0.8500 | 7.964E+09 |
| Cs-137 | 6.8977E-01 | 16.14 | 32.28 | 0.00E+00 | 1.11E+01 | 2.23E+01 | 1.2500 | 3.863E+09 |
| Eu-154 | 1.2238E-04 | 16.14 | 32.28 | 0.00E+00 | 1.97E-03 | 3.95E-03 | 1.7500 | 2.049E+08 |
| Eu-155 | 6.7158E-06 | 16.14 | 32.28 | 0.00E+00 | 1.08E-04 | 2.17E-04 | 2.2500 | 2.844E+04 |
| Fe-55 | 8.8165E-08 | 16.14 | 32.28 | 0.00E+00 | 1.42E-06 | 2.85E-06 | 2.7500 | 1.174E+04 |
| H-3 | 3.8376E-04 | 16.14 | 32.28 | 0.00E+00 | 6.19E-03 | 1.24E-02 | 3.5000 | 3.988E+01 |
| I-129 | 7.3684E-07 | 16.14 | 32.28 | 0.00E+00 | 1.19E-05 | 2.38E-05 | 5.0000 | 1.679E+01 |
| Kr-85 | 5.2316E-03 | 16.14 | 32.28 | 0.00E+00 | 8.44E-02 | 1.69E-01 | 7.0000 | 1.895E+00 |
| Np-237 | 1.3232E-06 | 16.14 | 32.28 | 0.00E+00 | 2.14E-05 | 4.27E-05 | 11.0000 | 2.154E-01 |
| Pa-231 | 1.8722E-08 | 16.14 | 32.28 | 0.00E+00 | 3.02E-07 | 6.04E-07 | | |
| Pb-210 | 1.2620E-12 | 16.14 | 32.28 | 0.00E+00 | 2.04E-11 | 4.07E-11 | | |
| Pm-147 | 2.7714E-07 | 16.14 | 32.28 | 0.00E+00 | 4.47E-06 | 8.95E-06 | | |
| Pu-238 | 6.4707E-04 | 16.14 | 32.28 | 0.00E+00 | 1.04E-02 | 2.09E-02 | | |
| Pu-239 | 5.5203E-03 | 16.14 | 32.28 | 0.00E+00 | 8.91E-02 | 1.78E-01 | | |
| Pu-240 | 2.1143E-03 | 16.14 | 32.28 | 0.00E+00 | 3.41E-02 | 6.82E-02 | | |
| Pu-241 | 5.6872E-03 | 16.14 | 32.28 | 0.00E+00 | 9.18E-02 | 1.84E-01 | | |
| Pu-242 | 2.3128E-07 | 16.14 | 32.28 | 0.00E+00 | 3.73E-06 | 7.46E-06 | | |
| Ra-226 | 2.6466E-12 | 16.14 | 32.28 | 0.00E+00 | 4.27E-11 | 8.54E-11 | | |
| Ra-228 | 2.5278E-10 | 16.14 | 32.28 | 0.00E+00 | 4.08E-09 | 8.16E-09 | | |
| Ru-106 | 1.1377E-19 | 16.14 | 32.28 | 0.00E+00 | 1.84E-18 | 3.67E-18 | | |
| Se-79 | 1.3009E-05 | 16.14 | 32.28 | 0.00E+00 | 2.10E-04 | 4.20E-04 | | |
| Sn-126 | 1.2162E-05 | 16.14 | 32.28 | 0.00E+00 | 1.96E-04 | 3.93E-04 | | |
| Sr-90 | 6.2511E-01 | 16.14 | 32.28 | 0.00E+00 | 1.01E+01 | 2.02E+01 | | |
| Tc-99 | 4.4241E-04 | 16.14 | 32.28 | 0.00E+00 | 7.14E-03 | 1.43E-02 | | |
| Th-229 | 9.4105E-10 | 16.14 | 32.28 | 0.00E+00 | 1.52E-08 | 3.04E-08 | | |
| Th-230 | 1.7098E-10 | 16.14 | 32.28 | 0.00E+00 | 2.76E-09 | 5.52E-09 | | |
| Th-232 | 2.5278E-10 | 16.14 | 32.28 | 0.00E+00 | 4.08E-09 | 8.16E-09 | | |
| Ti-208 | 1.0305E-08 | 16.14 | 32.28 | 0.00E+00 | 1.66E-07 | 3.33E-07 | | |
| U-232 | 2.7669E-08 | 16.14 | 32.28 | 0.00E+00 | 4.47E-07 | 8.93E-07 | | |
| U-233 | 1.2239E-07 | 16.14 | 32.28 | 0.00E+00 | 1.98E-06 | 3.95E-06 | | |
| U-234 | 3.1278E-07 | 16.14 | 32.28 | 0.00E+00 | 5.05E-06 | 1.01E-05 | | |
| U-235 | -2.6179E-06 | 16.14 | 0.00 | 2.03E-04 | 1.61E-04 | 2.03E-04 | | |
| U-236 | 1.2696E-05 | 16.14 | 32.28 | 0.00E+00 | 2.05E-04 | 4.10E-04 | | |
| U-238 | -3.6331E-08 | 16.14 | 0.00 | 1.27E-04 | 1.27E-04 | 1.27E-04 | | |
| Y-90 | 6.2541E-01 | 16.14 | 32.28 | 0.00E+00 | 1.01E+01 | 2.02E+01 | | |
| Other Radionuclides | | | | | 1.14E+01 | 2.29E+01 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences |
|----------------------------|-----------------------------------|-------------------------------|---------------------------------|
| Reactor Moderator | From SFD LW AND U ZIRC HYDRIDE | Used LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19.87312476 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 16.14 | 15.46 | |
| Bounding | | 32.28 | Nominal burnup taken directly from SFD (converted to MWd) Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 1.00 | 0.96 | |
| Bounding | 2.00 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA 8.5/20 FFCR SO. KOREA
SNF ID #: 734
Fuel Units & Descr: 3 - ELEMENT
Heavy Metal Mass: BOL=0.48kg; EOL=0.472kg
ROD Storage Site: INEEL

¹Fuel decay start date: 1996
Estimates as of: 2030
Template: TRIGA-SS (LW/U-Zr, SST, 10 to 20% U)
²Template Burnup (MWd): 6.65
Template BOL Heavy Metal Mass (MT): 0.000195
Template Decay Time: 25 years

Estimated
Canister usage:
18"x10"
0.04

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|-----------------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 4.1459E-09 | 11.70 | 23.39 | 0.00E+00 | 4.85E-08 | 9.70E-08 | Avg MeV | |
| Am-241 | 3.5850E-03 | 11.70 | 23.39 | 0.00E+00 | 4.19E-02 | 8.39E-02 | 0.0150 | 2.076E+12 |
| Am-242m | 1.2899E-06 | 11.70 | 23.39 | 0.00E+00 | 1.51E-05 | 3.02E-05 | 0.0250 | 4.316E+11 |
| Am-243 | 1.4747E-07 | 11.70 | 23.39 | 0.00E+00 | 1.72E-06 | 3.45E-06 | 0.0375 | 3.745E+11 |
| C-14 | 1.2839E-04 | 11.70 | 23.39 | 0.00E+00 | 1.50E-03 | 3.00E-03 | 0.0575 | 4.033E+11 |
| Cl-36 | 2.8120E-06 | 11.70 | 23.39 | 0.00E+00 | 3.29E-05 | 6.58E-05 | 0.0850 | 2.431E+11 |
| Cm-243 | 1.1038E-07 | 11.70 | 23.39 | 0.00E+00 | 1.29E-06 | 2.58E-06 | 0.1250 | 1.586E+11 |
| Cm-244 | 7.8917E-07 | 11.70 | 23.39 | 0.00E+00 | 9.23E-06 | 1.85E-05 | 0.2250 | 2.091E+11 |
| Co-60 | 9.2647E-02 | 11.70 | 23.39 | 0.00E+00 | 1.08E+00 | 2.17E+00 | 0.3750 | 9.130E+10 |
| Cs-134 | 1.0940E-04 | 11.70 | 23.39 | 0.00E+00 | 1.28E-03 | 2.56E-03 | 0.5750 | 1.514E+12 |
| Cs-135 | 3.2195E-05 | 11.70 | 23.39 | 0.00E+00 | 3.77E-04 | 7.53E-04 | 0.8500 | 1.625E+10 |
| Cs-137 | 1.7368E+00 | 11.70 | 23.39 | 0.00E+00 | 2.03E+01 | 4.06E+01 | 1.2500 | 1.669E+11 |
| Eu-154 | 3.0677E-03 | 11.70 | 23.39 | 0.00E+00 | 3.59E-02 | 7.18E-02 | 1.7500 | 4.230E+08 |
| Eu-155 | 1.7925E-03 | 11.70 | 23.39 | 0.00E+00 | 2.10E-02 | 4.19E-02 | 2.2500 | 8.919E+05 |
| Fe-55 | 3.7444E-03 | 11.70 | 23.39 | 0.00E+00 | 4.38E-02 | 8.76E-02 | 2.7500 | 1.508E+04 |
| H-3 | 3.6180E-03 | 11.70 | 23.39 | 0.00E+00 | 4.23E-02 | 8.46E-02 | 3.5000 | 3.190E+01 |
| I-129 | 7.3684E-07 | 11.70 | 23.39 | 0.00E+00 | 8.62E-06 | 1.72E-05 | 5.0000 | 1.243E+01 |
| Kr-85 | 6.9368E-02 | 11.70 | 23.39 | 0.00E+00 | 8.11E-01 | 1.62E+00 | 7.0000 | 1.403E+00 |
| Np-237 | 1.2662E-06 | 11.70 | 23.39 | 0.00E+00 | 1.48E-05 | 2.96E-05 | 11.0000 | 1.596E-01 |
| Pa-231 | 9.1654E-09 | 11.70 | 23.39 | 0.00E+00 | 1.07E-07 | 2.14E-07 | | |
| Pb-210 | 1.3728E-13 | 11.70 | 23.39 | 0.00E+00 | 1.61E-12 | 3.21E-12 | | |
| Pm-147 | 1.0702E-02 | 11.70 | 23.39 | 0.00E+00 | 1.25E-01 | 2.50E-01 | | |
| Pu-238 | 8.8692E-04 | 11.70 | 23.39 | 0.00E+00 | 1.04E-02 | 2.07E-02 | | |
| Pu-239 | 5.5263E-03 | 11.70 | 23.39 | 0.00E+00 | 6.46E-02 | 1.29E-01 | | |
| Pu-240 | 2.1233E-03 | 11.70 | 23.39 | 0.00E+00 | 2.48E-02 | 4.97E-02 | | |
| Pu-241 | 3.8962E-02 | 11.70 | 23.39 | 0.00E+00 | 4.56E-01 | 9.11E-01 | | |
| Pu-242 | 2.3128E-07 | 11.70 | 23.39 | 0.00E+00 | 2.70E-06 | 5.41E-06 | | |
| Ra-226 | 4.6752E-13 | 11.70 | 23.39 | 0.00E+00 | 5.47E-12 | 1.09E-11 | | |
| Ra-228 | 2.4827E-10 | 11.70 | 23.39 | 0.00E+00 | 2.90E-09 | 5.81E-09 | | |
| Ru-106 | 9.8526E-08 | 11.70 | 23.39 | 0.00E+00 | 1.15E-06 | 2.30E-06 | | |
| Se-79 | 1.3015E-05 | 11.70 | 23.39 | 0.00E+00 | 1.52E-04 | 3.04E-04 | | |
| Sn-126 | 1.2165E-05 | 11.70 | 23.39 | 0.00E+00 | 1.42E-04 | 2.85E-04 | | |
| Sr-90 | 1.6195E+00 | 11.70 | 23.39 | 0.00E+00 | 1.89E+01 | 3.79E+01 | | |
| Tc-99 | 4.4241E-04 | 11.70 | 23.39 | 0.00E+00 | 5.17E-03 | 1.03E-02 | | |
| Th-229 | 4.2451E-10 | 11.70 | 23.39 | 0.00E+00 | 4.96E-09 | 9.93E-09 | | |
| Th-230 | 6.1398E-11 | 11.70 | 23.39 | 0.00E+00 | 7.18E-10 | 1.44E-09 | | |
| Th-232 | 2.5278E-10 | 11.70 | 23.39 | 0.00E+00 | 2.96E-09 | 5.91E-09 | | |
| Ti-208 | 1.5098E-08 | 11.70 | 23.39 | 0.00E+00 | 1.77E-07 | 3.53E-07 | | |
| U-232 | 4.0662E-08 | 11.70 | 23.39 | 0.00E+00 | 4.76E-07 | 9.51E-07 | Thermal Power | |
| U-233 | 1.2217E-07 | 11.70 | 23.39 | 0.00E+00 | 1.43E-06 | 2.86E-06 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 2.2391E-07 | 11.70 | 23.39 | 0.00E+00 | 2.62E-06 | 5.24E-06 | 2.48E-01 | 4.96E-01 |
| U-235 | -2.6194E-06 | 11.70 | 0.00 | 2.07E-04 | 1.77E-04 | 2.07E-04 | Total | Total |
| U-236 | 1.2695E-05 | 11.70 | 23.39 | 0.00E+00 | 1.48E-04 | 2.97E-04 | | |
| U-238 | -3.6331E-08 | 11.70 | 0.00 | 1.29E-04 | 1.29E-04 | 1.29E-04 | | |
| Y-90 | 1.6195E+00 | 11.70 | 23.39 | 0.00E+00 | 1.89E+01 | 3.79E+01 | | |
| Other Radionuclides | | | | | 2.01E+01 | 4.02E+01 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator: | From SFD | Used | |
| | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding: | SST | SST | |
| BOL HM Constituents: | U | U | |
| BOL Enrichment %: | 20 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal: | 11.70 | 7.45 | |
| Bounding: | | 23.39 | Nominal burnup taken directly from SFD (converted to MWd). Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|-----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal: | 0.71 | 0.64 | |
| Bounding: | 1.43 | | 0.99 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA 8.5/20 FFCR U OF AZ
SNF ID #: 974
Fuel Units & Descr: 2 - ELEMENT
Heavy Metal Mass BOL=0.32kg EOL=0.319kg
ROD Storage Site: INEEL

¹Fuel decay start date: 2035
Estimates as of 2030
Template TRIGA-SS (LW/U-Zrx, SST, 10 to 20%, U)
²Template Burnup(MWd): 6.65
Template BOL Heavy Metal Mass (MT) 0.000195
Template Decay Time 5 years

Estimated
Canister usage
18"x10"
0.03

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.5173E-10 | 0.95 | 1.91 | 0.00E+00 | 8.13E-10 | 1.63E-09 | Avg MeV | |
| Am-241 | 1.8331E-03 | 0.95 | 1.91 | 0.00E+00 | 1.75E-03 | 3.50E-03 | 0.0150 | 3.086E+11 |
| Am-242m | 1.4129E-06 | 0.95 | 1.91 | 0.00E+00 | 1.35E-06 | 2.70E-06 | 0.0250 | 6.790E+10 |
| Am-243 | 1.4774E-07 | 0.95 | 1.91 | 0.00E+00 | 1.41E-07 | 2.82E-07 | 0.0375 | 5.782E+10 |
| C-14 | 1.2871E-04 | 0.95 | 1.91 | 0.00E+00 | 1.23E-04 | 2.46E-04 | 0.0575 | 5.935E+10 |
| Cl-36 | 2.8120E-06 | 0.95 | 1.91 | 0.00E+00 | 2.68E-06 | 5.37E-06 | 0.0850 | 3.677E+10 |
| Cm-243 | 1.7940E-07 | 0.95 | 1.91 | 0.00E+00 | 1.71E-07 | 3.43E-07 | 0.1250 | 2.670E+10 |
| Cm-244 | 1.6962E-06 | 0.95 | 1.91 | 0.00E+00 | 1.62E-06 | 3.24E-06 | 0.2250 | 3.119E+10 |
| Co-60 | 1.2839E+00 | 0.95 | 1.91 | 0.00E+00 | 1.23E+00 | 2.45E+00 | 0.3750 | 1.583E+10 |
| Cs-134 | 9.0541E-02 | 0.95 | 1.91 | 0.00E+00 | 8.64E-02 | 1.73E-01 | 0.5750 | 2.104E+11 |
| Cs-135 | 3.2195E-05 | 0.95 | 1.91 | 0.00E+00 | 3.07E-05 | 6.15E-05 | 0.8500 | 9.031E+09 |
| Cs-137 | 2.7564E+00 | 0.95 | 1.91 | 0.00E+00 | 2.63E+00 | 5.26E+00 | 1.2500 | 1.834E+11 |
| Eu-154 | 1.5368E-02 | 0.95 | 1.91 | 0.00E+00 | 1.47E-02 | 2.93E-02 | 1.7500 | 1.223E+08 |
| Eu-155 | 2.9293E-02 | 0.95 | 1.91 | 0.00E+00 | 2.80E-02 | 5.59E-02 | 2.2500 | 1.971E+08 |
| Fe-55 | 7.7158E-01 | 0.95 | 1.91 | 0.00E+00 | 7.37E-01 | 1.47E+00 | 2.7500 | 1.564E+06 |
| H-3 | 1.1111E-02 | 0.95 | 1.91 | 0.00E+00 | 1.06E-02 | 2.12E-02 | 3.5000 | 1.820E+05 |
| I-129 | 7.3684E-07 | 0.95 | 1.91 | 0.00E+00 | 7.03E-07 | 1.41E-06 | 5.0000 | 1.200E+00 |
| Kr-85 | 2.5263E-01 | 0.95 | 1.91 | 0.00E+00 | 2.41E-01 | 4.82E-01 | 7.0000 | 1.362E-01 |
| Np-237 | 1.2427E-06 | 0.95 | 1.91 | 0.00E+00 | 1.19E-06 | 2.37E-06 | 11.0000 | 1.553E-02 |
| Pa-231 | 3.8511E-09 | 0.95 | 1.91 | 0.00E+00 | 3.68E-09 | 7.35E-09 | | |
| Pb-210 | 7.3880E-15 | 0.95 | 1.91 | 0.00E+00 | 7.05E-15 | 1.41E-14 | | |
| Pm-147 | 2.1023E+00 | 0.95 | 1.91 | 0.00E+00 | 2.01E+00 | 4.01E+00 | | |
| Pu-238 | 1.0383E-03 | 0.95 | 1.91 | 0.00E+00 | 9.91E-04 | 1.98E-03 | | |
| Pu-239 | 5.5293E-03 | 0.95 | 1.91 | 0.00E+00 | 5.28E-03 | 1.06E-02 | | |
| Pu-240 | 2.1278E-03 | 0.95 | 1.91 | 0.00E+00 | 2.03E-03 | 4.06E-03 | | |
| Pu-241 | 1.0195E-01 | 0.95 | 1.91 | 0.00E+00 | 9.73E-02 | 1.95E-01 | | |
| Pu-242 | 2.3128E-07 | 0.95 | 1.91 | 0.00E+00 | 2.21E-07 | 4.42E-07 | | |
| Ra-226 | 5.2782E-14 | 0.95 | 1.91 | 0.00E+00 | 5.04E-14 | 1.01E-13 | | |
| Ra-228 | 1.9338E-10 | 0.95 | 1.91 | 0.00E+00 | 1.85E-10 | 3.69E-10 | | |
| Ru-106 | 9.1684E-02 | 0.95 | 1.91 | 0.00E+00 | 8.75E-02 | 1.75E-01 | | |
| Se-79 | 1.3018E-05 | 0.95 | 1.91 | 0.00E+00 | 1.24E-05 | 2.49E-05 | | |
| Sn-126 | 1.2167E-05 | 0.95 | 1.91 | 0.00E+00 | 1.16E-05 | 2.32E-05 | | |
| Sr-90 | 2.6045E+00 | 0.95 | 1.91 | 0.00E+00 | 2.49E+00 | 4.97E+00 | | |
| Tc-99 | 4.4241E-04 | 0.95 | 1.91 | 0.00E+00 | 4.22E-04 | 8.45E-04 | | |
| Th-229 | 1.3713E-10 | 0.95 | 1.91 | 0.00E+00 | 1.31E-10 | 2.62E-10 | | |
| Th-230 | 1.8090E-11 | 0.95 | 1.91 | 0.00E+00 | 1.73E-11 | 3.45E-11 | | |
| Th-232 | 2.5278E-10 | 0.95 | 1.91 | 0.00E+00 | 2.41E-10 | 4.83E-10 | | |
| Th-208 | 1.6947E-08 | 0.95 | 1.91 | 0.00E+00 | 1.62E-08 | 3.24E-08 | | |
| U-232 | 4.8737E-08 | 0.95 | 1.91 | 0.00E+00 | 4.65E-08 | 9.30E-08 | | |
| U-233 | 1.2203E-07 | 0.95 | 1.91 | 0.00E+00 | 1.16E-07 | 2.33E-07 | | |
| U-234 | 1.5925E-07 | 0.95 | 1.91 | 0.00E+00 | 1.52E-07 | 3.04E-07 | | |
| U-235 | -2.6194E-06 | 0.95 | 0.00 | 1.37E-04 | 1.35E-04 | 1.37E-04 | | |
| U-236 | 1.2693E-05 | 0.95 | 1.91 | 0.00E+00 | 1.21E-05 | 2.42E-05 | | |
| U-238 | -3.6331E-08 | 0.95 | 0.00 | 8.62E-05 | 8.61E-05 | 8.62E-05 | | |
| Y-90 | 2.6060E+00 | 0.95 | 1.91 | 0.00E+00 | 2.49E+00 | 4.98E+00 | | |
| Other Radionuclides | | | | | 3.44E+00 | 6.88E+00 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | SST | SST |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 19.875 | 10 to 20.1 |

Basis for Parameter Differences:

Burnup Summary (MWd)³

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | 0.78 | 0.95 |
| Bounding | | 1.91 |

Basis for burnup used in estimate

Nominal burnup calculated from the heavy metal mass destroyed.
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|-----------------------------------|
| Nominal | 0.09 | 1.22 |
| Bounding | 0.17 | |

Estimated EOL HM/Given EOL HM

1.00

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA 8.520 FCR U OF IL
 SNF ID #: 448
 Fuel Units & Descr: 4 - ELEMENT
 Heavy Metal Mass: BOL=0.8kg; EOL=0.751kg
 ROD Storage Site: INEEL

¹Fuel decay start date: 2035
 Estimates as of: 2030
 Template: TRIGA-SS (LW/U-Zrx, SST, 10 to 20%, U)
²Template Burnup(MWd): 6.65
 Template BOL Heavy Metal Mass (MT): 0.000195
 Template Decay Time: 5 years

Estimated
 Canister usage
 18"x10"
 0.05

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ³ | Bounding Fuel Burnup (MWd) ³ | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.5173E-10 | 46.58 | 93.17 | 0.00E+00 | 3.97E-08 | 7.94E-08 | Avg MeV | |
| Am-241 | 1.8331E-03 | 46.58 | 93.17 | 0.00E+00 | 8.54E-02 | 1.71E-01 | 0.0150 | 1.506E+13 |
| Am-242m | 1.4129E-06 | 46.58 | 93.17 | 0.00E+00 | 6.58E-05 | 1.32E-04 | 0.0250 | 3.313E+12 |
| Am-243 | 1.4774E-07 | 46.58 | 93.17 | 0.00E+00 | 6.88E-06 | 1.38E-05 | 0.0375 | 2.822E+12 |
| C-14 | 1.2871E-04 | 46.58 | 93.17 | 0.00E+00 | 6.00E-03 | 1.20E-02 | 0.0575 | 2.896E+12 |
| Cf-252 | 2.8120E-06 | 46.58 | 93.17 | 0.00E+00 | 1.31E-04 | 2.62E-04 | 0.0850 | 1.794E+12 |
| Cm-243 | 1.7940E-07 | 46.58 | 93.17 | 0.00E+00 | 8.36E-06 | 1.67E-05 | 0.1250 | 1.303E+12 |
| Cm-244 | 1.6962E-06 | 46.58 | 93.17 | 0.00E+00 | 7.90E-05 | 1.58E-04 | 0.2250 | 1.522E+12 |
| Co-60 | 1.2839E+00 | 46.58 | 93.17 | 0.00E+00 | 5.98E+01 | 1.20E+02 | 0.3750 | 7.724E+11 |
| Cs-134 | 9.0541E-02 | 46.58 | 93.17 | 0.00E+00 | 4.22E+00 | 8.44E+00 | 0.5750 | 1.027E+13 |
| Cs-135 | 3.2195E-05 | 46.58 | 93.17 | 0.00E+00 | 1.50E-03 | 3.00E-03 | 0.8500 | 4.407E+11 |
| Cs-137 | 2.7564E+00 | 46.58 | 93.17 | 0.00E+00 | 1.28E+02 | 2.57E+02 | 1.2500 | 8.950E+12 |
| Eu-154 | 1.5368E-02 | 46.58 | 93.17 | 0.00E+00 | 7.16E-01 | 1.43E+00 | 1.7500 | 5.966E+09 |
| Eu-155 | 2.9293E-02 | 46.58 | 93.17 | 0.00E+00 | 1.36E+00 | 2.73E+00 | 2.2500 | 9.617E+09 |
| Fe-55 | 7.7158E-01 | 46.58 | 93.17 | 0.00E+00 | 3.59E+01 | 7.19E+01 | 2.7500 | 7.631E+07 |
| H-3 | 1.1111E-02 | 46.58 | 93.17 | 0.00E+00 | 5.18E-01 | 1.04E+00 | 3.5000 | 8.881E+06 |
| I-129 | 7.3684E-07 | 46.58 | 93.17 | 0.00E+00 | 3.43E-05 | 6.87E-05 | 5.0000 | 4.932E+01 |
| Kr-85 | 2.5263E-01 | 46.58 | 93.17 | 0.00E+00 | 1.18E+01 | 2.35E+01 | 7.0000 | 5.583E+00 |
| Np-237 | 1.2427E-06 | 46.58 | 93.17 | 0.00E+00 | 5.79E-05 | 1.16E-04 | 11.0000 | 6.360E-01 |
| Pa-231 | 3.8511E-09 | 46.58 | 93.17 | 0.00E+00 | 1.79E-07 | 3.59E-07 | | |
| Pb-210 | 7.3880E-15 | 46.58 | 93.17 | 0.00E+00 | 3.44E-13 | 6.88E-13 | | |
| Pm-147 | 2.1023E+00 | 46.58 | 93.17 | 0.00E+00 | 9.79E+01 | 1.96E+02 | | |
| Pu-238 | 1.0383E-03 | 46.58 | 93.17 | 0.00E+00 | 4.84E-02 | 9.67E-02 | | |
| Pu-239 | 5.5293E-03 | 46.58 | 93.17 | 0.00E+00 | 2.58E-01 | 5.15E-01 | | |
| Pu-240 | 2.1278E-03 | 46.58 | 93.17 | 0.00E+00 | 9.91E-02 | 1.98E-01 | | |
| Pu-241 | 1.0195E-01 | 46.58 | 93.17 | 0.00E+00 | 4.75E+00 | 9.50E+00 | | |
| Pu-242 | 2.3128E-07 | 46.58 | 93.17 | 0.00E+00 | 1.08E-05 | 2.15E-05 | | |
| Ra-226 | 5.2782E-14 | 46.58 | 93.17 | 0.00E+00 | 2.46E-12 | 4.92E-12 | | |
| Ra-228 | 1.9338E-10 | 46.58 | 93.17 | 0.00E+00 | 9.01E-09 | 1.80E-08 | | |
| Ru-106 | 9.1684E-02 | 46.58 | 93.17 | 0.00E+00 | 4.27E+00 | 8.54E+00 | | |
| Se-79 | 1.3018E-05 | 46.58 | 93.17 | 0.00E+00 | 6.06E-04 | 1.21E-03 | | |
| Sn-126 | 1.2167E-05 | 46.58 | 93.17 | 0.00E+00 | 5.67E-04 | 1.13E-03 | | |
| Sr-90 | 2.6045E+00 | 46.58 | 93.17 | 0.00E+00 | 1.21E+02 | 2.43E+02 | | |
| Tc-99 | 4.4241E-04 | 46.58 | 93.17 | 0.00E+00 | 2.06E-02 | 4.12E-02 | | |
| Th-229 | 1.3713E-10 | 46.58 | 93.17 | 0.00E+00 | 6.39E-09 | 1.28E-08 | | |
| Th-230 | 1.8090E-11 | 46.58 | 93.17 | 0.00E+00 | 8.43E-10 | 1.69E-09 | | |
| Th-232 | 2.5278E-10 | 46.58 | 93.17 | 0.00E+00 | 1.18E-08 | 2.36E-08 | | |
| Ti-208 | 1.6947E-08 | 46.58 | 93.17 | 0.00E+00 | 7.89E-07 | 1.58E-06 | | |
| U-232 | 4.8737E-08 | 46.58 | 93.17 | 0.00E+00 | 2.27E-06 | 4.54E-06 | | |
| U-233 | 1.2203E-07 | 46.58 | 93.17 | 0.00E+00 | 5.68E-06 | 1.14E-05 | | |
| U-234 | 1.5925E-07 | 46.58 | 93.17 | 0.00E+00 | 7.42E-06 | 1.48E-05 | | |
| U-235 | -2.6194E-06 | 46.58 | 0.00 | 3.46E-04 | 2.24E-04 | 3.46E-04 | | |
| U-236 | 1.2693E-05 | 46.58 | 93.17 | 0.00E+00 | 5.91E-04 | 1.18E-03 | | |
| U-238 | -3.6331E-08 | 46.58 | 0.00 | 2.15E-04 | 2.13E-04 | 2.15E-04 | | |
| Y-90 | 2.6060E+00 | 46.58 | 93.17 | 0.00E+00 | 1.21E+02 | 2.43E+02 | | |
| Other Radionuclides | | | | | 1.68E+02 | 3.36E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator | From SFD | Used | |
| | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20.00000115 | 10 to 20.1 | |

| Burnup Summary (MWd) ⁴ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 19.49 | 46.58 | |
| Bounding | | 93.17 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 1.71 | 2.39 | |
| Bounding | 3.42 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA 8 5/20 FFCR U OF TX AUSTIN

SNF ID # 825

Fuel Units & Descr 3 - ELEMENT

Heavy Metal Mass BOL=0 48kg EOL=0 48kg

ROD Storage Site INEEL

¹Fuel decay start date 2035

Estimates as of 2030

Template

TRIGA-SS (LW/U-Zrx, SST, 10 to 20%, U)

²Template Burnup(MWd)

6 65

Template BOL Heavy Metal Mass (MT)

0 000195

Template Decay Time

5 years

Estimated
Canister usage
18"x10"
0 04

II. Estimates

| | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|--------------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity -- (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 5173E-10 | 9 16 | 18 33 | 0 00E+00 | 7 81E-09 | 1 56E-08 | Avg MeV | |
| Am-241 | 1 8331E-03 | 9 16 | 18 33 | 0 00E+00 | 1 68E-02 | 3 36E-02 | 0 0150 | 2 962E+12 |
| Am-242m | 1 4129E-06 | 9 16 | 18 33 | 0 00E+00 | 1 29E-05 | 2 59E-05 | 0 0250 | 6 518E+11 |
| Am-243 | 1 4774E-07 | 9 16 | 18 33 | 0 00E+00 | 1 35E-06 | 2 71E-06 | 0 0375 | 5 551E+11 |
| C-14 | 1 2871E-04 | 9 16 | 18 33 | 0 00E+00 | 1 18E-03 | 2 36E-03 | 0 0575 | 5 698E+11 |
| Ci-36 | 2 8120E-06 | 9 16 | 18 33 | 0 00E+00 | 2 58E-05 | 5 15E-05 | 0 0850 | 3 530E+11 |
| Cm-243 | 1 7940E-07 | 9 16 | 18 33 | 0 00E+00 | 1 64E-06 | 3 29E-06 | 0 1250 | 2 563E+11 |
| Cm-244 | 1 6962E-06 | 9 16 | 18 33 | 0 00E+00 | 1 55E-05 | 3 11E-05 | 0 2250 | 2 994E+11 |
| Co-60 | 1 2839E+00 | 9 16 | 18 33 | 0 00E+00 | 1 18E+01 | 2 35E+01 | 0 3750 | 1 520E+11 |
| Cs-134 | 9 0541E-02 | 9 16 | 18 33 | 0 00E+00 | 8 30E-01 | 1 66E+00 | 0 5750 | 2 020E+12 |
| Cs-135 | 3 2195E-05 | 9 16 | 18 33 | 0 00E+00 | 2 95E-04 | 5 90E-04 | 0 8500 | 8 670E+10 |
| Cs-137 | 2 7564E+00 | 9 16 | 18 33 | 0 00E+00 | 2 53E+01 | 5 05E+01 | 1 2500 | 1 761E+12 |
| Eu-154 | 1 5368E-02 | 9 16 | 18 33 | 0 00E+00 | 1 41E-01 | 2 82E-01 | 1 7500 | 1 174E+09 |
| Eu-155 | 2 9293E-02 | 9 16 | 18 33 | 0 00E+00 | 2 68E-01 | 5 37E-01 | 2 2500 | 1 892E+09 |
| Fe-55 | 7 7158E-01 | 9 16 | 18 33 | 0 00E+00 | 7 07E+00 | 1 41E+01 | 2 7500 | 1 501E+07 |
| H-3 | 1 1111E-02 | 9 16 | 18 33 | 0 00E+00 | 1 02E-01 | 2 04E-01 | 3 5000 | 1 747E+06 |
| I-129 | 7 3684E-07 | 9 16 | 18 33 | 0 00E+00 | 6 75E-06 | 1 35E-05 | 5 0000 | 9 905E+00 |
| Kr-85 | 2 5263E-01 | 9 16 | 18 33 | 0 00E+00 | 2 32E+00 | 4 63E+00 | 7 0000 | 1 122E+00 |
| Np-237 | 1 2427E-06 | 9 16 | 18 33 | 0 00E+00 | 1 14E-05 | 2 28E-05 | 11 0000 | 1 278E-01 |
| Pa-231 | 3 8511E-09 | 9 16 | 18 33 | 0 00E+00 | 3 53E-08 | 7 06E-08 | | |
| Pb-210 | 7 3880E-15 | 9 16 | 18 33 | 0 00E+00 | 6 77E-14 | 1 35E-13 | | |
| Pm-147 | 2 1023E+00 | 9 16 | 18 33 | 0 00E+00 | 1 93E+01 | 3 85E+01 | | |
| Pu-238 | 1 0383E-03 | 9 16 | 18 33 | 0 00E+00 | 9 52E-03 | 1 90E-02 | | |
| Pu-239 | 5 5293E-03 | 9 16 | 18 33 | 0 00E+00 | 5 07E-02 | 1 01E-01 | | |
| Pu-240 | 2 1278E-03 | 9 16 | 18 33 | 0 00E+00 | 1 95E-02 | 3 90E-02 | | |
| Pu-241 | 1 0195E-01 | 9 16 | 18 33 | 0 00E+00 | 9 34E-01 | 1 87E+00 | | |
| Pu-242 | 2 3128E-07 | 9 16 | 18 33 | 0 00E+00 | 2 12E-06 | 4 24E-06 | | |
| Ra-226 | 5 2782E-14 | 9 16 | 18 33 | 0 00E+00 | 4 84E-13 | 9 67E-13 | | |
| Ra-228 | 1 9338E-10 | 9 16 | 18 33 | 0 00E+00 | 1 77E-09 | 3 54E-09 | | |
| Ru-106 | 9 1684E-02 | 9 16 | 18 33 | 0 00E+00 | 8 40E-01 | 1 68E+00 | | |
| Se-79 | 1 3018E-05 | 9 16 | 18 33 | 0 00E+00 | 1 19E-04 | 2 39E-04 | | |
| Sn-126 | 1 2167E-05 | 9 16 | 18 33 | 0 00E+00 | 1 12E-04 | 2 23E-04 | | |
| Sr-90 | 2 6045E+00 | 9 16 | 18 33 | 0 00E+00 | 2 39E+01 | 4 77E+01 | | |
| Tc-99 | 4 4241E-04 | 9 16 | 18 33 | 0 00E+00 | 4 05E-03 | 8 11E-03 | | |
| Th-229 | 1 3713E-10 | 9 16 | 18 33 | 0 00E+00 | 1 26E-09 | 2 51E-09 | | |
| Th-230 | 1 8090E-11 | 9 16 | 18 33 | 0 00E+00 | 1 66E-10 | 3 32E-10 | | |
| Th-232 | 2 5278E-10 | 9 16 | 18 33 | 0 00E+00 | 2 32E-09 | 4 63E-09 | | |
| Ti-208 | 1 6947E-08 | 9 16 | 18 33 | 0 00E+00 | 1 55E-07 | 3 11E-07 | | |
| U-232 | 4 8737E-08 | 9 16 | 18 33 | 0 00E+00 | 4 47E-07 | 8 93E-07 | | |
| U-233 | 1 2203E-07 | 9 16 | 18 33 | 0 00E+00 | 1 12E-06 | 2 24E-06 | | |
| U-234 | 1 5925E-07 | 9 16 | 18 33 | 0 00E+00 | 1 46E-06 | 2 92E-06 | | |
| U-235 | 2 6194E-06 | 9 16 | 0 00 | 2 05E-04 | 1 81E-04 | 2 05E-04 | | |
| U-236 | 1 2693E-05 | 9 16 | 18 33 | 0 00E+00 | 1 16E-04 | 2 33E-04 | | |
| U-238 | 3 6331E-08 | 9 16 | 0 00 | 1 29E-04 | 1 29E-04 | 1 29E-04 | | |
| Y-90 | 2 6060E+00 | 9 16 | 18 33 | 0 00E+00 | 2 39E+01 | 4 78E+01 | | |
| Other Radionuclides | | | | | 3 30E+01 | 6 61E+01 | | |

Thermal Power

| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
|-----------------------------|------------------------------|
| 5 33E-01 | 1 07E+00 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences* |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| | From SFD | Used | |
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19 7916875 | 10 to 20 1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate |
|-----------------------------------|----------|-----------|-----------------------------------|
| | From SFD | Estimated | |
| Nominal | | 9 16 | |
| Bounding | | 18 33 | |

Nominal burnup assumed to be 2% of BOL heavy metal mass

Bounding burnup assumed to be twice nominal burnup

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|--------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0 56 | | |
| Bounding | 1 12 | | |

0 99

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

*Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA 8 5/20 FFCR ZAIRE
 SNF ID #: 735
 Fuel Units & Descr: 4 - ELEMENT
 Heavy Metal Mass: BOL=0.638kg, EOL=0.638kg
 ROD Storage Site: INEEL

¹Fuel decay start date: 2010
 Estimates as of: 2030
 Template: TRIGA-SS (LW/U-Zr, SST, 10 to 20%, U)
²Template Burnup(MWd): 6.65
 Template BOL Heavy Metal Mass (MT): 0.000195
 Template Decay Time: 20 years

Estimated
 Canister usage:
 18"x10"
 0.04

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.6436E-09 | 6.22 | 12.44 | 0.00E+00 | 1.64E-08 | 3.29E-08 | Avg MeV | |
| Am-241 | 3.1429E-03 | 6.22 | 12.44 | 0.00E+00 | 1.95E-02 | 3.91E-02 | 0.0150 | 1.246E+12 |
| Am-242m | 1.3195E-06 | 6.22 | 12.44 | 0.00E+00 | 8.20E-06 | 1.64E-05 | 0.0250 | 2.594E+11 |
| Am-243 | 1.4753E-07 | 6.22 | 12.44 | 0.00E+00 | 9.17E-07 | 1.83E-06 | 0.0375 | 2.247E+11 |
| C-14 | 1.2847E-04 | 6.22 | 12.44 | 0.00E+00 | 7.99E-04 | 1.60E-03 | 0.0575 | 2.418E+11 |
| Cl-36 | 2.8120E-06 | 6.22 | 12.44 | 0.00E+00 | 1.75E-05 | 3.50E-05 | 0.0850 | 1.460E+11 |
| Cm-243 | 1.2465E-07 | 6.22 | 12.44 | 0.00E+00 | 7.75E-07 | 1.55E-06 | 0.1250 | 9.540E+10 |
| Cm-244 | 9.5564E-07 | 6.22 | 12.44 | 0.00E+00 | 5.94E-06 | 1.19E-05 | 0.2250 | 1.253E+11 |
| Co-60 | 1.7880E-01 | 6.22 | 12.44 | 0.00E+00 | 1.11E+00 | 2.22E+00 | 0.3750 | 5.493E+10 |
| Cs-134 | 5.8692E-04 | 6.22 | 12.44 | 0.00E+00 | 3.65E-03 | 7.30E-03 | 0.5750 | 9.034E+11 |
| Cs-135 | 3.2195E-05 | 6.22 | 12.44 | 0.00E+00 | 2.00E-04 | 4.00E-04 | 0.8500 | 1.018E+10 |
| Cs-137 | 1.9489E+00 | 6.22 | 12.44 | 0.00E+00 | 1.21E+01 | 2.42E+01 | 1.2500 | 1.687E+11 |
| Eu-154 | 4.5895E-03 | 6.22 | 12.44 | 0.00E+00 | 2.85E-02 | 5.71E-02 | 1.7500 | 2.616E+08 |
| Eu-155 | 3.6045E-03 | 6.22 | 12.44 | 0.00E+00 | 2.24E-02 | 4.48E-02 | 2.2500 | 9.011E+05 |
| Fe-55 | 1.4185E-02 | 6.22 | 12.44 | 0.00E+00 | 8.82E-02 | 1.76E-01 | 2.7500 | 9.929E+03 |
| H-3 | 4.7895E-03 | 6.22 | 12.44 | 0.00E+00 | 2.98E-02 | 5.96E-02 | 3.5000 | 5.582E+01 |
| I-129 | 7.3684E-07 | 6.22 | 12.44 | 0.00E+00 | 4.58E-06 | 9.16E-06 | 5.0000 | 6.857E+00 |
| Kr-85 | 9.5820E-02 | 6.22 | 12.44 | 0.00E+00 | 5.96E-01 | 1.19E+00 | 7.0000 | 7.753E-01 |
| Np-237 | 1.2552E-06 | 6.22 | 12.44 | 0.00E+00 | 7.80E-06 | 1.56E-05 | 11.0000 | 8.825E-02 |
| Pa-231 | 7.0406E-09 | 6.22 | 12.44 | 0.00E+00 | 4.38E-08 | 8.76E-08 | | |
| Pb-210 | 5.8000E-14 | 6.22 | 12.44 | 0.00E+00 | 3.61E-13 | 7.21E-13 | | |
| Pm-147 | 4.0075E-02 | 6.22 | 12.44 | 0.00E+00 | 2.49E-01 | 4.98E-01 | | |
| Pu-238 | 9.2256E-04 | 6.22 | 12.44 | 0.00E+00 | 5.74E-03 | 1.15E-02 | | |
| Pu-239 | 5.5278E-03 | 6.22 | 12.44 | 0.00E+00 | 3.44E-02 | 6.87E-02 | | |
| Pu-240 | 2.1248E-03 | 6.22 | 12.44 | 0.00E+00 | 1.32E-02 | 2.64E-02 | | |
| Pu-241 | 4.9549E-02 | 6.22 | 12.44 | 0.00E+00 | 3.08E-01 | 6.16E-01 | | |
| Pu-242 | 2.3128E-07 | 6.22 | 12.44 | 0.00E+00 | 1.44E-06 | 2.88E-06 | | |
| Ra-226 | 2.4526E-13 | 6.22 | 12.44 | 0.00E+00 | 1.53E-12 | 3.05E-12 | | |
| Ra-228 | 2.4015E-10 | 6.22 | 12.44 | 0.00E+00 | 1.49E-09 | 2.99E-09 | | |
| Ru-106 | 3.0602E-06 | 6.22 | 12.44 | 0.00E+00 | 1.90E-05 | 3.81E-05 | | |
| Se-79 | 1.3015E-05 | 6.22 | 12.44 | 0.00E+00 | 8.09E-05 | 1.62E-04 | | |
| Sn-126 | 1.2165E-05 | 6.22 | 12.44 | 0.00E+00 | 7.56E-05 | 1.51E-04 | | |
| Sr-90 | 1.8226E+00 | 6.22 | 12.44 | 0.00E+00 | 1.13E+01 | 2.27E+01 | | |
| Tc-99 | 4.4241E-04 | 6.22 | 12.44 | 0.00E+00 | 2.75E-03 | 5.50E-03 | | |
| Th-229 | 3.0962E-10 | 6.22 | 12.44 | 0.00E+00 | 1.93E-09 | 3.85E-09 | | |
| Th-230 | 4.2346E-11 | 6.22 | 12.44 | 0.00E+00 | 2.63E-10 | 5.27E-10 | | |
| Th-232 | 2.5278E-10 | 6.22 | 12.44 | 0.00E+00 | 1.57E-09 | 3.14E-09 | | |
| Ti-208 | 1.5820E-08 | 6.22 | 12.44 | 0.00E+00 | 9.84E-08 | 1.97E-07 | | |
| U-232 | 4.2647E-08 | 6.22 | 12.44 | 0.00E+00 | 2.65E-07 | 5.30E-07 | | |
| U-233 | 1.2211E-07 | 6.22 | 12.44 | 0.00E+00 | 7.59E-07 | 1.52E-06 | | |
| U-234 | 1.9955E-07 | 6.22 | 12.44 | 0.00E+00 | 1.24E-06 | 2.48E-06 | | |
| U-235 | -2.6194E-06 | 6.22 | 0.00 | 2.76E-04 | 2.59E-04 | 2.76E-04 | | |
| U-236 | 1.2693E-05 | 6.22 | 12.44 | 0.00E+00 | 7.89E-05 | 1.58E-04 | | |
| U-238 | -3.6331E-08 | 6.22 | 0.00 | 1.72E-04 | 1.71E-04 | 1.72E-04 | | |
| Y-90 | 1.8241E+00 | 6.22 | 12.44 | 0.00E+00 | 1.13E+01 | 2.27E+01 | | |
| Other Radionuclides | | | | | 1.20E+01 | 2.39E+01 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| | From SFD | Used | |
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20.00000041 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate. |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 6.22 | | Nominal burnup taken directly from SFD (converted to MWd) |
| Bounding | | 12.44 | Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|--------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0.29 | 0.00 | 0.99 |
| Bounding | 0.57 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD (ACPR)
 SNF ID # 895
 Fuel Units & Descr 182 - ELEMENT
 Heavy Metal Mass BOL=48 357kg EOL=48 357kg
 ROD Storage Site INEEL

¹Fuel decay start date 2035
 Estimates as of 2030
 Template TRIGA-SS (LW/U Zrx, SST, 10 to 20%, U)
²Template Burnup(MWd) 6 65
 Template BOL Heavy Metal Mass (MT) 0.000195
 Template Decay Time 5 years

Estimated
 Canister usage
 18"x10"
 1 64

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 5173E-10 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | Avg MeV | |
| Am-241 | 1 8331E-03 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 0 0150 | 5 162E+08 |
| Am-242m | 1 4129E-06 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 0 0250 | 0 000E+00 |
| Am-243 | 1 4774E-07 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 0 0375 | 7 043E+05 |
| C-14 | 1 2871E-04 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 0 0575 | 4 276E+05 |
| Ci-36 | 2 8120E-06 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 0 0850 | 6 017E+07 |
| Cm-243 | 1 7940E-07 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 0 1250 | 1 188E+08 |
| Cm-244 | 1 6962E-06 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 0 2250 | 4 204E+08 |
| Co-60 | 1 2839E+00 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 0 3750 | 1 049E+06 |
| Cs-134 | 9 0541E-02 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 0 5750 | 5 161E+04 |
| Cs-135 | 3 2195E-05 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 0 8500 | 8 046E+03 |
| Cs-137 | 2 7564E+00 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 1 2500 | 4 756E+02 |
| Eu-154 | 1 5368E-02 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 1 7500 | 2 327E+02 |
| Eu-155 | 2 9293E-02 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 2 2500 | 1 348E+02 |
| Fe-55 | 7 7158E-01 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 2 7500 | 7 832E+01 |
| H-3 | 1 1111E-02 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 3 5000 | 7 002E+01 |
| I-129 | 7 3684E-07 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 5 0000 | 3 008E+01 |
| Kr-85 | 2 5263E-01 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 7 0000 | 3 463E+00 |
| Np-237 | 1 2427E-06 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 11 0000 | 3 981E-01 |
| Pa-231 | 3 8511E-09 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Pb-210 | 7 3880E-15 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Pm-147 | 2 1023E+00 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Pu-238 | 1 0383E-03 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Pu-239 | 5 5293E-03 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Pu-240 | 2 1278E-03 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Pu-241 | 1 0195E-01 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Pu-242 | 2 3128E-07 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Ra-226 | 5 2782E-14 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Ra-228 | 1 9338E-10 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Ru-106 | 9 1684E-02 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Se-79 | 1 3018E-05 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Sn-126 | 1 2167E-05 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Sr-90 | 2 6045E+00 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Tc-99 | 4 4241E-04 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Th-229 | 1 3713E-10 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Th-230 | 1 8090E-11 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Th-232 | 2 5278E-10 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Ti-208 | 1 6947E-08 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| U-232 | 4 8737E-08 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| U-233 | 1 2203E-07 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| U-234 | 1 5925E-07 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| U-235 | -2 6194E-06 | 0 00 | 0 00 | 2 08E-02 | 2 08E-02 | 2 08E-02 | | |
| U-236 | 1 2693E-05 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| U-238 | -3 6331E-08 | 0 00 | 0 00 | 1 30E-02 | 1 30E-02 | 1 30E-02 | | |
| Y-90 | 2 6060E+00 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Other Radionuclides | | | | | 0 00E+00 | 0 00E+00 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences |
|----------------------------|-----------------------|-----------------------|---------------------------------|
| Reactor Moderator | From SFD | Used | |
| Fuel Cladding | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| BOL HM Constituents | SST | SST | |
| BOL Enrichment % | U | U | |
| | 19 95031243 | 10 to 20 1 | |

| Burnup Summary (MWd) ² | | Basis for burnup used in estimate: |
|-----------------------------------|-----------|---|
| Nominal | From SFD | |
| Bounding | Estimated | |
| | 0 00 | Nominal burnup taken directly from SFD (converted to MWd) |
| | | Bounding burnup assumed to be twice nominal burnup |

| Checks | | Estimated EOL HM/Given EOL HM |
|----------|--------------------------------|-------------------------------|
| Nominal | Burnup Multiplier | |
| Bounding | Estimated Burnup/ Given Burnup | |
| | 0 00 | 1 00 |
| | 0 00 | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD (ALUM) ARRR

SNF ID #: 238

Fuel Units & Descr: 71 - ELEMENT

Heavy Metal Mass: BOL=13.376kg EOL=9 322kg

ROD Storage Site: INEEL

¹Fuel decay start date: 2035

Estimates as of 2030

Template: TRIGA-AJ (LW/U-Zrx, Alum, 10 to 20%, U)

²Template Burnup (MWd): 6 65

Template BOL Heavy Metal Mass (MT) 0 00018

Template Decay Time³ 5 years

Estimated
Canister usage
18"x10"
0 64

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 0632E-10 | 3,869 71 | 7,739 43 | 0 00E+00 | 3 12E-06 | 6 24E-06 | Avg MeV | |
| Am-241 | 2.2586E-03 | 3,869 71 | 7,739 43 | 0 00E+00 | 8.74E+00 | 1.75E+01 | 0.0150 | 1 310E+15 |
| Am-242m | 1 9925E-06 | 3,869 71 | 7,739 43 | 0 00E+00 | 7.71E-03 | 1 54E-02 | 0 0250 | 2 843E+14 |
| Am-243 | 2 3323E-07 | 3,869 71 | 7,739 43 | 0 00E+00 | 9 03E-04 | 1 81E-03 | 0 0375 | 3 541E+14 |
| C-14 | 4.3308E-05 | 3,869 71 | 7,739 43 | 0 00E+00 | 1 68E-01 | 3 35E-01 | 0.0575 | 2 715E+14 |
| Cl-36 | 4 3023E-08 | 3,869 71 | 7,739 43 | 0 00E+00 | 1 66E-04 | 3 33E-04 | 0 0850 | 1 900E+14 |
| Cm-243 | 2 7429E-07 | 3,869 71 | 7,739 43 | 0 00E+00 | 1 06E-03 | 2 12E-03 | 0 1250 | 2 842E+14 |
| Cm-244 | 3 1504E-06 | 3,869 71 | 7,739 43 | 0 00E+00 | 1.22E-02 | 2 44E-02 | 0.2250 | 1 586E+14 |
| Co-60 | 3 1008E-02 | 3,869 71 | 7,739 43 | 0 00E+00 | 1 20E+02 | 2 40E+02 | 0.3750 | 7 061E+13 |
| Cs-134 | 1 0367E-01 | 3,869 71 | 7,739 43 | 0 00E+00 | 4 01E+02 | 8 02E+02 | 0.5750 | 8 952E+14 |
| Cs-135 | 3 1549E-05 | 3,869 71 | 7,739 43 | 0 00E+00 | 1 22E-01 | 2 44E-01 | 0.8500 | 2 204E+14 |
| Cs-137 | 2 7564E+00 | 3,869 71 | 7,739 43 | 0 00E+00 | 1 07E+04 | 2.13E+04 | 1.2500 | 2 284E+14 |
| Eu-154 | 1.3490E+00 | 3,869 71 | 7,739 43 | 0 00E+00 | 5.22E+03 | 1 04E+04 | 1 7500 | 6 537E+12 |
| Eu-155 | 4.3880E-01 | 3,869 71 | 7,739 43 | 0 00E+00 | 1.70E+03 | 3.40E+03 | 2.2500 | 7 946E+11 |
| Fe-55 | 8 6782E-03 | 3,869 71 | 7,739 43 | 0 00E+00 | 3.36E+01 | 6 72E+01 | 2.7500 | 6 454E+09 |
| H-3 | 1 0805E-02 | 3,869 71 | 7,739 43 | 0 00E+00 | 4.18E+01 | 8 36E+01 | 3.5000 | 7 543E+08 |
| I-129 | 7.3805E-07 | 3,869 71 | 7,739 43 | 0 00E+00 | 2 86E-03 | 5 71E-03 | 5 0000 | 4 423E+03 |
| Kr-85 | 2 5218E-01 | 3,869 71 | 7,739 43 | 0 00E+00 | 9 76E+02 | 1 95E+03 | 7 0000 | 5 006E+02 |
| Np-237 | 1 4463E-06 | 3,869 71 | 7,739 43 | 0 00E+00 | 5 60E-03 | 1 12E-02 | 11 0000 | 5 701E+01 |
| Pa-231 | 3 5970E-09 | 3,869 71 | 7,739 43 | 0 00E+00 | 1 39E-05 | 2 78E-05 | | |
| Pb-210 | 8.2511E-15 | 3,869 71 | 7,739 43 | 0 00E+00 | 3 19E-11 | 6 39E-11 | | |
| Pm-147 | 2 0767E+00 | 3,869 71 | 7,739 43 | 0 00E+00 | 8 04E+03 | 1 61E+04 | | |
| Pu-238 | 1 3514E-03 | 3,869 71 | 7,739 43 | 0 00E+00 | 5.23E+00 | 1 05E+01 | | |
| Pu-239 | 5 6947E-03 | 3,869 71 | 7,739 43 | 0 00E+00 | 2.20E+01 | 4 41E+01 | | |
| Pu-240 | 2.2647E-03 | 3,869 71 | 7,739 43 | 0 00E+00 | 8 76E+00 | 1 75E+01 | | |
| Pu-241 | 1.2574E-01 | 3,869 71 | 7,739 43 | 0 00E+00 | 4 87E+02 | 9 73E+02 | | |
| Pu-242 | 3 0602E-07 | 3,869 71 | 7,739 43 | 0 00E+00 | 1 18E-03 | 2 37E-03 | | |
| Ra-226 | 5 7353E-14 | 3,869 71 | 7,739 43 | 0 00E+00 | 2 22E-10 | 4 44E-10 | | |
| Ra-228 | 1 8150E-10 | 3,869 71 | 7,739 43 | 0 00E+00 | 7 02E-07 | 1 40E-06 | | |
| Ru-106 | 9 3744E-02 | 3,869 71 | 7,739 43 | 0 00E+00 | 3 63E+02 | 7 26E+02 | | |
| Se-79 | 1.2938E-05 | 3,869 71 | 7,739 43 | 0 00E+00 | 5 01E-02 | 1 00E-01 | | |
| Sn-126 | 1.2239E-05 | 3,869 71 | 7,739 43 | 0 00E+00 | 4 74E-02 | 9 47E-02 | | |
| Sr-90 | 2 6000E+00 | 3,869 71 | 7,739 43 | 0 00E+00 | 1 01E+04 | 2 01E+04 | | |
| Tc-99 | 4 4120E-04 | 3,869 71 | 7,739 43 | 0 00E+00 | 1.71E+00 | 3 41E+00 | | |
| Th-229 | 1 4749E-10 | 3,869 71 | 7,739 43 | 0 00E+00 | 5 71E-07 | 1 14E-06 | | |
| Th-230 | 1 9549E-11 | 3,869 71 | 7,739 43 | 0 00E+00 | 7 56E-08 | 1 51E-07 | | |
| Th-232 | 2.3744E-10 | 3,869 71 | 7,739 43 | 0 00E+00 | 9 19E-07 | 1 84E-06 | | |
| Ti-208 | 1 9459E-08 | 3,869 71 | 7,739 43 | 0 00E+00 | 7 53E-05 | 1 51E-04 | | |
| U-232 | 5 6015E-08 | 3,869 71 | 7,739 43 | 0 00E+00 | 2 17E-04 | 4 34E-04 | | |
| U-233 | 1.3132E-07 | 3,869 71 | 7,739 43 | 0 00E+00 | 5 08E-04 | 1 02E-03 | | |
| U-234 | 1 7323E-07 | 3,869 71 | 7,739 43 | 0 00E+00 | 6 70E-04 | 1 34E-03 | | |
| U-235 | -2 6159E-06 | 3,869 71 | 0 00 | 5 67E-03 | 0 00E+00 | 5 67E-03 | | |
| U-236 | 1.2717E-05 | 3,869 71 | 7,739 43 | 0 00E+00 | 4 92E-02 | 9 84E-02 | | |
| U-238 | -3 8857E-08 | 3,869 71 | 0 00 | 3 61E-03 | 3 46E-03 | 3 61E-03 | | |
| Y-90 | 2 6015E+00 | 3,869 71 | 7,739 43 | 0 00E+00 | 1 01E+04 | 2 01E+04 | | |
| Other Radionuclides | | | | | 1 47E+04 | 2 94E+04 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| | From SFD | Used | |
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19 62614987 | 10 to 20 1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | 494 30 | 3 869 71 | Nominal burnup calculated from the heavy metal mass destroyed. |
| Bounding | | 7 739 43 | Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 7 83 | 7 83 | 1 23 |
| Bounding | 15 66 | | |

¹Reactor shutdown, core removal, storage shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD (ALUM) AUSTRIA
SNF ID #: 462
Fuel Units & Descr: 66 - ELEMENT
Heavy Metal Mass BOL=11.88kg EOL=11.814kg
ROD Storage Site INEEL

¹Fuel decay start date 2010
Estimates as of 2030
Template TRIGA-AJ (LW/U-Zrx, Alum, 10 to 20%, U)
²Template Burnup(MWd), 6.65
Template BOL Heavy Metal Mass (MT) 0.00018
Template Decay Time 20 years

Estimated
Canister usage
18"x10"
0.59

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.4556E-09 | 63.00 | 126.00 | 0.00E+00 | 1.55E-07 | 3.09E-07 | Avg MeV | |
| Am-241 | 3.8752E-03 | 63.00 | 126.00 | 0.00E+00 | 2.44E-01 | 4.88E-01 | 0.0150 | 1.293E+13 |
| Am-242m | 1.8617E-06 | 63.00 | 126.00 | 0.00E+00 | 1.17E-04 | 2.35E-04 | 0.0250 | 2.670E+12 |
| Am-243 | 2.3293E-07 | 63.00 | 126.00 | 0.00E+00 | 1.47E-05 | 2.93E-05 | 0.0375 | 2.795E+12 |
| C-14 | 4.3233E-05 | 63.00 | 126.00 | 0.00E+00 | 2.72E-03 | 5.45E-03 | 0.0575 | 2.583E+12 |
| Cl-36 | 4.3023E-08 | 63.00 | 126.00 | 0.00E+00 | 2.71E-06 | 5.42E-06 | 0.0850 | 1.573E+12 |
| Cm-243 | 1.9053E-07 | 63.00 | 126.00 | 0.00E+00 | 1.20E-05 | 2.40E-05 | 0.1250 | 1.765E+12 |
| Cm-244 | 1.7744E-06 | 63.00 | 126.00 | 0.00E+00 | 1.12E-04 | 2.24E-04 | 0.2250 | 1.425E+12 |
| Co-60 | 4.3188E-03 | 63.00 | 126.00 | 0.00E+00 | 2.72E-01 | 5.44E-01 | 0.3750 | 5.856E+11 |
| Cs-134 | 6.7188E-04 | 63.00 | 126.00 | 0.00E+00 | 4.23E-02 | 8.47E-02 | 0.5750 | 9.330E+12 |
| Cs-135 | 3.1549E-05 | 63.00 | 126.00 | 0.00E+00 | 1.99E-03 | 3.98E-03 | 0.8500 | 9.926E+11 |
| Cs-137 | 1.9489E+00 | 63.00 | 126.00 | 0.00E+00 | 1.23E+02 | 2.46E+02 | 1.2500 | 1.069E+12 |
| Eu-154 | 4.0301E-01 | 63.00 | 126.00 | 0.00E+00 | 2.54E+01 | 5.08E+01 | 1.7500 | 3.203E+10 |
| Eu-155 | 5.4000E-02 | 63.00 | 126.00 | 0.00E+00 | 3.40E+00 | 6.80E+00 | 2.2500 | 5.078E+05 |
| Fe-55 | 1.5955E-04 | 63.00 | 126.00 | 0.00E+00 | 1.01E-02 | 2.01E-02 | 2.7500 | 8.452E+04 |
| H-3 | 4.6571E-03 | 63.00 | 126.00 | 0.00E+00 | 2.93E-01 | 5.87E-01 | 3.5000 | 5.953E+02 |
| I-129 | 7.3805E-07 | 63.00 | 126.00 | 0.00E+00 | 4.65E-05 | 9.30E-05 | 5.0000 | 7.820E+01 |
| Kr-85 | 9.5684E-02 | 63.00 | 126.00 | 0.00E+00 | 6.03E+00 | 1.21E+01 | 7.0000 | 8.843E+00 |
| Np-237 | 1.4618E-06 | 63.00 | 126.00 | 0.00E+00 | 9.21E-05 | 1.84E-04 | 11.0000 | 1.007E+00 |
| Pa-231 | 6.4782E-09 | 63.00 | 126.00 | 0.00E+00 | 4.08E-07 | 8.16E-07 | | |
| Pb-210 | 6.3158E-14 | 63.00 | 126.00 | 0.00E+00 | 3.98E-12 | 7.96E-12 | | |
| Pm-147 | 3.9564E-02 | 63.00 | 126.00 | 0.00E+00 | 2.49E+00 | 4.98E+00 | | |
| Pu-238 | 1.2008E-03 | 63.00 | 126.00 | 0.00E+00 | 7.56E-02 | 1.51E-01 | | |
| Pu-239 | 5.6917E-03 | 63.00 | 126.00 | 0.00E+00 | 3.59E-01 | 7.17E-01 | | |
| Pu-240 | 2.2617E-03 | 63.00 | 126.00 | 0.00E+00 | 1.42E-01 | 2.85E-01 | | |
| Pu-241 | 6.1113E-02 | 63.00 | 126.00 | 0.00E+00 | 3.85E+00 | 7.70E+00 | | |
| Pu-242 | 3.0602E-07 | 63.00 | 126.00 | 0.00E+00 | 1.93E-05 | 3.86E-05 | | |
| Ra-226 | 2.6707E-13 | 63.00 | 126.00 | 0.00E+00 | 1.68E-11 | 3.36E-11 | | |
| Ra-228 | 2.2556E-10 | 63.00 | 126.00 | 0.00E+00 | 1.42E-08 | 2.84E-08 | | |
| Ru-106 | 3.1293E-06 | 63.00 | 126.00 | 0.00E+00 | 1.97E-04 | 3.94E-04 | | |
| Se-79 | 1.2935E-05 | 63.00 | 126.00 | 0.00E+00 | 8.15E-04 | 1.63E-03 | | |
| Sn-126 | 1.2238E-05 | 63.00 | 126.00 | 0.00E+00 | 7.71E-04 | 1.54E-03 | | |
| Sr-90 | 1.8195E+00 | 63.00 | 126.00 | 0.00E+00 | 1.15E+02 | 2.29E+02 | | |
| Tc-99 | 4.4120E-04 | 63.00 | 126.00 | 0.00E+00 | 2.78E-02 | 5.56E-02 | | |
| Th-229 | 3.3308E-10 | 63.00 | 126.00 | 0.00E+00 | 2.10E-08 | 4.20E-08 | | |
| Th-230 | 4.6526E-11 | 63.00 | 126.00 | 0.00E+00 | 2.93E-09 | 5.86E-09 | | |
| Th-232 | 2.3744E-10 | 63.00 | 126.00 | 0.00E+00 | 1.50E-08 | 2.99E-08 | | |
| Th-208 | 1.8195E-08 | 63.00 | 126.00 | 0.00E+00 | 1.15E-06 | 2.29E-06 | | |
| U-232 | 4.9098E-08 | 63.00 | 126.00 | 0.00E+00 | 3.09E-06 | 6.19E-06 | | |
| U-233 | 1.3140E-07 | 63.00 | 126.00 | 0.00E+00 | 8.28E-06 | 1.66E-05 | | |
| U-234 | 2.2571E-07 | 63.00 | 126.00 | 0.00E+00 | 1.42E-05 | 2.84E-05 | | |
| U-235 | -2.6159E-06 | 63.00 | 0.00 | 5.13E-03 | 4.97E-03 | 5.13E-03 | | |
| U-236 | 1.2719E-05 | 63.00 | 126.00 | 0.00E+00 | 8.01E-04 | 1.60E-03 | | |
| U-238 | -3.8857E-08 | 63.00 | 0.00 | 3.19E-03 | 3.19E-03 | 3.19E-03 | | |
| Y-90 | 1.8211E+00 | 63.00 | 126.00 | 0.00E+00 | 1.15E+02 | 2.29E+02 | | |
| Other Radionuclides | | | | | 1.32E+02 | 2.64E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator | From SFD | Used | |
| | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| | Fuel Cladding | ALUM | |
| | BOL HM Constituents | U | |
| BOL Enrichment % | 20 | 10 to 20.1 | |

| Burnup Summary (MWd) ⁴ | | | Basis for burnup used in estimate ⁴ |
|-----------------------------------|----------|-----------|---|
| Nominal | From SFD | Estimated | |
| | 57.89 | 63.00 | |
| Bounding | | 126.00 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| Nominal | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| | 0.14 | 1.09 | |
| Bounding | 0.29 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD (ALUM) BRAZIL
SNF ID #: 471
Fuel Units & Descr: 59 - ELEMENT
Heavy Metal Mass BOL=11 086kg, EOL=10 585kg
ROD Storage Site: INEEL

¹Fuel decay start date: 2006
Estimates as of: 2030
Template: TRIGA-AI (LW/U-Zr, Alum, 10 to 20%, U)
²Template Burnup(MWd): 6 65
Template BOL Heavy Metal Mass (MT): 0 00018
Template Decay Time: 20 years

Estimated
Canister usage
18"x10"
0.53

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2 455E-09 | 478 69 | 957 38 | 0 00E+00 | 1 18E-06 | 2 35E-06 | Avg. MeV | |
| Am-241 | 3 875E-03 | 478 69 | 957 38 | 0 00E+00 | 1 86E+00 | 3 71E+00 | 0 0150 | 9 825E+13 |
| Am-242m | 1 861E-06 | 478 69 | 957 38 | 0 00E+00 | 8 91E-04 | 1 78E-03 | 0 0250 | 2 029E+13 |
| Am-243 | 2 329E-07 | 478 69 | 957 38 | 0 00E+00 | 1 12E-04 | 2 23E-04 | 0 0375 | 2 123E+13 |
| C-14 | 4 323E-05 | 478 69 | 957 38 | 0 00E+00 | 2 07E-02 | 4 14E-02 | 0 0575 | 1 963E+13 |
| Cl-36 | 4 302E-08 | 478 69 | 957 38 | 0 00E+00 | 2 06E-05 | 4 12E-05 | 0 0850 | 1 195E+13 |
| Cm-243 | 1 905E-07 | 478 69 | 957 38 | 0 00E+00 | 9 12E-05 | 1 82E-04 | 0 1250 | 1 341E+13 |
| Cm-244 | 1 774E-06 | 478 69 | 957 38 | 0 00E+00 | 8 49E-04 | 1 70E-03 | 0 2250 | 1 083E+13 |
| Co-60 | 4 318E-03 | 478 69 | 957 38 | 0 00E+00 | 2 07E+00 | 4 13E+00 | 0 3750 | 4 450E+12 |
| Cs-134 | 6 718E-04 | 478 69 | 957 38 | 0 00E+00 | 3 22E-01 | 6 43E-01 | 0 5750 | 7 089E+13 |
| Cs-135 | 3 154E-05 | 478 69 | 957 38 | 0 00E+00 | 1 51E-02 | 3 02E-02 | 0 8500 | 7 543E+12 |
| Cs-137 | 1 948E+00 | 478 69 | 957 38 | 0 00E+00 | 9 33E+02 | 1 87E+03 | 1 2500 | 8 125E+12 |
| Eu-154 | 4 030E-01 | 478 69 | 957 38 | 0 00E+00 | 1 93E+02 | 3 86E+02 | 1 7500 | 2 434E+11 |
| Eu-155 | 5 400E-02 | 478 69 | 957 38 | 0 00E+00 | 2 58E+01 | 5 17E+01 | 2 2500 | 3 858E+06 |
| Fe-55 | 1 595E-04 | 478 69 | 957 38 | 0 00E+00 | 7 64E-02 | 1 53E-01 | 2 7500 | 6 421E+05 |
| H-3 | 4 657E-03 | 478 69 | 957 38 | 0 00E+00 | 2 23E+00 | 4 46E+00 | 3 5000 | 4 408E+03 |
| I-129 | 7 380E-07 | 478 69 | 957 38 | 0 00E+00 | 3 53E-04 | 7 07E-04 | 5 0000 | 5 450E+02 |
| Kr-85 | 9 568E-02 | 478 69 | 957 38 | 0 00E+00 | 4 58E+01 | 9 16E+01 | 7 0000 | 6 153E+01 |
| Np-237 | 1 461E-06 | 478 69 | 957 38 | 0 00E+00 | 7 00E-04 | 1 40E-03 | 11 0000 | 6 998E+00 |
| Pa-231 | 6 478E-09 | 478 69 | 957 38 | 0 00E+00 | 3 10E-06 | 6 20E-06 | | |
| Pb-210 | 6 315E-14 | 478 69 | 957 38 | 0 00E+00 | 3 02E-11 | 6 05E-11 | | |
| Pm-147 | 3 956E-02 | 478 69 | 957 38 | 0 00E+00 | 1 89E+01 | 3 79E+01 | | |
| Pu-238 | 1 200E-03 | 478 69 | 957 38 | 0 00E+00 | 5 75E-01 | 1 15E+00 | | |
| Pu-239 | 5 691E-03 | 478 69 | 957 38 | 0 00E+00 | 2 72E+00 | 5 45E+00 | | |
| Pu-240 | 2 261E-03 | 478 69 | 957 38 | 0 00E+00 | 1 08E+00 | 2 17E+00 | | |
| Pu-241 | 6 111E-02 | 478 69 | 957 38 | 0 00E+00 | 2 93E+01 | 5 85E+01 | | |
| Pu-242 | 3 060E-07 | 478 69 | 957 38 | 0 00E+00 | 1 46E-04 | 2 93E-04 | | |
| Ra-226 | 2 670E-13 | 478 69 | 957 38 | 0 00E+00 | 1 28E-10 | 2 56E-10 | | |
| Ra-228 | 2 255E-10 | 478 69 | 957 38 | 0 00E+00 | 1 08E-07 | 2 16E-07 | | |
| Ru-106 | 3 129E-06 | 478 69 | 957 38 | 0 00E+00 | 1 50E-03 | 3 00E-03 | | |
| Se-79 | 1 293E-05 | 478 69 | 957 38 | 0 00E+00 | 6 19E-03 | 1 24E-02 | | |
| Sn-126 | 1 223E-05 | 478 69 | 957 38 | 0 00E+00 | 5 86E-03 | 1 17E-02 | | |
| Sr-90 | 1 819E+00 | 478 69 | 957 38 | 0 00E+00 | 8 71E+02 | 1 74E+03 | | |
| Tc-99 | 4 412E-04 | 478 69 | 957 38 | 0 00E+00 | 2 11E-01 | 4 22E-01 | | |
| Th-229 | 3 330E-10 | 478 69 | 957 38 | 0 00E+00 | 1 59E-07 | 3 19E-07 | | |
| Th-230 | 4 652E-11 | 478 69 | 957 38 | 0 00E+00 | 2 23E-08 | 4 45E-08 | | |
| Th-232 | 2 374E-10 | 478 69 | 957 38 | 0 00E+00 | 1 14E-07 | 2 27E-07 | | |
| Th-208 | 1 819E-08 | 478 69 | 957 38 | 0 00E+00 | 8 71E-06 | 1 74E-05 | | |
| U-232 | 4 909E-08 | 478 69 | 957 38 | 0 00E+00 | 2 35E-05 | 4 70E-05 | | |
| U-233 | 1 314E-07 | 478 69 | 957 38 | 0 00E+00 | 6 29E-05 | 1 26E-04 | | |
| U-234 | 2 257E-07 | 478 69 | 957 38 | 0 00E+00 | 1 08E-04 | 2 16E-04 | | |
| U-235 | 2 615E-06 | 478 69 | 0 00 | 4 75E-03 | 3 49E-03 | 4 75E-03 | | |
| U-236 | 1 271E-05 | 478 69 | 957 38 | 0 00E+00 | 6 09E-03 | 1 22E-02 | | |
| U-238 | 3 885E-08 | 478 69 | 0 00 | 2 99E-03 | 2 97E-03 | 2 99E-03 | | |
| Y-90 | 1 821E+00 | 478 69 | 957 38 | 0 00E+00 | 8 72E+02 | 1 74E+03 | | |
| Other Radionuclides | | | | | 1 00E+03 | 2 00E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| | From SFD | Used | |
| Reactor Moderator: | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding: | ALUM | ALUM | |
| BOL HM Constituents: | U | U | |
| BOL Enrichment % | 19 81 | 10 to 20 1 | |

| Burnup Summary (MWd) ¹ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | 108.05 | 478 69 | |
| Bounding | | 957 38 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 1 17 | 4 43 | |
| Bounding | 2 34 | | 1 00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT).

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD (ALUM) CORNELL
SNF ID #: 1047
Fuel Units & Descr: 7 - ELEMENT
Heavy Metal Mass: BOL=1.295kg, EOL=1.263kg
ROD Storage Site INEEL

¹Fuel decay start date 2002
Estimates as of 2030
Template TRIGA-AI (LW/U-Zrx Alum, 10 to 20% U)
²Template Burnup(MWd): 6.65
Template BOL Heavy Metal Mass (MT): 0.00018
Template Decay Time: 25 years

Estimated
Canister usage
18"x10"
0.06

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 3.8271E-09 | 30.07 | 60.13 | 0.00E+00 | 1.15E-07 | 2.30E-07 | Avg MeV | |
| Am-241 | 4.4195E-03 | 30.07 | 60.13 | 0.00E+00 | 1.33E-01 | 2.66E-01 | 0.0150 | 5.435E+12 |
| Am-242m | 1.8195E-06 | 30.07 | 60.13 | 0.00E+00 | 5.47E-05 | 1.09E-04 | 0.0250 | 1.123E+12 |
| Am-243 | 2.3278E-07 | 30.07 | 60.13 | 0.00E+00 | 7.00E-06 | 1.40E-05 | 0.0375 | 1.124E+12 |
| C-14 | 4.3203E-05 | 30.07 | 60.13 | 0.00E+00 | 1.30E-03 | 2.60E-03 | 0.0575 | 1.078E+12 |
| Cl-36 | 4.3023E-08 | 30.07 | 60.13 | 0.00E+00 | 1.29E-06 | 2.59E-06 | 0.0850 | 6.486E+11 |
| Cm-243 | 1.6872E-07 | 30.07 | 60.13 | 0.00E+00 | 5.07E-06 | 1.01E-05 | 0.1250 | 6.594E+11 |
| Cm-244 | 1.4660E-06 | 30.07 | 60.13 | 0.00E+00 | 4.41E-05 | 8.82E-05 | 0.2250 | 5.868E+11 |
| Co-60 | 2.2376E-03 | 30.07 | 60.13 | 0.00E+00 | 6.73E-02 | 1.35E-01 | 0.3750 | 2.441E+11 |
| Cs-134 | 1.2525E-04 | 30.07 | 60.13 | 0.00E+00 | 3.77E-03 | 7.53E-03 | 0.5750 | 3.947E+12 |
| Cs-135 | 3.1549E-05 | 30.07 | 60.13 | 0.00E+00 | 9.49E-04 | 1.90E-03 | 0.8500 | 3.258E+11 |
| Cs-137 | 1.7368E+00 | 30.07 | 60.13 | 0.00E+00 | 5.22E+01 | 1.04E+02 | 1.2500 | 3.419E+11 |
| Eu-154 | 2.6947E-01 | 30.07 | 60.13 | 0.00E+00 | 8.10E+00 | 1.62E+01 | 1.7500 | 1.047E+10 |
| Eu-155 | 2.6857E-02 | 30.07 | 60.13 | 0.00E+00 | 8.08E-01 | 1.62E+00 | 2.2500 | 1.606E+05 |
| Fe-55 | 4.2105E-05 | 30.07 | 60.13 | 0.00E+00 | 1.27E-03 | 2.53E-03 | 2.7500 | 3.698E+04 |
| H-3 | 3.5173E-03 | 30.07 | 60.13 | 0.00E+00 | 1.06E-01 | 2.12E-01 | 3.5000 | 8.825E+01 |
| I-129 | 7.3805E-07 | 30.07 | 60.13 | 0.00E+00 | 2.22E-05 | 4.44E-05 | 5.0000 | 3.451E+01 |
| Kr-85 | 6.9263E-02 | 30.07 | 60.13 | 0.00E+00 | 2.08E+00 | 4.17E+00 | 7.0000 | 3.893E+00 |
| Np-237 | 1.4752E-06 | 30.07 | 60.13 | 0.00E+00 | 4.44E-05 | 8.87E-05 | 11.0000 | 4.427E-01 |
| Pa-231 | 8.3970E-09 | 30.07 | 60.13 | 0.00E+00 | 2.52E-07 | 5.05E-07 | | |
| Pb-210 | 1.4995E-13 | 30.07 | 60.13 | 0.00E+00 | 4.51E-12 | 9.02E-12 | | |
| Pm-147 | 1.0567E-02 | 30.07 | 60.13 | 0.00E+00 | 3.18E-01 | 6.35E-01 | | |
| Pu-238 | 1.1543E-03 | 30.07 | 60.13 | 0.00E+00 | 3.47E-02 | 6.94E-02 | | |
| Pu-239 | 5.6917E-03 | 30.07 | 60.13 | 0.00E+00 | 1.71E-01 | 3.42E-01 | | |
| Pu-240 | 2.2602E-03 | 30.07 | 60.13 | 0.00E+00 | 6.80E-02 | 1.36E-01 | | |
| Pu-241 | 4.8045E-02 | 30.07 | 60.13 | 0.00E+00 | 1.44E+00 | 2.89E+00 | | |
| Pu-242 | 3.0602E-07 | 30.07 | 60.13 | 0.00E+00 | 9.20E-06 | 1.84E-05 | | |
| Ra-226 | 5.1293E-13 | 30.07 | 60.13 | 0.00E+00 | 1.54E-11 | 3.08E-11 | | |
| Ra-228 | 2.3323E-10 | 30.07 | 60.13 | 0.00E+00 | 7.01E-09 | 1.40E-08 | | |
| Ru-106 | 1.0075E-07 | 30.07 | 60.13 | 0.00E+00 | 3.03E-06 | 6.06E-06 | | |
| Se-79 | 1.2935E-05 | 30.07 | 60.13 | 0.00E+00 | 3.89E-04 | 7.78E-04 | | |
| Sn-126 | 1.2238E-05 | 30.07 | 60.13 | 0.00E+00 | 3.68E-04 | 7.36E-04 | | |
| Sr-90 | 1.6165E+00 | 30.07 | 60.13 | 0.00E+00 | 4.86E+01 | 9.72E+01 | | |
| Tc-99 | 4.4120E-04 | 30.07 | 60.13 | 0.00E+00 | 1.33E-02 | 2.65E-02 | | |
| Th-229 | 4.5684E-10 | 30.07 | 60.13 | 0.00E+00 | 1.37E-08 | 2.75E-08 | | |
| Th-230 | 6.8271E-11 | 30.07 | 60.13 | 0.00E+00 | 2.05E-09 | 4.11E-09 | | |
| Th-232 | 2.3744E-10 | 30.07 | 60.13 | 0.00E+00 | 7.14E-09 | 1.43E-08 | | |
| Tl-208 | 1.7368E-08 | 30.07 | 60.13 | 0.00E+00 | 5.22E-07 | 1.04E-06 | | |
| U-232 | 4.6797E-08 | 30.07 | 60.13 | 0.00E+00 | 1.41E-06 | 2.81E-06 | Thermal Power | |
| U-233 | 1.3146E-07 | 30.07 | 60.13 | 0.00E+00 | 3.95E-06 | 7.91E-06 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 2.5729E-07 | 30.07 | 60.13 | 0.00E+00 | 7.74E-06 | 1.55E-05 | 6.70E-01 | 1.34E+00 |
| U-235 | -2.6159E-06 | 30.07 | 0.00 | 5.60E-04 | 4.81E-04 | 5.60E-04 | Total | Total |
| U-236 | 1.2719E-05 | 30.07 | 60.13 | 0.00E+00 | 3.82E-04 | 7.65E-04 | | |
| U-238 | -3.8857E-08 | 30.07 | 0.00 | 3.48E-04 | 3.47E-04 | 3.48E-04 | | |
| Y-90 | 1.6165E+00 | 30.07 | 60.13 | 0.00E+00 | 4.86E+01 | 9.72E+01 | | |
| Other Radionuclides | | | | | 5.66E+01 | 1.13E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | ALUM | ALUM |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 20 | 10 to 20.1 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | 6.31 | 30.07 |
| Bounding | | 60.13 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|-----------------------------------|
| Nominal | 0.63 | 4.76 |
| Bounding | 1.26 | |

Estimated EOL HM/Given EOL HM

1.00

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD (ALUM) CORNELL UNIV
SNF ID #: 235
Fuel Units & Descr: 65 - ELEMENT
Heavy Metal Mass: BOL=12.025kg, EOL=11.94kg
ROD Storage Site: INEEL

¹Fuel decay start date: 1973
Estimates as of: 2030
Template: TRIGA-AI (LW/U-Zr, Alum., 10 to 20% U)
²Template Burnup (MWd): 6.65
Template BOL Heavy Metal Mass (MT): 0.00018
Template Decay Time: 50 years

Estimated
Canister usage:
18"x10"
0.59

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.6842E-09 | 80.66 | 161.31 | 0.00E+00 | 7.00E-07 | 1.40E-06 | Avg MeV | |
| Am-241 | 4.9459E-03 | 80.66 | 161.31 | 0.00E+00 | 3.99E-01 | 7.98E-01 | 0.0150 | 7.910E+12 |
| Am-242m | 1.6241E-06 | 80.66 | 161.31 | 0.00E+00 | 1.31E-04 | 2.62E-04 | 0.0250 | 1.640E+12 |
| Am-243 | 2.3233E-07 | 80.66 | 161.31 | 0.00E+00 | 1.87E-05 | 3.75E-05 | 0.0375 | 1.480E+12 |
| C-14 | 4.3083E-05 | 80.66 | 161.31 | 0.00E+00 | 3.47E-03 | 6.95E-03 | 0.0575 | 1.549E+12 |
| Cl-36 | 4.3023E-08 | 80.66 | 161.31 | 0.00E+00 | 3.47E-06 | 6.94E-06 | 0.0850 | 9.239E+11 |
| Cm-243 | 9.1880E-08 | 80.66 | 161.31 | 0.00E+00 | 7.41E-06 | 1.48E-05 | 0.1250 | 6.856E+11 |
| Cm-244 | 5.6346E-07 | 80.66 | 161.31 | 0.00E+00 | 4.54E-05 | 9.09E-05 | 0.2250 | 8.108E+11 |
| Co-60 | 8.3699E-05 | 80.66 | 161.31 | 0.00E+00 | 6.75E-03 | 1.35E-02 | 0.3750 | 3.498E+11 |
| Cs-134 | 2.8211E-08 | 80.66 | 161.31 | 0.00E+00 | 2.28E-06 | 4.55E-06 | 0.5750 | 5.873E+12 |
| Cs-135 | 3.1549E-05 | 80.66 | 161.31 | 0.00E+00 | 2.54E-03 | 5.09E-03 | 0.8500 | 1.599E+11 |
| Cs-137 | 9.7519E-01 | 80.66 | 161.31 | 0.00E+00 | 7.87E+01 | 1.57E+02 | 1.2500 | 1.352E+11 |
| Eu-154 | 3.5970E-02 | 80.66 | 161.31 | 0.00E+00 | 2.90E+00 | 5.80E+00 | 1.7500 | 4.848E+09 |
| Eu-155 | 8.1774E-04 | 80.66 | 161.31 | 0.00E+00 | 6.60E-02 | 1.32E-01 | 2.2500 | 1.644E+05 |
| Fe-55 | 5.3940E-08 | 80.66 | 161.31 | 0.00E+00 | 4.35E-06 | 8.70E-06 | 2.7500 | 7.769E+04 |
| H-3 | 8.6571E-04 | 80.66 | 161.31 | 0.00E+00 | 6.98E-02 | 1.40E-01 | 3.5000 | 2.293E+02 |
| I-129 | 7.3805E-07 | 80.66 | 161.31 | 0.00E+00 | 5.95E-05 | 1.19E-04 | 5.0000 | 9.660E+01 |
| Kr-85 | 1.3771E-02 | 80.66 | 161.31 | 0.00E+00 | 1.11E+00 | 2.22E+00 | 7.0000 | 1.090E+01 |
| Np-237 | 1.5218E-06 | 80.66 | 161.31 | 0.00E+00 | 1.23E-04 | 2.45E-04 | 11.0000 | 1.240E+00 |
| Pa-231 | 1.4152E-08 | 80.66 | 161.31 | 0.00E+00 | 1.14E-06 | 2.28E-06 | | |
| Pb-210 | 7.9774E-13 | 80.66 | 161.31 | 0.00E+00 | 6.43E-11 | 1.29E-10 | | |
| Pm-147 | 1.4362E-05 | 80.66 | 161.31 | 0.00E+00 | 1.16E-03 | 2.32E-03 | | |
| Pu-238 | 9.4782E-04 | 80.66 | 161.31 | 0.00E+00 | 7.64E-02 | 1.53E-01 | | |
| Pu-239 | 5.6872E-03 | 80.66 | 161.31 | 0.00E+00 | 4.59E-01 | 9.17E-01 | | |
| Pu-240 | 2.2541E-03 | 80.66 | 161.31 | 0.00E+00 | 1.82E-01 | 3.64E-01 | | |
| Pu-241 | 1.4433E-02 | 80.66 | 161.31 | 0.00E+00 | 1.16E+00 | 2.33E+00 | | |
| Pu-242 | 3.0602E-07 | 80.66 | 161.31 | 0.00E+00 | 2.47E-05 | 4.94E-05 | | |
| Ra-226 | 1.8857E-12 | 80.66 | 161.31 | 0.00E+00 | 1.52E-10 | 3.04E-10 | | |
| Ra-228 | 2.3729E-10 | 80.66 | 161.31 | 0.00E+00 | 1.91E-08 | 3.83E-08 | | |
| Ru-106 | 3.4857E-15 | 80.66 | 161.31 | 0.00E+00 | 2.81E-13 | 5.62E-13 | | |
| Se-79 | 1.2931E-05 | 80.66 | 161.31 | 0.00E+00 | 1.04E-03 | 2.09E-03 | | |
| Sn-126 | 1.2235E-05 | 80.66 | 161.31 | 0.00E+00 | 9.87E-04 | 1.97E-03 | | |
| Sr-90 | 8.9173E-01 | 80.66 | 161.31 | 0.00E+00 | 7.19E+01 | 1.44E+02 | | |
| Tc-99 | 4.4120E-04 | 80.66 | 161.31 | 0.00E+00 | 3.56E-02 | 7.12E-02 | | |
| Th-229 | 8.2752E-10 | 80.66 | 161.31 | 0.00E+00 | 6.67E-08 | 1.33E-07 | | |
| Th-230 | 1.4908E-10 | 80.66 | 161.31 | 0.00E+00 | 1.20E-08 | 2.40E-08 | | |
| Th-232 | 2.3744E-10 | 80.66 | 161.31 | 0.00E+00 | 1.92E-08 | 3.83E-08 | | |
| Th-208 | 1.3668E-08 | 80.66 | 161.31 | 0.00E+00 | 1.10E-06 | 2.20E-06 | | |
| U-232 | 3.6797E-08 | 80.66 | 161.31 | 0.00E+00 | 2.97E-06 | 5.94E-06 | | |
| U-233 | 1.3164E-07 | 80.66 | 161.31 | 0.00E+00 | 1.06E-05 | 2.12E-05 | | |
| U-234 | 3.3865E-07 | 80.66 | 161.31 | 0.00E+00 | 2.73E-05 | 5.46E-05 | | |
| U-235 | -2.6144E-06 | 80.66 | 0.00 | 5.20E-03 | 4.99E-03 | 5.20E-03 | | |
| U-236 | 1.2722E-05 | 80.66 | 161.31 | 0.00E+00 | 1.03E-03 | 2.05E-03 | | |
| U-238 | -3.8857E-08 | 80.66 | 0.00 | 3.23E-03 | 3.23E-03 | 3.23E-03 | | |
| Y-90 | 8.9203E-01 | 80.66 | 161.31 | 0.00E+00 | 7.19E+01 | 1.44E+02 | | |
| Other Radionuclides | | | | | 9.01E+01 | 1.80E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator: | From SFD | Used | |
| | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding: | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 58.60 | 80.66 | |
| Bounding | | 161.31 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0.18 | 1.38 | |
| Bounding | 0.36 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD (ALUM) DOW
SNF ID # 970
Fuel Units & Descr 1 - ELEMENT
Heavy Metal Mass BOL=0 19kg EOL=0 18kg
ROD Storage Site INEEL

¹Fuel decay start date: 2035
Estimates as of: 2030
Template TRIGA-AJ (LW/U-Zrx, Alum, 10 to 20% U)
²Template Burnup(MWd): 6 65
Template BOL Heavy Metal Mass (MT) 0 00018
Template Decay Time 5 years

Estimated
Canister usage
18"x10"
0 01

| III. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 0632E-10 | 9 55 | 19 09 | 0 00E+00 | 7 70E-09 | 1 54E-08 | Avg MeV | |
| Am-241 | 2 2586E-03 | 9 55 | 19 09 | 0 00E+00 | 2 16E-02 | 4 31E-02 | 0 0150 | 3 230E+12 |
| Am-242m | 1 9925E-06 | 9 55 | 19 09 | 0 00E+00 | 1 90E-05 | 3 80E-05 | 0 0250 | 7 013E+11 |
| Am-243 | 2 3323E-07 | 9 55 | 19 09 | 0 00E+00 | 2 23E-06 | 4 45E-06 | 0 0375 | 8 735E+11 |
| C-14 | 4 3308E-05 | 9 55 | 19 09 | 0 00E+00 | 4 13E-04 | 8 27E-04 | 0 0575 | 6 697E+11 |
| Cf-252 | 4 3023E-08 | 9 55 | 19 09 | 0 00E+00 | 4 11E-07 | 8 21E-07 | 0 0850 | 4 687E+11 |
| Cm-243 | 2 7429E-07 | 9 55 | 19 09 | 0 00E+00 | 2 62E-06 | 5 24E-06 | 0 1250 | 7 011E+11 |
| Cm-244 | 3 1504E-06 | 9 55 | 19 09 | 0 00E+00 | 3 01E-05 | 6 01E-05 | 0 2250 | 3 913E+11 |
| Co-60 | 3 1008E-02 | 9 55 | 19 09 | 0 00E+00 | 2 96E-01 | 5 92E-01 | 0 3750 | 1 742E+11 |
| Cs-134 | 1 0367E-01 | 9 55 | 19 09 | 0 00E+00 | 9 90E-01 | 1 98E+00 | 0 5750 | 2 208E+12 |
| Cs-135 | 3 1549E-05 | 9 55 | 19 09 | 0 00E+00 | 3 01E-04 | 6 02E-04 | 0 8500 | 5 435E+11 |
| Cs-137 | 2 7564E+00 | 9 55 | 19 09 | 0 00E+00 | 2 63E+01 | 5 26E+01 | 1 2500 | 5 634E+11 |
| Eu-154 | 1 3490E+00 | 9 55 | 19 09 | 0 00E+00 | 1 29E+01 | 2 58E+01 | 1 7500 | 1 612E+10 |
| Eu-155 | 4 3880E-01 | 9 55 | 19 09 | 0 00E+00 | 4 19E+00 | 8 38E+00 | 2 2500 | 1 960E+09 |
| Fe-55 | 8 6782E-03 | 9 55 | 19 09 | 0 00E+00 | 8 28E-02 | 1 66E-01 | 2 7500 | 1 592E+07 |
| H-3 | 1 0805E-02 | 9 55 | 19 09 | 0 00E+00 | 1 03E-01 | 2 06E-01 | 3 5000 | 1 861E+06 |
| I-129 | 7 3805E-07 | 9 55 | 19 09 | 0 00E+00 | 7 04E-06 | 1 41E-05 | 5 0000 | 1 101E+01 |
| Kr-85 | 2 5218E-01 | 9 55 | 19 09 | 0 00E+00 | 2 41E+00 | 4 81E+00 | 7 0000 | 1 246E+00 |
| Np-237 | 1 4463E-06 | 9 55 | 19 09 | 0 00E+00 | 1 38E-05 | 2 76E-05 | 11 0000 | 1 419E-01 |
| Pa-231 | 3 5970E-09 | 9 55 | 19 09 | 0 00E+00 | 3 43E-08 | 6 87E-08 | | |
| Pb-210 | 8 2511E-15 | 9 55 | 19 09 | 0 00E+00 | 7 88E-14 | 1 58E-13 | | |
| Pm-147 | 2 0767E+00 | 9 55 | 19 09 | 0 00E+00 | 1 98E+01 | 3 96E+01 | | |
| Pu-238 | 1 3514E-03 | 9 55 | 19 09 | 0 00E+00 | 1 29E-02 | 2 58E-02 | | |
| Pu-239 | 5 6947E-03 | 9 55 | 19 09 | 0 00E+00 | 5 44E-02 | 1 09E-01 | | |
| Pu-240 | 2 2647E-03 | 9 55 | 19 09 | 0 00E+00 | 2 16E-02 | 4 32E-02 | | |
| Pu-241 | 1 2574E-01 | 9 55 | 19 09 | 0 00E+00 | 1 20E+00 | 2 40E+00 | | |
| Pu-242 | 3 0602E-07 | 9 55 | 19 09 | 0 00E+00 | 2 92E-06 | 5 84E-06 | | |
| Ra-226 | 5 7353E-14 | 9 55 | 19 09 | 0 00E+00 | 5 47E-13 | 1 09E-12 | | |
| Ra-228 | 1 8150E-10 | 9 55 | 19 09 | 0 00E+00 | 1 73E-09 | 3 46E-09 | | |
| Ru-106 | 9 3744E-02 | 9 55 | 19 09 | 0 00E+00 | 8 95E-01 | 1 79E+00 | | |
| Se-79 | 1 2938E-05 | 9 55 | 19 09 | 0 00E+00 | 1 23E-04 | 2 47E-04 | | |
| Sn-126 | 1 2239E-05 | 9 55 | 19 09 | 0 00E+00 | 1 17E-04 | 2 34E-04 | | |
| Sr-90 | 2 6000E+00 | 9 55 | 19 09 | 0 00E+00 | 2 48E+01 | 4 96E+01 | | |
| Tc-99 | 4 4120E-04 | 9 55 | 19 09 | 0 00E+00 | 4 21E-03 | 8 42E-03 | | |
| Th-229 | 1 4749E-10 | 9 55 | 19 09 | 0 00E+00 | 1 41E-09 | 2 82E-09 | | |
| Th-230 | 1 9549E-11 | 9 55 | 19 09 | 0 00E+00 | 1 87E-10 | 3 73E-10 | | |
| Th-232 | 2 3744E-10 | 9 55 | 19 09 | 0 00E+00 | 2 27E-09 | 4 53E-09 | | |
| Ti-208 | 1 9459E-08 | 9 55 | 19 09 | 0 00E+00 | 1 86E-07 | 3 71E-07 | | |
| U-232 | 5 6015E-08 | 9 55 | 19 09 | 0 00E+00 | 5 35E-07 | 1 07E-06 | | |
| U-233 | 1 3132E-07 | 9 55 | 19 09 | 0 00E+00 | 1 25E-06 | 2 51E-06 | | |
| U-234 | 1 7323E-07 | 9 55 | 19 09 | 0 00E+00 | 1 65E-06 | 3 31E-06 | | |
| U-235 | -2 6159E-06 | 9 55 | 0 00 | 8 21E-05 | 5 71E-05 | 8 21E-05 | | |
| U-236 | 1 2717E-05 | 9 55 | 19 09 | 0 00E+00 | 1 21E-04 | 2 43E-04 | | |
| U-238 | -3 8857E-08 | 9 55 | 0 00 | 5 11E-05 | 5 07E-05 | 5 11E-05 | | |
| Y-90 | 2 6015E+00 | 9 55 | 19 09 | 0 00E+00 | 2 48E+01 | 4 97E+01 | | |
| Other Radionuclides | | | | | 3 63E+01 | 7 26E+01 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences |
|----------------------------|-----------------------|-----------------------|---------------------------------|
| Reactor Moderator: | From SFD | Used | |
| | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding: | ALUM | ALUM | |
| BOL HM Constituents: | U | U | |
| BOL Enrichment %: | 20 | 10 to 20 1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 1 85 | 9 55 | |
| Bounding | | 19 09 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 1 36 | 5 15 | |
| Bounding | 2 72 | | 1 00 |

¹Reactor shutdown, core removal storage shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD (ALUM) FINLAND
SNF ID #: 463
Fuel Units & Descr: 69 - ELEMENT
Heavy Metal Mass: BOL=12.42kg; EOL=12.344kg
ROD Storage Site: INEEL

¹Fuel decay start date 2010
Estimates as of 2030
Template: TRIGA-AJ (LWAJ-Zrx, Alum., 10 to 20%, U)
²Template Burnup(MWd), 6.65
Template BOL Heavy Metal Mass (MT) 0.00018
Template Decay Time 20 years

Estimated
Canister usage
18"x10"
0.62

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Cu/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.4556E-09 | 72.45 | 144.90 | 0.00E+00 | 1.78E-07 | 3.56E-07 | Avg MeV | |
| Am-241 | 3.8752E-03 | 72.45 | 144.90 | 0.00E+00 | 2.81E-01 | 5.61E-01 | 0.0150 | 1.487E+13 |
| Am-242m | 1.8617E-06 | 72.45 | 144.90 | 0.00E+00 | 1.35E-04 | 2.70E-04 | 0.0250 | 3.070E+12 |
| Am-243 | 2.3293E-07 | 72.45 | 144.90 | 0.00E+00 | 1.69E-05 | 3.38E-05 | 0.0375 | 3.214E+12 |
| C-14 | 4.3233E-05 | 72.45 | 144.90 | 0.00E+00 | 3.13E-03 | 6.26E-03 | 0.0575 | 2.971E+12 |
| Cl-36 | 4.3023E-08 | 72.45 | 144.90 | 0.00E+00 | 3.12E-06 | 6.23E-06 | 0.0850 | 1.809E+12 |
| Cm-243 | 1.9053E-07 | 72.45 | 144.90 | 0.00E+00 | 1.38E-05 | 2.76E-05 | 0.1250 | 2.030E+12 |
| Cm-244 | 1.7744E-06 | 72.45 | 144.90 | 0.00E+00 | 1.29E-04 | 2.57E-04 | 0.2250 | 1.639E+12 |
| Co-60 | 4.3188E-03 | 72.45 | 144.90 | 0.00E+00 | 3.13E-01 | 6.26E-01 | 0.3750 | 6.735E+11 |
| Cs-134 | 6.7188E-04 | 72.45 | 144.90 | 0.00E+00 | 4.87E-02 | 9.74E-02 | 0.5750 | 1.073E+13 |
| Cs-135 | 3.1549E-05 | 72.45 | 144.90 | 0.00E+00 | 2.29E-03 | 4.57E-03 | 0.8500 | 1.142E+12 |
| Cs-137 | 1.9489E+00 | 72.45 | 144.90 | 0.00E+00 | 1.41E+02 | 2.82E+02 | 1.2500 | 1.230E+12 |
| Eu-154 | 4.0301E-01 | 72.45 | 144.90 | 0.00E+00 | 2.92E+01 | 5.84E+01 | 1.7500 | 3.684E+10 |
| Eu-155 | 5.4000E-02 | 72.45 | 144.90 | 0.00E+00 | 3.91E+00 | 7.82E+00 | 2.2500 | 5.840E+05 |
| Fe-55 | 1.5955E-04 | 72.45 | 144.90 | 0.00E+00 | 1.16E-02 | 2.31E-02 | 2.7500 | 9.720E+04 |
| H-3 | 4.6571E-03 | 72.45 | 144.90 | 0.00E+00 | 3.37E-01 | 6.75E-01 | 3.5000 | 6.827E+02 |
| I-129 | 7.3805E-07 | 72.45 | 144.90 | 0.00E+00 | 5.35E-05 | 1.07E-04 | 5.0000 | 8.916E+01 |
| Kr-85 | 9.5684E-02 | 72.45 | 144.90 | 0.00E+00 | 6.93E+00 | 1.39E+01 | 7.0000 | 1.008E+01 |
| Np-237 | 1.4618E-06 | 72.45 | 144.90 | 0.00E+00 | 1.06E-04 | 2.12E-04 | 11.0000 | 1.147E+00 |
| Pa-231 | 6.4782E-09 | 72.45 | 144.90 | 0.00E+00 | 4.69E-07 | 9.39E-07 | | |
| Pb-210 | 6.3158E-14 | 72.45 | 144.90 | 0.00E+00 | 4.58E-12 | 9.15E-12 | | |
| Pm-147 | 3.9564E-02 | 72.45 | 144.90 | 0.00E+00 | 2.87E+00 | 5.73E+00 | | |
| Pu-238 | 1.2008E-03 | 72.45 | 144.90 | 0.00E+00 | 8.70E-02 | 1.74E-01 | | |
| Pu-239 | 5.6917E-03 | 72.45 | 144.90 | 0.00E+00 | 4.12E-01 | 8.25E-01 | | |
| Pu-240 | 2.2617E-03 | 72.45 | 144.90 | 0.00E+00 | 1.64E-01 | 3.28E-01 | | |
| Pu-241 | 6.1113E-02 | 72.45 | 144.90 | 0.00E+00 | 4.43E+00 | 8.85E+00 | | |
| Pu-242 | 3.0602E-07 | 72.45 | 144.90 | 0.00E+00 | 2.22E-05 | 4.43E-05 | | |
| Ra-226 | 2.6707E-13 | 72.45 | 144.90 | 0.00E+00 | 1.93E-11 | 3.87E-11 | | |
| Ra-228 | 2.2556E-10 | 72.45 | 144.90 | 0.00E+00 | 1.63E-08 | 3.27E-08 | | |
| Ru-106 | 3.1293E-06 | 72.45 | 144.90 | 0.00E+00 | 2.27E-04 | 4.53E-04 | | |
| Se-79 | 1.2935E-05 | 72.45 | 144.90 | 0.00E+00 | 9.37E-04 | 1.87E-03 | | |
| Sn-126 | 1.2238E-05 | 72.45 | 144.90 | 0.00E+00 | 8.87E-04 | 1.77E-03 | | |
| Sr-90 | 1.8195E+00 | 72.45 | 144.90 | 0.00E+00 | 1.32E+02 | 2.64E+02 | | |
| Tc-99 | 4.4120E-04 | 72.45 | 144.90 | 0.00E+00 | 3.20E-02 | 6.39E-02 | | |
| Th-229 | 3.3308E-10 | 72.45 | 144.90 | 0.00E+00 | 2.41E-08 | 4.83E-08 | | |
| Th-230 | 4.6526E-11 | 72.45 | 144.90 | 0.00E+00 | 3.37E-09 | 6.74E-09 | | |
| Th-232 | 2.3744E-10 | 72.45 | 144.90 | 0.00E+00 | 1.72E-08 | 3.44E-08 | | |
| Ti-208 | 1.8195E-08 | 72.45 | 144.90 | 0.00E+00 | 1.32E-06 | 2.64E-06 | | |
| U-232 | 4.9098E-08 | 72.45 | 144.90 | 0.00E+00 | 3.56E-06 | 7.11E-06 | | |
| U-233 | 1.3140E-07 | 72.45 | 144.90 | 0.00E+00 | 9.52E-06 | 1.90E-05 | | |
| U-234 | 2.2571E-07 | 72.45 | 144.90 | 0.00E+00 | 1.64E-05 | 3.27E-05 | | |
| U-235 | -2.6159E-06 | 72.45 | 0.00 | 5.37E-03 | 5.18E-03 | 5.37E-03 | | |
| U-236 | 1.2719E-05 | 72.45 | 144.90 | 0.00E+00 | 9.21E-04 | 1.84E-03 | | |
| U-238 | -3.8857E-08 | 72.45 | 0.00 | 3.34E-03 | 3.34E-03 | 3.34E-03 | | |
| Y-90 | 1.8211E+00 | 72.45 | 144.90 | 0.00E+00 | 1.32E+02 | 2.64E+02 | | |
| Other Radionuclides | | | | | 1.52E+02 | 3.03E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| | From SFD | Used | |
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 | 10 to 20.1 | |

| Burnup Summary (MWd) ¹ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | 60.52 | 72.45 | |
| Bounding | | 144.90 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0.16 | 1.20 | |
| Bounding | 0.32 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD (ALUM) GA

SNF ID # 728

Fuel Units & Descr 52 - ELEMENT

Heavy Metal Mass BOL=9.412kg EOL=9.329kg

ROD Storage Site INEEL

¹Fuel decay start date 2035

Estimates as of 2030

Template TRIGA-AI (LW/U-Zrx, Alum, 10 to 20% U)

²Template Burnup(MWd) 6.65

Template BOL Heavy Metal Mass (MT) 0.00018

Template Decay Time 5 years

Estimated

Canister usage

18"x10"

0.47

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.0632E-10 | 91.73 | 183.46 | 0.00E+00 | 7.40E-08 | 1.48E-07 | Avg MeV | |
| Am-241 | 2.2586E-03 | 91.73 | 183.46 | 0.00E+00 | 2.07E-01 | 4.14E-01 | 0.0150 | 3.104E+13 |
| Am-242m | 1.9925E-06 | 91.73 | 183.46 | 0.00E+00 | 1.83E-04 | 3.66E-04 | 0.0250 | 6.739E+12 |
| Am-243 | 2.3323E-07 | 91.73 | 183.46 | 0.00E+00 | 2.14E-05 | 4.28E-05 | 0.0375 | 8.395E+12 |
| C-14 | 4.3308E-05 | 91.73 | 183.46 | 0.00E+00 | 3.97E-03 | 7.95E-03 | 0.0575 | 6.435E+12 |
| Cl-36 | 4.3023E-08 | 91.73 | 183.46 | 0.00E+00 | 3.95E-06 | 7.89E-06 | 0.0850 | 4.505E+12 |
| Cm-243 | 2.7429E-07 | 91.73 | 183.46 | 0.00E+00 | 2.52E-05 | 5.03E-05 | 0.1250 | 6.737E+12 |
| Cm-244 | 3.1504E-06 | 91.73 | 183.46 | 0.00E+00 | 2.89E-04 | 5.78E-04 | 0.2250 | 3.761E+12 |
| Co-60 | 3.1008E-02 | 91.73 | 183.46 | 0.00E+00 | 2.84E+00 | 5.69E+00 | 0.3750 | 1.674E+12 |
| Cs-134 | 1.0367E-01 | 91.73 | 183.46 | 0.00E+00 | 9.51E+00 | 1.90E+01 | 0.5750 | 2.122E+13 |
| Cs-135 | 3.1549E-05 | 91.73 | 183.46 | 0.00E+00 | 2.89E-03 | 5.79E-03 | 0.8500 | 5.223E+12 |
| Cs-137 | 2.7564E+00 | 91.73 | 183.46 | 0.00E+00 | 2.53E+02 | 5.06E+02 | 1.2500 | 5.414E+12 |
| Eu-154 | 1.3490E+00 | 91.73 | 183.46 | 0.00E+00 | 1.24E+02 | 2.47E+02 | 1.7500 | 1.550E+11 |
| Eu-155 | 4.3880E-01 | 91.73 | 183.46 | 0.00E+00 | 4.03E+01 | 8.05E+01 | 2.2500 | 1.884E+10 |
| Fe-55 | 8.6782E-03 | 91.73 | 183.46 | 0.00E+00 | 7.96E-01 | 1.59E+00 | 2.7500 | 1.530E+08 |
| H-3 | 1.0805E-02 | 91.73 | 183.46 | 0.00E+00 | 9.91E-01 | 1.98E+00 | 3.5000 | 1.788E+07 |
| I-129 | 7.3805E-07 | 91.73 | 183.46 | 0.00E+00 | 6.77E-05 | 1.35E-04 | 5.0000 | 1.105E+02 |
| Kr-85 | 2.5218E-01 | 91.73 | 183.46 | 0.00E+00 | 2.31E+01 | 4.63E+01 | 7.0000 | 1.252E+01 |
| Np-237 | 1.4463E-06 | 91.73 | 183.46 | 0.00E+00 | 1.33E-04 | 2.65E-04 | 11.0000 | 1.426E+00 |
| Pa-231 | 3.5970E-09 | 91.73 | 183.46 | 0.00E+00 | 3.30E-07 | 6.60E-07 | | |
| Pb-210 | 8.2511E-15 | 91.73 | 183.46 | 0.00E+00 | 7.57E-13 | 1.51E-12 | | |
| Pm-147 | 2.0767E+00 | 91.73 | 183.46 | 0.00E+00 | 1.90E+02 | 3.81E+02 | | |
| Pu-238 | 1.3514E-03 | 91.73 | 183.46 | 0.00E+00 | 1.24E-01 | 2.48E-01 | | |
| Pu-239 | 5.6947E-03 | 91.73 | 183.46 | 0.00E+00 | 5.22E-01 | 1.04E+00 | | |
| Pu-240 | 2.2647E-03 | 91.73 | 183.46 | 0.00E+00 | 2.08E-01 | 4.15E-01 | | |
| Pu-241 | 1.2574E-01 | 91.73 | 183.46 | 0.00E+00 | 1.15E+01 | 2.31E+01 | | |
| Pu-242 | 3.0602E-07 | 91.73 | 183.46 | 0.00E+00 | 2.81E-05 | 5.61E-05 | | |
| Ra-226 | 5.7353E-14 | 91.73 | 183.46 | 0.00E+00 | 5.26E-12 | 1.05E-11 | | |
| Ra-228 | 1.8150E-10 | 91.73 | 183.46 | 0.00E+00 | 1.66E-08 | 3.33E-08 | | |
| Ru-106 | 9.3744E-02 | 91.73 | 183.46 | 0.00E+00 | 8.60E+00 | 1.72E+01 | | |
| Se-79 | 1.2938E-05 | 91.73 | 183.46 | 0.00E+00 | 1.19E-03 | 2.37E-03 | | |
| Sn-126 | 1.2239E-05 | 91.73 | 183.46 | 0.00E+00 | 1.12E-03 | 2.25E-03 | | |
| Sr-90 | 2.6000E+00 | 91.73 | 183.46 | 0.00E+00 | 2.38E+02 | 4.77E+02 | | |
| Tc-99 | 4.4120E-04 | 91.73 | 183.46 | 0.00E+00 | 4.05E-02 | 8.09E-02 | | |
| Th-229 | 1.4749E-10 | 91.73 | 183.46 | 0.00E+00 | 1.35E-08 | 2.71E-08 | | |
| Th-230 | 1.9549E-11 | 91.73 | 183.46 | 0.00E+00 | 1.79E-09 | 3.59E-09 | | |
| Th-232 | 2.3744E-10 | 91.73 | 183.46 | 0.00E+00 | 2.18E-08 | 4.36E-08 | | |
| Th-208 | 1.9459E-08 | 91.73 | 183.46 | 0.00E+00 | 1.78E-06 | 3.57E-06 | | |
| U-232 | 5.6015E-08 | 91.73 | 183.46 | 0.00E+00 | 5.14E-06 | 1.03E-05 | | |
| U-233 | 1.3132E-07 | 91.73 | 183.46 | 0.00E+00 | 1.20E-05 | 2.41E-05 | | |
| U-234 | 1.7323E-07 | 91.73 | 183.46 | 0.00E+00 | 1.59E-05 | 3.18E-05 | | |
| U-235 | -2.6159E-06 | 91.73 | 0.00 | 4.03E-03 | 3.79E-03 | 4.03E-03 | | |
| U-236 | 1.2717E-05 | 91.73 | 183.46 | 0.00E+00 | 1.17E-03 | 2.33E-03 | | |
| U-238 | -3.8857E-08 | 91.73 | 0.00 | 2.54E-03 | 2.53E-03 | 2.54E-03 | | |
| Y-90 | 2.6015E+00 | 91.73 | 183.46 | 0.00E+00 | 2.39E+02 | 4.77E+02 | | |
| Other Radionuclides | | | | | 3.49E+02 | 6.97E+02 | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 4.61E+00 | 9.22E+00 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | ALUM | ALUM |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 19.8109242 | 10 to 20.1 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | 91.73 | 79.42 |
| Bounding | | 183.46 |

Basis for burnup used in estimate:

Nominal burnup taken directly from SFD (converted to MWd)
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|--------------------------------|
| Nominal | 0.26 | 0.87 |
| Bounding | 0.53 | |

Estimated EOL HM/Given EOL HM

1.00

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD (ALUM) GA

SNF ID #: 870

Fuel Units & Descr: 246 - ELEMENT

Heavy Metal Mass: BOL=46.74kg, EOL=45.19kg

ROD Storage Site: INEEL

¹Fuel decay start date 1973

Estimates as of: 2030

Template: TRIGA-AI (LW/U-Zr, Alum, 10 to 20% U)

²Template Burnup(MWd)³ 6.65

Template BOL Heavy Metal Mass (MT) 0.00018

Template Decay Time 50 years

Estimated

Canister usage⁴

18"x10"

2.22

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.6842E-09 | 1,479.31 | 2,958.63 | 0.00E+00 | 1.28E-05 | 2.57E-05 | Avg. MeV | |
| Am-241 | 4.9459E-03 | 1,479.31 | 2,958.63 | 0.00E+00 | 7.32E+00 | 1.46E+01 | 0.0150 | 1.451E+14 |
| Am-242m | 1.6241E-06 | 1,479.31 | 2,958.63 | 0.00E+00 | 2.40E-03 | 4.80E-03 | 0.0250 | 3.008E+13 |
| Am-243 | 2.3233E-07 | 1,479.31 | 2,958.63 | 0.00E+00 | 3.44E-04 | 6.87E-04 | 0.0375 | 2.714E+13 |
| C-14 | 4.3083E-05 | 1,479.31 | 2,958.63 | 0.00E+00 | 6.37E-02 | 1.27E-01 | 0.0575 | 2.840E+13 |
| Cl-36 | 4.3023E-08 | 1,479.31 | 2,958.63 | 0.00E+00 | 6.36E-05 | 1.27E-04 | 0.0850 | 1.694E+13 |
| Cm-243 | 9.1880E-08 | 1,479.31 | 2,958.63 | 0.00E+00 | 1.36E-04 | 2.72E-04 | 0.1250 | 1.257E+13 |
| Cm-244 | 5.6346E-07 | 1,479.31 | 2,958.63 | 0.00E+00 | 8.34E-04 | 1.67E-03 | 0.2250 | 1.487E+13 |
| Co-60 | 8.3699E-05 | 1,479.31 | 2,958.63 | 0.00E+00 | 1.24E-01 | 2.48E-01 | 0.3750 | 6.416E+12 |
| Cs-134 | 2.8211E-08 | 1,479.31 | 2,958.63 | 0.00E+00 | 4.17E-05 | 8.35E-05 | 0.5750 | 1.077E+14 |
| Cs-135 | 3.1549E-05 | 1,479.31 | 2,958.63 | 0.00E+00 | 4.67E-02 | 9.33E-02 | 0.8500 | 2.934E+12 |
| Cs-137 | 9.7519E-01 | 1,479.31 | 2,958.63 | 0.00E+00 | 1.44E+03 | 2.89E+03 | 1.2500 | 2.480E+12 |
| Eu-154 | 3.5970E-02 | 1,479.31 | 2,958.63 | 0.00E+00 | 5.32E+01 | 1.06E+02 | 1.7500 | 8.892E+10 |
| Eu-155 | 8.1774E-04 | 1,479.31 | 2,958.63 | 0.00E+00 | 1.21E+00 | 2.42E+00 | 2.2500 | 3.015E+06 |
| Fe-55 | 5.3940E-08 | 1,479.31 | 2,958.63 | 0.00E+00 | 7.98E-05 | 1.60E-04 | 2.7500 | 1.425E+06 |
| H-3 | 8.6571E-04 | 1,479.31 | 2,958.63 | 0.00E+00 | 1.28E+00 | 2.56E+00 | 3.5000 | 3.954E+03 |
| I-129 | 7.3805E-07 | 1,479.31 | 2,958.63 | 0.00E+00 | 1.09E-03 | 2.18E-03 | 5.0000 | 1.664E+03 |
| Kr-85 | 1.3771E-02 | 1,479.31 | 2,958.63 | 0.00E+00 | 2.04E+01 | 4.07E+01 | 7.0000 | 1.875E+01 |
| Np-237 | 1.5218E-06 | 1,479.31 | 2,958.63 | 0.00E+00 | 2.25E-03 | 4.50E-03 | 11.0000 | 2.131E+02 |
| Pa-231 | 1.4152E-08 | 1,479.31 | 2,958.63 | 0.00E+00 | 2.09E-05 | 4.19E-05 | | |
| Pb-210 | 7.9774E-13 | 1,479.31 | 2,958.63 | 0.00E+00 | 1.18E-09 | 2.36E-09 | | |
| Pm-147 | 1.4362E-05 | 1,479.31 | 2,958.63 | 0.00E+00 | 2.12E-02 | 4.25E-02 | | |
| Pu-238 | 9.4782E-04 | 1,479.31 | 2,958.63 | 0.00E+00 | 1.40E+00 | 2.80E+00 | | |
| Pu-239 | 5.6872E-03 | 1,479.31 | 2,958.63 | 0.00E+00 | 8.41E+00 | 1.68E+01 | | |
| Pu-240 | 2.2541E-03 | 1,479.31 | 2,958.63 | 0.00E+00 | 3.33E+00 | 6.67E+00 | | |
| Pu-241 | 1.4433E-02 | 1,479.31 | 2,958.63 | 0.00E+00 | 2.14E+01 | 4.27E+01 | | |
| Pu-242 | 3.0602E-07 | 1,479.31 | 2,958.63 | 0.00E+00 | 4.53E-04 | 9.05E-04 | | |
| Ra-226 | 1.8857E-12 | 1,479.31 | 2,958.63 | 0.00E+00 | 2.79E-09 | 5.58E-09 | | |
| Ra-228 | 2.3729E-10 | 1,479.31 | 2,958.63 | 0.00E+00 | 3.51E-07 | 7.02E-07 | | |
| Ru-106 | 3.4857E-15 | 1,479.31 | 2,958.63 | 0.00E+00 | 5.16E-12 | 1.03E-11 | | |
| Se-79 | 1.2931E-05 | 1,479.31 | 2,958.63 | 0.00E+00 | 1.91E-02 | 3.83E-02 | | |
| Sn-126 | 1.2235E-05 | 1,479.31 | 2,958.63 | 0.00E+00 | 1.81E-02 | 3.62E-02 | | |
| Sr-90 | 8.9173E-01 | 1,479.31 | 2,958.63 | 0.00E+00 | 1.32E+03 | 2.64E+03 | | |
| Tc-99 | 4.4120E-04 | 1,479.31 | 2,958.63 | 0.00E+00 | 6.53E-01 | 1.31E+00 | | |
| Th-229 | 8.2752E-10 | 1,479.31 | 2,958.63 | 0.00E+00 | 1.22E-06 | 2.45E-06 | | |
| Th-230 | 1.4908E-10 | 1,479.31 | 2,958.63 | 0.00E+00 | 2.21E-07 | 4.41E-07 | | |
| Th-232 | 2.3744E-10 | 1,479.31 | 2,958.63 | 0.00E+00 | 3.51E-07 | 7.03E-07 | | |
| Ti-208 | 1.3668E-08 | 1,479.31 | 2,958.63 | 0.00E+00 | 2.02E-05 | 4.04E-05 | | |
| U-232 | 3.6797E-08 | 1,479.31 | 2,958.63 | 0.00E+00 | 5.44E-05 | 1.09E-04 | | |
| U-233 | 1.3164E-07 | 1,479.31 | 2,958.63 | 0.00E+00 | 1.95E-04 | 3.89E-04 | | |
| U-234 | 3.3865E-07 | 1,479.31 | 2,958.63 | 0.00E+00 | 5.01E-04 | 1.00E-03 | | |
| U-235 | -2.6144E-06 | 1,479.31 | 0.00 | 2.01E-02 | 1.62E-02 | 2.01E-02 | | |
| U-236 | 1.2722E-05 | 1,479.31 | 2,958.63 | 0.00E+00 | 1.88E-02 | 3.76E-02 | | |
| U-238 | -3.8857E-08 | 1,479.31 | 0.00 | 1.26E-02 | 1.25E-02 | 1.26E-02 | | |
| Y-90 | 8.9203E-01 | 1,479.31 | 2,958.63 | 0.00E+00 | 1.32E+03 | 2.64E+03 | | |
| Other Radionuclides | | | | | 1.65E+03 | 3.30E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator: | From SFD | Used | |
| | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19.9 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|------------------------------------|
| | From SFD | Estimated | |
| Nominal | 455.53 | 1,479.31 | |
| Bounding | | 2,958.63 | |

Nominal burnup calculated from the heavy metal mass destroyed.

Bounding burnup assumed to be twice nominal burnup

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|--------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0.86 | 3.25 | |
| Bounding | 1.71 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD (ALUM) GERMANY
 SNF ID #: 465
 Fuel Units & Descr: 65 - ELEMENT
 Heavy Metal Mass BOL=11.7kg EOL=11.635kg
 ROD Storage Site INEEL

¹Fuel decay start date 2010
 Estimates as of 2030
 Template TRIGA-AJ (LW/U-Zrx, Alum 10 to 20% U)
²Template Burnup(MWd) 6.65
 Template BOL Heavy Metal Mass (MT) 0.00018
 Template Decay Time 20 years

Estimated
 Canister usage
 18"x10"
 0.59

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|--|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group Avg MeV Total Photons/sec (bounding) |
| Ac-227 | 2.4556E-09 | 62.04 | 124.09 | 0.00E+00 | 1.52E-07 | 3.05E-07 | 0.0150 1.273E+13 |
| Am-241 | 3.8752E-03 | 62.04 | 124.09 | 0.00E+00 | 2.40E-01 | 4.81E-01 | 0.0250 2.630E+12 |
| Am-242m | 1.8617E-06 | 62.04 | 124.09 | 0.00E+00 | 1.16E-04 | 2.31E-04 | 0.0375 2.752E+12 |
| Am-243 | 2.3293E-07 | 62.04 | 124.09 | 0.00E+00 | 1.45E-05 | 2.89E-05 | 0.0575 2.544E+12 |
| C-14 | 4.3233E-05 | 62.04 | 124.09 | 0.00E+00 | 2.68E-03 | 5.36E-03 | 0.0850 1.549E+12 |
| Cl-36 | 4.3023E-08 | 62.04 | 124.09 | 0.00E+00 | 2.67E-06 | 5.34E-06 | 0.1250 1.739E+12 |
| Cm-243 | 1.9053E-07 | 62.04 | 124.09 | 0.00E+00 | 1.18E-05 | 2.36E-05 | 0.2250 1.404E+12 |
| Cm-244 | 1.7744E-06 | 62.04 | 124.09 | 0.00E+00 | 1.10E-04 | 2.20E-04 | 0.3750 5.768E+11 |
| Co-60 | 4.3188E-03 | 62.04 | 124.09 | 0.00E+00 | 2.68E-01 | 5.36E-01 | 0.5750 9.188E+11 |
| Cs-134 | 6.7188E-04 | 62.04 | 124.09 | 0.00E+00 | 4.17E-02 | 8.34E-02 | 0.8500 9.776E+11 |
| Cs-135 | 3.1549E-05 | 62.04 | 124.09 | 0.00E+00 | 1.96E-03 | 3.91E-03 | 1.2500 1.053E+12 |
| Cs-137 | 1.9489E+00 | 62.04 | 124.09 | 0.00E+00 | 1.21E+02 | 2.42E+02 | 1.7500 3.155E+10 |
| Eu-154 | 4.0301E-01 | 62.04 | 124.09 | 0.00E+00 | 2.50E+01 | 5.00E+01 | 2.2500 5.001E+05 |
| Eu-155 | 5.4000E-02 | 62.04 | 124.09 | 0.00E+00 | 3.35E+00 | 6.70E+00 | 2.7500 8.324E+04 |
| Fe-55 | 1.5955E-04 | 62.04 | 124.09 | 0.00E+00 | 9.90E-03 | 1.98E-02 | 3.5000 5.862E+02 |
| H-3 | 4.6571E-03 | 62.04 | 124.09 | 0.00E+00 | 2.89E-01 | 5.78E-01 | 5.0000 7.701E+01 |
| I-129 | 7.3805E-07 | 62.04 | 124.09 | 0.00E+00 | 4.58E-05 | 9.16E-05 | 7.0000 8.709E+00 |
| Kr-85 | 9.5684E-02 | 62.04 | 124.09 | 0.00E+00 | 5.94E+00 | 1.19E+01 | 11.0000 9.914E-01 |
| Np-237 | 1.4618E-06 | 62.04 | 124.09 | 0.00E+00 | 9.07E-05 | 1.81E-04 | |
| Pa-231 | 6.4782E-09 | 62.04 | 124.09 | 0.00E+00 | 4.02E-07 | 8.04E-07 | |
| Pb-210 | 6.3158E-14 | 62.04 | 124.09 | 0.00E+00 | 3.92E-12 | 7.84E-12 | |
| Pm-147 | 3.9564E-02 | 62.04 | 124.09 | 0.00E+00 | 2.45E+00 | 4.91E+00 | |
| Pu-238 | 1.2008E-03 | 62.04 | 124.09 | 0.00E+00 | 7.45E-02 | 1.49E-01 | |
| Pu-239 | 5.6917E-03 | 62.04 | 124.09 | 0.00E+00 | 3.53E-01 | 7.06E-01 | |
| Pu-240 | 2.2617E-03 | 62.04 | 124.09 | 0.00E+00 | 1.40E-01 | 2.81E-01 | |
| Pu-241 | 6.1113E-02 | 62.04 | 124.09 | 0.00E+00 | 3.79E+00 | 7.58E+00 | |
| Pu-242 | 3.0602E-07 | 62.04 | 124.09 | 0.00E+00 | 1.90E-05 | 3.80E-05 | |
| Ra-226 | 2.6707E-13 | 62.04 | 124.09 | 0.00E+00 | 1.66E-11 | 3.31E-11 | |
| Ra-228 | 2.2556E-10 | 62.04 | 124.09 | 0.00E+00 | 1.40E-08 | 2.80E-08 | |
| Ru-106 | 3.1293E-06 | 62.04 | 124.09 | 0.00E+00 | 1.94E-04 | 3.88E-04 | |
| Se-79 | 1.2935E-05 | 62.04 | 124.09 | 0.00E+00 | 8.03E-04 | 1.61E-03 | |
| Sn-126 | 1.2238E-05 | 62.04 | 124.09 | 0.00E+00 | 7.59E-04 | 1.52E-03 | |
| Sr-90 | 1.8195E+00 | 62.04 | 124.09 | 0.00E+00 | 1.13E+02 | 2.26E+02 | |
| Tc-99 | 4.4120E-04 | 62.04 | 124.09 | 0.00E+00 | 2.74E-02 | 5.47E-02 | |
| Th-229 | 3.3308E-10 | 62.04 | 124.09 | 0.00E+00 | 2.07E-08 | 4.13E-08 | |
| Th-230 | 4.6526E-11 | 62.04 | 124.09 | 0.00E+00 | 2.89E-09 | 5.77E-09 | |
| Th-232 | 2.3744E-10 | 62.04 | 124.09 | 0.00E+00 | 1.47E-08 | 2.95E-08 | |
| Th-208 | 1.8195E-08 | 62.04 | 124.09 | 0.00E+00 | 1.13E-06 | 2.26E-06 | |
| U-232 | 4.9098E-08 | 62.04 | 124.09 | 0.00E+00 | 3.05E-06 | 6.09E-06 | |
| U-233 | 1.3140E-07 | 62.04 | 124.09 | 0.00E+00 | 8.15E-06 | 1.63E-05 | |
| U-234 | 2.2571E-07 | 62.04 | 124.09 | 0.00E+00 | 1.40E-05 | 2.80E-05 | |
| U-235 | -2.6159E-06 | 62.04 | 0.00 | 5.06E-03 | 4.89E-03 | 5.06E-03 | |
| U-236 | 1.2719E-05 | 62.04 | 124.09 | 0.00E+00 | 7.89E-04 | 1.58E-03 | |
| U-238 | -3.8857E-08 | 62.04 | 0.00 | 3.15E-03 | 3.14E-03 | 3.15E-03 | |
| Y-90 | 1.8211E+00 | 62.04 | 124.09 | 0.00E+00 | 1.13E+02 | 2.26E+02 | |
| Other Radionuclides | | | | | 1.30E+02 | 2.60E+02 | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator: | From SFD | - Used | |
| Fuel Cladding: | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| BOL HM Constituents: | ALUM | ALUM | |
| BOL Enrichment %: | U | U | |
| | 20 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 57.01 | 62.04 | |
| Bounding | | 124.09 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0.14 | 1.09 | |
| Bounding | 0.29 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD (ALUM) HANFORD
SNF ID #: 876
Fuel Units & Descr: 59 - ELEMENT
Heavy Metal Mass: BOL=10 915kg, EOL=10 838kg
ROD Storage Site: INEEL

¹Fuel decay start date: 1973
Estimates as of: 2030
Template: TRIGA-AI (LW/U-Zrx, Alum, 10 to 20%, U)
²Template Burnup(MWd): 6.65
Template BOL Heavy Metal Mass (MT): 0.00018
Template Decay Time*: 50 years

Estimated
Canister usage
18"x10"
0.53

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-----------------------------|------------------------------|---------------------|------------------------------|
| Radionuclide | Cu/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventones(Ci) | Bounding Fuel Inventones(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.6842E-09 | 73.21 | 146.42 | 0.00E+00 | 6.36E-07 | 1.27E-06 | Avg MeV | |
| Am-241 | 4.9459E-03 | 73.21 | 146.42 | 0.00E+00 | 3.62E-01 | 7.24E-01 | 0.0150 | 7.180E+12 |
| Am-242m | 1.6241E-06 | 73.21 | 146.42 | 0.00E+00 | 1.19E-04 | 2.38E-04 | 0.0250 | 1.488E+12 |
| Am-243 | 2.3233E-07 | 73.21 | 146.42 | 0.00E+00 | 1.70E-05 | 3.40E-05 | 0.0375 | 1.343E+12 |
| C-14 | 4.3083E-05 | 73.21 | 146.42 | 0.00E+00 | 3.15E-03 | 6.31E-03 | 0.0575 | 1.406E+12 |
| Cl-36 | 4.3023E-08 | 73.21 | 146.42 | 0.00E+00 | 3.15E-06 | 6.30E-06 | 0.0850 | 8.386E+11 |
| Cm-243 | 9.1880E-08 | 73.21 | 146.42 | 0.00E+00 | 6.73E-06 | 1.35E-05 | 0.1250 | 6.223E+11 |
| Cm-244 | 5.6346E-07 | 73.21 | 146.42 | 0.00E+00 | 4.13E-05 | 8.25E-05 | 0.2250 | 7.360E+11 |
| Co-60 | 8.3699E-05 | 73.21 | 146.42 | 0.00E+00 | 6.13E-03 | 1.23E-02 | 0.3750 | 3.175E+11 |
| Cs-134 | 2.8211E-08 | 73.21 | 146.42 | 0.00E+00 | 2.07E-06 | 4.13E-06 | 0.5750 | 5.331E+12 |
| Cs-135 | 3.1549E-05 | 73.21 | 146.42 | 0.00E+00 | 2.31E-03 | 4.62E-03 | 0.8500 | 1.452E+11 |
| Cs-137 | 9.7519E-01 | 73.21 | 146.42 | 0.00E+00 | 7.14E+01 | 1.43E+02 | 1.2500 | 1.227E+11 |
| Eu-154 | 3.5970E-02 | 73.21 | 146.42 | 0.00E+00 | 2.63E+00 | 5.27E+00 | 1.7500 | 4.401E+09 |
| Eu-155 | 8.1774E-04 | 73.21 | 146.42 | 0.00E+00 | 5.99E-02 | 1.20E-01 | 2.2500 | 1.492E+05 |
| Fe-55 | 5.3940E-08 | 73.21 | 146.42 | 0.00E+00 | 3.95E-06 | 7.90E-06 | 2.7500 | 7.052E+04 |
| H-3 | 8.6571E-04 | 73.21 | 146.42 | 0.00E+00 | 6.34E-02 | 1.27E-01 | 3.5000 | 2.081E+02 |
| I-129 | 7.3805E-07 | 73.21 | 146.42 | 0.00E+00 | 5.40E-05 | 1.08E-04 | 5.0000 | 8.768E+01 |
| Kr-85 | 1.3771E-02 | 73.21 | 146.42 | 0.00E+00 | 1.01E+00 | 2.02E+00 | 7.0000 | 9.897E+00 |
| Np-237 | 1.5218E-06 | 73.21 | 146.42 | 0.00E+00 | 1.11E-04 | 2.23E-04 | 11.0000 | 1.125E+00 |
| Pa-231 | 1.4152E-08 | 73.21 | 146.42 | 0.00E+00 | 1.04E-06 | 2.07E-06 | | |
| Pb-210 | 7.9744E-13 | 73.21 | 146.42 | 0.00E+00 | 5.84E-11 | 1.17E-10 | | |
| Pm-147 | 1.4362E-05 | 73.21 | 146.42 | 0.00E+00 | 1.05E-03 | 2.10E-03 | | |
| Pu-238 | 9.4782E-04 | 73.21 | 146.42 | 0.00E+00 | 6.94E-02 | 1.39E-01 | | |
| Pu-239 | 5.6872E-03 | 73.21 | 146.42 | 0.00E+00 | 4.16E-01 | 8.33E-01 | | |
| Pu-240 | 2.2541E-03 | 73.21 | 146.42 | 0.00E+00 | 1.65E-01 | 3.30E-01 | | |
| Pu-241 | 1.4433E-02 | 73.21 | 146.42 | 0.00E+00 | 1.06E+00 | 2.11E+00 | | |
| Pu-242 | 3.0602E-07 | 73.21 | 146.42 | 0.00E+00 | 2.24E-05 | 4.48E-05 | | |
| Ra-226 | 1.8857E-12 | 73.21 | 146.42 | 0.00E+00 | 1.38E-10 | 2.76E-10 | | |
| Ra-228 | 2.3729E-10 | 73.21 | 146.42 | 0.00E+00 | 1.74E-08 | 3.47E-08 | | |
| Ru-106 | 3.4857E-15 | 73.21 | 146.42 | 0.00E+00 | 2.55E-13 | 5.10E-13 | | |
| Se-79 | 1.2931E-05 | 73.21 | 146.42 | 0.00E+00 | 9.47E-04 | 1.89E-03 | | |
| Sn-126 | 1.2235E-05 | 73.21 | 146.42 | 0.00E+00 | 8.96E-04 | 1.79E-03 | | |
| Sr-90 | 8.9173E-01 | 73.21 | 146.42 | 0.00E+00 | 6.53E+01 | 1.31E+02 | | |
| Tc-99 | 4.4120E-04 | 73.21 | 146.42 | 0.00E+00 | 3.23E-02 | 6.46E-02 | | |
| Th-229 | 8.2752E-10 | 73.21 | 146.42 | 0.00E+00 | 6.06E-08 | 1.21E-07 | | |
| Th-230 | 1.4908E-10 | 73.21 | 146.42 | 0.00E+00 | 1.09E-08 | 2.18E-08 | | |
| Th-232 | 2.3744E-10 | 73.21 | 146.42 | 0.00E+00 | 1.74E-08 | 3.48E-08 | | |
| Ti-208 | 1.3668E-08 | 73.21 | 146.42 | 0.00E+00 | 1.00E-06 | 2.00E-06 | | |
| U-232 | 3.6797E-08 | 73.21 | 146.42 | 0.00E+00 | 2.69E-06 | 5.39E-06 | | |
| U-233 | 1.3164E-07 | 73.21 | 146.42 | 0.00E+00 | 9.64E-06 | 1.93E-05 | | |
| U-234 | 3.3865E-07 | 73.21 | 146.42 | 0.00E+00 | 2.48E-05 | 4.96E-05 | | |
| U-235 | -2.6144E-06 | 73.21 | 0.00 | 4.72E-03 | 4.53E-03 | 4.72E-03 | | |
| U-236 | 1.2722E-05 | 73.21 | 146.42 | 0.00E+00 | 9.31E-04 | 1.86E-03 | | |
| U-238 | -3.8857E-08 | 73.21 | 0.00 | 2.93E-03 | 2.93E-03 | 2.93E-03 | | |
| Y-90 | 8.9203E-01 | 73.21 | 146.42 | 0.00E+00 | 6.53E+01 | 1.31E+02 | | |
| Other Radionuclides | | | | | 8.17E+01 | 1.63E+02 | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 8.42E+01 | 1.68E+00 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | ALUM | ALUM |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 20 | 10 to 20.1 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | 53.19 | 73.21 |
| Bounding | | 146.42 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed.
Bounding burnup assumed to be twice nominal burnup.

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|-----------------------------------|
| Nominal | 0.18 | 1.38 |
| Bounding | 0.36 | |

Estimated EOL HM/Given EOL HM
1.00

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel.

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD (ALUM) HANNOVER
SNF ID # 303
Fuel Units & Descr 71 - ELEMENT
Heavy Metal Mass BOL=13.561kg EOL=13.419kg
ROD Storage Site INEEL

¹Fuel decay start date 1996
Estimates as of 2030
Template TRIGA-AJ (LW/U-Zrx, Alum, 10 to 20% U)
²Template Burnup(MWd) 6.65
Template BOL Heavy Metal Mass (MT) 0.00018
Template Decay Time 25 years

Estimated
Canister usage
18"x10"
0.64

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 3.8271E-09 | 135.54 | 271.08 | 0.00E+00 | 5.19E-07 | 1.04E-06 | Avg MeV | |
| Am-241 | 4.4195E-03 | 135.54 | 271.08 | 0.00E+00 | 5.99E-01 | 1.20E+00 | 0.0150 | 2.450E+13 |
| Am-242m | 1.8195E-06 | 135.54 | 271.08 | 0.00E+00 | 2.47E-04 | 4.93E-04 | 0.0250 | 5.061E+12 |
| Am-243 | 2.3278E-07 | 135.54 | 271.08 | 0.00E+00 | 3.16E-05 | 6.31E-05 | 0.0375 | 5.069E+12 |
| C-14 | 4.3203E-05 | 135.54 | 271.08 | 0.00E+00 | 5.86E-03 | 1.17E-02 | 0.0575 | 4.861E+12 |
| Cf-252 | 4.3023E-08 | 135.54 | 271.08 | 0.00E+00 | 5.83E-06 | 1.17E-05 | 0.0850 | 2.924E+12 |
| Cm-243 | 1.6872E-07 | 135.54 | 271.08 | 0.00E+00 | 2.29E-05 | 4.57E-05 | 0.1250 | 2.972E+12 |
| Cm-244 | 1.4660E-06 | 135.54 | 271.08 | 0.00E+00 | 1.99E-04 | 3.97E-04 | 0.2250 | 2.645E+12 |
| Co-60 | 2.2376E-03 | 135.54 | 271.08 | 0.00E+00 | 3.03E-01 | 6.07E-01 | 0.3750 | 1.100E+12 |
| Cs-134 | 1.2525E-04 | 135.54 | 271.08 | 0.00E+00 | 1.70E-02 | 3.40E-02 | 0.5750 | 1.779E+13 |
| Cs-135 | 3.1549E-05 | 135.54 | 271.08 | 0.00E+00 | 4.28E-03 | 8.55E-03 | 0.8500 | 1.469E+12 |
| Cs-137 | 1.7368E+00 | 135.54 | 271.08 | 0.00E+00 | 2.35E+02 | 4.71E+02 | 1.2500 | 1.541E+12 |
| Eu-154 | 2.6947E-01 | 135.54 | 271.08 | 0.00E+00 | 3.65E+01 | 7.30E+01 | 1.7500 | 4.718E+10 |
| Eu-155 | 2.6857E-02 | 135.54 | 271.08 | 0.00E+00 | 3.64E+00 | 7.28E+00 | 2.2500 | 7.238E+05 |
| Fe-55 | 4.2105E-06 | 135.54 | 271.08 | 0.00E+00 | 5.71E-03 | 1.14E-02 | 2.7500 | 1.667E+05 |
| H-3 | 3.5173E-03 | 135.54 | 271.08 | 0.00E+00 | 4.77E-01 | 9.53E-01 | 3.5000 | 4.090E+02 |
| I-129 | 7.3805E-07 | 135.54 | 271.08 | 0.00E+00 | 1.00E-04 | 2.00E-04 | 5.0000 | 1.603E+02 |
| Kr-85 | 6.9263E-02 | 135.54 | 271.08 | 0.00E+00 | 9.39E+00 | 1.88E+01 | 7.0000 | 1.810E+01 |
| Np-237 | 1.4752E-06 | 135.54 | 271.08 | 0.00E+00 | 2.00E-04 | 4.00E-04 | 11.0000 | 2.059E+00 |
| Pa-231 | 8.3970E-09 | 135.54 | 271.08 | 0.00E+00 | 1.14E-06 | 2.28E-06 | | |
| Pb-210 | 1.4995E-13 | 135.54 | 271.08 | 0.00E+00 | 2.03E-11 | 4.07E-11 | | |
| Pm-147 | 1.0567E-02 | 135.54 | 271.08 | 0.00E+00 | 1.43E+00 | 2.86E+00 | | |
| Pu-238 | 1.1543E-03 | 135.54 | 271.08 | 0.00E+00 | 1.56E-01 | 3.13E-01 | | |
| Pu-239 | 5.6917E-03 | 135.54 | 271.08 | 0.00E+00 | 7.71E-01 | 1.54E+00 | | |
| Pu-240 | 2.2602E-03 | 135.54 | 271.08 | 0.00E+00 | 3.06E-01 | 6.13E-01 | | |
| Pu-241 | 4.8045E-02 | 135.54 | 271.08 | 0.00E+00 | 6.51E+00 | 1.30E+01 | | |
| Pu-242 | 3.0602E-07 | 135.54 | 271.08 | 0.00E+00 | 4.15E-05 | 8.30E-05 | | |
| Ra-226 | 5.1293E-13 | 135.54 | 271.08 | 0.00E+00 | 6.95E-11 | 1.39E-10 | | |
| Ra-228 | 2.3323E-10 | 135.54 | 271.08 | 0.00E+00 | 3.16E-08 | 6.32E-08 | | |
| Ru-106 | 1.0075E-07 | 135.54 | 271.08 | 0.00E+00 | 1.37E-05 | 2.73E-05 | | |
| Se-79 | 1.2935E-05 | 135.54 | 271.08 | 0.00E+00 | 1.75E-03 | 3.51E-03 | | |
| Sn-126 | 1.2238E-05 | 135.54 | 271.08 | 0.00E+00 | 1.66E-03 | 3.32E-03 | | |
| Sr-90 | 1.6165E+00 | 135.54 | 271.08 | 0.00E+00 | 2.19E+02 | 4.38E+02 | | |
| Tc-99 | 4.4120E-04 | 135.54 | 271.08 | 0.00E+00 | 5.98E-02 | 1.20E-01 | | |
| Th-229 | 4.5684E-10 | 135.54 | 271.08 | 0.00E+00 | 6.19E-08 | 1.24E-07 | | |
| Th-230 | 6.8271E-11 | 135.54 | 271.08 | 0.00E+00 | 9.25E-09 | 1.85E-08 | | |
| Th-232 | 2.3744E-10 | 135.54 | 271.08 | 0.00E+00 | 3.22E-08 | 6.44E-08 | | |
| Ti-208 | 1.7368E-08 | 135.54 | 271.08 | 0.00E+00 | 2.35E-06 | 4.71E-06 | | |
| U-232 | 4.6797E-08 | 135.54 | 271.08 | 0.00E+00 | 6.34E-06 | 1.27E-05 | | |
| U-233 | 1.3146E-07 | 135.54 | 271.08 | 0.00E+00 | 1.78E-05 | 3.56E-05 | | |
| U-234 | 2.5729E-07 | 135.54 | 271.08 | 0.00E+00 | 3.49E-05 | 6.97E-05 | | |
| U-235 | -2.6159E-06 | 135.54 | 0.00 | 5.86E-03 | 5.51E-03 | 5.86E-03 | | |
| U-236 | 1.2719E-05 | 135.54 | 271.08 | 0.00E+00 | 1.72E-03 | 3.45E-03 | | |
| U-238 | -3.8857E-08 | 135.54 | 0.00 | 3.65E-03 | 3.64E-03 | 3.65E-03 | | |
| Y-90 | 1.6165E+00 | 135.54 | 271.08 | 0.00E+00 | 2.19E+02 | 4.38E+02 | | |
| Other Radionuclides | | | | | 2.55E+02 | 5.10E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences: |
|---------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20.00391594 | 10 to 20.1 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|----------|-----------|------------------------------------|
| Nominal | 132.17 | 135.54 | |
| Bounding | | 271.08 | |

Nominal burnup calculated from the heavy metal mass destroyed.
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0.27 | 1.03 | |
| Bounding | 0.54 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD (ALUM) HEIDELBERG
SNF ID #: 464
Fuel Units & Descr: 65 - ELEMENT
Heavy Metal Mass BOL=11 648kg, EOL=11 401kg
ROD Storage Site, INEEL

¹Fuel decay start date: 2010
Estimates as of: 2030
Template: TRIGA-AJ (LW/U-Zrx, Alum, 10 to 20%, U)
²Template Burnup(MWd): 6 65
Template BOL Heavy Metal Mass (MT): 0 00018
Template Decay Time: 20 years

Estimated
Canister usage:
18"x10"
0 59

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | CvMWd From Template | Nominal Fuel Burnup (MWd) ¹ | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2 4556E-09 | 283 80 | 567 61 | 0 00E+00 | 6 97E-07 | 1 39E-06 | Avg. MeV | |
| Am-241 | 3 8752E-03 | 283 80 | 567 61 | 0 00E+00 | 1 10E+00 | 2 20E+00 | 0 0150 | 5 825E+13 |
| Am-242m | 1 8617E-06 | 283 80 | 567 61 | 0 00E+00 | 5 28E-04 | 1 06E-03 | 0 0250 | 1 203E+13 |
| Am-243 | 2 3293E-07 | 283 80 | 567 61 | 0 00E+00 | 6 61E-05 | 1 32E-04 | 0 0375 | 1 259E+13 |
| C-14 | 4 3233E-05 | 283 80 | 567 61 | 0 00E+00 | 1 23E-02 | 2 45E-02 | 0 0575 | 1 164E+13 |
| Cl-36 | 4 3023E-08 | 283 80 | 567 61 | 0 00E+00 | 1 22E-05 | 2 44E-05 | 0 0850 | 7 085E+12 |
| Cm-243 | 1 9053E-07 | 283 80 | 567 61 | 0 00E+00 | 5 41E-05 | 1 08E-04 | 0 1250 | 7 953E+12 |
| Cm-244 | 1 7744E-06 | 283 80 | 567 61 | 0 00E+00 | 5 04E-04 | 1 01E-03 | 0 2250 | 6 420E+12 |
| Co-60 | 4 3188E-03 | 283 80 | 567 61 | 0 00E+00 | 1 23E+00 | 2 45E+00 | 0 3750 | 2 638E+12 |
| Cs-134 | 6 7188E-04 | 283 80 | 567 61 | 0 00E+00 | 1 91E-01 | 3 81E-01 | 0 5750 | 4 203E+13 |
| Cs-135 | 3 1549E-05 | 283 80 | 567 61 | 0 00E+00 | 8 95E-03 | 1 79E-02 | 0 8500 | 4 472E+12 |
| Cs-137 | 1 9489E+00 | 283 80 | 567 61 | 0 00E+00 | 5 53E+02 | 1 11E+03 | 1 2500 | 4 817E+12 |
| Eu-154 | 4 0301E-01 | 283 80 | 567 61 | 0 00E+00 | 1 14E+02 | 2 29E+02 | 1 7500 | 1 443E+11 |
| Eu-155 | 5 4000E-02 | 283 80 | 567 61 | 0 00E+00 | 1 53E+01 | 3 07E+01 | 2 2500 | 2 287E+06 |
| Fe-55 | 1 5955E-04 | 283 80 | 567 61 | 0 00E+00 | 4 53E-02 | 9 06E-02 | 2 7500 | 3 807E+05 |
| H-3 | 4 6571E-03 | 283 80 | 567 61 | 0 00E+00 | 1 32E+00 | 2 64E+00 | 3 5000 | 2 621E+03 |
| I-129 | 7 3805E-07 | 283 80 | 567 61 | 0 00E+00 | 2 09E-04 | 4 19E-04 | 5 0000 | 3 262E+02 |
| Kr-85 | 9 5684E-02 | 283 80 | 567 61 | 0 00E+00 | 2 72E+01 | 5 43E+01 | 7 0000 | 3 684E+01 |
| Np-237 | 1 4618E-06 | 283 80 | 567 61 | 0 00E+00 | 4 15E-04 | 8 30E-04 | 11 0000 | 4 191E+00 |
| Pa-231 | 6 4782E-09 | 283 80 | 567 61 | 0 00E+00 | 1 84E-06 | 3 68E-06 | | |
| Pb-210 | 6 3158E-14 | 283 80 | 567 61 | 0 00E+00 | 1 79E-11 | 3 58E-11 | | |
| Pm-147 | 3 9564E-02 | 283 80 | 567 61 | 0 00E+00 | 1 12E+01 | 2 25E+01 | | |
| Pu-238 | 1 2008E-03 | 283 80 | 567 61 | 0 00E+00 | 3 41E-01 | 6 82E-01 | | |
| Pu-239 | 5 6917E-03 | 283 80 | 567 61 | 0 00E+00 | 1 62E+00 | 3 23E+00 | | |
| Pu-240 | 2 2617E-03 | 283 80 | 567 61 | 0 00E+00 | 6 42E-01 | 1 28E+00 | | |
| Pu-241 | 6 1113E-02 | 283 80 | 567 61 | 0 00E+00 | 1 73E+01 | 3 47E+01 | | |
| Pu-242 | 3 0602E-07 | 283 80 | 567 61 | 0 00E+00 | 8 68E-05 | 1 74E-04 | | |
| Ra-226 | 2 6707E-13 | 283 80 | 567 61 | 0 00E+00 | 7 58E-11 | 1 52E-10 | | |
| Ra-228 | 2 2556E-10 | 283 80 | 567 61 | 0 00E+00 | 6 40E-08 | 1 28E-07 | | |
| Ru-106 | 3 1293E-06 | 283 80 | 567 61 | 0 00E+00 | 8 88E-04 | 1 78E-03 | | |
| Se-79 | 1 2935E-05 | 283 80 | 567 61 | 0 00E+00 | 3 67E-03 | 7 34E-03 | | |
| Sn-126 | 1 2238E-05 | 283 80 | 567 61 | 0 00E+00 | 3 47E-03 | 6 95E-03 | | |
| Sr-90 | 1 8195E+00 | 283 80 | 567 61 | 0 00E+00 | 5 16E+02 | 1 03E+03 | | |
| Tc-99 | 4 4120E-04 | 283 80 | 567 61 | 0 00E+00 | 1 25E-01 | 2 50E-01 | | |
| Th-229 | 3 3308E-10 | 283 80 | 567 61 | 0 00E+00 | 9 45E-08 | 1 89E-07 | | |
| Th-230 | 4 6526E-11 | 283 80 | 567 61 | 0 00E+00 | 1 32E-08 | 2 64E-08 | | |
| Th-232 | 2 3744E-10 | 283 80 | 567 61 | 0 00E+00 | 6 74E-08 | 1 35E-07 | | |
| Th-208 | 1 8195E-08 | 283 80 | 567 61 | 0 00E+00 | 5 16E-06 | 1 03E-05 | | |
| U-232 | 4 9098E-08 | 283 80 | 567 61 | 0 00E+00 | 1 39E-05 | 2 79E-05 | | |
| U-233 | 1 3140E-07 | 283 80 | 567 61 | 0 00E+00 | 3 73E-05 | 7 46E-05 | | |
| U-234 | 2 2571E-07 | 283 80 | 567 61 | 0 00E+00 | 6 41E-05 | 1 28E-04 | | |
| U-235 | -2 6159E-06 | 283 80 | 0 00 | 5 06E-03 | 4 31E-03 | 5 06E-03 | | |
| U-236 | 1 2719E-05 | 283 80 | 567 61 | 0 00E+00 | 3 61E-03 | 7 22E-03 | | |
| U-238 | -3 8857E-08 | 283 80 | 0 00 | 3 13E-03 | 3 12E-03 | 3 13E-03 | | |
| Y-90 | 1 8211E+00 | 283 80 | 567 61 | 0 00E+00 | 5 17E+02 | 1 03E+03 | | |
| Other Radionuclides | | | | | 5 94E+02 | 1 19E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator | From SFD | Used | |
| Fuel Cladding | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| BOL HM Constituents | ALUM | ALUM | |
| BOL Enrichment % | 20 08410778 | 10 to 20 1 | |

| Burnup Summary (MWd) ³ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | 283 80 | 235.77 | |
| Bounding | | 567 61 | Nominal burnup taken directly from SFD (converted to MWd). Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|--------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0 66 | 0 83 | |
| Bounding | 1 32 | | 1 00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD (ALUM) ITALY
SNF ID # 466
Fuel Units & Descr 60 - ELEMENT
Heavy Metal Mass BOL=10.8kg, EOL=10.74kg
ROD Storage Site INEEL

¹Fuel decay start date 2010
Estimates as of 2030
Template TRIGA-AI (LW/U-Zrx Alum, 10 to 20%, U)
²Template Burnup(MWd) 6.65
Template BOL Heavy Metal Mass (MT) 0.00018
Template Decay Time 20 years

Estimated
Canister usage
18"x10"
0.54

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.4556E-09 | 57.27 | 114.54 | 0.00E+00 | 1.41E-07 | 2.81E-07 | Avg MeV | |
| Am-241 | 3.8752E-03 | 57.27 | 114.54 | 0.00E+00 | 2.22E-01 | 4.44E-01 | 0.0150 | 1.176E+13 |
| Am-242m | 1.8617E-06 | 57.27 | 114.54 | 0.00E+00 | 1.07E-04 | 2.13E-04 | 0.0250 | 2.427E+12 |
| Am-243 | 2.3293E-07 | 57.27 | 114.54 | 0.00E+00 | 1.33E-05 | 2.67E-05 | 0.0375 | 2.541E+12 |
| C-14 | 4.3233E-05 | 57.27 | 114.54 | 0.00E+00 | 2.48E-03 | 4.95E-03 | 0.0575 | 2.348E+12 |
| Cl-36 | 4.3023E-08 | 57.27 | 114.54 | 0.00E+00 | 2.46E-06 | 4.93E-06 | 0.0850 | 1.430E+12 |
| Cm-243 | 1.9053E-07 | 57.27 | 114.54 | 0.00E+00 | 1.09E-05 | 2.18E-05 | 0.1250 | 1.605E+12 |
| Cm-244 | 1.7744E-06 | 57.27 | 114.54 | 0.00E+00 | 1.02E-04 | 2.03E-04 | 0.2250 | 1.296E+12 |
| Co-60 | 4.3188E-03 | 57.27 | 114.54 | 0.00E+00 | 2.47E-01 | 4.95E-01 | 0.3750 | 5.324E+11 |
| Cs-134 | 6.7188E-04 | 57.27 | 114.54 | 0.00E+00 | 3.85E-02 | 7.70E-02 | 0.5750 | 8.481E+12 |
| Cs-135 | 3.1549E-05 | 57.27 | 114.54 | 0.00E+00 | 1.81E-03 | 3.61E-03 | 0.8500 | 9.024E+11 |
| Cs-137 | 1.9489E+00 | 57.27 | 114.54 | 0.00E+00 | 1.12E+02 | 2.23E+02 | 1.2500 | 9.721E+11 |
| Eu-154 | 4.0301E-01 | 57.27 | 114.54 | 0.00E+00 | 2.31E+01 | 4.62E+01 | 1.7500 | 2.912E+10 |
| Eu-155 | 5.4000E-02 | 57.27 | 114.54 | 0.00E+00 | 3.09E+00 | 6.19E+00 | 2.2500 | 4.616E+05 |
| Fe-55 | 1.5955E-04 | 57.27 | 114.54 | 0.00E+00 | 9.14E-03 | 1.83E-02 | 2.7500 | 7.684E+04 |
| H-3 | 4.6571E-03 | 57.27 | 114.54 | 0.00E+00 | 2.67E-01 | 5.33E-01 | 3.5000 | 5.411E+02 |
| I-129 | 7.3805E-07 | 57.27 | 114.54 | 0.00E+00 | 4.23E-05 | 8.45E-05 | 5.0000 | 7.109E+01 |
| Kr-85 | 9.5684E-02 | 57.27 | 114.54 | 0.00E+00 | 5.48E+00 | 1.10E+01 | 7.0000 | 8.039E+00 |
| Np-237 | 1.4618E-06 | 57.27 | 114.54 | 0.00E+00 | 8.37E-05 | 1.67E-04 | 11.0000 | 9.152E-01 |
| Pa-231 | 6.4782E-09 | 57.27 | 114.54 | 0.00E+00 | 3.71E-07 | 7.42E-07 | | |
| Pb-210 | 6.3158E-14 | 57.27 | 114.54 | 0.00E+00 | 3.62E-12 | 7.23E-12 | | |
| Pm-147 | 3.9564E-02 | 57.27 | 114.54 | 0.00E+00 | 2.27E+00 | 4.53E+00 | | |
| Pu-238 | 1.2008E-03 | 57.27 | 114.54 | 0.00E+00 | 6.88E-02 | 1.38E-01 | | |
| Pu-239 | 5.6917E-03 | 57.27 | 114.54 | 0.00E+00 | 3.26E-01 | 6.52E-01 | | |
| Pu-240 | 2.2617E-03 | 57.27 | 114.54 | 0.00E+00 | 1.30E-01 | 2.59E-01 | | |
| Pu-241 | 6.1113E-02 | 57.27 | 114.54 | 0.00E+00 | 3.50E+00 | 7.00E+00 | | |
| Pu-242 | 3.0602E-07 | 57.27 | 114.54 | 0.00E+00 | 1.75E-05 | 3.51E-05 | | |
| Ra-226 | 2.6707E-13 | 57.27 | 114.54 | 0.00E+00 | 1.53E-11 | 3.06E-11 | | |
| Ra-228 | 2.2556E-10 | 57.27 | 114.54 | 0.00E+00 | 1.29E-08 | 2.58E-08 | | |
| Ru-106 | 3.1293E-06 | 57.27 | 114.54 | 0.00E+00 | 1.79E-04 | 3.58E-04 | | |
| Se-79 | 1.2935E-05 | 57.27 | 114.54 | 0.00E+00 | 7.41E-04 | 1.48E-03 | | |
| Sn-126 | 1.2238E-05 | 57.27 | 114.54 | 0.00E+00 | 7.01E-04 | 1.40E-03 | | |
| Sr-90 | 1.8195E+00 | 57.27 | 114.54 | 0.00E+00 | 1.04E+02 | 2.08E+02 | | |
| Tc-99 | 4.4120E-04 | 57.27 | 114.54 | 0.00E+00 | 2.53E-02 | 5.05E-02 | | |
| Th-229 | 3.3308E-10 | 57.27 | 114.54 | 0.00E+00 | 1.91E-08 | 3.82E-08 | | |
| Th-230 | 4.6526E-11 | 57.27 | 114.54 | 0.00E+00 | 2.66E-09 | 5.33E-09 | | |
| Th-232 | 2.3744E-10 | 57.27 | 114.54 | 0.00E+00 | 1.36E-08 | 2.72E-08 | | |
| Ti-208 | 1.8195E-08 | 57.27 | 114.54 | 0.00E+00 | 1.04E-06 | 2.08E-06 | | |
| U-232 | 4.9098E-08 | 57.27 | 114.54 | 0.00E+00 | 2.81E-06 | 5.62E-06 | | |
| U-233 | 1.3140E-07 | 57.27 | 114.54 | 0.00E+00 | 7.53E-06 | 1.51E-05 | | |
| U-234 | 2.2571E-07 | 57.27 | 114.54 | 0.00E+00 | 1.29E-05 | 2.59E-05 | | |
| U-235 | -2.6159E-06 | 57.27 | 0.00 | 4.67E-03 | 4.52E-03 | 4.67E-03 | | |
| U-236 | 1.2719E-05 | 57.27 | 114.54 | 0.00E+00 | 7.28E-04 | 1.46E-03 | | |
| U-238 | -3.8857E-08 | 57.27 | 0.00 | 2.90E-03 | 2.90E-03 | 2.90E-03 | | |
| Y-90 | 1.8211E+00 | 57.27 | 114.54 | 0.00E+00 | 1.04E+02 | 2.09E+02 | | |
| Other Radionuclides | | | | | 1.20E+02 | 2.40E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences [*] |
|----------------------------|-----------------------|-----------------------|--|
| | From SFD | Used | |
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|------------------------------------|
| | From SFD | Estimated | |
| Nominal | 52.63 | 57.27 | |
| Bounding | | 114.54 | |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0.14 | 1.09 | |
| Bounding | 0.29 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD (ALUM) ITALY
SNF ID #: 467
Fuel Units & Descr: 64 - ELEMENT
Heavy Metal Mass: BOL=11 93kg, EOL=11 904kg
ROD Storage Site: INEEL

¹Fuel decay start date: 1997
Estimates as of: 2030
Template: TRIGA-AI (LW/U-Zrx, Alum, 10 to 20%, U)
²Template Burnup(MWd): 6 65
Template BOL Heavy Metal Mass (MT): 0 00018
Template Decay Time: 25 years

Estimated
Canister usage
18"x10"
0 58

| II, Estimates | m | x _a | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 3 8271E-09 | 58 13 | 116 27 | 0 00E+00 | 2 22E-07 | 4 45E-07 | Avg MeV | |
| Am-241 | 4 4195E-03 | 58 13 | 116 27 | 0 00E+00 | 2 57E-01 | 5 14E-01 | 0 0150 | 1 051E+13 |
| Am-242m | 1 8195E-06 | 58 13 | 116 27 | 0 00E+00 | 1 06E-04 | 2 12E-04 | 0 0250 | 2 171E+12 |
| Am-243 | 2 3278E-07 | 58 13 | 116 27 | 0 00E+00 | 1 35E-05 | 2 71E-05 | 0 0375 | 2 174E+12 |
| C-14 | 4 3203E-05 | 58 13 | 116 27 | 0 00E+00 | 2 51E-03 | 5 02E-03 | 0 0575 | 2 085E+12 |
| Cl-36 | 4 3023E-08 | 58 13 | 116 27 | 0 00E+00 | 2 50E-06 | 5 00E-06 | 0 0850 | 1 254E+12 |
| Cm-243 | 1 6872E-07 | 58 13 | 116 27 | 0 00E+00 | 9 81E-06 | 1 96E-05 | 0 1250 | 1 275E+12 |
| Cm-244 | 1 4660E-06 | 58 13 | 116 27 | 0 00E+00 | 8 52E-05 | 1 70E-04 | 0 2250 | 1 135E+12 |
| Co-60 | 2 2376E-03 | 58 13 | 116 27 | 0 00E+00 | 1 30E-01 | 2 60E-01 | 0 3750 | 4 719E+11 |
| Cs-134 | 1 2525E-04 | 58 13 | 116 27 | 0 00E+00 | 7 28E-03 | 1 46E-02 | 0 5750 | 7 632E+12 |
| Cs-135 | 3 1549E-05 | 58 13 | 116 27 | 0 00E+00 | 1 83E-03 | 3 67E-03 | 0 8500 | 6 299E+11 |
| Cs-137 | 1 7368E+00 | 58 13 | 116 27 | 0 00E+00 | 1 01E+02 | 2 02E+02 | 1 2500 | 6 610E+11 |
| Eu-154 | 2 6947E-01 | 58 13 | 116 27 | 0 00E+00 | 1 57E+01 | 3 13E+01 | 1 7500 | 2 023E+10 |
| Eu-155 | 2 6857E-02 | 58 13 | 116 27 | 0 00E+00 | 1 56E+00 | 3 12E+00 | 2 2500 | 3 105E+05 |
| Fe-55 | 4 2105E-05 | 58 13 | 116 27 | 0 00E+00 | 2 45E-03 | 4 90E-03 | 2 7500 | 7 151E+04 |
| H-3 | 3 5173E-03 | 58 13 | 116 27 | 0 00E+00 | 2 04E-01 | 4 09E-01 | 3 5000 | 1 843E+02 |
| I-129 | 7 3805E-07 | 58 13 | 116 27 | 0 00E+00 | 4 29E-05 | 8 58E-05 | 5 0000 | 7 259E+01 |
| Kr-85 | 6 9263E-02 | 58 13 | 116 27 | 0 00E+00 | 4 03E+00 | 8 05E+00 | 7 0000 | 8 204E+00 |
| Np-237 | 1 4752E-06 | 58 13 | 116 27 | 0 00E+00 | 8 58E-05 | 1 72E-04 | 11 0000 | 9 337E-01 |
| Pa-231 | 8 3970E-09 | 58 13 | 116 27 | 0 00E+00 | 4 88E-07 | 9 76E-07 | | |
| Pb-210 | 1 4995E-13 | 58 13 | 116 27 | 0 00E+00 | 8 72E-12 | 1 74E-11 | | |
| Pm-147 | 1 0567E-02 | 58 13 | 116 27 | 0 00E+00 | 6 14E-01 | 1 23E+00 | | |
| Pu-238 | 1 1543E-03 | 58 13 | 116 27 | 0 00E+00 | 6 71E-02 | 1 34E-01 | | |
| Pu-239 | 5 6917E-03 | 58 13 | 116 27 | 0 00E+00 | 3 31E-01 | 6 62E-01 | | |
| Pu-240 | 2 2602E-03 | 58 13 | 116 27 | 0 00E+00 | 1 31E-01 | 2 63E-01 | | |
| Pu-241 | 4 8045E-02 | 58 13 | 116 27 | 0 00E+00 | 2 79E+00 | 5 59E+00 | | |
| Pu-242 | 3 0602E-07 | 58 13 | 116 27 | 0 00E+00 | 1 78E-05 | 3 56E-05 | | |
| Ra-226 | 5 1293E-13 | 58 13 | 116 27 | 0 00E+00 | 2 98E-11 | 5 96E-11 | | |
| Ra-228 | 2 3323E-10 | 58 13 | 116 27 | 0 00E+00 | 1 36E-08 | 2 71E-08 | | |
| Ru-106 | 1 0075E-07 | 58 13 | 116 27 | 0 00E+00 | 5 86E-06 | 1 17E-05 | | |
| Se-79 | 1 2935E-05 | 58 13 | 116 27 | 0 00E+00 | 7 52E-04 | 1 50E-03 | | |
| Sn-126 | 1 2238E-05 | 58 13 | 116 27 | 0 00E+00 | 7 11E-04 | 1 42E-03 | | |
| Sr-90 | 1 6165E+00 | 58 13 | 116 27 | 0 00E+00 | 9 40E+01 | 1 88E+02 | | |
| Tc-99 | 4 4120E-04 | 58 13 | 116 27 | 0 00E+00 | 2 56E-02 | 5 13E-02 | | |
| Th-229 | 4 5684E-10 | 58 13 | 116 27 | 0 00E+00 | 2 66E-08 | 5 31E-08 | | |
| Th-230 | 6 8271E-11 | 58 13 | 116 27 | 0 00E+00 | 3 97E-09 | 7 94E-09 | | |
| Th-232 | 2 3744E-10 | 58 13 | 116 27 | 0 00E+00 | 1 38E-08 | 2 76E-08 | | |
| Ti-208 | 1 7368E-08 | 58 13 | 116 27 | 0 00E+00 | 1 01E-06 | 2 02E-06 | | |
| U-232 | 4 6797E-08 | 58 13 | 116 27 | 0 00E+00 | 2 72E-06 | 5 44E-06 | | |
| U-233 | 1 3146E-07 | 58 13 | 116 27 | 0 00E+00 | 7 64E-06 | 1 53E-05 | | |
| U-234 | 2 5729E-07 | 58 13 | 116 27 | 0 00E+00 | 1 50E-05 | 2 99E-05 | | |
| U-235 | 2 6159E-06 | 58 13 | 0 00 | 5 10E-03 | 4 94E-03 | 5 10E-03 | | |
| U-236 | 1 2719E-05 | 58 13 | 116 27 | 0 00E+00 | 7 39E-04 | 1 48E-03 | | |
| U-238 | 3 8857E-08 | 58 13 | 0 00 | 3 22E-03 | 3 21E-03 | 3 22E-03 | | |
| Y-90 | 1 6165E+00 | 58 13 | 116 27 | 0 00E+00 | 9 40E+01 | 1 88E+02 | | |
| Other Radionuclides | | | | | 1 09E+02 | 2 19E+02 | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 1 29E+00 | 2 59E+00 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator | From SFD | Used | |
| Fuel Cladding | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| BOL HM Constituents | ALUM | ALUM | |
| BOL Enrichment % | U | U | |
| | 19 76448407 | 10 to 20 1 | |

| Burnup Summary (MWd) ¹ | | | Basis for burnup used in estimate* |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | 58 13 | 24 44 | |
| Bounding | | 116 27 | Nominal burnup taken directly from SFD (converted to MWd). Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|--------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0 13 | 0 42 | |
| Bounding | 0 26 | | 1 00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD (ALUM) JAPAN
 SNF ID # 481
 Fuel Units & Descr 71 - ELEMENT
 Heavy Metal Mass BOL=13.845kg EOL=13.774kg
 ROD Storage Site INEEL

¹Fuel decay start date 2010
 Estimates as of 2030
 Template TRIGA-AI (LW/U-Zrx, Alum, 10 to 20%, U)
²Template Burnup(MWd) 6.65
 Template BOL Heavy Metal Mass (MT) 0.00018
 Template Decay Time 20 years

Estimated
 Canister usage
 18"x10"
 0.64

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.4556E-09 | 134.93 | 269.87 | 0.00E+00 | 3.31E-07 | 6.63E-07 | Avg MeV | |
| Am-241 | 3.8752E-03 | 134.93 | 269.87 | 0.00E+00 | 5.23E-01 | 1.05E+00 | 0.0150 | 2.770E+13 |
| Am-242m | 1.8617E-06 | 134.93 | 269.87 | 0.00E+00 | 2.51E-04 | 5.02E-04 | 0.0250 | 5.719E+12 |
| Am-243 | 2.3293E-07 | 134.93 | 269.87 | 0.00E+00 | 3.14E-05 | 6.29E-05 | 0.0375 | 5.988E+12 |
| C-14 | 4.3233E-05 | 134.93 | 269.87 | 0.00E+00 | 5.83E-03 | 1.17E-02 | 0.0575 | 5.533E+12 |
| Cl-36 | 4.3023E-08 | 134.93 | 269.87 | 0.00E+00 | 5.81E-06 | 1.16E-05 | 0.0850 | 3.368E+12 |
| Cm-243 | 1.9053E-07 | 134.93 | 269.87 | 0.00E+00 | 2.57E-05 | 5.14E-05 | 0.1250 | 3.781E+12 |
| Cm-244 | 1.7744E-06 | 134.93 | 269.87 | 0.00E+00 | 2.39E-04 | 4.79E-04 | 0.2250 | 3.052E+12 |
| Co-60 | 4.3188E-03 | 134.93 | 269.87 | 0.00E+00 | 5.83E-01 | 1.17E+00 | 0.3750 | 1.254E+12 |
| Cs-134 | 6.7188E-04 | 134.93 | 269.87 | 0.00E+00 | 9.07E-02 | 1.81E-01 | 0.5750 | 1.998E+13 |
| Cs-135 | 3.1549E-05 | 134.93 | 269.87 | 0.00E+00 | 4.26E-03 | 8.51E-03 | 0.8500 | 2.126E+12 |
| Cs-137 | 1.9489E+00 | 134.93 | 269.87 | 0.00E+00 | 2.63E+02 | 5.26E+02 | 1.2500 | 2.290E+12 |
| Eu-154 | 4.0301E-01 | 134.93 | 269.87 | 0.00E+00 | 5.44E+01 | 1.09E+02 | 1.7500 | 6.861E+10 |
| Eu-155 | 5.4000E-02 | 134.93 | 269.87 | 0.00E+00 | 7.29E+00 | 1.46E+01 | 2.2500 | 1.088E+06 |
| Fe-55 | 1.5955E-04 | 134.93 | 269.87 | 0.00E+00 | 2.15E-02 | 4.31E-02 | 2.7500 | 1.810E+05 |
| H-3 | 4.6571E-03 | 134.93 | 269.87 | 0.00E+00 | 6.28E-01 | 1.26E+00 | 3.5000 | 1.258E+03 |
| I-129 | 7.3805E-07 | 134.93 | 269.87 | 0.00E+00 | 9.96E-05 | 1.99E-04 | 5.0000 | 1.603E+02 |
| Kr-85 | 9.5684E-02 | 134.93 | 269.87 | 0.00E+00 | 1.29E+01 | 2.58E+01 | 7.0000 | 1.811E+01 |
| Np-237 | 1.4618E-06 | 134.93 | 269.87 | 0.00E+00 | 1.97E-04 | 3.94E-04 | 11.0000 | 2.061E+00 |
| Pa-231 | 6.4782E-09 | 134.93 | 269.87 | 0.00E+00 | 8.74E-07 | 1.75E-06 | | |
| Pb-210 | 6.3158E-14 | 134.93 | 269.87 | 0.00E+00 | 8.52E-12 | 1.70E-11 | | |
| Pm-147 | 3.9564E-02 | 134.93 | 269.87 | 0.00E+00 | 5.34E+00 | 1.07E+01 | | |
| Pu-238 | 1.2008E-03 | 134.93 | 269.87 | 0.00E+00 | 1.62E-01 | 3.24E-01 | | |
| Pu-239 | 5.6917E-03 | 134.93 | 269.87 | 0.00E+00 | 7.68E-01 | 1.54E+00 | | |
| Pu-240 | 2.2617E-03 | 134.93 | 269.87 | 0.00E+00 | 3.05E-01 | 6.10E-01 | | |
| Pu-241 | 6.1113E-02 | 134.93 | 269.87 | 0.00E+00 | 8.25E+00 | 1.65E+01 | | |
| Pu-242 | 3.0602E-07 | 134.93 | 269.87 | 0.00E+00 | 4.13E-05 | 8.26E-05 | | |
| Ra-226 | 2.6707E-13 | 134.93 | 269.87 | 0.00E+00 | 3.60E-11 | 7.21E-11 | | |
| Ra-228 | 2.2556E-10 | 134.93 | 269.87 | 0.00E+00 | 3.04E-08 | 6.09E-08 | | |
| Ru-106 | 3.1293E-06 | 134.93 | 269.87 | 0.00E+00 | 4.22E-04 | 8.45E-04 | | |
| Se-79 | 1.2935E-05 | 134.93 | 269.87 | 0.00E+00 | 1.75E-03 | 3.49E-03 | | |
| Sn-126 | 1.2238E-05 | 134.93 | 269.87 | 0.00E+00 | 1.65E-03 | 3.30E-03 | | |
| Sr-90 | 1.8195E+00 | 134.93 | 269.87 | 0.00E+00 | 2.46E+02 | 4.91E+02 | | |
| Tc-99 | 4.4120E-04 | 134.93 | 269.87 | 0.00E+00 | 5.95E-02 | 1.19E-01 | | |
| Th-229 | 3.3308E-10 | 134.93 | 269.87 | 0.00E+00 | 4.49E-08 | 8.99E-08 | | |
| Th-230 | 4.6526E-11 | 134.93 | 269.87 | 0.00E+00 | 6.28E-09 | 1.26E-08 | | |
| Th-232 | 2.3744E-10 | 134.93 | 269.87 | 0.00E+00 | 3.20E-08 | 6.41E-08 | | |
| Ti-208 | 1.8195E-08 | 134.93 | 269.87 | 0.00E+00 | 2.46E-06 | 4.91E-06 | | |
| U-232 | 4.9098E-08 | 134.93 | 269.87 | 0.00E+00 | 6.62E-06 | 1.32E-05 | | |
| U-233 | 1.3140E-07 | 134.93 | 269.87 | 0.00E+00 | 1.77E-05 | 3.55E-05 | | |
| U-234 | 2.2571E-07 | 134.93 | 269.87 | 0.00E+00 | 3.05E-05 | 6.09E-05 | | |
| U-235 | -2.6159E-06 | 134.93 | 0.00 | 5.98E-03 | 5.63E-03 | 5.98E-03 | | |
| U-236 | 1.2719E-05 | 134.93 | 269.87 | 0.00E+00 | 1.72E-03 | 3.43E-03 | | |
| U-238 | -3.8857E-08 | 134.93 | 0.00 | 3.72E-03 | 3.72E-03 | 3.72E-03 | | |
| Y-90 | 1.8211E+00 | 134.93 | 269.87 | 0.00E+00 | 2.46E+02 | 4.91E+02 | | |
| Other Radionuclides | | | | | 2.83E+02 | 5.65E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | | Basis for Parameter Differences: |
|-----------------------------------|-----------------------|--------------------------------|--------------------------------|------------------------------------|
| Reactor Moderator | From SFD | Used | | |
| | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | | |
| | ALUM | ALUM | | |
| Fuel Cladding | U | U | | |
| BOL HM Constituents | 20.00000073 | 10 to 20.1 | | |
| BOL Enrichment % | | | | |
| Burnup Summary (MWd) ² | | | | Basis for burnup used in estimate: |
| Nominal | From SFD | Estimated | | |
| | 134.93 | 67.77 | | |
| | | 269.87 | | |
| Bounding | | | | |
| Checks | | | | |
| Nominal | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/ Given EOL HM | |
| | 0.26 | 0.50 | | |
| | 0.53 | | | |
| Bounding | | | 1.00 | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD (ALUM) KANSAS STATE UNIV
SNF ID #, 804
Fuel Units & Descr: 3 - ELEMENT
Heavy Metal Mass BOL=0.54kg, EOL=0.513kg
ROD Storage Site INEEL

¹Fuel decay start date 2035
Estimates as of: 2030
Template TRIGA-AI (LW/U-Zr, Alum., 10 to 20%, U)
²Template Burnup (MWd): 6.65
Template BOL Heavy Metal Mass (MT): 0.00018
Template Decay Time: 5 years

Estimated
Canister usage:
18"x10"
0.03

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| | m | x _n | x _b | b | y _n | y _b | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | | |
| Ac-227 | 8.0632E-10 | 25.77 | 51.54 | 0.00E+00 | 2.08E-08 | 4.16E-08 | Avg. MeV | |
| Am-241 | 2.2586E-03 | 25.77 | 51.54 | 0.00E+00 | 5.82E-02 | 1.16E-01 | 0.0150 | 8.721E+12 |
| Am-242m | 1.9925E-06 | 25.77 | 51.54 | 0.00E+00 | 5.14E-05 | 1.03E-04 | 0.0250 | 1.893E+12 |
| Am-243 | 2.3323E-07 | 25.77 | 51.54 | 0.00E+00 | 6.01E-06 | 1.20E-05 | 0.0375 | 2.359E+12 |
| C-14 | 4.3308E-05 | 25.77 | 51.54 | 0.00E+00 | 1.12E-03 | 2.23E-03 | 0.0675 | 1.808E+12 |
| Cl-36 | 4.3023E-08 | 25.77 | 51.54 | 0.00E+00 | 1.11E-06 | 2.22E-06 | 0.0850 | 1.266E+12 |
| Cm-243 | 2.7429E-07 | 25.77 | 51.54 | 0.00E+00 | 7.07E-06 | 1.41E-05 | 0.1250 | 1.893E+12 |
| Cm-244 | 3.1504E-06 | 25.77 | 51.54 | 0.00E+00 | 8.12E-05 | 1.62E-04 | 0.2250 | 1.057E+12 |
| Co-60 | 3.1008E-02 | 25.77 | 51.54 | 0.00E+00 | 7.99E-01 | 1.60E+00 | 0.3750 | 4.702E+11 |
| Cs-134 | 1.0367E-01 | 25.77 | 51.54 | 0.00E+00 | 2.67E+00 | 5.34E+00 | 0.5750 | 5.962E+12 |
| Cs-135 | 3.1549E-05 | 25.77 | 51.54 | 0.00E+00 | 8.13E-04 | 1.63E-03 | 0.8500 | 1.468E+12 |
| Cs-137 | 2.7564E+00 | 25.77 | 51.54 | 0.00E+00 | 7.10E+01 | 1.42E+02 | 1.2500 | 1.521E+12 |
| Eu-154 | 1.3490E+00 | 25.77 | 51.54 | 0.00E+00 | 3.48E+01 | 6.95E+01 | 1.7500 | 4.354E+10 |
| Eu-155 | 4.3880E-01 | 25.77 | 51.54 | 0.00E+00 | 1.13E+01 | 2.26E+01 | 2.2500 | 5.292E+09 |
| Fe-55 | 8.6782E-03 | 25.77 | 51.54 | 0.00E+00 | 2.24E-01 | 4.47E-01 | 2.7500 | 4.298E+07 |
| H-3 | 1.0805E-02 | 25.77 | 51.54 | 0.00E+00 | 2.78E-01 | 5.57E-01 | 3.5000 | 5.024E+06 |
| I-129 | 7.3805E-07 | 25.77 | 51.54 | 0.00E+00 | 1.90E-05 | 3.80E-05 | 5.0000 | 2.974E+01 |
| Kr-85 | 2.5218E-01 | 25.77 | 51.54 | 0.00E+00 | 6.50E+00 | 1.30E+01 | 7.0000 | 3.366E+00 |
| Np-237 | 1.4463E-06 | 25.77 | 51.54 | 0.00E+00 | 3.73E-05 | 7.45E-05 | 11.0000 | 3.834E-01 |
| Pa-231 | 3.5970E-09 | 25.77 | 51.54 | 0.00E+00 | 9.27E-08 | 1.85E-07 | | |
| Pb-210 | 8.2511E-15 | 25.77 | 51.54 | 0.00E+00 | 2.13E-13 | 4.25E-13 | | |
| Pm-147 | 2.0767E+00 | 25.77 | 51.54 | 0.00E+00 | 5.35E+01 | 1.07E+02 | | |
| Pu-238 | 1.3514E-03 | 25.77 | 51.54 | 0.00E+00 | 3.48E-02 | 6.97E-02 | | |
| Pu-239 | 5.6947E-03 | 25.77 | 51.54 | 0.00E+00 | 1.47E-01 | 2.94E-01 | | |
| Pu-240 | 2.2647E-03 | 25.77 | 51.54 | 0.00E+00 | 5.84E-02 | 1.17E-01 | | |
| Pu-241 | 1.2574E-01 | 25.77 | 51.54 | 0.00E+00 | 3.24E+00 | 6.48E+00 | | |
| Pu-242 | 3.0602E-07 | 25.77 | 51.54 | 0.00E+00 | 7.89E-06 | 1.58E-05 | | |
| Ra-226 | 5.7353E-14 | 25.77 | 51.54 | 0.00E+00 | 1.48E-12 | 2.96E-12 | | |
| Ra-228 | 1.8150E-10 | 25.77 | 51.54 | 0.00E+00 | 4.68E-09 | 9.36E-09 | | |
| Ru-106 | 9.3744E-02 | 25.77 | 51.54 | 0.00E+00 | 2.42E+00 | 4.83E+00 | | |
| Sa-79 | 1.2938E-05 | 25.77 | 51.54 | 0.00E+00 | 3.33E-04 | 6.67E-04 | | |
| Sn-126 | 1.2239E-05 | 25.77 | 51.54 | 0.00E+00 | 3.15E-04 | 6.31E-04 | | |
| Sr-90 | 2.6000E+00 | 25.77 | 51.54 | 0.00E+00 | 6.70E+01 | 1.34E+02 | | |
| Tc-99 | 4.4120E-04 | 25.77 | 51.54 | 0.00E+00 | 1.14E-02 | 2.27E-02 | | |
| Th-229 | 1.4749E-10 | 25.77 | 51.54 | 0.00E+00 | 3.80E-09 | 7.60E-09 | | |
| Th-230 | 1.9549E-11 | 25.77 | 51.54 | 0.00E+00 | 5.04E-10 | 1.01E-09 | | |
| Th-232 | 2.3744E-10 | 25.77 | 51.54 | 0.00E+00 | 6.12E-09 | 1.22E-08 | | |
| Tl-208 | 1.9459E-08 | 25.77 | 51.54 | 0.00E+00 | 5.01E-07 | 1.00E-06 | | |
| U-232 | 5.6015E-08 | 25.77 | 51.54 | 0.00E+00 | 1.44E-06 | 2.89E-06 | Thermal Power | |
| U-233 | 1.3132E-07 | 25.77 | 51.54 | 0.00E+00 | 3.38E-06 | 6.77E-06 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 1.7323E-07 | 25.77 | 51.54 | 0.00E+00 | 4.46E-06 | 8.93E-06 | 1.29E+00 | 2.59E+00 |
| U-235 | -2.6159E-06 | 25.77 | 0.00 | 2.33E-04 | 1.66E-04 | 2.33E-04 | Total | Total |
| U-236 | 1.2717E-05 | 25.77 | 51.54 | 0.00E+00 | 3.28E-04 | 6.55E-04 | | |
| U-238 | -3.8857E-08 | 25.77 | 0.00 | 1.45E-04 | 1.44E-04 | 1.45E-04 | | |
| Y-90 | 2.6015E+00 | 25.77 | 51.54 | 0.00E+00 | 6.70E+01 | 1.34E+02 | | |
| Other Radonucleides | | | | | 9.80E+01 | 1.96E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| | From SFD | Used | |
| Reactor Moderator: | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding: | ALUM | ALUM | |
| BOL HM Constituents: | U | U | |
| BOL Enrichment %: | 19.9999834 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | | 25.77 | |
| Bounding | | 51.54 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 1.29 | | |
| Bounding | 2.58 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT).

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD (ALUM) KSU
 SNF ID #: 871
 Fuel Units & Descr 61 - ELEMENT
 Heavy Metal Mass BOL=11.285kg EOL=11.206kg
 ROD Storage Site INEEL

¹Fuel decay start date 1973
 Estimates as of 2030
 Template TRIGA-AI (LW/U-Zr Alum, 10 to 20%, U)
²Template Burnup(MWd) 6.65
 Template BOL Heavy Metal Mass (MT) 0.00018
 Template Decay Time 50 years

Estimated
 Canister usage
 18"x10"
 0.55

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | Cv/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.6842E-09 | 109.98 | 219.97 | 0.00E+00 | 9.55E-07 | 1.91E-06 | Avg MeV | |
| Am-241 | 4.9459E-03 | 109.98 | 219.97 | 0.00E+00 | 5.44E-01 | 1.09E+00 | 0.0150 | 1.079E+13 |
| Am-242m | 1.6241E-06 | 109.98 | 219.97 | 0.00E+00 | 1.79E-04 | 3.57E-04 | 0.0250 | 2.236E+12 |
| Am-243 | 2.3233E-07 | 109.98 | 219.97 | 0.00E+00 | 2.56E-05 | 5.11E-05 | 0.0375 | 2.018E+12 |
| C-14 | 4.3083E-05 | 109.98 | 219.97 | 0.00E+00 | 4.74E-03 | 9.48E-03 | 0.0575 | 2.112E+12 |
| Cl-36 | 4.3023E-08 | 109.98 | 219.97 | 0.00E+00 | 4.73E-06 | 9.46E-06 | 0.0850 | 1.260E+12 |
| Cm-243 | 9.1880E-08 | 109.98 | 219.97 | 0.00E+00 | 1.01E-05 | 2.02E-05 | 0.1250 | 9.348E+11 |
| Cm-244 | 5.6346E-07 | 109.98 | 219.97 | 0.00E+00 | 6.20E-05 | 1.24E-04 | 0.2250 | 1.106E+12 |
| Co-60 | 8.3699E-05 | 109.98 | 219.97 | 0.00E+00 | 9.21E-03 | 1.84E-02 | 0.3750 | 4.770E+11 |
| Cs-134 | 2.8211E-08 | 109.98 | 219.97 | 0.00E+00 | 3.10E-06 | 6.21E-06 | 0.5750 | 8.009E+12 |
| Cs-135 | 3.1549E-05 | 109.98 | 219.97 | 0.00E+00 | 3.47E-03 | 6.94E-03 | 0.8500 | 2.181E+11 |
| Cs-137 | 9.7519E-01 | 109.98 | 219.97 | 0.00E+00 | 1.07E+02 | 2.15E+02 | 1.2500 | 1.844E+11 |
| Eu-154 | 3.5970E-02 | 109.98 | 219.97 | 0.00E+00 | 3.96E+00 | 7.91E+00 | 1.7500 | 6.611E+09 |
| Eu-155 | 8.1774E-04 | 109.98 | 219.97 | 0.00E+00 | 8.99E-02 | 1.80E-01 | 2.2500 | 2.242E+05 |
| Fe-55 | 5.3940E-08 | 109.98 | 219.97 | 0.00E+00 | 5.93E-06 | 1.19E-05 | 2.7500 | 1.059E+05 |
| H-3 | 8.6571E-04 | 109.98 | 219.97 | 0.00E+00 | 9.52E-02 | 1.90E-01 | 3.5000 | 3.053E+02 |
| I-129 | 7.3805E-07 | 109.98 | 219.97 | 0.00E+00 | 8.12E-05 | 1.62E-04 | 5.0000 | 1.285E+02 |
| Kr-85 | 1.3771E-02 | 109.98 | 219.97 | 0.00E+00 | 1.51E+00 | 3.03E+00 | 7.0000 | 1.450E+01 |
| Np-237 | 1.5218E-06 | 109.98 | 219.97 | 0.00E+00 | 1.67E-04 | 3.35E-04 | 11.0000 | 1.649E+00 |
| Pa-231 | 1.4152E-08 | 109.98 | 219.97 | 0.00E+00 | 1.56E-06 | 3.11E-06 | | |
| Pb-210 | 7.9774E-13 | 109.98 | 219.97 | 0.00E+00 | 8.77E-11 | 1.75E-10 | | |
| Pm-147 | 1.4362E-05 | 109.98 | 219.97 | 0.00E+00 | 1.58E-03 | 3.16E-03 | | |
| Pu-238 | 9.4782E-04 | 109.98 | 219.97 | 0.00E+00 | 1.04E-01 | 2.08E-01 | | |
| Pu-239 | 5.6872E-03 | 109.98 | 219.97 | 0.00E+00 | 6.26E-01 | 1.25E+00 | | |
| Pu-240 | 2.2541E-03 | 109.98 | 219.97 | 0.00E+00 | 2.48E-01 | 4.96E-01 | | |
| Pu-241 | 1.4433E-02 | 109.98 | 219.97 | 0.00E+00 | 1.59E+00 | 3.17E+00 | | |
| Pu-242 | 3.0602E-07 | 109.98 | 219.97 | 0.00E+00 | 3.37E-05 | 6.73E-05 | | |
| Ra-226 | 1.8857E-12 | 109.98 | 219.97 | 0.00E+00 | 2.07E-10 | 4.15E-10 | | |
| Ra-228 | 2.3729E-10 | 109.98 | 219.97 | 0.00E+00 | 2.61E-08 | 5.22E-08 | | |
| Ru-106 | 3.4857E-15 | 109.98 | 219.97 | 0.00E+00 | 3.83E-13 | 7.67E-13 | | |
| Se-79 | 1.2931E-05 | 109.98 | 219.97 | 0.00E+00 | 1.42E-03 | 2.84E-03 | | |
| Sn-126 | 1.2235E-05 | 109.98 | 219.97 | 0.00E+00 | 1.35E-03 | 2.69E-03 | | |
| Sr-90 | 8.9173E-01 | 109.98 | 219.97 | 0.00E+00 | 9.81E+01 | 1.96E+02 | | |
| Tc-99 | 4.4120E-04 | 109.98 | 219.97 | 0.00E+00 | 4.85E-02 | 9.71E-02 | | |
| Th-229 | 8.2752E-10 | 109.98 | 219.97 | 0.00E+00 | 9.10E-08 | 1.82E-07 | | |
| Th-230 | 1.4908E-10 | 109.98 | 219.97 | 0.00E+00 | 1.64E-08 | 3.28E-08 | | |
| Th-232 | 2.3744E-10 | 109.98 | 219.97 | 0.00E+00 | 2.61E-08 | 5.22E-08 | | |
| Ti-208 | 1.3668E-08 | 109.98 | 219.97 | 0.00E+00 | 1.50E-06 | 3.01E-06 | | |
| U-232 | 3.6797E-08 | 109.98 | 219.97 | 0.00E+00 | 4.05E-06 | 8.09E-06 | Thermal Power | |
| U-233 | 1.3164E-07 | 109.98 | 219.97 | 0.00E+00 | 1.45E-05 | 2.90E-05 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 3.3865E-07 | 109.98 | 219.97 | 0.00E+00 | 3.72E-05 | 7.45E-05 | 1.26E+00 | 2.53E+00 |
| U-235 | -2.6144E-06 | 109.98 | 0.00 | 4.88E-03 | 4.59E-03 | 4.88E-03 | Total | Total |
| U-236 | 1.2722E-05 | 109.98 | 219.97 | 0.00E+00 | 1.40E-03 | 2.80E-03 | | |
| U-238 | -3.8857E-08 | 109.98 | 0.00 | 3.03E-03 | 3.03E-03 | 3.03E-03 | | |
| Y-90 | 8.9203E-01 | 109.98 | 219.97 | 0.00E+00 | 9.81E+01 | 1.96E+02 | | |
| Other Radionuclides | | | | | 1.23E+02 | 2.46E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|---|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator Fuel Cladding BOL HM Constituents BOL Enrichment % | From SFD | Used | |
| | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| | ALUM | ALUM | |
| | U | U | |
| | 20 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| Nominal Bounding | From SFD | Estimated | |
| | 109.98 | 75.69 | |
| | | 219.97 | Nominal burnup taken directly from SFD (converted to MWd) Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|---------------------|-------------------|-----------------------------------|-------------------------------|
| Nominal Bounding | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| | 0.26 | 0.69 | |
| | 0.53 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD (ALUM) MSU
SNF ID #: 878
Fuel Units & Descr: 58 - ELEMENT
Heavy Metal Mass: BOL=10 73kg; EOL=10 655kg
ROD Storage Site: INEEL

¹Fuel decay start date: 1973
Estimates as of: 2030
Template: TRIGA-AJ (LW/U-Zrx, Alum, 10 to 20% U)
²Template Burnup(MWd): 6 65
Template BOL Heavy Metal Mass (MT): 0 00018
Template Decay Time: 50 years

Estimated
Canister usage:
18"x10"
0 52

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| | m | x _n | x _b | b | y _n | y _b | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | | |
| Ac-227 | 8 6842E-09 | 71 97 | 143 94 | 0 00E+00 | 6 25E-07 | 1 25E-06 | Avg. MeV | |
| Am-241 | 4 9459E-03 | 71 97 | 143 94 | 0 00E+00 | 3 56E-01 | 7 12E-01 | 0 0150 | 7 058E+12 |
| Am-242m | 1 6241E-06 | 71 97 | 143 94 | 0 00E+00 | 1 17E-04 | 2 34E-04 | 0 0250 | 1 463E+12 |
| Am-243 | 2 3233E-07 | 71 97 | 143 94 | 0 00E+00 | 1 67E-05 | 3 34E-05 | 0 0375 | 1 321E+12 |
| C-14 | 4 3083E-05 | 71 97 | 143 94 | 0 00E+00 | 3 10E-03 | 6 20E-03 | 0 0575 | 1 382E+12 |
| Cf-252 | 4 3023E-08 | 71 97 | 143 94 | 0 00E+00 | 3 10E-06 | 6 19E-06 | 0 0850 | 8 244E+11 |
| Cm-243 | 9 1880E-08 | 71 97 | 143 94 | 0 00E+00 | 6 61E-06 | 1 32E-05 | 0 1250 | 6 117E+11 |
| Cm-244 | 5 6346E-07 | 71 97 | 143 94 | 0 00E+00 | 4 06E-05 | 8 11E-05 | 0 2250 | 7 235E+11 |
| Co-60 | 8 3699E-05 | 71 97 | 143 94 | 0 00E+00 | 6 02E-03 | 1 20E-02 | 0 3750 | 3 122E+11 |
| Cs-134 | 2 8211E-08 | 71 97 | 143 94 | 0 00E+00 | 2 03E-06 | 4 06E-06 | 0 5750 | 5 241E+12 |
| Cs-135 | 3 1549E-05 | 71 97 | 143 94 | 0 00E+00 | 2 27E-03 | 4 54E-03 | 0 8500 | 1 427E+11 |
| Cs-137 | 9 7519E-01 | 71 97 | 143 94 | 0 00E+00 | 7 02E+01 | 1 40E+02 | 1 2500 | 1 206E+11 |
| Eu-154 | 3 5970E-02 | 71 97 | 143 94 | 0 00E+00 | 2 59E+00 | 5 18E+00 | 1 7500 | 4 326E+09 |
| Eu-155 | 8 1774E-04 | 71 97 | 143 94 | 0 00E+00 | 5 89E-02 | 1 18E-01 | 2 2500 | 1 467E+05 |
| Fe-55 | 5 3940E-08 | 71 97 | 143 94 | 0 00E+00 | 3 88E-06 | 7 76E-06 | 2 7500 | 6 933E+04 |
| H-3 | 8 6571E-04 | 71 97 | 143 94 | 0 00E+00 | 6 23E-02 | 1 25E-01 | 3 5000 | 2 046E+02 |
| I-129 | 7 3805E-07 | 71 97 | 143 94 | 0 00E+00 | 5 31E-05 | 1 06E-04 | 5 0000 | 8 619E+01 |
| Kr-85 | 1 3771E-02 | 71 97 | 143 94 | 0 00E+00 | 9 91E-01 | 1 98E+00 | 7 0000 | 9 729E+00 |
| Np-237 | 1 5218E-06 | 71 97 | 143 94 | 0 00E+00 | 1 10E-04 | 2 19E-04 | 11 0000 | 1 106E+00 |
| Pa-231 | 1 4152E-08 | 71 97 | 143 94 | 0 00E+00 | 1 02E-06 | 2 04E-06 | | |
| Pb-210 | 7 9774E-13 | 71 97 | 143 94 | 0 00E+00 | 5 74E-11 | 1 15E-10 | | |
| Pm-147 | 1 4362E-05 | 71 97 | 143 94 | 0 00E+00 | 1 03E-03 | 2 07E-03 | | |
| Pu-238 | 9 4782E-04 | 71 97 | 143 94 | 0 00E+00 | 6 82E-02 | 1 36E-01 | | |
| Pu-239 | 5 6872E-03 | 71 97 | 143 94 | 0 00E+00 | 4 09E-01 | 8 19E-01 | | |
| Pu-240 | 2 2541E-03 | 71 97 | 143 94 | 0 00E+00 | 1 62E-01 | 3 24E-01 | | |
| Pu-241 | 1 4433E-02 | 71 97 | 143 94 | 0 00E+00 | 1 04E+00 | 2 08E+00 | | |
| Pu-242 | 3 0602E-07 | 71 97 | 143 94 | 0 00E+00 | 2 20E-05 | 4 40E-05 | | |
| Ra-226 | 1 8857E-12 | 71 97 | 143 94 | 0 00E+00 | 1 36E-10 | 2 71E-10 | | |
| Ra-228 | 2 3729E-10 | 71 97 | 143 94 | 0 00E+00 | 1 71E-08 | 3 42E-08 | | |
| Ru-106 | 3 4857E-15 | 71 97 | 143 94 | 0 00E+00 | 2 51E-13 | 5 02E-13 | | |
| Se-79 | 1 2931E-05 | 71 97 | 143 94 | 0 00E+00 | 9 31E-04 | 1 86E-03 | | |
| Sn-126 | 1 2235E-05 | 71 97 | 143 94 | 0 00E+00 | 8 81E-04 | 1 76E-03 | | |
| Sr-90 | 8 9173E-01 | 71 97 | 143 94 | 0 00E+00 | 6 42E+01 | 1 28E+02 | | |
| Tc-99 | 4 4120E-04 | 71 97 | 143 94 | 0 00E+00 | 3 18E-02 | 6 35E-02 | | |
| Th-229 | 8 2752E-10 | 71 97 | 143 94 | 0 00E+00 | 5 96E-08 | 1 19E-07 | | |
| Th-230 | 1 4908E-10 | 71 97 | 143 94 | 0 00E+00 | 1 07E-08 | 2 15E-08 | | |
| Th-232 | 2 3744E-10 | 71 97 | 143 94 | 0 00E+00 | 1 71E-08 | 3 42E-08 | | |
| Th-208 | 1 3668E-08 | 71 97 | 143 94 | 0 00E+00 | 9 84E-07 | 1 97E-06 | | |
| U-232 | 3 6797E-08 | 71 97 | 143 94 | 0 00E+00 | 2 65E-06 | 5 30E-06 | Thermal Power | |
| U-233 | 1 3164E-07 | 71 97 | 143 94 | 0 00E+00 | 9 47E-06 | 1 89E-05 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 3 3865E-07 | 71 97 | 143 94 | 0 00E+00 | 2 44E-05 | 4 87E-05 | 8 28E-01 | 1 65E+00 |
| U-235 | -2 6144E-06 | 71 97 | 0 00 | 4 64E-03 | 4 45E-03 | 4 64E-03 | Total | Total |
| U-236 | 1 2722E-05 | 71 97 | 143 94 | 0 00E+00 | 9 16E-04 | 1 83E-03 | | |
| U-238 | -3 8857E-08 | 71 97 | 0 00 | 2 89E-03 | 2 88E-03 | 2 89E-03 | | |
| Y-90 | 8 9203E-01 | 71 97 | 143 94 | 0 00E+00 | 6 42E+01 | 1 28E+02 | | |
| Other Radionuclides | | | | | 8 04E+01 | 1 61E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator: | From SFD | Used | |
| | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 | 10 to 20 1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 52.29 | 71 97 | |
| Bounding | | 143 94 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|--------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0 18 | 1 38 | |
| Bounding | 0 36 | | 1 00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD (ALUM) REED COLLEGE
SNF ID # 256
Fuel Units & Descr. 58 - ELEMENT
Heavy Metal Mass BOL=10.927kg EOL=10.887kg
ROD Storage Site INEEL

¹Fuel decay start date 2026
Estimates as of 2030
Template TRIGA-AI (LW/U-Zrx Alum, 10 to 20% U)
²Template Burnup(MWd) 6.65
Template BOL Heavy Metal Mass (MT) 0.00018
Template Decay Time 5 years

Estimated
Canister usage
18"x10"
0.52

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| | m | x _a | x _b | b | y _a | y _b | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Avg MeV | |
| Ac-227 | 8.0632E-10 | 53.25 | 106.50 | 0.00E+00 | 4.29E-08 | 8.59E-08 | 0.0150 | 1.802E+13 |
| Am-241 | 2.2586E-03 | 53.25 | 106.50 | 0.00E+00 | 1.20E-01 | 2.41E-01 | 0.0250 | 3.912E+12 |
| Am-242m | 1.9925E-06 | 53.25 | 106.50 | 0.00E+00 | 1.06E-04 | 2.12E-04 | 0.0375 | 4.873E+12 |
| Am-243 | 2.3323E-07 | 53.25 | 106.50 | 0.00E+00 | 1.24E-05 | 2.48E-05 | 0.0575 | 3.736E+12 |
| C-14 | 4.3308E-05 | 53.25 | 106.50 | 0.00E+00 | 2.31E-03 | 4.61E-03 | 0.0850 | 2.615E+12 |
| Cl-36 | 4.3023E-08 | 53.25 | 106.50 | 0.00E+00 | 2.29E-06 | 4.58E-06 | 0.1250 | 3.911E+12 |
| Cm-243 | 2.7429E-07 | 53.25 | 106.50 | 0.00E+00 | 1.46E-05 | 2.92E-05 | 0.2250 | 2.183E+12 |
| Cm-244 | 3.1504E-06 | 53.25 | 106.50 | 0.00E+00 | 1.68E-04 | 3.36E-04 | 0.3750 | 9.716E+11 |
| Co-60 | 3.1008E-02 | 53.25 | 106.50 | 0.00E+00 | 1.65E+00 | 3.30E+00 | 0.5750 | 1.232E+13 |
| Cs-134 | 1.0367E-01 | 53.25 | 106.50 | 0.00E+00 | 5.52E+00 | 1.10E+01 | 0.8500 | 3.032E+12 |
| Cs-135 | 3.1549E-05 | 53.25 | 106.50 | 0.00E+00 | 1.68E-03 | 3.36E-03 | 1.2500 | 3.143E+12 |
| Cs-137 | 2.7564E+00 | 53.25 | 106.50 | 0.00E+00 | 1.47E+02 | 2.94E+02 | 1.7500 | 8.995E+10 |
| Eu-154 | 1.3490E+00 | 53.25 | 106.50 | 0.00E+00 | 7.18E+01 | 1.44E+02 | 2.2500 | 1.093E+10 |
| Eu-155 | 4.3880E-01 | 53.25 | 106.50 | 0.00E+00 | 2.34E+01 | 4.67E+01 | 2.7500 | 8.881E+07 |
| Fe-55 | 8.6782E-03 | 53.25 | 106.50 | 0.00E+00 | 4.62E-01 | 9.24E-01 | 3.5000 | 1.038E+07 |
| H-3 | 1.0805E-02 | 53.25 | 106.50 | 0.00E+00 | 5.75E-01 | 1.15E+00 | 5.0000 | 6.755E+01 |
| I-129 | 7.3805E-07 | 53.25 | 106.50 | 0.00E+00 | 3.93E-05 | 7.86E-05 | 7.0000 | 7.658E+00 |
| Kr-85 | 2.5218E-01 | 53.25 | 106.50 | 0.00E+00 | 1.34E+01 | 2.69E+01 | 11.0000 | 8.730E-01 |
| Np-237 | 1.4463E-06 | 53.25 | 106.50 | 0.00E+00 | 7.70E-05 | 1.54E-04 | | |
| Pa-231 | 3.5970E-09 | 53.25 | 106.50 | 0.00E+00 | 1.92E-07 | 3.83E-07 | | |
| Pb-210 | 8.2511E-15 | 53.25 | 106.50 | 0.00E+00 | 4.39E-13 | 8.79E-13 | | |
| Pm-147 | 2.0767E+00 | 53.25 | 106.50 | 0.00E+00 | 1.11E+02 | 2.21E+02 | | |
| Pu-238 | 1.3514E-03 | 53.25 | 106.50 | 0.00E+00 | 7.20E-02 | 1.44E-01 | | |
| Pu-239 | 5.6947E-03 | 53.25 | 106.50 | 0.00E+00 | 3.03E-01 | 6.06E-01 | | |
| Pu-240 | 2.2647E-03 | 53.25 | 106.50 | 0.00E+00 | 1.21E-01 | 2.41E-01 | | |
| Pu-241 | 1.2574E-01 | 53.25 | 106.50 | 0.00E+00 | 6.70E+00 | 1.34E+01 | | |
| Pu-242 | 3.0602E-07 | 53.25 | 106.50 | 0.00E+00 | 1.63E-05 | 3.26E-05 | | |
| Ra-226 | 5.7353E-14 | 53.25 | 106.50 | 0.00E+00 | 3.05E-12 | 6.11E-12 | | |
| Ra-228 | 1.8150E-10 | 53.25 | 106.50 | 0.00E+00 | 9.66E-09 | 1.93E-08 | | |
| Ru-106 | 9.3744E-02 | 53.25 | 106.50 | 0.00E+00 | 4.99E+00 | 9.98E+00 | | |
| Se-79 | 1.2938E-05 | 53.25 | 106.50 | 0.00E+00 | 6.89E-04 | 1.38E-03 | | |
| Sn-126 | 1.2239E-05 | 53.25 | 106.50 | 0.00E+00 | 6.52E-04 | 1.30E-03 | | |
| Sr-90 | 2.6000E+00 | 53.25 | 106.50 | 0.00E+00 | 1.38E+02 | 2.77E+02 | | |
| Tc-99 | 4.4120E-04 | 53.25 | 106.50 | 0.00E+00 | 2.35E-02 | 4.70E-02 | | |
| Th-229 | 1.4749E-10 | 53.25 | 106.50 | 0.00E+00 | 7.85E-09 | 1.57E-08 | | |
| Th-230 | 1.9549E-11 | 53.25 | 106.50 | 0.00E+00 | 1.04E-09 | 2.08E-09 | | |
| Th-232 | 2.3744E-10 | 53.25 | 106.50 | 0.00E+00 | 1.26E-08 | 2.53E-08 | | |
| Ti-208 | 1.9459E-08 | 53.25 | 106.50 | 0.00E+00 | 1.04E-06 | 2.07E-06 | | |
| U-232 | 5.6015E-08 | 53.25 | 106.50 | 0.00E+00 | 2.98E-06 | 5.97E-06 | | |
| U-233 | 1.3132E-07 | 53.25 | 106.50 | 0.00E+00 | 6.99E-06 | 1.40E-05 | | |
| U-234 | 1.7323E-07 | 53.25 | 106.50 | 0.00E+00 | 9.22E-06 | 1.84E-05 | | |
| U-235 | -2.6159E-06 | 53.25 | 0.00 | 4.70E-03 | 4.56E-03 | 4.70E-03 | | |
| U-236 | 1.2717E-05 | 53.25 | 106.50 | 0.00E+00 | 6.77E-04 | 1.35E-03 | | |
| U-238 | -3.8857E-08 | 53.25 | 0.00 | 2.94E-03 | 2.94E-03 | 2.94E-03 | | |
| Y-90 | 2.6015E+00 | 53.25 | 106.50 | 0.00E+00 | 1.39E+02 | 2.77E+02 | | |
| Other Radionuclides | | | | | 2.02E+02 | 4.05E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences |
|----------------------------|-----------------------|-----------------------|---------------------------------|
| Reactor Moderator | From SFD | Used | |
| | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19.89205598 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 53.25 | 38.75 | |
| Bounding | | 106.50 | Nominal burnup taken directly from SFD (converted to MWd) Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|--------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0.13 | 0.73 | |
| Bounding | 0.26 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD (ALUM) SLOVENIA
SNF ID #: 468
Fuel Units & Descr: 67 - ELEMENT
Heavy Metal Mass: BOL=11 879kg, EOL=11 531kg
ROD Storage Site: INEEL

¹Fuel decay start date: 1999
Estimates as of: 2030
Template: TRIGA-AI (LW/U Zrx, Alum, 10 to 20%, U)
²Template Burnup(MWd): 6 65
Template BOL Heavy Metal Mass (MT): 0 00018
Template Decay Time: 25 years

Estimated
Canister usage
18"x10"
0 60

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 3 8271E-09 | 405.21 | 810 42 | 0 00E+00 | 1 55E-06 | 3 10E-06 | Avg MeV | |
| Am-241 | 4 4195E-03 | 405.21 | 810 42 | 0 00E+00 | 1 79E+00 | 3 58E+00 | 0 0150 | 7 324E+13 |
| Am-242m | 1 8195E-06 | 405.21 | 810 42 | 0 00E+00 | 7 37E-04 | 1 47E-03 | 0 0250 | 1 513E+13 |
| Am-243 | 2 3278E-07 | 405.21 | 810 42 | 0 00E+00 | 9 43E-05 | 1 89E-04 | 0 0375 | 1 515E+13 |
| C-14 | 4 3203E-05 | 405.21 | 810 42 | 0 00E+00 | 1 75E-02 | 3 50E-02 | 0 0575 | 1 453E+13 |
| Cl-36 | 4 3023E-08 | 405.21 | 810 42 | 0 00E+00 | 1 74E-05 | 3 49E-05 | 0 0850 | 8 741E+12 |
| Cm-243 | 1 6872E-07 | 405.21 | 810 42 | 0 00E+00 | 6 84E-05 | 1 37E-04 | 0 1250 | 8 886E+12 |
| Cm-244 | 1 4660E-06 | 405.21 | 810 42 | 0 00E+00 | 5 94E-04 | 1 19E-03 | 0 2250 | 7 908E+12 |
| Co-60 | 2 2376E-03 | 405.21 | 810 42 | 0 00E+00 | 9 07E-01 | 1 81E+00 | 0.3750 | 3.289E+12 |
| Cs-134 | 1 2525E-04 | 405.21 | 810 42 | 0 00E+00 | 5 08E-02 | 1 02E-01 | 0 5750 | 5 320E+13 |
| Cs-135 | 3 1549E-05 | 405.21 | 810 42 | 0 00E+00 | 1 28E-02 | 2 56E-02 | 0 8500 | 4 391E+12 |
| Cs-137 | 1 7368E+00 | 405.21 | 810 42 | 0 00E+00 | 7 04E+02 | 1 41E+03 | 1 2500 | 4 607E+12 |
| Eu-154 | 2 6947E-01 | 405.21 | 810 42 | 0 00E+00 | 1 09E+02 | 2 18E+02 | 1 7500 | 1 410E+11 |
| Eu-155 | 2 6857E-02 | 405.21 | 810 42 | 0 00E+00 | 1 09E+01 | 2 18E+01 | 2 2500 | 2 164E+06 |
| Fe-55 | 4 2105E-05 | 405.21 | 810 42 | 0 00E+00 | 1 71E-02 | 3 41E-02 | 2 7500 | 4 983E+05 |
| H-3 | 3 5173E-03 | 405.21 | 810 42 | 0 00E+00 | 1 43E+00 | 2 85E+00 | 3 5000 | 1 181E+03 |
| I-129 | 7 3805E-07 | 405.21 | 810 42 | 0 00E+00 | 2 99E-04 | 5 98E-04 | 5 0000 | 4 616E+02 |
| Kr-85 | 6 9263E-02 | 405.21 | 810 42 | 0 00E+00 | 2 81E+01 | 5 61E+01 | 7 0000 | 5.207E+01 |
| Np-237 | 1 4752E-06 | 405.21 | 810 42 | 0 00E+00 | 5 98E-04 | 1 20E-03 | 11 0000 | 5 920E+00 |
| Pa-231 | 8 3970E-09 | 405.21 | 810 42 | 0 00E+00 | 3 40E-06 | 6 81E-06 | | |
| Pb-210 | 1 4995E-13 | 405.21 | 810 42 | 0 00E+00 | 6 08E-11 | 1 22E-10 | | |
| Pm-147 | 1 0567E-02 | 405.21 | 810 42 | 0 00E+00 | 4 28E+00 | 8 56E+00 | | |
| Pu-238 | 1 1543E-03 | 405.21 | 810 42 | 0 00E+00 | 4 68E-01 | 9 35E-01 | | |
| Pu-239 | 5 6917E-03 | 405.21 | 810 42 | 0 00E+00 | 2 31E+00 | 4 61E+00 | | |
| Pu-240 | 2 2602E-03 | 405.21 | 810 42 | 0 00E+00 | 9 16E-01 | 1 83E+00 | | |
| Pu-241 | 4 8045E-02 | 405.21 | 810 42 | 0 00E+00 | 1 95E+01 | 3 89E+01 | | |
| Pu-242 | 3 0602E-07 | 405.21 | 810 42 | 0 00E+00 | 1 24E-04 | 2 48E-04 | | |
| Ra-226 | 5 1293E-13 | 405.21 | 810 42 | 0 00E+00 | 2 08E-10 | 4 16E-10 | | |
| Ra-228 | 2 3323E-10 | 405.21 | 810 42 | 0 00E+00 | 9 45E-08 | 1 89E-07 | | |
| Ru-106 | 1 0075E-07 | 405.21 | 810 42 | 0 00E+00 | 4 08E-05 | 8 17E-05 | | |
| Se-79 | 1 2935E-05 | 405.21 | 810 42 | 0 00E+00 | 5 24E-03 | 1 05E-02 | | |
| Sn-126 | 1 2238E-05 | 405.21 | 810 42 | 0 00E+00 | 4 96E-03 | 9 92E-03 | | |
| Sr-90 | 1 6165E+00 | 405.21 | 810 42 | 0 00E+00 | 6 55E+02 | 1 31E+03 | | |
| Tc-99 | 4 4120E-04 | 405.21 | 810 42 | 0 00E+00 | 1 79E-01 | 3 58E-01 | | |
| Th-229 | 4 5684E-10 | 405.21 | 810 42 | 0 00E+00 | 1 85E-07 | 3 70E-07 | | |
| Th-230 | 6 8271E-11 | 405.21 | 810 42 | 0 00E+00 | 2 77E-08 | 5 53E-08 | | |
| Th-232 | 2 3744E-10 | 405.21 | 810 42 | 0 00E+00 | 9 62E-08 | 1 92E-07 | | |
| Th-208 | 1 7368E-08 | 405.21 | 810 42 | 0 00E+00 | 7 04E-06 | 1 41E-05 | | |
| U-232 | 4 6797E-08 | 405.21 | 810 42 | 0 00E+00 | 1 90E-05 | 3 79E-05 | | |
| U-233 | 1 3146E-07 | 405.21 | 810 42 | 0 00E+00 | 5 33E-05 | 1 07E-04 | | |
| U-234 | 2 5729E-07 | 405.21 | 810 42 | 0 00E+00 | 1 04E-04 | 2 09E-04 | | |
| U-235 | -2 6159E-06 | 405.21 | 0 00 | 5 14E-03 | 4 08E-03 | 5 14E-03 | | |
| U-236 | 1 2719E-05 | 405.21 | 810 42 | 0 00E+00 | 5 15E-03 | 1 03E-02 | | |
| U-238 | -3 8857E-08 | 405.21 | 0 00 | 3 19E-03 | 3 18E-03 | 3 19E-03 | | |
| Y-90 | 1 6165E+00 | 405.21 | 810 42 | 0 00E+00 | 6 55E+02 | 1 31E+03 | | |
| Other Radionuclides | | | | | 7 63E+02 | 1 53E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------------------|-------------------------------|----------------------------------|
| Reactor Moderator | From SFD LW AND U ZIRC HYDRIDE | Used LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 00337313 | 10 to 20 1 | |

| Burnup Summary (MWd) ¹ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 405.21 | 332.55 | Nominal burnup taken directly from SFD (converted to MWd) |
| Bounding | | 810 42 | Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0.92 | 0.82 | 0.99 |
| Bounding | 1.85 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD (ALUM) SO KOREA
SNF ID # 483
Fuel Units & Descr 69 - ELEMENT
Heavy Metal Mass BOL=13.11kg EOL=12.958kg
ROD Storage Site INEEL

Fuel decay start date 1972
Estimates as of 2030
Template TRIGA-AI (LW/U-Zrx Alum, 10 to 20% U)
*Template Burnup(MWd): 6.65
Template BOL Heavy Metal Mass (MT) 0.00018
Template Decay Time 50 years

Estimated
Canister usage:
18"x10"
0.62

| II. Estimates | m | x _n | x ₀ | b | y _n | y ₀ | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | CvMWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.6842E-09 | 383.31 | 766.62 | 0.00E+00 | 3.33E-06 | 6.66E-06 | Avg MeV | |
| Am-241 | 4.9459E-03 | 383.31 | 766.62 | 0.00E+00 | 1.90E+00 | 3.79E+00 | 0.0150 | 3.759E+13 |
| Am-242m | 1.6241E-06 | 383.31 | 766.62 | 0.00E+00 | 6.23E-04 | 1.25E-03 | 0.0250 | 7.793E+12 |
| Am-243 | 2.3233E-07 | 383.31 | 766.62 | 0.00E+00 | 8.91E-05 | 1.78E-04 | 0.0375 | 7.033E+12 |
| C-14 | 4.3083E-05 | 383.31 | 766.62 | 0.00E+00 | 1.65E-02 | 3.30E-02 | 0.0575 | 7.360E+12 |
| Cl-36 | 4.3023E-08 | 383.31 | 766.62 | 0.00E+00 | 1.65E-05 | 3.30E-05 | 0.0850 | 4.391E+12 |
| Cm-243 | 9.1880E-08 | 383.31 | 766.62 | 0.00E+00 | 3.52E-05 | 7.04E-05 | 0.1250 | 3.258E+12 |
| Cm-244 | 5.6346E-07 | 383.31 | 766.62 | 0.00E+00 | 2.16E-04 | 4.32E-04 | 0.2250 | 3.853E+12 |
| Co-60 | 8.3699E-05 | 383.31 | 766.62 | 0.00E+00 | 3.21E-02 | 6.42E-02 | 0.3750 | 1.663E+12 |
| Cs-134 | 2.8211E-08 | 383.31 | 766.62 | 0.00E+00 | 1.08E-05 | 2.16E-05 | 0.5750 | 2.791E+13 |
| Cs-135 | 3.1549E-05 | 383.31 | 766.62 | 0.00E+00 | 1.21E-02 | 2.42E-02 | 0.8500 | 7.601E+11 |
| Cs-137 | 9.7519E-01 | 383.31 | 766.62 | 0.00E+00 | 3.74E+02 | 7.48E+02 | 1.2500 | 6.425E+11 |
| Eu-154 | 3.5970E-02 | 383.31 | 766.62 | 0.00E+00 | 1.38E+01 | 2.76E+01 | 1.7500 | 2.304E+10 |
| Eu-155 | 8.1774E-04 | 383.31 | 766.62 | 0.00E+00 | 3.13E-01 | 6.27E-01 | 2.2500 | 7.812E+05 |
| Fe-55 | 5.3940E-08 | 383.31 | 766.62 | 0.00E+00 | 2.07E-05 | 4.14E-05 | 2.7500 | 3.692E+05 |
| H-3 | 8.6571E-04 | 383.31 | 766.62 | 0.00E+00 | 3.32E-01 | 6.64E-01 | 3.5000 | 1.026E+03 |
| I-129 | 7.3805E-07 | 383.31 | 766.62 | 0.00E+00 | 2.83E-04 | 5.66E-04 | 5.0000 | 4.317E+02 |
| Kr-85 | 1.3771E-02 | 383.31 | 766.62 | 0.00E+00 | 5.28E+00 | 1.06E+01 | 7.0000 | 4.867E+01 |
| Np-237 | 1.5218E-06 | 383.31 | 766.62 | 0.00E+00 | 5.83E-04 | 1.17E-03 | 11.0000 | 5.530E+00 |
| Pa-231 | 1.4152E-08 | 383.31 | 766.62 | 0.00E+00 | 5.42E-06 | 1.08E-05 | | |
| Pb-210 | 7.9774E-13 | 383.31 | 766.62 | 0.00E+00 | 3.06E-10 | 6.12E-10 | | |
| Pm-147 | 1.4362E-05 | 383.31 | 766.62 | 0.00E+00 | 5.51E-03 | 1.10E-02 | | |
| Pu-238 | 9.4782E-04 | 383.31 | 766.62 | 0.00E+00 | 3.63E-01 | 7.27E-01 | | |
| Pu-239 | 5.6872E-03 | 383.31 | 766.62 | 0.00E+00 | 2.18E+00 | 4.36E+00 | | |
| Pu-240 | 2.2541E-03 | 383.31 | 766.62 | 0.00E+00 | 8.64E-01 | 1.73E+00 | | |
| Pu-241 | 1.4433E-02 | 383.31 | 766.62 | 0.00E+00 | 5.53E+00 | 1.11E+01 | | |
| Pu-242 | 3.0602E-07 | 383.31 | 766.62 | 0.00E+00 | 1.17E-04 | 2.35E-04 | | |
| Ra-226 | 1.8857E-12 | 383.31 | 766.62 | 0.00E+00 | 7.23E-10 | 1.45E-09 | | |
| Ra-228 | 2.3729E-10 | 383.31 | 766.62 | 0.00E+00 | 9.10E-08 | 1.82E-07 | | |
| Ru-106 | 3.4857E-15 | 383.31 | 766.62 | 0.00E+00 | 1.34E-12 | 2.67E-12 | | |
| Se-79 | 1.2931E-05 | 383.31 | 766.62 | 0.00E+00 | 4.96E-03 | 9.91E-03 | | |
| Sn-126 | 1.2235E-05 | 383.31 | 766.62 | 0.00E+00 | 4.69E-03 | 9.38E-03 | | |
| Sr-90 | 8.9173E-01 | 383.31 | 766.62 | 0.00E+00 | 3.42E+02 | 6.84E+02 | | |
| Tc-99 | 4.4120E-04 | 383.31 | 766.62 | 0.00E+00 | 1.69E-01 | 3.38E-01 | | |
| Th-229 | 8.2752E-10 | 383.31 | 766.62 | 0.00E+00 | 3.17E-07 | 6.34E-07 | | |
| Th-230 | 1.4908E-10 | 383.31 | 766.62 | 0.00E+00 | 5.71E-08 | 1.14E-07 | | |
| Th-232 | 2.3744E-10 | 383.31 | 766.62 | 0.00E+00 | 9.10E-08 | 1.82E-07 | | |
| Th-208 | 1.3668E-08 | 383.31 | 766.62 | 0.00E+00 | 5.24E-06 | 1.05E-05 | | |
| U-232 | 3.6797E-08 | 383.31 | 766.62 | 0.00E+00 | 1.41E-05 | 2.82E-05 | | |
| U-233 | 1.3164E-07 | 383.31 | 766.62 | 0.00E+00 | 5.05E-05 | 1.01E-04 | | |
| U-234 | 3.3865E-07 | 383.31 | 766.62 | 0.00E+00 | 1.30E-04 | 2.60E-04 | | |
| U-235 | -2.6144E-06 | 383.31 | 0.00 | 5.67E-03 | 4.66E-03 | 5.67E-03 | | |
| U-236 | 1.2722E-05 | 383.31 | 766.62 | 0.00E+00 | 4.88E-03 | 9.75E-03 | | |
| U-238 | -3.8857E-08 | 383.31 | 0.00 | 3.53E-03 | 3.51E-03 | 3.53E-03 | | |
| Y-90 | 8.9203E-01 | 383.31 | 766.62 | 0.00E+00 | 3.42E+02 | 6.84E+02 | | |
| Other Radionuclides | | | | | 4.28E+02 | 8.56E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------------------|-------------------------------|----------------------------------|
| Reactor Moderator | From SFD LW AND U ZIRC HYDRIDE | Used LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 383.31 | 144.90 | |
| Bounding | | 766.62 | Nominal burnup taken directly from SFD (converted to MWd) Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0.79 | 0.38 | |
| Bounding | 1.58 | | 0.98 |

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

*Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD (ALUM) U OF IL
 SNF ID #: 447
 Fuel Units & Descr: 58 - ELEMENT
 Heavy Metal Mass: BOL=10 44kg; EOL=10 057kg
 ROD Storage Site: INEEL

¹Fuel decay start date 2035
 Estimates as of: 2030
 Template TRIGA-AI (LW/U-Zr, Alum, 10 to 20%, U)
²Template Burnup(MWd), 6 65
 Template BOL Heavy Metal Mass (MT)* 0 00018
 Template Decay Time* 5 years

Estimated
 Canister usage
 18"x10"
 0 52

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 0632E-10 | 365 39 | 730 78 | 0 00E+00 | 2 95E-07 | 5 89E-07 | Avg MeV | |
| Am-241 | 2 2586E-03 | 365 39 | 730 78 | 0 00E+00 | 8 25E-01 | 1 65E+00 | 0 0150 | 1 236E+14 |
| Am-242m | 1 9925E-06 | 365 39 | 730 78 | 0 00E+00 | 7 28E-04 | 1 46E-03 | 0 0250 | 2 684E+13 |
| Am-243 | 2 3323E-07 | 365 39 | 730 78 | 0 00E+00 | 8 52E-05 | 1 70E-04 | 0 0375 | 3 344E+13 |
| C-14 | 4 3308E-05 | 365 39 | 730 78 | 0 00E+00 | 1 58E-02 | 3 16E-02 | 0 0575 | 2 563E+13 |
| Cl-36 | 4 3023E-08 | 365 39 | 730 78 | 0 00E+00 | 1 57E-05 | 3 14E-05 | 0 0850 | 1 794E+13 |
| Cm-243 | 2 7429E-07 | 365 39 | 730 78 | 0 00E+00 | 1 00E-04 | 2 00E-04 | 0 1250 | 2 684E+13 |
| Cm-244 | 3 1504E-06 | 365 39 | 730 78 | 0 00E+00 | 1 15E-03 | 2 30E-03 | 0 2250 | 1 498E+13 |
| Co-60 | 3 1008E-02 | 365 39 | 730 78 | 0 00E+00 | 1 13E+01 | 2 27E+01 | 0 3750 | 6 667E+12 |
| Cs-134 | 1 0367E-01 | 365 39 | 730 78 | 0 00E+00 | 3 79E+01 | 7 58E+01 | 0 5750 | 8 452E+13 |
| Cs-135 | 3 1549E-05 | 365 39 | 730 78 | 0 00E+00 | 1 15E-02 | 2 31E-02 | 0 8500 | 2 081E+13 |
| Cs-137 | 2 7564E+00 | 365 39 | 730 78 | 0 00E+00 | 1 01E+03 | 2 01E+03 | 1 2500 | 2 157E+13 |
| Eu-154 | 1 3490E+00 | 365 39 | 730 78 | 0 00E+00 | 4 93E+02 | 9 86E+02 | 1 7500 | 6 172E+11 |
| Eu-155 | 4 3880E-01 | 365 39 | 730 78 | 0 00E+00 | 1 60E+02 | 3 21E+02 | 2 2500 | 7 503E+10 |
| Fe-55 | 8 6782E-03 | 365 39 | 730 78 | 0 00E+00 | 3 17E+00 | 6 34E+00 | 2 7500 | 6 094E+08 |
| H-3 | 1 0805E-02 | 365 39 | 730 78 | 0 00E+00 | 3 95E+00 | 7 90E+00 | 3 5000 | 7 123E+07 |
| I-129 | 7 3805E-07 | 365 39 | 730 78 | 0 00E+00 | 2 70E-04 | 5 39E-04 | 5 0000 | 4 234E+02 |
| Kr-85 | 2 5218E-01 | 365 39 | 730 78 | 0 00E+00 | 9 21E+01 | 1 84E+02 | 7 0000 | 4 792E+01 |
| Np-237 | 1 4463E-06 | 365 39 | 730 78 | 0 00E+00 | 5 28E-04 | 1 06E-03 | 11 0000 | 5 458E+00 |
| Pa-231 | 3 5970E-09 | 365 39 | 730 78 | 0 00E+00 | 1 31E-06 | 2 63E-06 | | |
| Pb-210 | 8 2511E-15 | 365 39 | 730 78 | 0 00E+00 | 3 01E-12 | 6 03E-12 | | |
| Pm-147 | 2 0767E+00 | 365 39 | 730 78 | 0 00E+00 | 7 59E+02 | 1 52E+03 | | |
| Pu-238 | 1 3514E-03 | 365 39 | 730 78 | 0 00E+00 | 4 94E-01 | 9 88E-01 | | |
| Pu-239 | 5 6947E-03 | 365 39 | 730 78 | 0 00E+00 | 2 08E+00 | 4 16E+00 | | |
| Pu-240 | 2 2647E-03 | 365 39 | 730 78 | 0 00E+00 | 8 27E-01 | 1 65E+00 | | |
| Pu-241 | 1 2574E-01 | 365 39 | 730 78 | 0 00E+00 | 4 59E+01 | 9 19E+01 | | |
| Pu-242 | 3 0602E-07 | 365 39 | 730 78 | 0 00E+00 | 1 12E-04 | 2 24E-04 | | |
| Ra-226 | 5 7353E-14 | 365 39 | 730 78 | 0 00E+00 | 2 10E-11 | 4 19E-11 | | |
| Ra-228 | 1 8150E-10 | 365 39 | 730 78 | 0 00E+00 | 6 63E-08 | 1 33E-07 | | |
| Ru-106 | 9 3744E-02 | 365 39 | 730 78 | 0 00E+00 | 3 43E+01 | 6 85E+01 | | |
| Se-79 | 1 2938E-05 | 365 39 | 730 78 | 0 00E+00 | 4 73E-03 | 9 46E-03 | | |
| Sn-126 | 1 2239E-05 | 365 39 | 730 78 | 0 00E+00 | 4 47E-03 | 8 94E-03 | | |
| Sr-90 | 2 6000E+00 | 365 39 | 730 78 | 0 00E+00 | 9 50E+02 | 1 90E+03 | | |
| Tc-99 | 4 4120E-04 | 365 39 | 730 78 | 0 00E+00 | 1 61E-01 | 3 22E-01 | | |
| Th-229 | 1 4749E-10 | 365 39 | 730 78 | 0 00E+00 | 5 39E-08 | 1 08E-07 | | |
| Th-230 | 1 9549E-11 | 365 39 | 730 78 | 0 00E+00 | 7 14E-09 | 1 43E-08 | | |
| Th-232 | 2 3744E-10 | 365 39 | 730 78 | 0 00E+00 | 8 68E-08 | 1 74E-07 | | |
| Tl-208 | 1 9459E-08 | 365 39 | 730 78 | 0 00E+00 | 7 11E-06 | 1 42E-05 | | |
| U-232 | 5 6015E-08 | 365 39 | 730 78 | 0 00E+00 | 2 05E-05 | 4 09E-05 | Thermal Power | |
| U-233 | 1 3132E-07 | 365 39 | 730 78 | 0 00E+00 | 4 80E-05 | 9 60E-05 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 1 7323E-07 | 365 39 | 730 78 | 0 00E+00 | 6 33E-05 | 1 27E-04 | 1 84E+01 | 3 67E+01 |
| U-235 | -2 6159E-06 | 365 39 | 0 00 | 4 51E-03 | 3 56E-03 | 4 51E-03 | Total | Total |
| U-236 | 1 2717E-05 | 365 39 | 730 78 | 0 00E+00 | 4 65E-03 | 9 29E-03 | | |
| U-238 | -3 8857E-08 | 365 39 | 0 00 | 2 81E-03 | 2 79E-03 | 2 81E-03 | | |
| Y-90 | 2 6015E+00 | 365 39 | 730 78 | 0 00E+00 | 9 51E+02 | 1 90E+03 | | |
| Other Radionuclides | | | | | 1 39E+03 | 2 78E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------------------|-------------------------------|----------------------------------|
| Reactor Moderator | From SFD LW AND U ZIRC HYDRIDE | Used LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19 9999834 | 10 to 20 1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 203 50 | 365 39 | |
| Bounding | | 730 78 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0 95 | 1 80 | |
| Bounding | 1 89 | | 1 00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD (ALUM) U OF IL
SNF ID #: 501
Fuel Units & Descr 1 - ELEMENT
Heavy Metal Mass BOL=0 18kg EOL=0 173kg
ROD Storage Site INEEL

¹Fuel decay start date 2035
Estimates as of 2030
Template TRIGA-SS (LW/U-Zr, SST, 10 to 20%, U)
²Template Burnup(MWd) 6.65
Template BOL Heavy Metal Mass (MT) 0.000195
Template Decay Time 5 years

Estimated
Canister usage
18"x10"
0.01

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.5173E-10 | 6.30 | 12.60 | 0.00E+00 | 5.37E-09 | 1.07E-08 | Avg MeV | |
| Am-241 | 1.8331E-03 | 6.30 | 12.60 | 0.00E+00 | 1.15E-02 | 2.31E-02 | 0.0150 | 2.037E+12 |
| Am-242m | 1.4129E-06 | 6.30 | 12.60 | 0.00E+00 | 8.90E-06 | 1.78E-05 | 0.0250 | 4.481E+11 |
| Am-243 | 1.4774E-07 | 6.30 | 12.60 | 0.00E+00 | 9.31E-07 | 1.86E-06 | 0.0375 | 3.816E+11 |
| C-14 | 1.2871E-04 | 6.30 | 12.60 | 0.00E+00 | 8.11E-04 | 1.62E-03 | 0.0575 | 3.917E+11 |
| Cl-36 | 2.8120E-06 | 6.30 | 12.60 | 0.00E+00 | 1.77E-05 | 3.54E-05 | 0.0850 | 2.427E+11 |
| Cm-243 | 1.7940E-07 | 6.30 | 12.60 | 0.00E+00 | 1.13E-06 | 2.26E-06 | 0.1250 | 1.762E+11 |
| Cm-244 | 1.6962E-06 | 6.30 | 12.60 | 0.00E+00 | 1.07E-05 | 2.14E-05 | 0.2250 | 2.059E+11 |
| Co-60 | 1.2839E+00 | 6.30 | 12.60 | 0.00E+00 | 8.09E+00 | 1.62E+01 | 0.3750 | 1.045E+11 |
| Cs-134 | 9.0541E-02 | 6.30 | 12.60 | 0.00E+00 | 5.70E-01 | 1.14E+00 | 0.5750 | 1.389E+12 |
| Cs-135 | 3.2195E-05 | 6.30 | 12.60 | 0.00E+00 | 2.03E-04 | 4.06E-04 | 0.8500 | 5.961E+10 |
| Cs-137 | 2.7564E+00 | 6.30 | 12.60 | 0.00E+00 | 1.74E+01 | 3.47E+01 | 1.2500 | 1.211E+12 |
| Eu-154 | 1.5368E-02 | 6.30 | 12.60 | 0.00E+00 | 9.68E-02 | 1.94E-01 | 1.7500 | 8.069E+08 |
| Eu-155 | 2.9293E-02 | 6.30 | 12.60 | 0.00E+00 | 1.85E-01 | 3.69E-01 | 2.2500 | 1.301E+09 |
| Fe-55 | 7.7158E-01 | 6.30 | 12.60 | 0.00E+00 | 4.86E+00 | 9.72E+00 | 2.7500 | 1.032E+07 |
| H-3 | 1.1111E-02 | 6.30 | 12.60 | 0.00E+00 | 7.00E-02 | 1.40E-01 | 3.5000 | 1.201E+06 |
| I-129 | 7.3684E-07 | 6.30 | 12.60 | 0.00E+00 | 4.64E-06 | 9.28E-06 | 5.0000 | 6.716E+00 |
| Kr-85 | 2.5263E-01 | 6.30 | 12.60 | 0.00E+00 | 1.59E+00 | 3.18E+00 | 7.0000 | 7.602E-01 |
| Np-237 | 1.2427E-06 | 6.30 | 12.60 | 0.00E+00 | 7.83E-06 | 1.57E-05 | 11.0000 | 8.661E-02 |
| Pa-231 | 3.8511E-09 | 6.30 | 12.60 | 0.00E+00 | 2.43E-08 | 4.85E-08 | | |
| Pb-210 | 7.3880E-15 | 6.30 | 12.60 | 0.00E+00 | 4.65E-14 | 9.31E-14 | | |
| Pm-147 | 2.1023E+00 | 6.30 | 12.60 | 0.00E+00 | 1.32E+01 | 2.65E+01 | | |
| Pu-238 | 1.0383E-03 | 6.30 | 12.60 | 0.00E+00 | 6.54E-03 | 1.31E-02 | | |
| Pu-239 | 5.5293E-03 | 6.30 | 12.60 | 0.00E+00 | 3.48E-02 | 6.97E-02 | | |
| Pu-240 | 2.1278E-03 | 6.30 | 12.60 | 0.00E+00 | 1.34E-02 | 2.68E-02 | | |
| Pu-241 | 1.0195E-01 | 6.30 | 12.60 | 0.00E+00 | 6.42E-01 | 1.28E+00 | | |
| Pu-242 | 2.3128E-07 | 6.30 | 12.60 | 0.00E+00 | 1.46E-06 | 2.91E-06 | | |
| Ra-226 | 5.2782E-14 | 6.30 | 12.60 | 0.00E+00 | 3.33E-13 | 6.65E-13 | | |
| Ra-228 | 1.9338E-10 | 6.30 | 12.60 | 0.00E+00 | 1.22E-09 | 2.44E-09 | | |
| Ru-106 | 9.1684E-02 | 6.30 | 12.60 | 0.00E+00 | 5.78E-01 | 1.16E+00 | | |
| Se-79 | 1.3018E-05 | 6.30 | 12.60 | 0.00E+00 | 8.20E-05 | 1.64E-04 | | |
| Sn-126 | 1.2167E-05 | 6.30 | 12.60 | 0.00E+00 | 7.67E-05 | 1.53E-04 | | |
| Sr-90 | 2.6045E+00 | 6.30 | 12.60 | 0.00E+00 | 1.64E+01 | 3.28E+01 | | |
| Tc-99 | 4.4241E-04 | 6.30 | 12.60 | 0.00E+00 | 2.79E-03 | 5.57E-03 | | |
| Th-229 | 1.3713E-10 | 6.30 | 12.60 | 0.00E+00 | 8.64E-10 | 1.73E-09 | | |
| Th-230 | 1.8090E-11 | 6.30 | 12.60 | 0.00E+00 | 1.14E-10 | 2.28E-10 | | |
| Th-232 | 2.5278E-10 | 6.30 | 12.60 | 0.00E+00 | 1.59E-09 | 3.19E-09 | | |
| Tl-208 | 1.6947E-08 | 6.30 | 12.60 | 0.00E+00 | 1.07E-07 | 2.14E-07 | | |
| U-232 | 4.8737E-08 | 6.30 | 12.60 | 0.00E+00 | 3.07E-07 | 6.14E-07 | | |
| U-233 | 1.2203E-07 | 6.30 | 12.60 | 0.00E+00 | 7.69E-07 | 1.54E-06 | | |
| U-234 | 1.5925E-07 | 6.30 | 12.60 | 0.00E+00 | 1.00E-06 | 2.01E-06 | | |
| U-235 | -2.6194E-06 | 6.30 | 0.00 | 7.78E-05 | 6.13E-05 | 7.78E-05 | | |
| U-236 | 1.2693E-05 | 6.30 | 12.60 | 0.00E+00 | 8.00E-05 | 1.60E-04 | | |
| U-238 | -3.6331E-08 | 6.30 | 0.00 | 4.84E-05 | 4.82E-05 | 4.84E-05 | | |
| Y-90 | 2.6060E+00 | 6.30 | 12.60 | 0.00E+00 | 1.64E+01 | 3.28E+01 | | |
| Other Radionuclides | | | | | 2.27E+01 | 4.54E+01 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------------------|-------------------------------|----------------------------------|
| Reactor Moderator: | From SFD LW AND U ZIRC HYDRIDE | Used LW AND U ZIRC HYDRIDE | |
| Fuel Cladding: | SST | SST | |
| BOL HM Constituents: | U | U | |
| BOL Enrichment % | 19.9999834 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | 3.51 | 6.30 | |
| Bounding | | 12.60 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 1.03 | 1.80 | |
| Bounding | 2.05 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD (ALUM) U OF UTAH
SNF ID #: 699
Fuel Units & Descr: 63 - ELEMENT
Heavy Metal Mass, BOL=11kg, EOL=10 723kg
ROD Storage Site: INEEL

¹Fuel decay start date: 2035
Estimates as of: 2030
Template: TRIGA-AI (LW/U-Zr, Alum, 10 to 20%, U)
²Template Burnup(MWd): 6 65
Template BOL Heavy Metal Mass (MT): 0 00018
Template Decay Time: 5 years

Estimated
Canister usage:
18"x10"
0 57

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 0632E-10 | 264 59 | 529 19 | 0 00E+00 | 2 13E-07 | 4 27E-07 | Avg MeV | |
| Am-241 | 2 2586E-03 | 264 59 | 529 19 | 0 00E+00 | 5 98E-01 | 1 20E+00 | 0.0150 | 8 954E+13 |
| Am-242m | 1 9925E-06 | 264 59 | 529 19 | 0 00E+00 | 5 27E-04 | 1 05E-03 | 0.0250 | 1 944E+13 |
| Am-243 | 2 3323E-07 | 264 59 | 529 19 | 0 00E+00 | 6 17E-05 | 1 23E-04 | 0.0375 | 2 421E+13 |
| C-14 | 4 3308E-05 | 264 59 | 529 19 | 0 00E+00 | 1 15E-02 | 2 29E-02 | 0.0575 | 1 856E+13 |
| Cl-36 | 4 3023E-08 | 264 59 | 529 19 | 0 00E+00 | 1 14E-05 | 2 28E-05 | 0.0850 | 1 299E+13 |
| Cm-243 | 2 7429E-07 | 264 59 | 529 19 | 0 00E+00 | 7 26E-05 | 1 45E-04 | 0.1250 | 1 943E+13 |
| Cm-244 | 3 1504E-06 | 264 59 | 529 19 | 0 00E+00 | 8 34E-04 | 1 67E-03 | 0.2250 | 1 085E+13 |
| Co-60 | 3 1008E-02 | 264 59 | 529 19 | 0 00E+00 | 8 20E+00 | 1 64E+01 | 0.3750 | 4 828E+12 |
| Cs-134 | 1 0367E-01 | 264 59 | 529 19 | 0 00E+00 | 2 74E+01 | 5 49E+01 | 0.5750 | 6 121E+13 |
| Cs-135 | 3 1549E-05 | 264 59 | 529 19 | 0 00E+00 | 8 35E-03 | 1 67E-02 | 0.8500 | 1 507E+13 |
| Cs-137 | 2 7564E+00 | 264 59 | 529 19 | 0 00E+00 | 7 29E+02 | 1 46E+03 | 1.2500 | 1 562E+13 |
| Eu-154 | 1 3490E-00 | 264 59 | 529 19 | 0 00E+00 | 3 57E+02 | 7 14E+02 | 1.7500 | 4 470E+11 |
| Eu-155 | 4 3880E-01 | 264 59 | 529 19 | 0 00E+00 | 1 16E+02 | 2 32E+02 | 2.2500 | 5 433E+10 |
| Fe-55 | 8 6782E-03 | 264 59 | 529 19 | 0 00E+00 | 2 30E+00 | 4 59E+00 | 2.7500 | 4 413E+08 |
| H-3 | 1 0805E-02 | 264 59 | 529 19 | 0 00E+00 | 2 86E+00 | 5 72E+00 | 3.5000 | 5 158E+07 |
| I-129 | 7 3805E-07 | 264 59 | 529 19 | 0 00E+00 | 1 95E-04 | 3 91E-04 | 5.0000 | 3 087E+02 |
| Kr-85 | 2 5218E-01 | 264 59 | 529 19 | 0 00E+00 | 6 67E+01 | 1 33E+02 | 7.0000 | 3 495E+01 |
| Np-237 | 1 4463E-06 | 264 59 | 529 19 | 0 00E+00 | 3 83E-04 | 7 65E-04 | 11.0000 | 3 981E+00 |
| Pa-231 | 3 5970E-09 | 264 59 | 529 19 | 0 00E+00 | 9 52E-07 | 1 90E-06 | | |
| Pb-210 | 8 2511E-15 | 264 59 | 529 19 | 0 00E+00 | 2 18E-12 | 4 37E-12 | | |
| Pm-147 | 2 0767E+00 | 264 59 | 529 19 | 0 00E+00 | 5 49E+02 | 1 10E+03 | | |
| Pu-238 | 1 3514E-03 | 264 59 | 529 19 | 0 00E+00 | 3 58E-01 | 7 15E-01 | | |
| Pu-239 | 5 6947E-03 | 264 59 | 529 19 | 0 00E+00 | 1 51E+00 | 3 01E+00 | | |
| Pu-240 | 2 2647E-03 | 264 59 | 529 19 | 0 00E+00 | 5 99E-01 | 1 20E+00 | | |
| Pu-241 | 1 2574E-01 | 264 59 | 529 19 | 0 00E+00 | 3 33E+01 | 6 65E+01 | | |
| Pu-242 | 3 0602E-07 | 264 59 | 529 19 | 0 00E+00 | 8 10E-05 | 1 62E-04 | | |
| Ra-226 | 5 7353E-14 | 264 59 | 529 19 | 0 00E+00 | 1 52E-11 | 3 04E-11 | | |
| Ra-228 | 1 8150E-10 | 264 59 | 529 19 | 0 00E+00 | 4 80E-08 | 9 60E-08 | | |
| Ru-106 | 9 3744E-02 | 264 59 | 529 19 | 0 00E+00 | 2 48E+01 | 4 96E+01 | | |
| Se-79 | 1 2938E-05 | 264 59 | 529 19 | 0 00E+00 | 3 42E-03 | 6 85E-03 | | |
| Sn-126 | 1 2239E-05 | 264 59 | 529 19 | 0 00E+00 | 3 24E-03 | 6 48E-03 | | |
| Sr-90 | 2 6000E+00 | 264 59 | 529 19 | 0 00E+00 | 6 88E+02 | 1 38E+03 | | |
| Tc-99 | 4 4120E-04 | 264 59 | 529 19 | 0 00E+00 | 1 17E-01 | 2 33E-01 | | |
| Th-229 | 1 4749E-10 | 264 59 | 529 19 | 0 00E+00 | 3 90E-08 | 7 80E-08 | | |
| Th-230 | 1 9549E-11 | 264 59 | 529 19 | 0 00E+00 | 5 17E-09 | 1 03E-08 | | |
| Th-232 | 2 3744E-10 | 264 59 | 529 19 | 0 00E+00 | 6 28E-08 | 1 26E-07 | | |
| Th-208 | 1 9459E-08 | 264 59 | 529 19 | 0 00E+00 | 5 15E-06 | 1 03E-05 | | |
| U-232 | 5 6015E-08 | 264 59 | 529 19 | 0 00E+00 | 1 48E-05 | 2 96E-05 | | |
| U-233 | 1 3132E-07 | 264 59 | 529 19 | 0 00E+00 | 3 47E-05 | 6 95E-05 | | |
| U-234 | 1 7323E-07 | 264 59 | 529 19 | 0 00E+00 | 4 58E-05 | 9 17E-05 | | |
| U-235 | -2 6159E-06 | 264 59 | 0 00 | 4 73E-03 | 4 04E-03 | 4 73E-03 | | |
| U-236 | 1 2717E-05 | 264 59 | 529 19 | 0 00E+00 | 3 36E-03 | 6 73E-03 | | |
| U-238 | -3 8857E-08 | 264 59 | 0 00 | 2 96E-03 | 2 95E-03 | 2 96E-03 | | |
| Y-90 | 2 6015E+00 | 264 59 | 529 19 | 0 00E+00 | 6 88E+02 | 1 38E+03 | | |
| Other Radionuclides | | | | | 1 01E+03 | 2 01E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------------------|-------------------------------|----------------------------------|
| Reactor Moderator | From SFD LW AND U ZIRC HYDRIDE | Used LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19 89699819 | 10 to 20 1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 214 41 | 264 59 | |
| Bounding | | 529 19 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0 65 | 1 23 | |
| Bounding | 1 30 | | 1 00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD (ALUM) UNIV OF TEXAS
SNF ID # 877
Fuel Units & Descr 69 - ELEMENT
Heavy Metal Mass BOL=12 765kg, EOL=12 675kg
ROD Storage Site INEEL

¹Fuel decay start date: 1973
Estimates as of 2030
Template TRIGA-AI (LW/U-Zr, Alum, 10 to 20%, U)
²Template Burnup(MWd): 6 65
Template BOL Heavy Metal Mass (MT) 0 00018
Template Decay Time 50 years

Estimated
Canister usage:
18"x10"
0 62

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 6842E-09 | 85 62 | 171 24 | 0 00E+00 | 7 44E-07 | 1 49E-06 | Avg. MeV | |
| Am-241 | 4 9459E-03 | 85 62 | 171 24 | 0 00E+00 | 4 23E-01 | 8 47E-01 | 0 0150 | 8 397E+12 |
| Am-242m | 1 6241E-06 | 85 62 | 171 24 | 0 00E+00 | 1 39E-04 | 2 78E-04 | 0 0250 | 1 741E+12 |
| Am-243 | 2 3233E-07 | 85 62 | 171 24 | 0 00E+00 | 1 99E-05 | 3 98E-05 | 0 0375 | 1 571E+12 |
| C-14 | 4 3083E-05 | 85 62 | 171 24 | 0 00E+00 | 3 69E-03 | 7 38E-03 | 0 0575 | 1 644E+12 |
| Ci-36 | 4 3023E-08 | 85 62 | 171 24 | 0 00E+00 | 3 68E-06 | 7 37E-06 | 0 0850 | 9 807E+11 |
| Cm-243 | 9 1880E-08 | 85 62 | 171 24 | 0 00E+00 | 7 87E-06 | 1 57E-05 | 0 1250 | 7 278E+11 |
| Cm-244 | 5 6346E-07 | 85 62 | 171 24 | 0 00E+00 | 4 82E-05 | 9 65E-05 | 0 2250 | 8 607E+11 |
| Co-60 | 8 3699E-05 | 85 62 | 171 24 | 0 00E+00 | 7 17E-03 | 1 43E-02 | 0 3750 | 3 714E+11 |
| Cs-134 | 2 8211E-08 | 85 62 | 171 24 | 0 00E+00 | 2 42E-06 | 4 83E-06 | 0 5750 | 6 234E+12 |
| Cs-135 | 3 1549E-05 | 85 62 | 171 24 | 0 00E+00 | 2 70E-03 | 5 40E-03 | 0 8500 | 1 698E+11 |
| Cs-137 | 9 7519E-01 | 85 62 | 171 24 | 0 00E+00 | 8 35E+01 | 1 67E+02 | 1 2500 | 1 435E+11 |
| Eu-154 | 3 5970E-02 | 85 62 | 171 24 | 0 00E+00 | 3 08E+00 | 6 16E+00 | 1 7500 | 5 146E+09 |
| Eu-155 | 8 1774E-04 | 85 62 | 171 24 | 0 00E+00 | 7 00E-02 | 1 40E-01 | 2 2500 | 1 745E+05 |
| Fe-55 | 5 3940E-08 | 85 62 | 171 24 | 0 00E+00 | 4 62E-06 | 9 24E-06 | 2 7500 | 8 247E+04 |
| H-3 | 8 6571E-04 | 85 62 | 171 24 | 0 00E+00 | 7 41E-02 | 1 48E-01 | 3 5000 | 2 434E+02 |
| I-129 | 7 3805E-07 | 85 62 | 171 24 | 0 00E+00 | 6 32E-05 | 1 26E-04 | 5 0000 | 1 025E+02 |
| Kr-85 | 1 3771E-02 | 85 62 | 171 24 | 0 00E+00 | 1 18E+00 | 2 36E+00 | 7 0000 | 1 157E+01 |
| Np-237 | 1 5218E-06 | 85 62 | 171 24 | 0 00E+00 | 1 30E-04 | 2 61E-04 | 11 0000 | 1 316E+00 |
| Pa-231 | 1 4152E-08 | 85 62 | 171 24 | 0 00E+00 | 1 21E-06 | 2 42E-06 | | |
| Pb-210 | 7 9774E-13 | 85 62 | 171 24 | 0 00E+00 | 6 83E-11 | 1 37E-10 | | |
| Pm-147 | 1 4362E-05 | 85 62 | 171 24 | 0 00E+00 | 1 23E-03 | 2 46E-03 | | |
| Pu-238 | 9 4782E-04 | 85 62 | 171 24 | 0 00E+00 | 8 12E-02 | 1 62E-01 | | |
| Pu-239 | 5 6872E-03 | 85 62 | 171 24 | 0 00E+00 | 4 87E-01 | 9 74E-01 | | |
| Pu-240 | 2 2541E-03 | 85 62 | 171 24 | 0 00E+00 | 1 93E-01 | 3 86E-01 | | |
| Pu-241 | 1 4433E-02 | 85 62 | 171 24 | 0 00E+00 | 1 24E+00 | 2 47E+00 | | |
| Pu-242 | 3 0602E-07 | 85 62 | 171 24 | 0 00E+00 | 2 62E-05 | 5 24E-05 | | |
| Ra-226 | 1 8857E-12 | 85 62 | 171 24 | 0 00E+00 | 1 61E-10 | 3 23E-10 | | |
| Ra-228 | 2 3729E-10 | 85 62 | 171 24 | 0 00E+00 | 2 03E-08 | 4 06E-08 | | |
| Ru-106 | 3 4857E-15 | 85 62 | 171 24 | 0 00E+00 | 2 98E-13 | 5 97E-13 | | |
| Se-79 | 1 2931E-05 | 85 62 | 171 24 | 0 00E+00 | 1 11E-03 | 2 21E-03 | | |
| Sn-126 | 1 2235E-05 | 85 62 | 171 24 | 0 00E+00 | 1 05E-03 | 2 10E-03 | | |
| Sr-90 | 8 9173E-01 | 85 62 | 171 24 | 0 00E+00 | 7 64E+01 | 1 53E+02 | | |
| Tc-99 | 4 4120E-04 | 85 62 | 171 24 | 0 00E+00 | 3 78E-02 | 7 56E-02 | | |
| Th-229 | 8 2752E-10 | 85 62 | 171 24 | 0 00E+00 | 7 09E-08 | 1 42E-07 | | |
| Th-230 | 1 4908E-10 | 85 62 | 171 24 | 0 00E+00 | 1 28E-08 | 2 55E-08 | | |
| Th-232 | 2 3744E-10 | 85 62 | 171 24 | 0 00E+00 | 2 03E-08 | 4 07E-08 | | |
| Ti-208 | 1 3668E-08 | 85 62 | 171 24 | 0 00E+00 | 1 17E-06 | 2 34E-06 | | |
| U-232 | 3 6797E-08 | 85 62 | 171 24 | 0 00E+00 | 3 15E-06 | 6 30E-06 | Thermal Power | |
| U-233 | 1 3164E-07 | 85 62 | 171 24 | 0 00E+00 | 1 13E-05 | 2 25E-05 | Nominal Heat | Bounding |
| U-234 | 3 3865E-07 | 85 62 | 171 24 | 0 00E+00 | 2 90E-05 | 5 80E-05 | Output (Watts) | Heat Output (Watts) |
| U-235 | -2 6144E-06 | 85 62 | 0 00 | 5 52E-03 | 5 29E-03 | 5 52E-03 | 9 84E-01 | 1 97E+00 |
| U-236 | 1 2722E-05 | 85 62 | 171 24 | 0 00E+00 | 1 09E-03 | 2 18E-03 | | |
| U-238 | -3 8857E-08 | 85 62 | 0 00 | 3 43E-03 | 3 43E-03 | 3 43E-03 | Total | Total |
| Y-90 | 8 9203E-01 | 85 62 | 171 24 | 0 00E+00 | 7 64E+01 | 1 53E+02 | | |
| Other Radionuclides | | | | | 9 56E+01 | 1 91E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences ¹ |
|----------------------------|-----------------------|-----------------------|--|
| Reactor Moderator | From SFD | Used | |
| | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 | 10 to 20 1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate |
|-----------------------------------|----------|-----------|---|
| Nominal | From SFD | Estimated | |
| | 62.20 | 85.62 | |
| Bounding | | 171.24 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|--------------------------------|-------------------------------|
| Nominal | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| | 0 18 | 1 38 | |
| Bounding | 0 36 | | 1 00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD (ALUM) USGS
SNF ID #: 267
Fuel Units & Descr: 222 - ELEMENT
Heavy Metal Mass: BOL=42.224kg, EOL=41.292kg
ROD Storage Site: INEEL

¹Fuel decay start date: 2035
Estimates as of: 2030
Template: TRIGA-AI (LW/U-Zrx, Alum, 10 to 20%, U)
²Template Burnup(MWd): 6.65
Template BOL Heavy Metal Mass (MT): 0.00018
Template Decay Time: 5 years

Estimated
Canister usage:
18"x10"
2.00

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.0632E-10 | 889.99 | 1,779.99 | 0.00E+00 | 7.18E-07 | 1.44E-06 | Avg MeV | |
| Am-241 | 2.2586E-03 | 889.99 | 1,779.99 | 0.00E+00 | 2.01E+00 | 4.02E+00 | 0.0150 | 3.012E+14 |
| Am-242m | 1.9925E-06 | 889.99 | 1,779.99 | 0.00E+00 | 1.77E-03 | 3.55E-03 | 0.0250 | 6.539E+13 |
| Am-243 | 2.3323E-07 | 889.99 | 1,779.99 | 0.00E+00 | 2.08E-04 | 4.15E-04 | 0.0375 | 8.145E+13 |
| C-14 | 4.3308E-05 | 889.99 | 1,779.99 | 0.00E+00 | 3.85E-02 | 7.71E-02 | 0.0575 | 6.244E+13 |
| Cl-36 | 4.3023E-08 | 889.99 | 1,779.99 | 0.00E+00 | 3.83E-05 | 7.66E-05 | 0.0850 | 4.371E+13 |
| Cm-243 | 2.7429E-07 | 889.99 | 1,779.99 | 0.00E+00 | 2.44E-04 | 4.88E-04 | 0.1250 | 6.537E+13 |
| Cm-244 | 3.1504E-06 | 889.99 | 1,779.99 | 0.00E+00 | 2.80E-03 | 5.61E-03 | 0.2250 | 3.649E+13 |
| Co-60 | 3.1008E-02 | 889.99 | 1,779.99 | 0.00E+00 | 2.76E+01 | 5.52E+01 | 0.3750 | 1.624E+13 |
| Cs-134 | 1.0367E-01 | 889.99 | 1,779.99 | 0.00E+00 | 9.23E+01 | 1.85E+02 | 0.5750 | 2.059E+14 |
| Cs-135 | 3.1549E-05 | 889.99 | 1,779.99 | 0.00E+00 | 2.81E-02 | 5.62E-02 | 0.8500 | 5.068E+13 |
| Cs-137 | 2.7564E+00 | 889.99 | 1,779.99 | 0.00E+00 | 2.45E+03 | 4.91E+03 | 1.2500 | 5.253E+13 |
| Eu-154 | 1.3490E+00 | 889.99 | 1,779.99 | 0.00E+00 | 1.20E+03 | 2.40E+03 | 1.7500 | 1.503E+12 |
| Eu-155 | 4.3880E-01 | 889.99 | 1,779.99 | 0.00E+00 | 3.91E+02 | 7.81E+02 | 2.2500 | 1.827E+11 |
| Fe-55 | 8.6782E-03 | 889.99 | 1,779.99 | 0.00E+00 | 7.72E+00 | 1.54E+01 | 2.7500 | 1.484E+09 |
| H-3 | 1.0805E-02 | 889.99 | 1,779.99 | 0.00E+00 | 9.62E+00 | 1.92E+01 | 3.5000 | 1.735E+08 |
| I-129 | 7.3805E-07 | 889.99 | 1,779.99 | 0.00E+00 | 6.57E-04 | 1.31E-03 | 5.0000 | 1.042E+03 |
| Kr-85 | 2.5218E-01 | 889.99 | 1,779.99 | 0.00E+00 | 2.24E+02 | 4.49E+02 | 7.0000 | 1.179E+02 |
| Np-237 | 1.4463E-06 | 889.99 | 1,779.99 | 0.00E+00 | 1.29E-03 | 2.57E-03 | 11.0000 | 1.343E+01 |
| Pa-231 | 3.5970E-09 | 889.99 | 1,779.99 | 0.00E+00 | 3.20E-06 | 6.40E-06 | | |
| Pb-210 | 8.2511E-15 | 889.99 | 1,779.99 | 0.00E+00 | 7.34E-12 | 1.47E-11 | | |
| Pm-147 | 2.0767E+00 | 889.99 | 1,779.99 | 0.00E+00 | 1.85E+03 | 3.70E+03 | | |
| Pu-238 | 1.3514E-03 | 889.99 | 1,779.99 | 0.00E+00 | 1.20E+00 | 2.41E+00 | | |
| Pu-239 | 5.6947E-03 | 889.99 | 1,779.99 | 0.00E+00 | 5.07E+00 | 1.01E+01 | | |
| Pu-240 | 2.2647E-03 | 889.99 | 1,779.99 | 0.00E+00 | 2.02E+00 | 4.03E+00 | | |
| Pu-241 | 1.2574E-01 | 889.99 | 1,779.99 | 0.00E+00 | 1.12E+02 | 2.24E+02 | | |
| Pu-242 | 3.0602E-07 | 889.99 | 1,779.99 | 0.00E+00 | 2.72E-04 | 5.45E-04 | | |
| Ra-226 | 5.7353E-14 | 889.99 | 1,779.99 | 0.00E+00 | 5.10E-11 | 1.02E-10 | | |
| Ra-228 | 1.8150E-10 | 889.99 | 1,779.99 | 0.00E+00 | 1.62E-07 | 3.23E-07 | | |
| Ru-106 | 9.3744E-02 | 889.99 | 1,779.99 | 0.00E+00 | 8.34E+01 | 1.67E+02 | | |
| Se-79 | 1.2938E-05 | 889.99 | 1,779.99 | 0.00E+00 | 1.15E-02 | 2.30E-02 | | |
| Sn-126 | 1.2239E-05 | 889.99 | 1,779.99 | 0.00E+00 | 1.09E-02 | 2.18E-02 | | |
| Sr-90 | 2.6000E+00 | 889.99 | 1,779.99 | 0.00E+00 | 2.31E+03 | 4.63E+03 | | |
| Tc-99 | 4.4120E-04 | 889.99 | 1,779.99 | 0.00E+00 | 3.93E-01 | 7.85E-01 | | |
| Th-229 | 1.4749E-10 | 889.99 | 1,779.99 | 0.00E+00 | 1.31E-07 | 2.63E-07 | | |
| Th-230 | 1.9549E-11 | 889.99 | 1,779.99 | 0.00E+00 | 1.74E-08 | 3.48E-08 | | |
| Th-232 | 2.3744E-10 | 889.99 | 1,779.99 | 0.00E+00 | 2.11E-07 | 4.23E-07 | | |
| Tl-208 | 1.9459E-08 | 889.99 | 1,779.99 | 0.00E+00 | 1.73E-05 | 3.46E-05 | | |
| U-232 | 5.6015E-08 | 889.99 | 1,779.99 | 0.00E+00 | 4.99E-05 | 9.97E-05 | | |
| U-233 | 1.3132E-07 | 889.99 | 1,779.99 | 0.00E+00 | 1.17E-04 | 2.34E-04 | | |
| U-234 | 1.7323E-07 | 889.99 | 1,779.99 | 0.00E+00 | 1.54E-04 | 3.08E-04 | | |
| U-235 | -2.6159E-06 | 889.99 | 0.00 | 1.82E-02 | 1.58E-02 | 1.82E-02 | | |
| U-236 | 1.2717E-05 | 889.99 | 1,779.99 | 0.00E+00 | 1.13E-02 | 2.26E-02 | | |
| U-238 | -3.8857E-08 | 889.99 | 0.00 | 1.14E-02 | 1.13E-02 | 1.14E-02 | | |
| Y-90 | 2.6015E+00 | 889.99 | 1,779.99 | 0.00E+00 | 2.32E+03 | 4.63E+03 | | |
| Other Radionuclides | | | | | 3.38E+03 | 6.77E+03 | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 4.47E+01 | 8.94E+01 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| | From SFD | Used | |
| Reactor Moderator: | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding: | ALUM | ALUM | |
| BOL HM Constituents: | U | U | |
| BOL Enrichment %: | 19.898 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | 102.86 | 889.99 | Nominal burnup calculated from the heavy metal mass destroyed. |
| Bounding | | 1,779.99 | Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 0.57 | 8.65 | 1.00 |
| Bounding | 1.14 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT).

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD (ALUM) ZAIRE
SNF ID # 487

Fuel Units & Descr 56 - ELEMENT

Heavy Metal Mass BOL=10 08kg EOL=10 052kg

ROD Storage Site INEEL

¹Fuel decay start date 2010
Estimates as of 2030

Template TRIGA-AI (LW/U-Zr Alum, 10 to 20%, U)

²Template Burnup(MWd) 6 65

Template BOL Heavy Metal Mass (MT) 0 00018

Template Decay Time 20 years

Estimated
Canister usage
18"x10"
0 50

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group Total Photons/sec (bounding) |
| Ac-227 | 2.4556E-09 | 147.36 | 294.72 | 0 00E+00 | 3 62E-07 | 7.24E-07 | Avg MeV |
| Am-241 | 3 8752E-03 | 147.36 | 294.72 | 0 00E+00 | 5 71E-01 | 1 14E+00 | 0 0150 3 025E+13 |
| Am-242m | 1.8617E-06 | 147.36 | 294.72 | 0 00E+00 | 2.74E-04 | 5 49E-04 | 0 0250 6.245E+12 |
| Am-243 | 2.3293E-07 | 147.36 | 294.72 | 0 00E+00 | 3 43E-05 | 6.86E-05 | 0 0375 6.537E+12 |
| C-14 | 4.3233E-05 | 147.36 | 294.72 | 0 00E+00 | 6.37E-03 | 1.27E-02 | 0 0575 6 042E+12 |
| Ci-36 | 4.3023E-08 | 147.36 | 294.72 | 0 00E+00 | 6.34E-06 | 1.27E-05 | 0 0850 3 679E+12 |
| Cm-243 | 1 9053E-07 | 147.36 | 294.72 | 0 00E+00 | 2 81E-05 | 5 62E-05 | 0 1250 4 129E+12 |
| Cm-244 | 1 7744E-06 | 147.36 | 294.72 | 0 00E+00 | 2 61E-04 | 5.23E-04 | 0 2250 3.334E+12 |
| Co-60 | 4.3188E-03 | 147.36 | 294.72 | 0 00E+00 | 6 36E-01 | 1.27E+00 | 0.3750 1.370E+12 |
| Cs-134 | 6 7188E-04 | 147.36 | 294.72 | 0 00E+00 | 9 90E-02 | 1 98E-01 | 0.5750 2.182E+13 |
| Cs-135 | 3 1549E-05 | 147.36 | 294.72 | 0 00E+00 | 4 65E-03 | 9 30E-03 | 0.8500 2.322E+12 |
| Cs-137 | 1 9489E+00 | 147.36 | 294.72 | 0 00E+00 | 2 87E+02 | 5 74E+02 | 1.2500 2.501E+12 |
| Eu-154 | 4 0301E-01 | 147.36 | 294.72 | 0 00E+00 | 5 94E+01 | 1 19E+02 | 1 7500 7 493E+10 |
| Eu-155 | 5 4000E-02 | 147.36 | 294.72 | 0 00E+00 | 7 96E+00 | 1.59E+01 | 2.2500 1 188E+06 |
| Fe-55 | 1.5955E-04 | 147.36 | 294.72 | 0 00E+00 | 2 35E-02 | 4 70E-02 | 2 7500 1.977E+05 |
| H-3 | 4 6571E-03 | 147.36 | 294.72 | 0 00E+00 | 6 86E-01 | 1.37E+00 | 3.5000 1.367E+03 |
| I-129 | 7.3805E-07 | 147.36 | 294.72 | 0 00E+00 | 1 09E-04 | 2 18E-04 | 5 0000 1 719E+02 |
| Kr-85 | 9 5684E-02 | 147.36 | 294.72 | 0 00E+00 | 1 41E+01 | 2 82E+01 | 7 0000 1.942E+01 |
| Np-237 | 1 4618E-06 | 147.36 | 294.72 | 0 00E+00 | 2 15E-04 | 4 31E-04 | 11 0000 2.209E+00 |
| Pa-231 | 6 4782E-09 | 147.36 | 294.72 | 0 00E+00 | 9 55E-07 | 1 91E-06 | |
| Pb-210 | 6 3158E-14 | 147.36 | 294.72 | 0 00E+00 | 9 31E-12 | 1 86E-11 | |
| Pm-147 | 3 9564E-02 | 147.36 | 294.72 | 0 00E+00 | 5 83E+00 | 1 17E+01 | |
| Pu-238 | 1 2008E-03 | 147.36 | 294.72 | 0 00E+00 | 1 77E-01 | 3 54E-01 | |
| Pu-239 | 5 6917E-03 | 147.36 | 294.72 | 0 00E+00 | 8 39E-01 | 1 68E+00 | |
| Pu-240 | 2 2617E-03 | 147.36 | 294.72 | 0 00E+00 | 3 33E-01 | 6 67E-01 | |
| Pu-241 | 6 1113E-02 | 147.36 | 294.72 | 0 00E+00 | 9 01E+00 | 1 80E+01 | |
| Pu-242 | 3 0602E-07 | 147.36 | 294.72 | 0 00E+00 | 4 51E-05 | 9 02E-05 | |
| Ra-226 | 2 6707E-13 | 147.36 | 294.72 | 0 00E+00 | 3 94E-11 | 7 87E-11 | |
| Ra-228 | 2 2556E-10 | 147.36 | 294.72 | 0 00E+00 | 3 32E-08 | 6 65E-08 | |
| Ru-106 | 3 1293E-06 | 147.36 | 294.72 | 0 00E+00 | 4 61E-04 | 9 22E-04 | |
| Se-79 | 1 2935E-05 | 147.36 | 294.72 | 0 00E+00 | 1 91E-03 | 3 81E-03 | |
| Sn-126 | 1 2238E-05 | 147.36 | 294.72 | 0 00E+00 | 1 80E-03 | 3 61E-03 | |
| Sr-90 | 1 8195E+00 | 147.36 | 294.72 | 0 00E+00 | 2 68E+02 | 5 36E+02 | |
| Tc-99 | 4 4120E-04 | 147.36 | 294.72 | 0 00E+00 | 6 50E-02 | 1.30E-01 | |
| Th-229 | 3 3308E-10 | 147.36 | 294.72 | 0 00E+00 | 4 91E-08 | 9 82E-08 | |
| Th-230 | 4 6526E-11 | 147.36 | 294.72 | 0 00E+00 | 6 86E-09 | 1.37E-08 | |
| Th-232 | 2 3744E-10 | 147.36 | 294.72 | 0 00E+00 | 3 50E-08 | 7.00E-08 | |
| Ti-208 | 1 8195E-08 | 147.36 | 294.72 | 0 00E+00 | 2 68E-06 | 5.36E-06 | |
| U-232 | 4 9098E-08 | 147.36 | 294.72 | 0 00E+00 | 7.24E-06 | 1.45E-05 | |
| U-233 | 1 3140E-07 | 147.36 | 294.72 | 0 00E+00 | 1.94E-05 | 3 87E-05 | |
| U-234 | 2 2571E-07 | 147.36 | 294.72 | 0 00E+00 | 3.33E-05 | 6 65E-05 | |
| U-235 | -2 6159E-06 | 147.36 | 0 00 | 4.36E-03 | 3.97E-03 | 4.36E-03 | |
| U-236 | 1 2719E-05 | 147.36 | 294.72 | 0 00E+00 | 1.87E-03 | 3 75E-03 | |
| U-238 | -3.8857E-08 | 147.36 | 0 00 | 2 71E-03 | 2 70E-03 | 2 71E-03 | |
| Y-90 | 1 8211E+00 | 147.36 | 294.72 | 0 00E+00 | 2 68E+02 | 5.37E+02 | |
| Other Radionuclides | | | | | 3.09E+02 | 6 17E+02 | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | ALUM | ALUM |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 20 | 10 to 20 1 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | 147.36 | 26 73 |
| Bounding | | 294 72 |

Basis for burnup used in estimate

Nominal burnup taken directly from SFD (converted to MWd)
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|-----------------------------------|
| Nominal | 0 40 | 0 18 |
| Bounding | 0 79 | |

Estimated EOL HM/Given EOL HM
0 99

¹Reactor shutdown, core removal storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 12/20 ROMANIA
 SNF ID #: 1078
 Fuel Units & Descr: 498 - ELEMENT
 Heavy Metal Mass: BOL=124.5kg; EOL=121.462kg
 ROD Storage Site: INEEL

¹Fuel decay start date: 2010
 Estimates as of: 2030
 Template: TRIGA-SS (LW/U-Zr, SST, 10 to 20%, U)
²Template Burnup(MWd): 6.65
 Template BOL Heavy Metal Mass (MT): 0.000195
 Template Decay Time: 20 years

Estimated
 Canister usage:
 18"x10"
 4.49

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|--|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) | |
| Ac-227 | 2.6436E-09 | 2,899.91 | 5,799.81 | 0.00E+00 | 7.67E-06 | 1.53E-05 | Avg. MeV | | |
| Am-241 | 3.1429E-03 | 2,899.91 | 5,799.81 | 0.00E+00 | 9.11E+00 | 1.82E+01 | 0.0150 | 5.812E+14 | |
| Am-242m | 1.3195E-06 | 2,899.91 | 5,799.81 | 0.00E+00 | 3.83E-03 | 7.65E-03 | 0.0250 | 1.210E+14 | |
| Am-243 | 1.4753E-07 | 2,899.91 | 5,799.81 | 0.00E+00 | 4.28E-04 | 8.56E-04 | 0.0375 | 1.048E+14 | |
| C-14 | 1.2847E-04 | 2,899.91 | 5,799.81 | 0.00E+00 | 3.73E-01 | 7.45E-01 | 0.0575 | 1.128E+14 | |
| Cl-36 | 2.8120E-06 | 2,899.91 | 5,799.81 | 0.00E+00 | 8.15E-03 | 1.63E-02 | 0.0850 | 6.807E+13 | |
| Cm-243 | 1.2465E-07 | 2,899.91 | 5,799.81 | 0.00E+00 | 3.61E-04 | 7.23E-04 | 0.1250 | 4.449E+13 | |
| Cm-244 | 9.5564E-07 | 2,899.91 | 5,799.81 | 0.00E+00 | 2.77E-03 | 5.54E-03 | 0.2250 | 5.845E+13 | |
| Co-60 | 1.7880E-01 | 2,899.91 | 5,799.81 | 0.00E+00 | 5.18E+02 | 1.04E+03 | 0.3750 | 2.562E+13 | |
| Cs-134 | 5.8692E-04 | 2,899.91 | 5,799.81 | 0.00E+00 | 1.70E+00 | 3.40E+00 | 0.5750 | 4.213E+14 | |
| Cs-135 | 3.2195E-05 | 2,899.91 | 5,799.81 | 0.00E+00 | 9.34E-02 | 1.87E-01 | 0.8500 | 4.749E+12 | |
| Cs-137 | 1.9489E+00 | 2,899.91 | 5,799.81 | 0.00E+00 | 5.65E+03 | 1.13E+04 | 1.2500 | 7.870E+13 | |
| Eu-154 | 4.5895E-03 | 2,899.91 | 5,799.81 | 0.00E+00 | 1.33E+01 | 2.66E+01 | 1.7500 | 1.220E+11 | |
| Eu-155 | 3.6045E-03 | 2,899.91 | 5,799.81 | 0.00E+00 | 1.05E+01 | 2.09E+01 | 2.2500 | 4.203E+08 | |
| Fe-55 | 1.4185E-02 | 2,899.91 | 5,799.81 | 0.00E+00 | 4.11E+01 | 8.23E+01 | 2.7500 | 4.630E+06 | |
| H-3 | 4.7895E-03 | 2,899.91 | 5,799.81 | 0.00E+00 | 1.39E+01 | 2.78E+01 | 3.5000 | 2.578E+04 | |
| I-129 | 7.3684E-07 | 2,899.91 | 5,799.81 | 0.00E+00 | 2.14E-03 | 4.27E-03 | 5.0000 | 3.091E+03 | |
| Kr-85 | 9.5820E-02 | 2,899.91 | 5,799.81 | 0.00E+00 | 2.78E+02 | 5.56E+02 | 7.0000 | 3.492E+02 | |
| Np-237 | 1.2552E-06 | 2,899.91 | 5,799.81 | 0.00E+00 | 3.64E-03 | 7.28E-03 | 11.0000 | 3.973E+01 | |
| Pa-231 | 7.0406E-09 | 2,899.91 | 5,799.81 | 0.00E+00 | 2.04E-05 | 4.08E-05 | | | |
| Pb-210 | 5.8000E-14 | 2,899.91 | 5,799.81 | 0.00E+00 | 1.68E-10 | 3.36E-10 | | | |
| Pm-147 | 4.0075E-02 | 2,899.91 | 5,799.81 | 0.00E+00 | 1.16E+02 | 2.32E+02 | | | |
| Pu-238 | 9.2256E-04 | 2,899.91 | 5,799.81 | 0.00E+00 | 2.68E+00 | 5.35E+00 | | | |
| Pu-239 | 5.5278E-03 | 2,899.91 | 5,799.81 | 0.00E+00 | 1.60E+01 | 3.21E+01 | | | |
| Pu-240 | 2.1248E-03 | 2,899.91 | 5,799.81 | 0.00E+00 | 6.16E+00 | 1.23E+01 | | | |
| Pu-241 | 4.9549E-02 | 2,899.91 | 5,799.81 | 0.00E+00 | 1.44E+02 | 2.87E+02 | | | |
| Pu-242 | 2.3128E-07 | 2,899.91 | 5,799.81 | 0.00E+00 | 6.71E-04 | 1.34E-03 | | | |
| Ra-226 | 2.4526E-13 | 2,899.91 | 5,799.81 | 0.00E+00 | 7.11E-10 | 1.42E-09 | | | |
| Ra-228 | 2.4015E-10 | 2,899.91 | 5,799.81 | 0.00E+00 | 6.96E-07 | 1.39E-06 | | | |
| Ru-106 | 3.0602E-06 | 2,899.91 | 5,799.81 | 0.00E+00 | 8.87E-03 | 1.77E-02 | | | |
| Se-79 | 1.3015E-05 | 2,899.91 | 5,799.81 | 0.00E+00 | 3.77E-02 | 7.55E-02 | | | |
| Sn-126 | 1.2165E-05 | 2,899.91 | 5,799.81 | 0.00E+00 | 3.53E-02 | 7.06E-02 | | | |
| Sr-90 | 1.8226E+00 | 2,899.91 | 5,799.81 | 0.00E+00 | 5.29E+03 | 1.06E+04 | | | |
| Tc-99 | 4.4241E-04 | 2,899.91 | 5,799.81 | 0.00E+00 | 1.28E+00 | 2.57E+00 | | | |
| Th-229 | 3.0962E-10 | 2,899.91 | 5,799.81 | 0.00E+00 | 8.98E-07 | 1.80E-06 | | | |
| Th-230 | 4.2346E-11 | 2,899.91 | 5,799.81 | 0.00E+00 | 1.23E-07 | 2.46E-07 | | | |
| Th-232 | 2.5278E-10 | 2,899.91 | 5,799.81 | 0.00E+00 | 7.33E-07 | 1.47E-06 | | | |
| Ti-208 | 1.5820E-08 | 2,899.91 | 5,799.81 | 0.00E+00 | 4.59E-05 | 9.18E-05 | | | |
| U-232 | 4.2647E-08 | 2,899.91 | 5,799.81 | 0.00E+00 | 1.24E-04 | 2.47E-04 | Thermal Power | | |
| U-233 | 1.2211E-07 | 2,899.91 | 5,799.81 | 0.00E+00 | 3.54E-04 | 7.08E-04 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) | |
| U-234 | 1.9955E-07 | 2,899.91 | 5,799.81 | 0.00E+00 | 5.79E-04 | 1.16E-03 | | | |
| U-235 | -2.6194E-06 | 2,899.91 | 0.00 | 5.35E-02 | 4.59E-02 | 5.35E-02 | 7.26E+01 | 1.45E+02 | |
| U-236 | 1.2693E-05 | 2,899.91 | 5,799.81 | 0.00E+00 | 3.68E-02 | 7.36E-02 | | | |
| U-238 | -3.6331E-08 | 2,899.91 | 0.00 | 3.35E-02 | 3.34E-02 | 3.35E-02 | Total | | |
| Y-90 | 1.8241E+00 | 2,899.91 | 5,799.81 | 0.00E+00 | 5.29E+03 | 1.06E+04 | | | |
| Other Radionuclides | | | | | 5.58E+03 | 1.12E+04 | | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| | From SFD | Used | |
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19.9 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 1,213.38 | 2,899.91 | Nominal burnup calculated from the heavy metal mass destroyed |
| Bounding | | 5,799.81 | Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|--------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0.68 | 2.39 | 1.00 |
| Bounding | 1.37 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 20/20 (IFE) ENGLAND

SNF ID # 1043

Fuel Units & Descr: 2 - ELEMENT

Heavy Metal Mass: BOL=0.376kg EOL=0.367kg

ROD Storage Site: INEEL

¹Fuel decay start date 2010

Estimates as of 2030

Template TRIGA-SS (LW/U-Zr, SST, 10 to 20%, U)

²Template Burnup(MWd) 6.65

Template BOL Heavy Metal Mass (MT) 0.000195

Template Decay Time 20 years

Estimated

Canister usage

18"x10"

0.02

II. Estimates

| | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.6436E-09 | 10.63 | 21.27 | 0.00E+00 | 2.81E-08 | 5.62E-08 | Avg MeV | |
| Am-241 | 3.1429E-03 | 10.63 | 21.27 | 0.00E+00 | 3.34E-02 | 6.68E-02 | 0.0150 | 2.131E+12 |
| Am-242m | 1.3195E-06 | 10.63 | 21.27 | 0.00E+00 | 1.40E-05 | 2.81E-05 | 0.0250 | 4.437E+11 |
| Am-243 | 1.4753E-07 | 10.63 | 21.27 | 0.00E+00 | 1.57E-06 | 3.14E-06 | 0.0375 | 3.843E+11 |
| C-14 | 1.2847E-04 | 10.63 | 21.27 | 0.00E+00 | 1.37E-03 | 2.73E-03 | 0.0575 | 4.135E+11 |
| Cl-36 | 2.8120E-06 | 10.63 | 21.27 | 0.00E+00 | 2.99E-05 | 5.98E-05 | 0.0850 | 2.496E+11 |
| Cm-243 | 1.2465E-07 | 10.63 | 21.27 | 0.00E+00 | 1.33E-06 | 2.65E-06 | 0.1250 | 1.631E+11 |
| Cm-244 | 9.5564E-07 | 10.63 | 21.27 | 0.00E+00 | 1.02E-05 | 2.03E-05 | 0.2250 | 2.143E+11 |
| Co-60 | 1.7880E-01 | 10.63 | 21.27 | 0.00E+00 | 1.90E+00 | 3.80E+00 | 0.3750 | 9.394E+10 |
| Cs-134 | 5.8692E-04 | 10.63 | 21.27 | 0.00E+00 | 6.24E-03 | 1.25E-02 | 0.5750 | 1.545E+12 |
| Cs-135 | 3.2195E-05 | 10.63 | 21.27 | 0.00E+00 | 3.42E-04 | 6.85E-04 | 0.8500 | 1.741E+10 |
| Cs-137 | 1.9489E+00 | 10.63 | 21.27 | 0.00E+00 | 2.07E+01 | 4.14E+01 | 1.2500 | 2.886E+11 |
| Eu-154 | 4.5895E-03 | 10.63 | 21.27 | 0.00E+00 | 4.88E-02 | 9.76E-02 | 1.7500 | 4.474E+08 |
| Eu-155 | 3.6045E-03 | 10.63 | 21.27 | 0.00E+00 | 3.83E-02 | 7.67E-02 | 2.2500 | 1.541E+06 |
| Fe-55 | 1.4185E-02 | 10.63 | 21.27 | 0.00E+00 | 1.51E-01 | 3.02E-01 | 2.7500 | 1.698E+04 |
| H-3 | 4.7895E-03 | 10.63 | 21.27 | 0.00E+00 | 5.09E-02 | 1.02E-01 | 3.5000 | 9.443E+01 |
| I-129 | 7.3684E-07 | 10.63 | 21.27 | 0.00E+00 | 7.84E-06 | 1.57E-05 | 5.0000 | 1.128E+01 |
| Kr-85 | 9.5820E-02 | 10.63 | 21.27 | 0.00E+00 | 1.02E+00 | 2.04E+00 | 7.0000 | 1.275E+00 |
| Np-237 | 1.2552E-06 | 10.63 | 21.27 | 0.00E+00 | 1.33E-05 | 2.67E-05 | 11.0000 | 1.450E-01 |
| Pa-231 | 7.0406E-09 | 10.63 | 21.27 | 0.00E+00 | 7.49E-08 | 1.50E-07 | | |
| Pb-210 | 5.8000E-14 | 10.63 | 21.27 | 0.00E+00 | 6.17E-13 | 1.23E-12 | | |
| Pm-147 | 4.0075E-02 | 10.63 | 21.27 | 0.00E+00 | 4.26E-01 | 8.52E-01 | | |
| Pu-238 | 9.2256E-04 | 10.63 | 21.27 | 0.00E+00 | 9.81E-03 | 1.96E-02 | | |
| Pu-239 | 5.5278E-03 | 10.63 | 21.27 | 0.00E+00 | 5.88E-02 | 1.18E-01 | | |
| Pu-240 | 2.1248E-03 | 10.63 | 21.27 | 0.00E+00 | 2.26E-02 | 4.52E-02 | | |
| Pu-241 | 4.9549E-02 | 10.63 | 21.27 | 0.00E+00 | 5.27E-01 | 1.05E+00 | | |
| Pu-242 | 2.3128E-07 | 10.63 | 21.27 | 0.00E+00 | 2.46E-06 | 4.92E-06 | | |
| Ra-226 | 2.4526E-13 | 10.63 | 21.27 | 0.00E+00 | 2.61E-12 | 5.22E-12 | | |
| Ra-228 | 2.4015E-10 | 10.63 | 21.27 | 0.00E+00 | 2.55E-09 | 5.11E-09 | | |
| Ru-106 | 3.0602E-06 | 10.63 | 21.27 | 0.00E+00 | 3.25E-05 | 6.51E-05 | | |
| Se-79 | 1.3015E-05 | 10.63 | 21.27 | 0.00E+00 | 1.38E-04 | 2.77E-04 | | |
| Sn-126 | 1.2165E-05 | 10.63 | 21.27 | 0.00E+00 | 1.29E-04 | 2.59E-04 | | |
| Sr-90 | 1.8226E+00 | 10.63 | 21.27 | 0.00E+00 | 1.94E+01 | 3.88E+01 | | |
| Tc-99 | 4.4241E-04 | 10.63 | 21.27 | 0.00E+00 | 4.70E-03 | 9.41E-03 | | |
| Th-229 | 3.0962E-10 | 10.63 | 21.27 | 0.00E+00 | 3.29E-09 | 6.58E-09 | | |
| Th-230 | 4.2346E-11 | 10.63 | 21.27 | 0.00E+00 | 4.50E-10 | 9.01E-10 | | |
| Th-232 | 2.5278E-10 | 10.63 | 21.27 | 0.00E+00 | 2.69E-09 | 5.38E-09 | | |
| Th-208 | 1.5820E-08 | 10.63 | 21.27 | 0.00E+00 | 1.68E-07 | 3.36E-07 | | |
| U-232 | 4.2647E-08 | 10.63 | 21.27 | 0.00E+00 | 4.53E-07 | 9.07E-07 | Thermal Power | |
| U-233 | 1.2211E-07 | 10.63 | 21.27 | 0.00E+00 | 1.30E-06 | 2.60E-06 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 1.9955E-07 | 10.63 | 21.27 | 0.00E+00 | 2.12E-06 | 4.24E-06 | 2.66E-01 | 5.32E-01 |
| U-235 | -2.6194E-06 | 10.63 | 0.00 | 1.62E-04 | 1.34E-04 | 1.62E-04 | Total | Total |
| U-236 | 1.2693E-05 | 10.63 | 21.27 | 0.00E+00 | 1.35E-04 | 2.70E-04 | | |
| U-238 | -3.6331E-08 | 10.63 | 0.00 | 1.01E-04 | 1.01E-04 | 1.01E-04 | | |
| Y-90 | 1.8241E+00 | 10.63 | 21.27 | 0.00E+00 | 1.94E+01 | 3.88E+01 | | |
| Other Radionuclides | | | | | 2.05E+01 | 4.10E+01 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | SST | SST |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 19.94680851 | 10 to 20.1 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | 10.63 | 8.97 |
| Bounding | | 21.27 |

Basis for burnup used in estimate

Nominal burnup taken directly from SFD (converted to MWd)
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0.83 | 0.84 | 1.00 |
| Bounding | 1.66 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 20/20 ARRR

SNF ID #: 780

Fuel Units & Descr: 15 - ELEMENT

Heavy Metal Mass: BOL=10.275kg, EOL=8.179kg

ROD Storage Site: INEEL

¹Fuel decay start date: 2035

Estimates as of 2030

Template TRIGA-SS (LW/U-Zrx, SST, 10 to 20%, U)

²Template Burnup(MWd): 6.65

Template BOL Heavy Metal Mass (MT) 0.000195

Template Decay Time: 5 years

Estimated

Canister usage:

18"x10"

0.14

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.5173E-10 | 2,000.38 | 4,000.76 | 0.00E+00 | 1.70E-06 | 3.41E-06 | Avg MeV | |
| Am-241 | 1.8331E-03 | 2,000.38 | 4,000.76 | 0.00E+00 | 3.67E+00 | 7.33E+00 | 0.0150 | 6.466E+14 |
| Am-242m | 1.4129E-06 | 2,000.38 | 4,000.76 | 0.00E+00 | 2.83E-03 | 5.65E-03 | 0.0250 | 1.423E+14 |
| Am-243 | 1.4774E-07 | 2,000.38 | 4,000.76 | 0.00E+00 | 2.96E-04 | 5.91E-04 | 0.0375 | 1.212E+14 |
| C-14 | 1.2871E-04 | 2,000.38 | 4,000.76 | 0.00E+00 | 2.57E-01 | 5.15E-01 | 0.0575 | 1.244E+14 |
| Cl-36 | 2.8120E-06 | 2,000.38 | 4,000.76 | 0.00E+00 | 5.63E-03 | 1.13E-02 | 0.0850 | 7.705E+13 |
| Cm-243 | 1.7940E-07 | 2,000.38 | 4,000.76 | 0.00E+00 | 3.59E-04 | 7.18E-04 | 0.1250 | 5.595E+13 |
| Cm-244 | 1.6962E-06 | 2,000.38 | 4,000.76 | 0.00E+00 | 3.39E-03 | 6.79E-03 | 0.2250 | 6.536E+13 |
| Co-60 | 1.2839E+00 | 2,000.38 | 4,000.76 | 0.00E+00 | 2.57E+03 | 5.14E+03 | 0.3750 | 3.317E+13 |
| Cs-134 | 9.0541E-02 | 2,000.38 | 4,000.76 | 0.00E+00 | 1.81E+02 | 3.62E+02 | 0.5750 | 4.410E+14 |
| Cs-135 | 3.2195E-05 | 2,000.38 | 4,000.76 | 0.00E+00 | 6.44E-02 | 1.29E-01 | 0.8500 | 1.893E+13 |
| Cs-137 | 2.7564E+00 | 2,000.38 | 4,000.76 | 0.00E+00 | 5.51E+03 | 1.10E+04 | 1.2500 | 3.843E+14 |
| Eu-154 | 1.5368E-02 | 2,000.38 | 4,000.76 | 0.00E+00 | 3.07E+01 | 6.15E+01 | 1.7500 | 2.562E+11 |
| Eu-155 | 2.9293E-02 | 2,000.38 | 4,000.76 | 0.00E+00 | 5.86E+01 | 1.17E+02 | 2.2500 | 4.129E+11 |
| Fe-55 | 7.7158E-01 | 2,000.38 | 4,000.76 | 0.00E+00 | 1.54E+03 | 3.09E+03 | 2.7500 | 3.277E+09 |
| H-3 | 1.1111E-02 | 2,000.38 | 4,000.76 | 0.00E+00 | 2.22E+01 | 4.45E+01 | 3.5000 | 3.814E+08 |
| I-129 | 7.3684E-07 | 2,000.38 | 4,000.76 | 0.00E+00 | 1.47E-03 | 2.95E-03 | 5.0000 | 2.103E+03 |
| Kr-85 | 2.5263E-01 | 2,000.38 | 4,000.76 | 0.00E+00 | 5.05E+02 | 1.01E+03 | 7.0000 | 2.380E+02 |
| Np-237 | 1.2427E-06 | 2,000.38 | 4,000.76 | 0.00E+00 | 2.49E-03 | 4.97E-03 | 11.0000 | 2.711E+01 |
| Pa-231 | 3.8511E-09 | 2,000.38 | 4,000.76 | 0.00E+00 | 7.70E-06 | 1.54E-05 | | |
| Pb-210 | 7.3880E-15 | 2,000.38 | 4,000.76 | 0.00E+00 | 1.48E-11 | 2.96E-11 | | |
| Pm-147 | 2.1023E+00 | 2,000.38 | 4,000.76 | 0.00E+00 | 4.21E+03 | 8.41E+03 | | |
| Pu-238 | 1.0383E-03 | 2,000.38 | 4,000.76 | 0.00E+00 | 2.08E+00 | 4.15E+00 | | |
| Pu-239 | 5.5293E-03 | 2,000.38 | 4,000.76 | 0.00E+00 | 1.11E+01 | 2.21E+01 | | |
| Pu-240 | 2.1278E-03 | 2,000.38 | 4,000.76 | 0.00E+00 | 4.26E+00 | 8.51E+00 | | |
| Pu-241 | 1.0195E-01 | 2,000.38 | 4,000.76 | 0.00E+00 | 2.04E+02 | 4.08E+02 | | |
| Pu-242 | 2.3128E-07 | 2,000.38 | 4,000.76 | 0.00E+00 | 4.63E-04 | 9.25E-04 | | |
| Ra-226 | 5.2782E-14 | 2,000.38 | 4,000.76 | 0.00E+00 | 1.06E-10 | 2.11E-10 | | |
| Ra-228 | 1.9338E-10 | 2,000.38 | 4,000.76 | 0.00E+00 | 3.87E-07 | 7.74E-07 | | |
| Ru-106 | 9.1684E-02 | 2,000.38 | 4,000.76 | 0.00E+00 | 1.83E+02 | 3.67E+02 | | |
| Se-79 | 1.3018E-05 | 2,000.38 | 4,000.76 | 0.00E+00 | 2.60E-02 | 5.21E-02 | | |
| Sn-126 | 1.2167E-05 | 2,000.38 | 4,000.76 | 0.00E+00 | 2.43E-02 | 4.87E-02 | | |
| Sr-90 | 2.6045E+00 | 2,000.38 | 4,000.76 | 0.00E+00 | 5.21E+03 | 1.04E+04 | | |
| Tc-99 | 4.4241E-04 | 2,000.38 | 4,000.76 | 0.00E+00 | 8.85E-01 | 1.77E+00 | | |
| Th-229 | 1.3713E-10 | 2,000.38 | 4,000.76 | 0.00E+00 | 2.74E-07 | 5.49E-07 | | |
| Th-230 | 1.8090E-11 | 2,000.38 | 4,000.76 | 0.00E+00 | 3.62E-08 | 7.24E-08 | | |
| Th-232 | 2.5278E-10 | 2,000.38 | 4,000.76 | 0.00E+00 | 5.06E-07 | 1.01E-06 | | |
| Ti-208 | 1.6947E-08 | 2,000.38 | 4,000.76 | 0.00E+00 | 3.39E-05 | 6.78E-05 | | |
| U-232 | 4.8737E-08 | 2,000.38 | 4,000.76 | 0.00E+00 | 9.75E-05 | 1.95E-04 | | |
| U-233 | 1.2203E-07 | 2,000.38 | 4,000.76 | 0.00E+00 | 2.44E-04 | 4.88E-04 | | |
| U-234 | 1.5925E-07 | 2,000.38 | 4,000.76 | 0.00E+00 | 3.19E-04 | 6.37E-04 | | |
| U-235 | -2.6194E-06 | 2,000.38 | 0.00 | 4.36E-03 | 0.00E+00 | 4.36E-03 | | |
| U-236 | 1.2693E-05 | 2,000.38 | 4,000.76 | 0.00E+00 | 2.54E-02 | 5.08E-02 | | |
| U-238 | -3.6331E-08 | 2,000.38 | 0.00 | 2.77E+03 | 2.70E-03 | 2.77E-03 | | |
| Y-90 | 2.6060E+00 | 2,000.38 | 4,000.76 | 0.00E+00 | 5.21E+03 | 1.04E+04 | | |
| Other Radionuclides | | | | | 7.21E+03 | 1.44E+04 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | SST | SST |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 19.64963504 | 10 to 20.1 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | 581.16 | 2,000.38 |
| Bounding | | 4,000.76 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed.
Bounding burnup assumed to be twice nominal burnup.

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/ Given EOL HM |
|----------|-------------------|--------------------------------|--------------------------------|
| Nominal | 5.71 | 3.44 | 1.06 |
| Bounding | 11.42 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 20/20 MNRC
 SNF ID #: 1053
 Fuel Units & Descr 8 - ELEMENT
 Heavy Metal Mass BOL=3.962kg, EOL=3.962kg
 ROD Storage Site INEEL

¹Fuel decay start date 2035
 Estimates as of 2030
 Template TRIGA-SS (LW/U-ZrC SST 10 to 20%, U)
²Template Burnup(MWd) 6.65
 Template BOL Heavy Metal Mass (MT) 0.000195
 Template Decay Time 5 years

Estimated
 Canister usage
 18"x10"
 0.07

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.5173E-10 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | Avg MeV | |
| Am-241 | 1.8331E-03 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0150 | 4.193E+07 |
| Am-242m | 1.4129E-06 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0250 | 0.000E+00 |
| Am-243 | 1.4774E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0375 | 5.713E+04 |
| C-14 | 1.2871E-04 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0575 | 3.498E+04 |
| Cl-36 | 2.8120E-06 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0850 | 4.881E+06 |
| Cm-243 | 1.7940E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.1250 | 9.636E+06 |
| Cm-244 | 1.6962E-06 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.2250 | 3.410E+07 |
| Co-60 | 1.2839E+00 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.3750 | 8.510E+04 |
| Cs-134 | 9.0541E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.5750 | 4.186E+03 |
| Cs-135 | 3.2195E-05 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.8500 | 6.537E+02 |
| Cs-137 | 2.7564E+00 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.2500 | 3.906E+01 |
| Eu-154 | 1.5368E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.7500 | 1.911E+01 |
| Eu-155 | 2.9293E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.2500 | 1.107E+01 |
| Fe-55 | 7.7158E-01 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.7500 | 6.433E+00 |
| H-3 | 1.1111E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 3.5000 | 5.751E+00 |
| I-129 | 7.3684E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 5.0000 | 2.471E+00 |
| Kr-85 | 2.5263E-01 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 7.0000 | 2.844E-01 |
| Np-237 | 1.2427E-06 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 11.0000 | 3.270E-02 |
| Pa-231 | 3.8511E-09 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pb-210 | 7.3880E-15 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pm-147 | 2.1023E+00 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-238 | 1.0383E-03 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-239 | 5.5293E-03 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-240 | 2.1278E-03 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-241 | 1.0195E-01 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-242 | 2.3128E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Ra-226 | 5.2782E-14 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Ra-228 | 1.9338E-10 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Ru-106 | 9.1684E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Se-79 | 1.3018E-05 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Sn-126 | 1.2167E-05 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Sr-90 | 2.6045E+00 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Tc-99 | 4.4241E-04 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Th-229 | 1.3713E-10 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Th-230 | 1.8090E-11 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Th-232 | 2.5278E-10 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Ti-208 | 1.6947E-08 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-232 | 4.8737E-08 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-233 | 1.2203E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-234 | 1.5925E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-235 | -2.6194E-06 | 0.00 | 0.00 | 1.69E-03 | 1.69E-03 | 1.69E-03 | | |
| U-236 | 1.2693E-05 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-238 | -3.6331E-08 | 0.00 | 0.00 | 1.07E-03 | 1.07E-03 | 1.07E-03 | | |
| Y-90 | 2.6060E+00 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Other Radionuclides | | | | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| | From SFD | Used | |
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19.74990819 | 10 to 20.1 | |

| Burnup Summary (MWd) ¹ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 0.00 | | |
| Bounding | | | Nominal burnup taken directly from SFD (converted to MWd) Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0.00 | | |
| Bounding | 0.00 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 20/20 MNRC
 SNF ID #: 1054
 Fuel Units & Descr: 84 - ELEMENT
 Heavy Metal Mass: BOL=41 605kg; EOL=40 555kg
 ROD Storage Site: INEEL

¹Fuel decay start date: 2035
 Estimates as of: 2030
 Template: TRIGA-SS (LW/U-Zr, SST, 10 to 20%, U)
²Template Burnup(MWd): 6 65
 Template BOL Heavy Metal Mass (MT): 0 000195
 Template Decay Time: 5 years

Estimated
 Canister usage:
 18"x10"
 0 76

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 5173E-10 | 1,002 34 | 2,004 68 | 0 00E+00 | 8 54E-07 | 1 71E-06 | Avg MeV | |
| Am-241 | 1 8331E-03 | 1,002 34 | 2,004 68 | 0 00E+00 | 1 84E+00 | 3 67E+00 | 0 0150 | 3.240E+14 |
| Am-242m | 1 4129E-06 | 1,002 34 | 2,004 68 | 0 00E+00 | 1 42E-03 | 2 83E-03 | 0 0250 | 7 129E+13 |
| Am-243 | 1 4774E-07 | 1,002 34 | 2,004 68 | 0 00E+00 | 1 48E-04 | 2 96E-04 | 0 0375 | 6 071E+13 |
| C-14 | 1 2871E-04 | 1,002 34 | 2,004 68 | 0 00E+00 | 1 29E-01 | 2 58E-01 | 0 0575 | 6 232E+13 |
| Cl-36 | 2 8120E-06 | 1,002 34 | 2,004 68 | 0 00E+00 | 2 82E-03 | 5 64E-03 | 0 0850 | 3 861E+13 |
| Cm-243 | 1 7940E-07 | 1,002 34 | 2,004 68 | 0 00E+00 | 1 80E-04 | 3 60E-04 | 0 1250 | 2 804E+13 |
| Cm-244 | 1 6962E-06 | 1,002 34 | 2,004 68 | 0 00E+00 | 1 70E-03 | 3 40E-03 | 0 2250 | 3 275E+13 |
| Co-60 | 1 2839E+00 | 1,002 34 | 2,004 68 | 0 00E+00 | 1 29E+03 | 2 57E+03 | 0 3750 | 1 662E+13 |
| Cs-134 | 9 0541E-02 | 1,002 34 | 2,004 68 | 0 00E+00 | 9 08E+01 | 1 82E+02 | 0 5750 | 2 210E+14 |
| Cs-135 | 3 2195E-05 | 1,002 34 | 2,004 68 | 0 00E+00 | 3 23E-02 | 6 45E-02 | 0 8500 | 9 483E+12 |
| Cs-137 | 2 7564E+00 | 1,002 34 | 2,004 68 | 0 00E+00 | 2 76E+03 | 5 53E+03 | 1 2500 | 1 926E+14 |
| Eu-154 | 1 5368E-02 | 1,002 34 | 2,004 68 | 0 00E+00 | 1 54E+01 | 3 08E+01 | 1 7500 | 1 284E+11 |
| Eu-155 | 2 9239E-02 | 1,002 34 | 2,004 68 | 0 00E+00 | 2 94E+01 | 5 87E+01 | 2 2500 | 2 069E+11 |
| Fe-55 | 7 7158E-01 | 1,002 34 | 2,004 68 | 0 00E+00 | 7 73E+02 | 1 55E+03 | 2 7500 | 1 642E+09 |
| H-3 | 1 1111E-02 | 1,002 34 | 2,004 68 | 0 00E+00 | 1 11E+01 | 2 23E+01 | 3 5000 | 1 911E+08 |
| I-129 | 7 3684E-07 | 1,002 34 | 2,004 68 | 0 00E+00 | 7 39E-04 | 1 48E-03 | 5 0000 | 1 077E+03 |
| Kr-85 | 2 5263E-01 | 1,002 34 | 2,004 68 | 0 00E+00 | 2 53E+02 | 5 06E+02 | 7 0000 | 1 219E+02 |
| Np-237 | 1 2427E-06 | 1,002 34 | 2,004 68 | 0 00E+00 | 1 25E-03 | 2 49E-03 | 11 0000 | 1 389E+01 |
| Pa-231 | 3 8511E-09 | 1,002 34 | 2,004 68 | 0 00E+00 | 3 86E-06 | 7 72E-06 | | |
| Pb-210 | 7 3880E-15 | 1,002 34 | 2,004 68 | 0 00E+00 | 7 41E-12 | 1 48E-11 | | |
| Pm-147 | 2 1023E+00 | 1,002 34 | 2,004 68 | 0 00E+00 | 2 11E+03 | 4 21E+03 | | |
| Pu-238 | 1 0383E-03 | 1,002 34 | 2,004 68 | 0 00E+00 | 1 04E+00 | 2 08E+00 | | |
| Pu-239 | 5 5293E-03 | 1,002 34 | 2,004 68 | 0 00E+00 | 5 54E+00 | 1 11E+01 | | |
| Pu-240 | 2 1278E-03 | 1,002 34 | 2,004 68 | 0 00E+00 | 2 13E+00 | 4 27E+00 | | |
| Pu-241 | 1 0195E-01 | 1,002 34 | 2,004 68 | 0 00E+00 | 1 02E+02 | 2 04E+02 | | |
| Pu-242 | 2 3128E-07 | 1,002 34 | 2,004 68 | 0 00E+00 | 2 32E-04 | 4 64E-04 | | |
| Ra-226 | 5 2782E-14 | 1,002 34 | 2 004 68 | 0 00E+00 | 5 29E-11 | 1 06E-10 | | |
| Ra-228 | 1 9338E-10 | 1,002 34 | 2,004 68 | 0 00E+00 | 1 94E-07 | 3 88E-07 | | |
| Ru-106 | 9 1684E-02 | 1,002 34 | 2,004 68 | 0 00E+00 | 9 19E+01 | 1 84E+02 | | |
| Se-79 | 1 3018E-05 | 1,002 34 | 2,004 68 | 0 00E+00 | 1 30E-02 | 2 61E-02 | | |
| Sn-126 | 1 2167E-05 | 1,002 34 | 2,004 68 | 0 00E+00 | 1 22E-02 | 2 44E-02 | | |
| Sr-90 | 2 6045E+00 | 1,002 34 | 2,004 68 | 0 00E+00 | 2 61E+03 | 5 22E+03 | | |
| Tc-99 | 4 4241E-04 | 1,002 34 | 2,004 68 | 0 00E+00 | 4 43E-01 | 8 87E-01 | | |
| Th-229 | 1 3713E-10 | 1,002 34 | 2,004 68 | 0 00E+00 | 1 37E-07 | 2 75E-07 | | |
| Th-230 | 1 8090E-11 | 1,002 34 | 2,004 68 | 0 00E+00 | 1 81E-08 | 3 63E-08 | | |
| Th-232 | 2 5278E-10 | 1,002 34 | 2,004 68 | 0 00E+00 | 2 53E-07 | 5 07E-07 | | |
| Ti-208 | 1 6947E-08 | 1,002 34 | 2,004 68 | 0 00E+00 | 1 70E-05 | 3 40E-05 | | |
| U-232 | 4 8737E-08 | 1,002 34 | 2,004 68 | 0 00E+00 | 4 89E-05 | 9 77E-05 | Thermal Power | |
| U-233 | 1 2203E-07 | 1,002 34 | 2,004 68 | 0 00E+00 | 1 22E-04 | 2 45E-04 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 1 5925E-07 | 1,002 34 | 2,004 68 | 0 00E+00 | 1 60E-04 | 3 19E-04 | 5 83E+01 | 1 17E+02 |
| U-235 | -2 6194E-06 | 1,002 34 | 0 00 | 1 78E-02 | 1 51E-02 | 1 78E-02 | Total | Total |
| U-236 | 1 2693E-05 | 1,002 34 | 2,004 68 | 0 00E+00 | 1 27E-02 | 2 54E-02 | | |
| U-238 | -3 6331E-08 | 1,002 34 | 0 00 | 1 12E-02 | 1 12E-02 | 1 12E-02 | | |
| Y-90 | 2 6060E+00 | 1,002 34 | 2,004 68 | 0 00E+00 | 2 61E+03 | 5 22E+03 | | |
| Other Radionuclides | | | | | 3 61E+03 | 7 23E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| | From SFD | Used | |
| Reactor Moderator: | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding: | SST | SST | |
| BOL HM Constituents: | U | U | |
| BOL Enrichment %: | 19 74990819 | 10 to 20 1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | 784 42 | 1,002 34 | |
| Bounding | | 2 004 68 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|--------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0 71 | 1 28 | |
| Bounding | 1 41 | | 1 00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 20/20 SOLVENIA
 SNF ID # 731
 Fuel Units & Descr: 10 - ELEMENT
 Heavy Metal Mass BOL=4 949kg EOL=4 754kg
 ROD Storage Site INEEL

¹Fuel decay start date 2010
 Estimates as of 2030
 Template TRIGA-SS (LW/U-Zrx, SST 10 to 20% U)
²Template Burnup(MWd) 6 65
 Template BOL Heavy Metal Mass (MT) 0 000195
 Template Decay Time 20 years

Estimated
 Canister usage
 18"x10"
 0 09

| II. Estimates | m | X _n | X _b | b | Y _n | Y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2 6436E-09 | 186 62 | 373 23 | 0 00E+00 | 4 93E-07 | 9 87E-07 | Avg MeV | |
| Am-241 | 3 1429E-03 | 186 62 | 373 23 | 0 00E+00 | 5 87E-01 | 1 17E+00 | 0 0150 | 3 740E+13 |
| Am-242m | 1 3195E-06 | 186 62 | 373 23 | 0 00E+00 | 2 46E-04 | 4 93E-04 | 0 0250 | 7 786E+12 |
| Am-243 | 1 4753E-07 | 186 62 | 373 23 | 0 00E+00 | 2 75E-05 | 5 51E-05 | 0 0375 | 6 745E+12 |
| C-14 | 1 2847E-04 | 186 62 | 373 23 | 0 00E+00 | 2 40E-02 | 4 79E-02 | 0 0575 | 7 256E+12 |
| Cl-36 | 2 8120E-06 | 186 62 | 373 23 | 0 00E+00 | 5 25E-04 | 1 05E-03 | 0 0850 | 4 381E+12 |
| Cm-243 | 1 2465E-07 | 186 62 | 373 23 | 0 00E+00 | 2 33E-05 | 4 65E-05 | 0 1250 | 2 863E+12 |
| Cm-244 | 9 5564E-07 | 186 62 | 373 23 | 0 00E+00 | 1 78E-04 | 3 57E-04 | 0 2250 | 3 761E+12 |
| Co-60 | 1 7880E-01 | 186 62 | 373 23 | 0 00E+00 | 3 34E+01 | 6 67E+01 | 0 3750 | 1 649E+12 |
| Cs-134 | 5 8692E-04 | 186 62 | 373 23 | 0 00E+00 | 1 10E-01 | 2 19E-01 | 0 5750 | 2 711E+13 |
| Cs-135 | 3 2195E-05 | 186 62 | 373 23 | 0 00E+00 | 6 01E-03 | 1 20E-02 | 0 8500 | 3 056E+11 |
| Cs-137 | 1 9489E+00 | 186 62 | 373 23 | 0 00E+00 | 3 64E+02 | 7 27E+02 | 1 2500 | 5 064E+12 |
| Eu-154 | 4 5895E-03 | 186 62 | 373 23 | 0 00E+00 | 8 56E-01 | 1 71E+00 | 1 7500 | 7 852E+09 |
| Eu-155 | 3 6045E-03 | 186 62 | 373 23 | 0 00E+00 | 6 73E-01 | 1 35E+00 | 2 2500 | 2 704E+07 |
| Fe-55 | 1 4185E-02 | 186 62 | 373 23 | 0 00E+00 | 2 65E+00 | 5 29E+00 | 2 7500 | 2 980E+05 |
| H-3 | 4 7895E-03 | 186 62 | 373 23 | 0 00E+00 | 8 94E-01 | 1 79E+00 | 3 5000 | 1 655E+03 |
| I-129 | 7 3684E-07 | 186 62 | 373 23 | 0 00E+00 | 1 38E-04 | 2 75E-04 | 5 0000 | 1 970E+02 |
| Kr-85 | 9 5820E-02 | 186 62 | 373 23 | 0 00E+00 | 1 79E+01 | 3 58E+01 | 7 0000 | 2 225E+01 |
| Np-237 | 1 2552E-06 | 186 62 | 373 23 | 0 00E+00 | 2 34E-04 | 4 68E-04 | 11 0000 | 2 532E+00 |
| Pa-231 | 7 0406E-09 | 186 62 | 373 23 | 0 00E+00 | 1 31E-06 | 2 63E-06 | | |
| Pb-210 | 5 8000E-14 | 186 62 | 373 23 | 0 00E+00 | 1 08E-11 | 2 16E-11 | | |
| Pm-147 | 4 0075E-02 | 186 62 | 373 23 | 0 00E+00 | 7 48E+00 | 1 50E+01 | | |
| Pu-238 | 9 2256E-04 | 186 62 | 373 23 | 0 00E+00 | 1 72E-01 | 3 44E-01 | | |
| Pu-239 | 5 5278E-03 | 186 62 | 373 23 | 0 00E+00 | 1 03E+00 | 2 06E+00 | | |
| Pu-240 | 2 1248E-03 | 186 62 | 373 23 | 0 00E+00 | 3 97E-01 | 7 93E-01 | | |
| Pu-241 | 4 9549E-02 | 186 62 | 373 23 | 0 00E+00 | 9 25E+00 | 1 85E+01 | | |
| Pu-242 | 2 3128E-07 | 186 62 | 373 23 | 0 00E+00 | 4 32E-05 | 8 63E-05 | | |
| Ra-226 | 2 4526E-13 | 186 62 | 373 23 | 0 00E+00 | 4 58E-11 | 9 15E-11 | | |
| Ra-228 | 2 4015E-10 | 186 62 | 373 23 | 0 00E+00 | 4 48E-08 | 8 96E-08 | | |
| Ru-106 | 3 0602E-06 | 186 62 | 373 23 | 0 00E+00 | 5 71E-04 | 1 14E-03 | | |
| Se-79 | 1 3015E-05 | 186 62 | 373 23 | 0 00E+00 | 2 43E-03 | 4 86E-03 | | |
| Sn-126 | 1 2165E-05 | 186 62 | 373 23 | 0 00E+00 | 2 27E-03 | 4 54E-03 | | |
| Sr-90 | 1 8226E+00 | 186 62 | 373 23 | 0 00E+00 | 3 40E+02 | 6 80E+02 | | |
| Tc-99 | 4 4241E-04 | 186 62 | 373 23 | 0 00E+00 | 8 26E-02 | 1 65E-01 | | |
| Th-229 | 3 0962E-10 | 186 62 | 373 23 | 0 00E+00 | 5 78E-08 | 1 16E-07 | | |
| Th-230 | 4 2346E-11 | 186 62 | 373 23 | 0 00E+00 | 7 90E-09 | 1 58E-08 | | |
| Th-232 | 2 5278E-10 | 186 62 | 373 23 | 0 00E+00 | 4 72E-08 | 9 43E-08 | | |
| Ti-208 | 1 5820E-08 | 186 62 | 373 23 | 0 00E+00 | 2 95E-06 | 5 90E-06 | | |
| U-232 | 4 2647E-08 | 186 62 | 373 23 | 0 00E+00 | 7 96E-06 | 1 59E-05 | | |
| U-233 | 1 2211E-07 | 186 62 | 373 23 | 0 00E+00 | 2 28E-05 | 4 56E-05 | | |
| U-234 | 1 9955E-07 | 186 62 | 373 23 | 0 00E+00 | 3 72E-05 | 7 45E-05 | | |
| U-235 | -2 6194E-06 | 186 62 | 0 00 | 2 11E-03 | 1 63E-03 | 2 11E-03 | | |
| U-236 | 1 2693E-05 | 186 62 | 373 23 | 0 00E+00 | 2 37E-03 | 4 74E-03 | | |
| U-238 | -3 6331E-08 | 186 62 | 0 00 | 1 33E-03 | 1 33E-03 | 1 33E-03 | | |
| Y-90 | 1 8241E+00 | 186 62 | 373 23 | 0 00E+00 | 3 40E+02 | 6 81E+02 | | |
| Other Radionuclides | | | | | 3 59E+02 | 7 19E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator | From SFD | Used | |
| Fuel Cladding | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| BOL HM Constituents | SST | SST | |
| BOL Enrichment % | U | U | |
| | 19 76747705 | 10 to 20 1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate* |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 186.62 | 186 15 | |
| Bounding | | 373.23 | Nominal burnup taken directly from SFD (converted to MWd) Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 1 11 | 1 00 | |
| Bounding | 2 21 | | 1 00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 30/20
SNF ID #: 995
Fuel Units & Descr: 19 - ELEMENT
Heavy Metal Mass: BOL=16 625kg; EOL=16 433kg
ROD Storage Site: INEEL

Fuel decay start date: 2035
Estimates as of: 2030
Template: TRIGA-SS (LW/U-Zr, SST, 10 to 20%, U)
Template Burnup(MWd): 6 65
Template BOL Heavy Metal Mass (MT): 0 000195
Template Decay Time: 5 years

Estimated
Canister usage:
18"x10"
0 17

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| | m | x _n | x _b | b | y _n | y _b | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | CvMWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Avg MeV | |
| Ac-227 | 8 5173E-10 | 183.19 | 366.38 | 0 00E+00 | 1 56E-07 | 3 12E-07 | 0 0150 | 5 922E+13 |
| Am-241 | 1 8331E-03 | 183.19 | 366.38 | 0 00E+00 | 3 36E-01 | 6 72E-01 | 0 0250 | 1 303E+13 |
| Am-242m | 1 4129E-06 | 183.19 | 366.38 | 0 00E+00 | 2 59E-04 | 5 18E-04 | 0 0375 | 1 110E+13 |
| Am-243 | 1 4774E-07 | 183.19 | 366.38 | 0 00E+00 | 2 71E-05 | 5 41E-05 | 0 0575 | 1 139E+13 |
| C-14 | 1 2871E-04 | 183.19 | 366.38 | 0 00E+00 | 2 36E-02 | 4 72E-02 | 0 0850 | 7 056E+12 |
| Cl-36 | 2 8120E-06 | 183.19 | 366.38 | 0 00E+00 | 5 15E-04 | 1 03E-03 | 0 1250 | 5 124E+12 |
| Cm-243 | 1 7940E-07 | 183.19 | 366.38 | 0 00E+00 | 3 29E-05 | 6 57E-05 | 0 2250 | 5 986E+12 |
| Cm-244 | 1 6962E-06 | 183.19 | 366.38 | 0 00E+00 | 3 11E-04 | 6 21E-04 | 0 3750 | 3 038E+12 |
| Co-60 | 1 2839E+00 | 183.19 | 366.38 | 0 00E+00 | 2 35E+02 | 4 70E+02 | 0 5750 | 4 038E+13 |
| Cs-134 | 9 0541E-02 | 183.19 | 366.38 | 0 00E+00 | 1 66E+01 | 3 32E+01 | 0 8500 | 1 733E+12 |
| Cs-135 | 3 2195E-05 | 183.19 | 366.38 | 0 00E+00 | 5 90E-03 | 1 18E-02 | 1 2500 | 3 520E+13 |
| Cs-137 | 2 7564E+00 | 183.19 | 366.38 | 0 00E+00 | 5 05E+02 | 1 01E+03 | 1 7500 | 2 346E+10 |
| Eu-154 | 1 5368E-02 | 183.19 | 366.38 | 0 00E+00 | 2 82E+00 | 5 63E+00 | 2 2500 | 3 782E+10 |
| Eu-155 | 2 9293E-02 | 183.19 | 366.38 | 0 00E+00 | 5 37E+00 | 1 07E+01 | 2 7500 | 3 001E+08 |
| Fe-55 | 7 7158E-01 | 183.19 | 366.38 | 0 00E+00 | 1 41E+02 | 2 83E+02 | 3 5000 | 3 493E+07 |
| H-3 | 1 1111E-02 | 183.19 | 366.38 | 0 00E+00 | 2 04E+00 | 4 07E+00 | 5 0000 | 2 023E+02 |
| I-129 | 7 3684E-07 | 183.19 | 366.38 | 0 00E+00 | 1 35E-04 | 2 70E-04 | 7 0000 | 2 292E+01 |
| Kr-85 | 2 5263E-01 | 183.19 | 366.38 | 0 00E+00 | 4 63E+01 | 9 26E+01 | 11 0000 | 2 612E+00 |
| Np-237 | 1 2427E-06 | 183.19 | 366.38 | 0 00E+00 | 2 28E-04 | 4 55E-04 | | |
| Pa-231 | 3 8511E-09 | 183.19 | 366.38 | 0 00E+00 | 7 05E-07 | 1 41E-06 | | |
| Pb-210 | 7 3880E-15 | 183.19 | 366.38 | 0 00E+00 | 1 35E-12 | 2 71E-12 | | |
| Pm-147 | 2 1023E+00 | 183.19 | 366.38 | 0 00E+00 | 3 85E+02 | 7 70E+02 | | |
| Pu-238 | 1 0383E-03 | 183.19 | 366.38 | 0 00E+00 | 1 90E-01 | 3 80E-01 | | |
| Pu-239 | 5 5293E-03 | 183.19 | 366.38 | 0 00E+00 | 1 01E+00 | 2 03E+00 | | |
| Pu-240 | 2 1278E-03 | 183.19 | 366.38 | 0 00E+00 | 3 90E-01 | 7 80E-01 | | |
| Pu-241 | 1 0195E-01 | 183.19 | 366.38 | 0 00E+00 | 1 87E+01 | 3 74E+01 | | |
| Pu-242 | 2 3128E-07 | 183.19 | 366.38 | 0 00E+00 | 4 24E-05 | 8 47E-05 | | |
| Ra-226 | 5 2782E-14 | 183.19 | 366.38 | 0 00E+00 | 9 67E-12 | 1 93E-11 | | |
| Ra-228 | 1 9338E-10 | 183.19 | 366.38 | 0 00E+00 | 3 54E-08 | 7 09E-08 | | |
| Ru-106 | 9 1684E-02 | 183.19 | 366.38 | 0 00E+00 | 1 68E+01 | 3 36E+01 | | |
| Se-79 | 1 3018E-05 | 183.19 | 366.38 | 0 00E+00 | 2 38E-03 | 4 77E-03 | | |
| Sn-126 | 1 2167E-05 | 183.19 | 366.38 | 0 00E+00 | 2 23E-03 | 4 46E-03 | | |
| Sr-90 | 2 6045E+00 | 183.19 | 366.38 | 0 00E+00 | 4 77E+02 | 9 54E+02 | | |
| Tc-99 | 4 4241E-04 | 183.19 | 366.38 | 0 00E+00 | 8 10E-02 | 1 62E-01 | | |
| Th-229 | 1 3713E-10 | 183.19 | 366.38 | 0 00E+00 | 2 51E-08 | 5 02E-08 | | |
| Th-230 | 1 8090E-11 | 183.19 | 366.38 | 0 00E+00 | 3 31E-09 | 6 63E-09 | | |
| Th-232 | 2 5278E-10 | 183.19 | 366.38 | 0 00E+00 | 4 63E-08 | 9 26E-08 | | |
| Ti-208 | 1 6947E-08 | 183.19 | 366.38 | 0 00E+00 | 3 10E-06 | 6 21E-06 | | |
| U-232 | 4 8737E-08 | 183.19 | 366.38 | 0 00E+00 | 8 93E-06 | 1 79E-05 | | |
| U-233 | 1 2203E-07 | 183.19 | 366.38 | 0 00E+00 | 2 24E-05 | 4 47E-05 | | |
| U-234 | 1 5925E-07 | 183.19 | 366.38 | 0 00E+00 | 2 92E-05 | 5 83E-05 | | |
| U-235 | -2 6194E-06 | 183.19 | 0 00 | 7 19E-03 | 6 71E-03 | 7 19E-03 | | |
| U-236 | 1 2693E-05 | 183.19 | 366.38 | 0 00E+00 | 2 33E-03 | 4 65E-03 | | |
| U-238 | -3 6331E-08 | 183.19 | 0 00 | 4 47E-03 | 4 46E-03 | 4 47E-03 | | |
| Y-90 | 2 6060E+00 | 183.19 | 366.38 | 0 00E+00 | 4 77E+02 | 9 55E+02 | | |
| Other Radionuclides | | | | | 6 60E+02 | 1 32E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| | From SFD | Used | |
| Reactor Moderator: | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding: | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | | 183.19 | |
| Bounding | | 366.38 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0.32 | | |
| Bounding | 0.65 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 30/20 MNRC
SNF ID # 704
Fuel Units & Descr 6 - ELEMENT
Heavy Metal Mass BOL=4 974kg EOL=4 974kg
ROD Storage Site INEEL
¹Fuel decay start date 2035
Estimates as of 2030
Template TRIGA-SS (LW/U-Zrx SST, 10 to 20%, U)
²Template Burnup(MWd) 6 65
Template BOL Heavy Metal Mass (MT) 0 000195
Template Decay Time 5 years

Estimated
Canister usage
18"x10"
0 05

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 5173E-10 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | Avg MeV | |
| Am-241 | 1.8331E-03 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 0 0150 | 5.280E+07 |
| Am-242m | 1 4129E-06 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 0 0250 | 0 000E+00 |
| Am-243 | 1.4774E-07 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 0 0375 | 7 199E+04 |
| C-14 | 1.2871E-04 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 0 0675 | 4.394E+04 |
| Cl-36 | 2 8120E-06 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 0 0850 | 6 150E+06 |
| Cm-243 | 1.7940E-07 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 0 1250 | 1.214E+07 |
| Cm-244 | 1.6962E-06 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 0 2250 | 4.297E+07 |
| Co-60 | 1.2839E+00 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 0 3750 | 1 072E+05 |
| Cs-134 | 9 0541E-02 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 0 5750 | 5.275E+03 |
| Cs-135 | 3.2195E-05 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 0 8500 | 8.232E+02 |
| Cs-137 | 2 7564E+00 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 1.2500 | 4 899E+01 |
| Eu-154 | 1.5368E-02 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 1 7500 | 2.397E+01 |
| Eu-155 | 2 9293E-02 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 2 2500 | 1 389E+01 |
| Fe-55 | 7.7158E-01 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 2 7500 | 8 068E+00 |
| H-3 | 1 1111E-02 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 3 5000 | 7.213E+00 |
| I-129 | 7.3684E-07 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 5 0000 | 3 099E+00 |
| Kr-85 | 2 5263E-01 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 7 0000 | 3 567E-01 |
| Np-237 | 1.2427E-06 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 11 0000 | 4 101E-02 |
| Pa-231 | 3 8511E-09 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Pb-210 | 7.3880E-15 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Pm-147 | 2 1023E+00 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Pu-238 | 1 0383E-03 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Pu-239 | 5 5293E-03 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Pu-240 | 2 1278E-03 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Pu-241 | 1 0195E-01 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Pu-242 | 2 3128E-07 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Ra-226 | 5 2782E-14 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Ra-228 | 1 9338E-10 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Ru-106 | 9 1684E-02 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Se-79 | 1 3018E-05 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Sn-126 | 1 2167E-05 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Sr-90 | 2 6045E+00 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Tc-99 | 4 4241E-04 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Th-229 | 1.3713E-10 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Th-230 | 1 8090E-11 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Th-232 | 2 5278E-10 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Ti-208 | 1 6947E-08 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| U-232 | 4 8737E-08 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| U-233 | 1.2203E-07 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| U-234 | 1 5925E-07 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| U-235 | -2 6194E-06 | 0 00 | 0 00 | 2 13E-03 | 2.13E-03 | 2.13E-03 | | |
| U-236 | 1.2693E-05 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| U-238 | -3 6331E-08 | 0 00 | 0 00 | 1 34E-03 | 1.34E-03 | 1.34E-03 | | |
| Y-90 | 2.6060E+00 | 0 00 | 0 00 | 0 00E+00 | 0 00E+00 | 0 00E+00 | | |
| Other Radionuclides | | | | | 0 00E+00 | 0 00E+00 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator | From SFD | Used | |
| | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19 82495894 | 10 to 20 1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | 0 00 | | |
| Bounding | | | Nominal burnup taken directly from SFD (converted to MWd). Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|--------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0 00 | | |
| Bounding | 0 00 | | 1 00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT).

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8.5/20

SNF ID #: 252

Fuel Units & Descr: 50 - ELEMENT

Heavy Metal Mass: BOL=9.37kg, EOL=9.07kg

ROD Storage Site: INEEL

Fuel decay start date: 2035

Estimates as of: 2030

Template: TRIGA-SS (LW/U-Zrx, SST, 10 to 20%, U)

Template Burnup (MWd): 6.65

Template BOL Heavy Metal Mass (MT): 0.000195

Template Decay Time: 5 years

Estimated

Canister usage:

18"x10"

0.45

II. Estimates

| | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.5173E-10 | 286.38 | 572.76 | 0.00E+00 | 2.44E-07 | 4.88E-07 | Avg. MeV | |
| Am-241 | 1.8331E-03 | 286.38 | 572.76 | 0.00E+00 | 5.25E-01 | 1.05E+00 | 0.0150 | 9.257E+13 |
| Am-242m | 1.4129E-06 | 286.38 | 572.76 | 0.00E+00 | 4.05E-04 | 8.09E-04 | 0.0250 | 2.037E+13 |
| Am-243 | 1.4774E-07 | 286.38 | 572.76 | 0.00E+00 | 4.23E-05 | 8.46E-05 | 0.0375 | 1.735E+13 |
| C-14 | 1.2871E-04 | 286.38 | 572.76 | 0.00E+00 | 3.69E-02 | 7.37E-02 | 0.0575 | 1.781E+13 |
| Ck-36 | 2.8120E-06 | 286.38 | 572.76 | 0.00E+00 | 8.05E-04 | 1.61E-03 | 0.0850 | 1.103E+13 |
| Cm-243 | 1.7940E-07 | 286.38 | 572.76 | 0.00E+00 | 5.14E-05 | 1.03E-04 | 0.1250 | 8.010E+12 |
| Cm-244 | 1.6962E-06 | 286.38 | 572.76 | 0.00E+00 | 4.86E-04 | 9.72E-04 | 0.2250 | 9.357E+12 |
| Co-60 | 1.2839E+00 | 286.38 | 572.76 | 0.00E+00 | 3.68E+02 | 7.35E+02 | 0.3750 | 4.749E+12 |
| Cs-134 | 9.0541E-02 | 286.38 | 572.76 | 0.00E+00 | 2.59E+01 | 5.19E+01 | 0.5750 | 6.313E+13 |
| Cs-135 | 3.2195E-05 | 286.38 | 572.76 | 0.00E+00 | 9.22E-03 | 1.84E-02 | 0.8500 | 2.709E+12 |
| Cs-137 | 2.7564E+00 | 286.38 | 572.76 | 0.00E+00 | 7.89E+02 | 1.58E+03 | 1.2500 | 5.502E+13 |
| Eu-154 | 1.5368E-02 | 286.38 | 572.76 | 0.00E+00 | 4.40E+00 | 8.80E+00 | 1.7500 | 3.668E+10 |
| Eu-155 | 2.9298E-02 | 286.38 | 572.76 | 0.00E+00 | 8.39E+00 | 1.68E+01 | 2.2500 | 5.912E+10 |
| Fe-55 | 7.7158E-01 | 286.38 | 572.76 | 0.00E+00 | 2.21E+02 | 4.42E+02 | 2.7500 | 4.691E+08 |
| H-3 | 1.1111E-02 | 286.38 | 572.76 | 0.00E+00 | 3.18E+00 | 6.36E+00 | 3.5000 | 5.460E+07 |
| I-129 | 7.3684E-07 | 286.38 | 572.76 | 0.00E+00 | 2.11E-04 | 4.22E-04 | 5.0000 | 3.060E+02 |
| Kr-85 | 2.5263E-01 | 286.38 | 572.76 | 0.00E+00 | 7.23E+01 | 1.45E+02 | 7.0000 | 3.465E+01 |
| Np-237 | 1.2427E-06 | 286.38 | 572.76 | 0.00E+00 | 3.56E-04 | 7.12E-04 | 11.0000 | 3.947E+00 |
| Pa-231 | 3.8511E-09 | 286.38 | 572.76 | 0.00E+00 | 1.10E-06 | 2.21E-06 | | |
| Pb-210 | 7.3880E-15 | 286.38 | 572.76 | 0.00E+00 | 2.12E-12 | 4.23E-12 | | |
| Pm-147 | 2.1023E+00 | 286.38 | 572.76 | 0.00E+00 | 6.02E+02 | 1.20E+03 | | |
| Pu-238 | 1.0383E-03 | 286.38 | 572.76 | 0.00E+00 | 2.97E-01 | 5.95E-01 | | |
| Pu-239 | 5.5293E-03 | 286.38 | 572.76 | 0.00E+00 | 1.58E+00 | 3.17E+00 | | |
| Pu-240 | 2.1278E-03 | 286.38 | 572.76 | 0.00E+00 | 6.09E-01 | 1.22E+00 | | |
| Pu-241 | 1.0195E-01 | 286.38 | 572.76 | 0.00E+00 | 2.92E+01 | 5.84E+01 | | |
| Pu-242 | 2.3128E-07 | 286.38 | 572.76 | 0.00E+00 | 6.62E-05 | 1.32E-04 | | |
| Ra-226 | 5.2782E-14 | 286.38 | 572.76 | 0.00E+00 | 1.51E-11 | 3.02E-11 | | |
| Ra-228 | 1.9338E-10 | 286.38 | 572.76 | 0.00E+00 | 5.54E-08 | 1.11E-07 | | |
| Ru-106 | 9.1684E-02 | 286.38 | 572.76 | 0.00E+00 | 2.63E+01 | 5.25E+01 | | |
| Se-79 | 1.3018E-05 | 286.38 | 572.76 | 0.00E+00 | 3.73E-03 | 7.46E-03 | | |
| Sn-126 | 1.2167E-05 | 286.38 | 572.76 | 0.00E+00 | 3.48E-03 | 6.97E-03 | | |
| Sr-90 | 2.6045E+00 | 286.38 | 572.76 | 0.00E+00 | 7.46E+02 | 1.49E+03 | | |
| Tc-99 | 4.4241E-04 | 286.38 | 572.76 | 0.00E+00 | 1.27E-01 | 2.53E-01 | | |
| Th-229 | 1.3713E-10 | 286.38 | 572.76 | 0.00E+00 | 3.93E-08 | 7.85E-08 | | |
| Th-230 | 1.8090E-11 | 286.38 | 572.76 | 0.00E+00 | 5.18E-09 | 1.04E-08 | | |
| Th-232 | 2.5278E-10 | 286.38 | 572.76 | 0.00E+00 | 7.24E-08 | 1.45E-07 | | |
| Ti-208 | 1.6947E-08 | 286.38 | 572.76 | 0.00E+00 | 4.85E-06 | 9.71E-06 | | |
| U-232 | 4.8737E-08 | 286.38 | 572.76 | 0.00E+00 | 1.40E-05 | 2.79E-05 | | |
| U-233 | 1.2203E-07 | 286.38 | 572.76 | 0.00E+00 | 3.49E-05 | 6.99E-05 | | |
| U-234 | 1.5925E-07 | 286.38 | 572.76 | 0.00E+00 | 4.56E-05 | 9.12E-05 | | |
| U-235 | -2.6194E-06 | 286.38 | 0.00 | 3.95E-03 | 3.20E-03 | 3.95E-03 | | |
| U-236 | 1.2693E-05 | 286.38 | 572.76 | 0.00E+00 | 3.64E-03 | 7.27E-03 | | |
| U-238 | -3.6331E-08 | 286.38 | 0.00 | 2.54E-03 | 2.53E-03 | 2.54E-03 | | |
| Y-90 | 2.6060E+00 | 286.38 | 572.76 | 0.00E+00 | 7.46E+02 | 1.49E+03 | | |
| Other Radionuclides | | | | | 1.03E+03 | 2.06E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|------------|----------------------------------|
| Reactor Moderator: | LW AND U ZIRC HYDRIDE | Used | |
| Fuel Cladding: | SST | SST | |
| BOL HM Constituents: | U | U | |
| BOL Enrichment % | 19.49184744 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 273.96 | 286.38 | |
| Bounding | | 572.76 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 0.90 | 1.05 | |
| Bounding | 1.79 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 8 5/20 (IFE) ITALY
SNF ID # 929
Fuel Units & Descr 2 - ELEMENT
Heavy Metal Mass BOL=0.383kg EOL=0.372kg
ROD Storage Site INEEL

¹Fuel decay start date 1999
Estimates as of 2030
Template TRIGA-SS (LW/U-Zrx SST, 10 to 20% U)
²Template Burnup(MWd) 6.65
Template BOL Heavy Metal Mass (MT) 0.000195
Template Decay Time 25 years

Estimated
Canister usage:
18"x10"
0.02

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 4.1459E-09 | 13.06 | 26.13 | 0.00E+00 | 5.42E-08 | 1.08E-07 | Avg MeV | |
| Am-241 | 3.5850E-03 | 13.06 | 26.13 | 0.00E+00 | 4.68E-02 | 9.37E-02 | 0.0150 | 2.319E+12 |
| Am-242m | 1.2899E-06 | 13.06 | 26.13 | 0.00E+00 | 1.69E-05 | 3.37E-05 | 0.0250 | 4.822E+11 |
| Am-243 | 1.4747E-07 | 13.06 | 26.13 | 0.00E+00 | 1.93E-06 | 3.85E-06 | 0.0375 | 4.183E+11 |
| C-14 | 1.2839E-04 | 13.06 | 26.13 | 0.00E+00 | 1.68E-03 | 3.35E-03 | 0.0675 | 4.505E+11 |
| Cl-36 | 2.8120E-06 | 13.06 | 26.13 | 0.00E+00 | 3.67E-05 | 7.35E-05 | 0.0850 | 2.715E+11 |
| Cm-243 | 1.1038E-07 | 13.06 | 26.13 | 0.00E+00 | 1.44E-06 | 2.88E-06 | 0.1250 | 1.772E+11 |
| Cm-244 | 7.8917E-07 | 13.06 | 26.13 | 0.00E+00 | 1.03E-05 | 2.06E-05 | 0.2250 | 2.335E+11 |
| Co-60 | 9.2647E-02 | 13.06 | 26.13 | 0.00E+00 | 1.21E+00 | 2.42E+00 | 0.3750 | 1.020E+11 |
| Cs-134 | 1.0940E-04 | 13.06 | 26.13 | 0.00E+00 | 1.43E-03 | 2.86E-03 | 0.5750 | 1.691E+12 |
| Cs-135 | 3.2195E-05 | 13.06 | 26.13 | 0.00E+00 | 4.21E-04 | 8.41E-04 | 0.8500 | 1.815E+10 |
| Cs-137 | 1.7368E+00 | 13.06 | 26.13 | 0.00E+00 | 2.27E+01 | 4.54E+01 | 1.2500 | 1.864E+11 |
| Eu-154 | 3.0677E-03 | 13.06 | 26.13 | 0.00E+00 | 4.01E-02 | 8.02E-02 | 1.7500 | 4.725E+08 |
| Eu-155 | 1.7925E-03 | 13.06 | 26.13 | 0.00E+00 | 2.34E-02 | 4.68E-02 | 2.2500 | 9.963E+05 |
| Fe-55 | 3.7444E-03 | 13.06 | 26.13 | 0.00E+00 | 4.89E-02 | 9.78E-02 | 2.7500 | 1.685E+04 |
| H-3 | 3.6180E-03 | 13.06 | 26.13 | 0.00E+00 | 4.73E-02 | 9.45E-02 | 3.5000 | 3.541E+01 |
| I-129 | 7.3684E-07 | 13.06 | 26.13 | 0.00E+00 | 9.63E-06 | 1.93E-05 | 5.0000 | 1.379E+01 |
| Kr-85 | 6.9368E-02 | 13.06 | 26.13 | 0.00E+00 | 9.06E-01 | 1.81E+00 | 7.0000 | 1.557E+00 |
| Np-237 | 1.2662E-06 | 13.06 | 26.13 | 0.00E+00 | 1.65E-05 | 3.31E-05 | 11.0000 | 1.771E-01 |
| Pa-231 | 9.1654E-09 | 13.06 | 26.13 | 0.00E+00 | 1.20E-07 | 2.39E-07 | | |
| Pb-210 | 1.3728E-13 | 13.06 | 26.13 | 0.00E+00 | 1.79E-12 | 3.59E-12 | | |
| Pm-147 | 1.0702E-02 | 13.06 | 26.13 | 0.00E+00 | 1.40E-01 | 2.80E-01 | | |
| Pu-238 | 8.8692E-04 | 13.06 | 26.13 | 0.00E+00 | 1.16E-02 | 2.32E-02 | | |
| Pu-239 | 5.5263E-03 | 13.06 | 26.13 | 0.00E+00 | 7.22E-02 | 1.44E-01 | | |
| Pu-240 | 2.1233E-03 | 13.06 | 26.13 | 0.00E+00 | 2.77E-02 | 5.55E-02 | | |
| Pu-241 | 3.8962E-02 | 13.06 | 26.13 | 0.00E+00 | 5.09E-01 | 1.02E+00 | | |
| Pu-242 | 2.3128E-07 | 13.06 | 26.13 | 0.00E+00 | 3.02E-06 | 6.04E-06 | | |
| Ra-226 | 4.6752E-13 | 13.06 | 26.13 | 0.00E+00 | 6.11E-12 | 1.22E-11 | | |
| Ra-228 | 2.4827E-10 | 13.06 | 26.13 | 0.00E+00 | 3.24E-09 | 6.49E-09 | | |
| Ru-106 | 9.8526E-08 | 13.06 | 26.13 | 0.00E+00 | 1.29E-06 | 2.57E-06 | | |
| Se-79 | 1.3015E-05 | 13.06 | 26.13 | 0.00E+00 | 1.70E-04 | 3.40E-04 | | |
| Sn-126 | 1.2165E-05 | 13.06 | 26.13 | 0.00E+00 | 1.59E-04 | 3.18E-04 | | |
| Sr-90 | 1.6195E+00 | 13.06 | 26.13 | 0.00E+00 | 2.12E+01 | 4.23E+01 | | |
| Tc-99 | 4.4241E-04 | 13.06 | 26.13 | 0.00E+00 | 5.78E-03 | 1.16E-02 | | |
| Th-229 | 4.2451E-10 | 13.06 | 26.13 | 0.00E+00 | 5.55E-09 | 1.11E-08 | | |
| Th-230 | 6.1398E-11 | 13.06 | 26.13 | 0.00E+00 | 8.02E-10 | 1.60E-09 | | |
| Th-232 | 2.5278E-10 | 13.06 | 26.13 | 0.00E+00 | 3.30E-09 | 6.60E-09 | | |
| Ti-208 | 1.5098E-08 | 13.06 | 26.13 | 0.00E+00 | 1.97E-07 | 3.94E-07 | | |
| U-232 | 4.0662E-08 | 13.06 | 26.13 | 0.00E+00 | 5.31E-07 | 1.06E-06 | | |
| U-233 | 1.2217E-07 | 13.06 | 26.13 | 0.00E+00 | 1.60E-06 | 3.19E-06 | | |
| U-234 | 2.2391E-07 | 13.06 | 26.13 | 0.00E+00 | 2.93E-06 | 5.85E-06 | | |
| U-235 | -2.6194E-06 | 13.06 | 0.00 | 1.66E-04 | 1.32E-04 | 1.66E-04 | | |
| U-236 | 1.2695E-05 | 13.06 | 26.13 | 0.00E+00 | 1.66E-04 | 3.32E-04 | | |
| U-238 | -3.6331E-08 | 13.06 | 0.00 | 1.03E-04 | 1.02E-04 | 1.03E-04 | | |
| Y-90 | 1.6195E+00 | 13.06 | 26.13 | 0.00E+00 | 2.12E+01 | 4.23E+01 | | |
| Other Radionuclides | | | | | 2.25E+01 | 4.50E+01 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences: |
|---------------------|-----------------------|-----------------------|--|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | This Template was used for the following reasons. |
| Fuel Cladding | SST | SST | This fuel matches on all parameters except enrichment (very close to 20%). |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20.10443864 | 10 to 20.1 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate |
|----------|----------|-----------|---|
| Nominal | 13.06 | 10.50 | Nominal burnup taken directly from SFD (converted to MWd) |
| Bounding | | 26.13 | Bounding burnup assumed to be twice nominal burnup |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/ Given EOL HM |
|----------|-------------------|--------------------------------|--------------------------------|
| Nominal | 1.00 | 0.80 | 0.99 |
| Bounding | 2.00 | | |

¹Reactor shutdown core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8.5/20 (IFE) OSU
 SNF ID #: 1040
 Fuel Units & Descr: 2 - ELEMENT
 Heavy Metal Mass: BOL=0.39kg, EOL=0.38kg
 ROD Storage Site: INEEL

¹Fuel decay start date: 2025
 Estimates as of: 2030
 Template: TRIGA-SS (LW/U-Zrx, SST, 10 to 20%, U)
²Template Burnup(MWd): 6.65
 Template BOL Heavy Metal Mass (MT): 0.000195
 Template Decay Time: 5 years

Estimated
 Canister usage
 18"x10"
 0.02

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.5173E-10 | 9.55 | 19.09 | 0.00E+00 | 8.13E-09 | 1.63E-08 | Avg MeV | |
| Am-241 | 1.8331E-03 | 9.55 | 19.09 | 0.00E+00 | 1.75E-02 | 3.50E-02 | 0.0150 | 3.086E+12 |
| Am-242m | 1.4129E-06 | 9.55 | 19.09 | 0.00E+00 | 1.35E-05 | 2.70E-05 | 0.0250 | 6.790E+11 |
| Am-243 | 1.4774E-07 | 9.55 | 19.09 | 0.00E+00 | 1.41E-06 | 2.82E-06 | 0.0375 | 5.782E+11 |
| C-14 | 1.2871E-04 | 9.55 | 19.09 | 0.00E+00 | 1.23E-03 | 2.46E-03 | 0.0575 | 5.935E+11 |
| Cl-36 | 2.8120E-06 | 9.55 | 19.09 | 0.00E+00 | 2.68E-05 | 5.37E-05 | 0.0850 | 3.677E+11 |
| Cm-243 | 1.7940E-07 | 9.55 | 19.09 | 0.00E+00 | 1.71E-06 | 3.43E-06 | 0.1250 | 2.670E+11 |
| Cm-244 | 1.6962E-06 | 9.55 | 19.09 | 0.00E+00 | 1.62E-05 | 3.24E-05 | 0.2250 | 3.119E+11 |
| Co-60 | 1.2839E+00 | 9.55 | 19.09 | 0.00E+00 | 1.23E+01 | 2.45E+01 | 0.3750 | 1.583E+11 |
| Cs-134 | 9.0541E-02 | 9.55 | 19.09 | 0.00E+00 | 8.64E-01 | 1.73E+00 | 0.5750 | 2.104E+12 |
| Cs-135 | 3.2195E-05 | 9.55 | 19.09 | 0.00E+00 | 3.07E-04 | 6.15E-04 | 0.8500 | 9.031E+10 |
| Cs-137 | 2.7564E+00 | 9.55 | 19.09 | 0.00E+00 | 2.63E+01 | 5.26E+01 | 1.2500 | 1.834E+12 |
| Eu-154 | 1.5368E-02 | 9.55 | 19.09 | 0.00E+00 | 1.47E-01 | 2.93E-01 | 1.7500 | 1.223E+09 |
| Eu-155 | 2.9293E-02 | 9.55 | 19.09 | 0.00E+00 | 2.80E-01 | 5.59E-01 | 2.2500 | 1.971E+09 |
| Fe-55 | 7.7158E-01 | 9.55 | 19.09 | 0.00E+00 | 7.37E+00 | 1.47E+01 | 2.7500 | 1.564E+07 |
| H-3 | 1.1111E-02 | 9.55 | 19.09 | 0.00E+00 | 1.06E-01 | 2.12E-01 | 3.5000 | 1.820E+06 |
| I-129 | 7.3684E-07 | 9.55 | 19.09 | 0.00E+00 | 7.03E-06 | 1.41E-05 | 5.0000 | 1.025E+01 |
| Kr-85 | 2.5263E-01 | 9.55 | 19.09 | 0.00E+00 | 2.41E+00 | 4.82E+00 | 7.0000 | 1.160E+00 |
| Np-237 | 1.2427E-06 | 9.55 | 19.09 | 0.00E+00 | 1.19E-05 | 2.37E-05 | 11.0000 | 1.322E-01 |
| Pa-231 | 3.8511E-09 | 9.55 | 19.09 | 0.00E+00 | 3.68E-08 | 7.35E-08 | | |
| Pb-210 | 7.3880E-15 | 9.55 | 19.09 | 0.00E+00 | 7.05E-14 | 1.41E-13 | | |
| Pm-147 | 2.1023E+00 | 9.55 | 19.09 | 0.00E+00 | 2.01E+01 | 4.01E+01 | | |
| Pu-238 | 1.0383E-03 | 9.55 | 19.09 | 0.00E+00 | 9.91E-03 | 1.98E-02 | | |
| Pu-239 | 5.5293E-03 | 9.55 | 19.09 | 0.00E+00 | 5.28E-02 | 1.06E-01 | | |
| Pu-240 | 2.1278E-03 | 9.55 | 19.09 | 0.00E+00 | 2.03E-02 | 4.06E-02 | | |
| Pu-241 | 1.0195E-01 | 9.55 | 19.09 | 0.00E+00 | 9.73E-01 | 1.95E+00 | | |
| Pu-242 | 2.3128E-07 | 9.55 | 19.09 | 0.00E+00 | 2.21E-06 | 4.42E-06 | | |
| Ra-226 | 5.2782E-14 | 9.55 | 19.09 | 0.00E+00 | 5.04E-13 | 1.01E-12 | | |
| Ra-228 | 1.9338E-10 | 9.55 | 19.09 | 0.00E+00 | 1.85E-09 | 3.69E-09 | | |
| Ru-106 | 9.1684E-02 | 9.55 | 19.09 | 0.00E+00 | 8.75E-01 | 1.75E+00 | | |
| Se-79 | 1.3018E-05 | 9.55 | 19.09 | 0.00E+00 | 1.24E-04 | 2.49E-04 | | |
| Sn-126 | 1.2167E-05 | 9.55 | 19.09 | 0.00E+00 | 1.16E-04 | 2.32E-04 | | |
| Sr-90 | 2.6045E+00 | 9.55 | 19.09 | 0.00E+00 | 2.49E+01 | 4.97E+01 | | |
| Tc-99 | 4.4241E-04 | 9.55 | 19.09 | 0.00E+00 | 4.22E-03 | 8.45E-03 | | |
| Th-229 | 1.3713E-10 | 9.55 | 19.09 | 0.00E+00 | 1.31E-09 | 2.62E-09 | | |
| Th-230 | 1.8090E-11 | 9.55 | 19.09 | 0.00E+00 | 1.73E-10 | 3.45E-10 | | |
| Th-232 | 2.5278E-10 | 9.55 | 19.09 | 0.00E+00 | 2.41E-09 | 4.83E-09 | | |
| Ti-208 | 1.6947E-08 | 9.55 | 19.09 | 0.00E+00 | 1.62E-07 | 3.24E-07 | | |
| U-232 | 4.8737E-08 | 9.55 | 19.09 | 0.00E+00 | 4.65E-07 | 9.30E-07 | | |
| U-233 | 1.2203E-07 | 9.55 | 19.09 | 0.00E+00 | 1.16E-06 | 2.33E-06 | | |
| U-234 | 1.5925E-07 | 9.55 | 19.09 | 0.00E+00 | 1.52E-06 | 3.04E-06 | | |
| U-235 | -2.6194E-06 | 9.55 | 0.00 | 1.68E-04 | 1.43E-04 | 1.68E-04 | | |
| U-236 | 1.2693E-05 | 9.55 | 19.09 | 0.00E+00 | 1.21E-04 | 2.42E-04 | | |
| U-238 | -3.6331E-08 | 9.55 | 0.00 | 1.05E-04 | 1.05E-04 | 1.05E-04 | | |
| Y-90 | 2.6060E+00 | 9.55 | 19.09 | 0.00E+00 | 2.49E+01 | 4.98E+01 | | |
| Other Radionuclides | | | | | 3.44E+01 | 6.88E+01 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| From SFD | | Used | |
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19.9 | 10 to 20.1 | |

| Burnup Summary (MWd) ¹ | | | Basis for burnup used in estimate: |
|-----------------------------------|------|-----------|--|
| From SFD | | Estimated | |
| Nominal | 3.80 | 9.55 | |
| Bounding | | 19.09 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|-------------------|------|-------------------------------|-------------------------------|
| Burnup Multiplier | | Estimated Burnup/Given Burnup | |
| Nominal | 0.72 | 2.51 | |
| Bounding | 1.44 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 8 5/20 (IFE) U OF AZ
SNF ID # 972
Fuel Units & Descr 1 - ELEMENT
Heavy Metal Mass BOL=0.195kg EOL=0.188kg
ROD Storage Site INEEL

¹Fuel decay start date 1998
Estimates as of 2030
Template TRIGA-SS (LW/U-Zrx SST, 10 to 20%, U)
²Template Burnup(MWd) 6.65
Template BOL Heavy Metal Mass (MT) 0.000195
Template Decay Time 25 years

Estimated
Canister usage
18"x10"
0.01

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 4.1459E-09 | 6.68 | 13.36 | 0.00E+00 | 2.77E-08 | 5.54E-08 | Avg. MeV | |
| Am-241 | 3.5850E-03 | 6.68 | 13.36 | 0.00E+00 | 2.40E-02 | 4.79E-02 | 0.0150 | 1.186E+12 |
| Am-242m | 1.2899E-06 | 6.68 | 13.36 | 0.00E+00 | 8.62E-06 | 1.72E-05 | 0.0250 | 2.466E+11 |
| Am-243 | 1.4747E-07 | 6.68 | 13.36 | 0.00E+00 | 9.85E-07 | 1.97E-06 | 0.0375 | 2.140E+11 |
| C-14 | 1.2839E-04 | 6.68 | 13.36 | 0.00E+00 | 8.58E-04 | 1.72E-03 | 0.0575 | 2.304E+11 |
| Cl-36 | 2.8120E-06 | 6.68 | 13.36 | 0.00E+00 | 1.88E-05 | 3.76E-05 | 0.0850 | 1.389E+11 |
| Cm-243 | 1.1038E-07 | 6.68 | 13.36 | 0.00E+00 | 7.38E-07 | 1.48E-06 | 0.1250 | 9.062E+10 |
| Cm-244 | 7.8917E-07 | 6.68 | 13.36 | 0.00E+00 | 5.27E-06 | 1.05E-05 | 0.2250 | 1.194E+11 |
| Co-60 | 9.2647E-02 | 6.68 | 13.36 | 0.00E+00 | 6.19E-01 | 1.24E+00 | 0.3750 | 5.217E+10 |
| Cs-134 | 1.0940E-04 | 6.68 | 13.36 | 0.00E+00 | 7.31E-04 | 1.46E-03 | 0.5750 | 8.648E+11 |
| Cs-135 | 3.2195E-05 | 6.68 | 13.36 | 0.00E+00 | 2.15E-04 | 4.30E-04 | 0.8500 | 9.285E+09 |
| Cs-137 | 1.7368E+00 | 6.68 | 13.36 | 0.00E+00 | 1.16E+01 | 2.32E+01 | 1.2500 | 9.534E+10 |
| Eu-154 | 3.0677E-03 | 6.68 | 13.36 | 0.00E+00 | 2.05E-02 | 4.10E-02 | 1.7500 | 2.417E+08 |
| Eu-155 | 1.7925E-03 | 6.68 | 13.36 | 0.00E+00 | 1.20E-02 | 2.40E-02 | 2.2500 | 5.096E+05 |
| Fe-55 | 3.7444E-03 | 6.68 | 13.36 | 0.00E+00 | 2.50E-02 | 5.00E-02 | 2.7500 | 8.617E+03 |
| H-3 | 3.6180E-03 | 6.68 | 13.36 | 0.00E+00 | 2.42E-02 | 4.84E-02 | 3.5000 | 1.811E+01 |
| I-129 | 7.3684E-07 | 6.68 | 13.36 | 0.00E+00 | 4.92E-06 | 9.85E-06 | 5.0000 | 7.053E+00 |
| Kr-85 | 6.9368E-02 | 6.68 | 13.36 | 0.00E+00 | 4.64E-01 | 9.27E-01 | 7.0000 | 7.962E-01 |
| Np-237 | 1.2662E-06 | 6.68 | 13.36 | 0.00E+00 | 8.46E-06 | 1.69E-05 | 11.0000 | 9.055E-02 |
| Pa-231 | 9.1654E-09 | 6.68 | 13.36 | 0.00E+00 | 6.12E-08 | 1.22E-07 | | |
| Pb-210 | 1.3728E-13 | 6.68 | 13.36 | 0.00E+00 | 9.17E-13 | 1.83E-12 | | |
| Pm-147 | 1.0702E-02 | 6.68 | 13.36 | 0.00E+00 | 7.15E-02 | 1.43E-01 | | |
| Pu-238 | 8.8692E-04 | 6.68 | 13.36 | 0.00E+00 | 5.93E-03 | 1.19E-02 | | |
| Pu-239 | 5.5263E-03 | 6.68 | 13.36 | 0.00E+00 | 3.69E-02 | 7.39E-02 | | |
| Pu-240 | 2.1233E-03 | 6.68 | 13.36 | 0.00E+00 | 1.42E-02 | 2.84E-02 | | |
| Pu-241 | 3.8962E-02 | 6.68 | 13.36 | 0.00E+00 | 2.60E-01 | 5.21E-01 | | |
| Pu-242 | 2.3128E-07 | 6.68 | 13.36 | 0.00E+00 | 1.55E-06 | 3.09E-06 | | |
| Ra-226 | 4.6752E-13 | 6.68 | 13.36 | 0.00E+00 | 3.12E-12 | 6.25E-12 | | |
| Ra-228 | 2.4827E-10 | 6.68 | 13.36 | 0.00E+00 | 1.66E-09 | 3.32E-09 | | |
| Ru-106 | 9.8526E-08 | 6.68 | 13.36 | 0.00E+00 | 6.58E-07 | 1.32E-06 | | |
| Se-79 | 1.3015E-05 | 6.68 | 13.36 | 0.00E+00 | 8.70E-05 | 1.74E-04 | | |
| Sn-126 | 1.2165E-05 | 6.68 | 13.36 | 0.00E+00 | 8.13E-05 | 1.63E-04 | | |
| Sr-90 | 1.6195E+00 | 6.68 | 13.36 | 0.00E+00 | 1.08E+01 | 2.16E+01 | | |
| Tc-99 | 4.4241E-04 | 6.68 | 13.36 | 0.00E+00 | 2.96E-03 | 5.91E-03 | | |
| Th-229 | 4.2451E-10 | 6.68 | 13.36 | 0.00E+00 | 2.84E-09 | 5.67E-09 | | |
| Th-230 | 6.1398E-11 | 6.68 | 13.36 | 0.00E+00 | 4.10E-10 | 8.21E-10 | | |
| Th-232 | 2.5278E-10 | 6.68 | 13.36 | 0.00E+00 | 1.69E-09 | 3.38E-09 | | |
| Th-208 | 1.5098E-08 | 6.68 | 13.36 | 0.00E+00 | 1.01E-07 | 2.02E-07 | | |
| U-232 | 4.0662E-08 | 6.68 | 13.36 | 0.00E+00 | 2.72E-07 | 5.43E-07 | | |
| U-233 | 1.2217E-07 | 6.68 | 13.36 | 0.00E+00 | 8.16E-07 | 1.63E-06 | | |
| U-234 | 2.2391E-07 | 6.68 | 13.36 | 0.00E+00 | 1.50E-06 | 2.99E-06 | | |
| U-235 | -2.6194E-06 | 6.68 | 0.00 | 8.43E-05 | 6.68E-05 | 8.43E-05 | | |
| U-236 | 1.2695E-05 | 6.68 | 13.36 | 0.00E+00 | 8.48E-05 | 1.70E-04 | | |
| U-238 | -3.6331E-08 | 6.68 | 0.00 | 5.24E-05 | 5.22E-05 | 5.24E-05 | | |
| Y-90 | 1.6195E+00 | 6.68 | 13.36 | 0.00E+00 | 1.08E+01 | 2.16E+01 | | |
| Other Radionuclides | | | | | 1.15E+01 | 2.30E+01 | | |

Other Radionuclides

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences* |
|---------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 | 10 to 20.1 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate* |
|----------|----------|-----------|--|
| Nominal | 1.90 | 6.68 | Nominal burnup calculated from the heavy metal mass destroyed. |
| Bounding | | 13.36 | Bounding burnup assumed to be twice nominal burnup |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 1.00 | 3.52 | 1.00 |
| Bounding | 2.01 | | |

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel.

*Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8.5/20 (IFE) U OF AZ
 SNF ID #: 973
 Fuel Units & Descr: 2 - ELEMENT
 Heavy Metal Mass: BOL=0.39kg EOL=0.378kg
 ROD Storage Site: INEEL

¹Fuel decay start date: 2035
 Estimates as of: 2030
 Template: TRIGA-SS (LW/U Zrx, SST, 10 to 20%, U)
²Template Burnup(MWd): 6.65
 Template BOL Heavy Metal Mass (MT): 0.000195
 Template Decay Time: 5 years

Estimated
 Canister usage:
 18"x10"
 0.02

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.5173E-10 | 11.46 | 22.91 | 0.00E+00 | 9.76E-09 | 1.95E-08 | Avg MeV | |
| Am-241 | 1.8331E-03 | 11.46 | 22.91 | 0.00E+00 | 2.10E-02 | 4.20E-02 | 0.0150 | 3.703E+12 |
| Am-242m | 1.4129E-06 | 11.46 | 22.91 | 0.00E+00 | 1.62E-05 | 3.24E-05 | 0.0250 | 8.148E+11 |
| Am-243 | 1.4774E-07 | 11.46 | 22.91 | 0.00E+00 | 1.69E-06 | 3.38E-06 | 0.0375 | 6.939E+11 |
| C-14 | 1.2871E-04 | 11.46 | 22.91 | 0.00E+00 | 1.47E-03 | 2.95E-03 | 0.0575 | 7.122E+11 |
| Cl-36 | 2.8120E-06 | 11.46 | 22.91 | 0.00E+00 | 3.22E-05 | 6.44E-05 | 0.0850 | 4.412E+11 |
| Cm-243 | 1.7940E-07 | 11.46 | 22.91 | 0.00E+00 | 2.06E-06 | 4.11E-06 | 0.1250 | 3.204E+11 |
| Cm-244 | 1.6962E-06 | 11.46 | 22.91 | 0.00E+00 | 1.94E-05 | 3.89E-05 | 0.2250 | 3.743E+11 |
| Co-60 | 1.2839E+00 | 11.46 | 22.91 | 0.00E+00 | 1.47E+01 | 2.94E+01 | 0.3750 | 1.899E+11 |
| Cs-134 | 9.0541E-02 | 11.46 | 22.91 | 0.00E+00 | 1.04E+00 | 2.07E+00 | 0.5750 | 2.525E+12 |
| Cs-135 | 3.2195E-05 | 11.46 | 22.91 | 0.00E+00 | 3.69E-04 | 7.38E-04 | 0.8500 | 1.084E+11 |
| Cs-137 | 2.7564E+00 | 11.46 | 22.91 | 0.00E+00 | 3.16E+01 | 6.32E+01 | 1.2500 | 2.201E+12 |
| Eu-154 | 1.5368E-02 | 11.46 | 22.91 | 0.00E+00 | 1.76E-01 | 3.52E-01 | 1.7500 | 1.467E+09 |
| Eu-155 | 2.9293E-02 | 11.46 | 22.91 | 0.00E+00 | 3.36E-01 | 6.71E-01 | 2.2500 | 2.365E+09 |
| Fe-55 | 7.7158E-01 | 11.46 | 22.91 | 0.00E+00 | 8.84E+00 | 1.77E+01 | 2.7500 | 1.877E+07 |
| H-3 | 1.1111E-02 | 11.46 | 22.91 | 0.00E+00 | 1.27E-01 | 2.55E-01 | 3.5000 | 2.184E+06 |
| I-129 | 7.3684E-07 | 11.46 | 22.91 | 0.00E+00 | 8.44E-06 | 1.69E-05 | 5.0000 | 1.225E+01 |
| Kr-85 | 2.5263E-01 | 11.46 | 22.91 | 0.00E+00 | 2.89E+00 | 5.79E+00 | 7.0000 | 1.387E+00 |
| Np-237 | 1.2427E-06 | 11.46 | 22.91 | 0.00E+00 | 1.42E-05 | 2.85E-05 | 11.0000 | 1.580E-01 |
| Pa-231 | 3.8511E-09 | 11.46 | 22.91 | 0.00E+00 | 4.41E-08 | 8.82E-08 | | |
| Pb-210 | 7.3880E-15 | 11.46 | 22.91 | 0.00E+00 | 8.46E-14 | 1.69E-13 | | |
| Pm-147 | 2.1023E+00 | 11.46 | 22.91 | 0.00E+00 | 2.41E+01 | 4.82E+01 | | |
| Pu-238 | 1.0383E-03 | 11.46 | 22.91 | 0.00E+00 | 1.19E-02 | 2.38E-02 | | |
| Pu-239 | 5.5293E-03 | 11.46 | 22.91 | 0.00E+00 | 6.33E-02 | 1.27E-01 | | |
| Pu-240 | 2.1278E-03 | 11.46 | 22.91 | 0.00E+00 | 2.44E-02 | 4.87E-02 | | |
| Pu-241 | 1.0195E-01 | 11.46 | 22.91 | 0.00E+00 | 1.17E+00 | 2.34E+00 | | |
| Pu-242 | 2.3128E-07 | 11.46 | 22.91 | 0.00E+00 | 2.65E-06 | 5.30E-06 | | |
| Ra-226 | 5.2782E-14 | 11.46 | 22.91 | 0.00E+00 | 6.05E-13 | 1.21E-12 | | |
| Ra-228 | 1.9338E-10 | 11.46 | 22.91 | 0.00E+00 | 2.22E-09 | 4.43E-09 | | |
| Ru-106 | 9.1684E-02 | 11.46 | 22.91 | 0.00E+00 | 1.05E+00 | 2.10E+00 | | |
| Se-79 | 1.3018E-05 | 11.46 | 22.91 | 0.00E+00 | 1.49E-04 | 2.98E-04 | | |
| Sn-126 | 1.2167E-05 | 11.46 | 22.91 | 0.00E+00 | 1.39E-04 | 2.79E-04 | | |
| Sr-90 | 2.6045E+00 | 11.46 | 22.91 | 0.00E+00 | 2.98E+01 | 5.97E+01 | | |
| Tc-99 | 4.4241E-04 | 11.46 | 22.91 | 0.00E+00 | 5.07E-03 | 1.01E-02 | | |
| Th-229 | 1.3713E-10 | 11.46 | 22.91 | 0.00E+00 | 1.57E-09 | 3.14E-09 | | |
| Th-230 | 1.8090E-11 | 11.46 | 22.91 | 0.00E+00 | 2.07E-10 | 4.14E-10 | | |
| Th-232 | 2.5278E-10 | 11.46 | 22.91 | 0.00E+00 | 2.90E-09 | 5.79E-09 | | |
| Th-208 | 1.6947E-08 | 11.46 | 22.91 | 0.00E+00 | 1.94E-07 | 3.88E-07 | | |
| U-232 | 4.8737E-08 | 11.46 | 22.91 | 0.00E+00 | 5.58E-07 | 1.12E-06 | | |
| U-233 | 1.2203E-07 | 11.46 | 22.91 | 0.00E+00 | 1.40E-06 | 2.80E-06 | | |
| U-234 | 1.5925E-07 | 11.46 | 22.91 | 0.00E+00 | 1.82E-06 | 3.65E-06 | | |
| U-235 | -2.6194E-06 | 11.46 | 0.00 | 1.69E-04 | 1.39E-04 | 1.69E-04 | | |
| U-236 | 1.2693E-05 | 11.46 | 22.91 | 0.00E+00 | 1.45E-04 | 2.91E-04 | | |
| U-238 | -3.6331E-08 | 11.46 | 0.00 | 1.05E-04 | 1.04E-04 | 1.05E-04 | | |
| Y-90 | 2.6060E+00 | 11.46 | 22.91 | 0.00E+00 | 2.99E+01 | 5.97E+01 | | |
| Other Radionuclides | | | | | 4.13E+01 | 8.26E+01 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| | From SFD | Used | |
| Reactor Moderator: | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 | 10 to 20.1 | |

| Burnup Summary (MWd) ³ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 1.90 | 11.46 | |
| Bounding | | 22.91 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0.86 | 6.03 | |
| Bounding | 1.72 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 8 5/20 (IFE) U OF IL
SNF ID # 1048
Fuel Units & Descr 8 - ELEMENT
Heavy Metal Mass BOL=1.56kg EOL=1.52kg
ROD Storage Site: INEEL

Fuel decay start date 2035
Estimates as of 2030
Template TRIGA-SS (LW/U-Zrx, SST, 10 to 20%, U)
Template Burnup(MWd) 6.65
Template BOL Heavy Metal Mass (MT): 0.000195
Template Decay Time 5 years

Estimated
Canister usage
18"x10"
0.07

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.5173E-10 | 38.18 | 76.37 | 0.00E+00 | 3.25E-08 | 6.50E-08 | Avg MeV | |
| Am-241 | 1.8331E-03 | 38.18 | 76.37 | 0.00E+00 | 7.00E-02 | 1.40E-01 | 0.0150 | 1.234E+13 |
| Am-242m | 1.4129E-06 | 38.18 | 76.37 | 0.00E+00 | 5.40E-05 | 1.08E-04 | 0.0250 | 2.716E+12 |
| Am-243 | 1.4774E-07 | 38.18 | 76.37 | 0.00E+00 | 5.64E-06 | 1.13E-05 | 0.0375 | 2.313E+12 |
| C-14 | 1.2871E-04 | 38.18 | 76.37 | 0.00E+00 | 4.91E-03 | 9.83E-03 | 0.0575 | 2.374E+12 |
| Ci-36 | 2.8120E-06 | 38.18 | 76.37 | 0.00E+00 | 1.07E-04 | 2.15E-04 | 0.0850 | 1.471E+12 |
| Cm-243 | 1.7940E-07 | 38.18 | 76.37 | 0.00E+00 | 6.85E-06 | 1.37E-05 | 0.1250 | 1.068E+12 |
| Cm-244 | 1.6962E-06 | 38.18 | 76.37 | 0.00E+00 | 6.48E-05 | 1.30E-04 | 0.2250 | 1.248E+12 |
| Co-60 | 1.2839E+00 | 38.18 | 76.37 | 0.00E+00 | 4.90E+01 | 9.81E+01 | 0.3750 | 6.331E+11 |
| Cs-134 | 9.0541E-02 | 38.18 | 76.37 | 0.00E+00 | 3.46E+00 | 6.91E+00 | 0.5750 | 8.417E+12 |
| Cs-135 | 3.2195E-05 | 38.18 | 76.37 | 0.00E+00 | 1.23E-03 | 2.46E-03 | 0.8500 | 3.613E+11 |
| Cs-137 | 2.7564E+00 | 38.18 | 76.37 | 0.00E+00 | 1.05E+02 | 2.11E+02 | 1.2500 | 7.336E+12 |
| Eu-154 | 1.5368E-02 | 38.18 | 76.37 | 0.00E+00 | 5.87E-01 | 1.17E+00 | 1.7500 | 4.890E+09 |
| Eu-155 | 2.9293E-02 | 38.18 | 76.37 | 0.00E+00 | 1.12E+00 | 2.24E+00 | 2.2500 | 7.883E+09 |
| Fe-55 | 7.7158E-01 | 38.18 | 76.37 | 0.00E+00 | 2.95E+01 | 5.89E+01 | 2.7500 | 6.255E+07 |
| H-3 | 1.1111E-02 | 38.18 | 76.37 | 0.00E+00 | 4.24E-01 | 8.49E-01 | 3.5000 | 7.280E+06 |
| I-129 | 7.3684E-07 | 38.18 | 76.37 | 0.00E+00 | 2.81E-05 | 5.63E-05 | 5.0000 | 4.099E+01 |
| Kr-85 | 2.5263E-01 | 38.18 | 76.37 | 0.00E+00 | 9.65E+00 | 1.93E+01 | 7.0000 | 4.641E+00 |
| Np-237 | 1.2427E-06 | 38.18 | 76.37 | 0.00E+00 | 4.75E-05 | 9.49E-05 | 11.0000 | 5.288E-01 |
| Pa-231 | 3.8511E-09 | 38.18 | 76.37 | 0.00E+00 | 1.47E-07 | 2.94E-07 | | |
| Pb-210 | 7.3880E-15 | 38.18 | 76.37 | 0.00E+00 | 2.82E-13 | 5.64E-13 | | |
| Pm-147 | 2.1023E+00 | 38.18 | 76.37 | 0.00E+00 | 8.03E+01 | 1.61E+02 | | |
| Pu-238 | 1.0383E-03 | 38.18 | 76.37 | 0.00E+00 | 3.96E-02 | 7.93E-02 | | |
| Pu-239 | 5.5293E-03 | 38.18 | 76.37 | 0.00E+00 | 2.11E-01 | 4.22E-01 | | |
| Pu-240 | 2.1278E-03 | 38.18 | 76.37 | 0.00E+00 | 8.12E-02 | 1.62E-01 | | |
| Pu-241 | 1.0195E-01 | 38.18 | 76.37 | 0.00E+00 | 3.89E+00 | 7.79E+00 | | |
| Pu-242 | 2.3128E-07 | 38.18 | 76.37 | 0.00E+00 | 8.83E-06 | 1.77E-05 | | |
| Ra-226 | 5.2782E-14 | 38.18 | 76.37 | 0.00E+00 | 2.02E-12 | 4.03E-12 | | |
| Ra-228 | 1.9338E-10 | 38.18 | 76.37 | 0.00E+00 | 7.38E-09 | 1.48E-08 | | |
| Ru-106 | 9.1684E-02 | 38.18 | 76.37 | 0.00E+00 | 3.50E+00 | 7.00E+00 | | |
| Se-79 | 1.3018E-05 | 38.18 | 76.37 | 0.00E+00 | 4.97E-04 | 9.94E-04 | | |
| Sn-126 | 1.2167E-05 | 38.18 | 76.37 | 0.00E+00 | 4.65E-04 | 9.29E-04 | | |
| Sr-90 | 2.6045E+00 | 38.18 | 76.37 | 0.00E+00 | 9.95E+01 | 1.99E+02 | | |
| Tc-99 | 4.4241E-04 | 38.18 | 76.37 | 0.00E+00 | 1.69E-02 | 3.38E-02 | | |
| Th-229 | 1.3713E-10 | 38.18 | 76.37 | 0.00E+00 | 5.24E-09 | 1.05E-08 | | |
| Th-230 | 1.8090E-11 | 38.18 | 76.37 | 0.00E+00 | 6.91E-10 | 1.38E-09 | | |
| Th-232 | 2.5278E-10 | 38.18 | 76.37 | 0.00E+00 | 9.65E-09 | 1.93E-08 | | |
| Th-208 | 1.6947E-08 | 38.18 | 76.37 | 0.00E+00 | 6.47E-07 | 1.29E-06 | | |
| U-232 | 4.8737E-08 | 38.18 | 76.37 | 0.00E+00 | 1.86E-06 | 3.72E-06 | Thermal Power | |
| U-233 | 1.2203E-07 | 38.18 | 76.37 | 0.00E+00 | 4.66E-06 | 9.32E-06 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 1.5925E-07 | 38.18 | 76.37 | 0.00E+00 | 6.08E-06 | 1.22E-05 | 2.22E+00 | 4.44E+00 |
| U-235 | -2.6194E-06 | 38.18 | 0.00 | 6.74E-04 | 5.74E-04 | 6.74E-04 | Total | Total |
| U-236 | 1.2693E-05 | 38.18 | 76.37 | 0.00E+00 | 4.85E-04 | 9.69E-04 | | |
| U-238 | -3.6331E-08 | 38.18 | 0.00 | 4.19E-04 | 4.18E-04 | 4.19E-04 | | |
| Y-90 | 2.6060E+00 | 38.18 | 76.37 | 0.00E+00 | 9.95E+01 | 1.99E+02 | | |
| Other Radionuclides | | | | | 1.38E+02 | 2.75E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | SST | SST |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 20 | 10 to 20.1 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | 30.41 | 38.18 |
| Bounding | | 76.37 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|--------------------------------|
| Nominal | 0.72 | 1.26 |
| Bounding | 1.44 | |

Estimated EOL HM/Given EOL HM

1.00

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8.5/20 (IFE) UNIV OF CAL-IRVINE
 SNF ID #: 824
 Fuel Units & Descr: 5 - ELEMENT
 Heavy Metal Mass: BOL=0.916kg EOL=0.916kg
 ROD Storage Site: INEEL

¹Fuel decay start date: 2035
 Estimates as of: 2030
 Template: TRIGA SS (LW/U-Zrx, SST, 10 to 20%, U)
²Template Burnup(MWd): 6.65
 Template BOL Heavy Metal Mass (MT): 0.000195
 Template Decay Time: 5 years

Estimated
 Canister usage
 18"x10"
 0.05

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Cv/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.5173E-10 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | Avg. MeV | |
| Am-241 | 1.8331E-03 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0150 | 9.804E+06 |
| Am-242m | 1.4129E-06 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0250 | 0.000E+00 |
| Am-243 | 1.4774E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0375 | 1.338E+04 |
| C-14 | 1.2871E-04 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0575 | 8.107E+03 |
| Cl-36 | 2.8120E-06 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0850 | 1.143E+06 |
| Cm-243 | 1.7940E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.1250 | 2.257E+06 |
| Cm-244 | 1.6962E-06 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.2250 | 7.988E+06 |
| Co-60 | 1.2839E+00 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.3750 | 1.993E+04 |
| Cs-134 | 9.0541E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.5750 | 9.805E+02 |
| Cs-135 | 3.2195E-05 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.8500 | 1.528E+02 |
| Cs-137 | 2.7564E+00 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.2500 | 9.009E+00 |
| Eu-154 | 1.5368E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.7500 | 4.408E+00 |
| Eu-155 | 2.9293E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.2500 | 2.553E+00 |
| Fe-55 | 7.7158E-01 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.7500 | 1.484E+00 |
| H-3 | 1.1111E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 3.5000 | 1.326E+00 |
| I-129 | 7.3684E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 5.0000 | 5.698E-01 |
| Kr-85 | 2.5263E-01 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 7.0000 | 6.559E-02 |
| Np-237 | 1.2427E-06 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 11.0000 | 7.541E-03 |
| Pa-231 | 3.8511E-09 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pb-210 | 7.3880E-15 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pm-147 | 2.1023E+00 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-238 | 1.0383E-03 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-239 | 5.5293E-03 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-240 | 2.1278E-03 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-241 | 1.0195E-01 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-242 | 2.3128E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Ra-226 | 5.2782E-14 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Ra-228 | 1.9338E-10 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Ru-106 | 9.1684E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Se-79 | 1.3018E-05 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Sn-126 | 1.2167E-05 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Sr-90 | 2.6045E+00 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Tc-99 | 4.4241E-04 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Th-229 | 1.3713E-10 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Th-230 | 1.8090E-11 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Th-232 | 2.5278E-10 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Ti-208 | 1.6947E-08 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-232 | 4.8737E-08 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-233 | 1.2203E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-234 | 1.5925E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-235 | -2.6194E-06 | 0.00 | 0.00 | 3.96E-04 | 3.96E-04 | 3.96E-04 | | |
| U-236 | 1.2693E-05 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-238 | -3.6331E-08 | 0.00 | 0.00 | 2.46E-04 | 2.46E-04 | 2.46E-04 | | |
| Y-90 | 2.6060E+00 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Other Radionuclides | | | | | 0.00E+00 | 0.00E+00 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator | From SFD | Used | |
| Fuel Cladding | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| BOL HM Constituents | SST | SST | |
| BOL Enrichment % | 19.99996708 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|------------------------------------|
| Nominal | From SFD | Estimated | |
| Bounding | 0.00 | | |

Nominal burnup taken directly from SFD (converted to MWd)
 Bounding burnup assumed to be twice nominal burnup.

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| Nominal | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Bounding | 0.00 | 0.00 | |

1.00

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8.5/20 (IFE) UNIV OF CAL-IRVINE
SNF ID #: 1051
Fuel Units & Descr: 1 - ELEMENT
Heavy Metal Mass: BOL=0.192kg EOL=0.19kg
ROD Storage Site: INEEL

¹Fuel decay start date 2035
Estimates as of 2030
Template TRIGA-SS (LW/U-Zr) SST, 10 to 20% U
²Template Burnup (MWd) 6.65
Template BOL Heavy Metal Mass (MT) 0.000195
Template Decay Time 5 years

Estimated
Canister usage.
18"x10"
0.01

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.5173E-10 | 1.87 | 3.73 | 0.00E+00 | 1.59E-09 | 3.18E-09 | Avg MeV | |
| Am-241 | 1.8331E-03 | 1.87 | 3.73 | 0.00E+00 | 3.42E-03 | 6.85E-03 | 0.0150 | 6.036E+11 |
| Am-242m | 1.4129E-06 | 1.87 | 3.73 | 0.00E+00 | 2.64E-06 | 5.28E-06 | 0.0250 | 1.328E+11 |
| Am-243 | 1.4774E-07 | 1.87 | 3.73 | 0.00E+00 | 2.76E-07 | 5.52E-07 | 0.0375 | 1.131E+11 |
| C-14 | 1.2871E-04 | 1.87 | 3.73 | 0.00E+00 | 2.40E-04 | 4.81E-04 | 0.0575 | 1.161E+11 |
| Cl-36 | 2.8120E-06 | 1.87 | 3.73 | 0.00E+00 | 5.25E-06 | 1.05E-05 | 0.0850 | 7.192E+10 |
| Cm-243 | 1.7940E-07 | 1.87 | 3.73 | 0.00E+00 | 3.35E-07 | 6.70E-07 | 0.1250 | 5.223E+10 |
| Cm-244 | 1.6962E-06 | 1.87 | 3.73 | 0.00E+00 | 3.17E-06 | 6.33E-06 | 0.2250 | 6.101E+10 |
| Co-60 | 1.2839E+00 | 1.87 | 3.73 | 0.00E+00 | 2.40E+00 | 4.79E+00 | 0.3750 | 3.096E+10 |
| Cs-134 | 9.0541E-02 | 1.87 | 3.73 | 0.00E+00 | 1.69E-01 | 3.38E-01 | 0.5750 | 4.116E+11 |
| Cs-135 | 3.2195E-05 | 1.87 | 3.73 | 0.00E+00 | 6.01E-05 | 1.20E-04 | 0.8500 | 1.767E+11 |
| Cs-137 | 2.7564E+00 | 1.87 | 3.73 | 0.00E+00 | 5.15E+00 | 1.03E+01 | 1.2500 | 3.588E+11 |
| Eu-154 | 1.5368E-02 | 1.87 | 3.73 | 0.00E+00 | 2.87E-02 | 5.74E-02 | 1.7500 | 2.392E+08 |
| Eu-155 | 2.9293E-02 | 1.87 | 3.73 | 0.00E+00 | 5.47E-02 | 1.09E-01 | 2.2500 | 3.855E+08 |
| Fe-55 | 7.7158E-01 | 1.87 | 3.73 | 0.00E+00 | 1.44E+00 | 2.88E+00 | 2.7500 | 3.059E+06 |
| H-3 | 1.1111E-02 | 1.87 | 3.73 | 0.00E+00 | 2.07E-02 | 4.15E-02 | 3.5000 | 3.560E+05 |
| I-129 | 7.3684E-07 | 1.87 | 3.73 | 0.00E+00 | 1.38E-06 | 2.75E-06 | 5.0000 | 2.076E+00 |
| Kr-85 | 2.5263E-01 | 1.87 | 3.73 | 0.00E+00 | 4.72E-01 | 9.43E-01 | 7.0000 | 2.352E-01 |
| Np-237 | 1.2427E-06 | 1.87 | 3.73 | 0.00E+00 | 2.32E-06 | 4.64E-06 | 11.0000 | 2.681E-02 |
| Pa-231 | 3.8511E-09 | 1.87 | 3.73 | 0.00E+00 | 7.19E-09 | 1.44E-08 | | |
| Pb-210 | 7.3880E-15 | 1.87 | 3.73 | 0.00E+00 | 1.38E-14 | 2.76E-14 | | |
| Pm-147 | 2.1023E+00 | 1.87 | 3.73 | 0.00E+00 | 3.93E+00 | 7.85E+00 | | |
| Pu-238 | 1.0383E-03 | 1.87 | 3.73 | 0.00E+00 | 1.94E-03 | 3.88E-03 | | |
| Pu-239 | 5.5293E-03 | 1.87 | 3.73 | 0.00E+00 | 1.03E-02 | 2.07E-02 | | |
| Pu-240 | 2.1278E-03 | 1.87 | 3.73 | 0.00E+00 | 3.97E-03 | 7.95E-03 | | |
| Pu-241 | 1.0195E-01 | 1.87 | 3.73 | 0.00E+00 | 1.90E-01 | 3.81E-01 | | |
| Pu-242 | 2.3128E-07 | 1.87 | 3.73 | 0.00E+00 | 4.32E-07 | 8.64E-07 | | |
| Ra-226 | 5.2782E-14 | 1.87 | 3.73 | 0.00E+00 | 9.86E-14 | 1.97E-13 | | |
| Ra-228 | 1.9338E-10 | 1.87 | 3.73 | 0.00E+00 | 3.61E-10 | 7.22E-10 | | |
| Ru-106 | 9.1684E-02 | 1.87 | 3.73 | 0.00E+00 | 1.71E-01 | 3.42E-01 | | |
| Se-79 | 1.3018E-05 | 1.87 | 3.73 | 0.00E+00 | 2.43E-05 | 4.86E-05 | | |
| Sn-126 | 1.2167E-05 | 1.87 | 3.73 | 0.00E+00 | 2.27E-05 | 4.54E-05 | | |
| Sr-90 | 2.6045E+00 | 1.87 | 3.73 | 0.00E+00 | 4.86E+00 | 9.73E+00 | | |
| Tc-99 | 4.4241E-04 | 1.87 | 3.73 | 0.00E+00 | 8.26E-04 | 1.65E-03 | | |
| Th-229 | 1.3713E-10 | 1.87 | 3.73 | 0.00E+00 | 2.56E-10 | 5.12E-10 | | |
| Th-230 | 1.8090E-11 | 1.87 | 3.73 | 0.00E+00 | 3.38E-11 | 6.76E-11 | | |
| Th-232 | 2.5278E-10 | 1.87 | 3.73 | 0.00E+00 | 4.72E-10 | 9.44E-10 | | |
| Ti-208 | 1.6947E-08 | 1.87 | 3.73 | 0.00E+00 | 3.16E-08 | 6.33E-08 | | |
| U-232 | 4.8737E-08 | 1.87 | 3.73 | 0.00E+00 | 9.10E-08 | 1.82E-07 | | |
| U-233 | 1.2203E-07 | 1.87 | 3.73 | 0.00E+00 | 2.28E-07 | 4.56E-07 | | |
| U-234 | 1.5925E-07 | 1.87 | 3.73 | 0.00E+00 | 2.97E-07 | 5.95E-07 | | |
| U-235 | -2.6194E-06 | 1.87 | 0.00 | 8.28E-05 | 7.79E-05 | 8.28E-05 | | |
| U-236 | 1.2693E-05 | 1.87 | 3.73 | 0.00E+00 | 2.37E-05 | 4.74E-05 | | |
| U-238 | -3.6331E-08 | 1.87 | 0.00 | 5.15E-05 | 5.14E-05 | 5.15E-05 | | |
| Y-90 | 2.6060E+00 | 1.87 | 3.73 | 0.00E+00 | 4.87E+00 | 9.73E+00 | | |
| Other Radionuclides | | | | | 6.73E+00 | 1.35E+01 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator | From SFD | Used | |
| | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20.0002088 | 10 to 20.1 | |

| Burnup Summary (MWd) ¹ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 1.87 | 1.43 | |
| Bounding | | 3.73 | Nominal burnup taken directly from SFD (converted to MWd) Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 0.29 | 0.77 | |
| Bounding | 0.57 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8 5/20 AFRRI
SNF ID #: 250
Fuel Units & Descr: 95 - ELEMENT
Heavy Metal Mass: BOL=18 525kg EOL=18 012kg
ROD Storage Site: INEEL

¹Fuel decay start date: 2019
Estimates as of: 2030
Template: TRIGA-SS (LW/U-Zrx, SST, 10 to 20%, U)
²Template Burnup(MWd) 6 65
Template BOL Heavy Metal Mass (MT): 0 000195
Template Decay Time 10 years

Estimated
Canister usage:
18"x10"
0 86

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 1 3731E-09 | 489 71 | 979 43 | 0 00E+00 | 6 72E-07 | 1 34E-06 | Avg MeV | |
| Am-241 | 2 3865E-03 | 489 71 | 979 43 | 0 00E+00 | 1 17E+00 | 2 34E+00 | 0 0150 | 1 265E+14 |
| Am-242m | 1 3812E-06 | 489 71 | 979 43 | 0 00E+00 | 6 76E-04 | 1 35E-03 | 0 0250 | 2 681E+13 |
| Am-243 | 1 4767E-07 | 489 71 | 979 43 | 0 00E+00 | 7 23E-05 | 1 45E-04 | 0 0375 | 2 289E+13 |
| C-14 | 1 2863E-04 | 489 71 | 979 43 | 0 00E+00 | 6 30E-02 | 1 26E-01 | 0 0575 | 2 440E+13 |
| Cl-36 | 2 8120E-06 | 489 71 | 979 43 | 0 00E+00 | 1 38E-03 | 2 75E-03 | 0 0850 | 1 480E+13 |
| Cm-243 | 1 5895E-07 | 489 71 | 979 43 | 0 00E+00 | 7 78E-05 | 1 56E-04 | 0 1250 | 9 732E+12 |
| Cm-244 | 1 4008E-06 | 489 71 | 979 43 | 0 00E+00 | 6 86E-04 | 1 37E-03 | 0 2250 | 1 263E+13 |
| Co-60 | 6 6541E-01 | 489 71 | 979 43 | 0 00E+00 | 3 26E+02 | 6 52E+02 | 0 3750 | 5 800E+12 |
| Cs-134 | 1 6887E-02 | 489 71 | 979 43 | 0 00E+00 | 8 27E+00 | 1 65E+01 | 0 5750 | 9 086E+13 |
| Cs-135 | 3 2195E-05 | 489 71 | 979 43 | 0 00E+00 | 1 58E-02 | 3 15E-02 | 0 8500 | 1 622E+12 |
| Cs-137 | 2 4556E+00 | 489 71 | 979 43 | 0 00E+00 | 1 20E+03 | 2 41E+03 | 1 2500 | 4 877E+13 |
| Eu-154 | 1 0268E-02 | 489 71 | 979 43 | 0 00E+00 | 5 03E+00 | 1 01E+01 | 1 7500 | 2 935E+10 |
| Eu-155 | 1 4570E-02 | 489 71 | 979 43 | 0 00E+00 | 7 14E+00 | 1 43E+01 | 2 2500 | 1 533E+09 |
| Fe-55 | 2 0361E-01 | 489 71 | 979 43 | 0 00E+00 | 9 97E+01 | 1 99E+02 | 2 7500 | 2 538E+07 |
| H-3 | 8 3940E-03 | 489 71 | 979 43 | 0 00E+00 | 4 11E+00 | 8 22E+00 | 3 5000 | 3 007E+06 |
| I-129 | 7 3684E-07 | 489 71 | 979 43 | 0 00E+00 | 3 61E-04 | 7 22E-04 | 5 0000 | 5 226E+02 |
| Kr-85 | 1 8286E-01 | 489 71 | 979 43 | 0 00E+00 | 8 95E+01 | 1 79E+02 | 7 0000 | 5 912E+01 |
| Np-237 | 1 2462E-06 | 489 71 | 979 43 | 0 00E+00 | 6 10E-04 | 1 22E-03 | 11 0000 | 6 731E+00 |
| Pa-231 | 4 9143E-09 | 489 71 | 979 43 | 0 00E+00 | 2 41E-06 | 4 81E-06 | | |
| Pb-210 | 1 7173E-14 | 489 71 | 979 43 | 0 00E+00 | 8 41E-12 | 1 68E-11 | | |
| Pm-147 | 5 6165E-01 | 489 71 | 979 43 | 0 00E+00 | 2 75E+02 | 5 50E+02 | | |
| Pu-238 | 9 9820E-04 | 489 71 | 979 43 | 0 00E+00 | 4 89E-01 | 9 78E-01 | | |
| Pu-239 | 5 5293E-03 | 489 71 | 979 43 | 0 00E+00 | 2 71E+00 | 5 42E+00 | | |
| Pu-240 | 2 1263E-03 | 489 71 | 979 43 | 0 00E+00 | 1 04E+00 | 2 08E+00 | | |
| Pu-241 | 8 0165E-02 | 489 71 | 979 43 | 0 00E+00 | 3 93E+01 | 7 85E+01 | | |
| Pu-242 | 2 3128E-07 | 489 71 | 979 43 | 0 00E+00 | 1 13E-04 | 2 27E-04 | | |
| Ra-226 | 9 9774E-14 | 489 71 | 979 43 | 0 00E+00 | 4 89E-11 | 9 77E-11 | | |
| Ra-228 | 2 1729E-10 | 489 71 | 979 43 | 0 00E+00 | 1 06E-07 | 2 13E-07 | | |
| Ru-106 | 2 9519E-03 | 489 71 | 979 43 | 0 00E+00 | 1 45E+00 | 2 89E+00 | | |
| Se-79 | 1 3017E-05 | 489 71 | 979 43 | 0 00E+00 | 6 37E-03 | 1 27E-02 | | |
| Sn-126 | 1 2167E-05 | 489 71 | 979 43 | 0 00E+00 | 5 96E-03 | 1 19E-02 | | |
| Sr-90 | 2 3128E+00 | 489 71 | 979 43 | 0 00E+00 | 1 13E+03 | 2 27E+03 | | |
| Tc-99 | 4 4241E-04 | 489 71 | 979 43 | 0 00E+00 | 2 17E-01 | 4 33E-01 | | |
| Th-229 | 1 9459E-10 | 489 71 | 979 43 | 0 00E+00 | 9 53E-08 | 1 91E-07 | | |
| Th-230 | 2 5564E-11 | 489 71 | 979 43 | 0 00E+00 | 1 25E-08 | 2 50E-08 | | |
| Th-232 | 2 5278E-10 | 489 71 | 979 43 | 0 00E+00 | 1 24E-07 | 2 48E-07 | | |
| Ti-208 | 1 6947E-08 | 489 71 | 979 43 | 0 00E+00 | 8 30E-06 | 1 66E-05 | | |
| U-232 | 4 6812E-08 | 489 71 | 979 43 | 0 00E+00 | 2 29E-05 | 4 58E-05 | | |
| U-233 | 1 2206E-07 | 489 71 | 979 43 | 0 00E+00 | 5 98E-05 | 1 20E-04 | | |
| U-234 | 1 7323E-07 | 489 71 | 979 43 | 0 00E+00 | 8 48E-05 | 1 70E-04 | | |
| U-235 | -2 6194E-06 | 489 71 | 0 00 | 8 01E-03 | 6 72E-03 | 8 01E-03 | | |
| U-236 | 1 2693E-05 | 489 71 | 979 43 | 0 00E+00 | 6 22E-03 | 1 24E-02 | | |
| U-238 | -3 6331E-08 | 489 71 | 0 00 | 4 98E-03 | 4 96E-03 | 4 98E-03 | | |
| Y-90 | 2 3128E+00 | 489 71 | 979 43 | 0 00E+00 | 1 13E+03 | 2 27E+03 | | |
| Other Radionuclides | | | | | 1 20E+03 | 2 40E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------------------|-------------------------------|----------------------------------|
| Reactor Moderator | From SFD LW AND U ZIRC HYDRIDE | Used LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 | 10 to 20 1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 90.27 | 489 71 | |
| Bounding | | 979 43 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0 78 | 5 42 | |
| Bounding | 1 55 | | 1 00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8 5/20 ANL-W
SNF ID #: 353
Fuel Units & Descr: 2 - ELEMENT
Heavy Metal Mass BOL=0.39kg EOL=0.17kg
ROD Storage Site INEEL

¹Fuel decay start date 1994
Estimates as of 2030
Template TRIGA-SS (LW/U-Zrx SST, 10 to 20% U)
²Template Burnup(MWd) 6.65
Template BOL Heavy Metal Mass (MT) 0.000195
Template Decay Time 35 years

Estimated
Canister usage
18"x10"
0.02

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-------------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity - (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6.7038E-09 | 209.82 | 372.30 | 0.00E+00 | 1.41E-06 | 2.50E-06 | Avg MeV | |
| Am-241 | 3.9068E-03 | 209.82 | 372.30 | 0.00E+00 | 8.20E-01 | 1.45E+00 | 0.0150 | 2.599E+13 |
| Am-242m | 1.2325E-06 | 209.82 | 372.30 | 0.00E+00 | 2.59E-04 | 4.59E-04 | 0.0250 | 5.400E+12 |
| Am-243 | 1.4732E-07 | 209.82 | 372.30 | 0.00E+00 | 3.09E-05 | 5.48E-05 | 0.0375 | 4.691E+12 |
| C-14 | 1.2824E-04 | 209.82 | 372.30 | 0.00E+00 | 2.69E-02 | 4.77E-02 | 0.0575 | 5.054E+12 |
| Cl-36 | 2.8120E-06 | 209.82 | 372.30 | 0.00E+00 | 5.90E-04 | 1.05E-03 | 0.0850 | 3.041E+12 |
| Cm-243 | 8.6556E-08 | 209.82 | 372.30 | 0.00E+00 | 1.82E-05 | 3.22E-05 | 0.1250 | 1.979E+12 |
| Cm-244 | 5.3835E-07 | 209.82 | 372.30 | 0.00E+00 | 1.13E-04 | 2.00E-04 | 0.2250 | 2.620E+12 |
| Co-60 | 2.4887E-02 | 209.82 | 372.30 | 0.00E+00 | 5.22E+00 | 9.27E+00 | 0.3750 | 1.142E+12 |
| Cs-134 | 3.8030E-06 | 209.82 | 372.30 | 0.00E+00 | 7.98E-04 | 1.42E-03 | 0.5750 | 1.911E+13 |
| Cs-135 | 3.2195E-05 | 209.82 | 372.30 | 0.00E+00 | 6.76E-03 | 1.20E-02 | 0.8500 | 1.955E+11 |
| Cs-137 | 1.3788E+00 | 209.82 | 372.30 | 0.00E+00 | 2.89E+02 | 5.13E+02 | 1.2500 | 7.588E+11 |
| Eu-154 | 1.3711E-03 | 209.82 | 372.30 | 0.00E+00 | 2.88E-01 | 5.10E-01 | 1.7500 | 5.075E+09 |
| Eu-155 | 4.4361E-04 | 209.82 | 372.30 | 0.00E+00 | 9.31E-02 | 1.65E-01 | 2.2500 | 4.159E+06 |
| Fe-55 | 2.6075E-04 | 209.82 | 372.30 | 0.00E+00 | 5.47E-02 | 9.71E-02 | 2.7500 | 1.912E+05 |
| H-3 | 2.0647E-03 | 209.82 | 372.30 | 0.00E+00 | 4.33E-01 | 7.69E-01 | 3.5000 | 4.573E+02 |
| I-129 | 7.3684E-07 | 209.82 | 372.30 | 0.00E+00 | 1.55E-04 | 2.74E-04 | 5.0000 | 1.925E+02 |
| Kr-85 | 3.6346E-02 | 209.82 | 372.30 | 0.00E+00 | 7.63E+00 | 1.35E+01 | 7.0000 | 2.171E+01 |
| Np-237 | 1.2844E-06 | 209.82 | 372.30 | 0.00E+00 | 2.69E-04 | 4.78E-04 | 11.0000 | 2.468E+00 |
| Pa-231 | 1.2352E-08 | 209.82 | 372.30 | 0.00E+00 | 2.59E-06 | 4.60E-06 | | |
| Pb-210 | 3.5338E-13 | 209.82 | 372.30 | 0.00E+00 | 7.41E-11 | 1.32E-10 | | |
| Pm-147 | 7.6346E-04 | 209.82 | 372.30 | 0.00E+00 | 1.60E-01 | 2.84E-01 | | |
| Pu-238 | 8.1970E-04 | 209.82 | 372.30 | 0.00E+00 | 1.72E-01 | 3.05E-01 | | |
| Pu-239 | 5.5248E-03 | 209.82 | 372.30 | 0.00E+00 | 1.16E+00 | 2.06E+00 | | |
| Pu-240 | 2.1203E-03 | 209.82 | 372.30 | 0.00E+00 | 4.45E-01 | 7.89E-01 | | |
| Pu-241 | 2.4075E-02 | 209.82 | 372.30 | 0.00E+00 | 5.05E+00 | 8.96E+00 | | |
| Pu-242 | 2.3128E-07 | 209.82 | 372.30 | 0.00E+00 | 4.85E-05 | 8.61E-05 | | |
| Ra-226 | 9.6481E-13 | 209.82 | 372.30 | 0.00E+00 | 2.02E-10 | 3.59E-10 | | |
| Ra-228 | 2.5188E-10 | 209.82 | 372.30 | 0.00E+00 | 5.29E-08 | 9.38E-08 | | |
| Ru-106 | 1.0214E-10 | 209.82 | 372.30 | 0.00E+00 | 2.14E-08 | 3.80E-08 | | |
| Se-79 | 1.3014E-05 | 209.82 | 372.30 | 0.00E+00 | 2.73E-03 | 4.84E-03 | | |
| Sn-126 | 1.2164E-05 | 209.82 | 372.30 | 0.00E+00 | 2.55E-03 | 4.53E-03 | | |
| Sr-90 | 1.2762E+00 | 209.82 | 372.30 | 0.00E+00 | 2.68E+02 | 4.75E+02 | | |
| Tc-99 | 4.4241E-04 | 209.82 | 372.30 | 0.00E+00 | 9.28E-02 | 1.65E-01 | | |
| Th-229 | 5.9684E-10 | 209.82 | 372.30 | 0.00E+00 | 1.25E-07 | 2.22E-07 | | |
| Th-230 | 9.3880E-11 | 209.82 | 372.30 | 0.00E+00 | 1.97E-08 | 3.50E-08 | | |
| Th-232 | 2.5278E-10 | 209.82 | 372.30 | 0.00E+00 | 5.30E-08 | 9.41E-08 | | |
| Ti-208 | 1.3723E-08 | 209.82 | 372.30 | 0.00E+00 | 2.88E-06 | 5.11E-06 | | |
| U-232 | 3.6932E-08 | 209.82 | 372.30 | 0.00E+00 | 7.75E-06 | 1.37E-05 | | |
| U-233 | 1.2224E-07 | 209.82 | 372.30 | 0.00E+00 | 2.56E-05 | 4.55E-05 | | |
| U-234 | 2.5714E-07 | 209.82 | 372.30 | 0.00E+00 | 5.40E-05 | 9.57E-05 | | |
| U-235 | -2.6194E-06 | 209.82 | 0.00 | 1.69E-04 | 0.00E+00 | 1.69E-04 | | |
| U-236 | 1.2695E-05 | 209.82 | 372.30 | 0.00E+00 | 2.66E-03 | 4.73E-03 | | |
| U-238 | -3.6331E-08 | 209.82 | 0.00 | 1.05E-04 | 9.72E-05 | 1.05E-04 | | |
| Y-90 | 1.2765E+00 | 209.82 | 372.30 | 0.00E+00 | 2.68E+02 | 4.75E+02 | | |
| Other Radionuclides | | | | | 2.89E+02 | 5.12E+02 | | |

Other Radionuclides

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | SST | SST |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 20 | 10 to 20.1 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | 13.30 | 209.82 |
| Bounding | 15.99 | 372.30 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed
Bounding burnup calculated assuming all BOL heavy metal burned.

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|-----------------------------------|
| Nominal | 15.78 | 15.77 |
| Bounding | 27.99 | 23.28 |

Estimated EOL HM/Given EOL HM

2.07

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8 5/20 ANL-W
SNF ID #: 370
Fuel Units & Descr: 40 - ELEMENT
Heavy Metal Mass: BOL=7 12kg, EOL=6 85kg
ROD Storage Site: INEEL

¹Fuel decay start date: 1994
Estimates as of: 2030
Template: TRIGA-SS (LW/U-Zrx, SST, 10 to 20%, U)
²Template Burnup(MWd): 6 65
Template BOL Heavy Metal Mass (MT): 0 000195
Template Decay Time: 35 years

Estimated
Canister usage:
18"x10"
0 36

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6 7038E-09 | 248.20 | 496 40 | 0 00E+00 | 1 66E-06 | 3 33E-06 | Avg MeV | |
| Am-241 | 3 9068E-03 | 248.20 | 496 40 | 0 00E+00 | 9 70E-01 | 1 94E+00 | 0 0150 | 3 465E+13 |
| Am-242m | 1 2325E-06 | 248.20 | 496 40 | 0 00E+00 | 3 06E-04 | 6 12E-04 | 0 0250 | 7 199E+12 |
| Am-243 | 1 4732E-07 | 248.20 | 496 40 | 0 00E+00 | 3 66E-05 | 7 31E-05 | 0 0375 | 6 255E+12 |
| C-14 | 1 2824E-04 | 248.20 | 496 40 | 0 00E+00 | 3 18E-02 | 6 37E-02 | 0 0575 | 6 739E+12 |
| Cl-36 | 2 8120E-06 | 248.20 | 496 40 | 0 00E+00 | 6 98E-04 | 1 40E-03 | 0 0850 | 4 055E+12 |
| Cm-243 | 8 6556E-08 | 248.20 | 496 40 | 0 00E+00 | 2 15E-05 | 4 30E-05 | 0 1250 | 2 639E+12 |
| Cm-244 | 5 3835E-07 | 248 20 | 496 40 | 0 00E+00 | 1 34E-04 | 2 67E-04 | 0 2250 | 3 493E+12 |
| Co-60 | 2 4887E-02 | 248.20 | 496 40 | 0 00E+00 | 6 18E+00 | 1 24E+01 | 0 3750 | 1 523E+12 |
| Cs-134 | 3 8030E-06 | 248.20 | 496 40 | 0 00E+00 | 9 44E-04 | 1 89E-03 | 0 5750 | 2 548E+13 |
| Cs-135 | 3 2195E-05 | 248 20 | 496 40 | 0 00E+00 | 7 99E-03 | 1 60E-02 | 0 8500 | 2 607E+11 |
| Cs-137 | 1 3788E+00 | 248 20 | 496 40 | 0 00E+00 | 3 42E+02 | 6 84E+02 | 1 2500 | 1 012E+12 |
| Eu-154 | 1 3711E-03 | 248 20 | 496 40 | 0 00E+00 | 3 40E-01 | 6 81E-01 | 1 7500 | 6 767E+09 |
| Eu-155 | 4 4361E-04 | 248 20 | 496 40 | 0 00E+00 | 1 10E-01 | 2 20E-01 | 2 2500 | 5 545E+06 |
| Fe-55 | 2 6075E-04 | 248 20 | 496 40 | 0 00E+00 | 6 47E-02 | 1 29E-01 | 2 7500 | 2 549E+05 |
| H-3 | 2 0647E-03 | 248 20 | 496 40 | 0 00E+00 | 5 12E-01 | 1 02E+00 | 3 5000 | 6 193E+02 |
| I-129 | 7 3684E-07 | 248 20 | 496 40 | 0 00E+00 | 1 83E-04 | 3 66E-04 | 5 0000 | 2 608E+02 |
| Kr-85 | 3 6346E-02 | 248 20 | 496 40 | 0 00E+00 | 9 02E+00 | 1 80E+01 | 7 0000 | 2 942E+01 |
| Np-237 | 1 2844E-06 | 248 20 | 496 40 | 0 00E+00 | 3 19E-04 | 6 38E-04 | 11 0000 | 3 346E+00 |
| Pa-231 | 1 2352E-08 | 248 20 | 496 40 | 0 00E+00 | 3 07E-06 | 6 13E-06 | | |
| Pb-210 | 3 5338E-13 | 248.20 | 496 40 | 0 00E+00 | 8 77E-11 | 1 75E-10 | | |
| Pm-147 | 7 6346E-04 | 248 20 | 496 40 | 0 00E+00 | 1 89E-01 | 3 79E-01 | | |
| Pu-238 | 8 1970E-04 | 248 20 | 496 40 | 0 00E+00 | 2 03E-01 | 4 07E-01 | | |
| Pu-239 | 5 5248E-03 | 248 20 | 496 40 | 0 00E+00 | 1 37E+00 | 2 74E+00 | | |
| Pu-240 | 2 1203E-03 | 248 20 | 496 40 | 0 00E+00 | 5 26E-01 | 1 05E+00 | | |
| Pu-241 | 2 4075E-02 | 248 20 | 496 40 | 0 00E+00 | 5 98E+00 | 1 20E+01 | | |
| Pu-242 | 2 3128E-07 | 248 20 | 496 40 | 0 00E+00 | 5 74E-05 | 1 15E-04 | | |
| Ra-226 | 9 6481E-13 | 248 20 | 496 40 | 0 00E+00 | 2 39E-10 | 4 79E-10 | | |
| Ra-228 | 2 5188E-10 | 248 20 | 496 40 | 0 00E+00 | 6 25E-08 | 1 25E-07 | | |
| Ru-106 | 1 0214E-10 | 248 20 | 496 40 | 0 00E+00 | 2 53E-08 | 5 07E-08 | | |
| Se-79 | 1 3014E-05 | 248 20 | 496 40 | 0 00E+00 | 3 23E-03 | 6 46E-03 | | |
| Sn-126 | 1 2164E-05 | 248 20 | 496 40 | 0 00E+00 | 3 02E-03 | 6 04E-03 | | |
| Sr-90 | 1 2762E+00 | 248 20 | 496 40 | 0 00E+00 | 3 17E+02 | 6 34E+02 | | |
| Tc-99 | 4 4241E-04 | 248 20 | 496 40 | 0 00E+00 | 1 10E-01 | 2 20E-01 | | |
| Th-229 | 5 9684E-10 | 248 20 | 496 40 | 0 00E+00 | 1 48E-07 | 2 96E-07 | | |
| Th-230 | 9 3880E-11 | 248 20 | 496 40 | 0 00E+00 | 2 33E-08 | 4 66E-08 | | |
| Th-232 | 2 5278E-10 | 248 20 | 496 40 | 0 00E+00 | 6 27E-08 | 1 25E-07 | | |
| Th-208 | 1 3723E-08 | 248 20 | 496 40 | 0 00E+00 | 3 41E-06 | 6 81E-06 | | |
| U-232 | 3 6932E-08 | 248 20 | 496 40 | 0 00E+00 | 9 17E-06 | 1 83E-05 | | |
| U-233 | 1 2224E-07 | 248 20 | 496 40 | 0 00E+00 | 3 03E-05 | 6 07E-05 | | |
| U-234 | 2 5714E-07 | 248 20 | 496 40 | 0 00E+00 | 6 38E-05 | 1 28E-04 | | |
| U-235 | -2 6194E-06 | 248 20 | 0 00 | 3 03E-03 | 2 38E-03 | 3 03E-03 | | |
| U-236 | 1 2695E-05 | 248 20 | 496 40 | 0 00E+00 | 3 15E-03 | 6 30E-03 | | |
| U-238 | -3 6331E-08 | 248 20 | 0 00 | 1 92E-03 | 1 91E-03 | 1 92E-03 | | |
| Y-90 | 1 2765E+00 | 248 20 | 496 40 | 0 00E+00 | 3 17E+02 | 6 34E+02 | | |
| Other Radionuclides | | | | | 3 41E+02 | 6 83E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| | From SFD | Used | |
| Reactor Moderator: | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19 66292135 | 10 to 20 1 | |

| Burnup Summary (MWd) ³ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 173 48 | 248 20 | Nominal burnup calculated from the heavy metal mass destroyed |
| Bounding | 291 92 | 496 40 | Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 1 02 | 1 43 | 1 00 |
| Bounding | 2 04 | 1 70 | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 8 5/20 AUSTRIA
SNF ID # 469
Fuel Units & Descr 30 - ELEMENT
Heavy Metal Mass BOL=5 85kg EOL=5 643kg
ROD Storage Site INEEL

¹Fuel decay start date 2010
Estimates as of 2030
Template TRIGA-SS (LW/U-Zr, SST, 10 to 20%, U)
²Template Burnup(MWd) 6 65
Template BOL Heavy Metal Mass (MT): 0 000195
Template Decay Time 20 years

Estimated
Canister usage:
18"x10"
0 27

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2 6436E-09 | 197.60 | 395.21 | 0 00E+00 | 5 22E-07 | 1.04E-06 | Avg MeV | |
| Am-241 | 3 1429E-03 | 197.60 | 395.21 | 0 00E+00 | 6 21E-01 | 1.24E+00 | 0 0150 | 3 961E+13 |
| Am-242m | 1.3195E-06 | 197.60 | 395.21 | 0 00E+00 | 2 61E-04 | 5.21E-04 | 0 0250 | 8.244E+12 |
| Am-243 | 1 4753E-07 | 197.60 | 395.21 | 0 00E+00 | 2 92E-05 | 5 83E-05 | 0 0375 | 7 142E+12 |
| C-14 | 1 2847E-04 | 197.60 | 395.21 | 0 00E+00 | 2 54E-02 | 5 08E-02 | 0 0575 | 7.684E+12 |
| Ct-36 | 2 8120E-06 | 197.60 | 395.21 | 0 00E+00 | 5 56E-04 | 1 11E-03 | 0 0850 | 4 638E+12 |
| Cm-243 | 1 2465E-07 | 197.60 | 395.21 | 0 00E+00 | 2 46E-05 | 4 93E-05 | 0 1250 | 3 032E+12 |
| Cm-244 | 9 5564E-07 | 197.60 | 395.21 | 0 00E+00 | 1 89E-04 | 3 78E-04 | 0.2250 | 3 983E+12 |
| Co-60 | 1 7880E-01 | 197.60 | 395.21 | 0 00E+00 | 3 53E+01 | 7 07E+01 | 0 3750 | 1 746E+12 |
| Cs-134 | 5 8692E-04 | 197.60 | 395.21 | 0 00E+00 | 1.16E-01 | 2 32E-01 | 0 5750 | 2 871E+13 |
| Cs-135 | 3 2195E-05 | 197.60 | 395.21 | 0 00E+00 | 6.36E-03 | 1.27E-02 | 0.8500 | 3.236E+11 |
| Cs-137 | 1 9489E+00 | 197.60 | 395.21 | 0 00E+00 | 3.85E+02 | 7 70E+02 | 1.2500 | 5 362E+12 |
| Eu-154 | 4 5895E-03 | 197.60 | 395.21 | 0 00E+00 | 9 07E-01 | 1 81E+00 | 1 7500 | 8 314E+09 |
| Eu-155 | 3 6045E-03 | 197.60 | 395.21 | 0 00E+00 | 7.12E-01 | 1 42E+00 | 2.2500 | 2 864E+07 |
| Fe-55 | 1.4185E-02 | 197.60 | 395.21 | 0 00E+00 | 2 80E+00 | 5 61E+00 | 2.7500 | 3 155E+05 |
| H-3 | 4 7895E-03 | 197.60 | 395.21 | 0 00E+00 | 9 46E-01 | 1.89E+00 | 3 5000 | 1 753E+03 |
| I-129 | 7.3684E-07 | 197.60 | 395.21 | 0 00E+00 | 1 46E-04 | 2 91E-04 | 5 0000 | 2.090E+02 |
| Kr-85 | 9 5820E-02 | 197.60 | 395.21 | 0 00E+00 | 1 89E+01 | 3 79E+01 | 7 0000 | 2.361E+01 |
| Np-237 | 1.2552E-06 | 197.60 | 395.21 | 0 00E+00 | 2 48E-04 | 4 96E-04 | 11 0000 | 2.686E+00 |
| Pa-231 | 7 0406E-09 | 197.60 | 395.21 | 0 00E+00 | 1.39E-06 | 2 78E-06 | | |
| Pb-210 | 5 8000E-14 | 197.60 | 395.21 | 0 00E+00 | 1.15E-11 | 2 29E-11 | | |
| Pm-147 | 4 0075E-02 | 197.60 | 395.21 | 0 00E+00 | 7 92E+00 | 1 58E+01 | | |
| Pu-238 | 9 2256E-04 | 197.60 | 395.21 | 0 00E+00 | 1.82E-01 | 3 65E-01 | | |
| Pu-239 | 5 5278E-03 | 197.60 | 395.21 | 0 00E+00 | 1 09E+00 | 2 18E+00 | | |
| Pu-240 | 2 1248E-03 | 197.60 | 395.21 | 0 00E+00 | 4.20E-01 | 8 40E-01 | | |
| Pu-241 | 4 9549E-02 | 197.60 | 395.21 | 0 00E+00 | 9 79E+00 | 1 96E+01 | | |
| Pu-242 | 2 3128E-07 | 197.60 | 395.21 | 0 00E+00 | 4 57E-05 | 9.14E-05 | | |
| Ra-226 | 2 4526E-13 | 197.60 | 395.21 | 0 00E+00 | 4 85E-11 | 9 69E-11 | | |
| Ra-228 | 2 4015E-10 | 197.60 | 395.21 | 0 00E+00 | 4 75E-08 | 9 49E-08 | | |
| Ru-106 | 3 0602E-06 | 197.60 | 395.21 | 0 00E+00 | 6 05E-04 | 1.21E-03 | | |
| Se-79 | 1.3015E-05 | 197.60 | 395.21 | 0 00E+00 | 2 57E-03 | 5 14E-03 | | |
| Sn-126 | 1.2165E-05 | 197.60 | 395.21 | 0 00E+00 | 2 40E-03 | 4 81E-03 | | |
| Sr-90 | 1 8226E+00 | 197.60 | 395.21 | 0 00E+00 | 3 60E+02 | 7.20E+02 | | |
| Tc-99 | 4 4241E-04 | 197.60 | 395.21 | 0 00E+00 | 8 74E-02 | 1 75E-01 | | |
| Th-229 | 3 0962E-10 | 197.60 | 395.21 | 0 00E+00 | 6 12E-08 | 1.22E-07 | | |
| Th-230 | 4 2346E-11 | 197.60 | 395.21 | 0 00E+00 | 8 37E-09 | 1 67E-08 | | |
| Th-232 | 2 5278E-10 | 197.60 | 395.21 | 0 00E+00 | 5.00E-08 | 9 99E-08 | | |
| Ti-208 | 1 5820E-08 | 197.60 | 395.21 | 0 00E+00 | 3 13E-06 | 6.25E-06 | | |
| U-232 | 4 2647E-08 | 197.60 | 395.21 | 0 00E+00 | 8 43E-06 | 1.69E-05 | Thermal Power | |
| U-233 | 1.2211E-07 | 197.60 | 395.21 | 0 00E+00 | 2 41E-05 | 4 83E-05 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 1 9955E-07 | 197.60 | 395.21 | 0 00E+00 | 3 94E-05 | 7 89E-05 | 4.94E+00 | 9 89E+00 |
| U-235 | -2 6194E-06 | 197.60 | 0 00 | 2 53E-03 | 2 01E-03 | 2 53E-03 | Total | Total |
| U-236 | 1.2693E-05 | 197.60 | 395.21 | 0 00E+00 | 2 51E-03 | 5 02E-03 | | |
| U-238 | -3 6331E-08 | 197.60 | 0 00 | 1 57E-03 | 1 57E-03 | 1 57E-03 | | |
| Y-90 | 1.8241E+00 | 197.60 | 395.21 | 0 00E+00 | 3 60E+02 | 7.21E+02 | | |
| Other Radionuclides | | | | | 3 81E+02 | 7 61E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences: |
|---------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 00000041 | 10 to 20 1 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|----------|-----------|--|
| Nominal | 57 01 | 197 60 | |
| Bounding | | 395.21 | |
| | | | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0 99 | 3 47 | |
| Bounding | 1 98 | | |
| | | | 1 00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8 5/20 BRAZIL
 SNF ID #: 1063
 Fuel Units & Descr: 9 - ELEMENT
 Heavy Metal Mass, BOL=1 755kg, EOL=1 741kg
 ROD Storage Site: INEEL

¹Fuel decay start date: 2006
 Estimates as of: 2030
 Template: TRIGA-SS (LW/U Zrx, SST, 10 to 20%, U)
²Template Burnup(MWd): 6 65
 Template BOL Heavy Metal Mass (MT): 0 000195
 Template Decay Time: 20 years

Estimated
 Canister usage
 18"x10"
 0 08

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2 6436E-09 | 17 10 | 34 21 | 0 00E+00 | 4 52E-08 | 9 04E-08 | Avg MeV | |
| Am-241 | 3 1429E-03 | 17 10 | 34 21 | 0 00E+00 | 5 38E-02 | 1 08E-01 | 0 0150 | 3 428E+12 |
| Am-242m | 1 3195E-06 | 17 10 | 34 21 | 0 00E+00 | 2 26E-05 | 4 51E-05 | 0 0250 | 7 136E+11 |
| Am-243 | 1 4753E-07 | 17 10 | 34 21 | 0 00E+00 | 2 52E-06 | 5 05E-06 | 0 0375 | 6 182E+11 |
| C-14 | 1 2847E-04 | 17 10 | 34 21 | 0 00E+00 | 2 20E-03 | 4 39E-03 | 0 0575 | 6 651E+11 |
| Cl-36 | 2 8120E-06 | 17 10 | 34 21 | 0 00E+00 | 4 81E-05 | 9 62E-05 | 0 0850 | 4 015E+11 |
| Cm-243 | 1 2465E-07 | 17 10 | 34 21 | 0 00E+00 | 2 13E-06 | 4 26E-06 | 0 1250 | 2 624E+11 |
| Cm-244 | 9 5564E-07 | 17 10 | 34 21 | 0 00E+00 | 1 63E-05 | 3 27E-05 | 0 2250 | 3 447E+11 |
| Co-60 | 1 7880E-01 | 17 10 | 34 21 | 0 00E+00 | 3 06E+00 | 6 12E+00 | 0 3750 | 1 511E+11 |
| Cs-134 | 5 8692E-04 | 17 10 | 34 21 | 0 00E+00 | 1 00E-02 | 2 01E-02 | 0 5750 | 2 485E+12 |
| Cs-135 | 3 2195E-05 | 17 10 | 34 21 | 0 00E+00 | 5 51E-04 | 1 10E-03 | 0 8500 | 2 801E+10 |
| Cs-137 | 1 9489E+00 | 17 10 | 34 21 | 0 00E+00 | 3 33E+01 | 6 67E+01 | 1 2500 | 4 642E+11 |
| Eu-154 | 4 5895E-03 | 17 10 | 34 21 | 0 00E+00 | 7 85E-02 | 1 57E-01 | 1 7500 | 7 197E+08 |
| Eu-155 | 3 6045E-03 | 17 10 | 34 21 | 0 00E+00 | 6 17E-02 | 1 23E-01 | 2 2500 | 2 479E+06 |
| Fe-55 | 1 4185E-02 | 17 10 | 34 21 | 0 00E+00 | 2 43E-01 | 4 85E-01 | 2 7500 | 2 731E+04 |
| H-3 | 4 7895E-03 | 17 10 | 34 21 | 0 00E+00 | 8 19E-02 | 1 64E-01 | 3 5000 | 1 535E+02 |
| I-129 | 7 3684E-07 | 17 10 | 34 21 | 0 00E+00 | 1 26E-05 | 2 52E-05 | 5 0000 | 1 886E+01 |
| Kr-85 | 9 5820E-02 | 17 10 | 34 21 | 0 00E+00 | 1 64E+00 | 3 28E+00 | 7 0000 | 2 133E+00 |
| Np-237 | 1 2552E-06 | 17 10 | 34 21 | 0 00E+00 | 2 15E-05 | 4 29E-05 | 11 0000 | 2 428E-01 |
| Pa-231 | 7 0406E-09 | 17 10 | 34 21 | 0 00E+00 | 1 20E-07 | 2 41E-07 | | |
| Pb-210 | 5 8000E-14 | 17 10 | 34 21 | 0 00E+00 | 9 92E-13 | 1 98E-12 | | |
| Pm-147 | 4 0075E-02 | 17 10 | 34 21 | 0 00E+00 | 6 85E-01 | 1 37E+00 | | |
| Pu-238 | 9 2256E-04 | 17 10 | 34 21 | 0 00E+00 | 1 58E-02 | 3 16E-02 | | |
| Pu-239 | 5 5278E-03 | 17 10 | 34 21 | 0 00E+00 | 9 45E-02 | 1 89E-01 | | |
| Pu-240 | 2 1248E-03 | 17 10 | 34 21 | 0 00E+00 | 3 63E-02 | 7 27E-02 | | |
| Pu-241 | 4 9549E-02 | 17 10 | 34 21 | 0 00E+00 | 8 47E-01 | 1 69E+00 | | |
| Pu-242 | 2 3128E-07 | 17 10 | 34 21 | 0 00E+00 | 3 96E-06 | 7 91E-06 | | |
| Ra-226 | 2 4526E-13 | 17 10 | 34 21 | 0 00E+00 | 4 20E-12 | 8 39E-12 | | |
| Ra-228 | 2 4015E-10 | 17 10 | 34 21 | 0 00E+00 | 4 11E-09 | 8 22E-09 | | |
| Ru-106 | 3 0602E-06 | 17 10 | 34 21 | 0 00E+00 | 5 23E-05 | 1 05E-04 | | |
| Se-79 | 1 3015E-05 | 17 10 | 34 21 | 0 00E+00 | 2 23E-04 | 4 45E-04 | | |
| Sn-126 | 1 2165E-05 | 17 10 | 34 21 | 0 00E+00 | 2 08E-04 | 4 16E-04 | | |
| Sr-90 | 1 8226E+00 | 17 10 | 34 21 | 0 00E+00 | 3 12E+01 | 6 23E+01 | | |
| Tc-99 | 4 4241E-04 | 17 10 | 34 21 | 0 00E+00 | 7 57E-03 | 1 51E-02 | | |
| Th-229 | 3 0962E-10 | 17 10 | 34 21 | 0 00E+00 | 5 30E-09 | 1 06E-08 | | |
| Th-230 | 4 2346E-11 | 17 10 | 34 21 | 0 00E+00 | 7 24E-10 | 1 45E-09 | | |
| Th-232 | 2 5278E-10 | 17 10 | 34 21 | 0 00E+00 | 4 32E-09 | 8 65E-09 | | |
| Ti-208 | 1 5820E-08 | 17 10 | 34 21 | 0 00E+00 | 2 71E-07 | 5 41E-07 | | |
| U-232 | 4 2647E-08 | 17 10 | 34 21 | 0 00E+00 | 7 29E-07 | 1 46E-06 | | |
| U-233 | 1 2211E-07 | 17 10 | 34 21 | 0 00E+00 | 2 09E-06 | 4 18E-06 | | |
| U-234 | 1 9955E-07 | 17 10 | 34 21 | 0 00E+00 | 3 41E-06 | 6 83E-06 | | |
| U-235 | -2 6194E-06 | 17 10 | 0 00 | 7 59E-04 | 7 14E-04 | 7 59E-04 | | |
| U-236 | 1 2693E-05 | 17 10 | 34 21 | 0 00E+00 | 2 17E-04 | 4 34E-04 | | |
| U-238 | -3 6331E-08 | 17 10 | 0 00 | 4 72E-04 | 4 71E-04 | 4 72E-04 | | |
| Y-90 | 1 8241E+00 | 17 10 | 34 21 | 0 00E+00 | 3 12E+01 | 6 24E+01 | | |
| Other Radionuclides | | | | | 3 29E+01 | 6 59E+01 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences ¹ |
|----------------------------|-----------------------------------|-------------------------------|--|
| Reactor Moderator | From SFD LW AND U ZIRC HYDRIDE | Used LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 | 10 to 20 1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | 17 10 | 13 75 | |
| Bounding | | 34 21 | Nominal burnup taken directly from SFD (converted to MWd). Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0 29 | 0 80 | |
| Bounding | 0 57 | | 1 00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 8 S/20 CORNELL
SNF ID # 246
Fuel Units & Descr 115 - ELEMENT
Heavy Metal Mass BOL=21 896kg EOL=21 586kg
ROD Storage Site INEEL

¹Fuel decay start date 2035
Estimates as of 2030
Template TRIGA-SS (LW/U-Zrx SST, 10 to 20% U)
²Template Burnup(MWd) 6.65
Template BOL Heavy Metal Mass (MT) 0.000195
Template Decay Time 5 years

Estimated
Canister usage
18"x10"
1.04

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.5173E-10 | 320.10 | 640.20 | 0.00E+00 | 2.73E-07 | 5.45E-07 | Avg MeV | |
| Am-241 | 1.8331E-03 | 320.10 | 640.20 | 0.00E+00 | 5.87E-01 | 1.17E+00 | 0.0150 | 1.035E+14 |
| Am-242m | 1.4129E-06 | 320.10 | 640.20 | 0.00E+00 | 4.52E-04 | 9.05E-04 | 0.0250 | 2.277E+13 |
| Am-243 | 1.4774E-07 | 320.10 | 640.20 | 0.00E+00 | 4.73E-05 | 9.46E-05 | 0.0375 | 1.939E+13 |
| C-14 | 1.2871E-04 | 320.10 | 640.20 | 0.00E+00 | 4.12E-02 | 8.24E-02 | 0.0575 | 1.990E+13 |
| Cl-36 | 2.8120E-06 | 320.10 | 640.20 | 0.00E+00 | 9.00E-04 | 1.80E-03 | 0.0850 | 1.233E+13 |
| Cm-243 | 1.7940E-07 | 320.10 | 640.20 | 0.00E+00 | 5.74E-05 | 1.15E-04 | 0.1250 | 8.953E+12 |
| Cm-244 | 1.6962E-06 | 320.10 | 640.20 | 0.00E+00 | 5.43E-04 | 1.09E-03 | 0.2250 | 1.046E+13 |
| Co-60 | 1.2839E+00 | 320.10 | 640.20 | 0.00E+00 | 4.11E+02 | 8.22E+02 | 0.3750 | 5.308E+12 |
| Cs-134 | 9.0541E-02 | 320.10 | 640.20 | 0.00E+00 | 2.90E+01 | 5.80E+01 | 0.5750 | 7.056E+13 |
| Cs-135 | 3.2195E-05 | 320.10 | 640.20 | 0.00E+00 | 1.03E-02 | 2.06E-02 | 0.8500 | 3.028E+12 |
| Cs-137 | 2.7564E+00 | 320.10 | 640.20 | 0.00E+00 | 8.82E+02 | 1.76E+03 | 1.2500 | 6.150E+13 |
| Eu-154 | 1.5368E-02 | 320.10 | 640.20 | 0.00E+00 | 4.92E+00 | 9.84E+00 | 1.7500 | 4.100E+10 |
| Eu-155 | 2.9293E-02 | 320.10 | 640.20 | 0.00E+00 | 9.38E+00 | 1.88E+01 | 2.2500 | 6.608E+10 |
| Fe-55 | 7.7158E-01 | 320.10 | 640.20 | 0.00E+00 | 2.47E+02 | 4.94E+02 | 2.7500 | 5.244E+08 |
| H-3 | 1.1111E-02 | 320.10 | 640.20 | 0.00E+00 | 3.56E+00 | 7.11E+00 | 3.5000 | 6.103E+07 |
| I-129 | 7.3684E-07 | 320.10 | 640.20 | 0.00E+00 | 2.36E-04 | 4.72E-04 | 5.0000 | 3.491E+02 |
| Kr-85 | 2.5263E-01 | 320.10 | 640.20 | 0.00E+00 | 8.09E+01 | 1.62E+02 | 7.0000 | 3.954E+01 |
| Np-237 | 1.2427E-06 | 320.10 | 640.20 | 0.00E+00 | 3.98E-04 | 7.96E-04 | 11.0000 | 4.505E+00 |
| Pa-231 | 3.8511E-09 | 320.10 | 640.20 | 0.00E+00 | 1.23E-06 | 2.47E-06 | | |
| Pb-210 | 7.3880E-15 | 320.10 | 640.20 | 0.00E+00 | 2.36E-12 | 4.73E-12 | | |
| Pm-147 | 2.1023E+00 | 320.10 | 640.20 | 0.00E+00 | 6.73E+02 | 1.35E+03 | | |
| Pu-238 | 1.0383E-03 | 320.10 | 640.20 | 0.00E+00 | 3.32E-01 | 6.65E-01 | | |
| Pu-239 | 5.5293E-03 | 320.10 | 640.20 | 0.00E+00 | 1.77E+00 | 3.54E+00 | | |
| Pu-240 | 2.1278E-03 | 320.10 | 640.20 | 0.00E+00 | 6.81E-01 | 1.36E+00 | | |
| Pu-241 | 1.0195E-01 | 320.10 | 640.20 | 0.00E+00 | 3.26E+01 | 6.53E+01 | | |
| Pu-242 | 2.3128E-07 | 320.10 | 640.20 | 0.00E+00 | 7.40E-05 | 1.48E-04 | | |
| Ra-226 | 5.2782E-14 | 320.10 | 640.20 | 0.00E+00 | 1.69E-11 | 3.38E-11 | | |
| Ra-228 | 1.9338E-10 | 320.10 | 640.20 | 0.00E+00 | 6.19E-08 | 1.24E-07 | | |
| Ru-106 | 9.1684E-02 | 320.10 | 640.20 | 0.00E+00 | 2.93E+01 | 5.87E+01 | | |
| Se-79 | 1.3018E-05 | 320.10 | 640.20 | 0.00E+00 | 4.17E-03 | 8.33E-03 | | |
| Sn-126 | 1.2167E-05 | 320.10 | 640.20 | 0.00E+00 | 3.89E-03 | 7.79E-03 | | |
| Sr-90 | 2.6045E+00 | 320.10 | 640.20 | 0.00E+00 | 8.34E+02 | 1.67E+03 | | |
| Tc-99 | 4.4241E-04 | 320.10 | 640.20 | 0.00E+00 | 1.42E-01 | 2.83E-01 | | |
| Th-229 | 1.3713E-10 | 320.10 | 640.20 | 0.00E+00 | 4.39E-08 | 8.78E-08 | | |
| Th-230 | 1.8090E-11 | 320.10 | 640.20 | 0.00E+00 | 5.79E-09 | 1.16E-08 | | |
| Th-232 | 2.5278E-10 | 320.10 | 640.20 | 0.00E+00 | 8.09E-08 | 1.62E-07 | | |
| Ti-208 | 1.6947E-08 | 320.10 | 640.20 | 0.00E+00 | 5.42E-06 | 1.08E-05 | | |
| U-232 | 4.8737E-08 | 320.10 | 640.20 | 0.00E+00 | 1.56E-05 | 3.12E-05 | | |
| U-233 | 1.2203E-07 | 320.10 | 640.20 | 0.00E+00 | 3.91E-05 | 7.81E-05 | | |
| U-234 | 1.5925E-07 | 320.10 | 640.20 | 0.00E+00 | 5.10E-05 | 1.02E-04 | | |
| U-235 | -2.6194E-06 | 320.10 | 0.00 | 9.45E-03 | 8.61E-03 | 9.45E-03 | | |
| U-236 | 1.2693E-05 | 320.10 | 640.20 | 0.00E+00 | 4.06E-03 | 8.13E-03 | | |
| U-238 | -3.6331E-08 | 320.10 | 0.00 | 5.89E-03 | 5.88E-03 | 5.89E-03 | | |
| Y-90 | 2.6060E+00 | 320.10 | 640.20 | 0.00E+00 | 8.34E+02 | 1.67E+03 | | |
| Other Radionuclides | | | | | 1.15E+03 | 2.31E+03 | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 1.86E+01 | 3.73E+01 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | SST | SST |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 19.97350572 | 10 to 20.1 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | 320.10 | 296.41 |
| Bounding | | 640.20 |

Basis for burnup used in estimate:

Nominal burnup taken directly from SFD (converted to MWd)
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|--------------------------------|
| Nominal | 0.43 | 0.93 |
| Bounding | 0.86 | |

Estimated EOL HM/Given EOL HM

1.00

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8.5/20 DOW
SNF ID #: 251
Fuel Units & Descr: 77 - ELEMENT
Heavy Metal Mass: BOL=15 015kg; EOL=14 63kg
ROD Storage Site: INEEL

¹Fuel decay start date: 2035
Estimates as of: 2030
Template: TRIGA-SS (LW/U-Zr, SST, 10 to 20% U)
²Template Burnup(MWd): 6 65
Template BOL Heavy Metal Mass (MT): 0.000195
Template Decay Time: 5 years

Estimated
Canister usage
18"x10"
0 69

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 5173E-10 | 367 52 | 735 05 | 0 00E+00 | 3 13E-07 | 6 26E-07 | Avg MeV | |
| Am-241 | 1 8331E-03 | 367 52 | 735 05 | 0 00E+00 | 6 74E-01 | 1 35E+00 | 0.0150 | 1 188E+14 |
| Am-242m | 1 4129E-06 | 367 52 | 735 05 | 0 00E+00 | 5 19E-04 | 1 04E-03 | 0.0250 | 2 614E+13 |
| Am-243 | 1 4774E-07 | 367 52 | 735 05 | 0 00E+00 | 5 43E-05 | 1 09E-04 | 0.0375 | 2 226E+13 |
| C-14 | 1 2871E-04 | 367 52 | 735 05 | 0 00E+00 | 4 73E-02 | 9 46E-02 | 0.0575 | 2 285E+13 |
| Cl-36 | 2 8120E-06 | 367 52 | 735 05 | 0 00E+00 | 1 03E-03 | 2 07E-03 | 0.0850 | 1 416E+13 |
| Cm-243 | 1 7940E-07 | 367 52 | 735 05 | 0 00E+00 | 6.59E-05 | 1 32E-04 | 0.1250 | 1 028E+13 |
| Cm-244 | 1 6962E-06 | 367 52 | 735 05 | 0 00E+00 | 6.23E-04 | 1 25E-03 | 0.2250 | 1 201E+13 |
| Co-60 | 1 2839E+00 | 367 52 | 735 05 | 0 00E+00 | 4 72E+02 | 9 44E+02 | 0.3750 | 6.094E+12 |
| Cs-134 | 9 0541E-02 | 367 52 | 735 05 | 0 00E+00 | 3 33E+01 | 6 66E+01 | 0.5750 | 8 102E+13 |
| Cs-135 | 3 2195E-05 | 367 52 | 735 05 | 0 00E+00 | 1.18E-02 | 2 37E-02 | 0.8500 | 3 477E+12 |
| Cs-137 | 2 7564E+00 | 367 52 | 735 05 | 0 00E+00 | 1 01E+03 | 2 03E+03 | 1.2500 | 7 061E+13 |
| Eu-154 | 1 5368E-02 | 367 52 | 735 05 | 0 00E+00 | 5 65E+00 | 1 13E+01 | 1.7500 | 4 707E+10 |
| Eu-155 | 2 9293E-02 | 367 52 | 735 05 | 0 00E+00 | 1 08E+01 | 2 15E+01 | 2.2500 | 7.587E+10 |
| Fe-55 | 7 7158E-01 | 367 52 | 735 05 | 0 00E+00 | 2 84E+02 | 5 67E+02 | 2.7500 | 6.021E+08 |
| H-3 | 1 1111E-02 | 367 52 | 735 05 | 0 00E+00 | 4 08E+00 | 8 17E+00 | 3.5000 | 7 007E+07 |
| I-129 | 7 3684E-07 | 367 52 | 735 05 | 0 00E+00 | 2.71E-04 | 5 42E-04 | 5.0000 | 3.946E+02 |
| Kr-85 | 2 5263E-01 | 367 52 | 735 05 | 0 00E+00 | 9 28E+01 | 1 86E+02 | 7.0000 | 4 467E+01 |
| Np-237 | 1 2427E-06 | 367 52 | 735 05 | 0 00E+00 | 4.57E-04 | 9 13E-04 | 11.0000 | 5.089E+00 |
| Pa-231 | 3 8511E-09 | 367 52 | 735 05 | 0 00E+00 | 1 42E-06 | 2 83E-06 | | |
| Pb-210 | 7 3880E-15 | 367 52 | 735 05 | 0 00E+00 | 2.72E-12 | 5 43E-12 | | |
| Pm-147 | 2 1023E+00 | 367 52 | 735 05 | 0 00E+00 | 7 73E+02 | 1 55E+03 | | |
| Pu-238 | 1 0383E-03 | 367 52 | 735 05 | 0 00E+00 | 3 82E-01 | 7 63E-01 | | |
| Pu-239 | 5 5293E-03 | 367 52 | 735 05 | 0 00E+00 | 2 03E+00 | 4 06E+00 | | |
| Pu-240 | 2 1278E-03 | 367 52 | 735 05 | 0 00E+00 | 7 82E-01 | 1 56E+00 | | |
| Pu-241 | 1 0195E-01 | 367 52 | 735 05 | 0 00E+00 | 3 75E+01 | 7 49E+01 | | |
| Pu-242 | 2 3128E-07 | 367 52 | 735 05 | 0 00E+00 | 8.50E-05 | 1 70E-04 | | |
| Ra-226 | 5 2782E-14 | 367 52 | 735 05 | 0 00E+00 | 1.94E-11 | 3 88E-11 | | |
| Ra-228 | 1 9338E-10 | 367 52 | 735 05 | 0 00E+00 | 7.11E-08 | 1 42E-07 | | |
| Ru-106 | 9 1684E-02 | 367 52 | 735 05 | 0 00E+00 | 3 37E+01 | 6 74E+01 | | |
| Se-79 | 1 3018E-05 | 367 52 | 735 05 | 0 00E+00 | 4.78E-03 | 9 57E-03 | | |
| Sn-126 | 1 2167E-05 | 367 52 | 735 05 | 0 00E+00 | 4 47E-03 | 8 94E-03 | | |
| Sr-90 | 2 6045E+00 | 367 52 | 735 05 | 0 00E+00 | 9 57E+02 | 1 91E+03 | | |
| Tc-99 | 4 4241E-04 | 367 52 | 735 05 | 0 00E+00 | 1 63E-01 | 3 25E-01 | | |
| Th-229 | 1 3713E-10 | 367 52 | 735 05 | 0 00E+00 | 5.04E-08 | 1 01E-07 | | |
| Th-230 | 1 8090E-11 | 367 52 | 735 05 | 0 00E+00 | 6 65E-09 | 1 33E-08 | | |
| Th-232 | 2 5278E-10 | 367 52 | 735 05 | 0 00E+00 | 9.29E-08 | 1 86E-07 | | |
| Ti-208 | 1 6947E-08 | 367 52 | 735 05 | 0 00E+00 | 6.23E-06 | 1.25E-05 | | |
| U-232 | 4 8737E-08 | 367 52 | 735 05 | 0 00E+00 | 1.79E-05 | 3 58E-05 | | |
| U-233 | 1 2203E-07 | 367 52 | 735 05 | 0 00E+00 | 4 48E-05 | 8 97E-05 | | |
| U-234 | 1 5925E-07 | 367 52 | 735 05 | 0 00E+00 | 5.85E-05 | 1 17E-04 | | |
| U-235 | -2 6194E-06 | 367 52 | 0 00 | 6 49E-03 | 5.53E-03 | 6 49E-03 | | |
| U-236 | 1 2693E-05 | 367 52 | 735 05 | 0 00E+00 | 4 67E-03 | 9 33E-03 | | |
| U-238 | -3 6331E-08 | 367 52 | 0 00 | 4 04E-03 | 4 02E-03 | 4 04E-03 | | |
| Y-90 | 2 6060E+00 | 367 52 | 735 05 | 0 00E+00 | 9 58E+02 | 1 92E+03 | | |
| Other Radionuclides | | | | | 1 33E+03 | 2 65E+03 | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 2.14E+01 | 4.28E+01 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|------------|----------------------------------|
| Reactor Moderator: | LW AND U ZIRC HYDRIDE | Used | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment %: | 20 | 10 to 20 1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal Bounding: | 219 50 | 367 52 | |
| | | 735 05 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|-------------------|-------------------|--------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal Bounding: | 0 72 | 1 67 | |
| | 1 44 | | 1 00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8 5/20 ENGLAND
SNF ID #: 485
Fuel Units & Descr: 84 - ELEMENT
Heavy Metal Mass: BOL=16 187kg EOL=15.826kg
ROD Storage Site: INEEL

¹Fuel decay start date: 2010
Estimates as of: 2030
Template: TRIGA-SS (LW/U-Zr, SST, 10 to 20%, U)
²Template Burnup(MWd): 6 65
Template BOL Heavy Metal Mass (MT): 0 000195
Template Decay Time: 20 years

Estimated
Canister usage
18"x10"
0 76

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2 6436E-09 | 394.39 | 788.78 | 0 00E+00 | 1 04E-06 | 2 09E-06 | Avg MeV | |
| Am-241 | 3 1429E-03 | 394.39 | 788.78 | 0 00E+00 | 1 24E+00 | 2 48E+00 | 0 0150 | 7 905E+13 |
| Am-242m | 1 3195E-06 | 394.39 | 788.78 | 0 00E+00 | 5 20E-04 | 1 04E-03 | 0 0250 | 1 645E+13 |
| Am-243 | 1 4753E-07 | 394.39 | 788.78 | 0 00E+00 | 5 82E-05 | 1 16E-04 | 0 0375 | 1 425E+13 |
| C-14 | 1 2847E-04 | 394.39 | 788.78 | 0 00E+00 | 5 07E-02 | 1 01E-01 | 0 0575 | 1 534E+13 |
| Ci-36 | 2 8120E-06 | 394.39 | 788.78 | 0 00E+00 | 1 11E-03 | 2 22E-03 | 0 0850 | 9 258E+12 |
| Cm-243 | 1 2465E-07 | 394.39 | 788.78 | 0 00E+00 | 4 92E-05 | 9 83E-05 | 0 1250 | 6 051E+12 |
| Cm-244 | 9 5564E-07 | 394.39 | 788.78 | 0 00E+00 | 3 77E-04 | 7 54E-04 | 0 2250 | 7 949E+12 |
| Co-60 | 1 7880E-01 | 394.39 | 788.78 | 0 00E+00 | 7 05E+01 | 1 41E+02 | 0 3750 | 3 484E+12 |
| Cs-134 | 5 8692E-04 | 394.39 | 788.78 | 0 00E+00 | 2 31E-01 | 4 63E-01 | 0 5750 | 5 730E+13 |
| Cs-135 | 3 2195E-05 | 394.39 | 788.78 | 0 00E+00 | 1 27E-02 | 2 54E-02 | 0 8500 | 6 459E+11 |
| Cs-137 | 1 9489E+00 | 394.39 | 788.78 | 0 00E+00 | 7 69E+02 | 1 54E+03 | 1 2500 | 1 070E+13 |
| Eu-154 | 4 5895E-03 | 394.39 | 788.78 | 0 00E+00 | 1 81E+00 | 3 62E+00 | 1 7500 | 1 659E+10 |
| Eu-155 | 3 6045E-03 | 394.39 | 788.78 | 0 00E+00 | 1 42E+00 | 2 84E+00 | 2 2500 | 5 716E+07 |
| Fe-55 | 1 4185E-02 | 394.39 | 788.78 | 0 00E+00 | 5 59E+00 | 1 12E+01 | 2 7500 | 6 297E+05 |
| H-3 | 4 7895E-03 | 394.39 | 788.78 | 0 00E+00 | 1 89E+00 | 3 78E+00 | 3 5000 | 3 505E+03 |
| I-129 | 7 3684E-07 | 394.39 | 788.78 | 0 00E+00 | 2 91E-04 | 5 81E-04 | 5 0000 | 4 199E+02 |
| Kr-85 | 9 5820E-02 | 394.39 | 788.78 | 0 00E+00 | 3 78E+01 | 7 56E+01 | 7 0000 | 4 744E+01 |
| Np-237 | 1 2552E-06 | 394.39 | 788.78 | 0 00E+00 | 4 95E-04 | 9 90E-04 | 11 0000 | 5 398E+00 |
| Pa-231 | 7 0406E-09 | 394.39 | 788.78 | 0 00E+00 | 2 78E-06 | 5 55E-06 | | |
| Pb-210 | 5 8000E-14 | 394.39 | 788.78 | 0 00E+00 | 2 29E-11 | 4 57E-11 | | |
| Pm-147 | 4 0075E-02 | 394.39 | 788.78 | 0 00E+00 | 1 58E+01 | 3 16E+01 | | |
| Pu-238 | 9 2256E-04 | 394.39 | 788.78 | 0 00E+00 | 3 64E-01 | 7 28E-01 | | |
| Pu-239 | 5 5278E-03 | 394.39 | 788.78 | 0 00E+00 | 2 18E+00 | 4 36E+00 | | |
| Pu-240 | 2 1248E-03 | 394.39 | 788.78 | 0 00E+00 | 8 38E-01 | 1 68E+00 | | |
| Pu-241 | 4 9549E-02 | 394.39 | 788.78 | 0 00E+00 | 1 95E+01 | 3 91E+01 | | |
| Pu-242 | 2 3128E-07 | 394.39 | 788.78 | 0 00E+00 | 9 12E-05 | 1 82E-04 | | |
| Ra-226 | 2 4526E-13 | 394.39 | 788.78 | 0 00E+00 | 9 67E-11 | 1 93E-10 | | |
| Ra-228 | 2 4015E-10 | 394.39 | 788.78 | 0 00E+00 | 9 47E-08 | 1 89E-07 | | |
| Ru-106 | 3 0602E-06 | 394.39 | 788.78 | 0 00E+00 | 1 21E-03 | 2 41E-03 | | |
| Se-79 | 1 3015E-05 | 394.39 | 788.78 | 0 00E+00 | 5 13E-03 | 1 03E-02 | | |
| Sn-126 | 1 2165E-05 | 394.39 | 788.78 | 0 00E+00 | 4 80E-03 | 9 60E-03 | | |
| Sr-90 | 1 8226E+00 | 394.39 | 788.78 | 0 00E+00 | 7 19E+02 | 1 44E+03 | | |
| Tc-99 | 4 4241E-04 | 394.39 | 788.78 | 0 00E+00 | 1 74E-01 | 3 49E-01 | | |
| Th-229 | 3 0962E-10 | 394.39 | 788.78 | 0 00E+00 | 1 22E-07 | 2 44E-07 | | |
| Th-230 | 4 2346E-11 | 394.39 | 788.78 | 0 00E+00 | 1 67E-08 | 3 34E-08 | | |
| Th-232 | 2 5278E-10 | 394.39 | 788.78 | 0 00E+00 | 9 97E-08 | 1 99E-07 | | |
| Ti-208 | 1 5820E-08 | 394.39 | 788.78 | 0 00E+00 | 6 24E-06 | 1 25E-05 | | |
| U-232 | 4 2647E-08 | 394.39 | 788.78 | 0 00E+00 | 1 68E-05 | 3 36E-05 | | |
| U-233 | 1 2211E-07 | 394.39 | 788.78 | 0 00E+00 | 4 82E-05 | 9 63E-05 | | |
| U-234 | 1 9955E-07 | 394.39 | 788.78 | 0 00E+00 | 7 87E-05 | 1 57E-04 | | |
| U-235 | -2 6194E-06 | 394.39 | 0 00 | 6 93E-03 | 5 90E-03 | 6 93E-03 | | |
| U-236 | 1 2693E-05 | 394.39 | 788.78 | 0 00E+00 | 5 01E-03 | 1 00E-02 | | |
| U-238 | -3 6331E-08 | 394.39 | 0 00 | 4 36E-03 | 4 35E-03 | 4 36E-03 | | |
| Y-90 | 1 8241E+00 | 394.39 | 788.78 | 0 00E+00 | 7 19E+02 | 1 44E+03 | | |
| Other Radionuclides | | | | | 7 59E+02 | 1 52E+03 | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 9 87E+00 | 1 97E+01 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | SST | SST |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 19 80853811 | 10 to 20 1 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | 394.39 | 344 80 |
| Bounding | | 788 78 |

Basis for burnup used in estimate:

Nominal burnup taken directly from SFD (converted to MWd)
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|--------------------------------|
| Nominal | 0 71 | 0 87 |
| Bounding | 1 43 | |

Estimated EOL HM/Given EOL HM

1 00

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8.5/20 FINLAND
 SNF ID #: 472
 Fuel Units & Descr: 102 - ELEMENT
 Heavy Metal Mass: BOL=19.89kg EOL=19.686kg
 ROD Storage Site: INEEL

Fuel decay start date: 2010
 Estimates as of: 2030
 Template: TRIGA-SS (LW/U Zrx, SST, 10 to 20%, U)
 *Template Burnup(MWd): 6.65
 Template BOL Heavy Metal Mass (MT): 0.000195
 Template Decay Time*: 20 years

Estimated
 Canister usage
 18"x10"
 0.92

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.6436E-09 | 194.74 | 389.48 | 0.00E+00 | 5.15E-07 | 1.03E-06 | Avg. MeV | |
| Am-241 | 3.1429E-03 | 194.74 | 389.48 | 0.00E+00 | 6.12E-01 | 1.22E+00 | 0.0150 | 3.903E+13 |
| Am-242m | 1.3195E-06 | 194.74 | 389.48 | 0.00E+00 | 2.57E-04 | 5.14E-04 | 0.0250 | 8.125E+12 |
| Am-243 | 1.4753E-07 | 194.74 | 389.48 | 0.00E+00 | 2.87E-05 | 5.75E-05 | 0.0375 | 7.039E+12 |
| C-14 | 1.2847E-04 | 194.74 | 389.48 | 0.00E+00 | 2.50E-02 | 5.00E-02 | 0.0575 | 7.572E+12 |
| Cl-36 | 2.8120E-06 | 194.74 | 389.48 | 0.00E+00 | 5.48E-04 | 1.10E-03 | 0.0850 | 4.571E+12 |
| Cm-243 | 1.2465E-07 | 194.74 | 389.48 | 0.00E+00 | 2.43E-05 | 4.85E-05 | 0.1250 | 2.988E+12 |
| Cm-244 | 9.5564E-07 | 194.74 | 389.48 | 0.00E+00 | 1.86E-04 | 3.72E-04 | 0.2250 | 3.925E+12 |
| Co-60 | 1.7880E-01 | 194.74 | 389.48 | 0.00E+00 | 3.48E+01 | 6.96E+01 | 0.3750 | 1.720E+12 |
| Cs-134 | 5.8692E-04 | 194.74 | 389.48 | 0.00E+00 | 1.14E-01 | 2.29E-01 | 0.5750 | 2.829E+13 |
| Cs-135 | 3.2195E-05 | 194.74 | 389.48 | 0.00E+00 | 6.27E-03 | 1.25E-02 | 0.8500 | 3.189E+11 |
| Cs-137 | 1.9489E+00 | 194.74 | 389.48 | 0.00E+00 | 3.80E+02 | 7.59E+02 | 1.2500 | 5.285E+12 |
| Eu-154 | 4.5895E-03 | 194.74 | 389.48 | 0.00E+00 | 8.94E-01 | 1.79E+00 | 1.7500 | 8.194E+09 |
| Eu-155 | 3.6045E-03 | 194.74 | 389.48 | 0.00E+00 | 7.02E-01 | 1.40E+00 | 2.2500 | 2.822E+07 |
| Fe-55 | 1.4185E-02 | 194.74 | 389.48 | 0.00E+00 | 2.76E+00 | 5.52E+00 | 2.7500 | 3.110E+05 |
| H-3 | 4.7895E-03 | 194.74 | 389.48 | 0.00E+00 | 9.33E-01 | 1.87E+00 | 3.5000 | 1.748E+03 |
| I-129 | 7.3684E-07 | 194.74 | 389.48 | 0.00E+00 | 1.43E-04 | 2.87E-04 | 5.0000 | 2.147E+02 |
| Kr-85 | 9.5820E-02 | 194.74 | 389.48 | 0.00E+00 | 1.87E+01 | 3.73E+01 | 7.0000 | 2.427E+01 |
| Np-237 | 1.2552E-06 | 194.74 | 389.48 | 0.00E+00 | 2.44E-04 | 4.89E-04 | 11.0000 | 2.763E+00 |
| Pa-231 | 7.0406E-09 | 194.74 | 389.48 | 0.00E+00 | 1.37E-06 | 2.74E-06 | | |
| Pb-210 | 5.8000E-14 | 194.74 | 389.48 | 0.00E+00 | 1.13E-11 | 2.26E-11 | | |
| Pm-147 | 4.0075E-02 | 194.74 | 389.48 | 0.00E+00 | 7.80E+00 | 1.56E+01 | | |
| Pu-238 | 9.2256E-04 | 194.74 | 389.48 | 0.00E+00 | 1.80E-01 | 3.59E-01 | | |
| Pu-239 | 5.5278E-03 | 194.74 | 389.48 | 0.00E+00 | 1.08E+00 | 2.15E+00 | | |
| Pu-240 | 2.1248E-03 | 194.74 | 389.48 | 0.00E+00 | 4.14E-01 | 8.28E-01 | | |
| Pu-241 | 4.9549E-02 | 194.74 | 389.48 | 0.00E+00 | 9.65E+00 | 1.93E+01 | | |
| Pu-242 | 2.3128E-07 | 194.74 | 389.48 | 0.00E+00 | 4.50E-05 | 9.01E-05 | | |
| Ra-226 | 2.4526E-13 | 194.74 | 389.48 | 0.00E+00 | 4.78E-11 | 9.55E-11 | | |
| Ra-228 | 2.4015E-10 | 194.74 | 389.48 | 0.00E+00 | 4.68E-08 | 9.35E-08 | | |
| Ru-106 | 3.0602E-06 | 194.74 | 389.48 | 0.00E+00 | 5.96E-04 | 1.19E-03 | | |
| Se-79 | 1.3015E-05 | 194.74 | 389.48 | 0.00E+00 | 2.53E-03 | 5.07E-03 | | |
| Sn-126 | 1.2165E-05 | 194.74 | 389.48 | 0.00E+00 | 2.37E-03 | 4.74E-03 | | |
| Sr-90 | 1.8226E+00 | 194.74 | 389.48 | 0.00E+00 | 3.55E+02 | 7.10E+02 | | |
| Tc-99 | 4.4241E-04 | 194.74 | 389.48 | 0.00E+00 | 8.62E-02 | 1.72E-01 | | |
| Th-229 | 3.0962E-10 | 194.74 | 389.48 | 0.00E+00 | 6.03E-08 | 1.21E-07 | | |
| Th-230 | 4.2346E-11 | 194.74 | 389.48 | 0.00E+00 | 8.25E-09 | 1.65E-08 | | |
| Th-232 | 2.5278E-10 | 194.74 | 389.48 | 0.00E+00 | 4.92E-08 | 9.85E-08 | | |
| Ti-208 | 1.5820E-08 | 194.74 | 389.48 | 0.00E+00 | 3.08E-06 | 6.16E-06 | | |
| U-232 | 4.2647E-08 | 194.74 | 389.48 | 0.00E+00 | 8.30E-06 | 1.66E-05 | Thermal Power | |
| U-233 | 1.2211E-07 | 194.74 | 389.48 | 0.00E+00 | 2.38E-05 | 4.76E-05 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 1.9955E-07 | 194.74 | 389.48 | 0.00E+00 | 3.89E-05 | 7.77E-05 | 4.87E+00 | 9.74E+00 |
| U-235 | -2.6194E-06 | 194.74 | 0.00 | 8.60E-03 | 8.09E-03 | 8.60E-03 | Total | Total |
| U-236 | 1.2693E-05 | 194.74 | 389.48 | 0.00E+00 | 2.47E-03 | 4.94E-03 | | |
| U-238 | -3.6331E-08 | 194.74 | 0.00 | 5.35E-03 | 5.34E-03 | 5.35E-03 | | |
| Y-90 | 1.8241E+00 | 194.74 | 389.48 | 0.00E+00 | 3.55E+02 | 7.10E+02 | | |
| Other Radionuclides | | | | | 3.75E+02 | 7.50E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------------------|-------------------------------|----------------------------------|
| Reactor Moderator | From SFD LW AND U ZIRC HYDRIDE | Used LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20.0000041 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | 193.85 | 194.74 | |
| Bounding | | 389.48 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0.29 | 1.00 | |
| Bounding | 0.57 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 8.5/20 GA
SNF ID #: 244
Fuel Units & Descr: 114 - ELEMENT
Heavy Metal Mass BOL=22.23kg EOL=19 688kg
ROD Storage Site INEEL

¹Fuel decay start date 1982
Estimates as of 2030
Template TRIGA-SS (LW/U-Zrx, SST, 10 to 20% U)
²Template Burnup(MWd) 6 65
Template BOL Heavy Metal Mass (MT) 0 000195
Template Decay Time 35 years

Estimated
Canister usage
18"x10"
1 03

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6.7038E-09 | 2,426 80 | 4,853 61 | 0 00E+00 | 1 63E-05 | 3 25E-05 | Avg MeV | |
| Am-241 | 3 9068E-03 | 2,426 80 | 4,853 61 | 0 00E+00 | 9 48E+00 | 1 90E+01 | 0 0150 | 3 388E+14 |
| Am-242m | 1.2325E-06 | 2,426 80 | 4,853 61 | 0 00E+00 | 2 99E-03 | 5 98E-03 | 0 0250 | 7 039E+13 |
| Am-243 | 1 4732E-07 | 2,426 80 | 4,853 61 | 0 00E+00 | 3 58E-04 | 7 15E-04 | 0 0375 | 6 116E+13 |
| C-14 | 1.2824E-04 | 2,426 80 | 4,853.61 | 0 00E+00 | 3 11E-01 | 6 22E-01 | 0 0575 | 6 589E+13 |
| Cl-36 | 2 8120E-06 | 2,426 80 | 4,853 61 | 0 00E+00 | 6 82E-03 | 1.36E-02 | 0 0850 | 3 965E+13 |
| Cm-243 | 8 6556E-08 | 2,426 80 | 4,853 61 | 0 00E+00 | 2 10E-04 | 4.20E-04 | 0 1250 | 2.580E+13 |
| Cm-244 | 5 3835E-07 | 2,426 80 | 4,853 61 | 0 00E+00 | 1.31E-03 | 2 61E-03 | 0.2250 | 3 415E+13 |
| Co-60 | 2 4887E-02 | 2,426.80 | 4,853 61 | 0 00E+00 | 6 04E+01 | 1.21E+02 | 0 3750 | 1.489E+13 |
| Cs-134 | 3 8030E-06 | 2,426 80 | 4,853 61 | 0 00E+00 | 9 23E-03 | 1.85E-02 | 0 5750 | 2 491E+14 |
| Cs-135 | 3.2195E-05 | 2,426 80 | 4,853 61 | 0 00E+00 | 7 81E-02 | 1.56E-01 | 0 8500 | 2.549E+12 |
| Cs-137 | 1.3788E+00 | 2,426 80 | 4,853 61 | 0 00E+00 | 3 35E+03 | 6 69E+03 | 1.2500 | 9 893E+12 |
| Eu-154 | 1.3711E-03 | 2,426 80 | 4,853 61 | 0 00E+00 | 3 33E+00 | 6 65E+00 | 1 7500 | 6 616E+10 |
| Eu-155 | 4 4361E-04 | 2,426 80 | 4,853 61 | 0 00E+00 | 1 08E+00 | 2 15E+00 | 2.2500 | 5 422E+07 |
| Fe-55 | 2.6075E-04 | 2,426 80 | 4,853 61 | 0 00E+00 | 6 33E-01 | 1 27E+00 | 2 7500 | 2.492E+06 |
| H-3 | 2 0647E-03 | 2,426 80 | 4,853 61 | 0 00E+00 | 5 01E+00 | 1 00E+01 | 3.5000 | 5 987E+03 |
| I-129 | 7.3684E-07 | 2,426 80 | 4,853 61 | 0 00E+00 | 1.79E-03 | 3 58E-03 | 5 0000 | 2.520E+03 |
| Kr-85 | 3 6346E-02 | 2,426 80 | 4,853 61 | 0 00E+00 | 8 82E+01 | 1 76E+02 | 7 0000 | 2.843E+02 |
| Np-237 | 1.2844E-06 | 2,426 80 | 4,853 61 | 0 00E+00 | 3 12E-03 | 6.23E-03 | 11 0000 | 3.232E+01 |
| Pa-231 | 1 2352E-08 | 2,426 80 | 4,853.61 | 0 00E+00 | 3 00E-05 | 6 00E-05 | | |
| Pb-210 | 3.5338E-13 | 2,426 80 | 4,853 61 | 0 00E+00 | 8 58E-10 | 1 72E-09 | | |
| Pm-147 | 7 6346E-04 | 2,426 80 | 4,853 61 | 0 00E+00 | 1 85E+00 | 3 71E+00 | | |
| Pu-238 | 8 1970E-04 | 2,426 80 | 4,853 61 | 0 00E+00 | 1 99E+00 | 3 98E+00 | | |
| Pu-239 | 5.5248E-03 | 2,426.80 | 4,853 61 | 0 00E+00 | 1.34E+01 | 2 68E+01 | | |
| Pu-240 | 2.1203E-03 | 2,426 80 | 4,853 61 | 0 00E+00 | 5 15E+00 | 1 03E+01 | | |
| Pu-241 | 2 4075E-02 | 2,426 80 | 4,853 61 | 0 00E+00 | 5 84E+01 | 1 17E+02 | | |
| Pu-242 | 2.3128E-07 | 2,426 80 | 4,853 61 | 0 00E+00 | 5 61E-04 | 1 12E-03 | | |
| Ra-226 | 9 6481E-13 | 2,426 80 | 4,853 61 | 0 00E+00 | 2 34E-09 | 4 68E-09 | | |
| Ra-228 | 2.5188E-10 | 2,426 80 | 4,853 61 | 0 00E+00 | 6 11E-07 | 1.22E-06 | | |
| Ru-106 | 1 0214E-10 | 2,426 80 | 4,853 61 | 0 00E+00 | 2 48E-07 | 4 96E-07 | | |
| Se-79 | 1.3014E-05 | 2,426 80 | 4,853 61 | 0 00E+00 | 3.16E-02 | 6.32E-02 | | |
| Sn-126 | 1.2164E-05 | 2,426 80 | 4,853 61 | 0 00E+00 | 2 95E-02 | 5 90E-02 | | |
| Sr-90 | 1.2762E+00 | 2,426 80 | 4,853 61 | 0 00E+00 | 3.10E+03 | 6.19E+03 | | |
| Tc-99 | 4 4241E-04 | 2,426 80 | 4,853.61 | 0 00E+00 | 1.07E+00 | 2.15E+00 | | |
| Th-229 | 5 9684E-10 | 2,426 80 | 4,853 61 | 0 00E+00 | 1 45E-06 | 2 90E-06 | | |
| Th-230 | 9 3880E-11 | 2,426 80 | 4,853 61 | 0 00E+00 | 2 28E-07 | 4 56E-07 | | |
| Th-232 | 2.5278E-10 | 2,426 80 | 4,853 61 | 0 00E+00 | 6 13E-07 | 1 23E-06 | | |
| Ti-208 | 1.3723E-08 | 2,426 80 | 4,853 61 | 0 00E+00 | 3 33E-05 | 6 66E-05 | | |
| U-232 | 3 6932E-08 | 2,426.80 | 4,853 61 | 0 00E+00 | 8 96E-05 | 1 79E-04 | | |
| U-233 | 1.2224E-07 | 2,426 80 | 4,853 61 | 0 00E+00 | 2 97E-04 | 5 93E-04 | | |
| U-234 | 2.5714E-07 | 2,426 80 | 4,853 61 | 0.00E+00 | 6.24E-04 | 1.25E-03 | | |
| U-235 | -2 6194E-06 | 2,426 80 | 0 00 | 9 61E-03 | 3.25E-03 | 9 61E-03 | | |
| U-236 | 1.2695E-05 | 2,426 80 | 4,853 61 | 0 00E+00 | 3.08E-02 | 6 16E-02 | | |
| U-238 | -3 6331E-08 | 2,426 80 | 0 00 | 5 98E-03 | 5.89E-03 | 5 98E-03 | | |
| Y-90 | 1.2765E+00 | 2,426 80 | 4,853 61 | 0 00E+00 | 3.10E+03 | 6.20E+03 | | |
| Other Radionuclides | | | | | 3.34E+03 | 6 67E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences* |
|---------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 | 10 to 20 1 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|----------|-----------|--|
| Nominal | 758.29 | 2 426 80 | Nominal burnup calculated from the heavy metal mass destroyed. |
| Bounding | | 4 853 61 | Bounding burnup assumed to be twice nominal burnup |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/ Given EOL HM |
|----------|-------------------|--------------------------------|--------------------------------|
| Nominal | 3.20 | 3.20 | 1 00 |
| Bounding | 6 40 | | |

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8 5/20 GERMANY
SNF ID #: 305
Fuel Units & Descr: 15 - ELEMENT
Heavy Metal Mass: BOL=2 925kg; EOL=2 883kg
ROD Storage Site: INEEL

¹Fuel decay start date: 2010
Estimates as of: 2030
Template: TRIGA-SS (LW/U-Zr, SST, 10 to 20%, U)
²Template Burnup(MWd): 6 65
Template BOL Heavy Metal Mass (MT): 0.000195
Template Decay Time: 20 years

Estimated
Canister usage
18"x10"
0 14

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2 6436E-09 | 40 09 | 80 19 | 0 00E+00 | 1 06E-07 | 2 12E-07 | Avg MeV | |
| Am-241 | 3 1429E-03 | 40 09 | 80 19 | 0 00E+00 | 1 26E-01 | 2 52E-01 | 0 0150 | 8 036E+12 |
| Am-242m | 1 3195E-06 | 40 09 | 80 19 | 0 00E+00 | 5 29E-05 | 1 06E-04 | 0 0250 | 1 673E+12 |
| Am-243 | 1 4753E-07 | 40 09 | 80 19 | 0 00E+00 | 5 92E-06 | 1 18E-05 | 0 0375 | 1 449E+12 |
| C-14 | 1 2847E-04 | 40 09 | 80 19 | 0 00E+00 | 5 15E-03 | 1 03E-02 | 0 0575 | 1 559E+12 |
| Cl-36 | 2 8120E-06 | 40 09 | 80 19 | 0 00E+00 | 1 13E-04 | 2 25E-04 | 0 0850 | 9 411E+11 |
| Cm-243 | 1 2465E-07 | 40 09 | 80 19 | 0 00E+00 | 5 00E-06 | 1 00E-05 | 0 1250 | 6 151E+11 |
| Cm-244 | 9 5564E-07 | 40 09 | 80 19 | 0 00E+00 | 3 83E-05 | 7 66E-05 | 0 2250 | 8 081E+11 |
| Co-60 | 1 7880E-01 | 40 09 | 80 19 | 0 00E+00 | 7 17E+00 | 1 43E+01 | 0 3750 | 3 542E+11 |
| Cs-134 | 5 8692E-04 | 40 09 | 80 19 | 0 00E+00 | 2 35E-02 | 4 71E-02 | 0 5750 | 5 825E+12 |
| Cs-135 | 3 2195E-05 | 40 09 | 80 19 | 0 00E+00 | 1 29E-03 | 2 58E-03 | 0 8500 | 6 566E+10 |
| Cs-137 | 1 9489E+00 | 40 09 | 80 19 | 0 00E+00 | 7 81E+01 | 1 56E+02 | 1 2500 | 1 088E+12 |
| Eu-154 | 4 5895E-03 | 40 09 | 80 19 | 0 00E+00 | 1 84E-01 | 3 68E-01 | 1 7500 | 1 687E+09 |
| Eu-155 | 3 6045E-03 | 40 09 | 80 19 | 0 00E+00 | 1 45E-01 | 2 89E-01 | 2 2500 | 5 810E+06 |
| Fe-55 | 1 4185E-02 | 40 09 | 80 19 | 0 00E+00 | 5 69E-01 | 1 14E+00 | 2 7500 | 6 402E+04 |
| H-3 | 4 7895E-03 | 40 09 | 80 19 | 0 00E+00 | 1 92E-01 | 3 84E-01 | 3 5000 | 3 582E+02 |
| I-129 | 7 3684E-07 | 40 09 | 80 19 | 0 00E+00 | 2 95E-05 | 5 91E-05 | 5 0000 | 4 348E+01 |
| Kr-85 | 9 5820E-02 | 40 09 | 80 19 | 0 00E+00 | 3 84E+00 | 7 68E+00 | 7 0000 | 4 914E+00 |
| Np-237 | 1 2552E-06 | 40 09 | 80 19 | 0 00E+00 | 5 03E-05 | 1 01E-04 | 11 0000 | 5 592E-01 |
| Pa-231 | 7 0406E-09 | 40 09 | 80 19 | 0 00E+00 | 2 82E-07 | 5 65E-07 | | |
| Pb-210 | 5 8000E-14 | 40 09 | 80 19 | 0 00E+00 | 2 33E-12 | 4 65E-12 | | |
| Pm-147 | 4 0075E-02 | 40 09 | 80 19 | 0 00E+00 | 1 61E+00 | 3 21E+00 | | |
| Pu-238 | 9 2256E-04 | 40 09 | 80 19 | 0 00E+00 | 3 70E-02 | 7 40E-02 | | |
| Pu-239 | 5 5278E-03 | 40 09 | 80 19 | 0 00E+00 | 2 22E-01 | 4 43E-01 | | |
| Pu-240 | 2 1248E-03 | 40 09 | 80 19 | 0 00E+00 | 8 52E-02 | 1 70E-01 | | |
| Pu-241 | 4 9549E-02 | 40 09 | 80 19 | 0 00E+00 | 1 99E+00 | 3 97E+00 | | |
| Pu-242 | 2 3128E-07 | 40 09 | 80 19 | 0 00E+00 | 9 27E-06 | 1 85E-05 | | |
| Ra-226 | 2 4526E-13 | 40 09 | 80 19 | 0 00E+00 | 9 83E-12 | 1 97E-11 | | |
| Ra-228 | 2 4015E-10 | 40 09 | 80 19 | 0 00E+00 | 9 63E-09 | 1 93E-08 | | |
| Ru-106 | 3 0602E-06 | 40 09 | 80 19 | 0 00E+00 | 1 23E-04 | 2 45E-04 | | |
| Se-79 | 1 3015E-05 | 40 09 | 80 19 | 0 00E+00 | 5 22E-04 | 1 04E-03 | | |
| Sn-126 | 1 2165E-05 | 40 09 | 80 19 | 0 00E+00 | 4 88E-04 | 9 76E-04 | | |
| Sr-90 | 1 8226E+00 | 40 09 | 80 19 | 0 00E+00 | 7 31E+01 | 1 46E+02 | | |
| Tc-99 | 4 4241E-04 | 40 09 | 80 19 | 0 00E+00 | 1 77E-02 | 3 55E-02 | | |
| Th-229 | 3 0962E-10 | 40 09 | 80 19 | 0 00E+00 | 1 24E-08 | 2 48E-08 | | |
| Th-230 | 4 2346E-11 | 40 09 | 80 19 | 0 00E+00 | 1 70E-09 | 3 40E-09 | | |
| Th-232 | 2 5278E-10 | 40 09 | 80 19 | 0 00E+00 | 1 01E-08 | 2 03E-08 | | |
| Ti-208 | 1 5820E-08 | 40 09 | 80 19 | 0 00E+00 | 6 34E-07 | 1 27E-06 | | |
| U-232 | 4 2647E-08 | 40 09 | 80 19 | 0 00E+00 | 1 71E-06 | 3 42E-06 | | |
| U-233 | 1 2211E-07 | 40 09 | 80 19 | 0 00E+00 | 4 90E-06 | 9 79E-06 | | |
| U-234 | 1 9955E-07 | 40 09 | 80 19 | 0 00E+00 | 8 00E-06 | 1 60E-05 | | |
| U-235 | -2 6194E-06 | 40 09 | 0 00 | 1 26E-03 | 1 16E-03 | 1 26E-03 | | |
| U-236 | 1 2693E-05 | 40 09 | 80 19 | 0 00E+00 | 5 09E-04 | 1 02E-03 | | |
| U-238 | -3 6331E-08 | 40 09 | 0 00 | 7 86E-04 | 7 85E-04 | 7 86E-04 | | |
| Y-90 | 1 8241E+00 | 40 09 | 80 19 | 0 00E+00 | 7 31E+01 | 1 46E+02 | | |
| Other Radionuclides | | | | | 7 72E+01 | 1 54E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------------------|-------------------------------|----------------------------------|
| Reactor Moderator | From SFD LW AND U ZIRC HYDRIDE | Used LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 00000041 | 10 to 20 1 | |

| Burnup Summary (MWd) ³ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | 28 51 | 40 09 | |
| Bounding | | 80 19 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0 40 | 1 41 | |
| Bounding | 0 80 | | 1 00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 8.5/20 GERMANY
SNF ID # 474
Fuel Units & Descr 70 - ELEMENT
Heavy Metal Mass: BOL=13 65kg EOL=13 377kg
ROD Storage Site INEEL

¹Fuel decay start date 2010
Estimates as of 2030
Template TRIGA-SS (LW/U-Zrx SST 10 to 20% U)
²Template Burnup(MWd) 6 65
Template BOL Heavy Metal Mass (MT) 0 000195
Template Decay Time 20 years

Estimated
Canister usage
18"x10"
0 63

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2 6436E-09 | 260 61 | 521 22 | 0 00E+00 | 6 89E-07 | 1 38E-06 | Avg MeV | |
| Am-241 | 3 1429E-03 | 260 61 | 521 22 | 0 00E+00 | 8 19E-01 | 1 64E+00 | 0 0150 | 5 223E+13 |
| Am-242m | 1 3195E-06 | 260 61 | 521 22 | 0 00E+00 | 3 44E-04 | 6 88E-04 | 0 0250 | 1 087E+13 |
| Am-243 | 1 4753E-07 | 260 61 | 521 22 | 0 00E+00 | 3 84E-05 | 7 69E-05 | 0 0375 | 9 419E+12 |
| C-14 | 1 2847E-04 | 260 61 | 521 22 | 0 00E+00 | 3 35E-02 | 6 70E-02 | 0 0575 | 1 013E+13 |
| Cl-36 | 2 8120E-06 | 260 61 | 521 22 | 0 00E+00 | 7 33E-04 | 1 47E-03 | 0 0850 | 6 117E+12 |
| Cm-243 | 1 2465E-07 | 260 61 | 521 22 | 0 00E+00 | 3 25E-05 | 6 50E-05 | 0 1250 | 3 998E+12 |
| Cm-244 | 9 5564E-07 | 260 61 | 521 22 | 0 00E+00 | 2 49E-04 | 4 98E-04 | 0 2250 | 5 253E+12 |
| Co-60 | 1 7880E-01 | 260 61 | 521 22 | 0 00E+00 | 4 66E+01 | 9 32E+01 | 0 3750 | 2 302E+12 |
| Cs-134 | 5 8692E-04 | 260 61 | 521 22 | 0 00E+00 | 1 53E-01 | 3 06E-01 | 0 5750 | 3 786E+13 |
| Cs-135 | 3 2195E-05 | 260 61 | 521 22 | 0 00E+00 | 8 39E-03 | 1 68E-02 | 0 8500 | 4 268E+11 |
| Cs-137 | 1 9489E+00 | 260 61 | 521 22 | 0 00E+00 | 5 08E+02 | 1 02E+03 | 1 2500 | 7 072E+12 |
| Eu-154 | 4 5895E-03 | 260 61 | 521 22 | 0 00E+00 | 1 20E+00 | 2 39E+00 | 1 7500 | 1 097E+10 |
| Eu-155 | 3 6045E-03 | 260 61 | 521 22 | 0 00E+00 | 9 39E-01 | 1 88E+00 | 2 2500 | 3 777E+07 |
| Fe-55 | 1 4185E-02 | 260 61 | 521 22 | 0 00E+00 | 3 70E+00 | 7 39E+00 | 2 7500 | 4 161E+05 |
| H-3 | 4 7895E-03 | 260 61 | 521 22 | 0 00E+00 | 1 25E+00 | 2 50E+00 | 3 5000 | 2 321E+03 |
| I-129 | 7 3684E-07 | 260 61 | 521 22 | 0 00E+00 | 1 92E-04 | 3 84E-04 | 5 0000 | 2 793E+02 |
| Kr-85 | 9 5820E-02 | 260 61 | 521 22 | 0 00E+00 | 2 50E+01 | 4 99E+01 | 7 0000 | 3 156E+01 |
| Np-237 | 1 2552E-06 | 260 61 | 521 22 | 0 00E+00 | 3 27E-04 | 6 54E-04 | 11 0000 | 3 591E+00 |
| Pa-231 | 7 0406E-09 | 260 61 | 521 22 | 0 00E+00 | 1 51E-11 | 3 02E-11 | | |
| Pb-210 | 5 8000E-14 | 260 61 | 521 22 | 0 00E+00 | 1 04E+01 | 2 09E+01 | | |
| Pm-147 | 4 0075E-02 | 260 61 | 521 22 | 0 00E+00 | 2 40E-01 | 4 81E-01 | | |
| Pu-238 | 9 2256E-04 | 260 61 | 521 22 | 0 00E+00 | 1 44E+00 | 2 88E+00 | | |
| Pu-239 | 5 5278E-03 | 260 61 | 521 22 | 0 00E+00 | 5 54E-01 | 1 11E+00 | | |
| Pu-240 | 2 1248E-03 | 260 61 | 521 22 | 0 00E+00 | 1 29E+01 | 2 58E+01 | | |
| Pu-241 | 4 9549E-02 | 260 61 | 521 22 | 0 00E+00 | 6 03E-05 | 1 21E-04 | | |
| Pu-242 | 2 3128E-07 | 260 61 | 521 22 | 0 00E+00 | 6 39E-11 | 1 28E-10 | | |
| Ra-226 | 2 4526E-13 | 260 61 | 521 22 | 0 00E+00 | 6 26E-08 | 1 25E-07 | | |
| Ra-228 | 2 4015E-10 | 260 61 | 521 22 | 0 00E+00 | 7 97E-04 | 1 59E-03 | | |
| Ru-106 | 3 0602E-06 | 260 61 | 521 22 | 0 00E+00 | 3 39E-03 | 6 78E-03 | | |
| Se-79 | 1 3015E-05 | 260 61 | 521 22 | 0 00E+00 | 3 17E-03 | 6 34E-03 | | |
| Sn-126 | 1 2165E-05 | 260 61 | 521 22 | 0 00E+00 | 4 75E+02 | 9 50E+02 | | |
| Sr-90 | 1 8226E+00 | 260 61 | 521 22 | 0 00E+00 | 1 15E-01 | 2 31E-01 | | |
| Tc-99 | 4 4241E-04 | 260 61 | 521 22 | 0 00E+00 | 8 07E-08 | 1 61E-07 | | |
| Th-229 | 3 0962E-10 | 260 61 | 521 22 | 0 00E+00 | 1 10E-08 | 2 21E-08 | | |
| Th-230 | 4 2346E-11 | 260 61 | 521 22 | 0 00E+00 | 6 59E-08 | 1 32E-07 | | |
| Th-232 | 2 5278E-10 | 260 61 | 521 22 | 0 00E+00 | 4 12E-06 | 8 25E-06 | | |
| Th-208 | 1 5820E-08 | 260 61 | 521 22 | 0 00E+00 | 1 11E-05 | 2 22E-05 | | |
| U-232 | 4 2647E-08 | 260 61 | 521 22 | 0 00E+00 | 3 18E-05 | 6 36E-05 | | |
| U-233 | 1 2211E-07 | 260 61 | 521 22 | 0 00E+00 | 5 20E-05 | 1 04E-04 | | |
| U-234 | 1 9955E-07 | 260 61 | 0 00 | 5 90E-03 | 5 22E-03 | 5 90E-03 | | |
| U-235 | -2 6194E-06 | 260 61 | 521 22 | 0 00E+00 | 3 31E-03 | 6 62E-03 | | |
| U-236 | 1 2693E-05 | 260 61 | 0 00 | 3 67E-03 | 3 66E-03 | 3 67E-03 | | |
| U-238 | -3 6331E-08 | 260 61 | 521 22 | 0 00E+00 | 4 75E+02 | 9 51E+02 | | |
| Y-90 | 1 8241E+00 | 260 61 | 521 22 | 0 00E+00 | 5 02E+02 | 1 00E+03 | | |

Other Radionuclides

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | SST | SST |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 20 00000041 | 10 to 20 1 |

Basis for Parameter Differences:

Burnup Summary (MWd)¹

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | 133 03 | 260 61 |
| Bounding | | 521 22 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|-----------------------------------|
| Nominal | 0 56 | 1 96 |
| Bounding | 1 12 | |

Estimated EOL HM/Given EOL HM
1 00

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8 5/20 HANNOVER
SNF ID #: 473
Fuel Units & Descr: 5 - ELEMENT
Heavy Metal Mass: BOL=0.972kg, EOL=0.95kg
ROD Storage Site: INEEL

¹Fuel decay start date: 1999
Estimates as of: 2030
Template: TRIGA-SS (LW/U-Zrx, SST, 10 to 20%, U)
²Template Burnup(MWd): 6.65
Template BOL Heavy Metal Mass (MT): 0.000195
Template Decay Time: 25 years

Estimated
Canister usage
18"x10"
0.05

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Cu/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 4.1459E-09 | 21.48 | 42.96 | 0.00E+00 | 8.90E-08 | 1.78E-07 | Avg MeV | |
| Am-241 | 3.5850E-03 | 21.48 | 42.96 | 0.00E+00 | 7.70E-02 | 1.54E-01 | 0.0150 | 3.813E+12 |
| Am-242m | 1.2899E-06 | 21.48 | 42.96 | 0.00E+00 | 2.77E-05 | 5.54E-05 | 0.0250 | 7.927E+11 |
| Am-243 | 1.4747E-07 | 21.48 | 42.96 | 0.00E+00 | 3.17E-06 | 6.34E-06 | 0.0375 | 6.877E+11 |
| C-14 | 1.2839E-04 | 21.48 | 42.96 | 0.00E+00 | 2.76E-03 | 5.52E-03 | 0.0575 | 7.406E+11 |
| Cl-36 | 2.8120E-06 | 21.48 | 42.96 | 0.00E+00 | 6.04E-05 | 1.21E-04 | 0.0850 | 4.464E+11 |
| Cm-243 | 1.1038E-07 | 21.48 | 42.96 | 0.00E+00 | 2.37E-06 | 4.74E-06 | 0.1250 | 2.913E+11 |
| Cm-244 | 7.8917E-07 | 21.48 | 42.96 | 0.00E+00 | 1.70E-05 | 3.39E-05 | 0.2250 | 3.839E+11 |
| Co-60 | 9.2647E-02 | 21.48 | 42.96 | 0.00E+00 | 1.99E+00 | 3.98E+00 | 0.3750 | 1.677E+11 |
| Cs-134 | 1.0940E-04 | 21.48 | 42.96 | 0.00E+00 | 2.35E-03 | 4.70E-03 | 0.5750 | 2.780E+12 |
| Cs-135 | 3.2195E-05 | 21.48 | 42.96 | 0.00E+00 | 6.92E-04 | 1.38E-03 | 0.8500 | 2.984E+10 |
| Cs-137 | 1.7368E+00 | 21.48 | 42.96 | 0.00E+00 | 3.73E+01 | 7.46E+01 | 1.2500 | 3.064E+11 |
| Eu-154 | 3.0677E-03 | 21.48 | 42.96 | 0.00E+00 | 6.59E-02 | 1.32E-01 | 1.7500 | 7.768E+08 |
| Eu-155 | 1.7925E-03 | 21.48 | 42.96 | 0.00E+00 | 3.85E-02 | 7.70E-02 | 2.2500 | 1.638E+06 |
| Fe-55 | 3.7444E-03 | 21.48 | 42.96 | 0.00E+00 | 8.04E-02 | 1.61E-01 | 2.7500 | 2.770E+04 |
| H-3 | 3.6180E-03 | 21.48 | 42.96 | 0.00E+00 | 7.77E-02 | 1.55E-01 | 3.5000 | 5.871E+01 |
| I-129 | 7.3684E-07 | 21.48 | 42.96 | 0.00E+00 | 1.58E-05 | 3.17E-05 | 5.0000 | 2.289E+01 |
| Kr-85 | 6.9368E-02 | 21.48 | 42.96 | 0.00E+00 | 1.49E+00 | 2.98E+00 | 7.0000 | 2.584E+00 |
| Np-237 | 1.2662E-06 | 21.48 | 42.96 | 0.00E+00 | 2.72E-05 | 5.44E-05 | 11.0000 | 2.939E-01 |
| Pa-231 | 9.1654E-09 | 21.48 | 42.96 | 0.00E+00 | 1.97E-07 | 3.94E-07 | | |
| Pb-210 | 1.3728E-13 | 21.48 | 42.96 | 0.00E+00 | 2.95E-12 | 5.90E-12 | | |
| Pm-147 | 1.0702E-02 | 21.48 | 42.96 | 0.00E+00 | 2.30E-01 | 4.60E-01 | | |
| Pu-238 | 8.8692E-04 | 21.48 | 42.96 | 0.00E+00 | 1.90E-02 | 3.81E-02 | | |
| Pu-239 | 5.5263E-03 | 21.48 | 42.96 | 0.00E+00 | 1.19E-01 | 2.37E-01 | | |
| Pu-240 | 2.1233E-03 | 21.48 | 42.96 | 0.00E+00 | 4.56E-02 | 9.12E-02 | | |
| Pu-241 | 3.8962E-02 | 21.48 | 42.96 | 0.00E+00 | 8.37E-01 | 1.67E+00 | | |
| Pu-242 | 2.3128E-07 | 21.48 | 42.96 | 0.00E+00 | 4.97E-06 | 9.94E-06 | | |
| Ra-226 | 4.6752E-13 | 21.48 | 42.96 | 0.00E+00 | 1.00E-11 | 2.01E-11 | | |
| Ra-228 | 2.4827E-10 | 21.48 | 42.96 | 0.00E+00 | 5.33E-09 | 1.07E-08 | | |
| Ru-106 | 9.8526E-08 | 21.48 | 42.96 | 0.00E+00 | 2.12E-06 | 4.23E-06 | | |
| Se-79 | 1.3015E-05 | 21.48 | 42.96 | 0.00E+00 | 2.80E-04 | 5.59E-04 | | |
| Sn-126 | 1.2165E-05 | 21.48 | 42.96 | 0.00E+00 | 2.61E-04 | 5.23E-04 | | |
| Sr-90 | 1.6195E+00 | 21.48 | 42.96 | 0.00E+00 | 3.48E+01 | 6.96E+01 | | |
| Tc-99 | 4.4241E-04 | 21.48 | 42.96 | 0.00E+00 | 9.50E-03 | 1.90E-02 | | |
| Th-229 | 4.2451E-10 | 21.48 | 42.96 | 0.00E+00 | 9.12E-09 | 1.82E-08 | | |
| Th-230 | 6.1398E-11 | 21.48 | 42.96 | 0.00E+00 | 1.32E-09 | 2.64E-09 | | |
| Th-232 | 2.5278E-10 | 21.48 | 42.96 | 0.00E+00 | 5.43E-09 | 1.09E-08 | | |
| Ti-208 | 1.5098E-08 | 21.48 | 42.96 | 0.00E+00 | 3.24E-07 | 6.49E-07 | | |
| U-232 | 4.0662E-08 | 21.48 | 42.96 | 0.00E+00 | 8.73E-07 | 1.75E-06 | | |
| U-233 | 1.2217E-07 | 21.48 | 42.96 | 0.00E+00 | 2.62E-06 | 5.25E-06 | | |
| U-234 | 2.2391E-07 | 21.48 | 42.96 | 0.00E+00 | 4.81E-06 | 9.62E-06 | | |
| U-235 | -2.6194E-06 | 21.48 | 0.00 | 4.16E-04 | 3.60E-04 | 4.16E-04 | | |
| U-236 | 1.2695E-05 | 21.48 | 42.96 | 0.00E+00 | 2.73E-04 | 5.45E-04 | | |
| U-238 | -3.6331E-08 | 21.48 | 0.00 | 2.62E-04 | 2.61E-04 | 2.62E-04 | | |
| Y-90 | 1.6195E+00 | 21.48 | 42.96 | 0.00E+00 | 3.48E+01 | 6.96E+01 | | |
| Other Radionuclides | | | | | | | | |
| | | | | | | | 3.70E+01 | 7.39E+01 |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| | From SFD | Used | |
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19.81481481 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | 2.37 | 21.48 | |
| Bounding | | 42.96 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0.65 | 9.07 | |
| Bounding | 1.30 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8 5/20 HEIDELBERG
SNF ID #: 1044
Fuel Units & Descr: 56 - ELEMENT
Heavy Metal Mass: BOL=10 713kg EOL=10 556kg
ROD Storage Site: INEEL

Fuel decay start date: 2006
Estimates as of: 2030
Template: TRIGA-SS (LW/U-Zr SST, 10 to 20%, U)
Template Burnup(MWd): 6 65
Template BOL Heavy Metal Mass (MT): 0 000195
Template Decay Time: 20 years

Estimated
Canister usage
18"x10"
0 50

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2 6436E-09 | 208 81 | 417 63 | 0 00E+00 | 5 52E-07 | 1 10E-06 | Avg MeV | |
| Am-241 | 3 1429E-03 | 208 81 | 417 63 | 0 00E+00 | 6 56E-01 | 1 31E+00 | 0 0150 | 4 185E+13 |
| Am-242m | 1 3195E-06 | 208 81 | 417 63 | 0 00E+00 | 2 76E-04 | 5 51E-04 | 0 0250 | 8 712E+12 |
| Am-243 | 1 4753E-07 | 208 81 | 417 63 | 0 00E+00 | 3 08E-05 | 6 16E-05 | 0 0375 | 7 547E+12 |
| C-14 | 1 2847E-04 | 208 81 | 417 63 | 0 00E+00 | 2 68E-02 | 5 37E-02 | 0 0575 | 8 119E+12 |
| Cl-36 | 2 8120E-06 | 208 81 | 417 63 | 0 00E+00 | 5 87E-04 | 1 17E-03 | 0 0850 | 4 902E+12 |
| Cm-243 | 1 2465E-07 | 208 81 | 417 63 | 0 00E+00 | 2 60E-05 | 5 21E-05 | 0 1250 | 3 204E+12 |
| Cm-244 | 9 5564E-07 | 208 81 | 417 63 | 0 00E+00 | 2 00E-04 | 3 99E-04 | 0 2250 | 4 209E+12 |
| Co-60 | 1 7880E-01 | 208 81 | 417 63 | 0 00E+00 | 3 73E+01 | 7 47E+01 | 0 3750 | 1 845E+12 |
| Cs-134 | 5 8692E-04 | 208 81 | 417 63 | 0 00E+00 | 1 23E-01 | 2 45E-01 | 0 5750 | 3 034E+13 |
| Cs-135 | 3 2195E-05 | 208 81 | 417 63 | 0 00E+00 | 6 72E-03 | 1 34E-02 | 0 8500 | 3 420E+11 |
| Cs-137 | 1 9489E+00 | 208 81 | 417 63 | 0 00E+00 | 4 07E+02 | 8 14E+02 | 1 2500 | 5 667E+12 |
| Eu-154 | 4 5895E-03 | 208 81 | 417 63 | 0 00E+00 | 9 58E-01 | 1 92E+00 | 1 7500 | 8 786E+09 |
| Eu-155 | 3 6045E-03 | 208 81 | 417 63 | 0 00E+00 | 7 53E-01 | 1 51E+00 | 2 2500 | 3 026E+07 |
| Fe-55 | 1 4185E-02 | 208 81 | 417 63 | 0 00E+00 | 2 96E+00 | 5 92E+00 | 2 7500 | 3 334E+05 |
| H-3 | 4 7895E-03 | 208 81 | 417 63 | 0 00E+00 | 1 00E+00 | 2 00E+00 | 3 5000 | 1 859E+03 |
| I-129 | 7 3684E-07 | 208 81 | 417 63 | 0 00E+00 | 1 54E-04 | 3 08E-04 | 5 0000 | 2 236E+02 |
| Kr-85 | 9 5820E-02 | 208 81 | 417 63 | 0 00E+00 | 2 00E+01 | 4 00E+01 | 7 0000 | 2 527E+01 |
| Np-237 | 1 2552E-06 | 208 81 | 417 63 | 0 00E+00 | 2 62E-04 | 5 24E-04 | 11 0000 | 2 876E+00 |
| Pa-231 | 7 0406E-09 | 208 81 | 417 63 | 0 00E+00 | 1 47E-06 | 2 94E-06 | | |
| Pb-210 | 5 8000E-14 | 208 81 | 417 63 | 0 00E+00 | 1 21E-11 | 2 42E-11 | | |
| Pm-147 | 4 0075E-02 | 208 81 | 417 63 | 0 00E+00 | 8 37E+00 | 1 67E+01 | | |
| Pu-238 | 9 2256E-04 | 208 81 | 417 63 | 0 00E+00 | 1 93E-01 | 3 85E-01 | | |
| Pu-239 | 5 5278E-03 | 208 81 | 417 63 | 0 00E+00 | 1 15E+00 | 2 31E+00 | | |
| Pu-240 | 2 1248E-03 | 208 81 | 417 63 | 0 00E+00 | 4 44E-01 | 8 87E-01 | | |
| Pu-241 | 4 9549E-02 | 208 81 | 417 63 | 0 00E+00 | 1 03E+01 | 2 07E+01 | | |
| Pu-242 | 2 3128E-07 | 208 81 | 417 63 | 0 00E+00 | 4 83E-05 | 9 66E-05 | | |
| Ra-226 | 2 4526E-13 | 208 81 | 417 63 | 0 00E+00 | 5 12E-11 | 1 02E-10 | | |
| Ra-228 | 2 4015E-10 | 208 81 | 417 63 | 0 00E+00 | 5 01E-08 | 1 00E-07 | | |
| Ru-106 | 3 0602E-06 | 208 81 | 417 63 | 0 00E+00 | 6 39E-04 | 1 28E-03 | | |
| Se-79 | 1 3015E-05 | 208 81 | 417 63 | 0 00E+00 | 2 72E-03 | 5 44E-03 | | |
| Sn-126 | 1 2165E-05 | 208 81 | 417 63 | 0 00E+00 | 2 54E-03 | 5 08E-03 | | |
| Sr-90 | 1 8226E+00 | 208 81 | 417 63 | 0 00E+00 | 3 81E+02 | 7 61E+02 | | |
| Tc-99 | 4 4241E-04 | 208 81 | 417 63 | 0 00E+00 | 9 24E-02 | 1 85E-01 | | |
| Th-229 | 3 0962E-10 | 208 81 | 417 63 | 0 00E+00 | 6 47E-08 | 1 29E-07 | | |
| Th-230 | 4 2346E-11 | 208 81 | 417 63 | 0 00E+00 | 8 84E-09 | 1 77E-08 | | |
| Th-232 | 2 5278E-10 | 208 81 | 417 63 | 0 00E+00 | 5 28E-08 | 1 06E-07 | | |
| Ti-208 | 1 5820E-08 | 208 81 | 417 63 | 0 00E+00 | 3 30E-06 | 6 61E-06 | | |
| U-232 | 4 2647E-08 | 208 81 | 417 63 | 0 00E+00 | 8 91E-06 | 1 78E-05 | | |
| U-233 | 1 2211E-07 | 208 81 | 417 63 | 0 00E+00 | 2 55E-05 | 5 10E-05 | | |
| U-234 | 1 9955E-07 | 208 81 | 417 63 | 0 00E+00 | 4 17E-05 | 8 33E-05 | | |
| U-235 | -2 6194E-06 | 208 81 | 0 00 | 4 57E-03 | 4 02E-03 | 4 57E-03 | | |
| U-236 | 1 2693E-05 | 208 81 | 417 63 | 0 00E+00 | 2 65E-03 | 5 30E-03 | | |
| U-238 | -3 6331E-08 | 208 81 | 0 00 | 2 89E-03 | 2 88E-03 | 2 89E-03 | | |
| Y-90 | 1 8241E+00 | 208 81 | 417 63 | 0 00E+00 | 3 81E+02 | 7 62E+02 | | |
| Other Radionuclides | | | | | 4 02E+02 | 8 04E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences: |
|---------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19 72849245 | 10 to 20 1 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|----------|-----------|---|
| Nominal | 208 81 | 149 68 | |
| Bounding | | 417 63 | Nominal burnup taken directly from SFD (converted to MWd) Bounding burnup assumed to be twice nominal burnup |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0 57 | 0 72 | |
| Bounding | 1 14 | | 0 99 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8 5/20 INDONESIA
SNF ID #: 475
Fuel Units & Descr: 174 - ELEMENT
Heavy Metal Mass: BOL=33.93kg; EOL=33.251kg
ROD Storage Site: INEEL

¹Fuel decay start date: 2010
Estimates as of: 2030
Template: TRIGA-SS (LW/U-Zrx, SST, 10 to 20%, U)
²Template Burnup (MWd): 6.65
Template BOL Heavy Metal Mass (MT): 0.000195
Template Decay Time: 20 years

Estimated
Canister usage
18"x10"
1.57

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|---------------------|------------------------------|
| Radionuclide | Cu/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.6436E-09 | 647.80 | 1,295.59 | 0.00E+00 | 1.71E-06 | 3.43E-06 | Avg MeV | |
| Am-241 | 3.1429E-03 | 647.80 | 1,295.59 | 0.00E+00 | 2.04E+00 | 4.07E+00 | 0.0150 | 1.298E+14 |
| Am-242m | 1.3195E-06 | 647.80 | 1,295.59 | 0.00E+00 | 8.55E-04 | 1.71E-03 | 0.0250 | 2.703E+13 |
| Am-243 | 1.4753E-07 | 647.80 | 1,295.59 | 0.00E+00 | 9.56E-05 | 1.91E-04 | 0.0375 | 2.341E+13 |
| C-14 | 1.2847E-04 | 647.80 | 1,295.59 | 0.00E+00 | 8.32E-02 | 1.66E-01 | 0.0575 | 2.519E+13 |
| Cl-36 | 2.8120E-06 | 647.80 | 1,295.59 | 0.00E+00 | 1.82E-03 | 3.64E-03 | 0.0850 | 1.521E+13 |
| Cm-243 | 1.2465E-07 | 647.80 | 1,295.59 | 0.00E+00 | 8.07E-05 | 1.61E-04 | 0.1250 | 9.938E+12 |
| Cm-244 | 9.5564E-07 | 647.80 | 1,295.59 | 0.00E+00 | 6.19E-04 | 1.24E-03 | 0.2250 | 1.306E+13 |
| Co-60 | 1.7880E-01 | 647.80 | 1,295.59 | 0.00E+00 | 1.16E+02 | 2.32E+02 | 0.3750 | 5.723E+12 |
| Cs-134 | 5.8692E-04 | 647.80 | 1,295.59 | 0.00E+00 | 3.80E-01 | 7.60E-01 | 0.5750 | 9.411E+13 |
| Cs-135 | 3.2195E-05 | 647.80 | 1,295.59 | 0.00E+00 | 2.09E-02 | 4.17E-02 | 0.8500 | 1.061E+12 |
| Cs-137 | 1.9489E+00 | 647.80 | 1,295.59 | 0.00E+00 | 1.26E+03 | 2.52E+03 | 1.2500 | 1.758E+13 |
| Eu-154 | 4.5895E-03 | 647.80 | 1,295.59 | 0.00E+00 | 2.97E+00 | 5.95E+00 | 1.7500 | 2.726E+10 |
| Eu-155 | 3.6045E-03 | 647.80 | 1,295.59 | 0.00E+00 | 2.33E+00 | 4.67E+00 | 2.2500 | 9.388E+07 |
| Fe-55 | 1.4185E-02 | 647.80 | 1,295.59 | 0.00E+00 | 9.19E+00 | 1.84E+01 | 2.7500 | 1.034E+06 |
| H-3 | 4.7895E-03 | 647.80 | 1,295.59 | 0.00E+00 | 3.10E+00 | 6.21E+00 | 3.5000 | 5.768E+03 |
| I-129 | 7.3684E-07 | 647.80 | 1,295.59 | 0.00E+00 | 4.77E-04 | 9.55E-04 | 5.0000 | 6.942E+02 |
| Kr-85 | 9.5820E-02 | 647.80 | 1,295.59 | 0.00E+00 | 6.21E+01 | 1.24E+02 | 7.0000 | 7.844E+01 |
| Np-237 | 1.2552E-06 | 647.80 | 1,295.59 | 0.00E+00 | 8.13E-04 | 1.63E-03 | 11.0000 | 8.926E+00 |
| Pa-231 | 7.0406E-09 | 647.80 | 1,295.59 | 0.00E+00 | 4.56E-06 | 9.12E-06 | | |
| Pb-210 | 5.8000E-14 | 647.80 | 1,295.59 | 0.00E+00 | 3.76E-11 | 7.51E-11 | | |
| Pm-147 | 4.0075E-02 | 647.80 | 1,295.59 | 0.00E+00 | 2.60E+01 | 5.19E+01 | | |
| Pu-238 | 9.2256E-04 | 647.80 | 1,295.59 | 0.00E+00 | 5.98E-01 | 1.20E+00 | | |
| Pu-239 | 5.5278E-03 | 647.80 | 1,295.59 | 0.00E+00 | 3.58E+00 | 7.16E+00 | | |
| Pu-240 | 2.1248E-03 | 647.80 | 1,295.59 | 0.00E+00 | 1.38E+00 | 2.75E+00 | | |
| Pu-241 | 4.9549E-02 | 647.80 | 1,295.59 | 0.00E+00 | 3.21E+01 | 6.42E+01 | | |
| Pu-242 | 2.3128E-07 | 647.80 | 1,295.59 | 0.00E+00 | 1.50E-04 | 3.00E-04 | | |
| Ra-226 | 2.4526E-13 | 647.80 | 1,295.59 | 0.00E+00 | 1.59E-10 | 3.18E-10 | | |
| Ra-228 | 2.4015E-10 | 647.80 | 1,295.59 | 0.00E+00 | 1.56E-07 | 3.11E-07 | | |
| Ru-106 | 3.0602E-06 | 647.80 | 1,295.59 | 0.00E+00 | 1.98E-03 | 3.96E-03 | | |
| Se-79 | 1.3015E-05 | 647.80 | 1,295.59 | 0.00E+00 | 8.43E-03 | 1.69E-02 | | |
| Sn-126 | 1.2165E-05 | 647.80 | 1,295.59 | 0.00E+00 | 7.88E-03 | 1.58E-02 | | |
| Sr-90 | 1.8226E+00 | 647.80 | 1,295.59 | 0.00E+00 | 1.18E+03 | 2.36E+03 | | |
| Tc-99 | 4.4241E-04 | 647.80 | 1,295.59 | 0.00E+00 | 2.87E-01 | 5.73E-01 | | |
| Th-229 | 3.0962E-10 | 647.80 | 1,295.59 | 0.00E+00 | 2.01E-07 | 4.01E-07 | | |
| Th-230 | 4.2346E-11 | 647.80 | 1,295.59 | 0.00E+00 | 2.74E-08 | 5.49E-08 | | |
| Th-232 | 2.5278E-10 | 647.80 | 1,295.59 | 0.00E+00 | 1.64E-07 | 3.28E-07 | | |
| Th-208 | 1.5820E-08 | 647.80 | 1,295.59 | 0.00E+00 | 1.02E-05 | 2.05E-05 | | |
| U-232 | 4.2647E-08 | 647.80 | 1,295.59 | 0.00E+00 | 2.76E-05 | 5.53E-05 | | |
| U-233 | 1.2211E-07 | 647.80 | 1,295.59 | 0.00E+00 | 7.91E-05 | 1.58E-04 | | |
| U-234 | 1.9955E-07 | 647.80 | 1,295.59 | 0.00E+00 | 1.29E-04 | 2.59E-04 | | |
| U-235 | 2.6194E-06 | 647.80 | 0.00 | 1.47E-02 | 1.30E-02 | 1.47E-02 | | |
| U-236 | 1.2693E-05 | 647.80 | 1,295.59 | 0.00E+00 | 8.22E-03 | 1.64E-02 | | |
| U-238 | 3.6331E-08 | 647.80 | 0.00 | 9.12E-03 | 9.10E-03 | 9.12E-03 | | |
| Y-90 | 1.8241E+00 | 647.80 | 1,295.59 | 0.00E+00 | 1.18E+03 | 2.36E+03 | | |
| Other Radionuclides | | | | | 1.25E+03 | 2.49E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------------------|-------------------------------|----------------------------------|
| Reactor Moderator | From SFD LW AND U ZIRC HYDRIDE | Used LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20.0000041 | 10 to 20.1 | |

| Burnup Summary (MWd) ³ | | | Basis for burnup used in estimate: |
|-----------------------------------|--------------------|---------------------|------------------------------------|
| Nominal | From SFD 330.68 | Estimated 647.80 | |
| Bounding | | 1,295.59 | |

Nominal burnup calculated from the heavy metal mass destroyed.
Bounding burnup assumed to be twice nominal burnup.

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|---------------------------|---|-------------------------------|
| Nominal | Burnup Multiplier 0.56 | Estimated Burnup/ Given Burnup 1.96 | |
| Bounding | 1.12 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8 5/20 INDONESIA
SNF ID #: 476
Fuel Units & Descr: 71 - ELEMENT
Heavy Metal Mass: BOL=13 845kg EOL=13 568kg
ROD Storage Site: INEEL

Fuel decay start date: 2010
Estimates as of: 2030
Template: TRIGA-SS (LW/U-Zrx SST, 10 to 20% U)
Template Burnup (MWd): 6 65
Template BOL Heavy Metal Mass (MT): 0 000195
Template Decay Time: 20 years

Estimated
Canister usage
18"x10"
0 64

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|---------------------|------------------------------|
| | m | x _a | x _b | b | y _a | y _b | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Avg MeV | |
| Ac-227 | 2 6436E-09 | 264 33 | 528 66 | 0 00E+00 | 6 99E-07 | 1 40E-06 | 0 0150 | 5 298E+13 |
| Am-241 | 3 1429E-03 | 264 33 | 528 66 | 0 00E+00 | 8 31E-01 | 1 66E+00 | 0 0250 | 1 103E+13 |
| Am-242m | 1 3195E-06 | 264 33 | 528 66 | 0 00E+00 | 3 49E-04 | 6 98E-04 | 0 0375 | 9 554E+12 |
| Am-243 | 1 4753E-07 | 264 33 | 528 66 | 0 00E+00 | 3 90E-05 | 7 80E-05 | 0 0575 | 1 028E+13 |
| C-14 | 1 2847E-04 | 264 33 | 528 66 | 0 00E+00 | 3 40E-02 | 6 79E-02 | 0 0850 | 6 205E+12 |
| Cl-36 | 2 8120E-06 | 264 33 | 528 66 | 0 00E+00 | 7 43E-04 | 1 49E-03 | 0 1250 | 4 055E+12 |
| Cm-243 | 1 2465E-07 | 264 33 | 528 66 | 0 00E+00 | 3 29E-05 | 6 59E-05 | 0 2250 | 5 328E+12 |
| Cm-244 | 9 5564E-07 | 264 33 | 528 66 | 0 00E+00 | 2 53E-04 | 5 05E-04 | 0 3750 | 2 335E+12 |
| Co-60 | 1 7880E-01 | 264 33 | 528 66 | 0 00E+00 | 4 73E+01 | 9 45E+01 | 0 5750 | 3 840E+13 |
| Cs-134 | 5 8692E-04 | 264 33 | 528 66 | 0 00E+00 | 1 55E-01 | 3 10E-01 | 0 8500 | 4 329E+11 |
| Cs-135 | 3 2195E-05 | 264 33 | 528 66 | 0 00E+00 | 8 51E-03 | 1 70E-02 | 1 2500 | 7 173E+12 |
| Cs-137 | 1 9489E+00 | 264 33 | 528 66 | 0 00E+00 | 5 15E+02 | 1 03E+03 | 1 7500 | 1 112E+10 |
| Eu-154 | 4 5895E-03 | 264 33 | 528 66 | 0 00E+00 | 1 21E+00 | 2 43E+00 | 2 2500 | 3 831E+07 |
| Eu-155 | 3 6045E-03 | 264 33 | 528 66 | 0 00E+00 | 9 53E-01 | 1 91E+00 | 2 7500 | 4 221E+05 |
| Fe-55 | 1 4185E-02 | 264 33 | 528 66 | 0 00E+00 | 3 75E+00 | 7 50E+00 | 3 5000 | 2 354E+03 |
| H-3 | 4 7895E-03 | 264 33 | 528 66 | 0 00E+00 | 1 27E+00 | 2 53E+00 | 5 0000 | 2 833E+02 |
| I-129 | 7 3684E-07 | 264 33 | 528 66 | 0 00E+00 | 1 95E-04 | 3 90E-04 | 7 0000 | 3 201E+01 |
| Kr-85 | 9 5820E-02 | 264 33 | 528 66 | 0 00E+00 | 2 53E+01 | 5 07E+01 | 11 0000 | 3 642E+00 |
| Np-237 | 1 2552E-06 | 264 33 | 528 66 | 0 00E+00 | 3 32E-04 | 6 64E-04 | | |
| Pa-231 | 7 0406E-09 | 264 33 | 528 66 | 0 00E+00 | 1 86E-06 | 3 72E-06 | | |
| Pb-210 | 5 8000E-14 | 264 33 | 528 66 | 0 00E+00 | 1 53E-11 | 3 07E-11 | | |
| Pm-147 | 4 0075E-02 | 264 33 | 528 66 | 0 00E+00 | 1 06E+01 | 2 12E+01 | | |
| Pu-238 | 9 2256E-04 | 264 33 | 528 66 | 0 00E+00 | 2 44E-01 | 4 88E-01 | | |
| Pu-239 | 5 5278E-03 | 264 33 | 528 66 | 0 00E+00 | 1 46E+00 | 2 92E+00 | | |
| Pu-240 | 2 1248E-03 | 264 33 | 528 66 | 0 00E+00 | 5 62E-01 | 1 12E+00 | | |
| Pu-241 | 4 9549E-02 | 264 33 | 528 66 | 0 00E+00 | 1 31E+01 | 2 62E+01 | | |
| Pu-242 | 2 3128E-07 | 264 33 | 528 66 | 0 00E+00 | 6 11E-05 | 1 22E-04 | | |
| Ra-226 | 2 4526E-13 | 264 33 | 528 66 | 0 00E+00 | 6 48E-11 | 1 30E-10 | | |
| Ra-228 | 2 4015E-10 | 264 33 | 528 66 | 0 00E+00 | 6 35E-08 | 1 27E-07 | | |
| Ru-106 | 3 0602E-06 | 264 33 | 528 66 | 0 00E+00 | 8 09E-04 | 1 62E-03 | | |
| Se-79 | 1 3015E-05 | 264 33 | 528 66 | 0 00E+00 | 3 44E-03 | 6 88E-03 | | |
| Sn-126 | 1 2165E-05 | 264 33 | 528 66 | 0 00E+00 | 3 22E-03 | 6 43E-03 | | |
| Sr-90 | 1 8226E+00 | 264 33 | 528 66 | 0 00E+00 | 4 82E+02 | 9 64E+02 | | |
| Tc-99 | 4 4241E-04 | 264 33 | 528 66 | 0 00E+00 | 1 17E-01 | 2 34E-01 | | |
| Th-229 | 3 0962E-10 | 264 33 | 528 66 | 0 00E+00 | 8 18E-08 | 1 64E-07 | | |
| Th-230 | 4 2346E-11 | 264 33 | 528 66 | 0 00E+00 | 1 12E-08 | 2 24E-08 | | |
| Th-232 | 2 5278E-10 | 264 33 | 528 66 | 0 00E+00 | 6 68E-08 | 1 34E-07 | | |
| Th-208 | 1 5820E-08 | 264 33 | 528 66 | 0 00E+00 | 4 18E-06 | 8 36E-06 | | |
| U-232 | 4 2647E-08 | 264 33 | 528 66 | 0 00E+00 | 1 13E-05 | 2 25E-05 | | |
| U-233 | 1 2211E-07 | 264 33 | 528 66 | 0 00E+00 | 3 23E-05 | 6 46E-05 | | |
| U-234 | 1 9955E-07 | 264 33 | 528 66 | 0 00E+00 | 5 27E-05 | 1 05E-04 | | |
| U-235 | -2 6194E-06 | 264 33 | 0 00 | 5 98E-03 | 5 29E-03 | 5 98E-03 | | |
| U-236 | 1 2693E-05 | 264 33 | 528 66 | 0 00E+00 | 3 36E-03 | 6 71E-03 | | |
| U-238 | -3 6331E-08 | 264 33 | 0 00 | 3 72E-03 | 3 71E-03 | 3 72E-03 | | |
| Y-90 | 1 8241E+00 | 264 33 | 528 66 | 0 00E+00 | 4 82E+02 | 9 64E+02 | | |
| Other Radionuclides | | | | | 5 09E+02 | 1 02E+03 | | |

Other Radionuclides

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | SST | SST |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 20 00000041 | 10 to 20 1 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | 134.93 | 264 33 |
| Bounding | | 528 66 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|-----------------------------------|
| Nominal | 0 56 | 1 96 |
| Bounding | 1 12 | |

Estimated EOL HM/Given EOL HM

1 00

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8 5/20 ITALY
SNF ID #: 477
Fuel Units & Descr: 48 - ELEMENT
Heavy Metal Mass: BOL=9.36kg; EOL=9.173kg
RAD Storage Site: INEEL

¹Fuel decay start date: 2010
Estimates as of: 2030

Template: TRIGA-SS (LW/U Zrx, SST, 10 to 20%, U)
²Template Burnup(MWd): 6.65
Template BOL Heavy Metal Mass (MT): 0.000195
Template Decay Time: 20 years

Estimated
Canister usage:
18"x10"
0.43

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.6436E-09 | 178.70 | 357.41 | 0.00E+00 | 4.72E-07 | 9.45E-07 | Avg MeV | |
| Am-241 | 3.1429E-03 | 178.70 | 357.41 | 0.00E+00 | 5.62E-01 | 1.12E+00 | 0.0150 | 3.582E+13 |
| Am-242m | 1.3195E-06 | 178.70 | 357.41 | 0.00E+00 | 2.36E-04 | 4.72E-04 | 0.0250 | 7.456E+12 |
| Am-243 | 1.4753E-07 | 178.70 | 357.41 | 0.00E+00 | 2.64E-05 | 5.27E-05 | 0.0375 | 6.459E+12 |
| C-14 | 1.2847E-04 | 178.70 | 357.41 | 0.00E+00 | 2.30E-02 | 4.59E-02 | 0.0575 | 6.949E+12 |
| Cl-36 | 2.8120E-06 | 178.70 | 357.41 | 0.00E+00 | 5.03E-04 | 1.01E-03 | 0.0850 | 4.195E+12 |
| Cm-243 | 1.2465E-07 | 178.70 | 357.41 | 0.00E+00 | 2.23E-05 | 4.45E-05 | 0.1250 | 2.742E+12 |
| Cm-244 | 9.5564E-07 | 178.70 | 357.41 | 0.00E+00 | 1.71E-04 | 3.42E-04 | 0.2250 | 3.602E+12 |
| Co-60 | 1.7880E-01 | 178.70 | 357.41 | 0.00E+00 | 3.20E+01 | 6.39E+01 | 0.3750 | 1.579E+12 |
| Cs-134 | 5.8692E-04 | 178.70 | 357.41 | 0.00E+00 | 1.05E-01 | 2.10E-01 | 0.5750 | 2.596E+13 |
| Cs-135 | 3.2195E-05 | 178.70 | 357.41 | 0.00E+00 | 5.75E-03 | 1.15E-02 | 0.8500 | 2.926E+11 |
| Cs-137 | 1.9489E+00 | 178.70 | 357.41 | 0.00E+00 | 3.48E+02 | 6.97E+02 | 1.2500 | 4.849E+12 |
| Eu-154 | 4.5895E-03 | 178.70 | 357.41 | 0.00E+00 | 8.20E-01 | 1.64E+00 | 1.7500 | 7.519E+09 |
| Eu-155 | 3.6045E-03 | 178.70 | 357.41 | 0.00E+00 | 6.44E-01 | 1.29E+00 | 2.2500 | 2.590E+07 |
| Fe-55 | 1.4185E-02 | 178.70 | 357.41 | 0.00E+00 | 2.53E+00 | 5.07E+00 | 2.7500 | 2.853E+05 |
| H-3 | 4.7895E-03 | 178.70 | 357.41 | 0.00E+00 | 8.56E-01 | 1.71E+00 | 3.5000 | 1.591E+03 |
| I-129 | 7.3684E-07 | 178.70 | 357.41 | 0.00E+00 | 1.32E-04 | 2.63E-04 | 5.0000 | 1.915E+02 |
| Kr-85 | 9.5820E-02 | 178.70 | 357.41 | 0.00E+00 | 1.71E+01 | 3.42E+01 | 7.0000 | 2.164E+01 |
| Np-237 | 1.2552E-06 | 178.70 | 357.41 | 0.00E+00 | 2.24E-04 | 4.49E-04 | 11.0000 | 2.462E+00 |
| Pa-231 | 7.0406E-09 | 178.70 | 357.41 | 0.00E+00 | 1.26E-06 | 2.52E-06 | | |
| Pb-210 | 5.8000E-14 | 178.70 | 357.41 | 0.00E+00 | 1.04E-11 | 2.07E-11 | | |
| Pm-147 | 4.0075E-02 | 178.70 | 357.41 | 0.00E+00 | 7.16E+00 | 1.43E+01 | | |
| Pu-238 | 9.2256E-04 | 178.70 | 357.41 | 0.00E+00 | 1.65E-01 | 3.30E-01 | | |
| Pu-239 | 5.5278E-03 | 178.70 | 357.41 | 0.00E+00 | 9.88E-01 | 1.98E+00 | | |
| Pu-240 | 2.1248E-03 | 178.70 | 357.41 | 0.00E+00 | 3.80E-01 | 7.59E-01 | | |
| Pu-241 | 4.9549E-02 | 178.70 | 357.41 | 0.00E+00 | 8.85E+00 | 1.77E+01 | | |
| Pu-242 | 2.3128E-07 | 178.70 | 357.41 | 0.00E+00 | 4.13E-05 | 8.27E-05 | | |
| Ra-226 | 2.4526E-13 | 178.70 | 357.41 | 0.00E+00 | 4.38E-11 | 8.77E-11 | | |
| Ra-228 | 2.4015E-10 | 178.70 | 357.41 | 0.00E+00 | 4.29E-08 | 8.58E-08 | | |
| Ru-106 | 3.0602E-06 | 178.70 | 357.41 | 0.00E+00 | 5.47E-04 | 1.09E-03 | | |
| Se-79 | 1.3015E-05 | 178.70 | 357.41 | 0.00E+00 | 2.33E-03 | 4.65E-03 | | |
| Sn-126 | 1.2165E-05 | 178.70 | 357.41 | 0.00E+00 | 2.17E-03 | 4.35E-03 | | |
| Sr-90 | 1.8226E+00 | 178.70 | 357.41 | 0.00E+00 | 3.26E+02 | 6.51E+02 | | |
| Tc-99 | 4.4241E-04 | 178.70 | 357.41 | 0.00E+00 | 7.91E-02 | 1.58E-01 | | |
| Th-229 | 3.0962E-10 | 178.70 | 357.41 | 0.00E+00 | 5.53E-08 | 1.11E-07 | | |
| Th-230 | 4.2346E-11 | 178.70 | 357.41 | 0.00E+00 | 7.57E-09 | 1.51E-08 | | |
| Th-232 | 2.5278E-10 | 178.70 | 357.41 | 0.00E+00 | 4.52E-08 | 9.03E-08 | | |
| Ti-208 | 1.5820E-08 | 178.70 | 357.41 | 0.00E+00 | 2.83E-06 | 5.65E-06 | | |
| U-232 | 4.2647E-08 | 178.70 | 357.41 | 0.00E+00 | 7.62E-06 | 1.52E-05 | | |
| U-233 | 1.2211E-07 | 178.70 | 357.41 | 0.00E+00 | 2.18E-05 | 4.36E-05 | | |
| U-234 | 1.9955E-07 | 178.70 | 357.41 | 0.00E+00 | 3.57E-05 | 7.13E-05 | | |
| U-235 | 2.6194E-06 | 178.70 | 0.00 | 4.05E-03 | 3.58E-03 | 4.05E-03 | | |
| U-236 | 1.2693E-05 | 178.70 | 357.41 | 0.00E+00 | 2.27E-03 | 4.54E-03 | | |
| U-238 | 3.6331E-08 | 178.70 | 0.00 | 2.52E-03 | 2.51E-03 | 2.52E-03 | | |
| Y-90 | 1.8241E+00 | 178.70 | 357.41 | 0.00E+00 | 3.26E+02 | 6.52E+02 | | |
| Other Radionuclides | | | | | 3.44E+02 | 6.88E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------------------|-------------------------------|----------------------------------|
| Reactor Moderator | From SFD LW AND U ZIRC HYDRIDE | Used LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | 91.22 | 178.70 | |
| Bounding | | 357.41 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0.56 | 1.96 | |
| Bounding | 1.12 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 8 5/20 ITALY
SNF ID # 478

Fuel Units & Descr. 71 - ELEMENT

Heavy Metal Mass: BOL=13 639kg EOL=12.837kg

ROD Storage Site INEEL

¹Fuel decay start date

1999

Estimates as of

2030

Template

TRIGA-SS (LW/U-Zr, SST, 10 to 20%, U)

²Template Burnup(MWd)

6 65

Template BOL Heavy Metal Mass (MT)

0 000195

Template Decay Time

25 years

Estimated

Canister usage

18"x10"

0 64

II. Estimates

| | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 4 1459E-09 | 765 88 | 1,531.76 | 0 00E+00 | 3 18E-06 | 6 35E-06 | Avg MeV | |
| Am-241 | 3 5850E-03 | 765 88 | 1,531.76 | 0 00E+00 | 2 75E+00 | 5 49E+00 | 0 0150 | 1.360E+14 |
| Am-242m | 1.2899E-06 | 765 88 | 1,531.76 | 0 00E+00 | 9 88E-04 | 1 98E-03 | 0 0250 | 2.827E+13 |
| Am-243 | 1.4747E-07 | 765 88 | 1,531.76 | 0 00E+00 | 1 13E-04 | 2 26E-04 | 0 0375 | 2.452E+13 |
| C-14 | 1.2839E-04 | 765 88 | 1,531.76 | 0 00E+00 | 9 83E-02 | 1 97E-01 | 0 0575 | 2.641E+13 |
| Cl-36 | 2 8120E-06 | 765 88 | 1,531.76 | 0 00E+00 | 2 15E-03 | 4 31E-03 | 0 0850 | 1.592E+13 |
| Cm-243 | 1 1038E-07 | 765 88 | 1,531.76 | 0 00E+00 | 8 45E-05 | 1 69E-04 | 0 1250 | 1 039E+13 |
| Cm-244 | 7 8917E-07 | 765 88 | 1,531.76 | 0 00E+00 | 6 04E-04 | 1 21E-03 | 0 2250 | 1.389E+13 |
| Co-60 | 9 2647E-02 | 765 88 | 1,531.76 | 0 00E+00 | 7.10E+01 | 1 42E+02 | 0 3750 | 5 979E+12 |
| Cs-134 | 1 0940E-04 | 765 88 | 1,531.76 | 0 00E+00 | 8.38E-02 | 1 68E-01 | 0 5750 | 9 912E+13 |
| Cs-135 | 3 2195E-05 | 765 88 | 1,531.76 | 0 00E+00 | 2.47E-02 | 4 93E-02 | 0 8500 | 1 064E+12 |
| Cs-137 | 1 7368E+00 | 765 88 | 1,531.76 | 0 00E+00 | 1.33E+03 | 2 66E+03 | 1 2500 | 1 093E+13 |
| Eu-154 | 3 0677E-03 | 765 88 | 1,531.76 | 0 00E+00 | 2.35E+00 | 4 70E+00 | 1 7500 | 2.770E+10 |
| Eu-155 | 1 7925E-03 | 765 88 | 1,531.76 | 0 00E+00 | 1.37E+00 | 2.75E+00 | 2 2500 | 5.841E+07 |
| Fe-55 | 3 7444E-03 | 765 88 | 1,531.76 | 0 00E+00 | 2 87E+00 | 5 74E+00 | 2 7500 | 9 876E+05 |
| H-3 | 3 6180E-03 | 765 88 | 1,531.76 | 0 00E+00 | 2 77E+00 | 5 54E+00 | 3 5000 | 2.063E+03 |
| I-129 | 7.3684E-07 | 765 88 | 1,531.76 | 0 00E+00 | 5 64E-04 | 1 13E-03 | 5 0000 | 8.029E+02 |
| Kr-85 | 6 9368E-02 | 765 88 | 1,531.76 | 0 00E+00 | 5 31E+01 | 1 06E+02 | 7 0000 | 9 063E+01 |
| Np-237 | 1.2662E-06 | 765 88 | 1,531.76 | 0 00E+00 | 9 70E-04 | 1 94E-03 | 11 0000 | 1.031E+01 |
| Pa-231 | 9 1654E-09 | 765 88 | 1,531.76 | 0 00E+00 | 7 02E-06 | 1 40E-05 | | |
| Pb-210 | 1.3728E-13 | 765 88 | 1,531.76 | 0 00E+00 | 1 05E-10 | 2 10E-10 | | |
| Pm-147 | 1 0702E-02 | 765 88 | 1,531.76 | 0 00E+00 | 8 20E+00 | 1 64E+01 | | |
| Pu-238 | 8 8692E-04 | 765 88 | 1,531.76 | 0 00E+00 | 6 79E-01 | 1 36E+00 | | |
| Pu-239 | 5 5263E-03 | 765 88 | 1,531.76 | 0 00E+00 | 4.23E+00 | 8 47E+00 | | |
| Pu-240 | 2 1233E-03 | 765 88 | 1,531.76 | 0 00E+00 | 1 63E+00 | 3.25E+00 | | |
| Pu-241 | 3 8962E-02 | 765 88 | 1,531.76 | 0 00E+00 | 2.98E+01 | 5 97E+01 | | |
| Pu-242 | 2 3128E-07 | 765 88 | 1,531.76 | 0 00E+00 | 1 77E-04 | 3 54E-04 | | |
| Ra-226 | 4 6752E-13 | 765 88 | 1,531.76 | 0 00E+00 | 3 58E-10 | 7.16E-10 | | |
| Ra-228 | 2 4827E-10 | 765 88 | 1,531.76 | 0 00E+00 | 1 90E-07 | 3 80E-07 | | |
| Ru-106 | 9 8526E-08 | 765 88 | 1,531.76 | 0 00E+00 | 7 55E-05 | 1 51E-04 | | |
| Se-79 | 1.3015E-05 | 765 88 | 1,531.76 | 0 00E+00 | 9 97E-03 | 1 99E-02 | | |
| Sn-126 | 1.2165E-05 | 765 88 | 1,531.76 | 0 00E+00 | 9 32E-03 | 1 86E-02 | | |
| Sr-90 | 1 6195E+00 | 765 88 | 1,531.76 | 0 00E+00 | 1 24E+03 | 2 48E+03 | | |
| Tc-99 | 4 4241E-04 | 765 88 | 1,531.76 | 0 00E+00 | 3 39E-01 | 6 78E-01 | | |
| Th-229 | 4.2451E-10 | 765 88 | 1,531.76 | 0 00E+00 | 3 25E-07 | 6.50E-07 | | |
| Th-230 | 6 1398E-11 | 765 88 | 1,531.76 | 0 00E+00 | 4 70E-08 | 9 40E-08 | | |
| Th-232 | 2.5278E-10 | 765 88 | 1,531.76 | 0 00E+00 | 1 94E-07 | 3 87E-07 | | |
| Th-208 | 1.5098E-08 | 765 88 | 1,531.76 | 0 00E+00 | 1.16E-05 | 2.31E-05 | | |
| U-232 | 4 0662E-08 | 765 88 | 1,531.76 | 0 00E+00 | 3.11E-05 | 6.23E-05 | Thermal Power | |
| U-233 | 1.2217E-07 | 765 88 | 1,531.76 | 0 00E+00 | 9.36E-05 | 1 87E-04 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 2.2391E-07 | 765 88 | 1,531.76 | 0 00E+00 | 1 71E-04 | 3 43E-04 | 1.63E+01 | 3.25E+01 |
| U-235 | -2 6194E-06 | 765 88 | 0 00 | 5 90E-03 | 3 90E-03 | 5 90E-03 | Total | Total |
| U-236 | 1.2695E-05 | 765 88 | 1,531.76 | 0 00E+00 | 9 72E-03 | 1 94E-02 | | |
| U-238 | -3 6331E-08 | 765 88 | 0 00 | 3 67E-03 | 3 64E-03 | 3 67E-03 | | |
| Y-90 | 1 6195E+00 | 765 88 | 1,531.76 | 0 00E+00 | 1.24E+03 | 2 48E+03 | | |
| Other Radionuclides | | | | | 1.32E+03 | 2 64E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator: | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | SST | SST |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 20 02640698 | 10 to 20 1 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | 465.24 | 765.88 |
| Bounding | | 1,531.76 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|-----------------------------------|
| Nominal | 1 65 | 1 65 |
| Bounding | 3 29 | |

Estimated EOL HM/Given EOL HM

1 00

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8 5/20 ITALY
SNF ID #: 1080
Fuel Units & Descr: 140 - ELEMENT
Heavy Metal Mass: BOL=26.894kg, EOL=25 312kg
ROD Storage Site: INEEL

¹Fuel decay start date: 2006
Estimates as of: 2030
Template: TRIGA-SS (LW/U-Zrx, SST, 10 to 20%, U)
²Template Burnup(MWd): 6 65
Template BOL Heavy Metal Mass (MT): 0 000195
Template Decay Time: 20 years

Estimated
Canister usage
18"x10"
1 26

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2 6436E-09 | 1,510 19 | 3,020 38 | 0 00E+00 | 3 99E-06 | 7 98E-06 | Avg. MeV | |
| Am-241 | 3 1429E-03 | 1,510 19 | 3,020 38 | 0 00E+00 | 4 75E+00 | 9 49E+00 | 0 0150 | 3 027E+14 |
| Am-242m | 1 3195E-06 | 1,510 19 | 3,020 38 | 0 00E+00 | 1 99E-03 | 3 99E-03 | 0 0250 | 6 301E+13 |
| Am-243 | 1 4753E-07 | 1,510 19 | 3,020 38 | 0 00E+00 | 2 23E-04 | 4 46E-04 | 0 0375 | 5 458E+13 |
| C-14 | 1 2847E-04 | 1,510 19 | 3 020 38 | 0 00E+00 | 1 94E-01 | 3 88E-01 | 0 0575 | 5 872E+13 |
| Ct-36 | 2 8120E-06 | 1,510 19 | 3,020 38 | 0 00E+00 | 4 25E-03 | 8 49E-03 | 0 0850 | 3 545E+13 |
| Cm-243 | 1 2465E-07 | 1,510 19 | 3,020 38 | 0 00E+00 | 1 88E-04 | 3 76E-04 | 0 1250 | 2 317E+13 |
| Cm-244 | 9 5564E-07 | 1,510 19 | 3,020 38 | 0 00E+00 | 1 44E-03 | 2 89E-03 | 0 2250 | 3 044E+13 |
| Co-60 | 1 7880E-01 | 1 510 19 | 3 020 38 | 0 00E+00 | 2 70E+02 | 5 40E+02 | 0 3750 | 1 334E+13 |
| Cs-134 | 5 8692E-04 | 1 510 19 | 3,020 38 | 0 00E+00 | 8 86E-01 | 1 77E+00 | 0 5750 | 2 194E+14 |
| Cs-135 | 3 2195E-05 | 1,510 19 | 3,020 38 | 0 00E+00 | 4 86E-02 | 9 72E-02 | 0 8500 | 2 473E+12 |
| Cs-137 | 1 9489E+00 | 1,510 19 | 3,020 38 | 0 00E+00 | 2 94E+03 | 5 89E+03 | 1 2500 | 4 098E+13 |
| Eu-154 | 4 5895E-03 | 1,510 19 | 3,020 38 | 0 00E+00 | 6 93E+00 | 1 39E+01 | 1 7500 | 6 354E+10 |
| Eu-155 | 3 6045E-03 | 1,510 19 | 3,020 38 | 0 00E+00 | 5 44E+00 | 1 09E+01 | 2 2500 | 2 189E+08 |
| Fe-55 | 1 4185E-02 | 1,510 19 | 3,020 38 | 0 00E+00 | 2 14E+01 | 4 28E+01 | 2 7500 | 2 411E+06 |
| H-3 | 4 7895E-03 | 1,510 19 | 3,020 38 | 0 00E+00 | 7 23E+00 | 1 45E+01 | 3 5000 | 1 337E+04 |
| I-129 | 7 3684E-07 | 1,510 19 | 3,020 38 | 0 00E+00 | 1 11E-03 | 2 23E-03 | 5 0000 | 1 586E+03 |
| Kr-85 | 9 5820E-02 | 1,510 19 | 3,020 38 | 0 00E+00 | 1 45E+02 | 2 89E+02 | 7 0000 | 1 791E+02 |
| Np-237 | 1 2552E-06 | 1,510 19 | 3,020 38 | 0 00E+00 | 1 90E-03 | 3 79E-03 | 11 0000 | 2 038E+01 |
| Pa-231 | 7 0406E-09 | 1,510 19 | 3,020 38 | 0 00E+00 | 1 06E-05 | 2 13E-05 | | |
| Pb-210 | 5 8000E-14 | 1,510 19 | 3,020 38 | 0 00E+00 | 8 76E-11 | 1 75E-10 | | |
| Pm-147 | 4 0075E-02 | 1,510 19 | 3,020 38 | 0 00E+00 | 6 05E+01 | 1 21E+02 | | |
| Pu-238 | 9 2256E-04 | 1,510 19 | 3,020 38 | 0 00E+00 | 1 39E+00 | 2 79E+00 | | |
| Pu-239 | 5 5278E-03 | 1,510 19 | 3,020 38 | 0 00E+00 | 8 35E+00 | 1 67E+01 | | |
| Pu-240 | 2 1248E-03 | 1,510 19 | 3,020 38 | 0 00E+00 | 3 21E+00 | 6 42E+00 | | |
| Pu-241 | 4 9549E-02 | 1,510 19 | 3,020 38 | 0 00E+00 | 7 48E+01 | 1 50E+02 | | |
| Pu-242 | 2 3128E-07 | 1,510 19 | 3,020 38 | 0 00E+00 | 3 49E-04 | 6 99E-04 | | |
| Ra-226 | 2 4526E-13 | 1,510 19 | 3,020 38 | 0 00E+00 | 3 70E-10 | 7 41E-10 | | |
| Ra-228 | 2 4015E-10 | 1,510 19 | 3,020 38 | 0 00E+00 | 3 63E-07 | 7 25E-07 | | |
| Ru-106 | 3 0602E-06 | 1,510 19 | 3,020 38 | 0 00E+00 | 4 62E-03 | 9 24E-03 | | |
| Se-79 | 1 3015E-05 | 1,510 19 | 3,020 38 | 0 00E+00 | 1 97E-02 | 3 93E-02 | | |
| Sn-126 | 1 2165E-05 | 1,510 19 | 3,020 38 | 0 00E+00 | 1 84E-02 | 3 67E-02 | | |
| Sr-90 | 1 8226E+00 | 1,510 19 | 3,020 38 | 0 00E+00 | 2 75E+03 | 5 50E+03 | | |
| Tc-99 | 4 4241E-04 | 1,510 19 | 3,020 38 | 0 00E+00 | 6 68E-01 | 1 34E+00 | | |
| Th-229 | 3 0962E-10 | 1,510 19 | 3,020 38 | 0 00E+00 | 4 68E-07 | 9 35E-07 | | |
| Th-230 | 4 2346E-11 | 1,510 19 | 3,020 38 | 0 00E+00 | 6 40E-08 | 1 28E-07 | | |
| Th-232 | 2 5278E-10 | 1,510 19 | 3,020 38 | 0 00E+00 | 3 82E-07 | 7 63E-07 | | |
| Th-208 | 1 5820E-08 | 1,510 19 | 3 020 38 | 0 00E+00 | 2 39E-05 | 4 78E-05 | | |
| U-232 | 4 2647E-08 | 1,510 19 | 3,020 38 | 0 00E+00 | 6 44E-05 | 1 29E-04 | | |
| U-233 | 1 2211E-07 | 1,510 19 | 3,020 38 | 0 00E+00 | 1 84E-04 | 3 69E-04 | | |
| U-234 | 1 9955E-07 | 1,510 19 | 3,020 38 | 0 00E+00 | 3 01E-04 | 6 03E-04 | | |
| U-235 | -2 6194E-06 | 1,510 19 | 0 00 | 1 16E-02 | 7 68E-03 | 1 16E-02 | | |
| U-236 | 1 2693E-05 | 1,510 19 | 3,020 38 | 0 00E+00 | 1 92E-02 | 3 83E-02 | | |
| U-238 | -3 6331E-08 | 1,510 19 | 0 00 | 7 23E-03 | 7 17E-03 | 7 23E-03 | | |
| Y-90 | 1 8241E+00 | 1,510 19 | 3,020 38 | 0 00E+00 | 2 75E+03 | 5 51E+03 | | |
| Other Radionuclides | | | | | 2 91E+03 | 5 82E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------------------|-------------------------------|----------------------------------|
| Reactor Moderator | From SFD LW AND U ZIRC HYDRIDE | Used LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 026 | 10 to 20 1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | 917 38 | 1,510 19 | |
| Bounding | | 3 020 38 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 1 65 | 1 65 | |
| Bounding | 3 29 | | 1 00 |

¹Reactor shutdown, core removal storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 8 5/20 JAPAN
SNF ID #: 479

Fuel Units & Descr 73 - ELEMENT
Heavy Metal Mass BOL=14.235kg EOL=14.089kg
ROD Storage Site INEEL

¹Fuel decay start date 2010
Estimates as of 2030
Template TRIGA-SS (LW/U-Zrx SST, 10 to 20%, U)
²Template Burnup(MWd) 6.65
Template BOL Heavy Metal Mass (MT) 0.000195
Template Decay Time 20 years

Estimated
Canister usage
18"x10"
0.66

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.6436E-09 | 139.37 | 278.75 | 0.00E+00 | 3.68E-07 | 7.37E-07 | Avg MeV | |
| Am-241 | 3.1429E-03 | 139.37 | 278.75 | 0.00E+00 | 4.38E-01 | 8.76E-01 | 0.0150 | 2.793E+13 |
| Am-242m | 1.3195E-06 | 139.37 | 278.75 | 0.00E+00 | 1.84E-04 | 3.68E-04 | 0.0250 | 5.815E+12 |
| Am-243 | 1.4753E-07 | 139.37 | 278.75 | 0.00E+00 | 2.06E-05 | 4.11E-05 | 0.0375 | 5.037E+12 |
| C-14 | 1.2847E-04 | 139.37 | 278.75 | 0.00E+00 | 1.79E-02 | 3.58E-02 | 0.0575 | 5.419E+12 |
| Ct-36 | 2.8120E-06 | 139.37 | 278.75 | 0.00E+00 | 3.92E-04 | 7.84E-04 | 0.0850 | 3.272E+12 |
| Cm-243 | 1.2465E-07 | 139.37 | 278.75 | 0.00E+00 | 1.74E-05 | 3.47E-05 | 0.1250 | 2.138E+12 |
| Cm-244 | 9.5564E-07 | 139.37 | 278.75 | 0.00E+00 | 1.33E-04 | 2.66E-04 | 0.2250 | 2.809E+12 |
| Co-60 | 1.7880E-01 | 139.37 | 278.75 | 0.00E+00 | 2.49E+01 | 4.98E+01 | 0.3750 | 1.231E+12 |
| Cs-134 | 5.8692E-04 | 139.37 | 278.75 | 0.00E+00 | 8.18E-02 | 1.64E-01 | 0.5750 | 2.025E+13 |
| Cs-135 | 3.2195E-05 | 139.37 | 278.75 | 0.00E+00 | 4.49E-03 | 8.97E-03 | 0.8500 | 2.282E+11 |
| Cs-137 | 1.9489E+00 | 139.37 | 278.75 | 0.00E+00 | 2.72E+02 | 5.43E+02 | 1.2500 | 3.782E+12 |
| Eu-154 | 4.5895E-03 | 139.37 | 278.75 | 0.00E+00 | 6.40E-01 | 1.28E+00 | 1.7500 | 5.864E+09 |
| Eu-155 | 3.6045E-03 | 139.37 | 278.75 | 0.00E+00 | 5.02E-01 | 1.00E+00 | 2.2500 | 2.020E+07 |
| Fe-55 | 1.4185E-02 | 139.37 | 278.75 | 0.00E+00 | 1.98E+00 | 3.95E+00 | 2.7500 | 2.226E+05 |
| H-3 | 4.7895E-03 | 139.37 | 278.75 | 0.00E+00 | 6.68E-01 | 1.34E+00 | 3.5000 | 1.251E+03 |
| I-129 | 7.3684E-07 | 139.37 | 278.75 | 0.00E+00 | 1.03E-04 | 2.05E-04 | 5.0000 | 1.537E+02 |
| Kr-85 | 9.5820E-02 | 139.37 | 278.75 | 0.00E+00 | 1.34E+01 | 2.67E+01 | 7.0000 | 1.737E+01 |
| Np-237 | 1.2552E-06 | 139.37 | 278.75 | 0.00E+00 | 1.75E-04 | 3.50E-04 | 11.0000 | 1.977E+00 |
| Pa-231 | 7.0406E-09 | 139.37 | 278.75 | 0.00E+00 | 9.81E-07 | 1.96E-06 | | |
| Pb-210 | 5.8000E-14 | 139.37 | 278.75 | 0.00E+00 | 8.08E-12 | 1.62E-11 | | |
| Pm-147 | 4.0075E-02 | 139.37 | 278.75 | 0.00E+00 | 5.59E+00 | 1.12E+01 | | |
| Pu-238 | 9.2256E-04 | 139.37 | 278.75 | 0.00E+00 | 1.29E-01 | 2.57E-01 | | |
| Pu-239 | 5.5278E-03 | 139.37 | 278.75 | 0.00E+00 | 7.70E-01 | 1.54E+00 | | |
| Pu-240 | 2.1248E-03 | 139.37 | 278.75 | 0.00E+00 | 2.96E-01 | 5.92E-01 | | |
| Pu-241 | 4.9549E-02 | 139.37 | 278.75 | 0.00E+00 | 6.91E+00 | 1.38E+01 | | |
| Pu-242 | 2.3128E-07 | 139.37 | 278.75 | 0.00E+00 | 3.22E-05 | 6.45E-05 | | |
| Ra-226 | 2.4526E-13 | 139.37 | 278.75 | 0.00E+00 | 3.42E-11 | 6.84E-11 | | |
| Ra-228 | 2.4015E-10 | 139.37 | 278.75 | 0.00E+00 | 3.35E-08 | 6.69E-08 | | |
| Ru-106 | 3.0602E-06 | 139.37 | 278.75 | 0.00E+00 | 4.27E-04 | 8.53E-04 | | |
| Se-79 | 1.3015E-05 | 139.37 | 278.75 | 0.00E+00 | 1.81E-03 | 3.63E-03 | | |
| Sn-126 | 1.2165E-05 | 139.37 | 278.75 | 0.00E+00 | 1.70E-03 | 3.39E-03 | | |
| Sr-90 | 1.8226E+00 | 139.37 | 278.75 | 0.00E+00 | 2.54E+02 | 5.08E+02 | | |
| Tc-99 | 4.4241E-04 | 139.37 | 278.75 | 0.00E+00 | 6.17E-02 | 1.23E-01 | | |
| Th-229 | 3.0962E-10 | 139.37 | 278.75 | 0.00E+00 | 4.32E-08 | 8.63E-08 | | |
| Th-230 | 4.2346E-11 | 139.37 | 278.75 | 0.00E+00 | 5.90E-09 | 1.18E-08 | | |
| Th-232 | 2.5278E-10 | 139.37 | 278.75 | 0.00E+00 | 3.52E-08 | 7.05E-08 | | |
| Ti-208 | 1.5820E-08 | 139.37 | 278.75 | 0.00E+00 | 2.20E-06 | 4.41E-06 | | |
| U-232 | 4.2647E-08 | 139.37 | 278.75 | 0.00E+00 | 5.94E-06 | 1.19E-05 | Thermal Power | |
| U-233 | 1.2211E-07 | 139.37 | 278.75 | 0.00E+00 | 1.70E-05 | 3.40E-05 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 1.9955E-07 | 139.37 | 278.75 | 0.00E+00 | 2.78E-05 | 5.56E-05 | 3.49E+00 | 6.97E+00 |
| U-235 | -2.6194E-06 | 139.37 | 0.00 | 6.15E-03 | 5.79E-03 | 6.15E-03 | Total | Total |
| U-236 | 1.2693E-05 | 139.37 | 278.75 | 0.00E+00 | 1.77E-03 | 3.54E-03 | | |
| U-238 | -3.6331E-08 | 139.37 | 0.00 | 3.83E-03 | 3.82E-03 | 3.83E-03 | | |
| Y-90 | 1.8241E+00 | 139.37 | 278.75 | 0.00E+00 | 2.54E+02 | 5.08E+02 | | |
| Other Radionuclides | | | | | 2.68E+02 | 5.37E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | SST | SST |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 20 | 10 to 20.1 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | 138.73 | 139.37 |
| Bounding | | 278.75 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|-----------------------------------|
| Nominal | 0.29 | 1.00 |
| Bounding | 0.57 | |

Estimated EOL HM/Given EOL HM
1.00

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8 5/20 KANSAS STATE UNIV
SNF ID #: 253
Fuel Units & Descr: 163 - ELEMENT
Heavy Metal Mass: BOL=31 785kg EOL=30 481kg
ROD Storage Site: INEEL

¹Fuel decay start date: 2035
Estimates as of: 2030
Template: TRIGA-SS (LW/J-Zrx SST, 10 to 20%, U)
²Template Burnup(MWd): 6 65
Template BOL Heavy Metal Mass (MT): 0.000195
Template Decay Time: 5 years

Estimated
Canister usage
18"x10"
1 47

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | CvMWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 5173E-10 | 1,244 81 | 2,489 62 | 0 00E+00 | 1 06E-06 | 2 12E-06 | Avg MeV | |
| Am-241 | 1 8331E-03 | 1,244 81 | 2,489 62 | 0 00E+00 | 2 28E+00 | 4 56E+00 | 0 0150 | 4 024E+14 |
| Am-242m | 1 4129E-06 | 1,244 81 | 2,489 62 | 0 00E+00 | 1 76E-03 | 3 52E-03 | 0 0250 | 8 854E+13 |
| Am-243 | 1 4774E-07 | 1,244 81 | 2,489 62 | 0 00E+00 | 1 84E-04 | 3 68E-04 | 0 0375 | 7 540E+13 |
| C-14 | 1 2871E-04 | 1,244 81 | 2,489 62 | 0 00E+00 | 1 60E-01 | 3 20E-01 | 0 0675 | 7 739E+13 |
| Cl-36 | 2 8120E-06 | 1,244 81 | 2,489 62 | 0 00E+00 | 3 50E-03 | 7 00E-03 | 0 0850 | 4 795E+13 |
| Cm-243 | 1 7940E-07 | 1,244 81 | 2,489 62 | 0 00E+00 | 2 23E-04 | 4 47E-04 | 0 1250 | 3 482E+13 |
| Cm-244 | 1 6962E-06 | 1,244 81 | 2,489 62 | 0 00E+00 | 2 11E-03 | 4 22E-03 | 0 2250 | 4 067E+13 |
| Co-60 | 1 2839E+00 | 1,244 81 | 2,489 62 | 0 00E+00 | 1 60E+03 | 3 20E+03 | 0 3750 | 2 064E+13 |
| Cs-134 | 9 0541E-02 | 1,244 81 | 2,489 62 | 0 00E+00 | 1 13E+02 | 2 25E+02 | 0 5750 | 2 744E+14 |
| Cs-135 | 3 2195E-05 | 1,244 81 | 2,489 62 | 0 00E+00 | 4 01E-02 | 8 02E-02 | 0 8500 | 1 178E+13 |
| Cs-137 | 2 7564E+00 | 1,244 81 | 2,489 62 | 0 00E+00 | 3 43E+03 | 6 86E+03 | 1 2500 | 2 392E+14 |
| Eu-154 | 1 5368E-02 | 1,244 81 | 2,489 62 | 0 00E+00 | 1 91E+01 | 3 83E+01 | 1 7500 | 1 594E+11 |
| Eu-155 | 2 9293E-02 | 1,244 81 | 2,489 62 | 0 00E+00 | 3 65E+01 | 7 29E+01 | 2 2500 | 2 570E+11 |
| Fe-55 | 7 7158E-01 | 1,244 81 | 2,489 62 | 0 00E+00 | 9 60E+02 | 1 92E+03 | 2 7500 | 2 039E+09 |
| H-3 | 1 1111E-02 | 1,244 81 | 2,489 62 | 0 00E+00 | 1 38E+01 | 2 77E+01 | 3 5000 | 2 373E+08 |
| I-129 | 7 3684E-07 | 1,244 81 | 2,489 62 | 0 00E+00 | 9 17E-04 | 1 83E-03 | 5 0000 | 1 324E+03 |
| Kr-85 | 2 5263E-01 | 1,244 81 | 2,489 62 | 0 00E+00 | 3 14E+02 | 6 29E+02 | 7 0000 | 1 499E+02 |
| Np-237 | 1 2427E-06 | 1,244 81 | 2,489 62 | 0 00E+00 | 1 55E-03 | 3 09E-03 | 11 0000 | 1 708E+01 |
| Pa-231 | 3 8511E-09 | 1,244 81 | 2,489 62 | 0 00E+00 | 4 79E-06 | 9 59E-06 | | |
| Pb-210 | 7 3880E-15 | 1,244 81 | 2,489 62 | 0 00E+00 | 9 20E-12 | 1 84E-11 | | |
| Pm-147 | 2 1023E+00 | 1,244 81 | 2,489 62 | 0 00E+00 | 2 62E+03 | 5 23E+03 | | |
| Pu-238 | 1 0383E-03 | 1,244 81 | 2,489 62 | 0 00E+00 | 1 29E+00 | 2 59E+00 | | |
| Pu-239 | 5 5293E-03 | 1,244 81 | 2,489 62 | 0 00E+00 | 6 88E+00 | 1 38E+01 | | |
| Pu-240 | 2 1278E-03 | 1,244 81 | 2,489 62 | 0 00E+00 | 2 65E+00 | 5 30E+00 | | |
| Pu-241 | 1 0195E-01 | 1,244 81 | 2,489 62 | 0 00E+00 | 1 27E+02 | 2 54E+02 | | |
| Pu-242 | 2 3128E-07 | 1,244 81 | 2,489 62 | 0 00E+00 | 2 88E-04 | 5 76E-04 | | |
| Ra-226 | 5 2782E-14 | 1,244 81 | 2,489 62 | 0 00E+00 | 6 57E-11 | 1 31E-10 | | |
| Ra-228 | 1 9338E-10 | 1,244 81 | 2,489 62 | 0 00E+00 | 2 41E-07 | 4 81E-07 | | |
| Ru-106 | 9 1684E-02 | 1,244 81 | 2,489 62 | 0 00E+00 | 1 14E+02 | 2 28E+02 | | |
| Se-79 | 1 3018E-05 | 1,244 81 | 2,489 62 | 0 00E+00 | 1 62E-02 | 3 24E-02 | | |
| Sn-126 | 1 2167E-05 | 1,244 81 | 2,489 62 | 0 00E+00 | 1 51E-02 | 3 03E-02 | | |
| Sr-90 | 2 6045E+00 | 1,244 81 | 2,489 62 | 0 00E+00 | 3 24E+03 | 6 48E+03 | | |
| Tc-99 | 4 4241E-04 | 1,244 81 | 2,489 62 | 0 00E+00 | 5 51E-01 | 1 10E+00 | | |
| Th-229 | 1 3713E-10 | 1,244 81 | 2,489 62 | 0 00E+00 | 1 71E-07 | 3 41E-07 | | |
| Th-230 | 1 8090E-11 | 1,244 81 | 2,489 62 | 0 00E+00 | 2 25E-08 | 4 50E-08 | | |
| Th-232 | 2 5278E-10 | 1,244 81 | 2,489 62 | 0 00E+00 | 3 15E-07 | 6 29E-07 | | |
| Ti-208 | 1 6947E-08 | 1,244 81 | 2,489 62 | 0 00E+00 | 2 11E-05 | 4 22E-05 | | |
| U-232 | 4 8737E-08 | 1,244 81 | 2,489 62 | 0 00E+00 | 6 07E-05 | 1 21E-04 | | |
| U-233 | 1 2203E-07 | 1,244 81 | 2,489 62 | 0 00E+00 | 1 52E-04 | 3 04E-04 | Thermal Power | |
| U-234 | 1 5925E-07 | 1,244 81 | 2,489 62 | 0 00E+00 | 1 98E-04 | 3 96E-04 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-235 | -2 6194E-06 | 1,244 81 | 0 00 | 1 37E-02 | 1 05E-02 | 1 37E-02 | 7 24E+01 | 1 45E+02 |
| U-236 | 1 2693E-05 | 1,244 81 | 2,489 62 | 0 00E+00 | 1 58E-02 | 3 16E-02 | Total | Total |
| U-238 | -3 6331E-08 | 1,244 81 | 0 00 | 8 55E-03 | 8 50E-03 | 8 55E-03 | | |
| Y-90 | 2 6060E+00 | 1,244 81 | 2,489 62 | 0 00E+00 | 3 24E+03 | 6 49E+03 | | |
| Other Radionuclides | | | | | 4 49E+03 | 8 98E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------------------|-------------------------------|----------------------------------|
| Reactor Moderator: | From SFD LW AND U ZIRC HYDRIDE | Used LW AND U ZIRC HYDRIDE | |
| Fuel Cladding: | SST | SST | |
| BOL HM Constituents: | U | U | |
| BOL Enrichment %: | 20 | 10 to 20 1 | |

| Burnup Summary (MWd) ¹ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | 774 44 | 1,244 81 | |
| Bounding | | 2 489 62 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 1 15 | 1 61 | |
| Bounding | 2 30 | | 1 00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 8 5/20 MEXICO
SNF ID # 482
Fuel Units & Descr: 151 - ELEMENT
Heavy Metal Mass BOL=29 445kg EOL=28 403kg
ROD Storage Site INEEL

¹Fuel decay start date 2006
Estimates as of 2030
Template TRIGA-SS (LW/U-Zrx SST 10 to 20%, U)
²Template Burnup(MWd) 6 65
Template BOL Heavy Metal Mass (MT) 0 000195
Template Decay Time 20 years

Estimated
Canister usage
18"x10"
1 36

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2 6436E-09 | 994 60 | 1,989 21 | 0 00E+00 | 2 63E-06 | 5.26E-06 | Avg MeV | |
| Am-241 | 3 1429E-03 | 994 60 | 1,989 21 | 0 00E+00 | 3 13E+00 | 6.25E+00 | 0 0150 | 1.993E+14 |
| Am-242m | 1 3195E-06 | 994 60 | 1,989 21 | 0 00E+00 | 1.31E-03 | 2.62E-03 | 0 0250 | 4 150E+13 |
| Am-243 | 1 4753E-07 | 994 60 | 1,989 21 | 0 00E+00 | 1 47E-04 | 2 93E-04 | 0 0375 | 3 595E+13 |
| C-14 | 1 2847E-04 | 994 60 | 1,989 21 | 0 00E+00 | 1 28E-01 | 2.56E-01 | 0 0575 | 3 867E+13 |
| Cl-36 | 2 8120E-06 | 994 60 | 1,989 21 | 0 00E+00 | 2 80E-03 | 5 59E-03 | 0 0850 | 2 335E+13 |
| Cm-243 | 1 2465E-07 | 994 60 | 1,989 21 | 0 00E+00 | 1 24E-04 | 2 48E-04 | 0 1250 | 1 526E+13 |
| Cm-244 | 9 5564E-07 | 994 60 | 1,989 21 | 0 00E+00 | 9 50E-04 | 1 90E-03 | 0 2250 | 2 005E+13 |
| Co-60 | 1 7880E-01 | 994 60 | 1,989 21 | 0 00E+00 | 1 78E+02 | 3 56E+02 | 0 3750 | 8 786E+12 |
| Cs-134 | 5 8692E-04 | 994 60 | 1,989 21 | 0 00E+00 | 5 84E-01 | 1 17E+00 | 0 5750 | 1 445E+14 |
| Cs-135 | 3 2195E-05 | 994 60 | 1,989 21 | 0 00E+00 | 3 20E-02 | 6 40E-02 | 0 8500 | 1 629E+12 |
| Cs-137 | 1 9489E+00 | 994 60 | 1,989 21 | 0 00E+00 | 1.94E+03 | 3 88E+03 | 1 2500 | 2 699E+13 |
| Eu-154 | 4 5895E-03 | 994 60 | 1,989 21 | 0 00E+00 | 4.56E+00 | 9.13E+00 | 1 7500 | 4 185E+10 |
| Eu-155 | 3 6045E-03 | 994 60 | 1,989 21 | 0 00E+00 | 3 59E+00 | 7.17E+00 | 2 2500 | 1 441E+08 |
| Fe-55 | 1 4185E-02 | 994 60 | 1,989 21 | 0 00E+00 | 1 41E+01 | 2 82E+01 | 2 7500 | 1 588E+06 |
| H-3 | 4 7895E-03 | 994 60 | 1,989 21 | 0 00E+00 | 4 76E+00 | 9 53E+00 | 3 5000 | 8 824E+03 |
| I-129 | 7 3684E-07 | 994 60 | 1,989 21 | 0 00E+00 | 7 33E-04 | 1 47E-03 | 5 0000 | 1 052E+03 |
| Kr-85 | 9 5820E-02 | 994 60 | 1,989 21 | 0 00E+00 | 9 53E+01 | 1 91E+02 | 7 0000 | 1 188E+02 |
| Np-237 | 1 2552E-06 | 994 60 | 1,989 21 | 0 00E+00 | 1 25E-03 | 2 50E-03 | 11 0000 | 1 352E+01 |
| Pa-231 | 7 0406E-09 | 994 60 | 1,989 21 | 0 00E+00 | 7 00E-06 | 1 40E-05 | | |
| Pb-210 | 5 8000E-14 | 994 60 | 1,989 21 | 0 00E+00 | 5 77E-11 | 1 15E-10 | | |
| Pm-147 | 4 0075E-02 | 994 60 | 1,989 21 | 0 00E+00 | 3 99E+01 | 7 97E+01 | | |
| Pu-238 | 9 2256E-04 | 994 60 | 1,989 21 | 0 00E+00 | 9 18E-01 | 1 84E+00 | | |
| Pu-239 | 5 5278E-03 | 994 60 | 1,989 21 | 0 00E+00 | 5 50E+00 | 1 10E+01 | | |
| Pu-240 | 2 1248E-03 | 994 60 | 1,989 21 | 0 00E+00 | 2 11E+00 | 4 23E+00 | | |
| Pu-241 | 4 9549E-02 | 994 60 | 1,989 21 | 0 00E+00 | 4 93E+01 | 9 86E+01 | | |
| Pu-242 | 2 3128E-07 | 994 60 | 1,989 21 | 0 00E+00 | 2 30E-04 | 4 60E-04 | | |
| Ra-226 | 2 4526E-13 | 994 60 | 1,989 21 | 0 00E+00 | 2 44E-10 | 4 88E-10 | | |
| Ra-228 | 2 4015E-10 | 994 60 | 1,989 21 | 0 00E+00 | 2 39E-07 | 4 78E-07 | | |
| Ru-106 | 3 0602E-06 | 994 60 | 1,989 21 | 0 00E+00 | 3 04E-03 | 6 09E-03 | | |
| Se-79 | 1 3015E-05 | 994 60 | 1,989 21 | 0 00E+00 | 1 29E-02 | 2 59E-02 | | |
| Sn-126 | 1 2165E-05 | 994 60 | 1,989 21 | 0 00E+00 | 1 21E-02 | 2 42E-02 | | |
| Sr-90 | 1 8226E+00 | 994 60 | 1,989 21 | 0 00E+00 | 1 81E+03 | 3 63E+03 | | |
| Tc-99 | 4 4241E-04 | 994 60 | 1,989 21 | 0 00E+00 | 4 40E-01 | 8 80E-01 | | |
| Th-229 | 3 0962E-10 | 994 60 | 1,989 21 | 0 00E+00 | 3 08E-07 | 6 16E-07 | | |
| Th-230 | 4 2346E-11 | 994 60 | 1,989 21 | 0 00E+00 | 4 21E-08 | 8 42E-08 | | |
| Th-232 | 2 5278E-10 | 994 60 | 1,989 21 | 0 00E+00 | 2 51E-07 | 5 03E-07 | | |
| Ti-208 | 1 5820E-08 | 994 60 | 1,989 21 | 0 00E+00 | 1 57E-05 | 3 15E-05 | | |
| U-232 | 4 2647E-08 | 994 60 | 1,989 21 | 0 00E+00 | 4 24E-05 | 8 48E-05 | | |
| U-233 | 1 2211E-07 | 994 60 | 1,989 21 | 0 00E+00 | 1 21E-04 | 2 43E-04 | | |
| U-234 | 1 9955E-07 | 994 60 | 1,989 21 | 0 00E+00 | 1 98E-04 | 3 97E-04 | | |
| U-235 | -2 6194E-06 | 994 60 | 0 00 | 1 27E-02 | 1 01E-02 | 1 27E-02 | | |
| U-236 | 1 2693E-05 | 994 60 | 1,989 21 | 0 00E+00 | 1 26E-02 | 2 52E-02 | | |
| U-238 | -3 6331E-08 | 994 60 | 0 00 | 7 92E-03 | 7 88E-03 | 7 92E-03 | | |
| Y-90 | 1 8241E+00 | 994 60 | 1,989 21 | 0 00E+00 | 1 81E+03 | 3 63E+03 | | |
| Other Radionuclides | | | | | 1 92E+03 | 3 83E+03 | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 2 49E+01 | 4 98E+01 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences* |
|---------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 00000041 | 10 to 20 1 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate |
|----------|----------|-----------|---|
| Nominal | | 994 60 | Nominal burnup calculated from the heavy metal mass destroyed |
| Bounding | | 1 989 21 | Bounding burnup assumed to be twice nominal burnup |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/ Given EOL HM |
|----------|-------------------|--------------------------------|--------------------------------|
| Nominal | 0 99 | | 1 00 |
| Bounding | 1 98 | | |

*Reactor shutdown, core removal, storage, shipping or other data confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 8.5/20 MNRC
SNF ID # 254
Fuel Units & Descr: 96 - ELEMENT
Heavy Metal Mass BOL=17 99kg; EOL=17 933kg
ROD Storage Site: INEEL

Fuel decay start date 2035
Estimates as of: 2030
Template: TRIGA-SS (LW/U-Zrx, SST, 10 to 20%, U)
Template Burnup (MWd) 6 65
Template BOL Heavy Metal Mass (MT): 0 000195
Template Decay Time: 5 years

Estimated
Canister usage:
18"x10"
0 86

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|---------------------|------------------------------|
| Radionuclide | Cu/MWd From Template | Nominal Fuel Burnup (MWd) ^a | Bounding Fuel Burnup (MWd) ^a | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 5173E-10 | 350 58 | 701 16 | 0 00E+00 | 2 99E-07 | 5 97E-07 | Avg. MeV | |
| Am-241 | 1 8331E-03 | 350 58 | 701 16 | 0 00E+00 | 6 43E-01 | 1 29E+00 | 0 0150 | 1 133E+14 |
| Am-242m | 1 4129E-06 | 350 58 | 701 16 | 0 00E+00 | 4 95E-04 | 9 91E-04 | 0 0250 | 2 494E+13 |
| Am-243 | 1 4774E-07 | 350 58 | 701 16 | 0 00E+00 | 5 18E-05 | 1 04E-04 | 0 0375 | 2 124E+13 |
| C-14 | 1 2871E-04 | 350 58 | 701 16 | 0 00E+00 | 4 51E-02 | 9 02E-02 | 0 0575 | 2 180E+13 |
| Cl-36 | 2 8120E-06 | 350 58 | 701 16 | 0 00E+00 | 9 86E-04 | 1 97E-03 | 0 0850 | 1 350E+13 |
| Cm-243 | 1 7940E-07 | 350 58 | 701 16 | 0 00E+00 | 6 29E-05 | 1 26E-04 | 0 1250 | 9 806E+12 |
| Cm-244 | 1 6962E-06 | 350 58 | 701 16 | 0 00E+00 | 5 95E-04 | 1 19E-03 | 0 2250 | 1 145E+13 |
| Co-60 | 1 2839E+00 | 350 58 | 701 16 | 0 00E+00 | 4 50E+02 | 9 00E+02 | 0 3750 | 5 813E+12 |
| Cs-134 | 9 0541E-02 | 350 58 | 701 16 | 0 00E+00 | 3 17E+01 | 6 35E+01 | 0 5750 | 7 728E+13 |
| Cs-135 | 3 2195E-05 | 350 58 | 701 16 | 0 00E+00 | 1 13E-02 | 2 26E-02 | 0 8500 | 3 317E+12 |
| Cs-137 | 2 7564E+00 | 350 58 | 701 16 | 0 00E+00 | 9 66E+02 | 1 93E+03 | 1 2500 | 6 736E+13 |
| Eu-154 | 1 5368E-02 | 350 58 | 701 16 | 0 00E+00 | 5 39E+00 | 1 08E+01 | 1 7500 | 4 490E+10 |
| Eu-155 | 2 9293E-02 | 350 58 | 701 16 | 0 00E+00 | 1 03E+01 | 2 05E+01 | 2 2500 | 7 237E+10 |
| Fe-55 | 7 7158E-01 | 350 58 | 701 16 | 0 00E+00 | 2 70E+02 | 5 41E+02 | 2 7500 | 5 743E+08 |
| H-3 | 1 1111E-02 | 350 58 | 701 16 | 0 00E+00 | 3 90E+00 | 7 79E+00 | 3 5000 | 6 684E+07 |
| I-129 | 7 3684E-07 | 350 58 | 701 16 | 0 00E+00 | 2 58E-04 | 5 17E-04 | 5 0000 | 3 787E+02 |
| Kr-85 | 2 5263E-01 | 350 58 | 701 16 | 0 00E+00 | 8 86E+01 | 1 77E+02 | 7 0000 | 4 288E+01 |
| Np-237 | 1 2427E-06 | 350 58 | 701 16 | 0 00E+00 | 4 36E-04 | 8 71E-04 | 11 0000 | 4 886E+00 |
| Pa-231 | 3 8511E-09 | 350 58 | 701 16 | 0 00E+00 | 1 35E-06 | 2 70E-06 | | |
| Pb-210 | 7 3880E-15 | 350 58 | 701 16 | 0 00E+00 | 2 59E-12 | 5 18E-12 | | |
| Pm-147 | 2 1023E+00 | 350 58 | 701 16 | 0 00E+00 | 7 37E+02 | 1 47E+03 | | |
| Pu-238 | 1 0383E-03 | 350 58 | 701 16 | 0 00E+00 | 3 64E-01 | 7 28E-01 | | |
| Pu-239 | 5 5293E-03 | 350 58 | 701 16 | 0 00E+00 | 1 94E+00 | 3 88E+00 | | |
| Pu-240 | 2 1278E-03 | 350 58 | 701 16 | 0 00E+00 | 7 46E-01 | 1 49E+00 | | |
| Pu-241 | 1 0195E-01 | 350 58 | 701 16 | 0 00E+00 | 3 57E+01 | 7 15E+01 | | |
| Pu-242 | 2 3128E-07 | 350 58 | 701 16 | 0 00E+00 | 8 11E-05 | 1 62E-04 | | |
| Ra-226 | 5 2782E-14 | 350 58 | 701 16 | 0 00E+00 | 1 85E-11 | 3 70E-11 | | |
| Ra-228 | 1 9338E-10 | 350 58 | 701 16 | 0 00E+00 | 6 78E-08 | 1 36E-07 | | |
| Ru-106 | 9 1684E-02 | 350 58 | 701 16 | 0 00E+00 | 3 21E+01 | 6 43E+01 | | |
| Se-79 | 1 3018E-05 | 350 58 | 701 16 | 0 00E+00 | 4 56E-03 | 9 13E-03 | | |
| Sn-126 | 1 2167E-05 | 350 58 | 701 16 | 0 00E+00 | 4 27E-03 | 8 53E-03 | | |
| Sr-90 | 2 6045E+00 | 350 58 | 701 16 | 0 00E+00 | 9 13E+02 | 1 83E+03 | | |
| Tc-99 | 4 4241E-04 | 350 58 | 701 16 | 0 00E+00 | 1 55E-01 | 3 10E-01 | | |
| Th-229 | 1 3713E-10 | 350 58 | 701 16 | 0 00E+00 | 4 81E-08 | 9 61E-08 | | |
| Th-230 | 1 8090E-11 | 350 58 | 701 16 | 0 00E+00 | 6 34E-09 | 1 27E-08 | | |
| Th-232 | 2 5278E-10 | 350 58 | 701 16 | 0 00E+00 | 8 86E-08 | 1 77E-07 | | |
| Ti-208 | 1 6947E-08 | 350 58 | 701 16 | 0 00E+00 | 5 94E-06 | 1 19E-05 | | |
| U-232 | 4 8737E-08 | 350 58 | 701 16 | 0 00E+00 | 1 71E-05 | 3 42E-05 | | |
| U-233 | 1 2203E-07 | 350 58 | 701 16 | 0 00E+00 | 4 28E-05 | 8 56E-05 | | |
| U-234 | 1 5925E-07 | 350 58 | 701 16 | 0 00E+00 | 5 58E-05 | 1 12E-04 | | |
| U-235 | -2 6194E-06 | 350 58 | 0 00 | 7 58E-03 | 6 66E-03 | 7 58E-03 | | |
| U-236 | 1 2693E-05 | 350 58 | 701 16 | 0 00E+00 | 4 45E-03 | 8 90E-03 | | |
| U-238 | -3 6331E-08 | 350 58 | 0 00 | 4 87E-03 | 4 86E-03 | 4 87E-03 | | |
| Y-90 | 2 6060E+00 | 350 58 | 701 16 | 0 00E+00 | 9 14E+02 | 1 83E+03 | | |
| Other Radionuclides | | | | | 1 26E+03 | 2 53E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences ^a |
|----------------------------|-----------------------|-----------------------|--|
| | From SFD | Used | |
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19 48980681 | 10 to 20 1 | |

| Burnup Summary (MWd) ^a | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | 350 58 | 54 99 | Nominal burnup taken directly from SFD (converted to MWd) |
| Bounding | | 701 16 | Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0 57 | 0 16 | 0 98 |
| Bounding | 1 14 | | |

^aReactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

^aTotal burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 8 5/20 MSU
SNF ID # 873
Fuel Units & Descr: 48 - ELEMENT
Heavy Metal Mass BOL=9.36kg EOL=8.29kg
ROD Storage Site INEEL

¹Fuel decay start date 1982
Estimates as of 2030
Template: TRIGA SS (LW/U-Zr, SST, 10 to 20%, U)
²Template Burnup(MWd) 6.65
Template BOL Heavy Metal Mass (MT) 0.000195
Template Decay Time 35 years

Estimated
Canister usage
18"x10"
0.43

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6.7038E-09 | 1.021.81 | 2.043.62 | 0.00E+00 | 6.85E-06 | 1.37E-05 | Avg MeV | |
| Am-241 | 3.9068E-03 | 1.021.81 | 2.043.62 | 0.00E+00 | 3.99E+00 | 7.98E+00 | 0.0150 | 1.426E+14 |
| Am-242m | 1.2325E-06 | 1.021.81 | 2.043.62 | 0.00E+00 | 1.26E-03 | 2.52E-03 | 0.0250 | 2.964E+13 |
| Am-243 | 1.4732E-07 | 1.021.81 | 2.043.62 | 0.00E+00 | 1.51E-04 | 3.01E-04 | 0.0375 | 2.575E+13 |
| C-14 | 1.2824E-04 | 1.021.81 | 2.043.62 | 0.00E+00 | 1.31E-01 | 2.62E-01 | 0.0575 | 2.774E+13 |
| Cl-36 | 2.8120E-06 | 1.021.81 | 2.043.62 | 0.00E+00 | 2.87E-03 | 5.75E-03 | 0.0850 | 1.669E+13 |
| Cm-243 | 8.6556E-08 | 1.021.81 | 2.043.62 | 0.00E+00 | 8.84E-05 | 1.77E-04 | 0.1250 | 1.086E+13 |
| Cm-244 | 5.3835E-07 | 1.021.81 | 2.043.62 | 0.00E+00 | 5.50E-04 | 1.10E-03 | 0.2250 | 1.438E+13 |
| Co-60 | 2.4887E-02 | 1.021.81 | 2.043.62 | 0.00E+00 | 2.54E+01 | 5.09E+01 | 0.3750 | 6.271E+12 |
| Cs-134 | 3.8030E-06 | 1.021.81 | 2.043.62 | 0.00E+00 | 3.89E-03 | 7.77E-03 | 0.5750 | 1.049E+14 |
| Cs-135 | 3.2195E-05 | 1.021.81 | 2.043.62 | 0.00E+00 | 3.29E-02 | 6.58E-02 | 0.8500 | 1.073E+12 |
| Cs-137 | 1.3788E+00 | 1.021.81 | 2.043.62 | 0.00E+00 | 1.41E+03 | 2.82E+03 | 1.2500 | 4.165E+12 |
| Eu-154 | 1.3711E-03 | 1.021.81 | 2.043.62 | 0.00E+00 | 1.40E+00 | 2.80E+00 | 1.7500 | 2.786E+10 |
| Eu-155 | 4.4361E-04 | 1.021.81 | 2.043.62 | 0.00E+00 | 4.53E-01 | 9.07E-01 | 2.2500 | 2.283E+07 |
| Fe-55 | 2.6075E-04 | 1.021.81 | 2.043.62 | 0.00E+00 | 2.66E-01 | 5.33E-01 | 2.7500 | 1.049E+06 |
| H-3 | 2.0647E-03 | 1.021.81 | 2.043.62 | 0.00E+00 | 2.11E+00 | 4.22E+00 | 3.5000 | 2.521E+03 |
| I-129 | 7.3684E-07 | 1.021.81 | 2.043.62 | 0.00E+00 | 7.53E-04 | 1.51E-03 | 5.0000 | 1.061E+03 |
| Kr-85 | 3.6346E-02 | 1.021.81 | 2.043.62 | 0.00E+00 | 3.71E+01 | 7.43E+01 | 7.0000 | 1.197E+02 |
| Np-237 | 1.2844E-06 | 1.021.81 | 2.043.62 | 0.00E+00 | 1.31E-03 | 2.62E-03 | 11.0000 | 1.361E+01 |
| Pa-231 | 1.2352E-08 | 1.021.81 | 2.043.62 | 0.00E+00 | 1.26E-05 | 2.52E-05 | | |
| Pb-210 | 3.5338E-13 | 1.021.81 | 2.043.62 | 0.00E+00 | 3.61E-10 | 7.22E-10 | | |
| Pm-147 | 7.6346E-04 | 1.021.81 | 2.043.62 | 0.00E+00 | 7.80E-01 | 1.56E+00 | | |
| Pu-238 | 8.1970E-04 | 1.021.81 | 2.043.62 | 0.00E+00 | 8.38E-01 | 1.68E+00 | | |
| Pu-239 | 5.5248E-03 | 1.021.81 | 2.043.62 | 0.00E+00 | 5.65E+00 | 1.13E+01 | | |
| Pu-240 | 2.1203E-03 | 1.021.81 | 2.043.62 | 0.00E+00 | 2.17E+00 | 4.33E+00 | | |
| Pu-241 | 2.4075E-02 | 1.021.81 | 2.043.62 | 0.00E+00 | 2.46E+01 | 4.92E+01 | | |
| Pu-242 | 2.3128E-07 | 1.021.81 | 2.043.62 | 0.00E+00 | 2.36E-04 | 4.73E-04 | | |
| Ra-226 | 9.6481E-13 | 1.021.81 | 2.043.62 | 0.00E+00 | 9.86E-10 | 1.97E-09 | | |
| Ra-228 | 2.5188E-10 | 1.021.81 | 2.043.62 | 0.00E+00 | 2.57E-07 | 5.15E-07 | | |
| Ru-106 | 1.0214E-10 | 1.021.81 | 2.043.62 | 0.00E+00 | 1.04E-07 | 2.09E-07 | | |
| Se-79 | 1.3014E-05 | 1.021.81 | 2.043.62 | 0.00E+00 | 1.33E-02 | 2.66E-02 | | |
| Sn-126 | 1.2164E-05 | 1.021.81 | 2.043.62 | 0.00E+00 | 1.24E-02 | 2.49E-02 | | |
| Sr-90 | 1.2762E+00 | 1.021.81 | 2.043.62 | 0.00E+00 | 1.30E+03 | 2.61E+03 | | |
| Tc-99 | 4.4241E-04 | 1.021.81 | 2.043.62 | 0.00E+00 | 4.52E-01 | 9.04E-01 | | |
| Th-229 | 5.9684E-10 | 1.021.81 | 2.043.62 | 0.00E+00 | 6.10E-07 | 1.22E-06 | | |
| Th-230 | 9.3880E-11 | 1.021.81 | 2.043.62 | 0.00E+00 | 9.59E-08 | 1.92E-07 | | |
| Th-232 | 2.5278E-10 | 1.021.81 | 2.043.62 | 0.00E+00 | 2.58E-07 | 5.17E-07 | | |
| Ti-208 | 1.3723E-08 | 1.021.81 | 2.043.62 | 0.00E+00 | 1.40E-05 | 2.80E-05 | | |
| U-232 | 3.6932E-08 | 1.021.81 | 2.043.62 | 0.00E+00 | 3.77E-05 | 7.55E-05 | Thermal Power | |
| U-233 | 1.2224E-07 | 1.021.81 | 2.043.62 | 0.00E+00 | 1.25E-04 | 2.50E-04 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 2.5714E-07 | 1.021.81 | 2.043.62 | 0.00E+00 | 2.63E-04 | 5.26E-04 | 1.54E+01 | 3.29E+01 |
| U-235 | -2.6194E-06 | 1.021.81 | 0.00 | 4.05E-03 | 1.37E-03 | 4.05E-03 | Total | Total |
| U-236 | 1.2695E-05 | 1.021.81 | 2.043.62 | 0.00E+00 | 1.30E-02 | 2.59E-02 | | |
| U-238 | -3.6331E-08 | 1.021.81 | 0.00 | 2.52E-03 | 2.48E-03 | 2.52E-03 | | |
| Y-90 | 1.2765E+00 | 1.021.81 | 2.043.62 | 0.00E+00 | 1.30E+03 | 2.61E+03 | | |
| Other Radionuclides | | | | | 1.41E+03 | 2.81E+03 | | |

Other Radionuclides

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences* |
|---------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 | 10 to 20.1 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|----------|-----------|--|
| Nominal | | 1.021.81 | |
| Bounding | | 2.043.62 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 3.20 | | |
| Bounding | 6.40 | | 1.00 |

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

*Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT).

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8 520 PENN STATE UNIV
SNF ID #: 237
Fuel Units & Descr: 203 - ELEMENT
Heavy Metal Mass: BOL=39 991kg; EOL=37.575kg
ROD Storage Site: INEEL

¹Fuel decay start date: 2035
Estimates as of: 2030
Template: TRIGA-SS (LW/U-Zrx, SST, 10 to 20%, U)
²Template Burnup(MWd): 6 65
Template BOL Heavy Metal Mass (MT): 0 000195
Template Decay Time: 5 years

Estimated
Canister usage
18"x10"
1 83

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | CvMWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 5173E-10 | 2,306 04 | 4,612 09 | 0 00E+00 | 1 96E-06 | 3 93E-06 | Avg MeV | |
| Am-241 | 1 8331E-03 | 2,306 04 | 4,612 09 | 0 00E+00 | 4 23E+00 | 8 45E+00 | 0 0150 | 7 454E+14 |
| Am-242m | 1 4129E-06 | 2,306 04 | 4,612 09 | 0 00E+00 | 3 26E-03 | 6 52E-03 | 0 0250 | 1 640E+14 |
| Am-243 | 1 4774E-07 | 2,306 04 | 4,612 09 | 0 00E+00 | 3 41E-04 | 6 81E-04 | 0 0375 | 1 397E+14 |
| C-14 | 1 2871E-04 | 2,306 04 | 4,612 09 | 0 00E+00 | 2 97E-01 | 5 94E-01 | 0 0575 | 1 434E+14 |
| Cf-254 | 2 8120E-06 | 2,306 04 | 4,612 09 | 0 00E+00 | 6 48E-03 | 1 30E-02 | 0 0850 | 8 882E+13 |
| Cm-243 | 1 7940E-07 | 2,306 04 | 4,612 09 | 0 00E+00 | 4 14E-04 | 8 27E-04 | 0 1250 | 6 450E+13 |
| Cm-244 | 1 6962E-06 | 2,306 04 | 4,612 09 | 0 00E+00 | 3 91E-03 | 7 82E-03 | 0 2250 | 7 535E+13 |
| Co-60 | 1 2839E+00 | 2,306 04 | 4,612 09 | 0 00E+00 | 2 96E+03 | 5 92E+03 | 0 3750 | 3 824E+13 |
| Cs-134 | 9 0541E-02 | 2,306 04 | 4,612 09 | 0 00E+00 | 2 09E+02 | 4 18E+02 | 0 5750 | 5 083E+14 |
| Cs-135 | 3 2195E-05 | 2,306 04 | 4,612 09 | 0 00E+00 | 7 42E-02 | 1 48E-01 | 0 8500 | 2 182E+13 |
| Cs-137 | 2 7564E+00 | 2,306 04 | 4,612 09 | 0 00E+00 | 6 36E+03 | 1 27E+04 | 1 2500 | 4 431E+14 |
| Eu-154 | 1 5368E-02 | 2,306 04 | 4,612 09 | 0 00E+00 | 3 54E+01 | 7 09E+01 | 1 7500 | 2 953E+11 |
| Eu-155 | 2 2939E-02 | 2,306 04 | 4,612 09 | 0 00E+00 | 6 76E+01 | 1 35E+02 | 2 2500 | 4 760E+11 |
| Fe-55 | 7 7158E-01 | 2,306 04 | 4,612 09 | 0 00E+00 | 1 78E+03 | 3 56E+03 | 2 7500 | 3 778E+09 |
| H-3 | 1 1111E-02 | 2,306 04 | 4,612 09 | 0 00E+00 | 2 56E+01 | 5 12E+01 | 3 5000 | 4 396E+08 |
| I-129 | 7 3684E-07 | 2,306 04 | 4,612 09 | 0 00E+00 | 1 70E-03 | 3 40E-03 | 5 0000 | 2 442E+03 |
| Kr-85 | 2 5263E-01 | 2,306 04 | 4,612 09 | 0 00E+00 | 5 83E+02 | 1 17E+03 | 7 0000 | 2 764E+02 |
| Np-237 | 1 2427E-06 | 2,306 04 | 4,612 09 | 0 00E+00 | 2 87E-03 | 5 73E-03 | 11 0000 | 3 149E+01 |
| Pa-231 | 3 8511E-09 | 2,306 04 | 4,612 09 | 0 00E+00 | 8 88E-06 | 1 78E-05 | | |
| Pb-210 | 7 3880E-15 | 2,306 04 | 4,612 09 | 0 00E+00 | 1 70E-11 | 3 41E-11 | | |
| Pm-147 | 2 1023E+00 | 2,306 04 | 4,612 09 | 0 00E+00 | 4 85E+03 | 9 70E+03 | | |
| Pu-238 | 1 0383E-03 | 2,306 04 | 4,612 09 | 0 00E+00 | 2 39E+00 | 4 79E+00 | | |
| Pu-239 | 5 5290E-03 | 2,306 04 | 4,612 09 | 0 00E+00 | 1 28E+01 | 2 55E+01 | | |
| Pu-240 | 2 1278E-03 | 2,306 04 | 4,612 09 | 0 00E+00 | 4 91E+00 | 9 81E+00 | | |
| Pu-241 | 1 0195E-01 | 2,306 04 | 4,612 09 | 0 00E+00 | 2 35E+02 | 4 70E+02 | | |
| Pu-242 | 2 3128E-07 | 2,306 04 | 4,612 09 | 0 00E+00 | 5 33E-04 | 1 07E-03 | | |
| Ra-226 | 5 2782E-14 | 2,306 04 | 4,612 09 | 0 00E+00 | 1 22E-10 | 2 43E-10 | | |
| Ra-228 | 1 9338E-10 | 2,306 04 | 4,612 09 | 0 00E+00 | 4 46E-07 | 8 92E-07 | | |
| Ru-106 | 9 1684E-02 | 2,306 04 | 4,612 09 | 0 00E+00 | 2 11E+02 | 4 23E+02 | | |
| Se-79 | 1 3018E-05 | 2,306 04 | 4,612 09 | 0 00E+00 | 3 00E-02 | 6 00E-02 | | |
| Sn-126 | 1 2167E-05 | 2,306 04 | 4,612 09 | 0 00E+00 | 2 81E-02 | 5 61E-02 | | |
| Sr-90 | 2 6045E+00 | 2,306 04 | 4,612 09 | 0 00E+00 | 6 01E+03 | 1 20E+04 | | |
| Tc-99 | 4 4241E-04 | 2,306 04 | 4,612 09 | 0 00E+00 | 1 02E+00 | 2 04E+00 | | |
| Th-229 | 1 3713E-10 | 2,306 04 | 4,612 09 | 0 00E+00 | 3 16E-07 | 6 32E-07 | | |
| Th-230 | 1 8090E-11 | 2,306 04 | 4,612 09 | 0 00E+00 | 4 17E-08 | 8 34E-08 | | |
| Th-232 | 2 5278E-10 | 2,306 04 | 4,612 09 | 0 00E+00 | 5 83E-07 | 1 17E-06 | | |
| Ti-208 | 1 6947E-08 | 2,306 04 | 4,612 09 | 0 00E+00 | 3 91E-05 | 7 82E-05 | | |
| U-232 | 4 8737E-08 | 2,306 04 | 4,612 09 | 0 00E+00 | 1 12E-04 | 2 25E-04 | | |
| U-233 | 1 2203E-07 | 2,306 04 | 4,612 09 | 0 00E+00 | 2 81E-04 | 5 63E-04 | | |
| U-234 | 1 5925E-07 | 2,306 04 | 4,612 09 | 0 00E+00 | 3 67E-04 | 7 34E-04 | | |
| U-235 | -2 6194E-06 | 2,306 04 | 0 00 | 1 71E-02 | 1 11E-02 | 1 71E-02 | | |
| U-236 | 1 2693E-05 | 2,306 04 | 4,612 09 | 0 00E+00 | 2 93E-02 | 5 85E-02 | | |
| U-238 | -3 6331E-08 | 2,306 04 | 0 00 | 1 08E-02 | 1 07E-02 | 1 08E-02 | | |
| Y-90 | 2 6060E+00 | 2,306 04 | 4,612 09 | 0 00E+00 | 6 01E+03 | 1 20E+04 | | |
| Other Radionuclides | | | | | 8 31E+03 | 1 66E+04 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator: | From SFD | Used | |
| | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding: | SST | SST | |
| BOL HM Constituents: | U | U | |
| BOL Enrichment %: | 19 79695431 | 10 to 20 1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | | 2,306 04 | |
| Bounding | | 4 612 09 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 1 69 | | |
| Bounding | 3 38 | | 1 00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 8.520 REED COLLEGE
SNF ID # 775
Fuel Units & Descr. 9 - ELEMENT
Heavy Metal Mass BOL=1 719kg EOL=1 706kg
ROD Storage Site INEEL

Fuel decay start date 2026
Estimates as of 2030
Template. TRIGA-SS (LW/U-Zr, SST, 10 to 20%, U)
Template Burnup(MWd) 6 65
Template BOL Heavy Metal Mass (MT) 0 000195
Template Decay Time* 5 years

Estimated
Canister usage
18"x10"
0 12

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| | m | x _a | x _b | b | y _a | y _b | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | | |
| Ac-227 | 8.5173E-10 | 12 89 | 25 77 | 0 00E+00 | 1 10E-08 | 2 20E-08 | Avg MeV | |
| Am-241 | 1.8331E-03 | 12 89 | 25 77 | 0 00E+00 | 2 36E-02 | 4 72E-02 | 0 0150 | 4 166E+12 |
| Am-242m | 1.4129E-06 | 12 89 | 25 77 | 0 00E+00 | 1 82E-05 | 3 64E-05 | 0 0250 | 9 166E+11 |
| Am-243 | 1.4774E-07 | 12 89 | 25 77 | 0 00E+00 | 1 90E-06 | 3 81E-06 | 0 0375 | 7 806E+11 |
| C-14 | 1.2871E-04 | 12 89 | 25 77 | 0 00E+00 | 1 66E-03 | 3 32E-03 | 0 0575 | 8 012E+11 |
| Cl-36 | 2.8120E-06 | 12 89 | 25 77 | 0 00E+00 | 3 62E-05 | 7 25E-05 | 0 0850 | 4 964E+11 |
| Cm-243 | 1 7940E-07 | 12 89 | 25 77 | 0 00E+00 | 2 31E-06 | 4 62E-06 | 0 1250 | 3 605E+11 |
| Cm-244 | 1 6962E-06 | 12 89 | 25 77 | 0 00E+00 | 2 19E-05 | 4 37E-05 | 0 2250 | 4 211E+11 |
| Co-60 | 1 2839E+00 | 12 89 | 25 77 | 0 00E+00 | 1 65E+01 | 3 31E+01 | 0 3750 | 2 137E+11 |
| Cs-134 | 9 0541E-02 | 12 89 | 25 77 | 0 00E+00 | 1 17E+00 | 2 33E+00 | 0 5750 | 2 841E+12 |
| Cs-135 | 3 2195E-05 | 12 89 | 25 77 | 0 00E+00 | 4 15E-04 | 8 30E-04 | 0 8500 | 1 219E+11 |
| Cs-137 | 2 7564E+00 | 12 89 | 25 77 | 0 00E+00 | 3 55E+01 | 7 10E+01 | 1 2500 | 2 476E+12 |
| Eu-154 | 1 5368E-02 | 12 89 | 25 77 | 0 00E+00 | 1 98E-01 | 3 96E-01 | 1 7500 | 1 650E+09 |
| Eu-155 | 2 9293E-02 | 12 89 | 25 77 | 0 00E+00 | 3 78E-01 | 7 55E-01 | 2 2500 | 2 660E+09 |
| Fe-55 | 7 7158E-01 | 12 89 | 25 77 | 0 00E+00 | 9 94E+00 | 1 99E+01 | 2 7500 | 2 111E+07 |
| H-3 | 1 1111E-02 | 12 89 | 25 77 | 0 00E+00 | 1 43E-01 | 2 86E-01 | 3 5000 | 2 457E+06 |
| I-129 | 7 3684E-07 | 12 89 | 25 77 | 0 00E+00 | 9 50E-06 | 1 90E-05 | 5 0000 | 1 457E+01 |
| Kr-85 | 2 5263E-01 | 12 89 | 25 77 | 0 00E+00 | 3 26E+00 | 6 51E+00 | 7 0000 | 1 651E+00 |
| Np-237 | 1 2427E-06 | 12 89 | 25 77 | 0 00E+00 | 1 60E-05 | 3 20E-05 | 11 0000 | 1 882E-01 |
| Pa-231 | 3 8511E-09 | 12 89 | 25 77 | 0 00E+00 | 4 96E-08 | 9 93E-08 | | |
| Pb-210 | 7 3880E-15 | 12 89 | 25 77 | 0 00E+00 | 9 52E-14 | 1 90E-13 | | |
| Pm-147 | 2 1023E+00 | 12 89 | 25 77 | 0 00E+00 | 2 71E+01 | 5 42E+01 | | |
| Pu-238 | 1 0383E-03 | 12 89 | 25 77 | 0 00E+00 | 1 34E-02 | 2 68E-02 | | |
| Pu-239 | 5 5293E-03 | 12 89 | 25 77 | 0 00E+00 | 7 13E-02 | 1 43E-01 | | |
| Pu-240 | 2 1278E-03 | 12 89 | 25 77 | 0 00E+00 | 2 74E-02 | 5 48E-02 | | |
| Pu-241 | 1 0195E-01 | 12 89 | 25 77 | 0 00E+00 | 1 31E+00 | 2 63E+00 | | |
| Pu-242 | 2 3128E-07 | 12 89 | 25 77 | 0 00E+00 | 2 98E-06 | 5 96E-06 | | |
| Ra-226 | 5 2782E-14 | 12 89 | 25 77 | 0 00E+00 | 6 80E-13 | 1 36E-12 | | |
| Ra-228 | 1 9338E-10 | 12 89 | 25 77 | 0 00E+00 | 2 49E-09 | 4 98E-09 | | |
| Ru-106 | 9 1684E-02 | 12 89 | 25 77 | 0 00E+00 | 1 18E+00 | 2 36E+00 | | |
| Se-79 | 1 3018E-05 | 12 89 | 25 77 | 0 00E+00 | 1 68E-04 | 3 36E-04 | | |
| Sn-126 | 1 2167E-05 | 12 89 | 25 77 | 0 00E+00 | 1 57E-04 | 3 14E-04 | | |
| Sr-90 | 2 6045E+00 | 12 89 | 25 77 | 0 00E+00 | 3 36E+01 | 6 71E+01 | | |
| Tc-99 | 4 4241E-04 | 12 89 | 25 77 | 0 00E+00 | 5 70E-03 | 1 14E-02 | | |
| Th-229 | 1 3713E-10 | 12 89 | 25 77 | 0 00E+00 | 1 77E-09 | 3 53E-09 | | |
| Th-230 | 1 8090E-11 | 12 89 | 25 77 | 0 00E+00 | 2 33E-10 | 4 66E-10 | | |
| Th-232 | 2 5278E-10 | 12 89 | 25 77 | 0 00E+00 | 3 26E-09 | 6 52E-09 | | |
| Ti-208 | 1 6947E-08 | 12 89 | 25 77 | 0 00E+00 | 2 18E-07 | 4 37E-07 | | |
| U-232 | 4 8737E-08 | 12 89 | 25 77 | 0 00E+00 | 6 28E-07 | 1 26E-06 | Thermal Power | |
| U-233 | 1 2203E-07 | 12 89 | 25 77 | 0 00E+00 | 1 57E-06 | 3 15E-06 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 1 5925E-07 | 12 89 | 25 77 | 0 00E+00 | 2 05E-06 | 4 10E-06 | 7 50E-01 | 1 50E+00 |
| U-235 | -2 6194E-06 | 12 89 | 0 00 | 7 49E-04 | 7 15E-04 | 7 49E-04 | Total | Total |
| U-236 | 1 2693E-05 | 12 89 | 25 77 | 0 00E+00 | 1 64E-04 | 3 27E-04 | | |
| U-238 | -3 6331E-08 | 12 89 | 0 00 | 4 61E-04 | 4 61E-04 | 4 61E-04 | | |
| Y-90 | 2 6060E+00 | 12 89 | 25 77 | 0 00E+00 | 3 36E+01 | 6 72E+01 | | |
| Other Radionuclides | | | | | 4 65E+01 | 9 29E+01 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences* |
|---|-----------------------|-----------------------|---|
| Reactor Moderator Fuel Cladding BOL HM Constituents BOL Enrichment % | From SFD | Used | |
| | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| | SST | SST | |
| | U | U | |
| | 20 15706806 | 10 to 20 1 | This Template was used for the following reasons This fuel matches on all parameters except enrichment (very close to 20%) |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate* |
|-----------------------------------|----------|----------------|---|
| Nominal Bounding | From SFD | Estimated | |
| | | 12 89 25 77 | |
| | | | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|---------------------|-------------------|-----------------------------------|-------------------------------|
| Nominal Bounding | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| | 0 22 0 44 | | |
| | | | 1 00 |

*Reactor shutdown, core removal, storage shipping or other date confirming that irradiation ceased for fuel

*Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8 5/20 SLOVENIA
SNF ID #: 488
Fuel Units & Descr: 122 - ELEMENT
Heavy Metal Mass: BOL=23.4kg EOL=22.594kg
ROD Storage Site: INEEL

¹Fuel decay start date: 2010
Estimates as of: 2030
Template: TRIGA-SS (LW/U-Zr, SST, 10 to 20%, U)
²Template Burnup(MWd): 6.65
Template BOL Heavy Metal Mass (MT): 0.000195
Template Decay Time: 20 years

Estimated
Canister usage:
18"x10"
1 10

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.6436E-09 | 768.65 | 1,537.30 | 0.00E+00 | 2.03E-06 | 4.06E-06 | Avg MeV | |
| Am-241 | 3.1429E-03 | 768.65 | 1,537.30 | 0.00E+00 | 2.42E+00 | 4.83E+00 | 0.0150 | 1.541E+14 |
| Am-242m | 1.3195E-06 | 768.65 | 1,537.30 | 0.00E+00 | 1.01E-03 | 2.03E-03 | 0.0250 | 3.207E+13 |
| Am-243 | 1.4753E-07 | 768.65 | 1,537.30 | 0.00E+00 | 1.13E-04 | 2.27E-04 | 0.0375 | 2.778E+13 |
| C-14 | 1.2847E-04 | 768.65 | 1,537.30 | 0.00E+00 | 9.87E-02 | 1.97E-01 | 0.0575 | 2.989E+13 |
| Cl-36 | 2.8120E-06 | 768.65 | 1,537.30 | 0.00E+00 | 2.16E-03 | 4.32E-03 | 0.0850 | 1.804E+13 |
| Cm-243 | 1.2465E-07 | 768.65 | 1,537.30 | 0.00E+00 | 9.58E-05 | 1.92E-04 | 0.1250 | 1.179E+13 |
| Cm-244 | 9.5564E-07 | 768.65 | 1,537.30 | 0.00E+00 | 7.35E-04 | 1.47E-03 | 0.2250 | 1.549E+13 |
| Co-60 | 1.7880E-01 | 768.65 | 1,537.30 | 0.00E+00 | 1.37E+02 | 2.75E+02 | 0.3750 | 6.790E+12 |
| Cs-134 | 5.8692E-04 | 768.65 | 1,537.30 | 0.00E+00 | 4.51E-01 | 9.02E-01 | 0.5750 | 1.117E+14 |
| Cs-135 | 3.2195E-05 | 768.65 | 1,537.30 | 0.00E+00 | 2.47E-02 | 4.95E-02 | 0.8500 | 1.259E+12 |
| Cs-137 | 1.9489E+00 | 768.65 | 1,537.30 | 0.00E+00 | 1.50E+03 | 3.00E+03 | 1.2500 | 2.086E+13 |
| Eu-154 | 4.5895E-03 | 768.65 | 1,537.30 | 0.00E+00 | 3.53E+00 | 7.06E+00 | 1.7500 | 3.234E+10 |
| Eu-155 | 3.6045E-03 | 768.65 | 1,537.30 | 0.00E+00 | 2.77E+00 | 5.54E+00 | 2.2500 | 1.114E+08 |
| Fe-55 | 1.4185E-02 | 768.65 | 1,537.30 | 0.00E+00 | 1.09E+01 | 2.18E+01 | 2.7500 | 1.227E+06 |
| H-3 | 4.7895E-03 | 768.65 | 1,537.30 | 0.00E+00 | 3.68E+00 | 7.36E+00 | 3.5000 | 6.820E+03 |
| I-129 | 7.3684E-07 | 768.65 | 1,537.30 | 0.00E+00 | 5.66E-04 | 1.13E-03 | 5.0000 | 8.132E+02 |
| Kr-85 | 9.5820E-02 | 768.65 | 1,537.30 | 0.00E+00 | 7.37E+01 | 1.47E+02 | 7.0000 | 9.187E+01 |
| Np-237 | 1.2552E-06 | 768.65 | 1,537.30 | 0.00E+00 | 9.65E-04 | 1.93E-03 | 11.0000 | 1.045E+01 |
| Pa-231 | 7.0406E-09 | 768.65 | 1,537.30 | 0.00E+00 | 5.41E-06 | 1.08E-05 | | |
| Pb-210 | 5.8000E-14 | 768.65 | 1,537.30 | 0.00E+00 | 4.46E-11 | 8.92E-11 | | |
| Pm-147 | 4.0075E-02 | 768.65 | 1,537.30 | 0.00E+00 | 3.08E+01 | 6.16E+01 | | |
| Pu-238 | 9.2256E-04 | 768.65 | 1,537.30 | 0.00E+00 | 7.09E-01 | 1.42E+00 | | |
| Pu-239 | 5.5278E-03 | 768.65 | 1,537.30 | 0.00E+00 | 4.25E+00 | 8.50E+00 | | |
| Pu-240 | 2.1248E-03 | 768.65 | 1,537.30 | 0.00E+00 | 1.63E+00 | 3.27E+00 | | |
| Pu-241 | 4.9549E-02 | 768.65 | 1,537.30 | 0.00E+00 | 3.81E+01 | 7.62E+01 | | |
| Pu-242 | 2.3128E-07 | 768.65 | 1,537.30 | 0.00E+00 | 1.78E-04 | 3.56E-04 | | |
| Ra-226 | 2.4526E-13 | 768.65 | 1,537.30 | 0.00E+00 | 1.89E-10 | 3.77E-10 | | |
| Ra-228 | 2.4015E-10 | 768.65 | 1,537.30 | 0.00E+00 | 1.85E-07 | 3.69E-07 | | |
| Ru-106 | 3.0602E-06 | 768.65 | 1,537.30 | 0.00E+00 | 2.35E-03 | 4.70E-03 | | |
| Se-79 | 1.3015E-05 | 768.65 | 1,537.30 | 0.00E+00 | 1.00E-02 | 2.00E-02 | | |
| Sn-126 | 1.2165E-05 | 768.65 | 1,537.30 | 0.00E+00 | 9.35E-03 | 1.87E-02 | | |
| Sr-90 | 1.8226E+00 | 768.65 | 1,537.30 | 0.00E+00 | 1.40E+03 | 2.80E+03 | | |
| Tc-99 | 4.4241E-04 | 768.65 | 1,537.30 | 0.00E+00 | 3.40E-01 | 6.80E-01 | | |
| Th-229 | 3.0962E-10 | 768.65 | 1,537.30 | 0.00E+00 | 2.38E-07 | 4.76E-07 | | |
| Th-230 | 4.2346E-11 | 768.65 | 1,537.30 | 0.00E+00 | 3.25E-08 | 6.51E-08 | | |
| Th-232 | 2.5278E-10 | 768.65 | 1,537.30 | 0.00E+00 | 1.94E-07 | 3.89E-07 | | |
| Ti-208 | 1.5820E-08 | 768.65 | 1,537.30 | 0.00E+00 | 1.22E-05 | 2.43E-05 | | |
| U-232 | 4.2647E-08 | 768.65 | 1,537.30 | 0.00E+00 | 3.28E-05 | 6.56E-05 | | |
| U-233 | 1.2211E-07 | 768.65 | 1,537.30 | 0.00E+00 | 9.39E-05 | 1.88E-04 | Thermal Power | |
| U-234 | 1.9955E-07 | 768.65 | 1,537.30 | 0.00E+00 | 1.53E-04 | 3.07E-04 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-235 | -2.6194E-06 | 768.65 | 0.00 | 1.01E-02 | 8.04E-03 | 1.01E-02 | 1.92E+01 | 3.85E+01 |
| U-236 | 1.2693E-05 | 768.65 | 1,537.30 | 0.00E+00 | 9.76E-03 | 1.95E-02 | Total | Total |
| U-238 | -3.6331E-08 | 768.65 | 0.00 | 6.30E-03 | 6.27E-03 | 6.30E-03 | | |
| Y-90 | 1.8241E+00 | 768.65 | 1,537.30 | 0.00E+00 | 1.40E+03 | 2.80E+03 | | |
| Other Radionuclides | | | | | 1.48E+03 | 2.96E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences ¹ |
|----------------------------|-----------------------|-----------------------|--|
| Reactor Moderator: | From SFD | Used | |
| Fuel Cladding | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| BOL HM Constituents | SST | SST | |
| BOL Enrichment % | U | U | |
| | 19.8857762 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | | 768.65 | |
| Bounding | | 1,537.30 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 0.96 | | |
| Bounding | 1.93 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8.5/20 SLOVENIA

SNF ID #: 1079

Fuel Units & Descr: 149 - ELEMENT

Heavy Metal Mass: BOL=28 578kg EOL=27 446kg

ROD Storage Site: INEEL

¹Fuel decay start date: 2010

Estimates as of: 2030

Template: TRIGA-SS (LW/U-Zr, SST 10 to 20% U)

²Template Burnup(MWd): 6 65

Template BOL Heavy Metal Mass (MT): 0 000195

Template Decay Time: 20 years

Estimated

Canister usage

18"x10"

1 34

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| | m | x _a | x _b | b | y _a | y _b | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Avg MeV | |
| Ac-227 | 2 6436E-09 | 1,081 00 | 2,161 99 | 0 00E+00 | 2 86E-06 | 5 72E-06 | 0 0150 | 2 167E+14 |
| Am-241 | 3 1429E-03 | 1,081 00 | 2,161 99 | 0 00E+00 | 3 40E+00 | 6 79E+00 | 0 0250 | 4 510E+13 |
| Am-242m | 1 3195E-06 | 1,081 00 | 2,161 99 | 0 00E+00 | 1 43E-03 | 2 85E-03 | 0 0375 | 3 907E+13 |
| Am-243 | 1 4753E-07 | 1,081 00 | 2,161 99 | 0 00E+00 | 1 59E-04 | 3 19E-04 | 0 0575 | 4 203E+13 |
| C-14 | 1 2847E-04 | 1,081 00 | 2,161 99 | 0 00E+00 | 1 39E-01 | 2 78E-01 | 0 0850 | 2 537E+13 |
| Cl-36 | 2 8120E-06 | 1,081 00 | 2,161 99 | 0 00E+00 | 3 04E-03 | 6 08E-03 | 0 1250 | 1 658E+13 |
| Cm-243 | 1 2465E-07 | 1,081 00 | 2,161 99 | 0 00E+00 | 1 35E-04 | 2 69E-04 | 0 2250 | 2 179E+12 |
| Cm-244 | 9 5564E-07 | 1,081 00 | 2,161 99 | 0 00E+00 | 1 03E-03 | 2 07E-03 | 0 3750 | 9 550E+12 |
| Co-60 | 1 7880E-01 | 1,081 00 | 2,161 99 | 0 00E+00 | 1 93E+02 | 3 87E+02 | 0 5750 | 1 571E+14 |
| Cs-134 | 5 8692E-04 | 1,081 00 | 2,161 99 | 0 00E+00 | 6 34E-01 | 1 27E+00 | 0 8500 | 1 770E+12 |
| Cs-135 | 3 2195E-05 | 1,081 00 | 2,161 99 | 0 00E+00 | 3 48E-02 | 6 96E-02 | 1 2500 | 2 934E+13 |
| Cs-137 | 1 9489E+00 | 1,081 00 | 2,161 99 | 0 00E+00 | 2 11E+03 | 4 21E+03 | 1 7500 | 4 548E+10 |
| Eu-154 | 4 5895E-03 | 1,081 00 | 2,161 99 | 0 00E+00 | 4 96E+00 | 9 92E+00 | 2 2500 | 1 567E+08 |
| Eu-155 | 3 6045E-03 | 1,081 00 | 2,161 99 | 0 00E+00 | 3 90E+00 | 7 79E+00 | 2 7500 | 1 726E+06 |
| Fe-55 | 1 4185E-02 | 1,081 00 | 2,161 99 | 0 00E+00 | 1 53E+01 | 3 07E+01 | 3 5000 | 9 585E+03 |
| H-3 | 4 7895E-03 | 1,081 00 | 2,161 99 | 0 00E+00 | 5 18E+00 | 1 04E+01 | 5 0000 | 1 141E+03 |
| I-129 | 7 3684E-07 | 1,081 00 | 2,161 99 | 0 00E+00 | 7 97E-04 | 1 59E-03 | 7 0000 | 1 289E+02 |
| Kr-85 | 9 5820E-02 | 1,081 00 | 2,161 99 | 0 00E+00 | 1 04E+02 | 2 07E+02 | 11 0000 | 1 466E+01 |
| Np-237 | 1 2552E-06 | 1,081 00 | 2,161 99 | 0 00E+00 | 1 36E-03 | 2 71E-03 | | |
| Pa-231 | 7 0406E-09 | 1,081 00 | 2,161 99 | 0 00E+00 | 7 61E-06 | 1 52E-05 | | |
| Pb-210 | 5 8000E-14 | 1,081 00 | 2,161 99 | 0 00E+00 | 6 27E-11 | 1 25E-10 | | |
| Pm-147 | 4 0075E-02 | 1,081 00 | 2,161 99 | 0 00E+00 | 4 33E+01 | 8 66E+01 | | |
| Pu-238 | 9 2256E-04 | 1,081 00 | 2,161 99 | 0 00E+00 | 9 97E-01 | 1 99E+00 | | |
| Pu-239 | 5 5278E-03 | 1,081 00 | 2,161 99 | 0 00E+00 | 5 98E+00 | 1 20E+01 | | |
| Pu-240 | 2 1248E-03 | 1,081 00 | 2,161 99 | 0 00E+00 | 2 30E+00 | 4 59E+00 | | |
| Pu-241 | 4 9549E-02 | 1,081 00 | 2,161 99 | 0 00E+00 | 5 36E+01 | 1 07E+02 | | |
| Pu-242 | 2 3128E-07 | 1,081 00 | 2,161 99 | 0 00E+00 | 2 50E-04 | 5 00E-04 | | |
| Ra-226 | 2 4526E-13 | 1,081 00 | 2,161 99 | 0 00E+00 | 2 65E-10 | 5 30E-10 | | |
| Ra-228 | 2 4015E-10 | 1,081 00 | 2,161 99 | 0 00E+00 | 2 60E-07 | 5 19E-07 | | |
| Ru-106 | 3 0602E-06 | 1,081 00 | 2,161 99 | 0 00E+00 | 3 31E-03 | 6 62E-03 | | |
| Se-79 | 1 3015E-05 | 1,081 00 | 2,161 99 | 0 00E+00 | 1 41E-02 | 2 81E-02 | | |
| Sn-126 | 1 2165E-05 | 1,081 00 | 2,161 99 | 0 00E+00 | 1 32E-02 | 2 63E-02 | | |
| Sr-90 | 1 8226E+00 | 1,081 00 | 2,161 99 | 0 00E+00 | 1 97E+03 | 3 94E+03 | | |
| Tc-99 | 4 4241E-04 | 1,081 00 | 2,161 99 | 0 00E+00 | 4 78E-01 | 9 56E-01 | | |
| Th-229 | 3 0962E-10 | 1,081 00 | 2,161 99 | 0 00E+00 | 3 35E-07 | 6 69E-07 | | |
| Th-230 | 4 2346E-11 | 1,081 00 | 2,161 99 | 0 00E+00 | 4 58E-08 | 9 16E-08 | | |
| Th-232 | 2 5278E-10 | 1,081 00 | 2,161 99 | 0 00E+00 | 2 73E-07 | 5 47E-07 | | |
| Ti-208 | 1 5820E-08 | 1,081 00 | 2,161 99 | 0 00E+00 | 1 71E-05 | 3 42E-05 | | |
| U-232 | 4 2647E-08 | 1,081 00 | 2,161 99 | 0 00E+00 | 4 61E-05 | 9 22E-05 | | |
| U-233 | 1 2211E-07 | 1,081 00 | 2,161 99 | 0 00E+00 | 1 32E-04 | 2 64E-04 | | |
| U-234 | 1 9955E-07 | 1,081 00 | 2,161 99 | 0 00E+00 | 2 16E-04 | 4 31E-04 | | |
| U-235 | -2 6194E-06 | 1,081 00 | 0 00 | 1 23E-02 | 9 45E-03 | 1 23E-02 | | |
| U-236 | 1 2693E-05 | 1,081 00 | 2,161 99 | 0 00E+00 | 1 37E-02 | 2 74E-02 | | |
| U-238 | -3 6331E-08 | 1,081 00 | 0 00 | 7 70E-03 | 7 66E-03 | 7 70E-03 | | |
| Y-90 | 1 8241E+00 | 1,081 00 | 2,161 99 | 0 00E+00 | 1 97E+03 | 3 94E+03 | | |
| Other Radionuclides | | | | | 2 08E+03 | 4 16E+03 | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 2 70E+01 | 5 41E+01 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | SST | SST |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 19 886 | 10 to 20 1 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | | 1 081 00 |
| Bounding | | 2 161 99 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|--------------------------------|
| Nominal | 1 11 | |
| Bounding | 2 22 | |

Estimated EOL HM/ Given EOL HM

1 00

¹Reactor shutdown, core removal storage shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8 520 SO KOREA
SNF ID #: 484
Fuel Units & Descr: 104 - ELEMENT
Heavy Metal Mass: BOL=19 76kg, EOL=19 261kg
ROD Storage Site: INEEL

¹Fuel decay start date: 1996
Estimates as of: 2030
Template: TRIGA-SS (LW/U-Zr, SST, 10 to 20%, U)
²Template Burnup(MWd): 6 65
Template BOL Heavy Metal Mass (MT): 0 000195
Template Decay Time: 25 years

Estimated
Canister usage
18"x10"
0 94

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ³ | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 4 1459E-09 | 476 54 | 953 08 | 0 00E+00 | 1 98E-06 | 3 95E-06 | Avg MeV | |
| Am-241 | 3 5850E-03 | 476 54 | 953 08 | 0 00E+00 | 1 71E+00 | 3 42E+00 | 0 0150 | 8 460E+13 |
| Am-242m | 1 2899E-06 | 476 54 | 953 08 | 0 00E+00 | 6 15E-04 | 1 23E-03 | 0 0250 | 1 759E+13 |
| Am-243 | 1 4747E-07 | 476 54 | 953 08 | 0 00E+00 | 7 03E-05 | 1 41E-04 | 0 0375 | 1 526E+13 |
| C-14 | 1 2839E-04 | 476 54 | 953 08 | 0 00E+00 | 6 12E-02 | 1 22E-01 | 0 0575 | 1 643E+13 |
| Cf-252 | 2 8120E-06 | 476 54 | 953 08 | 0 00E+00 | 1 34E-03 | 2 68E-03 | 0 0850 | 9 905E+12 |
| Cm-243 | 1 1038E-07 | 476 54 | 953 08 | 0 00E+00 | 5 26E-05 | 1 05E-04 | 0 1250 | 8 462E+12 |
| Cm-244 | 7 8917E-07 | 476 54 | 953 08 | 0 00E+00 | 3 76E-04 | 7 52E-04 | 0 2250 | 8 519E+12 |
| Co-60 | 9 2647E-02 | 476 54 | 953 08 | 0 00E+00 | 4 41E+01 | 8 83E+01 | 0 3750 | 3 720E+12 |
| Cs-134 | 1 0940E-04 | 476 54 | 953 08 | 0 00E+00 | 5 21E-02 | 1 04E-01 | 0 5750 | 6 167E+13 |
| Cs-135 | 3 2195E-05 | 476 54 | 953 08 | 0 00E+00 | 1 53E-02 | 3 07E-02 | 0 8500 | 6 621E+11 |
| Cs-137 | 1 7368E+00 | 476 54 | 953 08 | 0 00E+00 | 8 28E+02 | 1 66E+03 | 1 2500 | 6 799E+12 |
| Eu-154 | 3 0677E-03 | 476 54 | 953 08 | 0 00E+00 | 1 46E+00 | 2 92E+00 | 1 7500 | 1 723E+10 |
| Eu-155 | 1 7925E-03 | 476 54 | 953 08 | 0 00E+00 | 8 54E-01 | 1 71E+00 | 2 2500 | 3 634E+07 |
| Fe-55 | 3 7444E-03 | 476 54 | 953 08 | 0 00E+00 | 1 78E+00 | 3 57E+00 | 2 7500 | 6 145E+05 |
| H-3 | 3 6180E-03 | 476 54 | 953 08 | 0 00E+00 | 1 72E+00 | 3 45E+00 | 3 5000 | 1 300E+03 |
| I-129 | 7 3684E-07 | 476 54 | 953 08 | 0 00E+00 | 3 51E-04 | 7 02E-04 | 5 0000 | 5 066E+02 |
| Kr-85 | 6 9368E-02 | 476 54 | 953 08 | 0 00E+00 | 3 31E+01 | 6 61E+01 | 7 0000 | 5 720E+01 |
| Np-237 | 1 2662E-06 | 476 54 | 953 08 | 0 00E+00 | 6 03E-04 | 1 21E-03 | 11 0000 | 6 506E+00 |
| Pa-231 | 9 1654E-09 | 476 54 | 953 08 | 0 00E+00 | 4 37E-06 | 8 74E-06 | | |
| Pb-210 | 1 3728E-13 | 476 54 | 953 08 | 0 00E+00 | 6 54E-11 | 1 31E-10 | | |
| Pm-147 | 1 0702E-02 | 476 54 | 953 08 | 0 00E+00 | 5 10E+00 | 1 02E+01 | | |
| Pu-238 | 8 8692E-04 | 476 54 | 953 08 | 0 00E+00 | 4 23E-01 | 8 45E-01 | | |
| Pu-239 | 5 5263E-03 | 476 54 | 953 08 | 0 00E+00 | 2 63E+00 | 5 27E+00 | | |
| Pu-240 | 2 1233E-03 | 476 54 | 953 08 | 0 00E+00 | 1 01E+00 | 2 02E+00 | | |
| Pu-241 | 3 8962E-02 | 476 54 | 953 08 | 0 00E+00 | 1 86E+01 | 3 71E+01 | | |
| Pu-242 | 2 3128E-07 | 476 54 | 953 08 | 0 00E+00 | 1 10E-04 | 2 20E-04 | | |
| Ra-226 | 4 6752E-13 | 476 54 | 953 08 | 0 00E+00 | 2 23E-10 | 4 46E-10 | | |
| Ra-228 | 2 4827E-10 | 476 54 | 953 08 | 0 00E+00 | 1 18E-07 | 2 37E-07 | | |
| Ru-106 | 9 8526E-08 | 476 54 | 953 08 | 0 00E+00 | 4 70E-05 | 9 39E-05 | | |
| Se-79 | 1 3015E-05 | 476 54 | 953 08 | 0 00E+00 | 6 20E-03 | 1 24E-02 | | |
| Sn-126 | 1 2165E-05 | 476 54 | 953 08 | 0 00E+00 | 5 80E-03 | 1 16E-02 | | |
| Sr-90 | 1 6195E+00 | 476 54 | 953 08 | 0 00E+00 | 7 72E+02 | 1 54E+03 | | |
| Tc-99 | 4 4241E-04 | 476 54 | 953 08 | 0 00E+00 | 2 11E-01 | 4 22E-01 | | |
| Th-229 | 4 2451E-10 | 476 54 | 953 08 | 0 00E+00 | 2 02E-07 | 4 05E-07 | | |
| Th-230 | 6 1398E-11 | 476 54 | 953 08 | 0 00E+00 | 2 93E-08 | 5 85E-08 | | |
| Th-232 | 2 5278E-10 | 476 54 | 953 08 | 0 00E+00 | 1 20E-07 | 2 41E-07 | | |
| Ti-208 | 1 5098E-08 | 476 54 | 953 08 | 0 00E+00 | 7 19E-06 | 1 44E-05 | | |
| U-232 | 4 0662E-08 | 476 54 | 953 08 | 0 00E+00 | 1 94E-05 | 3 88E-05 | | |
| U-233 | 1 2217E-07 | 476 54 | 953 08 | 0 00E+00 | 5 82E-05 | 1 16E-04 | | |
| U-234 | 2 2391E-07 | 476 54 | 953 08 | 0 00E+00 | 1 07E-04 | 2 13E-04 | | |
| U-235 | -2 6194E-06 | 476 54 | 0 00 | 8 54E-03 | 7 29E-03 | 8 54E-03 | | |
| U-236 | 1 2695E-05 | 476 54 | 953 08 | 0 00E+00 | 6 05E-03 | 1 21E-02 | | |
| U-238 | -3 6331E-08 | 476 54 | 0 00 | 5 31E-03 | 5 30E-03 | 5 31E-03 | | |
| Y-90 | 1 6195E+00 | 476 54 | 953 08 | 0 00E+00 | 7 72E+02 | 1 54E+03 | | |
| Other Radionuclides | | | | | 8 20E+02 | 1 64E+03 | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 1 01E+01 | 2 02E+01 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------------------|-------------------------------|----------------------------------|
| Reactor Moderator | From SFD LW AND U ZIRC HYDRIDE | Used LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 | 10 to 20 1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal: | | 476.54 | |
| Bounding: | | 953.08 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|-----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal: | 0.71 | | |
| Bounding: | 1.41 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 8 5/20 TEXAS A&M
SNF ID # 258
Fuel Units & Descr 85 - ELEMENT
Heavy Metal Mass BOL=14.875kg EOL=14.34kg
ROD Storage Site: INEEL

¹Fuel decay start date 2035
Estimates as of 2030
Template TRIGA-SS (LW/U-Zrx, SST, 10 to 20% U)
²Template Burnup(MWd) 6.65
Template BOL Heavy Metal Mass (MT) 0.000195
Template Decay Time 5 years

Estimated
Canister usage
18"x10"
0.77

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| | m | x _n | x _b | b | y _n | y _b | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Avg MeV | |
| Ac-227 | 8.5173E-10 | 511.19 | 1,022.38 | 0.00E+00 | 4.35E-07 | 8.71E-07 | 0.0150 | 1.652E+14 |
| Am-241 | 1.8331E-03 | 511.19 | 1,022.38 | 0.00E+00 | 9.37E-01 | 1.87E+00 | 0.0250 | 3.636E+13 |
| Am-242m | 1.4129E-06 | 511.19 | 1,022.38 | 0.00E+00 | 7.22E-04 | 1.44E-03 | 0.0375 | 3.096E+13 |
| Am-243 | 1.4774E-07 | 511.19 | 1,022.38 | 0.00E+00 | 7.55E-05 | 1.51E-04 | 0.0575 | 3.178E+13 |
| C-14 | 1.2871E-04 | 511.19 | 1,022.38 | 0.00E+00 | 6.58E-02 | 1.32E-01 | 0.0850 | 1.969E+13 |
| Cl-36 | 2.8120E-06 | 511.19 | 1,022.38 | 0.00E+00 | 1.44E-03 | 2.87E-03 | 0.1250 | 1.430E+13 |
| Cm-243 | 1.7940E-07 | 511.19 | 1,022.38 | 0.00E+00 | 9.17E-05 | 1.83E-04 | 0.2250 | 1.670E+13 |
| Cm-244 | 1.6962E-06 | 511.19 | 1,022.38 | 0.00E+00 | 8.67E-04 | 1.73E-03 | 0.3750 | 8.476E+12 |
| Co-60 | 1.2839E+00 | 511.19 | 1,022.38 | 0.00E+00 | 6.56E+02 | 1.31E+03 | 0.5750 | 1.127E+14 |
| Cs-134 | 9.0541E-02 | 511.19 | 1,022.38 | 0.00E+00 | 4.63E+01 | 9.26E+01 | 0.8500 | 4.836E+12 |
| Cs-135 | 3.2195E-05 | 511.19 | 1,022.38 | 0.00E+00 | 1.65E-02 | 3.29E-02 | 1.2500 | 9.822E+13 |
| Cs-137 | 2.7564E+00 | 511.19 | 1,022.38 | 0.00E+00 | 1.41E+03 | 2.82E+03 | 1.7500 | 6.547E+10 |
| Eu-154 | 1.5368E-02 | 511.19 | 1,022.38 | 0.00E+00 | 7.86E+00 | 1.57E+01 | 2.2500 | 1.055E+11 |
| Eu-155 | 2.9293E-02 | 511.19 | 1,022.38 | 0.00E+00 | 1.50E+01 | 2.99E+01 | 2.7500 | 8.374E+08 |
| Fe-55 | 7.7158E-01 | 511.19 | 1,022.38 | 0.00E+00 | 3.94E+02 | 7.89E+02 | 3.5000 | 9.746E+07 |
| H-3 | 1.1111E-02 | 511.19 | 1,022.38 | 0.00E+00 | 5.68E+00 | 1.14E+01 | 5.0000 | 5.450E+02 |
| I-129 | 7.3684E-07 | 511.19 | 1,022.38 | 0.00E+00 | 3.77E-04 | 7.53E-04 | 7.0000 | 6.170E+01 |
| Kr-85 | 2.5263E-01 | 511.19 | 1,022.38 | 0.00E+00 | 1.29E+02 | 2.58E+02 | 11.0000 | 7.029E+00 |
| Np-237 | 1.2427E-06 | 511.19 | 1,022.38 | 0.00E+00 | 6.35E-04 | 1.27E-03 | | |
| Pa-231 | 3.8511E-09 | 511.19 | 1,022.38 | 0.00E+00 | 1.97E-06 | 3.94E-06 | | |
| Pb-210 | 7.3880E-15 | 511.19 | 1,022.38 | 0.00E+00 | 3.78E-12 | 7.55E-12 | | |
| Pm-147 | 2.1023E+00 | 511.19 | 1,022.38 | 0.00E+00 | 1.07E+03 | 2.15E+03 | | |
| Pu-238 | 1.0383E-03 | 511.19 | 1,022.38 | 0.00E+00 | 5.31E-01 | 1.06E+00 | | |
| Pu-239 | 5.5293E-03 | 511.19 | 1,022.38 | 0.00E+00 | 2.83E+00 | 5.65E+00 | | |
| Pu-240 | 2.1278E-03 | 511.19 | 1,022.38 | 0.00E+00 | 1.09E+00 | 2.18E+00 | | |
| Pu-241 | 1.0195E-01 | 511.19 | 1,022.38 | 0.00E+00 | 5.21E+01 | 1.04E+02 | | |
| Pu-242 | 2.3128E-07 | 511.19 | 1,022.38 | 0.00E+00 | 1.18E-04 | 2.36E-04 | | |
| Ra-226 | 5.2782E-14 | 511.19 | 1,022.38 | 0.00E+00 | 2.70E-11 | 5.40E-11 | | |
| Ra-228 | 1.9338E-10 | 511.19 | 1,022.38 | 0.00E+00 | 9.89E-08 | 1.98E-07 | | |
| Ru-106 | 9.1684E-02 | 511.19 | 1,022.38 | 0.00E+00 | 4.69E+01 | 9.37E+01 | | |
| Se-79 | 1.3018E-05 | 511.19 | 1,022.38 | 0.00E+00 | 6.65E-03 | 1.33E-02 | | |
| Sn-126 | 1.2167E-05 | 511.19 | 1,022.38 | 0.00E+00 | 6.22E-03 | 1.24E-02 | | |
| Sr-90 | 2.6045E+00 | 511.19 | 1,022.38 | 0.00E+00 | 1.33E+03 | 2.66E+03 | | |
| Tc-99 | 4.4241E-04 | 511.19 | 1,022.38 | 0.00E+00 | 2.26E-01 | 4.52E-01 | | |
| Th-229 | 1.3713E-10 | 511.19 | 1,022.38 | 0.00E+00 | 7.01E-08 | 1.40E-07 | | |
| Th-230 | 1.8090E-11 | 511.19 | 1,022.38 | 0.00E+00 | 9.25E-09 | 1.85E-08 | | |
| Th-232 | 2.5278E-10 | 511.19 | 1,022.38 | 0.00E+00 | 1.29E-07 | 2.58E-07 | | |
| Ti-208 | 1.6947E-08 | 511.19 | 1,022.38 | 0.00E+00 | 8.66E-06 | 1.73E-05 | | |
| U-232 | 4.8737E-08 | 511.19 | 1,022.38 | 0.00E+00 | 2.49E-05 | 4.98E-05 | | |
| U-233 | 1.2203E-07 | 511.19 | 1,022.38 | 0.00E+00 | 6.24E-05 | 1.25E-04 | | |
| U-234 | 1.5925E-07 | 511.19 | 1,022.38 | 0.00E+00 | 8.14E-05 | 1.63E-04 | | |
| U-235 | -2.6194E-06 | 511.19 | 0.00 | 6.43E-03 | 5.09E-03 | 6.43E-03 | | |
| U-236 | 1.2693E-05 | 511.19 | 1,022.38 | 0.00E+00 | 6.49E-03 | 1.30E-02 | | |
| U-238 | -3.6331E-08 | 511.19 | 0.00 | 4.00E-03 | 3.98E-03 | 4.00E-03 | | |
| Y-90 | 2.6060E+00 | 511.19 | 1,022.38 | 0.00E+00 | 1.33E+03 | 2.66E+03 | | |
| Other Radionuclides | | | | | 1.84E+03 | 3.69E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | SST | SST |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 20 | 10 to 20.1 |

Basis for Parameter Differences:

Burnup Summary (MWd)¹

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | | 511.19 |
| Bounding | | 1,022.38 |

Basis for burnup used in estimate

Nominal burnup calculated from the heavy metal mass destroyed
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|-----------------------------------|
| Nominal | 1.01 | |
| Bounding | 2.02 | |

Estimated EOL HM/Given EOL HM

1.00

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 8 5/20 THAILAND
SNF ID # 489
Fuel Units & Descr 100 - ELEMENT
Heavy Metal Mass BOL=19.5kg, EOL=19.3kg
ROD Storage Site INEEL

Fuel decay start date 2010
Estimates as of 2030

Template TRIGA-SS (LW/U-Zr, SST, 10 to 20% U)

Template Burnup(MWd) 6.65
Template BOL Heavy Metal Mass (MT) 0.000195
Template Decay Time 20 years

Estimated
Canister usage
18"x10"
0.90

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.6436E-09 | 190.92 | 381.84 | 0.00E+00 | 5.05E-07 | 1.01E-06 | Avg MeV | |
| Am-241 | 3.1429E-03 | 190.92 | 381.84 | 0.00E+00 | 6.00E-01 | 1.20E+00 | 0.0150 | 3.827E+13 |
| Am-242m | 1.3195E-06 | 190.92 | 381.84 | 0.00E+00 | 2.52E-04 | 5.04E-04 | 0.0250 | 7.965E+12 |
| Am-243 | 1.4753E-07 | 190.92 | 381.84 | 0.00E+00 | 2.82E-05 | 5.63E-05 | 0.0375 | 6.901E+12 |
| Ci-14 | 1.2847E-04 | 190.92 | 381.84 | 0.00E+00 | 2.45E-02 | 4.91E-02 | 0.0575 | 7.424E+12 |
| Cl-36 | 2.8120E-06 | 190.92 | 381.84 | 0.00E+00 | 5.37E-04 | 1.07E-03 | 0.0850 | 4.482E+12 |
| Cm-243 | 1.2465E-07 | 190.92 | 381.84 | 0.00E+00 | 2.38E-05 | 4.76E-05 | 0.1250 | 2.929E+12 |
| Cm-244 | 9.5564E-07 | 190.92 | 381.84 | 0.00E+00 | 1.82E-04 | 3.65E-04 | 0.2250 | 3.848E+12 |
| Co-60 | 1.7880E-01 | 190.92 | 381.84 | 0.00E+00 | 3.41E+01 | 6.83E+01 | 0.3750 | 1.687E+12 |
| Cs-134 | 5.8692E-04 | 190.92 | 381.84 | 0.00E+00 | 1.12E-01 | 2.24E-01 | 0.5750 | 2.774E+13 |
| Cs-135 | 3.2195E-05 | 190.92 | 381.84 | 0.00E+00 | 6.15E-03 | 1.23E-02 | 0.8500 | 3.127E+11 |
| Cs-137 | 1.9489E+00 | 190.92 | 381.84 | 0.00E+00 | 3.72E+02 | 7.44E+02 | 1.2500 | 5.181E+12 |
| Eu-154 | 4.5895E-03 | 190.92 | 381.84 | 0.00E+00 | 8.76E-01 | 1.75E+00 | 1.7500 | 8.033E+09 |
| Eu-155 | 3.6045E-03 | 190.92 | 381.84 | 0.00E+00 | 6.88E-01 | 1.38E+00 | 2.2500 | 2.767E+07 |
| Fe-55 | 1.4185E-02 | 190.92 | 381.84 | 0.00E+00 | 2.71E+00 | 5.42E+00 | 2.7500 | 3.049E+05 |
| H-3 | 4.7895E-03 | 190.92 | 381.84 | 0.00E+00 | 9.14E-01 | 1.83E+00 | 3.5000 | 1.714E+03 |
| I-129 | 7.3684E-07 | 190.92 | 381.84 | 0.00E+00 | 1.41E-04 | 2.81E-04 | 5.0000 | 2.105E+02 |
| Kr-85 | 9.5820E-02 | 190.92 | 381.84 | 0.00E+00 | 1.83E+01 | 3.66E+01 | 7.0000 | 2.380E+01 |
| Np-237 | 1.2552E-06 | 190.92 | 381.84 | 0.00E+00 | 2.40E-04 | 4.79E-04 | 11.0000 | 2.709E+00 |
| Pa-231 | 7.0406E-09 | 190.92 | 381.84 | 0.00E+00 | 1.34E-06 | 2.69E-06 | | |
| Pb-210 | 5.8000E-14 | 190.92 | 381.84 | 0.00E+00 | 1.11E-11 | 2.21E-11 | | |
| Pm-147 | 4.0075E-02 | 190.92 | 381.84 | 0.00E+00 | 7.65E+00 | 1.53E+01 | | |
| Pu-238 | 9.2256E-04 | 190.92 | 381.84 | 0.00E+00 | 1.76E-01 | 3.52E-01 | | |
| Pu-239 | 5.5278E-03 | 190.92 | 381.84 | 0.00E+00 | 1.06E+00 | 2.11E+00 | | |
| Pu-240 | 2.1248E-03 | 190.92 | 381.84 | 0.00E+00 | 4.06E-01 | 8.11E-01 | | |
| Pu-241 | 4.9549E-02 | 190.92 | 381.84 | 0.00E+00 | 9.46E+00 | 1.89E+01 | | |
| Pu-242 | 2.3128E-07 | 190.92 | 381.84 | 0.00E+00 | 4.42E-05 | 8.83E-05 | | |
| Ra-226 | 2.4526E-13 | 190.92 | 381.84 | 0.00E+00 | 4.68E-11 | 9.37E-11 | | |
| Ra-228 | 2.4015E-10 | 190.92 | 381.84 | 0.00E+00 | 4.58E-08 | 9.17E-08 | | |
| Ru-106 | 3.0602E-06 | 190.92 | 381.84 | 0.00E+00 | 5.84E-04 | 1.17E-03 | | |
| Se-79 | 1.3015E-05 | 190.92 | 381.84 | 0.00E+00 | 2.48E-03 | 4.97E-03 | | |
| Sn-126 | 1.2165E-05 | 190.92 | 381.84 | 0.00E+00 | 2.32E-03 | 4.65E-03 | | |
| Sr-90 | 1.8226E+00 | 190.92 | 381.84 | 0.00E+00 | 3.48E+02 | 6.96E+02 | | |
| Tc-99 | 4.4241E-04 | 190.92 | 381.84 | 0.00E+00 | 8.45E-02 | 1.69E-01 | | |
| Th-229 | 3.0962E-10 | 190.92 | 381.84 | 0.00E+00 | 5.91E-08 | 1.18E-07 | | |
| Th-230 | 4.2346E-11 | 190.92 | 381.84 | 0.00E+00 | 8.08E-09 | 1.62E-08 | | |
| Th-232 | 2.5278E-10 | 190.92 | 381.84 | 0.00E+00 | 4.83E-08 | 9.65E-08 | | |
| Ti-208 | 1.5820E-08 | 190.92 | 381.84 | 0.00E+00 | 3.02E-06 | 6.04E-06 | | |
| U-232 | 4.2647E-08 | 190.92 | 381.84 | 0.00E+00 | 8.14E-06 | 1.63E-05 | | |
| U-233 | 1.2211E-07 | 190.92 | 381.84 | 0.00E+00 | 2.33E-05 | 4.66E-05 | Thermal Power | |
| U-234 | 1.9955E-07 | 190.92 | 381.84 | 0.00E+00 | 3.81E-05 | 7.62E-05 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-235 | -2.6194E-06 | 190.92 | 0.00 | 8.43E-03 | 7.93E-03 | 8.43E-03 | 4.78E+00 | 9.55E+00 |
| U-236 | 1.2693E-05 | 190.92 | 381.84 | 0.00E+00 | 2.42E-03 | 4.85E-03 | Total | Total |
| U-238 | -3.6331E-08 | 190.92 | 0.00 | 5.24E-03 | 5.24E-03 | 5.24E-03 | | |
| Y-90 | 1.8241E+00 | 190.92 | 381.84 | 0.00E+00 | 3.48E+02 | 6.97E+02 | | |
| Other Radionuclides | | | | | 3.68E+02 | 7.35E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | SST | SST |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 20 | 10 to 20.1 |

Basis for Parameter Differences*

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | | 190.92 |
| Bounding | | 381.84 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed.
Bounding burnup assumed to be twice nominal burnup.

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|--------------------------------|
| Nominal | 0.29 | |
| Bounding | 0.57 | |

Estimated EOL HM/Given EOL HM

1.00

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 8.5/20 TURKEY
SNF ID # 490
Fuel Units & Descr 79 - ELEMENT
Heavy Metal Mass BOL=15.405kg, EOL=15.247kg
ROD Storage Site INEEL

¹Fuel decay start date 2010
Estimates as of 2030
Template TRIGA-SS (LW/U-Zrx SST, 10 to 20% U)
²Template Burnup(MWd) 6 65
Template BOL Heavy Metal Mass (MT) 0.000195
Template Decay Time 20 years

Estimated
Canister usage
18"x10"
0.71

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.6436E-09 | 150 83 | 301.66 | 0.00E+00 | 3.99E-07 | 7.97E-07 | Avg MeV | |
| Am-241 | 3.1429E-03 | 150 83 | 301.66 | 0.00E+00 | 4.74E-01 | 9.48E-01 | 0.0150 | 3.023E+13 |
| Am-242m | 1.3195E-06 | 150 83 | 301.66 | 0.00E+00 | 1.99E-04 | 3.98E-04 | 0.0250 | 6.293E+12 |
| Am-243 | 1.4753E-07 | 150 83 | 301.66 | 0.00E+00 | 2.23E-05 | 4.45E-05 | 0.0375 | 5.451E+12 |
| C-14 | 1.2847E-04 | 150 83 | 301.66 | 0.00E+00 | 1.94E-02 | 3.88E-02 | 0.0575 | 5.865E+12 |
| Cl-36 | 2.8120E-06 | 150 83 | 301.66 | 0.00E+00 | 4.24E-04 | 8.48E-04 | 0.0850 | 3.540E+12 |
| Cm-243 | 1.2465E-07 | 150 83 | 301.66 | 0.00E+00 | 1.88E-05 | 3.76E-05 | 0.1250 | 2.314E+12 |
| Cm-244 | 9.5564E-07 | 150 83 | 301.66 | 0.00E+00 | 1.44E-04 | 2.88E-04 | 0.2250 | 3.040E+12 |
| Co-60 | 1.7880E-01 | 150 83 | 301.66 | 0.00E+00 | 2.70E+01 | 5.39E+01 | 0.3750 | 1.332E+12 |
| Cs-134 | 5.8692E-04 | 150 83 | 301.66 | 0.00E+00 | 8.85E-02 | 1.77E-01 | 0.5750 | 2.191E+13 |
| Cs-135 | 3.2195E-05 | 150 83 | 301.66 | 0.00E+00 | 4.86E-03 | 9.71E-03 | 0.8500 | 2.470E+11 |
| Cs-137 | 1.9489E+00 | 150 83 | 301.66 | 0.00E+00 | 2.94E+02 | 5.88E+02 | 1.2500 | 4.093E+12 |
| Eu-154 | 4.5895E-03 | 150 83 | 301.66 | 0.00E+00 | 6.92E-01 | 1.38E+00 | 1.7500 | 6.346E+09 |
| Eu-155 | 3.6045E-03 | 150 83 | 301.66 | 0.00E+00 | 5.44E-01 | 1.09E+00 | 2.2500 | 2.186E+07 |
| Fe-55 | 1.4185E-02 | 150 83 | 301.66 | 0.00E+00 | 2.14E+00 | 4.28E+00 | 2.7500 | 2.408E+05 |
| H-3 | 4.7895E-03 | 150 83 | 301.66 | 0.00E+00 | 7.22E-01 | 1.44E+00 | 3.5000 | 1.354E+03 |
| I-129 | 7.3684E-07 | 150 83 | 301.66 | 0.00E+00 | 1.11E-04 | 2.22E-04 | 5.0000 | 1.663E+02 |
| Kr-85 | 9.5820E-02 | 150 83 | 301.66 | 0.00E+00 | 1.45E+01 | 2.89E+01 | 7.0000 | 1.880E+01 |
| Np-237 | 1.2552E-06 | 150 83 | 301.66 | 0.00E+00 | 1.89E-04 | 3.79E-04 | 11.0000 | 2.140E+00 |
| Pa-231 | 7.0406E-09 | 150 83 | 301.66 | 0.00E+00 | 1.06E-06 | 2.12E-06 | | |
| Pb-210 | 5.8000E-14 | 150 83 | 301.66 | 0.00E+00 | 8.75E-12 | 1.75E-11 | | |
| Pm-147 | 4.0075E-02 | 150 83 | 301.66 | 0.00E+00 | 6.04E+00 | 1.21E+01 | | |
| Pu-238 | 9.2256E-04 | 150 83 | 301.66 | 0.00E+00 | 1.39E-01 | 2.78E-01 | | |
| Pu-239 | 5.5278E-03 | 150 83 | 301.66 | 0.00E+00 | 8.34E-01 | 1.67E+00 | | |
| Pu-240 | 2.1248E-03 | 150 83 | 301.66 | 0.00E+00 | 3.20E-01 | 6.41E-01 | | |
| Pu-241 | 4.9549E-02 | 150 83 | 301.66 | 0.00E+00 | 7.47E+00 | 1.49E+01 | | |
| Pu-242 | 2.3128E-07 | 150 83 | 301.66 | 0.00E+00 | 3.49E-05 | 6.98E-05 | | |
| Ra-226 | 2.4526E-13 | 150 83 | 301.66 | 0.00E+00 | 3.70E-11 | 7.40E-11 | | |
| Ra-228 | 2.4015E-10 | 150 83 | 301.66 | 0.00E+00 | 3.62E-08 | 7.24E-08 | | |
| Ru-106 | 3.0602E-06 | 150 83 | 301.66 | 0.00E+00 | 4.62E-04 | 9.23E-04 | | |
| Se-79 | 1.3015E-05 | 150 83 | 301.66 | 0.00E+00 | 1.96E-03 | 3.93E-03 | | |
| Sn-126 | 1.2165E-05 | 150 83 | 301.66 | 0.00E+00 | 1.83E-03 | 3.67E-03 | | |
| Sr-90 | 1.8226E+00 | 150 83 | 301.66 | 0.00E+00 | 2.75E+02 | 5.50E+02 | | |
| Tc-99 | 4.4241E-04 | 150 83 | 301.66 | 0.00E+00 | 6.67E-02 | 1.33E-01 | | |
| Th-229 | 3.0962E-10 | 150 83 | 301.66 | 0.00E+00 | 4.67E-08 | 9.34E-08 | | |
| Th-230 | 4.2346E-11 | 150 83 | 301.66 | 0.00E+00 | 6.39E-09 | 1.28E-08 | | |
| Th-232 | 2.5278E-10 | 150 83 | 301.66 | 0.00E+00 | 3.81E-08 | 7.63E-08 | | |
| Ti-208 | 1.5820E-08 | 150 83 | 301.66 | 0.00E+00 | 2.39E-06 | 4.77E-06 | | |
| U-232 | 4.2647E-08 | 150 83 | 301.66 | 0.00E+00 | 6.43E-06 | 1.29E-05 | Thermal Power | |
| U-233 | 1.2211E-07 | 150 83 | 301.66 | 0.00E+00 | 1.84E-05 | 3.68E-05 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 1.9955E-07 | 150 83 | 301.66 | 0.00E+00 | 3.01E-05 | 6.02E-05 | 3.77E+00 | 7.55E+00 |
| U-235 | -2.6194E-06 | 150 83 | 0.00 | 6.66E-03 | 6.26E-03 | 6.66E-03 | Total | Total |
| U-236 | 1.2693E-05 | 150 83 | 301.66 | 0.00E+00 | 1.91E-03 | 3.83E-03 | | |
| U-238 | -3.6331E-08 | 150 83 | 0.00 | 4.14E-03 | 4.14E-03 | 4.14E-03 | | |
| Y-90 | 1.8241E+00 | 150 83 | 301.66 | 0.00E+00 | 2.75E+02 | 5.50E+02 | | |
| Other Radionuclides | | | | | 2.90E+02 | 5.81E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences* |
|---------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 | 10 to 20.1 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate* |
|----------|----------|-----------|--|
| Nominal | | 150 83 | |
| Bounding | | 301.66 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0.29 | | |
| Bounding | 0.57 | | 1.00 |

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

*Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8 5/20 U OF AZ

SNF ID #: 59

Fuel Units & Descr: 84 - ELEMENT

Heavy Metal Mass: BOL=16 38kg EOL=15 75kg

ROD Storage Site: INEEL

Fuel decay start date: 2035

Estimates as of: 2030

Template: TRIGA SS (LW/U-Zrx, SST, 10 to 20%, U)

Template Burnup (MWd), 6 65

Template BOL Heavy Metal Mass (MT): 0 000195

Template Decay Time: 5 years

Estimated

Canister usage:

18"x10"

0 76

II. Estimates

| | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|-------------------------------|--------------------------------|---------------------|------------------------------|
| Radionuclide | CvMWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 5173E-10 | 601 40 | 1,202 81 | 0 00E+00 | 5 12E-07 | 1 02E-06 | Avg. MeV | |
| Am-241 | 1 8331E-03 | 601 40 | 1,202 81 | 0 00E+00 | 1 10E+00 | 2 20E+00 | 0 0150 | 1 944E+14 |
| Am-242m | 1 4129E-06 | 601 40 | 1,202 81 | 0 00E+00 | 8 50E-04 | 1 70E-03 | 0 0250 | 4 278E+13 |
| Am-243 | 1 4774E-07 | 601 40 | 1,202 81 | 0 00E+00 | 8 89E-05 | 1 78E-04 | 0 0375 | 3 643E+13 |
| C-14 | 1 2871E-04 | 601 40 | 1,202 81 | 0 00E+00 | 7 74E-02 | 1 55E-01 | 0 0575 | 3 739E+13 |
| Cl-36 | 2 8120E-06 | 601 40 | 1,202 81 | 0 00E+00 | 1 69E-03 | 3 38E-03 | 0 0850 | 2 316E+13 |
| Cm-243 | 1 7940E-07 | 601 40 | 1,202 81 | 0 00E+00 | 1 08E-04 | 2 16E-04 | 0 1250 | 1 682E+13 |
| Cm-244 | 1 6962E-06 | 601 40 | 1,202 81 | 0 00E+00 | 1 02E-03 | 2 04E-03 | 0 2250 | 1 965E+13 |
| Co-60 | 1 2839E+00 | 601 40 | 1,202 81 | 0 00E+00 | 7 72E+02 | 1 54E+03 | 0 3750 | 9 972E+12 |
| Cs-134 | 9 0541E-02 | 601 40 | 1,202 81 | 0 00E+00 | 5 45E+01 | 1 09E+02 | 0 5750 | 1 326E+14 |
| Cs-135 | 3 2195E-05 | 601 40 | 1,202 81 | 0 00E+00 | 1 94E-02 | 3 87E-02 | 0 8500 | 5 690E+12 |
| Cs-137 | 2 7564E+00 | 601 40 | 1,202 81 | 0 00E+00 | 1 66E+03 | 3 32E+03 | 1 2500 | 1 155E+14 |
| Eu-154 | 1 5368E-02 | 601 40 | 1,202 81 | 0 00E+00 | 9 24E+00 | 1 85E+01 | 1 7500 | 7 702E+10 |
| Eu-155 | 2 9293E-02 | 601 40 | 1,202 81 | 0 00E+00 | 1 76E+01 | 3 52E+01 | 2 2500 | 1 241E+11 |
| Fe-55 | 7 7158E-01 | 601 40 | 1,202 81 | 0 00E+00 | 4 64E+02 | 9 28E+02 | 2 7500 | 9 852E+08 |
| H-3 | 1 1111E-02 | 601 40 | 1,202 81 | 0 00E+00 | 6 68E+00 | 1 34E+01 | 3 5000 | 1 147E+08 |
| I-129 | 7 3684E-07 | 601 40 | 1,202 81 | 0 00E+00 | 4 43E-04 | 8 86E-04 | 5 0000 | 6 405E+02 |
| Kr-85 | 2 5263E-01 | 601 40 | 1,202 81 | 0 00E+00 | 1 52E+02 | 3 04E+02 | 7 0000 | 7 251E+01 |
| Np-237 | 1 2427E-06 | 601 40 | 1,202 81 | 0 00E+00 | 7 47E-04 | 1 49E-03 | 11 0000 | 8 260E+00 |
| Pa-231 | 3 8511E-09 | 601 40 | 1,202 81 | 0 00E+00 | 2 32E-06 | 4 63E-06 | | |
| Pb-210 | 7 3880E-15 | 601 40 | 1,202 81 | 0 00E+00 | 4 44E-12 | 8 89E-12 | | |
| Pm-147 | 2 1023E+00 | 601 40 | 1,202 81 | 0 00E+00 | 1 26E+03 | 2 53E+03 | | |
| Pu-238 | 1 0383E-03 | 601 40 | 1,202 81 | 0 00E+00 | 6 24E-01 | 1 25E+00 | | |
| Pu-239 | 5 5293E-03 | 601 40 | 1,202 81 | 0 00E+00 | 3 33E+00 | 6 65E+00 | | |
| Pu-240 | 2 1278E-03 | 601 40 | 1,202 81 | 0 00E+00 | 1 28E+00 | 2 56E+00 | | |
| Pu-241 | 1 0195E-01 | 601 40 | 1,202 81 | 0 00E+00 | 6 13E+01 | 1 23E+02 | | |
| Pu-242 | 2 3128E-07 | 601 40 | 1,202 81 | 0 00E+00 | 1 39E-04 | 2 78E-04 | | |
| Ra-226 | 5 2782E-14 | 601 40 | 1,202 81 | 0 00E+00 | 3 17E-11 | 6 35E-11 | | |
| Ra-228 | 1 9338E-10 | 601 40 | 1,202 81 | 0 00E+00 | 1 16E-07 | 2 33E-07 | | |
| Ru-106 | 9 1684E-02 | 601 40 | 1,202 81 | 0 00E+00 | 5 51E+01 | 1 10E+02 | | |
| Se-79 | 1 3018E-05 | 601 40 | 1,202 81 | 0 00E+00 | 7 83E-03 | 1 57E-02 | | |
| Sn-126 | 1 2167E-05 | 601 40 | 1,202 81 | 0 00E+00 | 7 32E-03 | 1 46E-02 | | |
| Sr-90 | 2 6045E+00 | 601 40 | 1,202 81 | 0 00E+00 | 1 57E+03 | 3 13E+03 | | |
| Tc-99 | 4 4241E-04 | 601 40 | 1,202 81 | 0 00E+00 | 2 66E-01 | 5 32E-01 | | |
| Th-229 | 1 3713E-10 | 601 40 | 1,202 81 | 0 00E+00 | 8 25E-08 | 1 65E-07 | | |
| Th-230 | 1 8090E-11 | 601 40 | 1,202 81 | 0 00E+00 | 1 09E-08 | 2 18E-08 | | |
| Th-232 | 2 5278E-10 | 601 40 | 1,202 81 | 0 00E+00 | 1 52E-07 | 3 04E-07 | | |
| Ti-208 | 1 6947E-08 | 601 40 | 1,202 81 | 0 00E+00 | 1 02E-05 | 2 04E-05 | | |
| U-232 | 4 8737E-08 | 601 40 | 1,202 81 | 0 00E+00 | 2 93E-05 | 5 86E-05 | | |
| U-233 | 1 2203E-07 | 601 40 | 1,202 81 | 0 00E+00 | 7 34E-05 | 1 47E-04 | | |
| U-234 | 1 5925E-07 | 601 40 | 1,202 81 | 0 00E+00 | 9 58E-05 | 1 92E-04 | | |
| U-235 | -2 6194E-06 | 601 40 | 0 00 | 7 08E-03 | 5 50E-03 | 7 08E-03 | | |
| U-236 | 1 2693E-05 | 601 40 | 1,202 81 | 0 00E+00 | 7 63E-03 | 1 53E-02 | | |
| U-238 | -3 6331E-08 | 601 40 | 0 00 | 4 40E-03 | 4 38E-03 | 4 40E-03 | | |
| Y-90 | 2 6060E+00 | 601 40 | 1,202 81 | 0 00E+00 | 1 57E+03 | 3 13E+03 | | |
| Other Radionuclides | | | | | 2 17E+03 | 4 34E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | SST | SST |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 20 | 10 to 20 1 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | | 601 40 |
| Bounding | | 1,202 81 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|-----------------------------------|
| Nominal | 1 08 | |
| Bounding | 2 15 | |

Estimated EOL HM/Given EOL HM

1 00

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 8 5/20 U OF AZ
SNF ID # 975
Fuel Units & Descr 8 - ELEMENT
Heavy Metal Mass BOL=1.497kg EOL=1.497kg
ROD Storage Site INEEL

¹Fuel decay start date 2035
Estimates as of 2030
Template TRIGA-SS (LW/U-Zrx SST, 10 to 20%, U)
²Template Burnup(MWd) 6.65
Template BOL Heavy Metal Mass (MT) 0.000195
Template Decay Time 5 years

Estimated
Canister usage*
18"x10"
0.07

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.5173E-10 | 28.58 | 57.15 | 0.00E+00 | 2.43E-08 | 4.87E-08 | Avg MeV | |
| Am-241 | 1.8331E-03 | 28.58 | 57.15 | 0.00E+00 | 5.24E-02 | 1.05E-01 | 0.0150 | 9.238E+12 |
| Am-242m | 1.4129E-06 | 28.58 | 57.15 | 0.00E+00 | 4.04E-05 | 8.08E-05 | 0.0250 | 2.033E+12 |
| Am-243 | 1.4774E-07 | 28.58 | 57.15 | 0.00E+00 | 4.22E-06 | 8.44E-06 | 0.0375 | 1.731E+12 |
| C-14 | 1.2871E-04 | 28.58 | 57.15 | 0.00E+00 | 3.68E-03 | 7.36E-03 | 0.0575 | 1.777E+12 |
| Cf-252 | 2.8120E-06 | 28.58 | 57.15 | 0.00E+00 | 8.04E-05 | 1.61E-04 | 0.0850 | 1.101E+12 |
| Cm-243 | 1.7940E-07 | 28.58 | 57.15 | 0.00E+00 | 5.13E-06 | 1.03E-05 | 0.1250 | 7.993E+11 |
| Cm-244 | 1.6962E-06 | 28.58 | 57.15 | 0.00E+00 | 4.85E-05 | 9.69E-05 | 0.2250 | 9.337E+11 |
| Co-60 | 1.2839E+00 | 28.58 | 57.15 | 0.00E+00 | 3.67E+01 | 7.34E+01 | 0.3750 | 4.738E+11 |
| Cs-134 | 9.0541E-02 | 28.58 | 57.15 | 0.00E+00 | 2.59E+00 | 5.17E+00 | 0.5750 | 6.299E+12 |
| Cs-135 | 3.2195E-05 | 28.58 | 57.15 | 0.00E+00 | 9.20E-04 | 1.84E-03 | 0.8500 | 2.704E+11 |
| Cs-137 | 2.7564E+00 | 28.58 | 57.15 | 0.00E+00 | 7.88E+01 | 1.58E+02 | 1.2500 | 5.491E+12 |
| Eu-154 | 1.5368E-02 | 28.58 | 57.15 | 0.00E+00 | 4.39E-01 | 8.78E-01 | 1.7500 | 3.660E+09 |
| Eu-155 | 2.9293E-02 | 28.58 | 57.15 | 0.00E+00 | 8.37E-01 | 1.67E+00 | 2.2500 | 5.899E+09 |
| Fe-55 | 7.7158E-01 | 28.58 | 57.15 | 0.00E+00 | 2.20E+01 | 4.41E+01 | 2.7500 | 4.681E+07 |
| H-3 | 1.1111E-02 | 28.58 | 57.15 | 0.00E+00 | 3.18E-01 | 6.35E-01 | 3.5000 | 5.448E+06 |
| I-129 | 7.3684E-07 | 28.58 | 57.15 | 0.00E+00 | 2.11E-05 | 4.21E-05 | 5.0000 | 3.090E+01 |
| Kr-85 | 2.5263E-01 | 28.58 | 57.15 | 0.00E+00 | 7.22E+00 | 1.44E+01 | 7.0000 | 3.499E+00 |
| Np-237 | 1.2427E-06 | 28.58 | 57.15 | 0.00E+00 | 3.55E-05 | 7.10E-05 | 11.0000 | 3.987E-01 |
| Pa-231 | 3.8511E-09 | 28.58 | 57.15 | 0.00E+00 | 1.10E-07 | 2.20E-07 | | |
| Pb-210 | 7.3880E-15 | 28.58 | 57.15 | 0.00E+00 | 2.11E-13 | 4.22E-13 | | |
| Pm-147 | 2.1023E+00 | 28.58 | 57.15 | 0.00E+00 | 6.01E+01 | 1.20E+02 | | |
| Pu-238 | 1.0383E-03 | 28.58 | 57.15 | 0.00E+00 | 2.97E-02 | 5.93E-02 | | |
| Pu-239 | 5.5293E-03 | 28.58 | 57.15 | 0.00E+00 | 1.58E-01 | 3.16E-01 | | |
| Pu-240 | 2.1278E-03 | 28.58 | 57.15 | 0.00E+00 | 6.08E-02 | 1.22E-01 | | |
| Pu-241 | 1.0195E-01 | 28.58 | 57.15 | 0.00E+00 | 2.91E+00 | 5.83E+00 | | |
| Pu-242 | 2.3128E-07 | 28.58 | 57.15 | 0.00E+00 | 6.61E-06 | 1.32E-05 | | |
| Ra-226 | 5.2782E-14 | 28.58 | 57.15 | 0.00E+00 | 1.51E-12 | 3.02E-12 | | |
| Ra-228 | 1.9338E-10 | 28.58 | 57.15 | 0.00E+00 | 5.53E-09 | 1.11E-08 | | |
| Ru-106 | 9.1684E-02 | 28.58 | 57.15 | 0.00E+00 | 2.62E+00 | 5.24E+00 | | |
| Se-79 | 1.3018E-05 | 28.58 | 57.15 | 0.00E+00 | 3.72E-04 | 7.44E-04 | | |
| Sn-126 | 1.2167E-05 | 28.58 | 57.15 | 0.00E+00 | 3.48E-04 | 6.95E-04 | | |
| Sr-90 | 2.6045E+00 | 28.58 | 57.15 | 0.00E+00 | 7.44E+01 | 1.49E+02 | | |
| Tc-99 | 4.4241E-04 | 28.58 | 57.15 | 0.00E+00 | 1.26E-02 | 2.53E-02 | | |
| Th-229 | 1.3713E-10 | 28.58 | 57.15 | 0.00E+00 | 3.92E-09 | 7.84E-09 | | |
| Th-230 | 1.8090E-11 | 28.58 | 57.15 | 0.00E+00 | 5.17E-10 | 1.03E-09 | | |
| Th-232 | 2.5278E-10 | 28.58 | 57.15 | 0.00E+00 | 7.22E-09 | 1.44E-08 | | |
| Ti-208 | 1.6947E-08 | 28.58 | 57.15 | 0.00E+00 | 4.84E-07 | 9.69E-07 | | |
| U-232 | 4.8737E-08 | 28.58 | 57.15 | 0.00E+00 | 1.39E-06 | 2.79E-06 | | |
| U-233 | 1.2203E-07 | 28.58 | 57.15 | 0.00E+00 | 3.49E-06 | 6.97E-06 | | |
| U-234 | 1.5925E-07 | 28.58 | 57.15 | 0.00E+00 | 4.55E-06 | 9.10E-06 | | |
| U-235 | -2.6194E-06 | 28.58 | 0.00 | 5.95E-04 | 5.20E-04 | 5.95E-04 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-236 | 1.2693E-05 | 28.58 | 57.15 | 0.00E+00 | 3.63E-04 | 7.25E-04 | 1.66E+00 | 3.33E+00 |
| U-238 | -3.6331E-08 | 28.58 | 0.00 | 4.11E-04 | 4.09E-04 | 4.11E-04 | Total | Total |
| Y-90 | 2.6060E+00 | 28.58 | 57.15 | 0.00E+00 | 7.45E+01 | 1.49E+02 | | |
| Other Radionuclides | | | | | 1.03E+02 | 2.06E+02 | | |

Other Radionuclides

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences* |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator | From SFD | Used | |
| | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| | SST | SST | |
| | U | U | |
| BOL HM Constituents | 18.3974873 | 10 to 20.1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate |
|-----------------------------------|----------|-----------|---|
| Nominal | From SFD | Estimated | |
| | | 28.58 | |
| Bounding | | 57.15 | Nominal burnup assumed to be 2% of BOL heavy metal mass Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|--------------------------------|-------------------------------|
| Nominal | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| | 0.56 | | |
| Bounding | 1.12 | | 0.98 |

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8 5/20 U OF IL
 SNF ID #: 449
 Fuel Units & Descr: 139 - ELEMENT
 Heavy Metal Mass: BOL=27 8kg, EOL=26 41kg
 ROD Storage Site: INEEL

¹Fuel decay start date: 2035

Estimates as of: 2030

Template: TRIGA-SS (LW/U-Zr, SST, 10 to 20%, U)

²Template Burnup(MWd): 6 65

Template BOL Heavy Metal Mass (MT): 0 000195

Template Decay Time: 5 years

Estimated

Canister usage*

18"x10"

1.25

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 5173E-10 | 1,326 90 | 2,653 81 | 0 00E+00 | 1 13E-06 | 2 26E-06 | Avg MeV | |
| Am-241 | 1 8331E-03 | 1,326 90 | 2,653 81 | 0 00E+00 | 2 43E+00 | 4 86E+00 | 0.0150 | 4 289E+14 |
| Am-242m | 1 4129E-06 | 1,326 90 | 2,653 81 | 0 00E+00 | 1 87E-03 | 3 75E-03 | 0.0250 | 9 438E+13 |
| Am-243 | 1 4774E-07 | 1,326 90 | 2,653 81 | 0 00E+00 | 1 96E-04 | 3 92E-04 | 0.0375 | 8 037E+13 |
| C-14 | 1 2871E-04 | 1,326 90 | 2,653 81 | 0 00E+00 | 1 71E-01 | 3 42E-01 | 0.0575 | 8 250E+13 |
| Cl-36 | 2 8120E-06 | 1,326 90 | 2,653 81 | 0 00E+00 | 3 73E-03 | 7 46E-03 | 0.0850 | 5 111E+13 |
| Cm-243 | 1 7940E-07 | 1,326 90 | 2,653 81 | 0 00E+00 | 2 38E-04 | 4 76E-04 | 0.1250 | 3 711E+13 |
| Cm-244 | 1 6962E-06 | 1,326 90 | 2,653 81 | 0 00E+00 | 2 25E-03 | 4 50E-03 | 0.2250 | 4 336E+13 |
| Co-60 | 1 2839E+00 | 1,326 90 | 2,653 81 | 0 00E+00 | 1 70E+03 | 3 41E+03 | 0.3750 | 2 200E+13 |
| Cs-134 | 9 0541E-02 | 1,326 90 | 2,653 81 | 0 00E+00 | 1 20E+02 | 2 40E+02 | 0.5750 | 2 925E+14 |
| Cs-135 | 3 2195E-05 | 1,326 90 | 2,653 81 | 0 00E+00 | 4 27E-02 | 8 54E-02 | 0.8500 | 1 255E+13 |
| Cs-137 | 2 7564E+00 | 1,326 90 | 2,653 81 | 0 00E+00 | 3 66E+03 | 7 31E+03 | 1.2500 | 2 549E+14 |
| Eu-154 | 1 5368E-02 | 1,326 90 | 2,653 81 | 0 00E+00 | 2 04E+01 | 4 08E+01 | 1.7500 | 1 699E+11 |
| Eu-155 | 2 9293E-02 | 1,326 90 | 2,653 81 | 0 00E+00 | 3 89E+01 | 7 77E+01 | 2.2500 | 2 739E+11 |
| Fe-55 | 7 7158E-01 | 1,326 90 | 2,653 81 | 0 00E+00 | 1 02E+03 | 2 05E+03 | 2.7500 | 2 174E+09 |
| H-3 | 1 1111E-02 | 1,326 90 | 2,653 81 | 0 00E+00 | 1 47E+01 | 2 95E+01 | 3.5000 | 2 530E+08 |
| I-129 | 7 3684E-07 | 1,326 90 | 2,653 81 | 0 00E+00 | 9 78E-04 | 1 96E-03 | 5.0000 | 1 408E+03 |
| Kr-85 | 2 5263E-01 | 1,326 90 | 2,653 81 | 0 00E+00 | 3 35E+02 | 6 70E+02 | 7.0000 | 1 594E+02 |
| Np-237 | 1 2427E-06 | 1,326 90 | 2,653 81 | 0 00E+00 | 1 65E-03 | 3 30E-03 | 11.0000 | 1 816E+01 |
| Pa-231 | 3 8511E-09 | 1,326 90 | 2,653 81 | 0 00E+00 | 5 11E-06 | 1 02E-05 | | |
| Pb-210 | 7 3880E-15 | 1,326 90 | 2,653 81 | 0 00E+00 | 9 80E-12 | 1 96E-11 | | |
| Pm-147 | 2 1023E+00 | 1,326 90 | 2,653 81 | 0 00E+00 | 2 79E+03 | 5 58E+03 | | |
| Pu-238 | 1 0383E-03 | 1,326 90 | 2,653 81 | 0 00E+00 | 1 38E+00 | 2 76E+00 | | |
| Pu-239 | 5 5293E-03 | 1,326 90 | 2,653 81 | 0 00E+00 | 7 34E+00 | 1 47E+01 | | |
| Pu-240 | 2 1278E-03 | 1,326 90 | 2,653 81 | 0 00E+00 | 2 82E+00 | 5 65E+00 | | |
| Pu-241 | 1 0195E-01 | 1,326 90 | 2,653 81 | 0 00E+00 | 1 35E+02 | 2 71E+02 | | |
| Pu-242 | 2 3128E-07 | 1,326 90 | 2,653 81 | 0 00E+00 | 3 07E-04 | 6 14E-04 | | |
| Ra-226 | 5 2782E-14 | 1,326 90 | 2,653 81 | 0 00E+00 | 7 00E-11 | 1 40E-10 | | |
| Ra-228 | 1 9338E-10 | 1,326 90 | 2,653 81 | 0 00E+00 | 2 57E-07 | 5 13E-07 | | |
| Ru-106 | 9 1684E-02 | 1,326 90 | 2,653 81 | 0 00E+00 | 1 22E+02 | 2 43E+02 | | |
| Se-79 | 1 3018E-05 | 1,326 90 | 2,653 81 | 0 00E+00 | 1 73E-02 | 3 45E-02 | | |
| Sn-126 | 1 2167E-05 | 1,326 90 | 2,653 81 | 0 00E+00 | 1 61E-02 | 3 23E-02 | | |
| Sr-90 | 2 6045E+00 | 1,326 90 | 2,653 81 | 0 00E+00 | 3 46E+03 | 6 91E+03 | | |
| Tc-99 | 4 4241E-04 | 1,326 90 | 2,653 81 | 0 00E+00 | 5 87E-01 | 1 17E+00 | | |
| Th-229 | 1 3713E-10 | 1,326 90 | 2,653 81 | 0 00E+00 | 1 82E-07 | 3 64E-07 | | |
| Th-230 | 1 8090E-11 | 1,326 90 | 2,653 81 | 0 00E+00 | 2 40E-08 | 4 80E-08 | | |
| Th-232 | 2 5278E-10 | 1,326 90 | 2,653 81 | 0 00E+00 | 3 35E-07 | 6 71E-07 | | |
| Ti-208 | 1 6947E-08 | 1,326 90 | 2,653 81 | 0 00E+00 | 2 25E-05 | 4 50E-05 | | |
| U-232 | 4 8737E-08 | 1,326 90 | 2,653 81 | 0 00E+00 | 6 47E-05 | 1 29E-04 | | |
| U-233 | 1 2203E-07 | 1,326 90 | 2,653 81 | 0 00E+00 | 1 62E-04 | 3 24E-04 | | |
| U-234 | 1 5925E-07 | 1,326 90 | 2,653 81 | 0 00E+00 | 2 11E-04 | 4 23E-04 | | |
| U-235 | -2 6194E-06 | 1,326 90 | 0 00 | 1 20E-02 | 8 54E-03 | 1 20E-02 | | |
| U-236 | 1 2693E-05 | 1,326 90 | 2,653 81 | 0 00E+00 | 1 68E-02 | 3 37E-02 | | |
| U-238 | -3 6331E-08 | 1,326 90 | 0 00 | 7 47E-03 | 7 43E-03 | 7 47E-03 | | |
| Y-90 | 2 6060E+00 | 1,326 90 | 2,653 81 | 0 00E+00 | 3 46E+03 | 6 92E+03 | | |
| Other Radionuclides | | | | | 4 78E+03 | 9 57E+03 | | |

Thermal Power

Nominal Heat Output (Watts)

Bounding Heat Output (Watts)

7 72E+01 1 54E+02

Total Total

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | SST | SST |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 20 0000115 | 10 to 20 1 |

Basis for Parameter Differences:

Burnup Summary (MWd)³

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | | 1,326 90 |
| Bounding | | 2,653 81 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed.
 Bounding burnup assumed to be twice nominal burnup.

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|--------------------------------|
| Nominal | 1.40 | |
| Bounding | 2.80 | |

Estimated EOL HM/Given EOL HM

1.00

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 8 5/20 U OF TX AUSTIN
SNF ID # 265
Fuel Units & Descr: 156 - ELEMENT
Heavy Metal Mass: BOL=30 124kg EOL=29 765kg
ROD Storage Site INEEL

¹Fuel decay start date 2035
Estimates as of 2030
Template TRIGA-SS (LW/U Zrx, SST, 10 to 20% U)
²Template Burnup(MWd): 6 65
Template BOL Heavy Metal Mass (MT): 0 000195
Template Decay Time: 5 years

Estimated
Canister usage
18"x10"
1 41

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Cu/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 5173E-10 | 342 51 | 685 03 | 0 00E+00 | 2 92E-07 | 5 83E-07 | Avg MeV | |
| Am-241 | 1 8331E-03 | 342 51 | 685 03 | 0 00E+00 | 6 28E-01 | 1 26E+00 | 0 0150 | 1 107E+14 |
| Am-242m | 1 4129E-06 | 342 51 | 685 03 | 0 00E+00 | 4 84E-04 | 9 68E-04 | 0 0250 | 2 436E+13 |
| Am-243 | 1 4774E-07 | 342 51 | 685 03 | 0 00E+00 | 5 06E-05 | 1 01E-04 | 0 0375 | 2 075E+13 |
| C-14 | 1 2871E-04 | 342 51 | 685 03 | 0 00E+00 | 4 41E-02 | 8 82E-02 | 0 0575 | 1 229E+13 |
| Cl-36 | 2 8120E-06 | 342 51 | 685 03 | 0 00E+00 | 9 63E-04 | 1 93E-03 | 0 0850 | 1 319E+13 |
| Cm-243 | 1 7940E-07 | 342 51 | 685 03 | 0 00E+00 | 6 14E-05 | 1 23E-04 | 0 1250 | 9 580E+12 |
| Cm-244 | 1 6962E-06 | 342 51 | 685 03 | 0 00E+00 | 5 81E-04 | 1 16E-03 | 0 2250 | 1 119E+13 |
| Co-60 | 1 2839E+00 | 342 51 | 685 03 | 0 00E+00 | 4 40E+02 | 8 80E+02 | 0 3750 | 5 679E+12 |
| Cs-134 | 9 0541E-02 | 342 51 | 685 03 | 0 00E+00 | 3 10E+01 | 6 20E+01 | 0 5750 | 7 550E+13 |
| Cs-135 | 3 2195E-05 | 342 51 | 685 03 | 0 00E+00 | 1 10E-02 | 2 21E-02 | 0 8500 | 3 240E+12 |
| Cs-137 | 2 7564E+00 | 342 51 | 685 03 | 0 00E+00 | 9 44E+02 | 1 89E+03 | 1 2500 | 6 581E+13 |
| Eu-154 | 1 5368E-02 | 342 51 | 685 03 | 0 00E+00 | 5 26E+00 | 1 05E+01 | 1 7500 | 4 387E+10 |
| Eu-155 | 2 9233E-02 | 342 51 | 685 03 | 0 00E+00 | 1 00E+01 | 2 01E+01 | 2 2500 | 7 071E+10 |
| Fe-55 | 7 7158E-01 | 342 51 | 685 03 | 0 00E+00 | 2 64E+02 | 5 29E+02 | 2 7500 | 5 611E+08 |
| H-3 | 1 1111E-02 | 342 51 | 685 03 | 0 00E+00 | 3 81E+00 | 7 61E+00 | 3 5000 | 6 530E+07 |
| I-129 | 7 3684E-07 | 342 51 | 685 03 | 0 00E+00 | 2 52E-04 | 5 05E-04 | 5 0000 | 3 778E+02 |
| Kr-85 | 2 5263E-01 | 342 51 | 685 03 | 0 00E+00 | 8 65E+01 | 1 73E+02 | 7 0000 | 4 279E+01 |
| Np-237 | 1 2427E-06 | 342 51 | 685 03 | 0 00E+00 | 4 26E-04 | 8 51E-04 | 11 0000 | 4 876E+00 |
| Pa-231 | 3 8511E-09 | 342 51 | 685 03 | 0 00E+00 | 1 32E-06 | 2 64E-06 | | |
| Pb-210 | 7 3880E-15 | 342 51 | 685 03 | 0 00E+00 | 2 53E-12 | 5 06E-12 | | |
| Pm-147 | 2 1023E+00 | 342 51 | 685 03 | 0 00E+00 | 7 20E+02 | 1 44E+03 | | |
| Pu-238 | 1 0383E-03 | 342 51 | 685 03 | 0 00E+00 | 3 56E-01 | 7 11E-01 | | |
| Pu-239 | 5 5293E-03 | 342 51 | 685 03 | 0 00E+00 | 1 89E+00 | 3 79E+00 | | |
| Pu-240 | 2 1278E-03 | 342 51 | 685 03 | 0 00E+00 | 7 29E-01 | 1 46E+00 | | |
| Pu-241 | 1 0195E-01 | 342 51 | 685 03 | 0 00E+00 | 3 49E+01 | 6 98E+01 | | |
| Pu-242 | 2 3128E-07 | 342 51 | 685 03 | 0 00E+00 | 7 92E-05 | 1 58E-04 | | |
| Ra-226 | 5 2782E-14 | 342 51 | 685 03 | 0 00E+00 | 1 81E-11 | 3 62E-11 | | |
| Ra-228 | 1 9338E-10 | 342 51 | 685 03 | 0 00E+00 | 6 62E-08 | 1 32E-07 | | |
| Ru-106 | 9 1684E-02 | 342 51 | 685 03 | 0 00E+00 | 3 14E+01 | 6 28E+01 | | |
| Se-79 | 1 3018E-05 | 342 51 | 685 03 | 0 00E+00 | 4 46E-03 | 8 92E-03 | | |
| Sn-126 | 1 2167E-05 | 342 51 | 685 03 | 0 00E+00 | 4 17E-03 | 8 33E-03 | | |
| Sr-90 | 2 6045E+00 | 342 51 | 685 03 | 0 00E+00 | 8 92E+02 | 1 78E+03 | | |
| Tc-99 | 4 4241E-04 | 342 51 | 685 03 | 0 00E+00 | 1 52E-01 | 3 03E-01 | | |
| Th-229 | 1 3713E-10 | 342 51 | 685 03 | 0 00E+00 | 4 70E-08 | 9 39E-08 | | |
| Th-230 | 1 8090E-11 | 342 51 | 685 03 | 0 00E+00 | 6 20E-09 | 1 24E-08 | | |
| Th-232 | 2 5278E-10 | 342 51 | 685 03 | 0 00E+00 | 8 66E-08 | 1 73E-07 | | |
| Th-208 | 1 6947E-08 | 342 51 | 685 03 | 0 00E+00 | 5 80E-06 | 1 16E-05 | | |
| U-232 | 4 8737E-08 | 342 51 | 685 03 | 0 00E+00 | 1 67E-05 | 3 34E-05 | | |
| U-233 | 1 2203E-07 | 342 51 | 685 03 | 0 00E+00 | 4 18E-05 | 8 36E-05 | | |
| U-234 | 1 5925E-07 | 342 51 | 685 03 | 0 00E+00 | 5 45E-05 | 1 09E-04 | | |
| U-235 | -2 6194E-06 | 342 51 | 0 00 | 1 29E-02 | 1 20E-02 | 1 29E-02 | | |
| U-236 | 1 2693E-05 | 342 51 | 685 03 | 0 00E+00 | 4 35E-03 | 8 70E-03 | | |
| U-238 | -3 6331E-08 | 342 51 | 0 00 | 8 12E-03 | 8 11E-03 | 8 12E-03 | | |
| Y-90 | 2 6060E+00 | 342 51 | 685 03 | 0 00E+00 | 8 93E+02 | 1 79E+03 | | |
| Other Radionuclides | | | | | 1 23E+03 | 2 47E+03 | | |

Other Radionuclides

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | SST | SST |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 19 78958118 | 10 to 20 1 |

Basis for Parameter Differences

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | | 342 51 |
| Bounding | | 685 03 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|-----------------------------------|
| Nominal | 0 33 | |
| Bounding | 0 67 | |

Estimated EOL HM/Given EOL HM

1 00

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8 5/20 U OF UTAH
SNF ID #: 261
Fuel Units & Descr: 85 - ELEMENT
Heavy Metal Mass: BOL=14 773kg, EOL=14 518kg
ROD Storage Site: INEEL

¹Fuel decay start date: 2035
Estimates as of: 2030
Template: TRIGA-SS (LW/U-Zr, SST, 10 to 20%, U)
²Template Burnup(MWd): 6 65
Template BOL Heavy Metal Mass (MT): 0 000195
Template Decay Time: 5 years

Estimated
Canister usage
18"x10"
0 77

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | Cv/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 5173E-10 | 243 42 | 486 85 | 0 00E+00 | 2 07E-07 | 4 15E-07 | Avg. MeV | |
| Am-241 | 1 8331E-03 | 243 42 | 486 85 | 0 00E+00 | 4 46E-01 | 8 92E-01 | 0 0150 | 7 869E+13 |
| Am-242m | 1 4129E-06 | 243 42 | 486 85 | 0 00E+00 | 3 44E-04 | 6 88E-04 | 0 0250 | 1 731E+13 |
| Am-243 | 1 4774E-07 | 243 42 | 486 85 | 0 00E+00 | 3 60E-05 | 7 19E-05 | 0 0375 | 1 474E+13 |
| C-14 | 1 2871E-04 | 243 42 | 486 85 | 0 00E+00 | 3 13E-02 | 6 27E-02 | 0 0675 | 1 513E+13 |
| Cl-36 | 2 8120E-06 | 243 42 | 486 85 | 0 00E+00 | 6 85E-04 | 1 37E-03 | 0 0850 | 9 376E+12 |
| Cm-243 | 1 7940E-07 | 243 42 | 486 85 | 0 00E+00 | 4 37E-05 | 8 73E-05 | 0 1250 | 6 809E+12 |
| Cm-244 | 1 6962E-06 | 243 42 | 486 85 | 0 00E+00 | 4 13E-04 | 8 26E-04 | 0 2250 | 7 954E+12 |
| Co-60 | 1 2839E+00 | 243 42 | 486 85 | 0 00E+00 | 3 13E+02 | 6 25E+02 | 0 3750 | 4 036E+12 |
| Cs-134 | 9 0541E-02 | 243 42 | 486 85 | 0 00E+00 | 2 20E+01 | 4 41E+01 | 0 5750 | 5 366E+13 |
| Cs-135 | 3 2195E-05 | 243 42 | 486 85 | 0 00E+00 | 7 84E-03 | 1 57E-02 | 0 8500 | 2 303E+12 |
| Cs-137 | 2 7564E+00 | 243 42 | 486 85 | 0 00E+00 | 6 71E+02 | 1 34E+03 | 1 2500 | 4 677E+13 |
| Eu-154 | 1 5368E-02 | 243 42 | 486 85 | 0 00E+00 | 3 74E+00 | 7 48E+00 | 1 7500 | 3 118E+10 |
| Eu-155 | 2 9293E-02 | 243 42 | 486 85 | 0 00E+00 | 7 13E+00 | 1 43E+01 | 2 2500 | 5 025E+10 |
| Fe-55 | 7 7158E-01 | 243 42 | 486 85 | 0 00E+00 | 1 88E+02 | 3 76E+02 | 2 7500 | 3 988E+08 |
| H-3 | 1 1111E-02 | 243 42 | 486 85 | 0 00E+00 | 2 70E+00 | 5 41E+00 | 3 5000 | 4 641E+07 |
| I-129 | 7 3684E-07 | 243 42 | 486 85 | 0 00E+00 | 1 79E-04 | 3 59E-04 | 5 0000 | 2 643E+02 |
| Kr-85 | 2 5263E-01 | 243 42 | 486 85 | 0 00E+00 | 6 15E+01 | 1 23E+02 | 7 0000 | 2 993E+01 |
| Np-237 | 1 2427E-06 | 243 42 | 486 85 | 0 00E+00 | 3 03E-04 | 6 05E-04 | 11 0000 | 3 411E+00 |
| Pa-231 | 3 8511E-09 | 243 42 | 486 85 | 0 00E+00 | 9 37E-07 | 1 87E-06 | | |
| Pb-210 | 7 3880E-15 | 243 42 | 486 85 | 0 00E+00 | 1 80E-12 | 3 60E-12 | | |
| Pm-147 | 2 1023E+00 | 243 42 | 486 85 | 0 00E+00 | 5 12E+02 | 1 02E+03 | | |
| Pu-238 | 1 0383E-03 | 243 42 | 486 85 | 0 00E+00 | 2 53E-01 | 5 06E-01 | | |
| Pu-239 | 5 5293E-03 | 243 42 | 486 85 | 0 00E+00 | 1 35E+00 | 2 69E+00 | | |
| Pu-240 | 2 1278E-03 | 243 42 | 486 85 | 0 00E+00 | 5 18E-01 | 1 04E+00 | | |
| Pu-241 | 1 0195E-01 | 243 42 | 486 85 | 0 00E+00 | 2 48E+01 | 4 96E+01 | | |
| Pu-242 | 2 3128E-07 | 243 42 | 486 85 | 0 00E+00 | 5 63E-05 | 1 13E-04 | | |
| Ra-226 | 5 2782E-14 | 243 42 | 486 85 | 0 00E+00 | 1 28E-11 | 2 57E-11 | | |
| Ra-228 | 1 9338E-10 | 243 42 | 486 85 | 0 00E+00 | 4 71E-08 | 9 41E-08 | | |
| Ru-106 | 9 1684E-02 | 243 42 | 486 85 | 0 00E+00 | 2 23E+01 | 4 46E+01 | | |
| Se-79 | 1 3018E-05 | 243 42 | 486 85 | 0 00E+00 | 3 17E-03 | 6 34E-03 | | |
| Sn-126 | 1 2167E-05 | 243 42 | 486 85 | 0 00E+00 | 2 96E-03 | 5 92E-03 | | |
| Sr-90 | 2 6045E+00 | 243 42 | 486 85 | 0 00E+00 | 6 34E+02 | 1 27E+03 | | |
| Tc-99 | 4 4241E-04 | 243 42 | 486 85 | 0 00E+00 | 1 08E-01 | 2 15E-01 | | |
| Th-229 | 1 3713E-10 | 243 42 | 486 85 | 0 00E+00 | 3 34E-08 | 6 68E-08 | | |
| Th-230 | 1 8090E-11 | 243 42 | 486 85 | 0 00E+00 | 4 40E-09 | 8 81E-09 | | |
| Th-232 | 2 5278E-10 | 243 42 | 486 85 | 0 00E+00 | 6 15E-08 | 1 23E-07 | | |
| Ti-208 | 1 6947E-08 | 243 42 | 486 85 | 0 00E+00 | 4 13E-06 | 8 25E-06 | | |
| U-232 | 4 8737E-08 | 243 42 | 486 85 | 0 00E+00 | 1 19E-05 | 2 37E-05 | Thermal Power | |
| U-233 | 1 2203E-07 | 243 42 | 486 85 | 0 00E+00 | 2 97E-05 | 5 94E-05 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 1 5925E-07 | 243 42 | 486 85 | 0 00E+00 | 3 88E-05 | 7 75E-05 | 1 42E+01 | 2 83E+01 |
| U-235 | -2 6194E-06 | 243 42 | 0 00 | 6 35E-03 | 5 72E-03 | 6 35E-03 | Total | Total |
| U-236 | 1 2693E-05 | 243 42 | 486 85 | 0 00E+00 | 3 09E-03 | 6 18E-03 | | |
| U-238 | -3 6331E-08 | 243 42 | 0 00 | 3 98E-03 | 3 97E-03 | 3 98E-03 | | |
| Y-90 | 2 6060E+00 | 243 42 | 486 85 | 0 00E+00 | 6 34E+02 | 1 27E+03 | | |
| Other Radionuclides | | | | | 8 78E+02 | 1 76E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------------------|-------------------------------|----------------------------------|
| Reactor Moderator: | From SFD LW AND U ZIRC HYDRIDE | Used LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19 8999888 | 10 to 20 1 | |

| Burnup Summary (MWd) ³ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | | 243 42 | |
| Bounding | | 486 85 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0 48 | | |
| Bounding | 0 97 | | 1 00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel.

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8 5/20 UNIV OF MARYLAND
SNF ID #: 260
Fuel Units & Descr: 93 - ELEMENT
Heavy Metal Mass: BOL=17 205kg EOL=16 489kg
ROD Storage Site: INEEL

¹Fuel decay start date: 2035
Estimates as of: 2030

Template: TRIGA-SS (LW/U Zr, SST, 10 to 20% U)
²Template Burnup(MWd): 6 65
Template BOL Heavy Metal Mass (MT): 0 000195
Template Decay Time: 5 years

Estimated
Canister usage:
18"x10"
0 84

| II. Estimates | m | X _a | X _b | b | Y _a | Y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 5173E-10 | 683 59 | 1,367 19 | 0 00E+00 | 5 82E-07 | 1 16E-06 | Avg. MeV | |
| Am-241 | 1 8331E-03 | 683 59 | 1,367 19 | 0 00E+00 | 1 25E+00 | 2 51E+00 | 0 0150 | 2.210E+14 |
| Am-242m | 1 4129E-06 | 683 59 | 1,367 19 | 0 00E+00 | 9 66E-04 | 1 93E-03 | 0 0250 | 4.862E+13 |
| Am-243 | 1 4774E-07 | 683 59 | 1,367 19 | 0 00E+00 | 1 01E-04 | 2 02E-04 | 0 0375 | 4 141E+13 |
| C-14 | 1 2871E-04 | 683 59 | 1,367 19 | 0 00E+00 | 8 80E-02 | 1 76E-01 | 0 0575 | 4.250E+13 |
| Cl-36 | 2 8120E-06 | 683 59 | 1,367 19 | 0 00E+00 | 1 92E-03 | 3 84E-03 | 0 0850 | 2 633E+13 |
| Cm-243 | 1 7940E-07 | 683 59 | 1,367 19 | 0 00E+00 | 1 23E-04 | 2 45E-04 | 0 1250 | 1 912E+13 |
| Cm-244 | 1 6962E-06 | 683 59 | 1,367 19 | 0 00E+00 | 1 16E-03 | 2 32E-03 | 0.2250 | 2.234E+13 |
| Co-60 | 1 2839E+00 | 683 59 | 1,367 19 | 0 00E+00 | 8 78E+02 | 1 76E+03 | 0.3750 | 1 133E+13 |
| Cs-134 | 9 0541E-02 | 683 59 | 1,367 19 | 0 00E+00 | 6 19E+01 | 1 24E+02 | 0 5750 | 1 507E+14 |
| Cs-135 | 3 2195E-05 | 683 59 | 1,367 19 | 0 00E+00 | 2 20E-02 | 4 40E-02 | 0 8500 | 6 467E+12 |
| Cs-137 | 2 7564E+00 | 683 59 | 1,367 19 | 0 00E+00 | 1 88E+03 | 3 77E+03 | 1.2500 | 1 313E+14 |
| Eu-154 | 1 5368E-02 | 683 59 | 1,367 19 | 0 00E+00 | 1 05E+01 | 2 10E+01 | 1 7500 | 8 755E+10 |
| Eu-155 | 2 9293E-02 | 683 59 | 1,367 19 | 0 00E+00 | 2 00E+01 | 4 00E+01 | 2.2500 | 1 411E+11 |
| Fe-55 | 7 7158E-01 | 683 59 | 1,367 19 | 0 00E+00 | 5 27E+02 | 1 05E+03 | 2.7500 | 1 120E+09 |
| H-3 | 1 1111E-02 | 683 59 | 1,367 19 | 0 00E+00 | 7 60E+00 | 1 52E+01 | 3 5000 | 1 303E+08 |
| I-129 | 7 3684E-07 | 683 59 | 1,367 19 | 0 00E+00 | 5 04E-04 | 1 01E-03 | 5 0000 | 7.272E+02 |
| Kr-85 | 2 5263E-01 | 683 59 | 1,367 19 | 0 00E+00 | 1 73E+02 | 3 45E+02 | 7 0000 | 8.232E+01 |
| Np-237 | 1 2427E-06 | 683 59 | 1,367 19 | 0 00E+00 | 8 50E-04 | 1 70E-03 | 11 0000 | 9 378E+00 |
| Pa-231 | 3 8511E-09 | 683 59 | 1,367 19 | 0 00E+00 | 2 63E-06 | 5 27E-06 | | |
| Pb-210 | 7 3880E-15 | 683 59 | 1,367 19 | 0 00E+00 | 5 05E-12 | 1 01E-11 | | |
| Pm-147 | 2 1023E+00 | 683 59 | 1,367 19 | 0 00E+00 | 1 44E+03 | 2 87E+03 | | |
| Pu-238 | 1 0383E-03 | 683 59 | 1,367 19 | 0 00E+00 | 7 10E-01 | 1 42E+00 | | |
| Pu-239 | 5 5293E-03 | 683 59 | 1,367 19 | 0 00E+00 | 3 78E+00 | 7 56E+00 | | |
| Pu-240 | 2 1278E-03 | 683 59 | 1,367 19 | 0 00E+00 | 1 45E+00 | 2 91E+00 | | |
| Pu-241 | 1 0195E-01 | 683 59 | 1,367 19 | 0 00E+00 | 6 97E+01 | 1 39E+02 | | |
| Pu-242 | 2 3128E-07 | 683 59 | 1,367 19 | 0 00E+00 | 1 58E-04 | 3 16E-04 | | |
| Ra-226 | 5 2782E-14 | 683 59 | 1,367 19 | 0 00E+00 | 3 61E-11 | 7.22E-11 | | |
| Ra-228 | 1 9338E-10 | 683 59 | 1,367 19 | 0 00E+00 | 1 32E-07 | 2 64E-07 | | |
| Ru-106 | 9 1684E-02 | 683 59 | 1,367 19 | 0 00E+00 | 6.27E+01 | 1.25E+02 | | |
| Se-79 | 1.3018E-05 | 683 59 | 1,367 19 | 0 00E+00 | 8 90E-03 | 1 78E-02 | | |
| Sn-126 | 1.2167E-05 | 683 59 | 1,367 19 | 0 00E+00 | 8 32E-03 | 1 66E-02 | | |
| Sr-90 | 2 6045E+00 | 683 59 | 1,367 19 | 0 00E+00 | 1.78E+03 | 3.56E+03 | | |
| Tc-99 | 4 4241E-04 | 683 59 | 1,367 19 | 0 00E+00 | 3 02E-01 | 6 05E-01 | | |
| Th-229 | 1.3713E-10 | 683 59 | 1,367 19 | 0 00E+00 | 9 37E-08 | 1 87E-07 | | |
| Th-230 | 1 8090E-11 | 683 59 | 1,367 19 | 0 00E+00 | 1.24E-08 | 2 47E-08 | | |
| Th-232 | 2.5278E-10 | 683 59 | 1,367 19 | 0 00E+00 | 1 73E-07 | 3 46E-07 | | |
| Th-208 | 1 6947E-08 | 683 59 | 1,367 19 | 0 00E+00 | 1 16E-05 | 2.32E-05 | | |
| U-232 | 4 8737E-08 | 683 59 | 1,367 19 | 0 00E+00 | 3 33E-05 | 6 66E-05 | | |
| U-233 | 1.2203E-07 | 683 59 | 1,367 19 | 0 00E+00 | 8 34E-05 | 1 67E-04 | | |
| U-234 | 1.5925E-07 | 683 59 | 1,367 19 | 0 00E+00 | 1 09E-04 | 2.18E-04 | | |
| U-235 | -2 6194E-06 | 683 59 | 0 00 | 7 44E-03 | 5 65E-03 | 7 44E-03 | | |
| U-236 | 1.2693E-05 | 683 59 | 1,367 19 | 0 00E+00 | 8 68E-03 | 1.74E-02 | | |
| U-238 | -3 6331E-08 | 683 59 | 0 00 | 4 63E-03 | 4 60E-03 | 4 63E-03 | | |
| Y-90 | 2 6060E+00 | 683 59 | 1,367 19 | 0 00E+00 | 1 78E+03 | 3.56E+03 | | |
| Other Radionuclides | | | | | 2 46E+03 | 4 93E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------------------|-------------------------------|----------------------------------|
| Reactor Moderator: | From SFD LW AND U ZIRC HYDRIDE | Used LW AND U ZIRC HYDRIDE | |
| Fuel Cladding: | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 | 10 to 20 1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal: | | 683 59 | |
| Bounding: | | 1 367 19 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|-----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal: | 1 17 | | |
| Bounding: | 2.33 | | 1 00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel.

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 8 5/20 UNIV OF CAL-IRVINE
SNF ID # 264
Fuel Units & Descr 104 - ELEMENT
Heavy Metal Mass BOL=19 926kg EOL=19 77kg
ROD Storage Site INEEL

¹Fuel decay start date 2035
Estimates as of 2030
Template TRIGA-SS (LW/U-Zrx, SST, 10 to 20%, U)
²Template Burnup(MWd): 6 65
Template BOL Heavy Metal Mass (MT) 0 000195
Template Decay Time 5 years

Estimated
Canister usage:
18"x10"
0.94

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 5173E-10 | 148 92 | 297 84 | 0 00E+00 | 1 27E-07 | 2 54E-07 | Avg MeV | |
| Am-241 | 1 8331E-03 | 148 92 | 297 84 | 0 00E+00 | 2 73E-01 | 5 46E-01 | 0 0150 | 4 814E+13 |
| Am-242m | 1 4129E-06 | 148 92 | 297 84 | 0 00E+00 | 2 10E-04 | 4 21E-04 | 0 0250 | 1 059E+13 |
| Am-243 | 1 4774E-07 | 148 92 | 297 84 | 0 00E+00 | 2 20E-05 | 4 40E-05 | 0 0375 | 9 020E+12 |
| C-14 | 1 2871E-04 | 148 92 | 297 84 | 0 00E+00 | 1 92E-02 | 3 83E-02 | 0 0575 | 9 259E+12 |
| Cl-36 | 2 8120E-06 | 148 92 | 297 84 | 0 00E+00 | 4 19E-04 | 8 38E-04 | 0 0850 | 5 736E+12 |
| Cm-243 | 1 7940E-07 | 148 92 | 297 84 | 0 00E+00 | 2 67E-05 | 5 34E-05 | 0 1250 | 4 165E+12 |
| Cm-244 | 1 6962E-06 | 148 92 | 297 84 | 0 00E+00 | 2 53E-04 | 5 05E-04 | 0 2250 | 4 866E+12 |
| Co-60 | 1 2839E+00 | 148 92 | 297 84 | 0 00E+00 | 1 91E+02 | 3 82E+02 | 0 3750 | 2 469E+12 |
| Cs-134 | 9 0541E-02 | 148 92 | 297 84 | 0 00E+00 | 1 35E+01 | 2 70E+01 | 0 5750 | 3 283E+13 |
| Cs-135 | 3 2195E-05 | 148 92 | 297 84 | 0 00E+00 | 4 79E-03 | 9 59E-03 | 0 8500 | 1 409E+12 |
| Cs-137 | 2 7564E+00 | 148 92 | 297 84 | 0 00E+00 | 4 10E+02 | 8 21E+02 | 1 2500 | 2 861E+13 |
| Eu-154 | 1 5368E-02 | 148 92 | 297 84 | 0 00E+00 | 2 29E+00 | 4 58E+00 | 1 7500 | 1 907E+10 |
| Eu-155 | 2 9293E-02 | 148 92 | 297 84 | 0 00E+00 | 4 36E+00 | 8 72E+00 | 2 2500 | 3 074E+10 |
| Fe-55 | 7 7158E-01 | 148 92 | 297 84 | 0 00E+00 | 1 15E+02 | 2 30E+02 | 2 7500 | 2 440E+08 |
| H-3 | 1 1111E-02 | 148 92 | 297 84 | 0 00E+00 | 1 65E+00 | 3 31E+00 | 3 5000 | 2 839E+07 |
| I-129 | 7 3684E-07 | 148 92 | 297 84 | 0 00E+00 | 1 10E-04 | 2 19E-04 | 5 0000 | 1 685E+02 |
| Kr-85 | 2 5263E-01 | 148 92 | 297 84 | 0 00E+00 | 3 76E+01 | 7 52E+01 | 7 0000 | 1 909E+01 |
| Np-237 | 1 2427E-06 | 148 92 | 297 84 | 0 00E+00 | 1 85E-04 | 3 70E-04 | 11 0000 | 2 176E+00 |
| Pa-231 | 3 8511E-09 | 148 92 | 297 84 | 0 00E+00 | 5 74E-07 | 1 15E-06 | | |
| Pb-210 | 7 3880E-15 | 148 92 | 297 84 | 0 00E+00 | 1 10E-12 | 2 20E-12 | | |
| Pm-147 | 2 1023E+00 | 148 92 | 297 84 | 0 00E+00 | 3 13E+02 | 6 26E+02 | | |
| Pu-238 | 1 0383E-03 | 148 92 | 297 84 | 0 00E+00 | 1 55E-01 | 3 09E-01 | | |
| Pu-239 | 5 5293E-03 | 148 92 | 297 84 | 0 00E+00 | 8 23E-01 | 1 65E+00 | | |
| Pu-240 | 2 1278E-03 | 148 92 | 297 84 | 0 00E+00 | 3 17E-01 | 6 34E-01 | | |
| Pu-241 | 1 0195E-01 | 148 92 | 297 84 | 0 00E+00 | 1 52E+01 | 3 04E+01 | | |
| Pu-242 | 2 3128E-07 | 148 92 | 297 84 | 0 00E+00 | 3 44E-05 | 6 89E-05 | | |
| Ra-226 | 5 2782E-14 | 148 92 | 297 84 | 0 00E+00 | 7 86E-12 | 1 57E-11 | | |
| Ra-228 | 1 9338E-10 | 148 92 | 297 84 | 0 00E+00 | 2 88E-08 | 5 76E-08 | | |
| Ru-106 | 9 1684E-02 | 148 92 | 297 84 | 0 00E+00 | 1 37E+01 | 2 73E+01 | | |
| Se-79 | 1 3018E-05 | 148 92 | 297 84 | 0 00E+00 | 1 94E-03 | 3 88E-03 | | |
| Sn-126 | 1 2167E-05 | 148 92 | 297 84 | 0 00E+00 | 1 81E-03 | 3 62E-03 | | |
| Sr-90 | 2 6045E+00 | 148 92 | 297 84 | 0 00E+00 | 3 88E+02 | 7 76E+02 | | |
| Tc-99 | 4 4241E-04 | 148 92 | 297 84 | 0 00E+00 | 6 59E-02 | 1 32E-01 | | |
| Th-229 | 1 3713E-10 | 148 92 | 297 84 | 0 00E+00 | 2 04E-08 | 4 08E-08 | | |
| Th-230 | 1 8090E-11 | 148 92 | 297 84 | 0 00E+00 | 2 69E-09 | 5 39E-09 | | |
| Th-232 | 2 5278E-10 | 148 92 | 297 84 | 0 00E+00 | 3 76E-08 | 7 53E-08 | | |
| Ti-208 | 1 6947E-08 | 148 92 | 297 84 | 0 00E+00 | 2 52E-06 | 5 05E-06 | | |
| U-232 | 4 8737E-08 | 148 92 | 297 84 | 0 00E+00 | 7 26E-06 | 1 45E-05 | | |
| U-233 | 1 2203E-07 | 148 92 | 297 84 | 0 00E+00 | 1 82E-05 | 3 63E-05 | Thermal Power | |
| U-234 | 1 5925E-07 | 148 92 | 297 84 | 0 00E+00 | 2 37E-05 | 4 74E-05 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-235 | -2 6194E-06 | 148 92 | 0 00 | 8 61E-03 | 8 22E-03 | 8 61E-03 | 8 67E+00 | 1 73E+01 |
| U-236 | 1 2693E-05 | 148 92 | 297 84 | 0 00E+00 | 1 89E-03 | 3 78E-03 | Total | Total |
| U-238 | -3 6331E-08 | 148 92 | 0 00 | 5 36E-03 | 5 35E-03 | 5 36E-03 | | |
| Y-90 | 2 6060E+00 | 148 92 | 297 84 | 0 00E+00 | 3 88E+02 | 7 76E+02 | | |
| Other Radionuclides | | | | | 5 37E+02 | 1 07E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | SST | SST |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 20 00002088 | 10 to 20 1 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | | 148 92 |
| Bounding | | 297 84 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed.
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|-----------------------------------|
| Nominal | 0.22 | |
| Bounding | 0.44 | |

Estimated EOL HM/Given EOL HM

1 00

¹Reactor shutdown, core removal, storage shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8 5/20 UNIV OF WISCONSIN
 SNF ID #: 262
 Fuel Units & Descr: 128 - ELEMENT
 Heavy Metal Mass: BOL=24.96kg, EOL=22.182kg
 ROD Storage Site: INEEL

¹Fuel decay start date: 2035
 Estimates as of: 2030
 Template: TRIGA-SS (LW/U-Zr, SST, 10 to 20%, U)
²Template Burnup(MWd): 6.65
 Template BOL Heavy Metal Mass (MT): 0.000195
 Template Decay Time: 5 years

Estimated
 Canister usage
 18"x10"
 1 15

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Cu/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.5173E-10 | 2.651 52 | 5.303 03 | 0.00E+00 | 2.26E-06 | 4.52E-06 | Avg MeV | |
| Am-241 | 1.8331E-03 | 2.651 52 | 5.303 03 | 0.00E+00 | 4.86E+00 | 9.72E+00 | 0.0150 | 8.571E+14 |
| Am-242m | 1.4129E-06 | 2.651 52 | 5.303 03 | 0.00E+00 | 3.75E-03 | 7.49E-03 | 0.0250 | 1.886E+14 |
| Am-243 | 1.4774E-07 | 2.651 52 | 5.303 03 | 0.00E+00 | 3.92E-04 | 7.83E-04 | 0.0375 | 1.606E+14 |
| C-14 | 1.2871E-04 | 2.651 52 | 5.303 03 | 0.00E+00 | 3.41E-01 | 6.83E-01 | 0.0575 | 1.649E+14 |
| Cl-36 | 2.8120E-06 | 2.651 52 | 5.303 03 | 0.00E+00 | 7.46E-03 | 1.49E-02 | 0.0850 | 1.021E+14 |
| Cm-243 | 1.7940E-07 | 2.651 52 | 5.303 03 | 0.00E+00 | 4.76E-04 | 9.51E-04 | 0.1250 | 7.416E+13 |
| Cm-244 | 1.6962E-06 | 2.651 52 | 5.303 03 | 0.00E+00 | 4.50E-03 | 9.00E-03 | 0.2250 | 8.664E+13 |
| Co-60 | 1.2839E+00 | 2.651 52 | 5.303 03 | 0.00E+00 | 3.40E+03 | 6.81E+03 | 0.3750 | 4.397E+13 |
| Cs-134 | 9.0541E-02 | 2.651 52 | 5.303 03 | 0.00E+00 | 2.40E+02 | 4.80E+02 | 0.5750 | 5.845E+14 |
| Cs-135 | 3.2195E-05 | 2.651 52 | 5.303 03 | 0.00E+00 | 8.54E-02 | 1.71E-01 | 0.8500 | 2.509E+13 |
| Cs-137 | 2.7564E+00 | 2.651 52 | 5.303 03 | 0.00E+00 | 7.31E+03 | 1.46E+04 | 1.2500 | 5.094E+14 |
| Eu-154 | 1.5368E-02 | 2.651 52 | 5.303 03 | 0.00E+00 | 4.07E+01 | 8.15E+01 | 1.7500 | 3.396E+11 |
| Eu-155 | 2.9293E-02 | 2.651 52 | 5.303 03 | 0.00E+00 | 7.77E+01 | 1.55E+02 | 2.2500 | 5.474E+11 |
| Fe-55 | 7.7158E-01 | 2.651 52 | 5.303 03 | 0.00E+00 | 2.05E+03 | 4.09E+03 | 2.7500 | 4.344E+09 |
| H-3 | 1.1111E-02 | 2.651 52 | 5.303 03 | 0.00E+00 | 2.95E+01 | 5.89E+01 | 3.5000 | 5.055E+08 |
| I-129 | 7.3684E-07 | 2.651 52 | 5.303 03 | 0.00E+00 | 1.95E-03 | 3.91E-03 | 5.0000 | 2.795E+03 |
| Kr-85 | 2.5263E-01 | 2.651 52 | 5.303 03 | 0.00E+00 | 6.70E+02 | 1.34E+03 | 7.0000 | 3.163E+02 |
| Np-237 | 1.2427E-06 | 2.651 52 | 5.303 03 | 0.00E+00 | 3.30E-03 | 6.59E-03 | 11.0000 | 3.603E+01 |
| Pa-231 | 3.8511E-09 | 2.651 52 | 5.303 03 | 0.00E+00 | 1.02E-05 | 2.04E-05 | | |
| Pb-210 | 7.3880E-15 | 2.651 52 | 5.303 03 | 0.00E+00 | 1.96E-11 | 3.92E-11 | | |
| Pm-147 | 2.1023E+00 | 2.651 52 | 5.303 03 | 0.00E+00 | 5.57E+03 | 1.11E+04 | | |
| Pu-238 | 1.0383E-03 | 2.651 52 | 5.303 03 | 0.00E+00 | 2.75E+00 | 5.51E+00 | | |
| Pu-239 | 5.5293E-03 | 2.651 52 | 5.303 03 | 0.00E+00 | 1.47E+01 | 2.93E+01 | | |
| Pu-240 | 2.1278E-03 | 2.651 52 | 5.303 03 | 0.00E+00 | 5.64E+00 | 1.13E+01 | | |
| Pu-241 | 1.0195E-01 | 2.651 52 | 5.303 03 | 0.00E+00 | 2.70E+02 | 5.41E+02 | | |
| Pu-242 | 2.3128E-07 | 2.651 52 | 5.303 03 | 0.00E+00 | 6.13E-04 | 1.23E-03 | | |
| Ra-226 | 5.2782E-14 | 2.651 52 | 5.303 03 | 0.00E+00 | 1.40E-10 | 2.80E-10 | | |
| Ra-228 | 1.9338E-10 | 2.651 52 | 5.303 03 | 0.00E+00 | 5.13E-07 | 1.03E-06 | | |
| Ru-106 | 9.1684E-02 | 2.651 52 | 5.303 03 | 0.00E+00 | 2.43E+02 | 4.86E+02 | | |
| Se-79 | 1.3018E-05 | 2.651 52 | 5.303 03 | 0.00E+00 | 3.45E-02 | 6.90E-02 | | |
| Sn-126 | 1.2167E-05 | 2.651 52 | 5.303 03 | 0.00E+00 | 3.23E-02 | 6.45E-02 | | |
| Sr-90 | 2.6045E+00 | 2.651 52 | 5.303 03 | 0.00E+00 | 6.91E+03 | 1.38E+04 | | |
| Tc-99 | 4.4241E-04 | 2.651 52 | 5.303 03 | 0.00E+00 | 1.17E+00 | 2.35E+00 | | |
| Th-229 | 1.3713E-10 | 2.651 52 | 5.303 03 | 0.00E+00 | 3.64E-07 | 7.27E-07 | | |
| Th-230 | 1.8090E-11 | 2.651 52 | 5.303 03 | 0.00E+00 | 4.80E-08 | 9.59E-08 | | |
| Th-232 | 2.5278E-10 | 2.651 52 | 5.303 03 | 0.00E+00 | 6.70E-07 | 1.34E-06 | | |
| Ti-208 | 1.6947E-08 | 2.651 52 | 5.303 03 | 0.00E+00 | 4.49E-05 | 8.99E-05 | | |
| U-232 | 4.8737E-08 | 2.651 52 | 5.303 03 | 0.00E+00 | 1.29E-04 | 2.58E-04 | | |
| U-233 | 1.2203E-07 | 2.651 52 | 5.303 03 | 0.00E+00 | 3.24E-04 | 6.47E-04 | | |
| U-234 | 1.5925E-07 | 2.651 52 | 5.303 03 | 0.00E+00 | 4.22E-04 | 8.44E-04 | | |
| U-235 | -2.6194E-06 | 2.651 52 | 0.00 | 1.08E-02 | 3.84E-03 | 1.08E-02 | | |
| U-236 | 1.2693E-05 | 2.651 52 | 5.303 03 | 0.00E+00 | 3.37E-02 | 6.73E-02 | | |
| U-238 | -3.6331E-08 | 2.651 52 | 0.00 | 6.71E-03 | 6.61E-03 | 6.71E-03 | | |
| Y-90 | 2.6060E+00 | 2.651 52 | 5.303 03 | 0.00E+00 | 6.91E+03 | 1.38E+04 | | |
| Other Radionuclides | | | | | 9.56E+03 | 1.91E+04 | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 1.54E+02 | 3.09E+02 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding | SST | SST |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 20 | 10 to 20.1 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | | 2.651 52 |
| Bounding | | 5.303 03 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed.
 Bounding burnup assumed to be twice nominal burnup.

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|-----------------------------------|
| Nominal | 3.12 | |
| Bounding | 6.23 | |

Estimated EOL HM/Given EOL HM
 1.00

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 8.5/20 USGS
SNF ID # 964

Fuel Units & Descr 1 - ELEMENT

Heavy Metal Mass BOL=0 184kg EOL=0 183kg

ROD Storage Site INEEL

*Fuel decay start date

2035

Estimates as of

2030

Template

TRIGA SS (LW/U-Zrx SST, 10 to 20%, U)

*Template Burnup(MWd)

6 65

Template BOL Heavy Metal Mass (MT):

0 000195

Template Decay Time

5 years

Estimated

Canister usage

18"x10"

0 01

II. Estimates

| | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 5173E-10 | 0 76 | 1 53 | 0 00E+00 | 6 50E-10 | 1 30E-09 | Avg MeV | |
| Am-241 | 1 8331E-03 | 0 76 | 1 53 | 0 00E+00 | 1 40E-03 | 2 80E-03 | 0 0150 | 2 469E+11 |
| Am-242m | 1 4129E-06 | 0 76 | 1 53 | 0 00E+00 | 1 08E-06 | 2 16E-06 | 0 0250 | 5 432E+10 |
| Am-243 | 1 4774E-07 | 0 76 | 1 53 | 0 00E+00 | 1 13E-07 | 2 26E-07 | 0 0375 | 4 626E+10 |
| C-14 | 1 2871E-04 | 0 76 | 1 53 | 0 00E+00 | 9 83E-05 | 1 97E-04 | 0 0575 | 4 748E+10 |
| Cl-36 | 2 8120E-06 | 0 76 | 1 53 | 0 00E+00 | 2 15E-06 | 4 30E-06 | 0 0850 | 2 942E+10 |
| Cm-243 | 1 7940E-07 | 0 76 | 1 53 | 0 00E+00 | 1 37E-07 | 2 74E-07 | 0 1250 | 2 136E+10 |
| Cm-244 | 1 6962E-06 | 0 76 | 1 53 | 0 00E+00 | 1 30E-06 | 2 59E-06 | 0 2250 | 2 495E+10 |
| Co-60 | 1 2839E+00 | 0 76 | 1 53 | 0 00E+00 | 9 81E-01 | 1 96E+00 | 0 3750 | 1 266E+10 |
| Cs-134 | 9 0541E-02 | 0 76 | 1 53 | 0 00E+00 | 6 91E-02 | 1 38E-01 | 0 5750 | 1 683E+11 |
| Cs-135 | 3 2195E-05 | 0 76 | 1 53 | 0 00E+00 | 2 46E-05 | 4 92E-05 | 0 8500 | 7 225E+09 |
| Cs-137 | 2 7564E+00 | 0 76 | 1 53 | 0 00E+00 | 2 11E+00 | 4 21E+00 | 1 2500 | 1 467E+11 |
| Eu-154 | 1 5368E-02 | 0 76 | 1 53 | 0 00E+00 | 1 17E-02 | 2 35E-02 | 1 7500 | 9 781E+07 |
| Eu-155 | 2 9293E-02 | 0 76 | 1 53 | 0 00E+00 | 2 24E-02 | 4 47E-02 | 2 2500 | 1 577E+08 |
| Fe-55 | 7 7158E-01 | 0 76 | 1 53 | 0 00E+00 | 5 89E-01 | 1 18E+00 | 2 7500 | 1 251E+06 |
| H-3 | 1 1111E-02 | 0 76 | 1 53 | 0 00E+00 | 8 49E-03 | 1 70E-02 | 3 5000 | 1 456E+05 |
| I-129 | 7 3684E-07 | 0 76 | 1 53 | 0 00E+00 | 5 63E-07 | 1 13E-06 | 5 0000 | 9 154E-01 |
| Kr-85 | 2 5263E-01 | 0 76 | 1 53 | 0 00E+00 | 1 93E-01 | 3 86E-01 | 7 0000 | 1 038E-01 |
| Np-237 | 1 2427E-06 | 0 76 | 1 53 | 0 00E+00 | 9 49E-07 | 1 90E-06 | 11 0000 | 1 184E-02 |
| Pa-231 | 3 8511E-09 | 0 76 | 1 53 | 0 00E+00 | 2 94E-09 | 5 88E-09 | | |
| Pb-210 | 7 3880E-15 | 0 76 | 1 53 | 0 00E+00 | 5 64E-15 | 1 13E-14 | | |
| Pm-147 | 2 1023E+00 | 0 76 | 1 53 | 0 00E+00 | 1 61E+00 | 3 21E+00 | | |
| Pu-238 | 1 0383E-03 | 0 76 | 1 53 | 0 00E+00 | 7 93E-04 | 1 59E-03 | | |
| Pu-239 | 5 5293E-03 | 0 76 | 1 53 | 0 00E+00 | 4 22E-03 | 8 45E-03 | | |
| Pu-240 | 2 1278E-03 | 0 76 | 1 53 | 0 00E+00 | 1 62E-03 | 3 25E-03 | | |
| Pu-241 | 1 0195E-01 | 0 76 | 1 53 | 0 00E+00 | 7 79E-02 | 1 56E-01 | | |
| Pu-242 | 2 3128E-07 | 0 76 | 1 53 | 0 00E+00 | 1 77E-07 | 3 53E-07 | | |
| Ra-226 | 5 2782E-14 | 0 76 | 1 53 | 0 00E+00 | 4 03E-14 | 8 06E-14 | | |
| Ra-228 | 1 9338E-10 | 0 76 | 1 53 | 0 00E+00 | 1 48E-10 | 2 95E-10 | | |
| Ru-106 | 9 1684E-02 | 0 76 | 1 53 | 0 00E+00 | 7 00E-02 | 1 40E-01 | | |
| Se-79 | 1 3018E-05 | 0 76 | 1 53 | 0 00E+00 | 9 94E-06 | 1 99E-05 | | |
| Sn-126 | 1 2167E-05 | 0 76 | 1 53 | 0 00E+00 | 9 29E-06 | 1 86E-05 | | |
| Sr-90 | 2 6045E+00 | 0 76 | 1 53 | 0 00E+00 | 1 99E+00 | 3 98E+00 | | |
| Tc-99 | 4 4241E-04 | 0 76 | 1 53 | 0 00E+00 | 3 38E-04 | 6 76E-04 | | |
| Th-229 | 1 3713E-10 | 0 76 | 1 53 | 0 00E+00 | 1 05E-10 | 2 09E-10 | | |
| Th-230 | 1 8090E-11 | 0 76 | 1 53 | 0 00E+00 | 1 38E-11 | 2 76E-11 | | |
| Th-232 | 2 5278E-10 | 0 76 | 1 53 | 0 00E+00 | 1 93E-10 | 3 86E-10 | | |
| Ti-208 | 1 6947E-08 | 0 76 | 1 53 | 0 00E+00 | 1 29E-08 | 2 59E-08 | | |
| U-232 | 4 8737E-08 | 0 76 | 1 53 | 0 00E+00 | 3 72E-08 | 7 44E-08 | | |
| U-233 | 1 2203E-07 | 0 76 | 1 53 | 0 00E+00 | 9 32E-08 | 1 86E-07 | | |
| U-234 | 1 5925E-07 | 0 76 | 1 53 | 0 00E+00 | 1 22E-07 | 2 43E-07 | | |
| U-235 | -2 6194E-06 | 0 76 | 0 00 | 7 79E-05 | 7 59E-05 | 7 79E-05 | | |
| U-236 | 1 2693E-05 | 0 76 | 1 53 | 0 00E+00 | 9 69E-06 | 1 94E-05 | | |
| U-238 | -3 6331E-08 | 0 76 | 0 00 | 4 97E-05 | 4 97E-05 | 4 97E-05 | | |
| Y-90 | 2 6060E+00 | 0 76 | 1 53 | 0 00E+00 | 1 99E+00 | 3 98E+00 | | |
| Other Radionuclides | | | | | 2 75E+00 | 5 51E+00 | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 4 44E-02 | 8 89E-02 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-----------------------|-----------------------|
| Reactor Moderator: | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE |
| Fuel Cladding: | SST | SST |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 19 58243102 | 10 to 20 1 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | | 0 76 |
| Bounding | | 1 53 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed.
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|--------------------------------|
| Nominal | 0 12 | |
| Bounding | 0 24 | |

Estimated EOL HM/ Given EOL HM

1 00

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

*Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRIGA STD 8.5/20 WSU
SNF ID #: 268
Fuel Units & Descr: 137 - ELEMENT
Heavy Metal Mass: BOL=26 715kg EOL=23 482kg
ROD Storage Site: INEEL

¹Fuel decay start date: 2035
Estimates as of: 2030

Template: TRIGA-SS (LW/U-Zr, SST, 10 to 20% U)

²Template Burnup(MWd): 6 65

Template BOL Heavy Metal Mass (MT) 0.000195

Template Decay Time 5 years

Estimated
Canister usage
18"x10"
1 23

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 5173E-10 | 3,086 44 | 6,172 87 | 0 00E+00 | 2 63E-06 | 5 26E-06 | Avg. MeV | |
| Am-241 | 1 8331E-03 | 3,086 44 | 6,172 87 | 0 00E+00 | 5 66E+00 | 1 13E+01 | 0 0150 | 9 977E+14 |
| Am-242m | 1 4129E-06 | 3,086 44 | 6,172 87 | 0 00E+00 | 4 36E-03 | 8 72E-03 | 0 0250 | 2 195E+14 |
| Am-243 | 1 4774E-07 | 3,086 44 | 6,172 87 | 0 00E+00 | 4 56E-04 | 9 12E-04 | 0 0375 | 1 869E+14 |
| C-14 | 1 2871E-04 | 3,086 44 | 6,172 87 | 0 00E+00 | 3 97E-01 | 7 94E-01 | 0 0575 | 1 919E+14 |
| Cl-36 | 2 8120E-06 | 3,086 44 | 6,172 87 | 0 00E+00 | 8 68E-03 | 1 74E-02 | 0 0850 | 1 189E+14 |
| Cm-243 | 1 7940E-07 | 3,086 44 | 6,172 87 | 0 00E+00 | 5 54E-04 | 1 11E-03 | 0 1250 | 8 633E+13 |
| Cm-244 | 1 6962E-06 | 3,086 44 | 6,172 87 | 0 00E+00 | 5 24E-03 | 1 05E-02 | 0 2250 | 1 008E+14 |
| Co-60 | 1 2839E+00 | 3,086 44 | 6,172 87 | 0 00E+00 | 3 96E+03 | 7 93E+03 | 0 3750 | 5 118E+13 |
| Cs-134 | 9 0541E-02 | 3,086 44 | 6,172 87 | 0 00E+00 | 2 79E+02 | 5 59E+02 | 0 5750 | 6 804E+14 |
| Cs-135 | 3 2195E-05 | 3,086 44 | 6,172 87 | 0 00E+00 | 9 94E-02 | 1 99E-01 | 0 8500 | 2 920E+13 |
| Cs-137 | 2 7564E+00 | 3,086 44 | 6,172 87 | 0 00E+00 | 8 51E+03 | 1 70E+04 | 1 2500 | 5 930E+14 |
| Eu-154 | 1 5368E-02 | 3,086 44 | 6,172 87 | 0 00E+00 | 4 74E+01 | 9 49E+01 | 1 7500 | 3 953E+11 |
| Eu-155 | 2 9293E-02 | 3,086 44 | 6,172 87 | 0 00E+00 | 9 04E+01 | 1 81E+02 | 2 2500 | 6 371E+11 |
| Fe-55 | 7 7158E-01 | 3,086 44 | 6,172 87 | 0 00E+00 | 2 38E+03 | 4 76E+03 | 2 7500 | 5 056E+09 |
| H-3 | 1 1111E-02 | 3 086 44 | 6,172 87 | 0 00E+00 | 3 43E+01 | 6 86E+01 | 3 5000 | 5 884E+08 |
| I-129 | 7 3684E-07 | 3,086 44 | 6,172 87 | 0 00E+00 | 2 27E-03 | 4 55E-03 | 5 0000 | 3 252E+03 |
| Kr-85 | 2 5263E-01 | 3,086 44 | 6,172 87 | 0 00E+00 | 7 80E+02 | 1 56E+03 | 7 0000 | 3 680E+02 |
| Np-237 | 1 2427E-06 | 3,086 44 | 6,172 87 | 0 00E+00 | 3 84E-03 | 7 67E-03 | 11 0000 | 4 192E+01 |
| Pa-231 | 3 8511E-09 | 3,086 44 | 6,172 87 | 0 00E+00 | 1 19E-05 | 2 38E-05 | | |
| Pb-210 | 7 3880E-15 | 3,086 44 | 6,172 87 | 0 00E+00 | 2 28E-11 | 4 56E-11 | | |
| Pm-147 | 2 1023E+00 | 3,086 44 | 6,172 87 | 0 00E+00 | 6 49E+03 | 1 30E+04 | | |
| Pu-238 | 1 0383E-03 | 3,086 44 | 6,172 87 | 0 00E+00 | 3 20E+00 | 6 41E+00 | | |
| Pu-239 | 5 5293E-03 | 3,086 44 | 6,172 87 | 0 00E+00 | 1 71E+01 | 3 41E+01 | | |
| Pu-240 | 2 1278E-03 | 3,086 44 | 6,172 87 | 0 00E+00 | 6 57E+00 | 1 31E+01 | | |
| Pu-241 | 1 0195E-01 | 3,086 44 | 6,172 87 | 0 00E+00 | 3 15E+02 | 6 29E+02 | | |
| Pu-242 | 2 3128E-07 | 3,086 44 | 6,172 87 | 0 00E+00 | 7 14E-04 | 1 43E-03 | | |
| Ra-226 | 5 2782E-14 | 3,086 44 | 6,172 87 | 0 00E+00 | 1 63E-10 | 3 26E-10 | | |
| Ra-228 | 1 9338E-10 | 3,086 44 | 6,172 87 | 0 00E+00 | 5 97E-07 | 1 19E-06 | | |
| Ru-106 | 9 1684E-02 | 3,086 44 | 6,172 87 | 0 00E+00 | 2 83E+02 | 5 66E+02 | | |
| Se-79 | 1 3018E-05 | 3,086 44 | 6,172 87 | 0 00E+00 | 4 02E-02 | 8 04E-02 | | |
| Sn-126 | 1 2167E-05 | 3,086 44 | 6,172 87 | 0 00E+00 | 3 76E-02 | 7 51E-02 | | |
| Sr-90 | 2 6045E+00 | 3,086 44 | 6,172 87 | 0 00E+00 | 8 04E+03 | 1 61E+04 | | |
| Tc-99 | 4 4241E-04 | 3,086 44 | 6,172 87 | 0 00E+00 | 1 37E+00 | 2 73E+00 | | |
| Th-229 | 1 3713E-10 | 3,086 44 | 6,172 87 | 0 00E+00 | 4 23E-07 | 8 46E-07 | | |
| Th-230 | 1 8090E-11 | 3 086 44 | 6,172 87 | 0 00E+00 | 5 58E-08 | 1 12E-07 | | |
| Th-232 | 2 5278E-10 | 3,086 44 | 6,172 87 | 0 00E+00 | 7 80E-07 | 1 56E-06 | | |
| Ti-208 | 1 6947E-08 | 3,086 44 | 6,172 87 | 0 00E+00 | 5 23E-05 | 1 05E-04 | | |
| U-232 | 4 8737E-08 | 3,086 44 | 6,172 87 | 0 00E+00 | 1 50E-04 | 3 01E-04 | | |
| U-233 | 1 2203E-07 | 3,086 44 | 6,172 87 | 0 00E+00 | 3 77E-04 | 7 53E-04 | | |
| U-234 | 1 5925E-07 | 3,086 44 | 6,172 87 | 0 00E+00 | 4 92E-04 | 9 83E-04 | | |
| U-235 | -2 6194E-06 | 3 086 44 | 0 00 | 1 14E-02 | 3 35E-03 | 1 14E-02 | | |
| U-236 | 1 2693E-05 | 3,086 44 | 6,172 87 | 0 00E+00 | 3 92E-02 | 7 84E-02 | | |
| U-238 | -3 6331E-08 | 3,086 44 | 0 00 | 7 20E-03 | 7 09E-03 | 7 20E-03 | | |
| Y-90 | 2 6060E+00 | 3,086 44 | 6,172 87 | 0 00E+00 | 8 04E+03 | 1 61E+04 | | |
| Other Radionuclides | | | | | 1 11E+04 | 2 23E+04 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator: | From SFD | Used | |
| LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding: | SST | SST | |
| BOL HM Constituents: | U | U | |
| BOL Enrichment % | 19 8 | 10 to 20 1 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| Nominal | From SFD | Estimated | |
| Bounding | 3 086 44 | 6 172 87 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|--------------------------------|-------------------------------|
| Nominal | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Bounding | 3 39 | 6 78 | 1 00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRIGA STD 8 5/20 ZAIRE
 SNF ID # 486
 Fuel Units & Descr: 80 - ELEMENT
 Heavy Metal Mass BOL=15 448kg EOL=15.288kg
 ROD Storage Site INEEL
¹Fuel decay start date 2010
 Estimates as of 2030
 Template TRIGA-SS (LW/U-Zrx SST, 10 to 20% U)
²Template Burnup(MWd) 6.65
 Template BOL Heavy Metal Mass (MT) 0.000195
 Template Decay Time 20 years

Estimated
 Canister usage
 18"x10"
 0.72

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.6436E-09 | 152.74 | 305.47 | 0.00E+00 | 4.04E-07 | 8.08E-07 | Avg MeV | |
| Am-241 | 3.1429E-03 | 152.74 | 305.47 | 0.00E+00 | 4.80E-01 | 9.60E-01 | 0.0150 | 3.061E+13 |
| Am-242m | 1.3195E-06 | 152.74 | 305.47 | 0.00E+00 | 2.02E-04 | 4.03E-04 | 0.0250 | 6.372E+12 |
| Am-243 | 1.4753E-07 | 152.74 | 305.47 | 0.00E+00 | 2.25E-05 | 4.51E-05 | 0.0375 | 5.520E+12 |
| C-14 | 1.2847E-04 | 152.74 | 305.47 | 0.00E+00 | 1.96E-02 | 3.92E-02 | 0.0575 | 5.939E+12 |
| Cf-252 | 2.8120E-06 | 152.74 | 305.47 | 0.00E+00 | 4.30E-04 | 8.59E-04 | 0.0850 | 3.585E+12 |
| Cm-243 | 1.2465E-07 | 152.74 | 305.47 | 0.00E+00 | 1.90E-05 | 3.81E-05 | 0.1250 | 2.343E+12 |
| Cm-244 | 9.5564E-07 | 152.74 | 305.47 | 0.00E+00 | 1.46E-04 | 2.92E-04 | 0.2250 | 3.079E+12 |
| Co-60 | 1.7880E-01 | 152.74 | 305.47 | 0.00E+00 | 2.73E+01 | 5.46E+01 | 0.3750 | 1.349E+12 |
| Cs-134 | 5.8692E-04 | 152.74 | 305.47 | 0.00E+00 | 8.96E-02 | 1.79E-01 | 0.5750 | 2.219E+13 |
| Cs-135 | 3.2195E-05 | 152.74 | 305.47 | 0.00E+00 | 4.92E-03 | 9.83E-03 | 0.8500 | 2.501E+11 |
| Cs-137 | 1.9489E+00 | 152.74 | 305.47 | 0.00E+00 | 2.98E+02 | 5.95E+02 | 1.2500 | 4.145E+12 |
| Eu-154 | 4.5895E-03 | 152.74 | 305.47 | 0.00E+00 | 7.01E-01 | 1.40E+00 | 1.7500 | 6.426E+09 |
| Eu-155 | 3.6045E-03 | 152.74 | 305.47 | 0.00E+00 | 5.51E-01 | 1.10E+00 | 2.2500 | 2.213E+07 |
| Fe-55 | 1.4185E-02 | 152.74 | 305.47 | 0.00E+00 | 2.17E+00 | 4.33E+00 | 2.7500 | 2.439E+05 |
| H-3 | 4.7895E-03 | 152.74 | 305.47 | 0.00E+00 | 7.32E-01 | 1.46E+00 | 3.5000 | 1.371E+03 |
| I-129 | 7.3684E-07 | 152.74 | 305.47 | 0.00E+00 | 1.13E-04 | 2.25E-04 | 5.0000 | 1.683E+02 |
| Kr-85 | 9.5820E-02 | 152.74 | 305.47 | 0.00E+00 | 1.46E+01 | 2.93E+01 | 7.0000 | 1.903E+01 |
| Np-237 | 1.2552E-06 | 152.74 | 305.47 | 0.00E+00 | 1.92E-04 | 3.83E-04 | 11.0000 | 2.166E+00 |
| Pa-231 | 7.0406E-09 | 152.74 | 305.47 | 0.00E+00 | 1.08E-06 | 2.15E-06 | | |
| Pb-210 | 5.8000E-14 | 152.74 | 305.47 | 0.00E+00 | 8.86E-12 | 1.77E-11 | | |
| Pm-147 | 4.0075E-02 | 152.74 | 305.47 | 0.00E+00 | 6.12E+00 | 1.22E+01 | | |
| Pu-238 | 9.2256E-04 | 152.74 | 305.47 | 0.00E+00 | 1.41E-01 | 2.82E-01 | | |
| Pu-239 | 5.5278E-03 | 152.74 | 305.47 | 0.00E+00 | 8.44E-01 | 1.69E+00 | | |
| Pu-240 | 2.1248E-03 | 152.74 | 305.47 | 0.00E+00 | 3.25E-01 | 6.49E-01 | | |
| Pu-241 | 4.9549E-02 | 152.74 | 305.47 | 0.00E+00 | 7.57E+00 | 1.51E+01 | | |
| Pu-242 | 2.3128E-07 | 152.74 | 305.47 | 0.00E+00 | 3.53E-05 | 7.06E-05 | | |
| Ra-226 | 2.4526E-13 | 152.74 | 305.47 | 0.00E+00 | 3.75E-11 | 7.49E-11 | | |
| Ra-228 | 2.4015E-10 | 152.74 | 305.47 | 0.00E+00 | 3.67E-08 | 7.34E-08 | | |
| Ru-106 | 3.0602E-06 | 152.74 | 305.47 | 0.00E+00 | 4.67E-04 | 9.35E-04 | | |
| Se-79 | 1.3015E-05 | 152.74 | 305.47 | 0.00E+00 | 1.99E-03 | 3.98E-03 | | |
| Sn-126 | 1.2165E-05 | 152.74 | 305.47 | 0.00E+00 | 1.86E-03 | 3.72E-03 | | |
| Sr-90 | 1.8226E+00 | 152.74 | 305.47 | 0.00E+00 | 2.78E+02 | 5.57E+02 | | |
| Tc-99 | 4.4241E-04 | 152.74 | 305.47 | 0.00E+00 | 6.76E-02 | 1.35E-01 | | |
| Th-229 | 3.0962E-10 | 152.74 | 305.47 | 0.00E+00 | 4.73E-08 | 9.46E-08 | | |
| Th-230 | 4.2346E-11 | 152.74 | 305.47 | 0.00E+00 | 6.47E-09 | 1.29E-08 | | |
| Th-232 | 2.5278E-10 | 152.74 | 305.47 | 0.00E+00 | 3.86E-08 | 7.72E-08 | | |
| Tl-208 | 1.5820E-08 | 152.74 | 305.47 | 0.00E+00 | 2.42E-06 | 4.83E-06 | | |
| U-232 | 4.2647E-08 | 152.74 | 305.47 | 0.00E+00 | 6.51E-06 | 1.30E-05 | Thermal Power | |
| U-233 | 1.2211E-07 | 152.74 | 305.47 | 0.00E+00 | 1.87E-05 | 3.73E-05 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 1.9955E-07 | 152.74 | 305.47 | 0.00E+00 | 3.05E-05 | 6.10E-05 | 3.82E+00 | 7.64E+00 |
| U-235 | -2.6194E-06 | 152.74 | 0.00 | 6.68E-03 | 6.28E-03 | 6.68E-03 | Total | Total |
| U-236 | 1.2693E-05 | 152.74 | 305.47 | 0.00E+00 | 1.94E-03 | 3.88E-03 | | |
| U-238 | -3.6331E-08 | 152.74 | 0.00 | 4.15E-03 | 4.15E-03 | 4.15E-03 | | |
| Y-90 | 1.8241E+00 | 152.74 | 305.47 | 0.00E+00 | 2.79E+02 | 5.57E+02 | | |
| Other Radionuclides | | | | | 2.94E+02 | 5.88E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences: |
|---------------------|-----------------------|-----------------------|----------------------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20.0000041 | 10 to 20.1 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate |
|----------|----------|-----------|---|
| Nominal | | 152.74 | |
| Bounding | | 305.47 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0.29 | | |
| Bounding | 0.58 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TRU SCRAP SNF (MOX)
SNF ID #: 368
Fuel Units & Descr: 1 - CANISTER OF SCRAP
Heavy Metal Mass: BOL = , EOL=106.338kg
ROD Storage Site: INEEL

Fuel decay start date: 1994
Estimates as of: 2030
Template: FFTF (FAST, SST, 10 to 30%, Pu & U)
Template Burnup (MWd): 5011.2
Template BOL Heavy Metal Mass (MT): 0.0329181
Template Decay Time: 35 years

Estimated
Canister usage
HIC
1 00

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|-----------------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6 1822E-12 | 106,140 24 | 106,140 24 | 0 00E+00 | 6 56E-07 | 6 56E-07 | Avg. MeV | |
| Am-241 | 1 1066E-01 | 106,140 24 | 106,140 24 | 4.10E+02 | 1.22E+04 | 1 22E+04 | 0 0150 | 3 432E+15 |
| Am-242m | 1 9247E-03 | 106,140 24 | 106,140 24 | 0 00E+00 | 2 04E+02 | 2 04E+02 | 0 0250 | 6 897E+14 |
| Am-243 | 1 0740E-04 | 106,140 24 | 106,140 24 | 0 00E+00 | 1 14E+01 | 1 14E+01 | 0 0375 | 8 019E+14 |
| C-14 | 2 6042E-05 | 106,140 24 | 106,140 24 | 0 00E+00 | 2 76E+00 | 2 76E+00 | 0 0575 | 7 887E+14 |
| Cl-36 | 3 4243E-10 | 106,140 24 | 106,140 24 | 0 00E+00 | 3 63E-05 | 3 63E-05 | 0 0850 | 3 841E+14 |
| Cm-243 | 4 0629E-04 | 106,140 24 | 106,140 24 | 0 00E+00 | 4 31E+01 | 4 31E+01 | 0 1250 | 2 703E+14 |
| Cm-244 | 1 6024E-03 | 106,140 24 | 106,140 24 | 0 00E+00 | 1 70E+02 | 1 70E+02 | 0 2250 | 3 100E+14 |
| Co-60 | 3 4275E-03 | 106,140 24 | 106,140 24 | 0 00E+00 | 3 64E+02 | 3 64E+02 | 0 3750 | 1 344E+14 |
| Cs-134 | 1 5566E-03 | 106,140 24 | 106,140 24 | 0 00E+00 | 1 65E+02 | 1 65E+02 | 0 5750 | 5 444E+15 |
| Cs-135 | 4 7693E-05 | 106,140 24 | 106,140 24 | 0 00E+00 | 5 06E+00 | 5 06E+00 | 0 8500 | 5 688E+13 |
| Cs-137 | 1 4007E+00 | 106,140 24 | 106,140 24 | 0 00E+00 | 1 49E+05 | 1 49E+05 | 1 2500 | 6 808E+13 |
| Eu-154 | 1 6184E-02 | 106,140 24 | 106,140 24 | 0 00E+00 | 1 72E+03 | 1 72E+03 | 1 7500 | 1 540E+12 |
| Eu-155 | 1 3774E-02 | 106,140 24 | 106,140 24 | 0 00E+00 | 1 46E+03 | 1 46E+03 | 2 2500 | 3 048E+08 |
| Fe-55 | 3 8028E-04 | 106,140 24 | 106,140 24 | 0 00E+00 | 4 04E+01 | 4 04E+01 | 2 7500 | 1 757E+09 |
| H-3 | 3 8454E-03 | 106,140 24 | 106,140 24 | 0 00E+00 | 4 08E+02 | 4 08E+02 | 3 5000 | 6 515E+06 |
| I-129 | 1 2891E-06 | 106,140 24 | 106,140 24 | 0 00E+00 | 1 37E-01 | 1 37E-01 | 5 0000 | 2 062E+06 |
| Kr-85 | 2 7848E-02 | 106,140 24 | 106,140 24 | 0 00E+00 | 2 96E+03 | 2 96E+03 | 7 0000 | 2 355E+05 |
| Np-237 | 3 7516E-06 | 106,140 24 | 106,140 24 | 0 00E+00 | 3 98E-01 | 3 98E-01 | 11 0000 | 2 695E+04 |
| Pa-231 | 1 2488E-11 | 106,140 24 | 106,140 24 | 0 00E+00 | 1 33E-06 | 1 33E-06 | | |
| Pb-210 | 2 4206E-12 | 106,140 24 | 106,140 24 | 0 00E+00 | 2 57E-07 | 2 57E-07 | | |
| Pm-147 | 1 5671E-02 | 106,140 24 | 106,140 24 | 0 00E+00 | 1 66E+03 | 1 66E+03 | | |
| Pu-238 | 1 4877E-02 | 106,140 24 | 106,140 24 | 0 00E+00 | 1 58E+03 | 1 58E+03 | | |
| Pu-239 | -3 5520E-02 | 106,140 24 | 0 00 | 3 37E+03 | 0 00E+00 | 3 37E+03 | | |
| Pu-240 | 2 0690E-02 | 106,140 24 | 106,140 24 | 1 71E+03 | 3 91E+03 | 3 91E+03 | | |
| Pu-241 | -1 4799E+00 | 106,140 24 | 0 00 | 7 68E+04 | 0 00E+00 | 7 68E+04 | | |
| Pu-242 | 1 1252E-05 | 106,140 24 | 106,140 24 | 4 56E-01 | 1 65E+00 | 1 65E+00 | | |
| Ra-226 | 7 8524E-12 | 106,140 24 | 106,140 24 | 0 00E+00 | 8 33E-07 | 8 33E-07 | | |
| Ra-228 | 2 4086E-16 | 106,140 24 | 106,140 24 | 0 00E+00 | 2 56E-11 | 2 56E-11 | | |
| Ru-106 | 1 5066E-05 | 106,140 24 | 106,140 24 | 0 00E+00 | 1 60E+00 | 1 60E+00 | | |
| Se-79 | 1 0127E-05 | 106,140 24 | 106,140 24 | 0 00E+00 | 1 07E+00 | 1 07E+00 | | |
| Sm-126 | 4 3902E-05 | 106,140 24 | 106,140 24 | 0 00E+00 | 4 66E+00 | 4 66E+00 | | |
| Sr-90 | 5 0088E-01 | 106,140 24 | 106,140 24 | 0 00E+00 | 5 32E+04 | 5 32E+04 | | |
| Tc-99 | 3 9412E-04 | 106,140 24 | 106,140 24 | 0 00E+00 | 4 18E+01 | 4 18E+01 | | |
| Th-229 | 2 7219E-12 | 106,140 24 | 106,140 24 | 0 00E+00 | 2 89E-07 | 2 89E-07 | | |
| Th-230 | 1 0441E-09 | 106,140 24 | 106,140 24 | 0 00E+00 | 1 11E-04 | 1 11E-04 | | |
| Th-232 | 3 1689E-16 | 106,140 24 | 106,140 24 | 0 00E+00 | 3 36E-11 | 3 36E-11 | | |
| Tl-208 | 4 6636E-07 | 106,140 24 | 106,140 24 | 0 00E+00 | 4 95E-02 | 4 95E-02 | | |
| U-232 | 1 2638E-06 | 106,140 24 | 106,140 24 | 0 00E+00 | 1 34E-01 | 1 34E-01 | Thermal Power | |
| U-233 | 5 7451E-10 | 106,140 24 | 106,140 24 | 0 00E+00 | 6 10E-05 | 6 10E-05 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 4 3044E-06 | 106,140 24 | 106,140 24 | 0 00E+00 | 4 57E-01 | 4 57E-01 | 1 69E+03 | 1 80E+03 |
| U-235 | -7 7765E-09 | 106,140 24 | 0 00 | 6 91E-04 | 0 00E+00 | 6 91E-04 | Total | Total |
| U-236 | 1 8050E-07 | 106,140 24 | 106,140 24 | 0 00E+00 | 1 92E-02 | 1 92E-02 | | |
| U-238 | -1 7914E-07 | 106,140 24 | 0 00 | 5 03E-02 | 3 13E-02 | 5 03E-02 | | |
| Y-90 | 5 0088E-01 | 106,140 24 | 106,140 24 | 0 00E+00 | 5 32E+04 | 5 32E+04 | | |
| Other Radionuclides | | | | | 1 50E+05 | 1 50E+05 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|----------|----------|---|
| | From SFD | Used | |
| Reactor Moderator: | FAST | FAST | This Template was used for the following reasons: This fuel matches on all parameters except cladding (SST is conservative) and enrichment (unknown) |
| Fuel Cladding: | UNKNOWN | SST | |
| BOL HM Constituents: | Pu and U | Pu and U | |
| BOL Enrichment %: | | 10 to 30 | |

| Burnup Summary (MWd) ¹ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|------------|---|
| | From SFD | Estimated | |
| Nominal | | 106 140 24 | Nominal burnup set equal to bounding burnup. Bounding burnup estimated by assuming BOL heavy metal mass was twice EOL. |
| Bounding | | 106 140 24 | |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 3.28 | | 1 05 |
| Bounding | 3.28 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name TRU SCRAP SNF (U METAL)
SNF ID # 904
Fuel Units & Descr 1 - CANISTER OF SCRAP
Heavy Metal Mass BOL= , EOL=106.338kg
ROD Storage Site INEEL

¹Fuel decay start date 1994
Estimates as of 2030
Template FERMI (Fast, Zirc, 10 to 40% U)
²Template Burnup(MWd) 58 6725048
Template BOL Heavy Metal Mass (MT) 0 018774
Template Decay Time 35 years

Estimated
Canister usage
HIC
4 00

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 9 6110E-08 | 93,768 99 | 93,768 99 | 0 00E+00 | 9 01E-03 | 9 01E-03 | Avg MeV | |
| Am-241 | 6 5601E-07 | 93,768 99 | 93,768 99 | 0 00E+00 | 6 15E-02 | 6 15E-02 | 0 0150 | 6 205E+15 |
| Am-242m | 0 0000E+00 | 93,768 99 | 93,768 99 | 0 00E+00 | 0 00E+00 | 0 00E+00 | 0 0250 | 1 289E+15 |
| Am-243 | 8 3770E-15 | 93,768 99 | 93,768 99 | 0 00E+00 | 7 86E-10 | 7 86E-10 | 0 0375 | 1 134E+15 |
| C-14 | 2 1714E-05 | 93,768 99 | 93,768 99 | 0 00E+00 | 2 04E+00 | 2 04E+00 | 0 0575 | 1 201E+15 |
| Cl-36 | 5 5188E-08 | 93,768 99 | 93,768 99 | 0 00E+00 | 5 17E-03 | 5 17E-03 | 0 0850 | 7 264E+14 |
| Cm-243 | 1 5496E-14 | 93,768 99 | 93,768 99 | 0 00E+00 | 1 45E-09 | 1 45E-09 | 0 1250 | 4 705E+14 |
| Cm-244 | 5 2375E-16 | 93,768 99 | 93,768 99 | 0 00E+00 | 4 91E-11 | 4 91E-11 | 0 2250 | 6 235E+14 |
| Co-60 | 2 0947E-03 | 93,768 99 | 93,768 99 | 0 00E+00 | 1 96E+02 | 1 96E+02 | 0 3750 | 2 717E+14 |
| Cs-134 | 6 2448E-07 | 93,768 99 | 93,768 99 | 0 00E+00 | 5 86E-02 | 5 86E-02 | 0 5750 | 4 799E+15 |
| Cs-135 | 4 4996E-05 | 93,768 99 | 93,768 99 | 0 00E+00 | 4 22E+00 | 4 22E+00 | 0 8500 | 4 432E+13 |
| Cs-137 | 1 3775E+00 | 93,768 99 | 93,768 99 | 0 00E+00 | 1 29E+05 | 1 29E+05 | 1 2500 | 2 940E+13 |
| Eu-154 | 1 8510E-04 | 93,768 99 | 93,768 99 | 0 00E+00 | 1 74E+01 | 1 74E+01 | 1 7500 | 1 144E+12 |
| Eu-155 | 1 4163E-03 | 93,768 99 | 93,768 99 | 0 00E+00 | 1 33E+02 | 1 33E+02 | 2 2500 | 2 017E+08 |
| Fe-55 | 1 4179E-05 | 93,768 99 | 93,768 99 | 0 00E+00 | 1 33E+00 | 1 33E+00 | 2 7500 | 1 944E+07 |
| H-3 | 3 5383E-03 | 93,768 99 | 93,768 99 | 0 00E+00 | 3 32E+02 | 3 32E+02 | 3 5000 | 1 608E+04 |
| I-129 | 1 1426E-06 | 93,768 99 | 93,768 99 | 0 00E+00 | 1 07E-01 | 1 07E-01 | 5 0000 | 5 319E+03 |
| Kr-85 | 3 8604E-02 | 93,768 99 | 93,768 99 | 0 00E+00 | 3 62E+03 | 3 62E+03 | 7 0000 | 4 316E+02 |
| Np-237 | 3 3099E-06 | 93,768 99 | 93,768 99 | 0 00E+00 | 3 10E-01 | 3 10E-01 | 11 0000 | 3 760E+01 |
| Pa-231 | 1 8953E-07 | 93,768 99 | 93,768 99 | 0 00E+00 | 1 78E-02 | 1 78E-02 | | |
| Pb-210 | 8 9531E-12 | 93,768 99 | 93,768 99 | 0 00E+00 | 8 40E-07 | 8 40E-07 | | |
| Pm-147 | 1 1588E-03 | 93,768 99 | 93,768 99 | 0 00E+00 | 1 09E+02 | 1 09E+02 | | |
| Pu-238 | 1 7146E-04 | 93,768 99 | 93,768 99 | 0 00E+00 | 1 61E+01 | 1 61E+01 | | |
| Pu-239 | 1 9464E-02 | 93,768 99 | 93,768 99 | 0 00E+00 | 1 83E+03 | 1 83E+03 | | |
| Pu-240 | 6 7919E-05 | 93,768 99 | 93,768 99 | 0 00E+00 | 6 37E+00 | 6 37E+00 | | |
| Pu-241 | 4 1774E-06 | 93,768 99 | 93,768 99 | 0 00E+00 | 3 92E-01 | 3 92E-01 | | |
| Pu-242 | 4 3751E-13 | 93,768 99 | 93,768 99 | 0 00E+00 | 4 10E-08 | 4 10E-08 | | |
| Ra-226 | 2 4219E-11 | 93,768 99 | 93,768 99 | 0 00E+00 | 2 27E-06 | 2 27E-06 | | |
| Ra-228 | 2 3572E-11 | 93,768 99 | 93,768 99 | 0 00E+00 | 2 21E-06 | 2 21E-06 | | |
| Ru-106 | 3 0951E-10 | 93,768 99 | 93,768 99 | 0 00E+00 | 2 90E-05 | 2 90E-05 | | |
| Se-79 | 1 6488E-05 | 93,768 99 | 93,768 99 | 0 00E+00 | 1 55E+00 | 1 55E+00 | | |
| Sn-126 | 3 7564E-05 | 93,768 99 | 93,768 99 | 0 00E+00 | 3 52E+00 | 3 52E+00 | | |
| Sr-90 | 1 2052E+00 | 93,768 99 | 93,768 99 | 0 00E+00 | 1 13E+05 | 1 13E+05 | | |
| Tc-99 | 4 4825E-04 | 93,768 99 | 93,768 99 | 0 00E+00 | 4 20E+01 | 4 20E+01 | | |
| Th-229 | 4 6478E-11 | 93,768 99 | 93,768 99 | 0 00E+00 | 4 36E-06 | 4 36E-06 | | |
| Th-230 | 2 2259E-09 | 93,768 99 | 93,768 99 | 0 00E+00 | 2 09E-04 | 2 09E-04 | | |
| Th-232 | 2 3691E-11 | 93,768 99 | 93,768 99 | 0 00E+00 | 2 22E-06 | 2 22E-06 | | |
| Ti-208 | 5 8256E-09 | 93,768 99 | 93,768 99 | 0 00E+00 | 5 46E-04 | 5 46E-04 | | |
| U-232 | 1 5759E-08 | 93,768 99 | 93,768 99 | 0 00E+00 | 1 48E-03 | 1 48E-03 | | |
| U-233 | 1 0110E-08 | 93,768 99 | 93,768 99 | 0 00E+00 | 9 48E-04 | 9 48E-04 | | |
| U-234 | 4 9001E-06 | 93,768 99 | 93,768 99 | 0 00E+00 | 4 59E-01 | 4 59E-01 | | |
| U-235 | -2 3191E-06 | 93,768 99 | 0 00 | 1 18E-01 | 0 00E+00 | 1 18E-01 | | |
| U-236 | 1 2633E-05 | 93,768 99 | 93,768 99 | 0 00E+00 | 1 18E+00 | 1 18E+00 | | |
| U-238 | -9 5407E-08 | 93,768 99 | 0 00 | 5 32E-02 | 4 42E-02 | 5 32E-02 | | |
| Y-90 | 1 2053E+00 | 93,768 99 | 93,768 99 | 0 00E+00 | 1 13E+05 | 1 13E+05 | | |
| Other Radionuclides | | | | | 1 28E+05 | 1 28E+05 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences |
|---------------------|----------|----------|--|
| Reactor Moderator: | FAST | FAST | This Template was used for the following reasons |
| Fuel Cladding | UNKNOWN | ZIRC | This fuel matches on all parameters except cladding (unknown) and enrichment (unknown) |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | | 10 to 40 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate |
|----------|----------|-----------|--|
| Nominal | | 93 768 99 | Nominal burnup set equal to bounding burnup |
| Bounding | | 93 768 99 | Bounding burnup estimated by assuming BOL heavy metal mass was twice EOL |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 141.08 | | 1.69 |
| Bounding | 141.08 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: TURKEY POINT
SNF ID #: 271
Fuel Units & Descr: 5 - 15 X 15 ROD ARRAY
Heavy Metal Mass: BOL=2285kg; EOL=2221 6kg
ROD Storage Site: INEEL

Fuel decay start date: 1977
Estimates as of: 2030
Template: PWR (Light Water, Zirc. 0 to 5%, U)
Template Burnup (MWd): 61.92
Template BOL Heavy Metal Mass (MT): 0.00176911
Template Decay Time: 50 years

Estimated
Canister usage:
Bare Fuel Transfer

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|-------------------------------|--------------------------------|---------------------|------------------------------|
| Radionuclide | CvMWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 1.0733E-09 | 63,036.30 | 63,666.96 | 0.00E+00 | 6.77E-05 | 6.83E-05 | Avg MeV | |
| Am-241 | 1.4751E-01 | 63,036.30 | 63,666.96 | 0.00E+00 | 9.30E+03 | 9.39E+03 | 0.0150 | 2.423E+15 |
| Am-242m | 2.6809E-04 | 63,036.30 | 63,666.96 | 0.00E+00 | 1.69E+01 | 1.71E+01 | 0.0250 | 4.855E+14 |
| Am-243 | 6.2484E-04 | 63,036.30 | 63,666.96 | 0.00E+00 | 3.94E+01 | 3.98E+01 | 0.0375 | 4.575E+14 |
| C-14 | 4.7820E-05 | 63,036.30 | 63,666.96 | 0.00E+00 | 3.01E+00 | 3.04E+00 | 0.0575 | 5.724E+14 |
| Cl-36 | 8.0297E-07 | 63,036.30 | 63,666.96 | 0.00E+00 | 5.06E-02 | 5.11E-02 | 0.0850 | 2.675E+14 |
| Cm-243 | 1.7426E-04 | 63,036.30 | 63,666.96 | 0.00E+00 | 1.10E+01 | 1.11E+01 | 0.1250 | 1.779E+14 |
| Cm-244 | 2.7616E-02 | 63,036.30 | 63,666.96 | 0.00E+00 | 1.74E+03 | 1.76E+03 | 0.2250 | 2.284E+14 |
| Co-60 | 3.5610E-04 | 63,036.30 | 63,666.96 | 0.00E+00 | 2.24E+01 | 2.27E+01 | 0.3750 | 9.863E+13 |
| Cs-134 | 2.6260E-07 | 63,036.30 | 63,666.96 | 0.00E+00 | 1.66E-02 | 1.67E-02 | 0.5750 | 2.323E+15 |
| Cs-135 | 1.4433E-05 | 63,036.30 | 63,666.96 | 0.00E+00 | 9.10E-01 | 9.19E-01 | 0.8500 | 2.268E+13 |
| Cs-137 | 9.8870E-01 | 63,036.30 | 63,666.96 | 0.00E+00 | 6.23E+04 | 6.29E+04 | 1.2500 | 1.443E+13 |
| Eu-154 | 6.0320E-03 | 63,036.30 | 63,666.96 | 0.00E+00 | 3.80E+02 | 3.84E+02 | 1.7500 | 6.344E+11 |
| Eu-155 | 2.1770E-04 | 63,036.30 | 63,666.96 | 0.00E+00 | 1.37E+01 | 1.39E+01 | 2.2500 | 1.043E+08 |
| Fe-55 | 7.9296E-07 | 63,036.30 | 63,666.96 | 0.00E+00 | 5.00E-02 | 5.05E-02 | 2.7500 | 3.675E+08 |
| H-3 | 8.9486E-03 | 63,036.30 | 63,666.96 | 0.00E+00 | 5.64E+02 | 5.70E+02 | 3.5000 | 2.622E+07 |
| I-129 | 9.8288E-07 | 63,036.30 | 63,666.96 | 0.00E+00 | 6.20E-02 | 6.26E-02 | 5.0000 | 1.121E+07 |
| Kr-85 | 1.0707E-02 | 63,036.30 | 63,666.96 | 0.00E+00 | 6.75E+02 | 6.82E+02 | 7.0000 | 1.291E+06 |
| Np-237 | 1.1927E-05 | 63,036.30 | 63,666.96 | 0.00E+00 | 7.52E-01 | 7.59E-01 | 11.0000 | 1.483E+05 |
| Pa-231 | 1.4703E-09 | 63,036.30 | 63,666.96 | 0.00E+00 | 9.27E-05 | 9.36E-05 | | |
| Pb-210 | 1.6828E-10 | 63,036.30 | 63,666.96 | 0.00E+00 | 1.06E-05 | 1.07E-05 | | |
| Pm-147 | 6.9606E-06 | 63,036.30 | 63,666.96 | 0.00E+00 | 4.39E-01 | 4.43E-01 | | |
| Pu-238 | 6.6263E-02 | 63,036.30 | 63,666.96 | 0.00E+00 | 4.18E+03 | 4.22E+03 | | |
| Pu-239 | 1.1618E-02 | 63,036.30 | 63,666.96 | 0.00E+00 | 7.32E+02 | 7.40E+02 | | |
| Pu-240 | 1.5142E-02 | 63,036.30 | 63,666.96 | 0.00E+00 | 9.55E+02 | 9.64E+02 | | |
| Pu-241 | 4.3766E-01 | 63,036.30 | 63,666.96 | 0.00E+00 | 2.76E+04 | 2.79E+04 | | |
| Pu-242 | 6.4260E-05 | 63,036.30 | 63,666.96 | 0.00E+00 | 4.05E+00 | 4.09E+00 | | |
| Ra-226 | 3.8501E-10 | 63,036.30 | 63,666.96 | 0.00E+00 | 2.43E-05 | 2.45E-05 | | |
| Ra-228 | 5.2955E-12 | 63,036.30 | 63,666.96 | 0.00E+00 | 3.34E-07 | 3.37E-07 | | |
| Ru-106 | 2.0413E-14 | 63,036.30 | 63,666.96 | 0.00E+00 | 1.29E-09 | 1.30E-09 | | |
| Se-79 | 1.2376E-05 | 63,036.30 | 63,666.96 | 0.00E+00 | 7.80E-01 | 7.88E-01 | | |
| Sn-126 | 2.5210E-05 | 63,036.30 | 63,666.96 | 0.00E+00 | 1.59E+00 | 1.61E+00 | | |
| Sr-90 | 6.4163E-01 | 63,036.30 | 63,666.96 | 0.00E+00 | 4.04E+04 | 4.09E+04 | | |
| Tc-99 | 3.9357E-04 | 63,036.30 | 63,666.96 | 0.00E+00 | 2.48E+01 | 2.51E+01 | | |
| Th-229 | 1.5644E-10 | 63,036.30 | 63,666.96 | 0.00E+00 | 9.86E-06 | 9.96E-06 | | |
| Th-230 | 2.7972E-08 | 63,036.30 | 63,666.96 | 0.00E+00 | 1.76E-03 | 1.78E-03 | | |
| Th-232 | 5.3036E-12 | 63,036.30 | 63,666.96 | 0.00E+00 | 3.34E-07 | 3.38E-07 | | |
| Th-208 | 1.5136E-07 | 63,036.30 | 63,666.96 | 0.00E+00 | 9.54E-03 | 9.64E-03 | | |
| U-232 | 4.1005E-07 | 63,036.30 | 63,666.96 | 0.00E+00 | 2.58E-02 | 2.61E-02 | | |
| U-233 | 2.5856E-08 | 63,036.30 | 63,666.96 | 0.00E+00 | 1.63E-03 | 1.65E-03 | | |
| U-234 | 5.2665E-05 | 63,036.30 | 63,666.96 | 0.00E+00 | 3.32E+00 | 3.35E+00 | | |
| U-235 | -1.4487E-06 | 63,036.30 | 0.00 | 1.26E-01 | 3.51E-02 | 1.26E-01 | | |
| U-236 | 7.5888E-06 | 63,036.30 | 63,666.96 | 0.00E+00 | 4.78E-01 | 4.83E-01 | | |
| U-238 | -2.6129E-07 | 63,036.30 | 0.00 | 7.48E-01 | 7.32E-01 | 7.48E-01 | | |
| Y-90 | 6.4180E-01 | 63,036.30 | 63,666.96 | 0.00E+00 | 4.05E+04 | 4.09E+04 | | |
| Other Radionuclides | | | | | 6.01E+04 | 6.07E+04 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-------------|-------------|----------------------------------|
| | From SFD | Used | |
| Reactor Moderator | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding | ZIRC | ZIRC | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 2.55999934 | 0 to 5 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|-----------|------------|---|
| | From SFD | Estimated | |
| Nominal | 63,036.30 | 60,290.40 | |
| Bounding | 63,666.96 | 120,580.80 | Nominal burnup taken directly from SFD (converted to MWd). Bounding burnup taken directly from SFD (converted to MWd). |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0.79 | 0.96 | |
| Bounding | 0.80 | 1.89 | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name US/UK FUEL PINS
SNF ID # 356
Fuel Units & Descr 66 - ROD
Heavy Metal Mass BOL = ; EOL=8 039kg
ROD Storage Site INEEL

*Fuel decay start date- 1994
Estimates as of 2030
Template (Worst Case)
*Template Burnup(MWd) 62.5
Template BOL Heavy Metal Mass (MT) 0.00186865
Template Decay Time 35 years

Estimated
Canister usage
18"x10"
0.51

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.3072E-06 | 7,639.69 | 7,639.69 | 0.00E+00 | 1.76E-02 | 1.76E-02 | Avg MeV | |
| Am-241 | 8.4448E+00 | 7,639.69 | 7,639.69 | 0.00E+00 | 6.45E+04 | 6.45E+04 | 0.0150 | 9.362E+15 |
| Am-242m | 1.6848E-02 | 7,639.69 | 7,639.69 | 0.00E+00 | 1.29E+02 | 1.29E+02 | 0.0250 | 1.863E+15 |
| Am-243 | 1.6320E-02 | 7,639.69 | 7,639.69 | 0.00E+00 | 1.25E+02 | 1.25E+02 | 0.0375 | 1.627E+15 |
| C-14 | 1.2090E-01 | 7,639.69 | 7,639.69 | 0.00E+00 | 9.24E+02 | 9.24E+02 | 0.0575 | 2.561E+15 |
| Cl-36 | 2.2849E-03 | 7,639.69 | 7,639.69 | 0.00E+00 | 1.75E+01 | 1.75E+01 | 0.0850 | 9.994E+14 |
| Cm-243 | 8.6624E-04 | 7,639.69 | 7,639.69 | 0.00E+00 | 6.62E+00 | 6.62E+00 | 0.1250 | 7.833E+14 |
| Cm-244 | 1.6848E-01 | 7,639.69 | 7,639.69 | 0.00E+00 | 1.29E+03 | 1.29E+03 | 0.2250 | 8.658E+14 |
| Co-60 | 2.8086E+01 | 7,639.69 | 7,639.69 | 0.00E+00 | 2.15E+05 | 2.15E+05 | 0.3750 | 3.703E+14 |
| Cs-134 | 3.4148E-04 | 7,639.69 | 7,639.69 | 0.00E+00 | 2.61E+00 | 2.61E+00 | 0.5750 | 6.022E+15 |
| Cs-135 | 4.3976E-04 | 7,639.69 | 7,639.69 | 0.00E+00 | 3.36E+00 | 3.36E+00 | 0.8500 | 2.301E+14 |
| Cs-137 | 2.1049E+01 | 7,639.69 | 7,639.69 | 0.00E+00 | 1.61E+05 | 1.61E+05 | 1.2500 | 1.609E+16 |
| Eu-154 | 1.2500E+00 | 7,639.69 | 7,639.69 | 0.00E+00 | 9.55E+03 | 9.55E+03 | 1.7500 | 7.116E+12 |
| Eu-155 | 6.8986E-02 | 7,639.69 | 7,639.69 | 0.00E+00 | 5.27E+02 | 5.27E+02 | 2.2500 | 8.436E+10 |
| Fe-55 | 2.9308E-01 | 7,639.69 | 7,639.69 | 0.00E+00 | 2.24E+03 | 2.24E+03 | 2.7500 | 2.377E+10 |
| H-3 | 2.4311E-01 | 7,639.69 | 7,639.69 | 0.00E+00 | 1.86E+03 | 1.86E+03 | 3.5000 | 1.902E+07 |
| I-129 | 1.0618E-05 | 7,639.69 | 7,639.69 | 0.00E+00 | 8.11E-02 | 8.11E-02 | 5.0000 | 8.080E+06 |
| Kr-85 | 5.9882E-01 | 7,639.69 | 7,639.69 | 0.00E+00 | 4.57E+03 | 4.57E+03 | 7.0000 | 9.253E+05 |
| Np-237 | 1.5668E-04 | 7,639.69 | 7,639.69 | 0.00E+00 | 1.20E+00 | 1.20E+00 | 11.0000 | 1.059E+05 |
| Pa-231 | 2.8656E-06 | 7,639.69 | 7,639.69 | 0.00E+00 | 2.19E-02 | 2.19E-02 | | |
| Pb-210 | 2.3918E-08 | 7,639.69 | 7,639.69 | 0.00E+00 | 1.83E-04 | 1.83E-04 | | |
| Pm-147 | 1.6900E-02 | 7,639.69 | 7,639.69 | 0.00E+00 | 1.29E+02 | 1.29E+02 | | |
| Pu-238 | -8.6120E-01 | 7,639.69 | 0.00 | 2.07E+03 | 0.00E+00 | 2.07E+03 | | |
| Pu-239 | -4.8440E-02 | 7,639.69 | 0.00 | 2.50E+02 | 0.00E+00 | 2.50E+02 | | |
| Pu-240 | -3.0095E-01 | 7,639.69 | 0.00 | 3.19E+02 | 0.00E+00 | 3.19E+02 | | |
| Pu-241 | -1.0411E+02 | 7,639.69 | 0.00 | 8.22E+04 | 0.00E+00 | 8.22E+04 | | |
| Pu-242 | -1.1381E-04 | 7,639.69 | 0.00 | 1.38E+00 | 5.12E-01 | 1.38E+00 | | |
| Ra-226 | 6.4400E-08 | 7,639.69 | 7,639.69 | 0.00E+00 | 4.92E-04 | 4.92E-04 | | |
| Ra-228 | 5.9952E-07 | 7,639.69 | 7,639.69 | 0.00E+00 | 4.58E-03 | 4.58E-03 | | |
| Ru-106 | 8.5526E-07 | 7,639.69 | 7,639.69 | 0.00E+00 | 6.53E-03 | 6.53E-03 | | |
| Se-79 | 1.9181E-04 | 7,639.69 | 7,639.69 | 0.00E+00 | 1.47E+00 | 1.47E+00 | | |
| Sn-126 | 1.6671E-04 | 7,639.69 | 7,639.69 | 0.00E+00 | 1.27E+00 | 1.27E+00 | | |
| Sr-90 | 1.9799E+01 | 7,639.69 | 7,639.69 | 0.00E+00 | 1.51E+05 | 1.51E+05 | | |
| Tc-99 | 6.7678E-03 | 7,639.69 | 7,639.69 | 0.00E+00 | 5.17E+01 | 5.17E+01 | | |
| Th-229 | 1.7488E-06 | 7,639.69 | 7,639.69 | 0.00E+00 | 1.34E-02 | 1.34E-02 | | |
| Th-230 | 5.8704E-06 | 7,639.69 | 7,639.69 | 0.00E+00 | 4.48E-02 | 4.48E-02 | | |
| Th-232 | 6.0208E-07 | 7,639.69 | 7,639.69 | 0.00E+00 | 4.60E-03 | 4.60E-03 | | |
| Ti-208 | 8.7573E-05 | 7,639.69 | 7,639.69 | 0.00E+00 | 6.69E-01 | 6.69E-01 | | |
| U-232 | 2.3706E-04 | 7,639.69 | 7,639.69 | 0.00E+00 | 1.81E+00 | 1.81E+00 | Thermal Power | |
| U-233 | 3.6128E-04 | 7,639.69 | 7,639.69 | 0.00E+00 | 2.76E+00 | 2.76E+00 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 1.2788E-02 | 7,639.69 | 7,639.69 | 0.00E+00 | 9.77E+01 | 9.77E+01 | 7.53E+03 | 7.62E+03 |
| U-235 | 5.7486E-04 | 7,639.69 | 7,639.69 | 6.92E-03 | 4.40E+00 | 4.40E+00 | Total | Total |
| U-236 | 2.3485E-04 | 7,639.69 | 7,639.69 | 0.00E+00 | 1.79E+00 | 1.79E+00 | | |
| U-238 | 1.1581E-04 | 7,639.69 | 7,639.69 | 8.61E-04 | 8.86E-01 | 8.86E-01 | | |
| Y-90 | 1.9804E+01 | 7,639.69 | 7,639.69 | 0.00E+00 | 1.51E+05 | 1.51E+05 | | |
| Other Radionuclides | | | | | 4.71E+05 | 4.71E+05 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|-----------------------------------|-------------------|--------------------------------|--|
| Reactor Moderator | From SFD | Used | |
| Fuel Cladding | GRAPHITE | (Worst Case) | This fuel didn't closely match any existing templates, therefore the worst case template was used. |
| BOL HM Constituents | SST | SST/Inconel | |
| BOL Enrichment % | Pu and U | U, Th, & Pu | |
| | | 0 to 100 | |
| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
| Nominal | From SFD | Estimated | |
| Bounding | | 7.639.69 | Nominal burnup set equal to bounding burnup |
| | | 7.639.69 | Bounding burnup estimated by assuming BOL heavy metal mass was twice EOL |
| Checks | | | Estimated EOL HM/Given EOL HM |
| Nominal | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Bounding | 14.21 | | 591.64 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: VBWR (GENEVA)
SNF ID #: 285
Fuel Units & Descr: 4 - 6 X 6 ROD ARRAY
Heavy Metal Mass: BOL=12 536kg, EOL=12.392kg
ROD Storage Site: INEEL

Fuel decay start date: 1961
Estimates as of: 2030
Template: Pathfinder (Light Water, SST, 60 to 100%, U)
Template Burnup (MWd): 6.01
Template BOL Heavy Metal Mass (MT): 0.00012882
Template Decay Time: 65 years

Estimated
Canister usage:
18"x10"
0.31

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Cv/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 4.5940E-08 | 135.65 | 271.30 | 0.00E+00 | 6.23E-06 | 1.25E-05 | Avg. MeV | |
| Am-241 | 1.1471E-04 | 135.65 | 271.30 | 0.00E+00 | 1.56E-02 | 3.11E-02 | 0.0150 | 9.903E+12 |
| Am-242m | 7.4210E-09 | 135.65 | 271.30 | 0.00E+00 | 1.01E-06 | 2.01E-06 | 0.0250 | 2.057E+12 |
| Am-243 | 9.8236E-10 | 135.65 | 271.30 | 0.00E+00 | 1.33E-07 | 2.67E-07 | 0.0375 | 1.788E+12 |
| C-14 | 2.2928E-04 | 135.65 | 271.30 | 0.00E+00 | 3.11E-02 | 6.22E-02 | 0.0575 | 1.919E+12 |
| Cl-36 | 1.2260E-06 | 135.65 | 271.30 | 0.00E+00 | 1.66E-04 | 3.33E-04 | 0.0850 | 1.159E+12 |
| Cm-243 | 1.2000E-10 | 135.65 | 271.30 | 0.00E+00 | 1.63E-08 | 3.26E-08 | 0.1250 | 7.514E+11 |
| Cm-244 | 7.3577E-10 | 135.65 | 271.30 | 0.00E+00 | 9.98E-08 | 2.00E-07 | 0.2250 | 9.988E+11 |
| Co-60 | 1.3732E-03 | 135.65 | 271.30 | 0.00E+00 | 1.86E-01 | 3.73E-01 | 0.3750 | 4.356E+11 |
| Cs-134 | 1.2709E-10 | 135.65 | 271.30 | 0.00E+00 | 1.72E-08 | 3.45E-08 | 0.5750 | 7.328E+12 |
| Cs-135 | 3.0316E-05 | 135.65 | 271.30 | 0.00E+00 | 4.11E-03 | 8.22E-03 | 0.8500 | 7.117E+10 |
| Cs-137 | 7.2579E-01 | 135.65 | 271.30 | 0.00E+00 | 9.85E+01 | 1.97E+02 | 1.2500 | 5.151E+10 |
| Eu-154 | 5.9750E-05 | 135.65 | 271.30 | 0.00E+00 | 8.11E-03 | 1.62E-02 | 1.7500 | 1.831E+09 |
| Eu-155 | 1.0577E-05 | 135.65 | 271.30 | 0.00E+00 | 1.43E-03 | 2.87E-03 | 2.2500 | 3.463E+05 |
| Fe-55 | 4.1631E-07 | 135.65 | 271.30 | 0.00E+00 | 5.65E-05 | 1.13E-04 | 2.7500 | 1.551E+05 |
| H-3 | 4.6722E-04 | 135.65 | 271.30 | 0.00E+00 | 6.34E-02 | 1.27E-01 | 3.5000 | 3.325E+01 |
| I-129 | 7.3195E-07 | 135.65 | 271.30 | 0.00E+00 | 9.93E-05 | 1.99E-04 | 5.0000 | 1.402E+01 |
| Kr-85 | 5.9418E-03 | 135.65 | 271.30 | 0.00E+00 | 8.06E-01 | 1.61E+00 | 7.0000 | 1.585E+00 |
| Np-237 | 1.1499E-06 | 135.65 | 271.30 | 0.00E+00 | 1.56E-04 | 3.12E-04 | 11.0000 | 1.803E-01 |
| Pa-231 | 7.0899E-08 | 135.65 | 271.30 | 0.00E+00 | 9.62E-06 | 1.92E-05 | | |
| Pb-210 | 2.2363E-12 | 135.65 | 271.30 | 0.00E+00 | 3.03E-10 | 6.07E-10 | | |
| Pm-147 | 4.2296E-07 | 135.65 | 271.30 | 0.00E+00 | 5.74E-05 | 1.15E-04 | | |
| Pu-238 | 2.3295E-04 | 135.65 | 271.30 | 0.00E+00 | 3.16E-02 | 6.32E-02 | | |
| Pu-239 | 6.6722E-04 | 135.65 | 271.30 | 0.00E+00 | 9.05E-02 | 1.81E-01 | | |
| Pu-240 | 8.6556E-05 | 135.65 | 271.30 | 0.00E+00 | 1.17E-02 | 2.35E-02 | | |
| Pu-241 | 1.6889E-04 | 135.65 | 271.30 | 0.00E+00 | 2.29E-02 | 4.58E-02 | | |
| Pu-242 | 1.9717E-09 | 135.65 | 271.30 | 0.00E+00 | 2.67E-07 | 5.35E-07 | | |
| Ra-226 | 4.5740E-12 | 135.65 | 271.30 | 0.00E+00 | 6.20E-10 | 1.24E-09 | | |
| Ra-228 | 8.3511E-12 | 135.65 | 271.30 | 0.00E+00 | 1.13E-09 | 2.27E-09 | | |
| Ru-106 | 2.0516E-19 | 135.65 | 271.30 | 0.00E+00 | 2.78E-17 | 5.57E-17 | | |
| Se-79 | 1.3220E-05 | 135.65 | 271.30 | 0.00E+00 | 1.79E-03 | 3.59E-03 | | |
| Sn-126 | 1.1489E-05 | 135.65 | 271.30 | 0.00E+00 | 1.56E-03 | 3.12E-03 | | |
| Sr-90 | 6.6872E-01 | 135.65 | 271.30 | 0.00E+00 | 9.07E+01 | 1.81E+02 | | |
| Tc-99 | 4.6639E-04 | 135.65 | 271.30 | 0.00E+00 | 6.33E-02 | 1.27E-01 | | |
| Th-229 | 2.3727E-11 | 135.65 | 271.30 | 0.00E+00 | 3.22E-09 | 6.44E-09 | | |
| Th-230 | 2.7354E-10 | 135.65 | 271.30 | 0.00E+00 | 3.71E-08 | 7.42E-08 | | |
| Th-232 | 8.3594E-12 | 135.65 | 271.30 | 0.00E+00 | 1.13E-09 | 2.27E-09 | | |
| Ti-208 | 1.6228E-08 | 135.65 | 271.30 | 0.00E+00 | 2.20E-06 | 4.40E-06 | | |
| U-232 | 4.3960E-08 | 135.65 | 271.30 | 0.00E+00 | 5.96E-06 | 1.19E-05 | | |
| U-233 | 3.3344E-09 | 135.65 | 271.30 | 0.00E+00 | 4.52E-07 | 9.05E-07 | | |
| U-234 | 4.0749E-07 | 135.65 | 271.30 | 0.00E+00 | 5.53E-05 | 1.11E-04 | | |
| U-235 | -2.7761E-06 | 135.65 | 0.00 | 5.99E-03 | 5.62E-03 | 5.99E-03 | | |
| U-236 | 1.6190E-05 | 135.65 | 271.30 | 0.00E+00 | 2.20E-03 | 4.39E-03 | | |
| U-238 | -2.8547E-09 | 135.65 | 0.00 | 3.28E-03 | 3.28E-03 | 3.28E-03 | | |
| Y-90 | 6.6889E-01 | 135.65 | 271.30 | 0.00E+00 | 9.07E+01 | 1.81E+02 | | |
| Other Radionuclides | | | | | 1.23E+02 | 2.46E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-------------|-------------|---|
| Reactor Moderator | From SFD | Used | |
| Fuel Cladding | LIGHT WATER | LIGHT WATER | This Template was used for the following reasons: This fuel matches on all parameters except enrichment. |
| BOL HM Constituents | SST | SST | |
| BOL Enrichment % | U | U | |
| | 22.12897667 | 60 to 100 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | | 135.65 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup. |
| Bounding | | 271.30 | |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0.23 | | 1.00 |
| Bounding | 0.46 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name VEPCO
SNF ID # 286
Fuel Units & Descr 20 - 15 X 15 ROD ARRAY
Heavy Metal Mass BOL=9148.286kg, EOL=8832.178kg
ROD Storage Site INEEL

¹Fuel decay start date 1983
Estimates as of 2030
Template: PWR (Light Water, Zirc, 0 to 5% U)
²Template Burnup(MWd) 61.92
Template BOL Heavy Metal Mass (MT) 0.00176911
Template Decay Time 35 years

Estimated
Canister usage
Bare Fuel Transfer

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| | m | x _n | x _b | b | y _n | y _b | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Avg MeV | |
| Ac-227 | 8.7758E-10 | 300,603.76 | 601,207.51 | 0.00E+00 | 2.64E-04 | 5.28E-04 | 0.0150 | 3.235E+16 |
| Am-241 | 1.4352E-01 | 300,603.76 | 601,207.51 | 0.00E+00 | 4.31E+04 | 8.63E+04 | 0.0250 | 6.523E+15 |
| Am-242m | 2.8698E-04 | 300,603.76 | 601,207.51 | 0.00E+00 | 8.63E+01 | 1.73E+02 | 0.0375 | 6.221E+15 |
| Am-243 | 6.2565E-04 | 300,603.76 | 601,207.51 | 0.00E+00 | 1.88E+02 | 3.76E+02 | 0.0575 | 7.189E+15 |
| C-14 | 4.7901E-05 | 300,603.76 | 601,207.51 | 0.00E+00 | 1.44E+01 | 2.88E+01 | 0.0850 | 3.620E+15 |
| Ct-36 | 8.0297E-07 | 300,603.76 | 601,207.51 | 0.00E+00 | 2.41E-01 | 4.83E-01 | 0.1250 | 2.512E+15 |
| Cm-243 | 2.5081E-04 | 300,603.76 | 601,207.51 | 0.00E+00 | 7.54E+01 | 1.51E+02 | 0.2250 | 3.104E+15 |
| Cm-244 | 4.9015E-02 | 300,603.76 | 601,207.51 | 0.00E+00 | 1.47E+04 | 2.95E+04 | 0.3750 | 1.335E+15 |
| Co-60 | 2.5581E-03 | 300,603.76 | 601,207.51 | 0.00E+00 | 7.69E+02 | 1.54E+03 | 0.5750 | 3.104E+16 |
| Cs-134 | 4.0536E-05 | 300,603.76 | 601,207.51 | 0.00E+00 | 1.22E+01 | 2.44E+01 | 0.8500 | 4.294E+14 |
| Cs-135 | 1.4433E-05 | 300,603.76 | 601,207.51 | 0.00E+00 | 4.34E+00 | 8.68E+00 | 1.2500 | 4.218E+14 |
| Cs-137 | 1.9979E+00 | 300,603.76 | 601,207.51 | 0.00E+00 | 4.20E+05 | 8.40E+05 | 1.7500 | 1.263E+13 |
| Eu-154 | 2.0203E-02 | 300,603.76 | 601,207.51 | 0.00E+00 | 6.07E+03 | 1.21E+04 | 2.2500 | 2.034E+09 |
| Eu-155 | 1.7684E-03 | 300,603.76 | 601,207.51 | 0.00E+00 | 5.32E+02 | 1.06E+03 | 2.7500 | 4.167E+09 |
| Fe-55 | 4.3136E-05 | 300,603.76 | 601,207.51 | 0.00E+00 | 1.30E+01 | 2.59E+01 | 3.5000 | 4.291E+08 |
| H-3 | 2.0769E-02 | 300,603.76 | 601,207.51 | 0.00E+00 | 6.24E+03 | 1.25E+04 | 5.0000 | 1.835E+08 |
| I-129 | 9.8288E-07 | 300,603.76 | 601,207.51 | 0.00E+00 | 2.95E-01 | 5.91E-01 | 7.0000 | 2.115E+07 |
| Kr-85 | 2.8214E-02 | 300,603.76 | 601,207.51 | 0.00E+00 | 8.48E+03 | 1.70E+04 | 11.0000 | 2.429E+06 |
| Np-237 | 1.1218E-05 | 300,603.76 | 601,207.51 | 0.00E+00 | 3.37E+00 | 6.74E+00 | | |
| Pa-231 | 1.3036E-09 | 300,603.76 | 601,207.51 | 0.00E+00 | 3.92E-04 | 7.84E-04 | | |
| Pb-210 | 8.5078E-11 | 300,603.76 | 601,207.51 | 0.00E+00 | 2.56E-05 | 5.11E-05 | | |
| Pm-147 | 3.6531E-04 | 300,603.76 | 601,207.51 | 0.00E+00 | 1.10E+02 | 2.20E+02 | | |
| Pu-238 | 7.4564E-02 | 300,603.76 | 601,207.51 | 0.00E+00 | 2.24E+04 | 4.48E+04 | | |
| Pu-239 | 1.1623E-02 | 300,603.76 | 601,207.51 | 0.00E+00 | 3.49E+03 | 6.99E+03 | | |
| Pu-240 | 1.5132E-02 | 300,603.76 | 601,207.51 | 0.00E+00 | 4.55E+03 | 9.10E+03 | | |
| Pu-241 | 9.0036E-01 | 300,603.76 | 601,207.51 | 0.00E+00 | 2.71E+05 | 5.41E+05 | | |
| Pu-242 | 6.4260E-05 | 300,603.76 | 601,207.51 | 0.00E+00 | 1.93E+01 | 3.86E+01 | | |
| Ra-226 | 2.2804E-10 | 300,603.76 | 601,207.51 | 0.00E+00 | 6.85E-05 | 1.37E-04 | | |
| Ra-228 | 5.2713E-12 | 300,603.76 | 601,207.51 | 0.00E+00 | 1.58E-06 | 3.17E-06 | | |
| Ru-106 | 6.1160E-10 | 300,603.76 | 601,207.51 | 0.00E+00 | 1.84E-04 | 3.68E-04 | | |
| Se-79 | 1.2377E-05 | 300,603.76 | 601,207.51 | 0.00E+00 | 3.72E+00 | 7.44E+00 | | |
| Sn-126 | 5.2210E-05 | 300,603.76 | 601,207.51 | 0.00E+00 | 7.58E+00 | 1.52E+01 | | |
| Sr-90 | 9.1667E-01 | 300,603.76 | 601,207.51 | 0.00E+00 | 2.76E+05 | 5.51E+05 | | |
| Tc-99 | 3.9357E-04 | 300,603.76 | 601,207.51 | 0.00E+00 | 1.18E+02 | 2.37E+02 | | |
| Th-229 | 1.2057E-10 | 300,603.76 | 601,207.51 | 0.00E+00 | 3.62E-05 | 7.25E-05 | | |
| Th-230 | 2.1043E-08 | 300,603.76 | 601,207.51 | 0.00E+00 | 6.33E-03 | 1.27E-02 | | |
| Th-232 | 5.2972E-12 | 300,603.76 | 601,207.51 | 0.00E+00 | 1.59E-06 | 3.18E-06 | | |
| Th-208 | 1.7474E-07 | 300,603.76 | 601,207.51 | 0.00E+00 | 5.25E-02 | 1.05E-01 | | |
| U-232 | 4.7368E-07 | 300,603.76 | 601,207.51 | 0.00E+00 | 1.42E-01 | 2.85E-01 | | |
| U-233 | 2.5097E-08 | 300,603.76 | 601,207.51 | 0.00E+00 | 7.54E-03 | 1.51E-02 | | |
| U-234 | 5.0000E-05 | 300,603.76 | 601,207.51 | 0.00E+00 | 1.50E+01 | 3.01E+01 | | |
| U-235 | -1.4489E-06 | 300,603.76 | 0.00 | 5.90E-01 | 1.55E-01 | 5.90E-01 | | |
| U-236 | 7.5824E-06 | 300,603.76 | 601,207.51 | 0.00E+00 | 2.28E+00 | 4.56E+00 | | |
| U-238 | -2.6129E-07 | 300,603.76 | 0.00 | 2.98E+00 | 2.90E+00 | 2.98E+00 | | |
| Y-90 | 9.1699E-01 | 300,603.76 | 601,207.51 | 0.00E+00 | 2.76E+05 | 5.51E+05 | | |
| Other Radionuclides | | | | | 4.04E+05 | 8.07E+05 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences* |
|-----------------------------------|-------------------|-----------------------------------|--|
| Reactor Moderator: | From SFD | Used | |
| Fuel Cladding: | LIGHT WATER | LIGHT WATER | |
| BOL HM Constituents | ZIRC | ZIRC | |
| BOL Enrichment % | U | U | |
| | 2.986167273 | 0 to 5 | |
| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate* |
| | From SFD | Estimated | |
| Nominal | 268 593.68 | 300 603.76 | |
| Bounding | 288 637.57 | 601,207.51 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |
| Checks | | | |
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
| Nominal | 0.94 | 1.12 | |
| Bounding | 1.88 | 2.08 | |

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

*Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: VEPCO
SNF ID #: 700
Fuel Units & Descr: 12 - 15 X 15 ROD ARRAY
Heavy Metal Mass: BOL=5488.2kg, EOL=5313.52kg
ROD Storage Site: INEEL

¹Fuel decay start date: 1981
Estimates as of: 2030
Template: PWR (Light Water, Zirc, 0 to 5%, U)
²Template Burnup (MWd): 61.92
Template BOL Heavy Metal Mass (MT): 0.00176911
Template Decay Time: 35 years

Estimated
Canister usage:
Bare Fuel Transfer

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|---------------------|------------------------------|
| Radionuclide | Cu/MWd From Template | Nominal Fuel Burnup (MWd) ³ | Bounding Fuel Burnup (MWd) ³ | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.7758E-10 | 166,112.80 | 332,225.60 | 0.00E+00 | 1.46E-04 | 2.92E-04 | Avg MeV | |
| Am-241 | 1.4352E-01 | 166,112.80 | 332,225.60 | 0.00E+00 | 2.38E+04 | 4.77E+04 | 0.0150 | 1.788E+16 |
| Am-242m | 2.8698E-04 | 166,112.80 | 332,225.60 | 0.00E+00 | 4.77E+01 | 9.53E+01 | 0.0250 | 3.605E+15 |
| Am-243 | 6.2565E-04 | 166,112.80 | 332,225.60 | 0.00E+00 | 1.04E+02 | 2.08E+02 | 0.0375 | 3.438E+15 |
| C-14 | 4.7901E-05 | 166,112.80 | 332,225.60 | 0.00E+00 | 7.96E+00 | 1.59E+01 | 0.0575 | 3.972E+15 |
| Cl-36 | 8.0297E-07 | 166,112.80 | 332,225.60 | 0.00E+00 | 1.33E-01 | 2.67E-01 | 0.0850 | 2.000E+15 |
| Cm-243 | 2.5081E-04 | 166,112.80 | 332,225.60 | 0.00E+00 | 4.17E+01 | 8.33E+01 | 0.1250 | 1.388E+15 |
| Cm-244 | 4.9015E-02 | 166,112.80 | 332,225.60 | 0.00E+00 | 8.14E+03 | 1.63E+04 | 0.2250 | 1.715E+15 |
| Co-60 | 2.5581E-03 | 166,112.80 | 332,225.60 | 0.00E+00 | 4.25E+02 | 8.50E+02 | 0.3750 | 7.375E+14 |
| Cs-134 | 4.0536E-05 | 166,112.80 | 332,225.60 | 0.00E+00 | 6.73E+00 | 1.35E+01 | 0.5750 | 1.715E+16 |
| Cs-135 | 1.4433E-05 | 166,112.80 | 332,225.60 | 0.00E+00 | 2.40E+00 | 4.80E+00 | 0.8500 | 2.373E+14 |
| Cs-137 | 1.3979E+00 | 166,112.80 | 332,225.60 | 0.00E+00 | 2.32E+05 | 4.64E+05 | 1.2500 | 2.331E+14 |
| Eu-154 | 2.0703E-02 | 166,112.80 | 332,225.60 | 0.00E+00 | 3.36E+03 | 6.71E+03 | 1.7500 | 6.981E+12 |
| Eu-155 | 1.7684E-03 | 166,112.80 | 332,225.60 | 0.00E+00 | 2.94E+02 | 5.88E+02 | 2.2500 | 1.124E+09 |
| Fe-55 | 4.3136E-05 | 166,112.80 | 332,225.60 | 0.00E+00 | 7.17E+00 | 1.43E+01 | 2.7500 | 2.303E+09 |
| H-3 | 2.0769E-02 | 166,112.80 | 332,225.60 | 0.00E+00 | 3.45E+03 | 6.90E+03 | 3.5000 | 2.371E+08 |
| I-129 | 9.8288E-07 | 166,112.80 | 332,225.60 | 0.00E+00 | 1.63E-01 | 3.27E-01 | 5.0000 | 1.014E+08 |
| Kr-85 | 2.8214E-02 | 166,112.80 | 332,225.60 | 0.00E+00 | 4.69E+03 | 9.37E+03 | 7.0000 | 1.169E+07 |
| Np-237 | 1.1218E-05 | 166,112.80 | 332,225.60 | 0.00E+00 | 1.86E+00 | 3.73E+00 | 11.0000 | 1.342E+06 |
| Pa-231 | 1.3036E-09 | 166,112.80 | 332,225.60 | 0.00E+00 | 2.17E-04 | 4.33E-04 | | |
| Pb-210 | 8.5078E-11 | 166,112.80 | 332,225.60 | 0.00E+00 | 1.41E-05 | 2.83E-05 | | |
| Pm-147 | 3.6531E-04 | 166,112.80 | 332,225.60 | 0.00E+00 | 6.07E+01 | 1.21E+02 | | |
| Pu-238 | 7.4564E-02 | 166,112.80 | 332,225.60 | 0.00E+00 | 1.24E+04 | 2.48E+04 | | |
| Pu-239 | 1.1623E-02 | 166,112.80 | 332,225.60 | 0.00E+00 | 1.93E+03 | 3.86E+03 | | |
| Pu-240 | 1.5132E-02 | 166,112.80 | 332,225.60 | 0.00E+00 | 2.51E+03 | 5.03E+03 | | |
| Pu-241 | 9.0036E-01 | 166,112.80 | 332,225.60 | 0.00E+00 | 1.50E+05 | 2.99E+05 | | |
| Pu-242 | 6.4260E-05 | 166,112.80 | 332,225.60 | 0.00E+00 | 1.07E+01 | 2.13E+01 | | |
| Ra-226 | 2.2804E-10 | 166,112.80 | 332,225.60 | 0.00E+00 | 3.79E-05 | 7.58E-05 | | |
| Ra-228 | 5.2713E-12 | 166,112.80 | 332,225.60 | 0.00E+00 | 8.76E-07 | 1.75E-06 | | |
| Ru-106 | 6.1160E-10 | 166,112.80 | 332,225.60 | 0.00E+00 | 1.02E-04 | 2.03E-04 | | |
| Se-79 | 1.2377E-05 | 166,112.80 | 332,225.60 | 0.00E+00 | 2.06E+00 | 4.11E+00 | | |
| Sn-126 | 2.5210E-05 | 166,112.80 | 332,225.60 | 0.00E+00 | 4.19E+00 | 8.38E+00 | | |
| Sr-90 | 9.1667E-01 | 166,112.80 | 332,225.60 | 0.00E+00 | 1.52E+05 | 3.05E+05 | | |
| Tc-99 | 3.9357E-04 | 166,112.80 | 332,225.60 | 0.00E+00 | 6.54E+01 | 1.31E+02 | | |
| Th-229 | 1.2057E-10 | 166,112.80 | 332,225.60 | 0.00E+00 | 2.00E-05 | 4.01E-05 | | |
| Th-230 | 2.1043E-08 | 166,112.80 | 332,225.60 | 0.00E+00 | 3.50E-03 | 6.99E-03 | | |
| Th-232 | 5.2972E-12 | 166,112.80 | 332,225.60 | 0.00E+00 | 8.80E-07 | 1.76E-06 | | |
| Th-208 | 1.7474E-07 | 166,112.80 | 332,225.60 | 0.00E+00 | 2.90E-02 | 5.81E-02 | | |
| U-232 | 4.7368E-07 | 166,112.80 | 332,225.60 | 0.00E+00 | 7.87E-02 | 1.57E-01 | | |
| U-233 | 2.5097E-08 | 166,112.80 | 332,225.60 | 0.00E+00 | 4.17E-03 | 8.34E-03 | | |
| U-234 | 5.0000E-05 | 166,112.80 | 332,225.60 | 0.00E+00 | 8.31E+00 | 1.66E+01 | | |
| U-235 | -1.4489E-06 | 166,112.80 | 0.00 | 3.36E-01 | 9.54E-02 | 3.36E-01 | | |
| U-236 | 7.5824E-06 | 166,112.80 | 332,225.60 | 0.00E+00 | 1.26E+00 | 2.52E+00 | | |
| U-238 | -2.6129E-07 | 166,112.80 | 0.00 | 1.79E+00 | 1.75E+00 | 1.79E+00 | | |
| Y-90 | 9.1699E-01 | 166,112.80 | 332,225.60 | 0.00E+00 | 1.52E+05 | 3.05E+05 | | |
| Other Radionuclides | | | | | 2.23E+05 | 4.46E+05 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-------------|-------------|----------------------------------|
| Reactor Moderator: | From SFD | Used | |
| | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding: | ZIRC | ZIRC | |
| BOL HM Constituents: | U | U | |
| BOL Enrichment % | 2.833496228 | 0 to 5 | |

| Burnup Summary (MWd) ³ | | | Basis for burnup used in estimate: |
|-----------------------------------|------------|------------|---|
| | From SFD | Estimated | |
| Nominal | 161.133.55 | 166,112.80 | |
| Bounding | 173,158.20 | 332,225.60 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 0.86 | 1.03 | |
| Bounding | 1.73 | 1.92 | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name VEPCO (T-11 ASSEMBLY)
 SNF ID # 993
 Fuel Units & Descr 1 - 15 X 15 ROD ARRAY
 Heavy Metal Mass BOL=457 414kg EOL=440kg
 ROD Storage Site INEEL

¹Fuel decay start date 1983
 Estimates as of 2030
 Template PWR (Light Water, Zirc 0 to 5%, U)
²Template Burnup(MWd): 61 92
 Template BOL Heavy Metal Mass (MT) 0 00176911
 Template Decay Time 35 years

Estimated
 Canister usage
 HIC
 1 00

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| | m | x _a | x _b | b | y _a | y _b | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Avg MeV | |
| Ac-227 | 8 7758E-10 | 16,560 18 | 33,120 35 | 0 00E+00 | 1 45E-05 | 2 91E-05 | 0 0150 | 1 782E+15 |
| Am-241 | 1 4352E-01 | 16,560 18 | 33,120 35 | 0 00E+00 | 2 38E+03 | 4 75E+03 | 0 0250 | 3 594E+14 |
| Am-242m | 2 8698E-04 | 16,560 18 | 33,120 35 | 0 00E+00 | 4 75E+00 | 9 50E+00 | 0 0375 | 3 427E+14 |
| Am-243 | 6 2565E-04 | 16,560 18 | 33,120 35 | 0 00E+00 | 1 04E+01 | 2 07E+01 | 0 0575 | 3 960E+14 |
| C-14 | 4 7901E-05 | 16,560 18 | 33,120 35 | 0 00E+00 | 7 93E-01 | 1 59E+00 | 0 0850 | 1 994E+14 |
| Ci-36 | 8 0297E-07 | 16,560 18 | 33,120 35 | 0 00E+00 | 1 33E-02 | 2 66E-02 | 0 1250 | 1 384E+14 |
| Cm-243 | 2 5081E-04 | 16,560 18 | 33,120 35 | 0 00E+00 | 4 15E+00 | 8 31E+00 | 0 2250 | 1 710E+14 |
| Cm-244 | 4 9015E-02 | 16,560 18 | 33,120 35 | 0 00E+00 | 8 12E+02 | 1 62E+03 | 0 3750 | 7 353E+13 |
| Co-60 | 2 5581E-03 | 16,560 18 | 33,120 35 | 0 00E+00 | 4 24E+01 | 8 47E+01 | 0 5750 | 1 710E+15 |
| Cs-134 | 4 0536E-05 | 16,560 18 | 33,120 35 | 0 00E+00 | 6 71E-01 | 1 34E+00 | 0 8500 | 2 366E+13 |
| Cs-135 | 1 4433E-05 | 16,560 18 | 33,120 35 | 0 00E+00 | 2 39E-01 | 4 78E-01 | 1 2500 | 2 324E+13 |
| Cs-137 | 1 3979E+00 | 16,560 18 | 33,120 35 | 0 00E+00 | 2 32E+04 | 4 63E+04 | 1 7500 | 6 959E+11 |
| Eu-154 | 2 0203E-02 | 16,560 18 | 33,120 35 | 0 00E+00 | 3 35E+02 | 6 69E+02 | 2 2500 | 1 121E+08 |
| Eu-155 | 1 7684E-03 | 16,560 18 | 33,120 35 | 0 00E+00 | 2 93E+01 | 5 86E+01 | 2 7500 | 2 296E+08 |
| Fe-55 | 4 3136E-05 | 16,560 18 | 33,120 35 | 0 00E+00 | 7 14E-01 | 1 43E+00 | 3 5000 | 2 364E+07 |
| H-3 | 2 0769E-02 | 16,560 18 | 33,120 35 | 0 00E+00 | 3 44E+02 | 6 88E+02 | 5 0000 | 1 011E+07 |
| I-129 | 9 8288E-07 | 16,560 18 | 33,120 35 | 0 00E+00 | 1 63E-02 | 3 26E-02 | 7 0000 | 1 165E+06 |
| Kr-85 | 2 8214E-02 | 16,560 18 | 33,120 35 | 0 00E+00 | 4 67E+02 | 9 34E+02 | 11 0000 | 1 338E+05 |
| Np-237 | 1 1218E-05 | 16,560 18 | 33,120 35 | 0 00E+00 | 1 86E-01 | 3 72E-01 | | |
| Pa-231 | 1 3036E-09 | 16,560 18 | 33,120 35 | 0 00E+00 | 2 16E-05 | 4 32E-05 | | |
| Pb-210 | 8 5078E-11 | 16,560 18 | 33,120 35 | 0 00E+00 | 1 41E-06 | 2 82E-06 | | |
| Pm-147 | 3 6531E-04 | 16,560 18 | 33,120 35 | 0 00E+00 | 6 05E+00 | 1 21E+01 | | |
| Pu-238 | 7 4564E-02 | 16,560 18 | 33,120 35 | 0 00E+00 | 1 23E+03 | 2 47E+03 | | |
| Pu-239 | 1 1623E-02 | 16,560 18 | 33,120 35 | 0 00E+00 | 1 92E+02 | 3 85E+02 | | |
| Pu-240 | 1 5132E-02 | 16,560 18 | 33,120 35 | 0 00E+00 | 2 51E+02 | 5 01E+02 | | |
| Pu-241 | 9 0036E-01 | 16,560 18 | 33,120 35 | 0 00E+00 | 1 49E+04 | 2 98E+04 | | |
| Pu-242 | 6 4260E-05 | 16,560 18 | 33,120 35 | 0 00E+00 | 1 06E+00 | 2 13E+00 | | |
| Ra-226 | 2 2804E-10 | 16,560 18 | 33,120 35 | 0 00E+00 | 3 78E-06 | 7 55E-06 | | |
| Ra-228 | 5 2713E-12 | 16,560 18 | 33,120 35 | 0 00E+00 | 8 73E-08 | 1 75E-07 | | |
| Ru-106 | 6 1160E-10 | 16,560 18 | 33,120 35 | 0 00E+00 | 1 01E-05 | 2 03E-05 | | |
| Se-79 | 1 2377E-05 | 16,560 18 | 33,120 35 | 0 00E+00 | 2 05E-01 | 4 10E-01 | | |
| Sn-126 | 2 5210E-05 | 16,560 18 | 33,120 35 | 0 00E+00 | 4 17E-01 | 8 35E-01 | | |
| Sr-90 | 9 1667E-01 | 16,560 18 | 33,120 35 | 0 00E+00 | 1 52E+04 | 3 04E+04 | | |
| Tc-99 | 3 9357E-04 | 16,560 18 | 33,120 35 | 0 00E+00 | 6 52E+00 | 1 30E+01 | | |
| Th-229 | 1 2057E-10 | 16,560 18 | 33,120 35 | 0 00E+00 | 2 00E-06 | 3 99E-06 | | |
| Th-230 | 2 1043E-08 | 16,560 18 | 33,120 35 | 0 00E+00 | 3 48E-04 | 6 97E-04 | | |
| Th-232 | 5 2972E-12 | 16,560 18 | 33,120 35 | 0 00E+00 | 8 77E-08 | 1 75E-07 | | |
| Ti-208 | 1 7474E-07 | 16,560 18 | 33,120 35 | 0 00E+00 | 2 89E-03 | 5 79E-03 | | |
| U-232 | 4 7368E-07 | 16,560 18 | 33,120 35 | 0 00E+00 | 7 84E-03 | 1 57E-02 | | |
| U-233 | 2 5097E-08 | 16,560 18 | 33,120 35 | 0 00E+00 | 4 16E-04 | 8 31E-04 | | |
| U-234 | 5 0000E-05 | 16,560 18 | 33,120 35 | 0 00E+00 | 8 28E-01 | 1 66E+00 | | |
| U-235 | -1 4489E-06 | 16,560 18 | 0 00 | 2 95E-02 | 5 52E-03 | 2 95E-02 | | |
| U-236 | 7 5824E-06 | 16,560 18 | 33,120 35 | 0 00E+00 | 1 26E-01 | 2 51E-01 | | |
| U-238 | -2 6129E-07 | 16,560 18 | 0 00 | 1 49E-01 | 1 45E-01 | 1 49E-01 | | |
| Y-90 | 9 1699E-01 | 16,560 18 | 33,120 35 | 0 00E+00 | 1 52E+04 | 3 04E+04 | | |
| Other Radionuclides | | | | | 2 22E+04 | 4 45E+04 | | |

Thermal Power
 Nominal Heat Output (Watts)
 Bounding Heat Output (Watts)
 3 81E+02 7 62E+02
 Total Total

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|-----------------------------------|-------------------|-----------------------------------|---|
| | From SFD | Used | |
| Reactor Moderator: | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding | ZIRC | ZIRC | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 2 986167273 | 0 to 5 | |
| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
| | From SFD | Estimated | |
| Nominal | 13 429 68 | 16 560 18 | |
| Bounding | 14 431 88 | 33 120 35 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup |
| Checks | | | |
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
| Nominal | 1 03 | 1 23 | 1 00 |
| Bounding | 2 07 | 2 29 | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: VEPCO (T-11 RODS)
SNF ID #: 1049
Fuel Units & Descr: 9 - ROD
Heavy Metal Mass: BOL=20 18kg EOL=19 678kg
ROD Storage Site: INEEL

¹Fuel decay start date: 1983
Estimates as of: 2030
Template: PWR (Light Water, Zirc, 0 to 5%, U)
²Template Burnup(MWd): 61 92
Template BOL Heavy Metal Mass (MT): 0 00176911
Template Decay Time: 35 years

Estimated
Canister usage
18"x10"
0 07

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | CvMWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 7758E-10 | 592 48 | 636 69 | 0 00E+00 | 5 20E-07 | 5 59E-07 | Avg MeV | |
| Am-241 | 1 4352E-01 | 592 48 | 636 69 | 0 00E+00 | 8 50E+01 | 9 14E+01 | 0 0150 | 3 426E+13 |
| Am-242m | 2 8698E-04 | 592 48 | 636 69 | 0 00E+00 | 1 70E-01 | 1 83E-01 | 0 0250 | 6 908E+12 |
| Am-243 | 6 2565E-04 | 592 48 | 636 69 | 0 00E+00 | 3 71E-01 | 3 98E-01 | 0 0375 | 6 589E+12 |
| C-14 | 4 7901E-05 | 592 48 | 636 69 | 0 00E+00 | 2 84E-02 | 3 05E-02 | 0 0575 | 7 613E+12 |
| Ct-36 | 8 0297E-07 | 592 48 | 636 69 | 0 00E+00 | 4 76E-04 | 5 11E-04 | 0 0850 | 3 833E+12 |
| Cm-243 | 2 5081E-04 | 592 48 | 636 69 | 0 00E+00 | 1 49E-01 | 1 60E-01 | 0 1250 | 2 660E+12 |
| Cm-244 | 4 9015E-02 | 592 48 | 636 69 | 0 00E+00 | 2 90E+01 | 3 12E+01 | 0 2250 | 3 287E+12 |
| Co-60 | 2 5581E-03 | 592 48 | 636 69 | 0 00E+00 | 1 52E+00 | 1 63E+00 | 0 3750 | 1 413E+12 |
| Cs-134 | 4 0536E-05 | 592 48 | 636 69 | 0 00E+00 | 2 40E-02 | 2 58E-02 | 0 5750 | 3 287E+13 |
| Cs-135 | 1 4433E-05 | 592 48 | 636 69 | 0 00E+00 | 8 55E-03 | 9 19E-03 | 0 8500 | 4 548E+11 |
| Cs-137 | 1 3979E+00 | 592 48 | 636 69 | 0 00E+00 | 8 28E+02 | 8 90E+02 | 1 2500 | 4 467E+11 |
| Eu-154 | 2 0203E-02 | 592 48 | 636 69 | 0 00E+00 | 1 20E+01 | 1 29E+01 | 1 7500 | 1 338E+10 |
| Eu-155 | 1 7684E-03 | 592 48 | 636 69 | 0 00E+00 | 1 05E+00 | 1 13E+00 | 2 2500 | 2 154E+06 |
| Fe-55 | 4 3136E-05 | 592 48 | 636 69 | 0 00E+00 | 2 56E-02 | 2 75E-02 | 2 7500 | 4 413E+06 |
| H-3 | 2 0769E-02 | 592 48 | 636 69 | 0 00E+00 | 1 23E+01 | 1 32E+01 | 3 5000 | 4 544E+05 |
| I-129 | 9 8288E-07 | 592 48 | 636 69 | 0 00E+00 | 5 82E-04 | 6 26E-04 | 5 0000 | 1 943E+05 |
| Kr-85 | 2 8214E-02 | 592 48 | 636 69 | 0 00E+00 | 1 67E+01 | 1 80E+01 | 7 0000 | 2 239E+04 |
| Np-237 | 1 1218E-05 | 592 48 | 636 69 | 0 00E+00 | 6 65E-03 | 7 14E-03 | 11 0000 | 2 572E+03 |
| Pa-231 | 1 3036E-09 | 592 48 | 636 69 | 0 00E+00 | 7 72E-07 | 8 30E-07 | | |
| Pb-210 | 8 5078E-11 | 592 48 | 636 69 | 0 00E+00 | 5 04E-08 | 5 42E-08 | | |
| Pm-147 | 3 6531E-04 | 592 48 | 636 69 | 0 00E+00 | 2 16E-01 | 2 33E-01 | | |
| Pu-238 | 7 4564E-02 | 592 48 | 636 69 | 0 00E+00 | 4 42E+01 | 4 75E+01 | | |
| Pu-239 | 1 1623E-02 | 592 48 | 636 69 | 0 00E+00 | 6 89E+00 | 7 40E+00 | | |
| Pu-240 | 1 5132E-02 | 592 48 | 636 69 | 0 00E+00 | 8 97E+00 | 9 63E+00 | | |
| Pu-241 | 9 0036E-01 | 592 48 | 636 69 | 0 00E+00 | 5 33E+02 | 5 73E+02 | | |
| Pu-242 | 6 4260E-05 | 592 48 | 636 69 | 0 00E+00 | 3 81E-02 | 4 09E-02 | | |
| Ra-226 | 2 2804E-10 | 592 48 | 636 69 | 0 00E+00 | 1 35E-07 | 1 45E-07 | | |
| Ra-228 | 5 2713E-12 | 592 48 | 636 69 | 0 00E+00 | 3 12E-09 | 3 36E-09 | | |
| Ru-106 | 6 1160E-10 | 592 48 | 636 69 | 0 00E+00 | 3 62E-07 | 3 89E-07 | | |
| Se-79 | 1 2377E-05 | 592 48 | 636 69 | 0 00E+00 | 7 33E-03 | 7 88E-03 | | |
| Sn-126 | 2 5210E-05 | 592 48 | 636 69 | 0 00E+00 | 1 49E-02 | 1 61E-02 | | |
| Sr-90 | 9 1667E-01 | 592 48 | 636 69 | 0 00E+00 | 5 43E+02 | 5 84E+02 | | |
| Tc-99 | 3 9357E-04 | 592 48 | 636 69 | 0 00E+00 | 2 33E-01 | 2 51E-01 | | |
| Th-229 | 1 2057E-10 | 592 48 | 636 69 | 0 00E+00 | 7 14E-08 | 7 68E-08 | | |
| Th-230 | 2 1043E-08 | 592 48 | 636 69 | 0 00E+00 | 1 25E-05 | 1 34E-05 | | |
| Th-232 | 5 2972E-12 | 592 48 | 636 69 | 0 00E+00 | 3 14E-09 | 3 37E-09 | | |
| Th-208 | 1 7474E-07 | 592 48 | 636 69 | 0 00E+00 | 1 04E-04 | 1 11E-04 | | |
| U-232 | 4 7368E-07 | 592 48 | 636 69 | 0 00E+00 | 2 81E-04 | 3 02E-04 | | |
| U-233 | 2 5097E-08 | 592 48 | 636 69 | 0 00E+00 | 1 49E-05 | 1 60E-05 | | |
| U-234 | 5 0000E-05 | 592 48 | 636 69 | 0 00E+00 | 2 96E-02 | 3 18E-02 | | |
| U-235 | -1 4489E-06 | 592 48 | 0 00 | 1 30E-03 | 4 44E-04 | 1 30E-03 | | |
| U-236 | 7 5824E-06 | 592 48 | 636 69 | 0 00E+00 | 4 49E-03 | 4 83E-03 | | |
| U-238 | -2 6129E-07 | 592 48 | 0 00 | 6 58E-03 | 6 43E-03 | 6 58E-03 | | |
| Y-90 | 9 1699E-01 | 592 48 | 636 69 | 0 00E+00 | 5 43E+02 | 5 84E+02 | | |
| Other Radionuclides | | | | | 7 95E+02 | 8 55E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-------------|-------------|----------------------------------|
| Reactor Moderator | From SFD | Used | |
| Fuel Cladding | LIGHT WATER | LIGHT WATER | |
| BOL HM Constituents | ZIRC | ZIRC | |
| BOL Enrichment % | 2 986165227 | 0 to 5 | |

| Burnup Summary (MWd) ¹ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|------------------------------------|
| | From SFD | Estimated | |
| Nominal | 592 48 | 477 57 | |
| Bounding | 636 69 | 955 14 | |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0 84 | 0 81 | |
| Bounding | 0 90 | 1 50 | 0 99 |

¹Reactor shutdown, core removal storage shipping or other date confirming that irradiation ceased for fuel.

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT).

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: VEPOT T-11
SNF ID #: 994
Fuel Units & Descr: 3 - ROD
Heavy Metal Mass BOL=6 727kg EOL=6.559kg
ROD Storage Site INEEL

Fuel decay start date 1983
Estimates as of 2030
Template PWR (Light Water, Zirc, 0 to 5%, U)
*Template Burnup(MWd) 61.92
Template BOL Heavy Metal Mass (MT) 0 00176911
Template Decay Time 35 years

Estimated
Canister usage
18"x10"
0 02

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8 7758E-10 | 197 49 | 212 23 | 0 00E+00 | 1 73E-07 | 1 86E-07 | Avg MeV | |
| Am-241 | 1 4352E-01 | 197 49 | 212 23 | 0 00E+00 | 2 83E+01 | 3 05E+01 | 0 0150 | 1 142E+13 |
| Am-242m | 2 8698E-04 | 197 49 | 212 23 | 0 00E+00 | 5 67E-02 | 6 09E-02 | 0 0250 | 2 303E+12 |
| Am-243 | 6 2565E-04 | 197 49 | 212 23 | 0 00E+00 | 1 24E-01 | 1 33E-01 | 0 0375 | 2 196E+12 |
| C-14 | 4 7901E-05 | 197 49 | 212 23 | 0 00E+00 | 9 46E-03 | 1 02E-02 | 0 0675 | 2 538E+12 |
| Cl-36 | 8 0297E-07 | 197 49 | 212 23 | 0 00E+00 | 1 59E-04 | 1 70E-04 | 0 0850 | 1 278E+12 |
| Cm-243 | 2 5081E-04 | 197 49 | 212 23 | 0 00E+00 | 4 95E-02 | 5 32E-02 | 0 1250 | 8 867E+11 |
| Cm-244 | 4 9015E-02 | 197 49 | 212 23 | 0 00E+00 | 9 68E+00 | 1 04E+01 | 0 2250 | 1 096E+12 |
| Co-60 | 2 5581E-03 | 197 49 | 212 23 | 0 00E+00 | 5 05E-01 | 5 43E-01 | 0 3750 | 4 712E+11 |
| Cs-134 | 4 0536E-05 | 197 49 | 212 23 | 0 00E+00 | 8 01E-03 | 8 60E-03 | 0 5750 | 1 096E+13 |
| Cs-135 | 1 4433E-05 | 197 49 | 212 23 | 0 00E+00 | 2 85E-03 | 3 06E-03 | 0 8500 | 1 516E+11 |
| Cs-137 | 1 3979E+00 | 197 49 | 212 23 | 0 00E+00 | 2 76E+02 | 2 97E+02 | 1 2500 | 1 489E+11 |
| Eu-154 | 2 0203E-02 | 197 49 | 212 23 | 0 00E+00 | 3 99E+00 | 4 29E+00 | 1 7500 | 4 459E+09 |
| Eu-155 | 1 7684E-03 | 197 49 | 212 23 | 0 00E+00 | 3 49E-01 | 3 75E-01 | 2 2500 | 7 181E+05 |
| Fe-55 | 4 3136E-05 | 197 49 | 212 23 | 0 00E+00 | 8 52E-03 | 9 15E-03 | 2 7500 | 1 471E+06 |
| H-3 | 2 0769E-02 | 197 49 | 212 23 | 0 00E+00 | 4 10E+00 | 4 41E+00 | 3 5000 | 1 515E+05 |
| I-129 | 9 8288E-07 | 197 49 | 212 23 | 0 00E+00 | 1 94E-04 | 2 09E-04 | 5 0000 | 6 477E+04 |
| Kr-85 | 2 8214E-02 | 197 49 | 212 23 | 0 00E+00 | 5 57E+00 | 5 99E+00 | 7 0000 | 7 465E+03 |
| Np-237 | 1 1218E-05 | 197 49 | 212 23 | 0 00E+00 | 2 22E-03 | 2 38E-03 | 11 0000 | 8 574E+02 |
| Pa-231 | 1 3036E-09 | 197 49 | 212 23 | 0 00E+00 | 2 57E-07 | 2 77E-07 | | |
| Pb-210 | 8 5078E-11 | 197 49 | 212 23 | 0 00E+00 | 1 68E-08 | 1 81E-08 | | |
| Pm-147 | 3 6531E-04 | 197 49 | 212 23 | 0 00E+00 | 7 21E-02 | 7 75E-02 | | |
| Pu-238 | 7 4564E-02 | 197 49 | 212 23 | 0 00E+00 | 1 47E+01 | 1 58E+01 | | |
| Pu-239 | 1 1623E-02 | 197 49 | 212 23 | 0 00E+00 | 2 30E+00 | 2 47E+00 | | |
| Pu-240 | 1 5132E-02 | 197 49 | 212 23 | 0 00E+00 | 2 99E+00 | 3 21E+00 | | |
| Pu-241 | 9 0036E-01 | 197 49 | 212 23 | 0 00E+00 | 1 78E+02 | 1 91E+02 | | |
| Pu-242 | 6 4260E-05 | 197 49 | 212 23 | 0 00E+00 | 1 27E-02 | 1 36E-02 | | |
| Ra-226 | 2 2804E-10 | 197 49 | 212 23 | 0 00E+00 | 4 50E-08 | 4 84E-08 | | |
| Ra-228 | 5 2713E-12 | 197 49 | 212 23 | 0 00E+00 | 1 04E-09 | 1 12E-09 | | |
| Ru-106 | 6 1160E-10 | 197 49 | 212 23 | 0 00E+00 | 1 21E-07 | 1 30E-07 | | |
| Se-79 | 1 2377E-05 | 197 49 | 212 23 | 0 00E+00 | 2 44E-03 | 2 63E-03 | | |
| Sn-126 | 2 5210E-05 | 197 49 | 212 23 | 0 00E+00 | 4 98E-03 | 5 35E-03 | | |
| Sr-90 | 9 1667E-01 | 197 49 | 212 23 | 0 00E+00 | 1 81E+02 | 1 95E+02 | | |
| Tc-99 | 3 9357E-04 | 197 49 | 212 23 | 0 00E+00 | 7 77E-02 | 8 35E-02 | | |
| Th-229 | 1 2057E-10 | 197 49 | 212 23 | 0 00E+00 | 2 38E-08 | 2 56E-08 | | |
| Th-230 | 2 1043E-08 | 197 49 | 212 23 | 0 00E+00 | 4 16E-06 | 4 47E-06 | | |
| Th-232 | 5 2972E-12 | 197 49 | 212 23 | 0 00E+00 | 1 05E-09 | 1 12E-09 | | |
| Ti-208 | 1 7474E-07 | 197 49 | 212 23 | 0 00E+00 | 3 45E-05 | 3 71E-05 | | |
| U-232 | 4 7368E-07 | 197 49 | 212 23 | 0 00E+00 | 9 35E-05 | 1 01E-04 | Thermal Power | |
| U-233 | 2 5097E-08 | 197 49 | 212 23 | 0 00E+00 | 4 96E-06 | 5 33E-06 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 5 0000E-05 | 197 49 | 212 23 | 0 00E+00 | 9 87E-03 | 1 06E-02 | 4 54E+00 | 4 88E+00 |
| U-235 | -1 4489E-06 | 197 49 | 0 00 | 4 34E-04 | 1 48E-04 | 4 34E-04 | Total | Total |
| U-236 | 7 5824E-06 | 197 49 | 212 23 | 0 00E+00 | 1 50E-03 | 1 61E-03 | | |
| U-238 | -2 6129E-07 | 197 49 | 0 00 | 2 19E-03 | 2 14E-03 | 2 19E-03 | | |
| Y-90 | 9 1699E-01 | 197 49 | 212 23 | 0 00E+00 | 1 81E+02 | 1 95E+02 | | |
| Other Radionuclides | | | | | 2 65E+02 | 2 85E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences |
|---------------------|-------------|-------------|---------------------------------|
| Reactor Moderator: | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding | ZIRC | ZIRC | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 2.986165227 | 0 to 5 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate* |
|----------|----------|-----------|------------------------------------|
| Nominal | 197.49 | 159.19 | |
| Bounding | 212.23 | 318.38 | |

Nominal burnup taken directly from SFD (converted to MWd)
Bounding burnup taken directly from SFD (converted to MWd)

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0.84 | 0.81 | |
| Bounding | 0.90 | 1.50 | |

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

*Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: ANLJ
SNF ID #: 5
Fuel Units & Descr: 19 - ELEMENT
Heavy Metal Mass: BOL=2.793kg, EOL=2.789kg
ROD Storage Site: SRS

¹Fuel decay start date: 1966
Estimates as of: 2030
Template: ATR (Light Water, Alum 60 to 100%, U)
²Template Burnup(MWd): 367.2
Template BOL Heavy Metal Mass (MT): 0.00116689
Template Decay Time: 50 years

Estimated
Canister usage:
18"x10"
0.79

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.9739E-09 | 3.60 | 7.20 | 0.00E+00 | 1.07E-08 | 2.14E-08 | Avg. MeV | |
| Am-241 | 2.5986E-03 | 3.60 | 7.20 | 0.00E+00 | 9.35E-03 | 1.87E-02 | 0.0150 | 3.709E+11 |
| Am-242m | 3.7010E-07 | 3.60 | 7.20 | 0.00E+00 | 1.33E-06 | 2.66E-06 | 0.0250 | 7.697E+10 |
| Am-243 | 1.4858E-06 | 3.60 | 7.20 | 0.00E+00 | 5.35E-06 | 1.07E-05 | 0.0375 | 6.689E+10 |
| C-14 | 5.6944E-09 | 3.60 | 7.20 | 0.00E+00 | 2.05E-08 | 4.10E-08 | 0.0575 | 7.206E+10 |
| Cl-36 | 1.3124E-32 | 3.60 | 7.20 | 0.00E+00 | 4.72E-32 | 9.45E-32 | 0.0850 | 4.338E+10 |
| Cm-243 | 7.9303E-08 | 3.60 | 7.20 | 0.00E+00 | 2.85E-07 | 5.71E-07 | 0.1250 | 2.837E+10 |
| Cm-244 | 9.3083E-06 | 3.60 | 7.20 | 0.00E+00 | 3.35E-05 | 6.70E-05 | 0.2250 | 3.752E+10 |
| Co-60 | 1.0310E-07 | 3.60 | 7.20 | 0.00E+00 | 3.71E-07 | 7.42E-07 | 0.3750 | 1.630E+10 |
| Cs-134 | 1.3254E-07 | 3.60 | 7.20 | 0.00E+00 | 4.77E-07 | 9.54E-07 | 0.5750 | 2.723E+11 |
| Cs-135 | 3.4477E-06 | 3.60 | 7.20 | 0.00E+00 | 1.24E-05 | 2.48E-05 | 0.8500 | 2.917E+09 |
| Cs-137 | 1.0161E+00 | 3.60 | 7.20 | 0.00E+00 | 3.66E+00 | 7.31E+00 | 1.2500 | 1.180E+09 |
| Eu-154 | 2.1879E-03 | 3.60 | 7.20 | 0.00E+00 | 7.87E-03 | 1.57E-02 | 1.7500 | 7.727E+07 |
| Eu-155 | 7.2930E-05 | 3.60 | 7.20 | 0.00E+00 | 2.62E-04 | 5.25E-04 | 2.2500 | 7.495E+03 |
| Fe-55 | 4.1912E-08 | 3.60 | 7.20 | 0.00E+00 | 1.51E-07 | 3.02E-07 | 2.7500 | 8.850E+03 |
| H-3 | 8.4913E-04 | 3.60 | 7.20 | 0.00E+00 | 3.06E-03 | 6.11E-03 | 3.5000 | 5.381E+00 |
| I-129 | 7.5300E-07 | 3.60 | 7.20 | 0.00E+00 | 2.71E-06 | 5.42E-06 | 5.0000 | 2.196E+00 |
| Kr-85 | 1.5615E-02 | 3.60 | 7.20 | 0.00E+00 | 5.62E-02 | 1.12E-01 | 7.0000 | 2.396E-01 |
| Np-237 | 9.5861E-06 | 3.60 | 7.20 | 0.00E+00 | 3.45E-05 | 6.90E-05 | 11.0000 | 2.668E-02 |
| Pa-231 | 5.0790E-09 | 3.60 | 7.20 | 0.00E+00 | 1.83E-08 | 3.66E-08 | | |
| Pb-210 | 6.6176E-10 | 3.60 | 7.20 | 0.00E+00 | 2.38E-09 | 4.76E-09 | | |
| Pm-147 | 1.7606E-05 | 3.60 | 7.20 | 0.00E+00 | 6.34E-05 | 1.27E-04 | | |
| Pu-238 | 1.4406E-02 | 3.60 | 7.20 | 0.00E+00 | 5.18E-02 | 1.04E-01 | | |
| Pu-239 | 4.2783E-04 | 3.60 | 7.20 | 0.00E+00 | 1.54E-03 | 3.08E-03 | | |
| Pu-240 | 2.4297E-04 | 3.60 | 7.20 | 0.00E+00 | 8.74E-04 | 1.75E-03 | | |
| Pu-241 | 7.8949E-03 | 3.60 | 7.20 | 0.00E+00 | 2.84E-02 | 5.68E-02 | | |
| Pu-242 | 3.6329E-07 | 3.60 | 7.20 | 0.00E+00 | 1.31E-06 | 2.61E-06 | | |
| Ra-226 | 1.5169E-09 | 3.60 | 7.20 | 0.00E+00 | 5.46E-09 | 1.09E-08 | | |
| Ra-228 | 4.2429E-14 | 3.60 | 7.20 | 0.00E+00 | 1.53E-13 | 3.05E-13 | | |
| Ru-106 | 7.0833E-15 | 3.60 | 7.20 | 0.00E+00 | 2.55E-14 | 5.10E-14 | | |
| Se-79 | 1.2928E-05 | 3.60 | 7.20 | 0.00E+00 | 4.65E-05 | 9.30E-05 | | |
| Sn-126 | 1.1571E-05 | 3.60 | 7.20 | 0.00E+00 | 4.16E-05 | 8.33E-05 | | |
| Sr-90 | 9.4308E-01 | 3.60 | 7.20 | 0.00E+00 | 3.39E+00 | 6.79E+00 | | |
| Tc-99 | 4.2239E-04 | 3.60 | 7.20 | 0.00E+00 | 1.52E-03 | 3.04E-03 | | |
| Th-229 | 1.7968E-11 | 3.60 | 7.20 | 0.00E+00 | 6.47E-11 | 1.29E-10 | | |
| Th-230 | 1.0855E-07 | 3.60 | 7.20 | 0.00E+00 | 3.91E-07 | 7.81E-07 | | |
| Th-232 | 4.9809E-14 | 3.60 | 7.20 | 0.00E+00 | 1.79E-13 | 3.58E-13 | | |
| Ti-208 | 3.4995E-08 | 3.60 | 7.20 | 0.00E+00 | 1.26E-07 | 2.52E-07 | | |
| U-232 | 9.4798E-08 | 3.60 | 7.20 | 0.00E+00 | 3.41E-07 | 6.82E-07 | | |
| U-233 | 4.2538E-09 | 3.60 | 7.20 | 0.00E+00 | 1.53E-08 | 3.06E-08 | | |
| U-234 | 1.8617E-04 | 3.60 | 7.20 | 0.00E+00 | 6.70E-04 | 1.34E-03 | | |
| U-235 | -2.7235E-06 | 3.60 | 0.00 | 5.63E-03 | 5.62E-03 | 5.63E-03 | | |
| U-236 | 1.5493E-05 | 3.60 | 7.20 | 0.00E+00 | 5.58E-05 | 1.12E-04 | | |
| U-238 | -4.2851E-09 | 3.60 | 0.00 | 6.39E-05 | 6.38E-05 | 6.39E-05 | | |
| Y-90 | 9.4308E-01 | 3.60 | 7.20 | 0.00E+00 | 3.39E+00 | 6.79E+00 | | |
| Other Radionuclides | | | | | 3.49E+00 | 6.98E+00 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|---------------------|-------------|----------------------------------|
| Reactor Moderator | From SFD | Used | |
| | LIGHT WATER | LIGHT WATER | |
| | Fuel Cladding | ALUM | |
| | BOL HM Constituents | U | |
| BOL Enrichment % | 93.197 | 60 to 100 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| Nominal | From SFD | Estimated | |
| | | 3.60 | |
| Bounding | | 7.20 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| Nominal | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| | 0.00 | | |
| Bounding | 0.01 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name ASTRA-(AUSTRIA)(LEU U308)
SNF ID # 1058
Fuel Units & Descr: 3 - 19 FLAT PLATES
Heavy Metal Mass: BOL=5.379kg, EOL=4 818kg
ROD Storage Site SRS

¹Fuel decay start date 1985
Estimates as of 2030
Template ATR (Light Water Alum, 60 to 100%, U)
²Template Burnup(MWd) 367.2
Template BOL Heavy Metal Mass (MT) 0 00116689
Template Decay Time 35 years

Estimated
Canister usage
18"x10"
0 08

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| | m | x _a | x _b | b | y _a | y _b | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Avg MeV | |
| Ac-227 | 2 0068E-09 | 530 99 | 1,061 99 | 0.00E+00 | 1 07E-06 | 2 13E-06 | 0 0150 | 7.822E+13 |
| Am-241 | 2 5251E-03 | 530 99 | 1,061 99 | 0 00E+00 | 1.34E+00 | 2 68E+00 | 0 0250 | 1 624E+13 |
| Am-242m | 3 9624E-07 | 530 99 | 1,061 99 | 0 00E+00 | 2 10E-04 | 4.21E-04 | 0 0375 | 1 412E+13 |
| Am-243 | 1 4880E-06 | 530 99 | 1,061 99 | 0 00E+00 | 7 90E-04 | 1.58E-03 | 0 0575 | 1 520E+13 |
| C-14 | 5.7053E-09 | 530 99 | 1,061 99 | 0 00E+00 | 3 03E-06 | 6 06E-06 | 0 0850 | 9 156E+12 |
| Cl-36 | 1.3124E-32 | 530 99 | 1,061 99 | 0 00E+00 | 6 97E-30 | 1.39E-29 | 0 1250 | 6 047E+12 |
| Cm-243 | 1 1419E-07 | 530 99 | 1,061 99 | 0 00E+00 | 6 06E-05 | 1.21E-04 | 0 2250 | 7.904E+12 |
| Cm-244 | 1 6522E-05 | 530 99 | 1,061 99 | 0 00E+00 | 8 77E-03 | 1 75E-02 | 0 3750 | 3.439E+12 |
| Co-60 | 7 4047E-07 | 530 99 | 1,061 99 | 0 00E+00 | 3.93E-04 | 7 86E-04 | 0 5750 | 5.683E+13 |
| Cs-134 | 2 0455E-05 | 530 99 | 1,061 99 | 0 00E+00 | 1.09E-02 | 2 17E-02 | 0 8500 | 6.942E+11 |
| Cs-135 | 3 4477E-06 | 530 99 | 1,061 99 | 0 00E+00 | 1 83E-03 | 3 66E-03 | 1 2500 | 3.358E+11 |
| Cs-137 | 1 4365E+00 | 530 99 | 1,061 99 | 0 00E+00 | 7.63E+02 | 1.53E+03 | 1 7500 | 1.890E+10 |
| Eu-154 | 7 3230E-03 | 530 99 | 1,061 99 | 0 00E+00 | 3 89E+00 | 7 78E+00 | 2 2500 | 1.580E+06 |
| Eu-155 | 5 9259E-04 | 530 99 | 1,061 99 | 0 00E+00 | 3 15E-01 | 6 29E-01 | 2 7500 | 1.508E+06 |
| Fe-55 | 2 2791E-06 | 530 99 | 1,061 99 | 0 00E+00 | 1 21E-03 | 2 42E-03 | 3 5000 | 8 812E+02 |
| H-3 | 1 0698E-03 | 530 99 | 1,061 99 | 0 00E+00 | 1 05E+00 | 2 09E+00 | 5 0000 | 3 602E+02 |
| I-129 | 7.5300E-07 | 530 99 | 1,061 99 | 0 00E+00 | 4 00E-04 | 8 00E-04 | 7 0000 | 3 944E+01 |
| Kr-85 | 4 1176E-02 | 530 99 | 1,061 99 | 0 00E+00 | 2 19E+01 | 4.37E+01 | 11 0000 | 4 398E+00 |
| Np-237 | 9.5752E-06 | 530 99 | 1,061 99 | 0 00E+00 | 5 08E-03 | 1 02E-02 | | |
| Pa-231 | 3 9379E-09 | 530 99 | 1,061 99 | 0 00E+00 | 2 09E-06 | 4 18E-06 | | |
| Pb-210 | 3 3115E-10 | 530 99 | 1,061 99 | 0 00E+00 | 1.76E-07 | 3 52E-07 | | |
| Pm-147 | 9.2402E-04 | 530 99 | 1,061 99 | 0 00E+00 | 4.91E-01 | 9 81E-01 | | |
| Pu-238 | 1 6217E-02 | 530 99 | 1,061 99 | 0 00E+00 | 8 61E+00 | 1 72E+01 | | |
| Pu-239 | 4 2810E-04 | 530 99 | 1,061 99 | 0 00E+00 | 2 27E-01 | 4 55E-01 | | |
| Pu-240 | 2 4333E-04 | 530 99 | 1,061 99 | 0 00E+00 | 1.29E-01 | 2 58E-01 | | |
| Pu-241 | 1 6242E-02 | 530 99 | 1,061 99 | 0 00E+00 | 8 62E+00 | 1 72E+01 | | |
| Pu-242 | 3 6329E-07 | 530 99 | 1,061 99 | 0 00E+00 | 1 93E-04 | 3 86E-04 | | |
| Ra-226 | 9 0114E-10 | 530 99 | 1,061 99 | 0 00E+00 | 4 79E-07 | 9 57E-07 | | |
| Ra-228 | 3 1019E-14 | 530 99 | 1,061 99 | 0 00E+00 | 1 65E-11 | 3 29E-11 | | |
| Ru-106 | 2 1225E-10 | 530 99 | 1,061 99 | 0 00E+00 | 1 13E-07 | 2 25E-07 | | |
| Se-79 | 1.2930E-05 | 530 99 | 1,061 99 | 0 00E+00 | 6 87E-03 | 1 37E-02 | | |
| Sn-126 | 1.1571E-05 | 530 99 | 1,061 99 | 0 00E+00 | 6 14E-03 | 1 23E-02 | | |
| Sr-90 | 1.3472E+00 | 530 99 | 1,061 99 | 0 00E+00 | 7 15E+02 | 1 43E+03 | | |
| Tc-99 | 4.2239E-04 | 530 99 | 1,061 99 | 0 00E+00 | 2 24E-01 | 4 49E-01 | | |
| Th-229 | 1.2407E-11 | 530 99 | 1,061 99 | 0 00E+00 | 6.59E-09 | 1 32E-08 | | |
| Th-230 | 8 3497E-08 | 530 99 | 1,061 99 | 0 00E+00 | 4 43E-05 | 8 87E-05 | | |
| Th-232 | 3 8371E-14 | 530 99 | 1,061 99 | 0 00E+00 | 2 04E-11 | 4 08E-11 | | |
| Th-208 | 4 0414E-08 | 530 99 | 1,061 99 | 0 00E+00 | 2 15E-05 | 4 29E-05 | | |
| U-232 | 1 0948E-07 | 530 99 | 1,061 99 | 0 00E+00 | 5 81E-05 | 1 16E-04 | | |
| U-233 | 3 6275E-09 | 530 99 | 1,061 99 | 0 00E+00 | 1 93E-06 | 3 85E-06 | | |
| U-234 | 1 8562E-04 | 530 99 | 1,061 99 | 0 00E+00 | 9 86E-02 | 1 97E-01 | | |
| U-235 | -2 7235E-06 | 530 99 | 0 00 | 2.27E-03 | 8 21E-04 | 2 27E-03 | | |
| U-236 | 1.5493E-05 | 530 99 | 1,061 99 | 0 00E+00 | 8 23E-03 | 1 65E-02 | | |
| U-238 | -4 2851E-09 | 530 99 | 0 00 | 1.46E-03 | 1 45E-03 | 1 46E-03 | | |
| Y-90 | 1.3475E+00 | 530 99 | 1,061 99 | 0 00E+00 | 7 16E+02 | 1 43E+03 | | |
| Other Radionuclides | | | | | 7 27E+02 | 1 45E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| Reactor Moderator Fuel Cladding BOL HM Constituents BOL Enrichment % | From SFD | Used | Basis for Parameter Differences: This Template was used for the following reasons: This fuel matches ATR Template on all but one parameter (enrichment) making ATR a reasonable match |
|---|-------------|-------------|---|
| | LIGHT WATER | LIGHT WATER | |
| | ALUM | ALUM | |
| | U | U | |
| | 19.50065847 | 60 to 100 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |
|----------|----------|-----------|---|
| Nominal | | 530 99 | |
| Bounding | | 1,061 99 | |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0 31 | | 1 01 |
| Bounding | 0 63 | | |

¹Reactor shutdown core removal storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: ASTRA-(AUSTRIA)(LEU U3Si2)
SNF ID #: 712
Fuel Units & Descr: 39 - 19 FLAT PLATES
Heavy Metal Mass: BOL=72.236kg; EOL=66 183kg
ROD Storage Site: SRS

¹Fuel decay start date: 1985
Estimates as of: 2030
Template: ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup(MWd): 367.2
Template BOL Heavy Metal Mass (MT): 0.00116689
Template Decay Time: 35 years

Estimated
Canister usage
18"x10"
1.08

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Cv/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.0068E-09 | 5,732.12 | 11,464.24 | 0.00E+00 | 1.15E-05 | 2.30E-05 | Avg MeV | |
| Am-241 | 2.5251E-03 | 5,732.12 | 11,464.24 | 0.00E+00 | 1.45E+01 | 2.89E+01 | 0.0150 | 8.444E+14 |
| Am-242m | 3.9624E-07 | 5,732.12 | 11,464.24 | 0.00E+00 | 2.27E-03 | 4.54E-03 | 0.0250 | 1.753E+14 |
| Am-243 | 1.4880E-06 | 5,732.12 | 11,464.24 | 0.00E+00 | 8.53E-03 | 1.71E-02 | 0.0375 | 1.524E+14 |
| C-14 | 5.7053E-09 | 5,732.12 | 11,464.24 | 0.00E+00 | 3.27E-05 | 6.54E-05 | 0.0575 | 1.640E+14 |
| Cl-36 | 1.3124E-32 | 5,732.12 | 11,464.24 | 0.00E+00 | 7.52E-29 | 1.50E-28 | 0.0850 | 9.884E+13 |
| Cm-243 | 1.1419E-07 | 5,732.12 | 11,464.24 | 0.00E+00 | 6.55E-04 | 1.31E-03 | 0.1250 | 6.528E+13 |
| Cm-244 | 1.6522E-05 | 5,732.12 | 11,464.24 | 0.00E+00 | 9.47E-02 | 1.89E-01 | 0.2250 | 8.532E+13 |
| Co-60 | 7.4047E-07 | 5,732.12 | 11,464.24 | 0.00E+00 | 4.24E-03 | 8.49E-03 | 0.3750 | 3.712E+13 |
| Cs-134 | 2.0455E-05 | 5,732.12 | 11,464.24 | 0.00E+00 | 1.17E-01 | 2.34E-01 | 0.5750 | 6.135E+14 |
| Cs-135 | 3.4477E-06 | 5,732.12 | 11,464.24 | 0.00E+00 | 1.98E-02 | 3.95E-02 | 0.8500 | 7.494E+12 |
| Cs-137 | 1.4365E+00 | 5,732.12 | 11,464.24 | 0.00E+00 | 8.23E+03 | 1.65E+04 | 1.2500 | 3.624E+12 |
| Eu-154 | 7.3230E-03 | 5,732.12 | 11,464.24 | 0.00E+00 | 4.20E+01 | 8.40E+01 | 1.7500 | 2.040E+11 |
| Eu-155 | 5.9259E-04 | 5,732.12 | 11,464.24 | 0.00E+00 | 3.40E+00 | 6.79E+00 | 2.2500 | 1.706E+07 |
| Fe-55 | 2.2791E-06 | 5,732.12 | 11,464.24 | 0.00E+00 | 1.31E-02 | 2.61E-02 | 2.7500 | 1.628E+07 |
| H-3 | 1.9698E-03 | 5,732.12 | 11,464.24 | 0.00E+00 | 1.13E+01 | 2.26E+01 | 3.5000 | 9.532E+03 |
| I-129 | 7.5300E-07 | 5,732.12 | 11,464.24 | 0.00E+00 | 4.32E-03 | 8.63E-03 | 5.0000 | 3.897E+03 |
| Kr-85 | 4.1176E-02 | 5,732.12 | 11,464.24 | 0.00E+00 | 2.36E+02 | 4.72E+02 | 7.0000 | 4.267E+02 |
| Np-237 | 9.5752E-06 | 5,732.12 | 11,464.24 | 0.00E+00 | 5.49E-02 | 1.10E-01 | 11.0000 | 4.760E+01 |
| Pa-231 | 3.9379E-09 | 5,732.12 | 11,464.24 | 0.00E+00 | 2.26E-05 | 4.51E-05 | | |
| Pb-210 | 3.3115E-10 | 5,732.12 | 11,464.24 | 0.00E+00 | 1.90E-06 | 3.80E-06 | | |
| Pm-147 | 9.2402E-04 | 5,732.12 | 11,464.24 | 0.00E+00 | 5.30E+00 | 1.06E+01 | | |
| Pu-238 | 1.6217E-02 | 5,732.12 | 11,464.24 | 0.00E+00 | 9.30E+01 | 1.86E+02 | | |
| Pu-239 | 4.2810E-04 | 5,732.12 | 11,464.24 | 0.00E+00 | 2.45E+00 | 4.91E+00 | | |
| Pu-240 | 2.4333E-04 | 5,732.12 | 11,464.24 | 0.00E+00 | 1.39E+00 | 2.79E+00 | | |
| Pu-241 | 1.6242E-02 | 5,732.12 | 11,464.24 | 0.00E+00 | 9.31E+01 | 1.86E+02 | | |
| Pu-242 | 3.6329E-07 | 5,732.12 | 11,464.24 | 0.00E+00 | 2.08E-03 | 4.16E-03 | | |
| Ra-226 | 9.0114E-10 | 5,732.12 | 11,464.24 | 0.00E+00 | 5.17E-06 | 1.03E-05 | | |
| Ra-228 | 3.1019E-14 | 5,732.12 | 11,464.24 | 0.00E+00 | 1.78E-10 | 3.56E-10 | | |
| Ru-106 | 2.1225E-10 | 5,732.12 | 11,464.24 | 0.00E+00 | 1.22E-06 | 2.43E-06 | | |
| Se-79 | 1.2930E-05 | 5,732.12 | 11,464.24 | 0.00E+00 | 7.41E-02 | 1.48E-01 | | |
| Sn-126 | 1.1571E-05 | 5,732.12 | 11,464.24 | 0.00E+00 | 6.63E-02 | 1.33E-01 | | |
| Sr-90 | 1.3472E+00 | 5,732.12 | 11,464.24 | 0.00E+00 | 7.72E+03 | 1.54E+04 | | |
| Tc-99 | 4.2239E-04 | 5,732.12 | 11,464.24 | 0.00E+00 | 2.42E+00 | 4.84E+00 | | |
| Th-229 | 1.2407E-11 | 5,732.12 | 11,464.24 | 0.00E+00 | 7.11E-08 | 1.42E-07 | | |
| Th-230 | 8.3497E-08 | 5,732.12 | 11,464.24 | 0.00E+00 | 4.79E-04 | 9.57E-04 | | |
| Th-232 | 3.8371E-14 | 5,732.12 | 11,464.24 | 0.00E+00 | 2.20E-10 | 4.40E-10 | | |
| Ti-208 | 4.0414E-08 | 5,732.12 | 11,464.24 | 0.00E+00 | 2.32E-04 | 4.63E-04 | | |
| U-232 | 1.0948E-07 | 5,732.12 | 11,464.24 | 0.00E+00 | 6.28E-04 | 1.26E-03 | | |
| U-233 | 3.6275E-09 | 5,732.12 | 11,464.24 | 0.00E+00 | 2.08E-05 | 4.16E-05 | | |
| U-234 | 1.8562E-04 | 5,732.12 | 11,464.24 | 0.00E+00 | 1.06E+00 | 2.13E+00 | | |
| U-235 | -2.7235E-06 | 5,732.12 | 0.00 | 3.10E-02 | 1.54E-02 | 3.10E-02 | | |
| U-236 | 1.5493E-05 | 5,732.12 | 11,464.24 | 0.00E+00 | 8.88E-02 | 1.78E-01 | | |
| U-238 | -4.2851E-09 | 5,732.12 | 0.00 | 1.95E-02 | 1.94E-02 | 1.95E-02 | | |
| Y-90 | 1.3475E+00 | 5,732.12 | 11,464.24 | 0.00E+00 | 7.72E+03 | 1.54E+04 | | |
| Other Radionuclides | | | | | 7.84E+03 | 1.57E+04 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-------------|-------------|--|
| Reactor Moderator | From SFD | Used | |
| Fuel Cladding | LIGHT WATER | LIGHT WATER | This Template was used for the following reasons: This fuel matches ATR Template on all but one parameter (enrichment) making ATR a reasonable match. |
| BOL HM Constituents | ALUM | ALUM | |
| BOL Enrichment % | U | U | |
| | 19.83800556 | 60 to 100 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | | 5,732.12 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |
| Bounding | | 11,464.24 | |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0.25 | | 1.01 |
| Bounding | 0.50 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: ASTRA-AUSTRIA (UALX-HEU)
SNF ID #: 646
Fuel Units & Descr: 33 - MTR TYPE
Heavy Metal Mass: BOL=9.026kg, EOL=4.359kg
ROD Storage Site: SRS
Fuel decay start date: 1985
Estimates as of: 2030
Template: ATR (Light Water, Alum, 60 to 100% U)
Template Burnup (MWd): 367.2
Template BOL Heavy Metal Mass (MT): 0.00116689
Template Decay Time: 35 years

Estimated
Canister usage
18"x10"
0.92

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.0068E-09 | 4,418.98 | 8,547.32 | 0.00E+00 | 8.87E-06 | 1.72E-05 | Avg MeV | |
| Am-241 | 2.5251E-03 | 4,418.98 | 8,547.32 | 0.00E+00 | 1.12E+01 | 2.16E+01 | 0.0150 | 6.295E+14 |
| Am-242m | 3.9624E-07 | 4,418.98 | 8,547.32 | 0.00E+00 | 1.75E-03 | 3.39E-03 | 0.0250 | 1.307E+14 |
| Am-243 | 1.4880E-06 | 4,418.98 | 8,547.32 | 0.00E+00 | 6.58E-03 | 1.27E-02 | 0.0375 | 1.136E+14 |
| C-14 | 5.7053E-09 | 4,418.98 | 8,547.32 | 0.00E+00 | 2.52E-05 | 4.88E-05 | 0.0575 | 1.223E+14 |
| Cl-36 | 1.3124E-32 | 4,418.98 | 8,547.32 | 0.00E+00 | 5.80E-29 | 1.12E-28 | 0.0850 | 7.369E+13 |
| Cm-243 | 1.1419E-07 | 4,418.98 | 8,547.32 | 0.00E+00 | 5.05E-04 | 9.76E-04 | 0.1250 | 4.867E+13 |
| Cm-244 | 1.6522E-05 | 4,418.98 | 8,547.32 | 0.00E+00 | 7.30E-02 | 1.41E-01 | 0.2250 | 6.361E+13 |
| Co-60 | 7.4047E-07 | 4,418.98 | 8,547.32 | 0.00E+00 | 3.27E-03 | 6.33E-03 | 0.3750 | 2.768E+13 |
| Cs-134 | 2.0455E-05 | 4,418.98 | 8,547.32 | 0.00E+00 | 9.04E-02 | 1.75E-01 | 0.5750 | 4.574E+14 |
| Cs-135 | 3.4477E-06 | 4,418.98 | 8,547.32 | 0.00E+00 | 1.52E-02 | 2.95E-02 | 0.8500 | 5.587E+12 |
| Cs-137 | 1.4365E+00 | 4,418.98 | 8,547.32 | 0.00E+00 | 6.35E+03 | 1.23E+04 | 1.2500 | 2.702E+12 |
| Eu-154 | 7.3230E-03 | 4,418.98 | 8,547.32 | 0.00E+00 | 3.24E+01 | 6.26E+01 | 1.7500 | 1.521E+11 |
| Eu-155 | 5.9259E-04 | 4,418.98 | 8,547.32 | 0.00E+00 | 2.62E+00 | 5.07E+00 | 2.2500 | 1.272E+07 |
| Fe-55 | 2.2791E-06 | 4,418.98 | 8,547.32 | 0.00E+00 | 1.01E-02 | 1.95E-02 | 2.7500 | 1.214E+07 |
| H-3 | 1.9698E-03 | 4,418.98 | 8,547.32 | 0.00E+00 | 8.70E+00 | 1.68E+01 | 3.5000 | 7.031E+03 |
| I-129 | 7.5300E-07 | 4,418.98 | 8,547.32 | 0.00E+00 | 3.33E-03 | 6.44E-03 | 5.0000 | 2.873E+03 |
| Kr-85 | 4.1176E-02 | 4,418.98 | 8,547.32 | 0.00E+00 | 1.82E+02 | 3.52E+02 | 7.0000 | 3.144E+02 |
| Np-237 | 9.5752E-06 | 4,418.98 | 8,547.32 | 0.00E+00 | 4.23E-02 | 8.18E-02 | 11.0000 | 3.505E+01 |
| Pa-231 | 3.9379E-09 | 4,418.98 | 8,547.32 | 0.00E+00 | 1.74E-05 | 3.37E-05 | | |
| Pb-210 | 3.3115E-10 | 4,418.98 | 8,547.32 | 0.00E+00 | 1.46E-06 | 2.83E-06 | | |
| Pm-147 | 2.4022E-04 | 4,418.98 | 8,547.32 | 0.00E+00 | 4.08E+00 | 7.90E+00 | | |
| Pu-238 | 1.6217E-02 | 4,418.98 | 8,547.32 | 0.00E+00 | 7.17E+01 | 1.39E+02 | | |
| Pu-239 | 4.2810E-04 | 4,418.98 | 8,547.32 | 0.00E+00 | 1.89E+00 | 3.66E+00 | | |
| Pu-240 | 2.4333E-04 | 4,418.98 | 8,547.32 | 0.00E+00 | 1.08E+00 | 2.08E+00 | | |
| Pu-241 | 1.6242E-02 | 4,418.98 | 8,547.32 | 0.00E+00 | 7.18E+01 | 1.39E+02 | | |
| Pu-242 | 3.6329E-07 | 4,418.98 | 8,547.32 | 0.00E+00 | 1.61E-03 | 3.11E-03 | | |
| Ra-226 | 9.0114E-10 | 4,418.98 | 8,547.32 | 0.00E+00 | 3.98E-06 | 7.70E-06 | | |
| Ra-228 | 3.1019E-14 | 4,418.98 | 8,547.32 | 0.00E+00 | 1.37E-10 | 2.65E-10 | | |
| Ru-106 | 2.1225E-10 | 4,418.98 | 8,547.32 | 0.00E+00 | 9.38E-07 | 1.81E-06 | | |
| Se-79 | 1.2930E-05 | 4,418.98 | 8,547.32 | 0.00E+00 | 5.71E-02 | 1.11E-01 | | |
| Sn-126 | 1.1571E-05 | 4,418.98 | 8,547.32 | 0.00E+00 | 5.11E-02 | 9.89E-02 | | |
| Sr-90 | 1.3472E+00 | 4,418.98 | 8,547.32 | 0.00E+00 | 5.95E+03 | 1.15E+04 | | |
| Tc-99 | 4.2239E-04 | 4,418.98 | 8,547.32 | 0.00E+00 | 1.87E+00 | 3.61E+00 | | |
| Th-229 | 1.2407E-11 | 4,418.98 | 8,547.32 | 0.00E+00 | 5.48E-08 | 1.06E-07 | | |
| Th-230 | 8.3497E-08 | 4,418.98 | 8,547.32 | 0.00E+00 | 3.69E-04 | 7.14E-04 | | |
| Th-232 | 3.8371E-14 | 4,418.98 | 8,547.32 | 0.00E+00 | 1.70E-10 | 3.28E-10 | | |
| Ti-208 | 4.0414E-08 | 4,418.98 | 8,547.32 | 0.00E+00 | 1.79E-04 | 3.45E-04 | | |
| U-232 | 1.0948E-07 | 4,418.98 | 8,547.32 | 0.00E+00 | 4.84E-04 | 9.36E-04 | | |
| U-233 | 3.6275E-09 | 4,418.98 | 8,547.32 | 0.00E+00 | 1.60E-05 | 3.10E-05 | | |
| U-234 | 1.8562E-04 | 4,418.98 | 8,547.32 | 0.00E+00 | 8.20E-01 | 1.59E+00 | | |
| U-235 | 2.7235E-06 | 4,418.98 | 0.00 | 1.82E-02 | 6.12E-03 | 1.82E-02 | | |
| U-236 | 1.5493E-05 | 4,418.98 | 8,547.32 | 0.00E+00 | 6.85E-02 | 1.32E-01 | | |
| U-238 | 4.2851E-09 | 4,418.98 | 0.00 | 2.10E-04 | 1.91E-04 | 2.10E-04 | | |
| Y-90 | 1.3475E+00 | 4,418.98 | 8,547.32 | 0.00E+00 | 5.95E+03 | 1.15E+04 | | |
| Other Radionuclides | | | | | | | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences |
|---------------------|-------------|-------------|---------------------------------|
| | LIGHT WATER | LIGHT WATER | |
| Reactor Moderator: | | | |
| Fuel Cladding: | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 93.07350223 | 60 to 100 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate |
|----------|----------|-----------|--|
| Nominal | | 4,418.98 | |
| Bounding | | 8,547.32 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup calculated assuming all BOL heavy metal burned. |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 1.56 | | |
| Bounding | 3.01 | | 1.06 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: ASTRA-AUSTRIA (UALX-MEU)
SNF ID #: 568
Fuel Units & Descr: 5 - MTR TYPE
Heavy Metal Mass: BOL=3.62kg EOL=2.766kg
ROD Storage Site: SRS

¹Fuel decay start date, 1985
Estimates as of 2030
Template: ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup(MWd), 367.2
Template BOL Heavy Metal Mass (MT), 0.00116689
Template Decay Time 35 years

Estimated
Canister usage:
18"x10"
0.14

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(CI) | Bounding Fuel Inventories(CI) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.0068E-09 | 807.81 | 1,615.62 | 0.00E+00 | 1.62E-06 | 3.24E-06 | Avg. MeV | |
| Am-241 | 2.5251E-03 | 807.81 | 1,615.62 | 0.00E+00 | 2.04E+00 | 4.08E+00 | 0.0150 | 1.190E+14 |
| Am-242m | 3.9624E-07 | 807.81 | 1,615.62 | 0.00E+00 | 3.20E-04 | 6.40E-04 | 0.0250 | 2.471E+13 |
| Am-243 | 1.4880E-06 | 807.81 | 1,615.62 | 0.00E+00 | 1.20E-03 | 2.40E-03 | 0.0375 | 2.148E+13 |
| C-14 | 5.7053E-09 | 807.81 | 1,615.62 | 0.00E+00 | 4.61E-06 | 9.22E-06 | 0.0575 | 2.312E+13 |
| Cl-36 | 1.3124E-32 | 807.81 | 1,615.62 | 0.00E+00 | 1.06E-29 | 2.12E-29 | 0.0850 | 1.393E+13 |
| Cm-243 | 1.1419E-07 | 807.81 | 1,615.62 | 0.00E+00 | 9.22E-05 | 1.84E-04 | 0.1250 | 9.200E+12 |
| Cm-244 | 1.6522E-05 | 807.81 | 1,615.62 | 0.00E+00 | 1.33E-02 | 2.67E-02 | 0.2250 | 1.202E+13 |
| Co-60 | 7.4047E-07 | 807.81 | 1,615.62 | 0.00E+00 | 5.98E-04 | 1.20E-03 | 0.3750 | 5.231E+12 |
| Cs-134 | 2.0455E-05 | 807.81 | 1,615.62 | 0.00E+00 | 1.65E-02 | 3.30E-02 | 0.5750 | 8.646E+13 |
| Cs-135 | 3.4477E-06 | 807.81 | 1,615.62 | 0.00E+00 | 2.79E-03 | 5.57E-03 | 0.8500 | 1.056E+12 |
| Cs-137 | 1.4365E+00 | 807.81 | 1,615.62 | 0.00E+00 | 1.16E+03 | 2.32E+03 | 1.2500 | 5.108E+11 |
| Eu-154 | 7.3230E-03 | 807.81 | 1,615.62 | 0.00E+00 | 5.92E+00 | 1.18E+01 | 1.7500 | 2.875E+10 |
| Eu-155 | 5.9259E-04 | 807.81 | 1,615.62 | 0.00E+00 | 4.79E-01 | 9.57E-01 | 2.2500 | 2.404E+06 |
| Fe-55 | 2.2791E-06 | 807.81 | 1,615.62 | 0.00E+00 | 1.84E-03 | 3.68E-03 | 2.7500 | 2.294E+06 |
| H-3 | 1.9698E-03 | 807.81 | 1,615.62 | 0.00E+00 | 1.59E+00 | 3.18E+00 | 3.5000 | 1.332E+03 |
| I-129 | 7.5300E-07 | 807.81 | 1,615.62 | 0.00E+00 | 6.08E-04 | 1.22E-03 | 5.0000 | 5.445E+02 |
| Kr-85 | 4.1176E-02 | 807.81 | 1,615.62 | 0.00E+00 | 3.33E+01 | 6.65E+01 | 7.0000 | 5.959E+01 |
| Np-237 | 9.5752E-06 | 807.81 | 1,615.62 | 0.00E+00 | 7.73E-03 | 1.55E-02 | 11.0000 | 6.645E+00 |
| Pa-231 | 3.9379E-09 | 807.81 | 1,615.62 | 0.00E+00 | 3.18E-06 | 6.36E-06 | | |
| Pb-210 | 3.3115E-10 | 807.81 | 1,615.62 | 0.00E+00 | 2.68E-07 | 5.35E-07 | | |
| Pm-147 | 9.2402E-04 | 807.81 | 1,615.62 | 0.00E+00 | 7.46E-01 | 1.49E+00 | | |
| Pu-238 | 1.6217E-02 | 807.81 | 1,615.62 | 0.00E+00 | 1.31E+01 | 2.62E+01 | | |
| Pu-239 | 4.2810E-04 | 807.81 | 1,615.62 | 0.00E+00 | 3.46E-01 | 6.92E-01 | | |
| Pu-240 | 2.4333E-04 | 807.81 | 1,615.62 | 0.00E+00 | 1.97E-01 | 3.93E-01 | | |
| Pu-241 | 1.6242E-02 | 807.81 | 1,615.62 | 0.00E+00 | 1.31E+01 | 2.62E+01 | | |
| Pu-242 | 3.6329E-07 | 807.81 | 1,615.62 | 0.00E+00 | 2.93E-04 | 5.87E-04 | | |
| Ra-226 | 9.0114E-10 | 807.81 | 1,615.62 | 0.00E+00 | 7.28E-07 | 1.46E-06 | | |
| Ra-228 | 3.1019E-14 | 807.81 | 1,615.62 | 0.00E+00 | 2.51E-11 | 5.01E-11 | | |
| Ru-106 | 2.1225E-10 | 807.81 | 1,615.62 | 0.00E+00 | 1.71E-07 | 3.43E-07 | | |
| Se-79 | 1.2930E-05 | 807.81 | 1,615.62 | 0.00E+00 | 1.04E-02 | 2.09E-02 | | |
| Sn-126 | 1.1571E-05 | 807.81 | 1,615.62 | 0.00E+00 | 9.35E-03 | 1.87E-02 | | |
| Sr-90 | 1.3472E+00 | 807.81 | 1,615.62 | 0.00E+00 | 1.09E+03 | 2.18E+03 | | |
| Tc-99 | 4.2239E-04 | 807.81 | 1,615.62 | 0.00E+00 | 3.41E-01 | 6.82E-01 | | |
| Th-229 | 1.2407E-11 | 807.81 | 1,615.62 | 0.00E+00 | 1.00E-08 | 2.00E-08 | | |
| Th-230 | 8.3497E-08 | 807.81 | 1,615.62 | 0.00E+00 | 6.74E-05 | 1.35E-04 | | |
| Th-232 | 3.8371E-14 | 807.81 | 1,615.62 | 0.00E+00 | 3.10E-11 | 6.20E-11 | | |
| Ti-208 | 4.0414E-08 | 807.81 | 1,615.62 | 0.00E+00 | 3.26E-05 | 6.53E-05 | | |
| U-232 | 1.0948E-07 | 807.81 | 1,615.62 | 0.00E+00 | 8.84E-05 | 1.77E-04 | | |
| U-233 | 3.6275E-09 | 807.81 | 1,615.62 | 0.00E+00 | 2.93E-06 | 5.86E-06 | | |
| U-234 | 1.8562E-04 | 807.81 | 1,615.62 | 0.00E+00 | 1.50E-01 | 3.00E-01 | | |
| U-235 | -2.7235E-06 | 807.81 | 0.00 | 3.48E-03 | 1.28E-03 | 3.48E-03 | | |
| U-236 | 1.5493E-05 | 807.81 | 1,615.62 | 0.00E+00 | 1.25E-02 | 2.50E-02 | | |
| U-238 | -4.2851E-09 | 807.81 | 0.00 | 6.76E-04 | 6.72E-04 | 6.76E-04 | | |
| Y-90 | 1.3475E+00 | 807.81 | 1,615.62 | 0.00E+00 | 1.09E+03 | 2.18E+03 | | |
| Other Radionuclides | | | | | 1.11E+03 | 2.21E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-------------|-------------|---|
| Reactor Moderator: | From SFD | Used | |
| Fuel Cladding | LIGHT WATER | LIGHT WATER | This Template was used for the following reasons: This fuel matches ATR Template on all but one parameter (enrichment) making ATR a reasonable match |
| BOL HM Constituents | ALUM | ALUM | |
| BOL Enrichment % | U | U | |
| | 44.43904151 | 60 to 100 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate* |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | | 807.81 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |
| Bounding | | 1.615.62 | |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0.71 | | 1.02 |
| Bounding | 1.42 | | |

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

*Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name ATSR
SNF ID # 17
Fuel Units & Descr 20 - 19 FLAT PLATES
Heavy Metal Mass BOL= , EOL=3.21kg
ROD Storage Site SRS

Fuel decay start date 1988
Estimates as of 2030
Template ATR (Light Water, Alum, 60 to 100%, U)
Template Burnup(MWd) 367.2
Template BOL Heavy Metal Mass (MT) 0.00116689
Template Decay Time 35 years

Estimated
Canister usage:
18"x10"
0.56

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.0068E-09 | 3.039 93 | 3.039 93 | 0.00E+00 | 6.10E-06 | 6.10E-06 | 0.0150 | 2.239E+14 |
| Am-241 | 2.5251E-03 | 3.039 93 | 3.039 93 | 0.00E+00 | 7.68E+00 | 7.68E+00 | 0.0250 | 4.649E+13 |
| Am-242m | 3.9624E-07 | 3.039 93 | 3.039 93 | 0.00E+00 | 1.20E-03 | 1.20E-03 | 0.0375 | 4.041E+13 |
| Am-243 | 1.4880E-06 | 3.039 93 | 3.039 93 | 0.00E+00 | 4.52E-03 | 4.52E-03 | 0.0575 | 4.350E+13 |
| C-14 | 5.7053E-09 | 3.039 93 | 3.039 93 | 0.00E+00 | 1.73E-05 | 1.73E-05 | 0.0850 | 2.621E+13 |
| Cl-36 | 1.3124E-32 | 3.039 93 | 3.039 93 | 0.00E+00 | 3.99E-29 | 3.99E-29 | 0.1250 | 1.731E+13 |
| Cm-243 | 1.1419E-07 | 3.039 93 | 3.039 93 | 0.00E+00 | 3.47E-04 | 3.47E-04 | 0.2250 | 2.263E+13 |
| Cm-244 | 1.6522E-05 | 3.039 93 | 3.039 93 | 0.00E+00 | 5.02E-02 | 5.02E-02 | 0.3750 | 9.843E+12 |
| Co-60 | 7.4047E-07 | 3.039 93 | 3.039 93 | 0.00E+00 | 2.25E-03 | 2.25E-03 | 0.5750 | 1.627E+14 |
| Cs-134 | 2.0455E-05 | 3.039 93 | 3.039 93 | 0.00E+00 | 6.22E-02 | 6.22E-02 | 0.8500 | 1.987E+12 |
| Cs-135 | 3.4477E-06 | 3.039 93 | 3.039 93 | 0.00E+00 | 1.05E-02 | 1.05E-02 | 1.2500 | 9.611E+11 |
| Cs-137 | 1.4365E+00 | 3.039 93 | 3.039 93 | 0.00E+00 | 4.37E+03 | 4.37E+03 | 1.7500 | 5.409E+10 |
| Eu-154 | 7.3230E-03 | 3.039 93 | 3.039 93 | 0.00E+00 | 2.23E+01 | 2.23E+01 | 2.2500 | 4.523E+06 |
| Eu-155 | 5.9259E-04 | 3.039 93 | 3.039 93 | 0.00E+00 | 1.80E+00 | 1.80E+00 | 2.7500 | 4.317E+06 |
| Fe-55 | 2.2791E-06 | 3.039 93 | 3.039 93 | 0.00E+00 | 6.93E-03 | 6.93E-03 | 3.5000 | 2.501E+03 |
| H-3 | 1.9698E-03 | 3.039 93 | 3.039 93 | 0.00E+00 | 5.99E+00 | 5.99E+00 | 5.0000 | 1.022E+03 |
| I-129 | 7.5300E-07 | 3.039 93 | 3.039 93 | 0.00E+00 | 2.29E-03 | 2.29E-03 | 7.0000 | 1.118E+02 |
| Kr-85 | 4.1176E-02 | 3.039 93 | 3.039 93 | 0.00E+00 | 1.25E+02 | 1.25E+02 | 11.0000 | 1.247E+01 |
| Np-237 | 9.5752E-06 | 3.039 93 | 3.039 93 | 0.00E+00 | 2.91E-02 | 2.91E-02 | | |
| Pa-231 | 3.9379E-09 | 3.039 93 | 3.039 93 | 0.00E+00 | 1.20E-05 | 1.20E-05 | | |
| Pb-210 | 3.3115E-10 | 3.039 93 | 3.039 93 | 0.00E+00 | 1.01E-06 | 1.01E-06 | | |
| Pm-147 | 9.2402E-04 | 3.039 93 | 3.039 93 | 0.00E+00 | 2.81E+00 | 2.81E+00 | | |
| Pu-238 | 1.6217E-02 | 3.039 93 | 3.039 93 | 0.00E+00 | 4.93E+01 | 4.93E+01 | | |
| Pu-239 | 4.2810E-04 | 3.039 93 | 3.039 93 | 0.00E+00 | 1.30E+00 | 1.30E+00 | | |
| Pu-240 | 2.4333E-04 | 3.039 93 | 3.039 93 | 0.00E+00 | 7.40E-01 | 7.40E-01 | | |
| Pu-241 | 1.6242E-02 | 3.039 93 | 3.039 93 | 0.00E+00 | 4.94E+01 | 4.94E+01 | | |
| Pu-242 | 3.6329E-07 | 3.039 93 | 3.039 93 | 0.00E+00 | 1.10E-03 | 1.10E-03 | | |
| Ra-226 | 9.0114E-10 | 3.039 93 | 3.039 93 | 0.00E+00 | 2.74E-06 | 2.74E-06 | | |
| Ra-228 | 3.1019E-14 | 3.039 93 | 3.039 93 | 0.00E+00 | 9.43E-11 | 9.43E-11 | | |
| Ru-106 | 2.1225E-10 | 3.039 93 | 3.039 93 | 0.00E+00 | 6.45E-07 | 6.45E-07 | | |
| Se-79 | 1.2930E-05 | 3.039 93 | 3.039 93 | 0.00E+00 | 3.93E-02 | 3.93E-02 | | |
| Sn-126 | 1.1571E-05 | 3.039 93 | 3.039 93 | 0.00E+00 | 3.52E-02 | 3.52E-02 | | |
| Sr-90 | 1.3472E+00 | 3.039 93 | 3.039 93 | 0.00E+00 | 4.10E+03 | 4.10E+03 | | |
| Tc-99 | 4.2239E-04 | 3.039 93 | 3.039 93 | 0.00E+00 | 1.28E+00 | 1.28E+00 | | |
| Th-229 | 1.2407E-11 | 3.039 93 | 3.039 93 | 0.00E+00 | 3.77E-08 | 3.77E-08 | | |
| Th-230 | 8.3497E-08 | 3.039 93 | 3.039 93 | 0.00E+00 | 2.54E-04 | 2.54E-04 | | |
| Th-232 | 3.8371E-14 | 3.039 93 | 3.039 93 | 0.00E+00 | 1.17E-10 | 1.17E-10 | | |
| Ti-208 | 4.0414E-08 | 3.039 93 | 3.039 93 | 0.00E+00 | 1.23E-04 | 1.23E-04 | | |
| U-232 | 1.0948E-07 | 3.039 93 | 3.039 93 | 0.00E+00 | 3.33E-04 | 3.33E-04 | | |
| U-233 | 3.6275E-09 | 3.039 93 | 3.039 93 | 0.00E+00 | 1.10E-05 | 1.10E-05 | | |
| U-234 | 1.8562E-04 | 3.039 93 | 3.039 93 | 0.00E+00 | 5.64E-01 | 5.64E-01 | | |
| U-235 | -2.7235E-06 | 3.039 93 | 0.00 | 1.28E-02 | 4.50E-03 | 1.28E-02 | | |
| U-236 | 1.5493E-05 | 3.039 93 | 3.039 93 | 0.00E+00 | 4.71E-02 | 4.71E-02 | | |
| U-238 | -4.2851E-09 | 3.039 93 | 0.00 | 1.29E-04 | 1.16E-04 | 1.29E-04 | | |
| Y-90 | 1.3475E+00 | 3.039 93 | 3.039 93 | 0.00E+00 | 4.10E+03 | 4.10E+03 | | |
| Other Radionuclides | | | | | 4.16E+03 | 4.16E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences* |
|---------------------|-------------|-------------|---|
| Reactor Moderator | LIGHT WATER | LIGHT WATER | This Template was used for the following reasons |
| Fuel Cladding | ALUM | ALUM | This fuel matches on all parameters except enrichment (unknown) |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 60 to 100 | | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate. |
|----------|----------|-----------|--|
| Nominal | | 3.039 93 | Nominal burnup set equal to bounding burnup |
| Bounding | | 3.039 93 | Bounding burnup estimated by assuming BOL heavy metal mass was twice EOL |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 1.50 | | 1.02 |
| Bounding | 1.50 | | |

*Reactor shutdown core removal, storage, shipping or other date confirming that irradiation ceased for fuel

*Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: BABCOCK & WILCOX SCRAP
 SNF ID #: 18
 Fuel Units & Descr: 1 - CANISTER OF SCRAP
 Heavy Metal Mass: BOL = : EOL=0.07kg
 ROD Storage Site: INEEL

¹Fuel decay start date: 1969
 Estimates as of: 2030
 Template: (Worst Case)
²Template Burnup(MWd): 62.5
 Template BOL Heavy Metal Mass (MT): 0.00186865
 Template Decay Time: 50 years

Estimated
 Canister usage:
 HIC
 1.00

| II. Estimates | m | X _a | X _b | b | Y _a | Y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.5200E-06 | 66.52 | 66.52 | 0.00E+00 | 1.68E-04 | 1.68E-04 | Avg MeV | |
| Am-241 | 8.6432E+00 | 66.52 | 66.52 | 0.00E+00 | 5.75E+02 | 5.75E+02 | 0.0150 | 5.639E+13 |
| Am-242m | 1.5728E-02 | 66.52 | 66.52 | 0.00E+00 | 1.05E+00 | 1.05E+00 | 0.0250 | 1.114E+13 |
| Am-243 | 1.6288E-02 | 66.52 | 66.52 | 0.00E+00 | 1.08E+00 | 1.08E+00 | 0.0375 | 9.415E+12 |
| C-14 | 1.2068E-01 | 66.52 | 66.52 | 0.00E+00 | 8.03E+00 | 8.03E+00 | 0.0575 | 1.778E+13 |
| Cl-36 | 2.2849E-03 | 66.52 | 66.52 | 0.00E+00 | 1.52E-01 | 1.52E-01 | 0.0850 | 5.961E+12 |
| Cm-243 | 6.0144E-04 | 66.52 | 66.52 | 0.00E+00 | 4.00E-02 | 4.00E-02 | 0.1250 | 4.218E+12 |
| Cm-244 | 9.4880E-02 | 66.52 | 66.52 | 0.00E+00 | 6.31E+00 | 6.31E+00 | 0.2250 | 5.159E+12 |
| Co-60 | 3.9052E+00 | 66.52 | 66.52 | 0.00E+00 | 2.60E+02 | 2.60E+02 | 0.3750 | 2.233E+12 |
| Cs-134 | 2.2139E-06 | 66.52 | 66.52 | 0.00E+00 | 1.47E-04 | 1.47E-04 | 0.5750 | 3.695E+13 |
| Cs-135 | 4.3976E-04 | 66.52 | 66.52 | 0.00E+00 | 2.93E-02 | 2.93E-02 | 0.8500 | 8.094E+11 |
| Cs-137 | 1.4887E+01 | 66.52 | 66.52 | 0.00E+00 | 9.90E+02 | 9.90E+02 | 1.2500 | 1.984E+13 |
| Eu-154 | 3.7342E-01 | 66.52 | 66.52 | 0.00E+00 | 2.48E+01 | 2.48E+01 | 1.7500 | 2.384E+10 |
| Eu-155 | 8.4893E-03 | 66.52 | 66.52 | 0.00E+00 | 5.65E-01 | 5.65E-01 | 2.2500 | 1.031E+08 |
| Fe-55 | 5.3750E-03 | 66.52 | 66.52 | 0.00E+00 | 3.58E-01 | 3.58E-01 | 2.7500 | 1.775E+08 |
| H-3 | 1.0472E-01 | 66.52 | 66.52 | 0.00E+00 | 6.97E+00 | 6.97E+00 | 3.5000 | 9.662E+04 |
| I-129 | 1.0618E-05 | 66.52 | 66.52 | 0.00E+00 | 7.06E-04 | 7.06E-04 | 5.0000 | 4.083E+04 |
| Kr-85 | 2.2717E-01 | 66.52 | 66.52 | 0.00E+00 | 1.51E+01 | 1.51E+01 | 7.0000 | 4.651E+03 |
| Np-237 | 1.6400E-04 | 66.52 | 66.52 | 0.00E+00 | 1.09E-02 | 1.09E-02 | 11.0000 | 5.305E+02 |
| Pa-231 | 2.8688E-06 | 66.52 | 66.52 | 0.00E+00 | 1.91E-04 | 1.91E-04 | | |
| Pb-210 | 4.7312E-08 | 66.52 | 66.52 | 0.00E+00 | 3.15E-06 | 3.15E-06 | | |
| Pm-147 | 3.2198E-04 | 66.52 | 66.52 | 0.00E+00 | 2.14E-02 | 2.14E-02 | | |
| Pu-238 | -1.1924E+00 | 66.52 | 0.00 | 1.80E+01 | 0.00E+00 | 1.80E+01 | | |
| Pu-239 | -4.8600E-02 | 66.52 | 0.00 | 2.18E+00 | 0.00E+00 | 2.18E+00 | | |
| Pu-240 | -3.0127E-01 | 66.52 | 0.00 | 2.78E+00 | 0.00E+00 | 2.78E+00 | | |
| Pu-241 | -1.2917E+02 | 66.52 | 0.00 | 7.16E+02 | 0.00E+00 | 7.16E+02 | | |
| Pu-242 | -1.1381E-04 | 66.52 | 0.00 | 1.20E-02 | 4.46E-03 | 1.20E-02 | | |
| Ra-226 | 1.0760E-07 | 66.52 | 66.52 | 0.00E+00 | 7.16E-06 | 7.16E-06 | | |
| Ra-228 | 6.0160E-07 | 66.52 | 66.52 | 0.00E+00 | 4.00E-05 | 4.00E-05 | | |
| Ru-106 | 1.3388E-13 | 66.52 | 66.52 | 0.00E+00 | 8.91E-12 | 8.91E-12 | | |
| Se-79 | 1.9179E-04 | 66.52 | 66.52 | 0.00E+00 | 1.28E-02 | 1.28E-02 | | |
| Sn-126 | 1.6669E-04 | 66.52 | 66.52 | 0.00E+00 | 1.11E-02 | 1.11E-02 | | |
| Sr-90 | 1.3859E+01 | 66.52 | 66.52 | 0.00E+00 | 9.22E+02 | 9.22E+02 | | |
| Tc-99 | 6.7678E-03 | 66.52 | 66.52 | 0.00E+00 | 4.50E-01 | 4.50E-01 | | |
| Th-229 | 2.2592E-06 | 66.52 | 66.52 | 0.00E+00 | 1.50E-04 | 1.50E-04 | | |
| Th-230 | 7.5955E-06 | 66.52 | 66.52 | 0.00E+00 | 5.05E-04 | 5.05E-04 | | |
| Th-232 | 6.0208E-07 | 66.52 | 66.52 | 0.00E+00 | 4.01E-05 | 4.01E-05 | | |
| Ti-208 | 7.5795E-05 | 66.52 | 66.52 | 0.00E+00 | 5.04E-03 | 5.04E-03 | | |
| U-232 | 2.0521E-04 | 66.52 | 66.52 | 0.00E+00 | 1.37E-02 | 1.37E-02 | | |
| U-233 | 3.6128E-04 | 66.52 | 66.52 | 0.00E+00 | 2.40E-02 | 2.40E-02 | | |
| U-234 | 1.2788E-02 | 66.52 | 66.52 | 0.00E+00 | 8.51E-01 | 8.51E-01 | | |
| U-235 | 5.7486E-04 | 66.52 | 66.52 | 6.02E-05 | 3.83E-02 | 3.83E-02 | | |
| U-236 | 2.3485E-04 | 66.52 | 66.52 | 0.00E+00 | 1.56E-02 | 1.56E-02 | | |
| U-238 | 1.1581E-04 | 66.52 | 66.52 | 7.49E-06 | 7.71E-03 | 7.71E-03 | | |
| Y-90 | 1.3861E+01 | 66.52 | 66.52 | 0.00E+00 | 9.22E+02 | 9.22E+02 | | |
| Other Radionuclides | | | | | 3.42E+03 | 3.42E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-------------|--------------|---|
| Reactor Moderator: | From SFD | Used | |
| Fuel Cladding | LIGHT WATER | (Worst Case) | |
| BOL HM Constituents | SST | SST/Inconel | |
| BOL Enrichment % | Pu and U | U, Th, & Pu | This fuel didn't closely match any existing templates, therefore the worst case template was used |
| | | 0 to 100 | |

| Burnup Summary (MWd) ¹ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | | 66.52 | |
| Bounding | | 66.52 | Nominal burnup set equal to bounding burnup |
| | | | Bounding burnup estimated by assuming BOL heavy metal mass was twice EOL |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 14.21 | | |
| Bounding | 14.21 | | 591.64 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name BER-II (HM) (END BOXES) GERMANY

SNF ID # 892

Fuel Units & Descr 6 - MTR TYPE

Heavy Metal Mass BOL=0kg EOL=0kg

ROD Storage Site: SRS

Fuel decay start date 1996

Estimates as of 2030

Template ATR (Light Water Alum, 60 to 100%, U)

*Template Burnup(MWd) 367.2

Template BOL Heavy Metal Mass (MT) 0.00116689

Template Decay Time 25 years

Estimated

Canister usage

HIC

1.00

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 1.1465E-09 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | Avg MeV | |
| Am-241 | 2.3056E-03 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0150 | 0.000E+00 |
| Am-242m | 4.1476E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0250 | 0.000E+00 |
| Am-243 | 1.4894E-06 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0375 | 0.000E+00 |
| C-14 | 5.7108E-09 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0575 | 0.000E+00 |
| Cl-36 | 1.3124E-32 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.0850 | 0.000E+00 |
| Cm-243 | 1.4562E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.1250 | 0.000E+00 |
| Cm-244 | 2.4221E-05 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.2250 | 0.000E+00 |
| Co-60 | 2.7560E-06 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.3750 | 0.000E+00 |
| Cs-134 | 5.8851E-04 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.5750 | 0.000E+00 |
| Cs-135 | 3.4477E-06 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.8500 | 0.000E+00 |
| Cs-137 | 1.8099E+00 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.2500 | 0.000E+00 |
| Eu-154 | 1.6386E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.7500 | 0.000E+00 |
| Eu-155 | 2.3957E-03 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.2500 | 0.000E+00 |
| Fe-55 | 3.2707E-05 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.7500 | 0.000E+00 |
| H-3 | 3.4504E-03 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 3.5000 | 0.000E+00 |
| I-129 | 7.5300E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 5.0000 | 0.000E+00 |
| Kr-85 | 7.8540E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 7.0000 | 0.000E+00 |
| Np-237 | 9.5615E-06 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 11.0000 | 0.000E+00 |
| Pa-231 | 2.7968E-09 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pb-210 | 1.2612E-10 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pm-147 | 1.2952E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-238 | 1.7549E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-239 | 4.2810E-04 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-240 | 2.4357E-04 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-241 | 2.6277E-02 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Pu-242 | 3.6329E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Ra-226 | 4.4444E-10 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Ra-228 | 1.9714E-14 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Ru-106 | 2.0477E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Se-79 | 1.2933E-05 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Sn-126 | 1.1574E-05 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Sr-90 | 1.7092E+00 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Tc-99 | 4.2239E-04 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Th-229 | 7.7260E-12 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Th-230 | 5.8497E-08 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Th-232 | 2.6906E-14 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Th-208 | 4.4336E-08 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-232 | 1.2037E-07 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-233 | 3.0011E-09 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-234 | 1.8497E-04 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-235 | 2.7235E-06 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-236 | 1.5493E-05 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| U-238 | 4.2851E-09 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Y-90 | 1.7094E+00 | 0.00 | 0.00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | |
| Other Radionuclides | | | | | 0.00E+00 | 0.00E+00 | | |

Thermal Power

Nominal Heat Output (Watts)

Bounding Heat Output (Watts)

0.00E+00 0.00E+00

Total Total

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-------------|-------------|
| Reactor Moderator | LIGHT WATER | LIGHT WATER |
| Fuel Cladding | ALUM | ALUM |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 100 | 60 to 100 |

Basis for Parameter Differences*

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | | |
| Bounding | | |

Basis for burnup used in estimate:

Nominal burnup assumed to be 2% of BOL heavy metal mass

Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|--------------------------------|
| Nominal | | |
| Bounding | | |

Estimated EOL HM/ Given EOL HM

*Reactor shutdown core removal, storage, shipping or other date confirming that irradiation ceased for fuel

*Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: BER-II [HMJ] (UALX HEU) GERMANY
SNF ID #: 758
Fuel Units & Descr: 112 - 17 FLAT PLATES
Heavy Metal Mass: BOL=20 653kg, EOL=12.074kg
ROD Storage Site: SRS

¹Fuel decay start date: 1996
Estimates as of: 2030
Template: ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup (MWd): 367.2
Template BOL Heavy Metal Mass (MT): 0.00116689
Template Decay Time: 25 years

Estimated
Canister usage:
18"x10"
4 67

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 1.1465E-09 | 8,124.67 | 16,249.34 | 0.00E+00 | 9.32E-06 | 1.86E-05 | Avg. MeV | |
| Am-241 | 2.3056E-03 | 8,124.67 | 16,249.34 | 0.00E+00 | 1.87E+01 | 3.75E+01 | 0.0150 | 1.520E+15 |
| Am-242m | 4.1476E-07 | 8,124.67 | 16,249.34 | 0.00E+00 | 3.37E-03 | 6.74E-03 | 0.0250 | 3.159E+14 |
| Am-243 | 1.4894E-06 | 8,124.67 | 16,249.34 | 0.00E+00 | 1.21E-02 | 2.42E-02 | 0.0375 | 2.751E+14 |
| C-14 | 5.7108E-09 | 8,124.67 | 16,249.34 | 0.00E+00 | 4.64E-05 | 9.28E-05 | 0.0575 | 2.954E+14 |
| Cl-36 | 1.3124E-32 | 8,124.67 | 16,249.34 | 0.00E+00 | 1.07E-28 | 2.13E-28 | 0.0850 | 1.782E+14 |
| Cm-243 | 1.4562E-07 | 8,124.67 | 16,249.34 | 0.00E+00 | 1.18E-03 | 2.37E-03 | 0.1250 | 1.194E+14 |
| Cm-244 | 2.4221E-05 | 8,124.67 | 16,249.34 | 0.00E+00 | 1.97E-01 | 3.94E-01 | 0.2250 | 1.539E+14 |
| Co-60 | 2.7560E-06 | 8,124.67 | 16,249.34 | 0.00E+00 | 2.24E-02 | 4.48E-02 | 0.3750 | 6.690E+13 |
| Cs-134 | 5.8851E-04 | 8,124.67 | 16,249.34 | 0.00E+00 | 4.78E+00 | 9.56E+00 | 0.5750 | 1.097E+15 |
| Cs-135 | 3.4477E-06 | 8,124.67 | 16,249.34 | 0.00E+00 | 2.80E-02 | 5.60E-02 | 0.8500 | 1.580E+13 |
| Cs-137 | 1.8099E+00 | 8,124.67 | 16,249.34 | 0.00E+00 | 1.47E+04 | 2.94E+04 | 1.2500 | 8.789E+12 |
| Eu-154 | 1.6386E-02 | 8,124.67 | 16,249.34 | 0.00E+00 | 1.33E+02 | 2.66E+02 | 1.7500 | 4.342E+11 |
| Eu-155 | 2.3957E-03 | 8,124.67 | 16,249.34 | 0.00E+00 | 1.95E+01 | 3.89E+01 | 2.2500 | 3.095E+07 |
| Fe-55 | 3.2707E-05 | 8,124.67 | 16,249.34 | 0.00E+00 | 2.66E-01 | 5.31E-01 | 2.7500 | 2.534E+07 |
| H-3 | 3.4504E-03 | 8,124.67 | 16,249.34 | 0.00E+00 | 2.80E+01 | 5.61E+01 | 3.5000 | 1.912E+04 |
| I-129 | 7.5300E-07 | 8,124.67 | 16,249.34 | 0.00E+00 | 6.12E-03 | 1.22E-02 | 5.0000 | 6.431E+03 |
| Kr-85 | 7.8540E-02 | 8,124.67 | 16,249.34 | 0.00E+00 | 6.38E+02 | 1.28E+03 | 7.0000 | 7.077E+02 |
| Np-237 | 9.5615E-06 | 8,124.67 | 16,249.34 | 0.00E+00 | 7.77E-02 | 1.55E-01 | 11.0000 | 7.916E+01 |
| Pa-231 | 2.7968E-09 | 8,124.67 | 16,249.34 | 0.00E+00 | 2.27E-05 | 4.54E-05 | | |
| Pb-210 | 1.2612E-10 | 8,124.67 | 16,249.34 | 0.00E+00 | 1.02E-06 | 2.05E-06 | | |
| Pm-147 | 1.2952E-02 | 8,124.67 | 16,249.34 | 0.00E+00 | 1.05E+02 | 2.10E+02 | | |
| Pu-238 | 1.7549E-02 | 8,124.67 | 16,249.34 | 0.00E+00 | 1.43E+02 | 2.85E+02 | | |
| Pu-239 | 4.2810E-04 | 8,124.67 | 16,249.34 | 0.00E+00 | 3.48E+00 | 6.96E+00 | | |
| Pu-240 | 2.4357E-04 | 8,124.67 | 16,249.34 | 0.00E+00 | 1.98E+00 | 3.96E+00 | | |
| Pu-241 | 2.6277E-02 | 8,124.67 | 16,249.34 | 0.00E+00 | 2.13E+02 | 4.27E+02 | | |
| Pu-242 | 3.6329E-07 | 8,124.67 | 16,249.34 | 0.00E+00 | 2.95E-03 | 5.90E-03 | | |
| Ra-226 | 4.4444E-10 | 8,124.67 | 16,249.34 | 0.00E+00 | 3.61E-06 | 7.22E-06 | | |
| Ra-228 | 1.9714E-14 | 8,124.67 | 16,249.34 | 0.00E+00 | 1.60E-10 | 3.20E-10 | | |
| Ru-106 | 2.0477E-07 | 8,124.67 | 16,249.34 | 0.00E+00 | 1.66E-03 | 3.33E-03 | | |
| Se-79 | 1.2933E-05 | 8,124.67 | 16,249.34 | 0.00E+00 | 1.05E-01 | 2.10E-01 | | |
| Sn-126 | 1.1574E-05 | 8,124.67 | 16,249.34 | 0.00E+00 | 9.40E-02 | 1.88E-01 | | |
| Sr-90 | 1.7092E+00 | 8,124.67 | 16,249.34 | 0.00E+00 | 1.39E+04 | 2.78E+04 | | |
| Tc-99 | 4.2239E-04 | 8,124.67 | 16,249.34 | 0.00E+00 | 3.43E+00 | 6.86E+00 | | |
| Th-229 | 7.7260E-12 | 8,124.67 | 16,249.34 | 0.00E+00 | 6.28E-08 | 1.26E-07 | | |
| Th-230 | 5.8497E-08 | 8,124.67 | 16,249.34 | 0.00E+00 | 4.75E-04 | 9.51E-04 | | |
| Th-232 | 2.6906E-14 | 8,124.67 | 16,249.34 | 0.00E+00 | 2.19E-10 | 4.37E-10 | | |
| Th-208 | 4.4336E-08 | 8,124.67 | 16,249.34 | 0.00E+00 | 3.60E-04 | 7.20E-04 | | |
| U-232 | 1.2037E-07 | 8,124.67 | 16,249.34 | 0.00E+00 | 9.78E-04 | 1.96E-03 | | |
| U-233 | 3.0011E-09 | 8,124.67 | 16,249.34 | 0.00E+00 | 2.44E-05 | 4.88E-05 | | |
| U-234 | 1.8497E-04 | 8,124.67 | 16,249.34 | 0.00E+00 | 1.50E+00 | 3.01E+00 | | |
| U-235 | -2.7235E-06 | 8,124.67 | 0.00 | 4.15E-02 | 1.94E-02 | 4.15E-02 | | |
| U-236 | 1.5493E-05 | 8,124.67 | 16,249.34 | 0.00E+00 | 1.26E-01 | 2.52E-01 | | |
| U-238 | -4.2851E-09 | 8,124.67 | 0.00 | 4.84E-04 | 4.49E-04 | 4.84E-04 | | |
| Y-90 | 1.7094E+00 | 8,124.67 | 16,249.34 | 0.00E+00 | 1.39E+04 | 2.78E+04 | | |
| Other Radionuclides | | | | | 1.40E+04 | 2.80E+04 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-------------|-------------|----------------------------------|
| Reactor Moderator | From SFD | Used | |
| | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 93.03245367 | 60 to 100 | |

| Burnup Summary (MWd) ³ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | | 8,124.67 | |
| Bounding | | 16,249.34 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 1.25 | | |
| Bounding | 2.50 | | 1.04 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name BNL MEDICAL RX (BMRR)
SNF ID # 21
Fuel Units & Descr 40 - CYLINDRICAL SECTIONS
Heavy Metal Mass BOL=6 188kg EOL=5 124kg
ROD Storage Site SRS

¹Fuel decay start date: 1989
Estimates as of: 2030
Template: ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup(MWd): 367.2
Template BOL Heavy Metal Mass (MT) 0 00116689
Template Decay Time 35 years

Estimated
Canister usage
18"x10"
1 11

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| | m | x _a | x _b | b | y _a | y _b | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Avg MeV | |
| Ac-227 | 2 0068E-09 | 1,007 63 | 2,015 26 | 0 00E+00 | 2 02E-06 | 4 04E-06 | 0 0150 | 1.484E+14 |
| Am-241 | 3 5251E-03 | 1,007 63 | 2,015 26 | 0 00E+00 | 2 54E+00 | 5 09E+00 | 0 0250 | 3 082E+13 |
| Am-242m | 9 9624E-07 | 1,007 63 | 2,015 26 | 0 00E+00 | 3 99E-04 | 7 99E-04 | 0 0375 | 2 679E+13 |
| Am-243 | 1 4880E-06 | 1,007 63 | 2,015 26 | 0 00E+00 | 1.50E-03 | 3 00E-03 | 0 0575 | 2 884E+13 |
| C-14 | 5 7053E-09 | 1,007 63 | 2,015 26 | 0 00E+00 | 5 75E-06 | 1 15E-05 | 0 0850 | 1 737E+13 |
| Cl-36 | 1.3124E-32 | 1,007 63 | 2,015 26 | 0 00E+00 | 1 32E-29 | 2 64E-29 | 0 1250 | 1 148E+13 |
| Cm-243 | 1 1419E-07 | 1,007 63 | 2,015 26 | 0 00E+00 | 1 66E-02 | 3 33E-02 | 0 2250 | 1 500E+13 |
| Cm-244 | 1 6522E-05 | 1,007 63 | 2,015 26 | 0 00E+00 | 1 66E-02 | 3 33E-02 | 0 3750 | 6 525E+12 |
| Co-60 | 7 4047E-07 | 1,007 63 | 2,015 26 | 0 00E+00 | 7 46E-04 | 1 49E-03 | 0 5750 | 1 078E+14 |
| Cs-134 | 2 0455E-05 | 1,007 63 | 2,015 26 | 0 00E+00 | 2 06E-02 | 4 12E-02 | 0 8500 | 1 317E+12 |
| Cs-135 | 3 4477E-06 | 1,007 63 | 2,015 26 | 0 00E+00 | 3.47E-03 | 6 95E-03 | 1 2500 | 6 371E+11 |
| Cs-137 | 1 4365E+00 | 1,007 63 | 2,015 26 | 0 00E+00 | 1.45E+03 | 2 90E+03 | 1 7500 | 3 586E+10 |
| Cs-137 | 7 3230E-03 | 1,007 63 | 2,015 26 | 0 00E+00 | 7.38E+00 | 1 48E+01 | 2 2500 | 2 998E+06 |
| Eu-154 | 5 9259E-04 | 1,007 63 | 2,015 26 | 0 00E+00 | 5 97E-01 | 1 19E+00 | 2 7500 | 2 862E+06 |
| Eu-155 | 2 2791E-06 | 1,007 63 | 2,015 26 | 0 00E+00 | 2 30E-03 | 4.59E-03 | 3 5000 | 1 659E+03 |
| Fe-55 | 1 9698E-03 | 1,007 63 | 2,015 26 | 0 00E+00 | 1 98E+00 | 3 97E+00 | 5 0000 | 6 777E+02 |
| H-3 | 7 5300E-07 | 1,007 63 | 2,015 26 | 0 00E+00 | 7.59E-04 | 1 52E-03 | 7 0000 | 7 416E+01 |
| I-129 | 4 1176E-02 | 1,007 63 | 2,015 26 | 0 00E+00 | 4 15E+01 | 8 30E+01 | 11 0000 | 8 269E+00 |
| Kr-85 | 9 5752E-06 | 1,007 63 | 2,015 26 | 0 00E+00 | 9 65E-03 | 1 93E-02 | | |
| Np-237 | 3 9379E-09 | 1,007 63 | 2,015 26 | 0 00E+00 | 3 97E-06 | 7 94E-06 | | |
| Pa-231 | 3 3115E-10 | 1,007 63 | 2,015 26 | 0 00E+00 | 3 34E-07 | 6 67E-07 | | |
| Pm-147 | 9 2402E-04 | 1,007 63 | 2,015 26 | 0 00E+00 | 9 31E-01 | 1 86E+00 | | |
| Pu-238 | 1 6217E-02 | 1,007 63 | 2,015 26 | 0 00E+00 | 1 63E+01 | 3 27E+01 | | |
| Pu-239 | 4 2810E-04 | 1,007 63 | 2,015 26 | 0 00E+00 | 4 31E-01 | 8 63E-01 | | |
| Pu-240 | 2 4333E-04 | 1,007 63 | 2,015 26 | 0 00E+00 | 2 45E-01 | 4 90E-01 | | |
| Pu-241 | 1 6242E-02 | 1,007 63 | 2,015 26 | 0 00E+00 | 1 64E+01 | 3 27E+01 | | |
| Pu-242 | 3 6329E-07 | 1,007 63 | 2,015 26 | 0 00E+00 | 3 66E-04 | 7 32E-04 | | |
| Ra-226 | 9 0114E-10 | 1,007 63 | 2,015 26 | 0 00E+00 | 9 08E-07 | 1 82E-06 | | |
| Ra-228 | 3 1019E-14 | 1,007 63 | 2,015 26 | 0 00E+00 | 3 13E-11 | 6 25E-11 | | |
| Ru-106 | 2 1225E-10 | 1,007 63 | 2,015 26 | 0 00E+00 | 2 14E-07 | 4 28E-07 | | |
| Se-79 | 1 2930E-05 | 1,007 63 | 2,015 26 | 0 00E+00 | 1 30E-02 | 2 61E-02 | | |
| Sn-126 | 1 1571E-05 | 1,007 63 | 2,015 26 | 0 00E+00 | 1 17E-02 | 2 33E-02 | | |
| Sr-90 | 1 3472E+00 | 1,007 63 | 2,015 26 | 0 00E+00 | 1 36E+03 | 2 71E+03 | | |
| Tc-99 | 4 2239E-04 | 1,007 63 | 2,015 26 | 0 00E+00 | 4 26E-01 | 8 51E-01 | | |
| Th-229 | 1 2407E-11 | 1,007 63 | 2,015 26 | 0 00E+00 | 1 25E-08 | 2 50E-08 | | |
| Th-230 | 8 3497E-08 | 1,007 63 | 2,015 26 | 0 00E+00 | 8 41E-05 | 1 68E-04 | | |
| Th-232 | 3 8371E-14 | 1,007 63 | 2,015 26 | 0 00E+00 | 3 87E-11 | 7 73E-11 | | |
| Ti-208 | 4 0414E-08 | 1,007 63 | 2,015 26 | 0 00E+00 | 4 07E-05 | 8 14E-05 | | |
| U-232 | 1 0948E-07 | 1,007 63 | 2,015 26 | 0 00E+00 | 1 10E-04 | 2 21E-04 | | |
| U-233 | 3 6275E-09 | 1,007 63 | 2,015 26 | 0 00E+00 | 3 66E-06 | 7 31E-06 | | |
| U-234 | 1 8562E-04 | 1,007 63 | 2,015 26 | 0 00E+00 | 1 87E-01 | 3 74E-01 | | |
| U-235 | -2 7235E-06 | 1,007 63 | 0 00 | 1 24E-02 | 9 65E-03 | 1 24E-02 | | |
| U-236 | 1 5493E-05 | 1,007 63 | 2,015 26 | 0 00E+00 | 1 56E-02 | 3 12E-02 | | |
| U-238 | -4 2851E-09 | 1,007 63 | 0 00 | 1 53E-04 | 1 49E-04 | 1 53E-04 | | |
| Y-90 | 1 3475E+00 | 1,007 63 | 2,015 26 | 0 00E+00 | 1 36E+03 | 2 72E+03 | | |
| Other Radionuclides | | | | | 1 38E+03 | 2 76E+03 | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 1.69E+01 | 3 37E+01 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-------------|-------------|----------------------------------|
| | From SFD | Used | |
| Reactor Moderator | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 92 65152255 | 60 to 100 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|------------------------------------|
| | From SFD | Estimated | |
| Nominal | | 1 007 63 | |
| Bounding | | 2 015 26 | |

Nominal burnup calculated from the heavy metal mass destroyed
Bounding burnup assumed to be twice nominal burnup

| Checks | | |
|----------|-------------------|--------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
| Nominal | 0.52 | |
| Bounding | 1 03 | |

Estimated EOL HM/ Given EOL HM
1 01

¹Reactor shutdown, core removal, storage, shipping or other data confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: BSR
SNF ID #: 31
Fuel Units & Descr: 41 - 19 PLATE MTR ASSY
Heavy Metal Mass: BOL=7 856kg; EOL=6 941kg
ROD Storage Site: SRS

Fuel decay start date: 1991
Estimates as of: 2030

Template: ATR (Light Water, Alum, 60 to 100%, U)

Template Burnup(MWd): 367.2

Template BOL Heavy Metal Mass (MT): 0.00116689

Template Decay Time: 35 years

Estimated
Canister usage:
18"x10"
1.71

| II. Estimates | m | X _a | X _b | b | Y _a | Y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Cu/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.0068E-09 | 865.86 | 1,731.72 | 0.00E+00 | 1.74E-06 | 3.48E-06 | Avg MeV | |
| Am-241 | 2.5251E-03 | 865.86 | 1,731.72 | 0.00E+00 | 2.19E+00 | 4.37E+00 | 0.0150 | 1.275E+14 |
| Am-242m | 3.9624E-07 | 865.86 | 1,731.72 | 0.00E+00 | 3.43E-04 | 6.86E-04 | 0.0250 | 2.648E+13 |
| Am-243 | 1.4880E-06 | 865.86 | 1,731.72 | 0.00E+00 | 1.29E-03 | 2.58E-03 | 0.0375 | 2.302E+13 |
| C-14 | 5.7053E-09 | 865.86 | 1,731.72 | 0.00E+00 | 4.94E-06 | 9.88E-06 | 0.0575 | 2.478E+13 |
| Ci-36 | 1.3124E-32 | 865.86 | 1,731.72 | 0.00E+00 | 1.14E-29 | 2.27E-29 | 0.0850 | 1.493E+13 |
| Cm-243 | 1.1419E-07 | 865.86 | 1,731.72 | 0.00E+00 | 9.89E-05 | 1.98E-04 | 0.1250 | 9.861E+12 |
| Cm-244 | 1.6522E-05 | 865.86 | 1,731.72 | 0.00E+00 | 1.43E-02 | 2.86E-02 | 0.2250 | 1.289E+13 |
| Co-60 | 7.4047E-07 | 865.86 | 1,731.72 | 0.00E+00 | 6.41E-04 | 1.28E-03 | 0.3750 | 5.607E+12 |
| Cs-134 | 2.0455E-05 | 865.86 | 1,731.72 | 0.00E+00 | 1.77E-02 | 3.54E-02 | 0.5750 | 9.267E+13 |
| Cs-135 | 3.4477E-06 | 865.86 | 1,731.72 | 0.00E+00 | 2.99E-03 | 5.97E-03 | 0.8500 | 1.132E+12 |
| Cs-137 | 1.4365E+00 | 865.86 | 1,731.72 | 0.00E+00 | 1.24E+03 | 2.49E+03 | 1.2500 | 5.475E+11 |
| Eu-154 | 7.3230E-03 | 865.86 | 1,731.72 | 0.00E+00 | 6.34E+00 | 1.27E+01 | 1.7500 | 3.081E+10 |
| Eu-155 | 5.9259E-04 | 865.86 | 1,731.72 | 0.00E+00 | 5.13E-01 | 1.03E+00 | 2.2500 | 2.576E+06 |
| Fe-55 | 2.2791E-06 | 865.86 | 1,731.72 | 0.00E+00 | 1.97E-03 | 3.95E-03 | 2.7500 | 2.459E+06 |
| H-3 | 1.9698E-03 | 865.86 | 1,731.72 | 0.00E+00 | 1.71E+00 | 3.41E+00 | 3.5000 | 1.426E+03 |
| I-129 | 7.5300E-07 | 865.86 | 1,731.72 | 0.00E+00 | 6.52E-04 | 1.30E-03 | 5.0000 | 5.825E+02 |
| Kr-85 | 4.1176E-02 | 865.86 | 1,731.72 | 0.00E+00 | 3.57E+01 | 7.13E+01 | 7.0000 | 6.375E+01 |
| Np-237 | 9.5752E-06 | 865.86 | 1,731.72 | 0.00E+00 | 8.29E-03 | 1.66E-02 | 11.0000 | 7.108E+00 |
| Pa-231 | 3.9379E-09 | 865.86 | 1,731.72 | 0.00E+00 | 3.41E-06 | 6.82E-06 | | |
| Pb-210 | 3.3115E-10 | 865.86 | 1,731.72 | 0.00E+00 | 2.87E-07 | 5.73E-07 | | |
| Pm-147 | 9.2402E-04 | 865.86 | 1,731.72 | 0.00E+00 | 8.00E-01 | 1.60E+00 | | |
| Pu-238 | 1.6217E-02 | 865.86 | 1,731.72 | 0.00E+00 | 1.40E+01 | 2.81E+01 | | |
| Pu-239 | 4.2810E-04 | 865.86 | 1,731.72 | 0.00E+00 | 3.71E-01 | 7.41E-01 | | |
| Pu-240 | 2.4333E-04 | 865.86 | 1,731.72 | 0.00E+00 | 2.11E-01 | 4.21E-01 | | |
| Pu-241 | 1.6242E-02 | 865.86 | 1,731.72 | 0.00E+00 | 1.41E+01 | 2.81E+01 | | |
| Pu-242 | 3.6329E-07 | 865.86 | 1,731.72 | 0.00E+00 | 3.15E-04 | 6.29E-04 | | |
| Ra-226 | 9.0114E-10 | 865.86 | 1,731.72 | 0.00E+00 | 7.80E-07 | 1.56E-06 | | |
| Ra-228 | 3.1019E-14 | 865.86 | 1,731.72 | 0.00E+00 | 2.69E-11 | 5.37E-11 | | |
| Ru-106 | 2.1225E-10 | 865.86 | 1,731.72 | 0.00E+00 | 1.84E-07 | 3.68E-07 | | |
| Se-79 | 1.2930E-05 | 865.86 | 1,731.72 | 0.00E+00 | 1.12E-02 | 2.24E-02 | | |
| Sn-126 | 1.1571E-05 | 865.86 | 1,731.72 | 0.00E+00 | 1.00E-02 | 2.00E-02 | | |
| Sr-90 | 1.3472E+00 | 865.86 | 1,731.72 | 0.00E+00 | 1.17E+03 | 2.33E+03 | | |
| Tc-99 | 4.2239E-04 | 865.86 | 1,731.72 | 0.00E+00 | 3.66E-01 | 7.31E-01 | | |
| Th-229 | 1.2407E-11 | 865.86 | 1,731.72 | 0.00E+00 | 1.07E-08 | 2.15E-08 | | |
| Th-230 | 8.3497E-08 | 865.86 | 1,731.72 | 0.00E+00 | 7.23E-05 | 1.45E-04 | | |
| Th-232 | 3.8371E-14 | 865.86 | 1,731.72 | 0.00E+00 | 3.32E-11 | 6.64E-11 | | |
| Ti-208 | 4.0414E-08 | 865.86 | 1,731.72 | 0.00E+00 | 3.50E-05 | 7.00E-05 | | |
| U-232 | 1.0948E-07 | 865.86 | 1,731.72 | 0.00E+00 | 9.48E-05 | 1.90E-04 | | |
| U-233 | 3.6275E-09 | 865.86 | 1,731.72 | 0.00E+00 | 3.14E-06 | 6.28E-06 | | |
| U-234 | 1.8562E-04 | 865.86 | 1,731.72 | 0.00E+00 | 1.61E-01 | 3.21E-01 | | |
| U-235 | -2.7235E-06 | 865.86 | 0.00 | 1.58E-02 | 1.35E-02 | 1.58E-02 | | |
| U-236 | 1.5493E-05 | 865.86 | 1,731.72 | 0.00E+00 | 1.34E-02 | 2.68E-02 | | |
| U-238 | -4.2851E-09 | 865.86 | 0.00 | 1.79E-04 | 1.75E-04 | 1.79E-04 | | |
| Y-90 | 1.3475E+00 | 865.86 | 1,731.72 | 0.00E+00 | 1.17E+03 | 2.33E+03 | | |
| Other Radionuclides | | | | | 1.18E+03 | 2.37E+03 | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 1.45E+01 | 2.90E+01 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-------------|-------------|
| Reactor Moderator: | LIGHT WATER | LIGHT WATER |
| Fuel Cladding | ALUM | ALUM |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 93.23369049 | 60 to 100 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | | 865.86 |
| Bounding | | 1,731.72 |

Basis for burnup used in estimate:
Nominal burnup calculated from the heavy metal mass destroyed
Bounding burnup assumed to be twice nominal burnup.

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|--------------------------------|
| Nominal | 0.35 | |
| Bounding | 0.70 | |

Estimated EOL HM/Given EOL HM

1.01

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: CANDU
SNF ID #: 979
Fuel Units & Descr: 4 - ROD
Heavy Metal Mass BOL= , EOL=49.32kg
ROD Storage Site: INEEL

¹Fuel decay start date 1964
Estimates as of 2030
Template HFBR (Heavy Water, Zirc, 0 to 5% U)
²Template Burnup(MWd) 5
Template BOL Heavy Metal Mass (MT): 0.00034251
Template Decay Time 65 years

Estimated
Canister usage:
18"x15"
0.14

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 7.7980E-09 | 47,275.85 | 47,275.85 | 0.00E+00 | 3.69E-04 | 3.69E-04 | Avg MeV | |
| Am-241 | 2.3560E-02 | 47,275.85 | 47,275.85 | 0.00E+00 | 1.11E+03 | 1.11E+03 | 0.0150 | 1.618E+15 |
| Am-242m | 3.0880E-06 | 47,275.85 | 47,275.85 | 0.00E+00 | 1.46E-01 | 1.46E-01 | 0.0250 | 3.342E+14 |
| Am-243 | 2.0520E-06 | 47,275.85 | 47,275.85 | 0.00E+00 | 9.70E-02 | 9.70E-02 | 0.0375 | 2.942E+14 |
| C-14 | 1.1222E-03 | 47,275.85 | 47,275.85 | 0.00E+00 | 5.31E+01 | 5.31E+01 | 0.0575 | 3.259E+14 |
| Cl-36 | 8.3760E-11 | 47,275.85 | 47,275.85 | 0.00E+00 | 3.96E-06 | 3.96E-06 | 0.0850 | 1.875E+14 |
| Cm-243 | 2.4260E-07 | 47,275.85 | 47,275.85 | 0.00E+00 | 1.15E-02 | 1.15E-02 | 0.1250 | 1.218E+14 |
| Cm-244 | 3.3140E-06 | 47,275.85 | 47,275.85 | 0.00E+00 | 1.57E-01 | 1.57E-01 | 0.2250 | 1.614E+14 |
| Co-60 | 1.2454E-03 | 47,275.85 | 47,275.85 | 0.00E+00 | 5.89E+01 | 5.89E+01 | 0.3750 | 7.028E+13 |
| Cs-134 | 3.3040E-10 | 47,275.85 | 47,275.85 | 0.00E+00 | 1.56E-05 | 1.56E-05 | 0.5750 | 1.257E+15 |
| Cs-135 | 7.9140E-06 | 47,275.85 | 47,275.85 | 0.00E+00 | 3.74E-01 | 3.74E-01 | 0.8500 | 1.201E+13 |
| Cs-137 | 7.1580E-01 | 47,275.85 | 47,275.85 | 0.00E+00 | 3.38E+04 | 3.38E+04 | 1.2500 | 8.677E+12 |
| Eu-154 | 6.0500E-04 | 47,275.85 | 47,275.85 | 0.00E+00 | 2.86E+01 | 2.86E+01 | 1.7500 | 3.102E+11 |
| Eu-155 | 9.4860E-06 | 47,275.85 | 47,275.85 | 0.00E+00 | 4.48E-01 | 4.48E-01 | 2.2500 | 5.583E+07 |
| Fe-55 | 1.9322E-08 | 47,275.85 | 47,275.85 | 0.00E+00 | 9.13E-04 | 9.13E-04 | 2.7500 | 5.801E+07 |
| H-3 | 4.4180E-03 | 47,275.85 | 47,275.85 | 0.00E+00 | 2.09E+02 | 2.09E+02 | 3.5000 | 2.364E+05 |
| I-129 | 7.5020E-07 | 47,275.85 | 47,275.85 | 0.00E+00 | 3.55E-02 | 3.55E-02 | 5.0000 | 9.820E+04 |
| Kr-85 | 5.4940E-03 | 47,275.85 | 47,275.85 | 0.00E+00 | 2.60E+02 | 2.60E+02 | 7.0000 | 1.115E+04 |
| Np-237 | 5.8040E-06 | 47,275.85 | 47,275.85 | 0.00E+00 | 2.74E-01 | 2.74E-01 | 11.0000 | 1.265E+03 |
| Pa-231 | 1.1096E-08 | 47,275.85 | 47,275.85 | 0.00E+00 | 5.25E-04 | 5.25E-04 | | |
| Pb-210 | 1.4712E-08 | 47,275.85 | 47,275.85 | 0.00E+00 | 6.96E-04 | 6.96E-04 | | |
| Pm-147 | 3.5920E-07 | 47,275.85 | 47,275.85 | 0.00E+00 | 1.70E-02 | 1.70E-02 | | |
| Pu-238 | 5.0700E-03 | 47,275.85 | 47,275.85 | 0.00E+00 | 2.40E+02 | 2.40E+02 | | |
| Pu-239 | 1.8728E-02 | 47,275.85 | 47,275.85 | 0.00E+00 | 8.85E+02 | 8.85E+02 | | |
| Pu-240 | 8.3280E-03 | 47,275.85 | 47,275.85 | 0.00E+00 | 3.94E+02 | 3.94E+02 | | |
| Pu-241 | 3.4460E-02 | 47,275.85 | 47,275.85 | 0.00E+00 | 1.63E+03 | 1.63E+03 | | |
| Pu-242 | 2.0380E-06 | 47,275.85 | 47,275.85 | 0.00E+00 | 9.63E-02 | 9.63E-02 | | |
| Ra-226 | 2.9640E-08 | 47,275.85 | 47,275.85 | 0.00E+00 | 1.40E-03 | 1.40E-03 | | |
| Ra-228 | 1.1922E-09 | 47,275.85 | 47,275.85 | 0.00E+00 | 5.64E-05 | 5.64E-05 | | |
| Ru-106 | 3.5780E-19 | 47,275.85 | 47,275.85 | 0.00E+00 | 1.69E-14 | 1.69E-14 | | |
| Se-79 | 1.2520E-05 | 47,275.85 | 47,275.85 | 0.00E+00 | 5.92E-01 | 5.92E-01 | | |
| Sn-126 | 1.2050E-05 | 47,275.85 | 47,275.85 | 0.00E+00 | 5.70E-01 | 5.70E-01 | | |
| Sr-90 | 6.1880E-01 | 47,275.85 | 47,275.85 | 0.00E+00 | 2.93E+04 | 2.93E+04 | | |
| Tc-99 | 4.4120E-04 | 47,275.85 | 47,275.85 | 0.00E+00 | 2.09E+01 | 2.09E+01 | | |
| Th-229 | 6.9280E-09 | 47,275.85 | 47,275.85 | 0.00E+00 | 3.28E-04 | 3.28E-04 | | |
| Th-230 | 1.7084E-06 | 47,275.85 | 47,275.85 | 0.00E+00 | 8.08E-02 | 8.08E-02 | | |
| Th-232 | 1.1926E-09 | 47,275.85 | 47,275.85 | 0.00E+00 | 5.64E-05 | 5.64E-05 | | |
| Ti-208 | 3.4740E-08 | 47,275.85 | 47,275.85 | 0.00E+00 | 1.64E-03 | 1.64E-03 | | |
| U-232 | 9.2940E-08 | 47,275.85 | 47,275.85 | 0.00E+00 | 4.39E-03 | 4.39E-03 | | |
| U-233 | 9.1680E-07 | 47,275.85 | 47,275.85 | 0.00E+00 | 4.33E-02 | 4.33E-02 | | |
| U-234 | 2.3440E-03 | 47,275.85 | 47,275.85 | 0.00E+00 | 1.11E+02 | 1.11E+02 | | |
| U-235 | -2.3296E-06 | 47,275.85 | 0.00 | 1.07E-02 | 0.00E+00 | 1.07E-02 | | |
| U-236 | 2.6620E-05 | 47,275.85 | 47,275.85 | 0.00E+00 | 1.26E+00 | 1.26E+00 | | |
| U-238 | -1.3291E-07 | 47,275.85 | 0.00 | 3.12E-02 | 2.49E-02 | 3.12E-02 | | |
| Y-90 | 6.1900E-01 | 47,275.85 | 47,275.85 | 0.00E+00 | 2.93E+04 | 2.93E+04 | | |
| Other Radionuclides | | | | | 3.24E+04 | 3.24E+04 | | |

Other Radionuclides

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences* |
|---------------------|-------------|-------------|---|
| Reactor Moderator | HEAVY WATER | HEAVY WATER | This Template was used for the following reasons. |
| Fuel Cladding | ZIRC | ZIRC | This fuel matches on all parameters except enrichment (unknown) |
| BOL HM Constituents | U | U | |
| BOL Enrichment %: | | 0 to 5 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|----------|-----------|--|
| Nominal | | 47,275.85 | Nominal burnup set equal to bounding burnup |
| Bounding | | 47,275.85 | Bounding burnup estimated by assuming BOL heavy metal mass was twice EOL |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 32.83 | | 2.59 |
| Bounding | 32.83 | | |

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: CVTR FUEL
SNF ID #: 37
Fuel Units & Descr: 34 - ROD
Heavy Metal Mass: BOL=68 656kg, EOL=67 47kg
ROD Storage Site: INEEL

¹Fuel decay start date: 1967
Estimates as of: 2030
Template: HFBR (Heavy Water, Zirc., 0 to 5%, U)
²Template Burnup(MWd): 5
Template BOL Heavy Metal Mass (MT): 0 00034251
Template Decay Time: 50 years

Estimated
Canister usage
18"x15"
0 45

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ¹ | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6 2320E-09 | 1,137 42 | 2,274 84 | 0 00E+00 | 7 09E-06 | 1 42E-05 | Avg. MeV | |
| Am-241 | 2 3540E-02 | 1,137 42 | 2,274 84 | 0 00E+00 | 2 68E+01 | 5 35E+01 | 0 0150 | 1 110E+14 |
| Am-242m | 3 3060E-06 | 1,137 42 | 2,274 84 | 0 00E+00 | 3 76E-03 | 7 52E-03 | 0 0250 | 2 296E+13 |
| Am-243 | 2 0560E-06 | 1,137 42 | 2,274 84 | 0 00E+00 | 2 34E-03 | 4 68E-03 | 0 0375 | 2 020E+13 |
| C-14 | 1 1244E-03 | 1,137 42 | 2,274 84 | 0 00E+00 | 1 28E+00 | 2 56E+00 | 0 0575 | 2 210E+13 |
| Ci-36 | 8 3760E-11 | 1,137 42 | 2,274 84 | 0 00E+00 | 9 53E-08 | 1 91E-07 | 0 0850 | 1 289E+13 |
| Cm-243 | 3 4960E-07 | 1,137 42 | 2,274 84 | 0 00E+00 | 3 98E-04 | 7 95E-04 | 0 1250 | 8 420E+12 |
| Cm-244 | 5 8860E-06 | 1,137 42 | 2,274 84 | 0 00E+00 | 6 69E-03 | 1 34E-02 | 0 2250 | 1 111E+13 |
| Co-60 | 8 9560E-03 | 1,137 42 | 2,274 84 | 0 00E+00 | 1 02E+01 | 2 04E+01 | 0 3750 | 4 834E+12 |
| Cs-134 | 5 1180E-08 | 1,137 42 | 2,274 84 | 0 00E+00 | 5 82E-05 | 1 16E-04 | 0 5750 | 8 557E+13 |
| Cs-135 | 7 9140E-06 | 1,137 42 | 2,274 84 | 0 00E+00 | 9 00E-03 | 1 80E-02 | 0 8500 | 8 698E+11 |
| Cs-137 | 1 0122E+00 | 1,137 42 | 2,274 84 | 0 00E+00 | 1 15E+03 | 2 30E+03 | 1 2500 | 1 856E+12 |
| Eu-154 | 2 0260E-03 | 1,137 42 | 2,274 84 | 0 00E+00 | 2 30E+00 | 4 61E+00 | 1 7500 | 2 288E+10 |
| Eu-155 | 7 7180E-05 | 1,137 42 | 2,274 84 | 0 00E+00 | 8 78E-02 | 1 76E-01 | 2 2500 | 1 023E+07 |
| Fe-55 | 1 0538E-06 | 1,137 42 | 2,274 84 | 0 00E+00 | 1 20E-03 | 2 40E-03 | 2 7500 | 3 238E+06 |
| H-3 | 1 0256E-02 | 1,137 42 | 2,274 84 | 0 00E+00 | 1 17E+01 | 2 33E+01 | 3 5000 | 1 163E+04 |
| I-129 | 7 5020E-07 | 1,137 42 | 2,274 84 | 0 00E+00 | 8 53E-04 | 1 71E-03 | 5 0000 | 4 879E+03 |
| Kr-85 | 1 4492E-02 | 1,137 42 | 2,274 84 | 0 00E+00 | 1 65E+01 | 3 30E+01 | 7 0000 | 5 488E+02 |
| Np-237 | 5 6900E-06 | 1,137 42 | 2,274 84 | 0 00E+00 | 6 47E-03 | 1 29E-02 | 11 0000 | 6 227E+01 |
| Pa-231 | 9 4900E-09 | 1,137 42 | 2,274 84 | 0 00E+00 | 1 08E-05 | 2 16E-05 | | |
| Pb-210 | 8 6720E-09 | 1,137 42 | 2,274 84 | 0 00E+00 | 9 86E-06 | 1 97E-05 | | |
| Pm-147 | 1 8906E-05 | 1,137 42 | 2,274 84 | 0 00E+00 | 2 15E-02 | 4 30E-02 | | |
| Pu-238 | 5 7080E-03 | 1,137 42 | 2,274 84 | 0 00E+00 | 6 49E+00 | 1 30E+01 | | |
| Pu-239 | 1 8736E-02 | 1,137 42 | 2,274 84 | 0 00E+00 | 2 13E+01 | 4 26E+01 | | |
| Pu-240 | 8 3420E-03 | 1,137 42 | 2,274 84 | 0 00E+00 | 9 49E+00 | 1 90E+01 | | |
| Pu-241 | 7 0960E-02 | 1,137 42 | 2,274 84 | 0 00E+00 | 8 07E+01 | 1 61E+02 | | |
| Pu-242 | 2 0400E-06 | 1,137 42 | 2,274 84 | 0 00E+00 | 2 32E-03 | 4 64E-03 | | |
| Ra-226 | 1 9722E-08 | 1,137 42 | 2,274 84 | 0 00E+00 | 2 24E-05 | 4 49E-05 | | |
| Ra-228 | 1 1912E-09 | 1,137 42 | 2,274 84 | 0 00E+00 | 1 35E-06 | 2 71E-06 | | |
| Ru-106 | 1 0798E-14 | 1,137 42 | 2,274 84 | 0 00E+00 | 1 23E-11 | 2 46E-11 | | |
| Se-79 | 1 2522E-05 | 1,137 42 | 2,274 84 | 0 00E+00 | 1 42E-02 | 2 85E-02 | | |
| Sn-126 | 1 2052E-05 | 1,137 42 | 2,274 84 | 0 00E+00 | 1 37E-02 | 2 74E-02 | | |
| Sr-90 | 8 8440E-01 | 1,137 42 | 2,274 84 | 0 00E+00 | 1 01E+03 | 2 01E+03 | | |
| Tc-99 | 4 4120E-04 | 1,137 42 | 2,274 84 | 0 00E+00 | 5 02E-01 | 1 00E+00 | | |
| Th-229 | 5 6400E-09 | 1,137 42 | 2,274 84 | 0 00E+00 | 6 42E-06 | 1 28E-05 | | |
| Th-230 | 1 3922E-06 | 1,137 42 | 2,274 84 | 0 00E+00 | 1 58E-03 | 3 17E-03 | | |
| Th-232 | 1 1926E-09 | 1,137 42 | 2,274 84 | 0 00E+00 | 1 36E-06 | 2 71E-06 | | |
| Ti-208 | 4 0060E-08 | 1,137 42 | 2,274 84 | 0 00E+00 | 4 56E-05 | 9 11E-05 | | |
| U-232 | 1 0738E-07 | 1,137 42 | 2,274 84 | 0 00E+00 | 1 22E-04 | 2 44E-04 | | |
| U-233 | 9 1640E-07 | 1,137 42 | 2,274 84 | 0 00E+00 | 1 04E-03 | 2 08E-03 | | |
| U-234 | 2 3440E-03 | 1,137 42 | 2,274 84 | 0 00E+00 | 2 67E+00 | 5 33E+00 | | |
| U-235 | -2 3296E-06 | 1,137 42 | 0 00 | 2 67E-03 | 2 09E-05 | 2 67E-03 | | |
| U-236 | 2 6620E-05 | 1,137 42 | 2,274 84 | 0 00E+00 | 3 03E-02 | 6 06E-02 | | |
| U-238 | -1 3291E-07 | 1,137 42 | 0 00 | 2 27E-02 | 2 25E-02 | 2 27E-02 | | |
| Y-90 | 8 8460E-01 | 1,137 42 | 2,274 84 | 0 00E+00 | 1 01E+03 | 2 01E+03 | | |
| Other Radionuclides | | | | | 1 10E+03 | 2 20E+03 | | |
| | | | | | | | Thermal Power | |
| | | | | | | | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| | | | | | | | 1 46E+01 | 2 93E+01 |
| | | | | | | | Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences* |
|----------------------------|-------------|-------------|--|
| Reactor Moderator: | From SFD | Used | |
| Fuel Cladding: | HEAVY WATER | HEAVY WATER | This Template was used for the following reasons. This fuel matches on all parameters except possibly cladding. |
| BOL HM Constituents: | ZIRC OR SST | ZIRC | |
| BOL Enrichment %: | U | U | |
| | 1 8 | 0 to 5 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal: | | 1,137 42 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup |
| Bounding: | | 2,274 84 | |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 1 13 | | 1 01 |
| Bounding | 2 27 | | |

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name DR-3 (U3O8 LEU)(DENMARK)
SNF ID # 1059
Fuel Units & Descr 3 - 4 CONCENTRIC TUBES
Heavy Metal Mass BOL=2 752kg EOL=2.517kg
ROD Storage Site SRS

¹Fuel decay start date 1997
Estimates as of 2030
Template: HFBR (Heavy Water Alum, 10 to 20%, U)
²Template Burnup(MWd) 15
Template BOL Heavy Metal Mass (MT): 0 00034251
Template Decay Time* 25 years

Estimated
Canister usage
18"x10"
0 08

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 1 4973E-09 | 224 12 | 448 24 | 0 00E+00 | 3 36E-07 | 6 71E-07 | Avg MeV | |
| Am-241 | 2 6120E-02 | 224 12 | 448 24 | 0 00E+00 | 5 85E+00 | 1 17E+01 | 0 0150 | 4 029E+13 |
| Am-242m | 8 7133E-06 | 224 12 | 448 24 | 0 00E+00 | 1 95E-03 | 3 91E-03 | 0 0250 | 8 360E+12 |
| Am-243 | 6 3980E-06 | 224 12 | 448 24 | 0 00E+00 | 1 43E-03 | 2 87E-03 | 0 0375 | 7 333E+12 |
| C-14 | 2 9600E-08 | 224 12 | 448 24 | 0 00E+00 | 6 63E-06 | 1 33E-05 | 0 0575 | 7 951E+12 |
| Cl-36 | 5 9507E-35 | 224 12 | 448 24 | 0 00E+00 | 1 33E-32 | 2 67E-32 | 0 0850 | 4 707E+12 |
| Cm-243 | 1 9560E-06 | 224 12 | 448 24 | 0 00E+00 | 4 38E-04 | 8 77E-04 | 0 1250 | 3 140E+12 |
| Cm-244 | 9 0867E-05 | 224 12 | 448 24 | 0 00E+00 | 2 04E-02 | 4 07E-02 | 0 2250 | 4 059E+12 |
| Co-60 | 8 4667E-06 | 224 12 | 448 24 | 0 00E+00 | 1 90E-03 | 3 80E-03 | 0 3750 | 1 764E+12 |
| Cs-134 | 3 9760E-04 | 224 12 | 448 24 | 0 00E+00 | 8 91E-02 | 1 78E-01 | 0 5750 | 3 008E+13 |
| Cs-135 | 4 8607E-06 | 224 12 | 448 24 | 0 00E+00 | 1 09E-03 | 2 18E-03 | 0 8500 | 4 008E+11 |
| Cs-137 | 1 8020E+00 | 224 12 | 448 24 | 0 00E+00 | 4 04E+02 | 8 08E+02 | 1 2500 | 2 168E+11 |
| Eu-154 | 1 3960E-02 | 224 12 | 448 24 | 0 00E+00 | 3 13E+00 | 6 26E+00 | 1 7500 | 1 100E+10 |
| Eu-155 | 2 0313E-03 | 224 12 | 448 24 | 0 00E+00 | 4 55E-01 | 9 11E-01 | 2 2500 | 8 218E+05 |
| Fe-55 | 3 7360E-04 | 224 12 | 448 24 | 0 00E+00 | 8 37E-02 | 1 67E-01 | 2 7500 | 1 184E+05 |
| H-3 | 3 5233E-03 | 224 12 | 448 24 | 0 00E+00 | 7 90E-01 | 1 58E+00 | 3 5000 | 2 241E+03 |
| I-129 | 7 1600E-07 | 224 12 | 448 24 | 0 00E+00 | 1 60E-04 | 3 21E-04 | 5 0000 | 8 888E+02 |
| Kr-85 | 7 4133E-02 | 224 12 | 448 24 | 0 00E+00 | 1 66E+01 | 3 32E+01 | 7 0000 | 1 003E+02 |
| Np-237 | 3 8020E-06 | 224 12 | 448 24 | 0 00E+00 | 8 52E-04 | 1 70E-03 | 11 0000 | 1 140E+01 |
| Pa-231 | 3 7020E-09 | 224 12 | 448 24 | 0 00E+00 | 8 30E-07 | 1 66E-06 | | |
| Pb-210 | 1 4067E-13 | 224 12 | 448 24 | 0 00E+00 | 3 15E-11 | 6 31E-11 | | |
| Pm-147 | 1 2360E-02 | 224 12 | 448 24 | 0 00E+00 | 2 77E+00 | 5 54E+00 | | |
| Pu-238 | 5 3133E-03 | 224 12 | 448 24 | 0 00E+00 | 1 19E+00 | 2 38E+00 | | |
| Pu-239 | 1 0313E-02 | 224 12 | 448 24 | 0 00E+00 | 2 31E+00 | 4 62E+00 | | |
| Pu-240 | 5 4153E-03 | 224 12 | 448 24 | 0 00E+00 | 1 21E+00 | 2 43E+00 | | |
| Pu-241 | 2 9540E-01 | 224 12 | 448 24 | 0 00E+00 | 6 62E+01 | 1 32E+02 | | |
| Pu-242 | 3 0713E-06 | 224 12 | 448 24 | 0 00E+00 | 6 88E-04 | 1 38E-03 | | |
| Ra-226 | 5 9440E-13 | 224 12 | 448 24 | 0 00E+00 | 1 33E-10 | 2 66E-10 | | |
| Ra-228 | 1 6733E-14 | 224 12 | 448 24 | 0 00E+00 | 3 75E-12 | 7 50E-12 | | |
| Ru-106 | 2 7233E-07 | 224 12 | 448 24 | 0 00E+00 | 6 10E-05 | 1 22E-04 | | |
| Se-79 | 1 2533E-05 | 224 12 | 448 24 | 0 00E+00 | 2 81E-03 | 5 62E-03 | | |
| Sn-126 | 1 1393E-05 | 224 12 | 448 24 | 0 00E+00 | 2 55E-03 | 5 11E-03 | | |
| Sr-90 | 1 6333E+00 | 224 12 | 448 24 | 0 00E+00 | 3 66E+02 | 7 32E+02 | | |
| Tc-99 | 4 3533E-04 | 224 12 | 448 24 | 0 00E+00 | 9 76E-02 | 1 95E-01 | | |
| Th-229 | 1 0827E-12 | 224 12 | 448 24 | 0 00E+00 | 2 43E-10 | 4 85E-10 | | |
| Th-230 | 1 0793E-10 | 224 12 | 448 24 | 0 00E+00 | 2 42E-08 | 4 84E-08 | | |
| Th-232 | 2 2773E-14 | 224 12 | 448 24 | 0 00E+00 | 5 10E-12 | 1 02E-11 | | |
| Ti-208 | 7 3067E-09 | 224 12 | 448 24 | 0 00E+00 | 1 64E-06 | 3 28E-06 | | |
| U-232 | 1 9833E-08 | 224 12 | 448 24 | 0 00E+00 | 4 45E-06 | 8 89E-06 | | |
| U-233 | 6 0453E-10 | 224 12 | 448 24 | 0 00E+00 | 1 35E-07 | 2 71E-07 | | |
| U-234 | 6 1000E-07 | 224 12 | 448 24 | 0 00E+00 | 1 37E-04 | 2 73E-04 | | |
| U-235 | -2 5335E-06 | 224 12 | 0 00 | 1 16E-03 | 5 97E-04 | 1 16E-03 | | |
| U-236 | 1 3000E-05 | 224 12 | 448 24 | 0 00E+00 | 2 91E-03 | 5 83E-03 | | |
| U-238 | -1 4207E-08 | 224 12 | 0 00 | 7 44E-04 | 7 41E-04 | 7 44E-04 | | |
| Y-90 | 1 6340E+00 | 224 12 | 448 24 | 0 00E+00 | 3 66E+02 | 7 32E+02 | | |
| Other Radionuclides | | | | | 3 84E+02 | 7 67E+02 | | |

Other Radionuclides

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences* |
|---------------------|-------------|-------------|----------------------------------|
| Reactor Moderator | HEAVY WATER | HEAVY WATER | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19 58291238 | 10 to 20 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate* |
|----------|----------|-----------|--|
| Nominal | | 224 12 | |
| Bounding | | 448 24 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 1 86 | | |
| Bounding | 3 72 | | 1 02 |

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

*Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: DR-3 (U3Si2 LEU)(DENMARK)

SNF ID #: 759

Fuel Units & Descr: 375 - 4 CONCENTRIC TUBES

Heavy Metal Mass: BOL=341 562kg, EOL=309 112kg

ROD Storage Site: SRS

Fuel decay start date: 1997

Estimates as of: 2030

Template HFBR (Heavy Water, Alum, 10 to 20%, U)

Template Burnup(MWd), 15

Template BOL Heavy Metal Mass (MT)* 0 00034251

Template Decay Time 25 years

Estimated

Canister usage:

18"x10"

10 42

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Cu/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 1 4973E-09 | 30,937 63 | 61,875 26 | 0 00E+00 | 4 63E-05 | 9 26E-05 | Avg MeV | |
| Am-241 | 2 6120E-02 | 30,937 63 | 61,875 26 | 0 00E+00 | 8 08E+02 | 1 62E+03 | 0 0150 | 5 562E+15 |
| Am-242m | 8 7133E-06 | 30,937 63 | 61,875 26 | 0 00E+00 | 2 70E-01 | 5 39E-01 | 0 0250 | 1 154E+15 |
| Am-243 | 6 3980E-06 | 30,937 63 | 61,875 26 | 0 00E+00 | 1 98E-01 | 3 96E-01 | 0 0375 | 1 012E+15 |
| C-14 | 2 9600E-08 | 30,937 63 | 61,875 26 | 0 00E+00 | 9 16E-04 | 1 83E-03 | 0 0575 | 1 098E+15 |
| Cl-36 | 5 9507E-35 | 30,937 63 | 61,875 26 | 0 00E+00 | 1 84E-30 | 3 68E-30 | 0 0850 | 6 497E+14 |
| Cm-243 | 1 9560E-06 | 30,937 63 | 61,875 26 | 0 00E+00 | 6 05E-02 | 1 21E-01 | 0 1250 | 4 335E+14 |
| Cm-244 | 9 0867E-05 | 30,937 63 | 61,875 26 | 0 00E+00 | 2 81E+00 | 5 62E+00 | 0 2250 | 5 603E+14 |
| Co-60 | 8 4667E-06 | 30,937 63 | 61,875 26 | 0 00E+00 | 2 62E-01 | 5 24E-01 | 0 3750 | 2 435E+14 |
| Cs-134 | 3 9760E-04 | 30,937 63 | 61,875 26 | 0 00E+00 | 1 23E+01 | 2 46E+01 | 0 5750 | 4 152E+15 |
| Cs-135 | 4 8607E-06 | 30,937 63 | 61,875 26 | 0 00E+00 | 1 50E-01 | 3 01E-01 | 0 8500 | 5 533E+13 |
| Cs-137 | 1 8020E+00 | 30,937 63 | 61,875 26 | 0 00E+00 | 5 57E+04 | 1 11E+05 | 1 2500 | 2 993E+13 |
| Eu-154 | 1 3960E-02 | 30,937 63 | 61,875 26 | 0 00E+00 | 4 32E+02 | 8 64E+02 | 1 7500 | 1 519E+12 |
| Eu-155 | 2 0313E-03 | 30,937 63 | 61,875 26 | 0 00E+00 | 6 28E+01 | 1 26E+02 | 2 2500 | 1 134E+08 |
| Fe-55 | 3 7360E-04 | 30,937 63 | 61,875 26 | 0 00E+00 | 1 16E+01 | 2 31E+01 | 2 7500 | 1 634E+07 |
| H-3 | 3 5233E-03 | 30,937 63 | 61,875 26 | 0 00E+00 | 1 09E+02 | 2 18E+02 | 3 5000 | 3 092E+05 |
| I-129 | 7 1600E-07 | 30,937 63 | 61,875 26 | 0 00E+00 | 2 22E-02 | 4 43E-02 | 5 0000 | 1 227E+05 |
| Kr-85 | 7 4133E-02 | 30,937 63 | 61,875 26 | 0 00E+00 | 2 29E+03 | 4 59E+03 | 7 0000 | 1 385E+04 |
| Np-237 | 3 8020E-06 | 30,937 63 | 61,875 26 | 0 00E+00 | 1 18E-01 | 2 35E-01 | 11 0000 | 1 573E+03 |
| Pa-231 | 3 7020E-09 | 30,937 63 | 61,875 26 | 0 00E+00 | 1 15E-04 | 2 29E-04 | | |
| Pb-210 | 1 4067E-13 | 30,937 63 | 61,875 26 | 0 00E+00 | 4 35E-09 | 8 70E-09 | | |
| Pm-147 | 1 2360E-02 | 30,937 63 | 61,875 26 | 0 00E+00 | 3 82E+02 | 7 65E+02 | | |
| Pu-238 | 5 3133E-03 | 30,937 63 | 61,875 26 | 0 00E+00 | 1 64E+02 | 3 29E+02 | | |
| Pu-239 | 1 0313E-02 | 30,937 63 | 61,875 26 | 0 00E+00 | 3 19E+02 | 6 38E+02 | | |
| Pu-240 | 5 4153E-03 | 30,937 63 | 61,875 26 | 0 00E+00 | 1 68E+02 | 3 35E+02 | | |
| Pu-241 | 2 9540E-01 | 30,937 63 | 61,875 26 | 0 00E+00 | 9 14E+03 | 1 83E+04 | | |
| Pu-242 | 3 0713E-06 | 30,937 63 | 61,875 26 | 0 00E+00 | 9 50E-02 | 1 90E-01 | | |
| Ra-226 | 5 9440E-13 | 30,937 63 | 61,875 26 | 0 00E+00 | 1 84E-08 | 3 68E-08 | | |
| Ra-228 | 1 6733E-14 | 30,937 63 | 61,875 26 | 0 00E+00 | 5 18E-10 | 1 04E-09 | | |
| Ru-106 | 2 7233E-07 | 30,937 63 | 61,875 26 | 0 00E+00 | 8 43E-03 | 1 69E-02 | | |
| Se-79 | 1 2533E-05 | 30,937 63 | 61,875 26 | 0 00E+00 | 3 88E-01 | 7 76E-01 | | |
| Sn-126 | 1 1393E-05 | 30,937 63 | 61,875 26 | 0 00E+00 | 3 52E-01 | 7 05E-01 | | |
| Sr-90 | 1 6333E+00 | 30,937 63 | 61,875 26 | 0 00E+00 | 5 05E+04 | 1 01E+05 | | |
| Tc-99 | 4 3533E-04 | 30,937 63 | 61,875 26 | 0 00E+00 | 1 35E+01 | 2 69E+01 | | |
| Th-229 | 1 0827E-12 | 30,937 63 | 61,875 26 | 0 00E+00 | 3 35E-08 | 6 70E-08 | | |
| Th-230 | 1 0793E-10 | 30,937 63 | 61,875 26 | 0 00E+00 | 3 34E-06 | 6 68E-06 | | |
| Th-232 | 2 2773E-14 | 30,937 63 | 61,875 26 | 0 00E+00 | 7 05E-10 | 1 41E-09 | | |
| Th-208 | 7 3067E-09 | 30,937 63 | 61,875 26 | 0 00E+00 | 2 26E-04 | 4 52E-04 | | |
| U-232 | 1 9833E-08 | 30,937 63 | 61,875 26 | 0 00E+00 | 6 14E-04 | 1 23E-03 | | |
| U-233 | 6 0453E-10 | 30,937 63 | 61,875 26 | 0 00E+00 | 1 87E-05 | 3 74E-05 | | |
| U-234 | 6 1000E-07 | 30,937 63 | 61,875 26 | 0 00E+00 | 1 89E-02 | 3 77E-02 | | |
| U-235 | -2 5335E-06 | 30,937 63 | 0 00 | 1 46E-01 | 6 75E-02 | 1 46E-01 | | |
| U-236 | 1 3000E-05 | 30,937 63 | 61,875 26 | 0 00E+00 | 4 02E-01 | 8 04E-01 | | |
| U-238 | -1 4207E-08 | 30,937 63 | 0 00 | 9 21E-02 | 9 17E-02 | 9 21E-02 | | |
| Y-90 | 1 6340E+00 | 30,937 63 | 61,875 26 | 0 00E+00 | 5 06E+04 | 1 01E+05 | | |
| Other Radionuclides | | | | | 5 29E+04 | 1 06E+05 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-------------|-------------|
| Reactor Moderator: | HEAVY WATER | HEAVY WATER |
| Fuel Cladding | ALUM | ALUM |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 19 7578539 | 10 to 20 |

Basis for Parameter Differences:

Burnup Summary (MWd)³

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | | 30 937 63 |
| Bounding | | 61 875 26 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed.

Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|--------------------------------|
| Nominal | 2 07 | |
| Bounding | 4 14 | |

Estimated EOL HM/Given EOL HM

1 02

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel.

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: DR-3 (UALX HEU)(DENMARK)
SNF ID #: 714
Fuel Units & Descr: 88 - 4 CONCENTRIC TUBES
Heavy Metal Mass: BOL=14.529kg EOL=8.8kg
ROD Storage Site: SRS

Fuel decay start date: 1997
Estimates as of: 2030
Template: HFBR (Heavy Water Alum, 40 to 100%, U)
Template Burnup(MWd): 164.6
Template BOL Heavy Metal Mass (MT): 0.000377
Template Decay Time: 25 years

Estimated
Canister usage
18"x10"
2.44

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 5.4520E-10 | 5,276.81 | 10,553.63 | 0.00E+00 | 2.88E-06 | 5.75E-06 | Avg MeV | |
| Am-241 | 9.2284E-03 | 5,276.81 | 10,553.63 | 0.00E+00 | 4.87E+01 | 9.74E+01 | 0.0150 | 9.894E+14 |
| Am-242m | 1.3390E-06 | 5,276.81 | 10,553.63 | 0.00E+00 | 7.07E-03 | 1.41E-02 | 0.0250 | 2.036E+14 |
| Am-243 | 3.7084E-05 | 5,276.81 | 10,553.63 | 0.00E+00 | 1.96E-01 | 3.91E-01 | 0.0375 | 1.798E+14 |
| C-14 | 2.6452E-08 | 5,276.81 | 10,553.63 | 0.00E+00 | 1.40E-04 | 2.79E-04 | 0.0575 | 1.918E+14 |
| Cl-36 | 4.4441E-31 | 5,276.81 | 10,553.63 | 0.00E+00 | 2.35E-27 | 4.69E-27 | 0.0850 | 1.154E+14 |
| Cm-243 | 5.0498E-06 | 5,276.81 | 10,553.63 | 0.00E+00 | 2.66E-02 | 5.33E-02 | 0.1250 | 8.010E+13 |
| Cm-244 | 3.8451E-03 | 5,276.81 | 10,553.63 | 0.00E+00 | 2.03E-01 | 4.06E-01 | 0.2250 | 9.963E+13 |
| Co-60 | 2.5225E-05 | 5,276.81 | 10,553.63 | 0.00E+00 | 1.33E-01 | 2.66E-01 | 0.3750 | 4.313E+13 |
| Cs-134 | 1.9830E-03 | 5,276.81 | 10,553.63 | 0.00E+00 | 1.05E+01 | 2.09E+01 | 0.5750 | 7.152E+14 |
| Cs-135 | 4.2564E-06 | 5,276.81 | 10,553.63 | 0.00E+00 | 2.25E-02 | 4.49E-02 | 0.8500 | 1.409E+13 |
| Cs-137 | 1.8141E+00 | 5,276.81 | 10,553.63 | 0.00E+00 | 9.57E+03 | 1.91E+04 | 1.2500 | 9.507E+12 |
| Eu-154 | 3.4733E-02 | 5,276.81 | 10,553.63 | 0.00E+00 | 1.83E+02 | 3.67E+02 | 1.7500 | 3.935E+11 |
| Eu-155 | 7.1081E-03 | 5,276.81 | 10,553.63 | 0.00E+00 | 3.75E+01 | 7.50E+01 | 2.2500 | 2.121E+07 |
| Fe-55 | 3.5790E-04 | 5,276.81 | 10,553.63 | 0.00E+00 | 1.89E+00 | 3.78E+00 | 2.7500 | 1.823E+07 |
| H-3 | 3.945E-03 | 5,276.81 | 10,553.63 | 0.00E+00 | 1.84E+01 | 3.69E+01 | 3.5000 | 6.259E+05 |
| I-129 | 6.6403E-07 | 5,276.81 | 10,553.63 | 0.00E+00 | 3.50E-03 | 7.01E-03 | 5.0000 | 2.653E+05 |
| Kr-85 | 7.8250E-02 | 5,276.81 | 10,553.63 | 0.00E+00 | 4.13E+02 | 8.26E+02 | 7.0000 | 3.043E+04 |
| Np-237 | 3.1567E-05 | 5,276.81 | 10,553.63 | 0.00E+00 | 1.67E-01 | 3.33E-01 | 11.0000 | 3.486E+03 |
| Pa-231 | 1.3372E-09 | 5,276.81 | 10,553.63 | 0.00E+00 | 7.06E-06 | 1.41E-05 | | |
| Pb-210 | 3.0644E-11 | 5,276.81 | 10,553.63 | 0.00E+00 | 1.62E-07 | 3.23E-07 | | |
| Pm-147 | 6.5188E-03 | 5,276.81 | 10,553.63 | 0.00E+00 | 3.44E+01 | 6.88E+01 | | |
| Pu-238 | 1.4769E-01 | 5,276.81 | 10,553.63 | 0.00E+00 | 7.79E+02 | 1.56E+03 | | |
| Pu-239 | 6.9502E-04 | 5,276.81 | 10,553.63 | 0.00E+00 | 3.67E+00 | 7.33E+00 | | |
| Pu-240 | 3.7928E-04 | 5,276.81 | 10,553.63 | 0.00E+00 | 2.00E+00 | 4.00E+00 | | |
| Pu-241 | 1.0565E-01 | 5,276.81 | 10,553.63 | 0.00E+00 | 5.57E+02 | 1.11E+03 | | |
| Pu-242 | 3.0911E-06 | 5,276.81 | 10,553.63 | 0.00E+00 | 1.63E-02 | 3.26E-02 | | |
| Ra-226 | 1.1081E-10 | 5,276.81 | 10,553.63 | 0.00E+00 | 5.85E-07 | 1.17E-06 | | |
| Ra-228 | 2.1185E-14 | 5,276.81 | 10,553.63 | 0.00E+00 | 1.12E-10 | 2.24E-10 | | |
| Ru-106 | 2.3621E-07 | 5,276.81 | 10,553.63 | 0.00E+00 | 1.25E-03 | 2.49E-03 | | |
| Se-79 | 1.2339E-05 | 5,276.81 | 10,553.63 | 0.00E+00 | 6.51E-02 | 1.30E-01 | | |
| Sn-126 | 1.0194E-05 | 5,276.81 | 10,553.63 | 0.00E+00 | 5.38E-02 | 1.08E-01 | | |
| Sr-90 | 1.6932E+00 | 5,276.81 | 10,553.63 | 0.00E+00 | 8.93E+03 | 1.79E+04 | | |
| Tc-99 | 3.8056E-04 | 5,276.81 | 10,553.63 | 0.00E+00 | 2.01E+00 | 4.02E+00 | | |
| Th-229 | 9.1252E-12 | 5,276.81 | 10,553.63 | 0.00E+00 | 4.82E-08 | 9.63E-08 | | |
| Th-230 | 1.5407E-08 | 5,276.81 | 10,553.63 | 0.00E+00 | 8.13E-05 | 1.63E-04 | | |
| Th-232 | 2.8937E-14 | 5,276.81 | 10,553.63 | 0.00E+00 | 1.53E-10 | 3.05E-10 | | |
| Ti-208 | 4.7272E-08 | 5,276.81 | 10,553.63 | 0.00E+00 | 2.49E-04 | 4.99E-04 | | |
| U-232 | 1.2855E-07 | 5,276.81 | 10,553.63 | 0.00E+00 | 6.78E-04 | 1.36E-03 | | |
| U-233 | 5.1470E-09 | 5,276.81 | 10,553.63 | 0.00E+00 | 2.72E-05 | 5.43E-05 | | |
| U-234 | 5.6069E-05 | 5,276.81 | 10,553.63 | 0.00E+00 | 2.96E-01 | 5.92E-01 | | |
| U-235 | -2.8661E-06 | 5,276.81 | 0.00 | 2.79E-02 | 1.28E-02 | 2.79E-02 | | |
| U-236 | 1.6701E-05 | 5,276.81 | 10,553.63 | 0.00E+00 | 8.81E-02 | 1.76E-01 | | |
| U-238 | -9.4194E-09 | 5,276.81 | 0.00 | 5.43E-04 | 4.94E-04 | 5.43E-04 | | |
| Y-90 | 1.6932E+00 | 5,276.81 | 10,553.63 | 0.00E+00 | 8.93E+03 | 1.79E+04 | | |
| Other Radionuclides | | | | | 9.16E+03 | 1.83E+04 | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 1.37E+02 | 2.74E+02 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|-----------------------------------|-------------------|-------------------------------|---|
| | From SFD | Used | |
| Reactor Moderator | HEAVY WATER | HEAVY WATER | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 88.87461392 | 40 to 100 | |
| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
| | From SFD | Estimated | |
| Nominal | | 5,276.81 | Nominal burnup calculated from the heavy metal mass destroyed |
| Bounding | | 10,553.63 | Bounding burnup assumed to be twice nominal burnup |
| Checks | | | Estimated EOL HM/Given EOL HM |
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 0.83 | | 1.01 |
| Bounding | 1.66 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: DRESDEN I THO2UO2 (LEU)
SNF ID #: 44
Fuel Units & Descr: 1000 - ROD
Heavy Metal Mass: BOL= , EOL=2382.5kg
ROD Storage Site: INEEL

Fuel decay start date: 1966
Estimates as of: 2030
Template LWBR (Light Water, Zirc, 60 to 100%, Th and U)
Template Burnup (MWd): 10269 14
Template BOL Heavy Metal Mass (MT) 0.45991251
Template Decay Time 50 years

Estimated
Canister usage:
18"x15"
5.00

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ^a | Bounding Fuel Burnup (MWd) ^a | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 1.0595E-04 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 2.46E+02 | 2.46E+02 | Avg. MeV | |
| Am-241 | 2.4968E-04 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 5.79E+02 | 5.79E+02 | 0.0150 | 1.341E+17 |
| Am-242m | 1.3847E-06 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 3.21E+00 | 3.21E+00 | 0.0250 | 2.756E+16 |
| Am-243 | 3.1103E-07 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 7.21E-01 | 7.21E-01 | 0.0375 | 2.355E+16 |
| C-14 | 9.2267E-05 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 2.14E+02 | 2.14E+02 | 0.0575 | 2.575E+16 |
| Cl-36 | 1.8103E-06 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 4.20E+00 | 4.20E+00 | 0.0850 | 1.666E+16 |
| Cm-243 | 2.1248E-07 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 4.93E-01 | 4.93E-01 | 0.1250 | 1.019E+16 |
| Cm-244 | 7.9666E-06 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 1.85E+01 | 1.85E+01 | 0.2250 | 1.505E+16 |
| Co-60 | 1.2143E-04 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 2.82E+02 | 2.82E+02 | 0.3750 | 5.942E+15 |
| Cs-134 | 1.6535E-07 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 3.83E-01 | 3.83E-01 | 0.5750 | 9.154E+16 |
| Cs-135 | 2.8639E-05 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 6.64E+01 | 6.64E+01 | 0.8500 | 1.575E+15 |
| Cs-137 | 1.0449E+00 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 2.42E+06 | 2.42E+06 | 1.2500 | 4.791E+14 |
| Eu-154 | 2.5679E-03 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 5.95E+03 | 5.95E+03 | 1.7500 | 1.253E+14 |
| Eu-155 | 8.1175E-05 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 1.88E+02 | 1.88E+02 | 2.2500 | 2.791E+09 |
| Fe-55 | 4.2194E-08 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 9.78E-02 | 9.78E-02 | 2.7500 | 9.838E+14 |
| H-3 | 9.1673E-04 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 2.13E+03 | 2.13E+03 | 3.5000 | 3.385E+06 |
| I-129 | 1.5853E-06 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 3.68E+00 | 3.68E+00 | 5.0000 | 1.048E+06 |
| Kr-85 | 2.3741E-02 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 5.50E+04 | 5.50E+04 | 7.0000 | 7.466E+04 |
| Np-237 | 1.2747E-07 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 2.96E-01 | 2.96E-01 | 11.0000 | 5.506E+03 |
| Pa-231 | 1.2007E-04 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 2.78E+02 | 2.78E+02 | | |
| Pb-210 | 1.8424E-08 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 4.27E-02 | 4.27E-02 | | |
| Pm-147 | 4.9829E-06 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 1.16E+01 | 1.16E+01 | | |
| Pu-238 | 3.7744E-04 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 8.75E+02 | 8.75E+02 | | |
| Pu-239 | 2.7510E-05 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 6.38E+01 | 6.38E+01 | | |
| Pu-240 | 1.6175E-05 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 3.75E+01 | 3.75E+01 | | |
| Pu-241 | 7.1379E-04 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 1.65E+03 | 1.65E+03 | | |
| Pu-242 | 4.0831E-08 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 9.47E-02 | 9.47E-02 | | |
| Ra-226 | 2.9038E-08 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 6.73E-02 | 6.73E-02 | | |
| Ra-228 | 4.6352E-06 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 1.07E+01 | 1.07E+01 | | |
| Ru-106 | 1.3321E-15 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 3.09E-09 | 3.09E-09 | | |
| Se-79 | 3.5407E-05 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 8.21E+01 | 8.21E+01 | | |
| Sn-126 | 3.9838E-05 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 9.24E+01 | 9.24E+01 | | |
| Sr-90 | 1.0449E+00 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 2.42E+06 | 2.42E+06 | | |
| Tc-99 | 3.2525E-04 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 7.54E+02 | 7.54E+02 | | |
| Th-229 | 8.2305E-05 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 1.91E+02 | 1.91E+02 | | |
| Th-230 | 1.2533E-06 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 2.91E+00 | 2.91E+00 | | |
| Th-232 | -9.0328E-08 | 2,318,560.61 | 0.00 | 5.03E-01 | 2.94E-01 | 5.03E-01 | | |
| Th-208 | 1.2085E-02 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 2.80E+04 | 2.80E+04 | | |
| U-232 | 3.2729E-02 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 7.59E+04 | 7.59E+04 | | |
| U-233 | -3.3244E-03 | 2,318,560.61 | 0.00 | 1.69E+03 | 0.00E+00 | 1.69E+03 | | |
| U-234 | 8.1769E-04 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 1.90E+03 | 1.90E+03 | | |
| U-235 | 5.7813E-08 | 2,318,560.61 | 2,318,560.61 | 3.46E-04 | 1.34E-01 | 1.34E-01 | | |
| U-236 | 1.3273E-07 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 3.08E-01 | 3.08E-01 | | |
| U-238 | -3.1121E-10 | 2,318,560.61 | 0.00 | 2.21E-04 | 0.00E+00 | 2.21E-04 | | |
| Y-90 | 1.0449E+00 | 2,318,560.61 | 2,318,560.61 | 0.00E+00 | 2.42E+06 | 2.42E+06 | | |
| Other Radionuclides | | | | | 2.84E+06 | 2.84E+06 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-------------|-------------|---|
| Reactor Moderator: | From SFD | Used | |
| Fuel Cladding: | LIGHT WATER | LIGHT WATER | This Template was used for the following reasons: This fuel matches on all parameters except cladding and enrichment (unknown) |
| BOL HM Constituents: | SST | ZIRC | |
| BOL Enrichment % | Th and U | Th and U | |

| Burnup Summary (MWd) ^a | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|--------------|---|
| | From SFD | Estimated | |
| Nominal | | 2,318,560.61 | Nominal burnup set equal to bounding burnup. Bounding burnup estimated by assuming BOL heavy metal mass was twice EOL. |
| Bounding | | 2,318,560.61 | |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 21.79 | | 1.28 |
| Bounding | 21.79 | | |

^aReactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

^aTotal burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name DRESDEN UO2 (LEU)
SNF ID # 49
Fuel Units & Descr: 72 - ROD
Heavy Metal Mass: BOL= ; EOL=162.382kg
ROD Storage Site INEEL

Fuel decay start date 1966
Estimates as of 2030
Template Pathfinder (Light Water SST, 60 to 100%, U)
Template Burnup(MWd) 6 01
Template BOL Heavy Metal Mass (MT) 0 00012882
Template Decay Time 50 years

Estimated
Canister usage
18"x15"
0 36

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 3 4276E-08 | 153,393 39 | 153,393 39 | 0 00E+00 | 5 26E-03 | 5 26E-03 | Avg MeV | |
| Am-241 | 1 1458E-04 | 153,393 39 | 153,393 39 | 0 00E+00 | 1 76E+01 | 1 76E+01 | 0 0150 | 7 998E+15 |
| Am-242m | 7 9468E-09 | 153,393 39 | 153,393 39 | 0 00E+00 | 1 22E-03 | 1 22E-03 | 0 0250 | 1 662E+15 |
| Am-243 | 9 8386E-10 | 153,393 39 | 153,393 39 | 0 00E+00 | 1 51E-04 | 1 51E-04 | 0 0375 | 1 441E+15 |
| C-14 | 2 2978E-04 | 153,393 39 | 153,393 39 | 0 00E+00 | 3 52E+01 | 3 52E+01 | 0 0575 | 1 550E+15 |
| Cl-36 | 1 2261E-06 | 153,393 39 | 153,393 39 | 0 00E+00 | 1 88E-01 | 1 88E-01 | 0 0850 | 9 363E+14 |
| Cm-243 | 1 7271E-10 | 153,393 39 | 153,393 39 | 0 00E+00 | 2 65E-05 | 2 65E-05 | 0 1250 | 6 074E+14 |
| Cm-244 | 1 3058E-09 | 153,393 39 | 153,393 39 | 0 00E+00 | 2 00E-04 | 2 00E-04 | 0 2250 | 8 069E+14 |
| Co-60 | 9 8636E-03 | 153,393 39 | 153,393 39 | 0 00E+00 | 1 51E+03 | 1 51E+03 | 0 3750 | 3 520E+14 |
| Cs-134 | 1 9617E-08 | 153,393 39 | 153,393 39 | 0 00E+00 | 3 01E-03 | 3 01E-03 | 0 5750 | 5 860E+15 |
| Cs-135 | 3 0316E-05 | 153,393 39 | 153,393 39 | 0 00E+00 | 4 65E+00 | 4 65E+00 | 0 8500 | 5 786E+13 |
| Cs-137 | 1 0263E+00 | 153,393 39 | 153,393 39 | 0 00E+00 | 1 57E+05 | 1 57E+05 | 1 2500 | 1 318E+14 |
| Eu-154 | 2 0017E-04 | 153,393 39 | 153,393 39 | 0 00E+00 | 3 07E+01 | 3 07E+01 | 1 7500 | 1 490E+12 |
| Eu-155 | 8 5957E-05 | 153,393 39 | 153,393 39 | 0 00E+00 | 1 32E+01 | 1 32E+01 | 2 2500 | 7 550E+08 |
| Fe-55 | 2 2646E-05 | 153,393 39 | 153,393 39 | 0 00E+00 | 3 47E+00 | 3 47E+00 | 2 7500 | 1 028E+08 |
| H-3 | 1 0835E-03 | 153,393 39 | 153,393 39 | 0 00E+00 | 1 66E+02 | 1 66E+02 | 3 5000 | 8 989E+03 |
| I-129 | 7 3195E-07 | 153,393 39 | 153,393 39 | 0 00E+00 | 1 12E-01 | 1 12E-01 | 5 0000 | 3 711E+03 |
| Kr-85 | 1 5661E-02 | 153,393 39 | 153,393 39 | 0 00E+00 | 2 40E+03 | 2 40E+03 | 7 0000 | 4 099E+02 |
| Np-237 | 1 1494E-06 | 153,393 39 | 153,393 39 | 0 00E+00 | 1 76E-01 | 1 76E-01 | 11 0000 | 4 601E+01 |
| Pa-231 | 5 8070E-08 | 153,393 39 | 153,393 39 | 0 00E+00 | 8 91E-03 | 8 91E-03 | | |
| Pb-210 | 1 2985E-12 | 153,393 39 | 153,393 39 | 0 00E+00 | 1 99E-07 | 1 99E-07 | | |
| Pm-147 | 2 2196E-05 | 153,393 39 | 153,393 39 | 0 00E+00 | 3 40E+00 | 3 40E+00 | | |
| Pu-238 | 2 6223E-04 | 153,393 39 | 153,393 39 | 0 00E+00 | 4 02E+01 | 4 02E+01 | | |
| Pu-239 | 6 6739E-04 | 153,393 39 | 153,393 39 | 0 00E+00 | 1 02E+02 | 1 02E+02 | | |
| Pu-240 | 8 6705E-05 | 153,393 39 | 153,393 39 | 0 00E+00 | 1 33E+01 | 1 33E+01 | | |
| Pu-241 | 3 4759E-04 | 153,393 39 | 153,393 39 | 0 00E+00 | 5 33E+01 | 5 33E+01 | | |
| Pu-242 | 1 9717E-09 | 153,393 39 | 153,393 39 | 0 00E+00 | 3 02E-04 | 3 02E-04 | | |
| Ra-226 | 3 0000E-12 | 153,393 39 | 153,393 39 | 0 00E+00 | 4 60E-07 | 4 60E-07 | | |
| Ra-228 | 8 3328E-12 | 153,393 39 | 153,393 39 | 0 00E+00 | 1 28E-06 | 1 28E-06 | | |
| Ru-106 | 6 1464E-15 | 153,393 39 | 153,393 39 | 0 00E+00 | 9 43E-10 | 9 43E-10 | | |
| Se-79 | 1 3221E-05 | 153,393 39 | 153,393 39 | 0 00E+00 | 2 03E+00 | 2 03E+00 | | |
| Sn-126 | 1 1491E-05 | 153,393 39 | 153,393 39 | 0 00E+00 | 1 76E+00 | 1 76E+00 | | |
| Sr-90 | 9 5541E-01 | 153,393 39 | 153,393 39 | 0 00E+00 | 1 47E+05 | 1 47E+05 | | |
| Tc-99 | 4 6656E-04 | 153,393 39 | 153,393 39 | 0 00E+00 | 7 16E+01 | 7 16E+01 | | |
| Th-229 | 1 9085E-11 | 153,393 39 | 153,393 39 | 0 00E+00 | 2 93E-06 | 2 93E-06 | | |
| Th-230 | 2 1913E-10 | 153,393 39 | 153,393 39 | 0 00E+00 | 3 36E-05 | 3 36E-05 | | |
| Th-232 | 8 3478E-12 | 153,393 39 | 153,393 39 | 0 00E+00 | 1 28E-06 | 1 28E-06 | | |
| Ti-208 | 1 8752E-08 | 153,393 39 | 153,393 39 | 0 00E+00 | 2 88E-03 | 2 88E-03 | | |
| U-232 | 5 0782E-08 | 153,393 39 | 153,393 39 | 0 00E+00 | 7 79E-03 | 7 79E-03 | Thermal Power | |
| U-233 | 3 2596E-09 | 153,393 39 | 153,393 39 | 0 00E+00 | 5 00E-04 | 5 00E-04 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 3 9817E-07 | 153,393 39 | 153,393 39 | 0 00E+00 | 6 11E-02 | 6 11E-02 | 1 79E+03 | 1 79E+03 |
| U-235 | -2 7761E-06 | 153,393 39 | 0 00 | 6 56E-01 | 2 30E-01 | 6 56E-01 | Total | Total |
| U-236 | 1 6190E-05 | 153,393 39 | 153,393 39 | 0 00E+00 | 2 48E+00 | 2 48E+00 | | |
| U-238 | -2 8547E-09 | 153,393 39 | 0 00 | 7 09E-03 | 6 65E-03 | 7 09E-03 | | |
| Y-90 | 9 5557E-01 | 153,393 39 | 153,393 39 | 0 00E+00 | 1 47E+05 | 1 47E+05 | | |
| Other Radionuclides | | | | | 1 87E+05 | 1 87E+05 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences: This Template was used for the following reasons This fuel matches on all parameters except enrichment (unknown) |
|---------------------|-------------|-------------|---|
| Reactor Moderator | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding | SST | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | | 60 to 100 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate [*] |
|----------|----------|------------|--|
| Nominal | | 153,393.39 | |
| Bounding | | 153,393.39 | |

Nominal burnup set equal to bounding burnup
Bounding burnup estimated by assuming BOL heavy metal mass was twice EOL

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 10 12 | | |
| Bounding | 10 12 | | |

1 02

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: EBWR (6% UO2) LEU

SNF ID #: 65

Fuel Units & Descr: 61 - 6 FLAT PLATES

Heavy Metal Mass: BOL=1636 02kg, EOL=1603.519kg

ROD Storage Site: INEEL

Fuel decay start date: 1966

Estimates as of: 2030

Template: PWR (Light Water, Zirc, 0 to 5%, U)

Template Burnup (MWd): 61 92

Template BOL Heavy Metal Mass (MT): 0 00176911

Template Decay Time: 50 years

Estimated
Canister usage
18"x10"
5 08

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|-----------------------------|------------------------------|
| Radionuclide | Cv/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 1 0733E-09 | 30,906.72 | 61,813.45 | 0 00E+00 | 3.32E-05 | 6 63E-05 | Avg. MeV | |
| Am-241 | 1 4751E-01 | 30,906.72 | 61,813.45 | 0 00E+00 | 4.56E+03 | 9 12E+03 | 0 0150 | 2.352E+15 |
| Am-242m | 2 6809E-04 | 30,906.72 | 61,813.45 | 0 00E+00 | 8.29E+00 | 1 66E+01 | 0 0250 | 4 714E+14 |
| Am-243 | 6 2484E-04 | 30,906.72 | 61,813.45 | 0 00E+00 | 1 93E+01 | 3 86E+01 | 0 0375 | 4 442E+14 |
| C-14 | 4 7820E-05 | 30,906.72 | 61,813.45 | 0 00E+00 | 1 48E+00 | 2 96E+00 | 0 0575 | 5 558E+14 |
| Cl-36 | 8 0297E-07 | 30,906.72 | 61,813.45 | 0 00E+00 | 2 48E-02 | 4 96E-02 | 0 0850 | 2.597E+14 |
| Cm-243 | 1 7426E-04 | 30,906.72 | 61,813.45 | 0 00E+00 | 5 39E+00 | 1 08E+01 | 0 1250 | 1 728E+14 |
| Cm-244 | 2 7616E-02 | 30,906.72 | 61,813.45 | 0 00E+00 | 8 54E+02 | 1 71E+03 | 0 2250 | 2.217E+14 |
| Co-60 | 3 5610E-04 | 30,906.72 | 61,813.45 | 0 00E+00 | 1 10E+01 | 2 20E+01 | 0 3750 | 9 575E+13 |
| Cs-134 | 2 6260E-07 | 30,906.72 | 61,813.45 | 0 00E+00 | 8.12E-03 | 1 62E-02 | 0 5750 | 2.255E+15 |
| Cs-135 | 1 4433E-05 | 30,906.72 | 61,813.45 | 0 00E+00 | 4 46E-01 | 8 92E-01 | 0 8500 | 2.202E+13 |
| Cs-137 | 9 8870E-01 | 30,906.72 | 61,813.45 | 0 00E+00 | 3 06E+04 | 6 11E+04 | 1 2500 | 1 401E+13 |
| Eu-154 | 6 0320E-03 | 30,906.72 | 61,813.45 | 0 00E+00 | 1 86E+02 | 3 73E+02 | 1 7500 | 6 160E+11 |
| Eu-155 | 2 1770E-04 | 30,906.72 | 61,813.45 | 0 00E+00 | 6 73E+00 | 1 35E+01 | 2 2500 | 1 012E+08 |
| Fe-55 | 7 9296E-07 | 30,906.72 | 61,813.45 | 0 00E+00 | 2 45E-02 | 4 90E-02 | 2 7500 | 3.568E+08 |
| H-3 | 8 9486E-03 | 30,906.72 | 61,813.45 | 0 00E+00 | 2 77E+02 | 5 53E+02 | 3 5000 | 2.546E+07 |
| I-129 | 9 8288E-07 | 30,906.72 | 61,813.45 | 0 00E+00 | 3 04E-02 | 6 08E-02 | 5 0000 | 1 088E+07 |
| Kr-85 | 1 0707E-02 | 30,906.72 | 61,813.45 | 0 00E+00 | 3 31E+02 | 6 62E+02 | 7 0000 | 1 253E+06 |
| Np-237 | 1 1927E-05 | 30,906.72 | 61,813.45 | 0 00E+00 | 3 69E-01 | 7 37E-01 | 11 0000 | 1 439E+05 |
| Pa-231 | 1 4703E-09 | 30,906.72 | 61,813.45 | 0 00E+00 | 4 54E-05 | 9 09E-05 | | |
| Pb-210 | 1 6828E-10 | 30,906.72 | 61,813.45 | 0 00E+00 | 5.20E-06 | 1 04E-05 | | |
| Pm-147 | 6.9606E-06 | 30,906.72 | 61,813.45 | 0 00E+00 | 2 15E-01 | 4 30E-01 | | |
| Pu-238 | 6 6263E-02 | 30,906.72 | 61,813.45 | 0 00E+00 | 2 05E+03 | 4 10E+03 | | |
| Pu-239 | 1.1618E-02 | 30,906.72 | 61 813 45 | 0 00E+00 | 3 59E+02 | 7.18E+02 | | |
| Pu-240 | 1 5142E-02 | 30,906.72 | 61,813.45 | 0 00E+00 | 4 68E+02 | 9 36E+02 | | |
| Pu-241 | 4 3766E-01 | 30,906.72 | 61,813.45 | 0 00E+00 | 1.35E+04 | 2.71E+04 | | |
| Pu-242 | 6.4260E-05 | 30,906.72 | 61,813.45 | 0 00E+00 | 1 99E+00 | 3 97E+00 | | |
| Ra-226 | 3 8501E-10 | 30,906.72 | 61,813.45 | 0 00E+00 | 1 19E-05 | 2.38E-05 | | |
| Ra-228 | 5.2955E-12 | 30,906.72 | 61,813.45 | 0 00E+00 | 1 64E-07 | 3.27E-07 | | |
| Ru-106 | 2 0413E-14 | 30,906.72 | 61,813.45 | 0 00E+00 | 6 31E-10 | 1.26E-09 | | |
| Se-79 | 1 2376E-05 | 30,906.72 | 61,813.45 | 0 00E+00 | 3 82E-01 | 7 65E-01 | | |
| Sn-126 | 2 5210E-05 | 30,906.72 | 61,813.45 | 0 00E+00 | 7 79E-01 | 1.56E+00 | | |
| Sr-90 | 6 4163E-01 | 30,906.72 | 61,813.45 | 0 00E+00 | 1.98E+04 | 3 97E+04 | | |
| Tc-99 | 3 9357E-04 | 30,906.72 | 61,813.45 | 0 00E+00 | 1.22E+01 | 2 43E+01 | | |
| Th-229 | 1 5644E-10 | 30,906.72 | 61,813.45 | 0 00E+00 | 4 84E-06 | 9 67E-06 | | |
| Th-230 | 2 7972E-08 | 30,906.72 | 61,813.45 | 0 00E+00 | 8 65E-04 | 1.73E-03 | | |
| Th-232 | 5 3036E-12 | 30,906.72 | 61,813.45 | 0 00E+00 | 1 64E-07 | 3.28E-07 | | |
| Th-208 | 1 5136E-07 | 30,906.72 | 61,813.45 | 0 00E+00 | 4 68E-03 | 9.36E-03 | | |
| U-232 | 4 1005E-07 | 30,906.72 | 61,813.45 | 0 00E+00 | 1.27E-02 | 2.53E-02 | Thermal Power | |
| U-233 | 2 5856E-08 | 30,906.72 | 61,813.45 | 0 00E+00 | 7 99E-04 | 1 60E-03 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 5 2665E-05 | 30,906.72 | 61,813.45 | 0 00E+00 | 1 63E+00 | 3.26E+00 | 5 59E+02 | 1 12E+03 |
| U-235 | -1 4487E-06 | 30,906.72 | 0 00 | 2.11E-01 | 1 66E-01 | 2.11E-01 | Total | Total |
| U-236 | 7 5888E-06 | 30,906.72 | 61,813.45 | 0 00E+00 | 2.35E-01 | 4 69E-01 | | |
| U-238 | -2 6129E-07 | 30,906.72 | 0 00 | 5 17E-01 | 5 09E-01 | 5 17E-01 | | |
| Y-90 | 6 4180E-01 | 30,906.72 | 61,813.45 | 0 00E+00 | 1 98E+04 | 3 97E+04 | | |
| Other Radionuclides | | | | | 2 95E+04 | 5 89E+04 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| From SFD | | Used | Basis for Parameter Differences: This Template was used for the following reasons: This fuel matches PWR Template on all but one parameter (enrichment) making PWR a reasonable match. |
|---------------------|-------------|-------------|--|
| Reactor Moderator | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding | ZIRC | ZIRC | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 5 973154429 | 0 to 5 | |

Burnup Summary (MWd)³

| From SFD | | Estimated | Basis for burnup used in estimate: Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |
|----------|-----------|-----------|--|
| Nominal | 30,906.72 | 30,906.72 | |
| Bounding | 2 617 63 | 61 813 45 | |

Checks

| Burnup Multiplier | | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|-------------------|------|-----------------------------------|-------------------------------|
| Nominal | 0.54 | | |
| Bounding | 1 08 | 23 61 | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name EBWR (FUEL FOLLOWER) HEU
SNF ID # 740
Fuel Units & Descr 4 - CANISTER OF SCRAP
Heavy Metal Mass BOL=176kg EOL=1728kg
ROD Storage Site INEEL

¹Fuel decay start date: 1966
Estimates as of 2030
Template Pathfinder (Light Water, SST, 60 to 100%, U)
²Template Burnup(MWd) 6.01
Template BOL Heavy Metal Mass (MT): 0.00012882
Template Decay Time* 50 years

Estimated
Canister usage
HIC
1.00

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 3.4276E-08 | 29.85 | 59.70 | 0.00E+00 | 1.02E-06 | 2.05E-06 | Avg MeV | |
| Am-241 | 1.1458E-04 | 29.85 | 59.70 | 0.00E+00 | 3.42E-03 | 6.84E-03 | 0.0150 | 3.113E+12 |
| Am-242m | 7.9468E-09 | 29.85 | 59.70 | 0.00E+00 | 2.37E-07 | 4.74E-07 | 0.0250 | 6.469E+11 |
| Am-243 | 9.8386E-10 | 29.85 | 59.70 | 0.00E+00 | 2.94E-08 | 5.87E-08 | 0.0375 | 5.609E+11 |
| C-14 | 2.2978E-04 | 29.85 | 59.70 | 0.00E+00 | 6.86E-03 | 1.37E-02 | 0.0575 | 6.033E+11 |
| Cl-36 | 1.2261E-06 | 29.85 | 59.70 | 0.00E+00 | 3.66E-05 | 7.32E-05 | 0.0850 | 3.644E+11 |
| Cm-243 | 1.7271E-10 | 29.85 | 59.70 | 0.00E+00 | 5.16E-09 | 1.03E-08 | 0.1250 | 2.364E+11 |
| Cm-244 | 1.3058E-09 | 29.85 | 59.70 | 0.00E+00 | 3.90E-08 | 7.80E-08 | 0.2250 | 3.141E+11 |
| Co-60 | 9.8636E-03 | 29.85 | 59.70 | 0.00E+00 | 2.94E-01 | 5.89E-01 | 0.3750 | 1.370E+11 |
| Cs-134 | 1.9617E-08 | 29.85 | 59.70 | 0.00E+00 | 5.86E-07 | 1.17E-06 | 0.5750 | 2.281E+12 |
| Cs-135 | 3.0316E-05 | 29.85 | 59.70 | 0.00E+00 | 9.05E-04 | 1.81E-03 | 0.8500 | 2.252E+10 |
| Cs-137 | 1.0263E+00 | 29.85 | 59.70 | 0.00E+00 | 3.06E+01 | 6.13E+01 | 1.2500 | 5.129E+10 |
| Eu-154 | 2.0017E-04 | 29.85 | 59.70 | 0.00E+00 | 5.98E-03 | 1.20E-02 | 1.7500 | 5.798E+08 |
| Eu-155 | 8.5957E-05 | 29.85 | 59.70 | 0.00E+00 | 2.57E-03 | 5.13E-03 | 2.2500 | 2.939E+05 |
| Fe-55 | 2.2646E-05 | 29.85 | 59.70 | 0.00E+00 | 6.76E-04 | 1.35E-03 | 2.7500 | 4.003E+04 |
| H-3 | 1.0835E-03 | 29.85 | 59.70 | 0.00E+00 | 3.23E-02 | 6.47E-02 | 3.5000 | 3.796E+00 |
| I-129 | 7.3195E-07 | 29.85 | 59.70 | 0.00E+00 | 2.18E-05 | 4.37E-05 | 5.0000 | 1.569E+00 |
| Kr-85 | 1.5661E-02 | 29.85 | 59.70 | 0.00E+00 | 4.67E-01 | 9.35E-01 | 7.0000 | 1.736E-01 |
| Np-237 | 1.1494E-06 | 29.85 | 59.70 | 0.00E+00 | 3.43E-05 | 6.86E-05 | 11.0000 | 1.950E-02 |
| Pa-231 | 5.8070E-08 | 29.85 | 59.70 | 0.00E+00 | 1.73E-06 | 3.47E-06 | | |
| Pb-210 | 1.2985E-12 | 29.85 | 59.70 | 0.00E+00 | 3.88E-11 | 7.75E-11 | | |
| Pm-147 | 2.2196E-05 | 29.85 | 59.70 | 0.00E+00 | 6.63E-04 | 1.33E-03 | | |
| Pu-238 | 2.6223E-04 | 29.85 | 59.70 | 0.00E+00 | 7.83E-03 | 1.57E-02 | | |
| Pu-239 | 6.6739E-04 | 29.85 | 59.70 | 0.00E+00 | 1.99E-02 | 3.98E-02 | | |
| Pu-240 | 8.6705E-05 | 29.85 | 59.70 | 0.00E+00 | 2.59E-03 | 5.18E-03 | | |
| Pu-241 | 3.4759E-04 | 29.85 | 59.70 | 0.00E+00 | 1.04E-02 | 2.08E-02 | | |
| Pu-242 | 1.9717E-09 | 29.85 | 59.70 | 0.00E+00 | 5.89E-08 | 1.18E-07 | | |
| Ra-226 | 3.0000E-12 | 29.85 | 59.70 | 0.00E+00 | 8.96E-11 | 1.79E-10 | | |
| Ra-228 | 8.3328E-12 | 29.85 | 59.70 | 0.00E+00 | 2.49E-10 | 4.97E-10 | | |
| Ru-106 | 6.1464E-15 | 29.85 | 59.70 | 0.00E+00 | 1.83E-13 | 3.67E-13 | | |
| Se-79 | 1.3221E-05 | 29.85 | 59.70 | 0.00E+00 | 3.95E-04 | 7.89E-04 | | |
| Sn-126 | 1.1491E-05 | 29.85 | 59.70 | 0.00E+00 | 3.43E-04 | 6.86E-04 | | |
| Sr-90 | 9.5541E-01 | 29.85 | 59.70 | 0.00E+00 | 2.85E+01 | 5.70E+01 | | |
| Tc-99 | 4.6656E-04 | 29.85 | 59.70 | 0.00E+00 | 1.39E-02 | 2.79E-02 | | |
| Th-229 | 1.9085E-11 | 29.85 | 59.70 | 0.00E+00 | 5.70E-10 | 1.14E-09 | | |
| Th-230 | 2.1913E-10 | 29.85 | 59.70 | 0.00E+00 | 6.54E-09 | 1.31E-08 | | |
| Th-232 | 8.3478E-12 | 29.85 | 59.70 | 0.00E+00 | 2.49E-10 | 4.98E-10 | | |
| Ti-208 | 1.8752E-08 | 29.85 | 59.70 | 0.00E+00 | 5.60E-07 | 1.12E-06 | | |
| U-232 | 5.0782E-08 | 29.85 | 59.70 | 0.00E+00 | 1.52E-06 | 3.03E-06 | | |
| U-233 | 3.2596E-09 | 29.85 | 59.70 | 0.00E+00 | 9.73E-08 | 1.95E-07 | | |
| U-234 | 3.9817E-07 | 29.85 | 59.70 | 0.00E+00 | 1.19E-05 | 2.38E-05 | | |
| U-235 | -2.7761E-06 | 29.85 | 0.00 | 3.56E-03 | 3.48E-03 | 3.56E-03 | | |
| U-236 | 1.6190E-05 | 29.85 | 59.70 | 0.00E+00 | 4.83E-04 | 9.67E-04 | | |
| U-238 | -2.8547E-09 | 29.85 | 0.00 | 3.76E-05 | 3.76E-05 | 3.76E-05 | | |
| Y-90 | 9.5557E-01 | 29.85 | 59.70 | 0.00E+00 | 2.85E+01 | 5.70E+01 | | |
| Other Radionuclides | | | | | 3.64E+01 | 7.28E+01 | | |

Thermal Power
Nominal Heat Output (Watts)
Bounding Heat Output (Watts)
3.48E-01
6.97E-01
Total
Total

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences* |
|---------------------|-------------|-------------|---|
| Reactor Moderator | LIGHT WATER | LIGHT WATER | This Template was used for the following reasons: This fuel matches Pathfinder Template on all but one parameter (cladding but substituting Stainless Steel is a good conservative assumption) |
| Fuel Cladding | ZIRC | SST | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 93.636 | 60 to 100 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate* |
|----------|----------|-----------|---|
| Nominal | | 29.85 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup |
| Bounding | | 59.70 | |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0.36 | | 1.00 |
| Bounding | 0.73 | | |

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

*Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: EBWR (MOX)
SNF ID #: 63
Fuel Units & Descr: 25 - 6 FLAT PLATES
Heavy Metal Mass BOL=986kg, EOL=932.562kg
ROD Storage Site INEEL

¹Fuel decay start date: 1966
Estimates as of: 2030
Template: (Worst Case)
²Template Burnup(MWd): 62.5
Template BOL Heavy Metal Mass (MT): 0.00186865
Template Decay Time: 50 years

Estimated
Canister usage:
18"x10"
2.08

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Cu/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.5200E-06 | 50,784.46 | 101,568.92 | 0.00E+00 | 1.28E-01 | 2.56E-01 | Avg MeV | |
| Am-241 | 8.6432E+00 | 50,784.46 | 101,568.92 | 0.00E+00 | 4.39E+05 | 8.78E+05 | 0.0150 | 8.689E+16 |
| Am-242m | 1.5728E-02 | 50,784.46 | 101,568.92 | 0.00E+00 | 7.99E+02 | 1.60E+03 | 0.0250 | 1.700E+16 |
| Am-243 | 1.6288E-02 | 50,784.46 | 101,568.92 | 0.00E+00 | 8.27E+02 | 1.65E+03 | 0.0375 | 1.438E+16 |
| C-14 | 1.2068E-01 | 50,784.46 | 101,568.92 | 0.00E+00 | 6.13E+03 | 1.23E+04 | 0.0575 | 2.715E+16 |
| Cf-252 | 2.2849E-03 | 50,784.46 | 101,568.92 | 0.00E+00 | 1.16E+02 | 2.32E+02 | 0.0850 | 9.101E+15 |
| Cm-243 | 6.0144E-04 | 50,784.46 | 101,568.92 | 0.00E+00 | 3.05E+01 | 6.11E+01 | 0.1250 | 6.440E+15 |
| Cm-244 | 9.4880E-02 | 50,784.46 | 101,568.92 | 0.00E+00 | 4.82E+03 | 9.64E+03 | 0.2250 | 7.877E+15 |
| Co-60 | 3.9052E+00 | 50,784.46 | 101,568.92 | 0.00E+00 | 1.98E+05 | 3.97E+05 | 0.3750 | 3.410E+15 |
| Cs-134 | 2.2139E-06 | 50,784.46 | 101,568.92 | 0.00E+00 | 1.12E-01 | 2.25E-01 | 0.5750 | 5.642E+16 |
| Cs-135 | 4.3976E-04 | 50,784.46 | 101,568.92 | 0.00E+00 | 2.23E+01 | 4.47E+01 | 0.8500 | 1.236E+15 |
| Cs-137 | 1.4887E+01 | 50,784.46 | 101,568.92 | 0.00E+00 | 7.56E+05 | 1.51E+06 | 1.2500 | 3.029E+16 |
| Eu-154 | 3.7342E-01 | 50,784.46 | 101,568.92 | 0.00E+00 | 1.90E+04 | 3.79E+04 | 1.7500 | 3.640E+13 |
| Eu-155 | 8.4893E-03 | 50,784.46 | 101,568.92 | 0.00E+00 | 4.31E+02 | 8.62E+02 | 2.2500 | 1.574E+11 |
| Fe-55 | 5.3750E-03 | 50,784.46 | 101,568.92 | 0.00E+00 | 2.73E+02 | 5.46E+02 | 2.7500 | 2.710E+11 |
| H-3 | 1.0472E-01 | 50,784.46 | 101,568.92 | 0.00E+00 | 5.32E+03 | 1.06E+04 | 3.5000 | 1.621E+08 |
| I-129 | 1.0618E-05 | 50,784.46 | 101,568.92 | 0.00E+00 | 5.39E-01 | 1.08E+00 | 5.0000 | 6.851E+07 |
| Kr-85 | 2.2717E-01 | 50,784.46 | 101,568.92 | 0.00E+00 | 1.15E+04 | 2.31E+04 | 7.0000 | 7.798E+06 |
| Np-237 | 1.6400E-04 | 50,784.46 | 101,568.92 | 0.00E+00 | 8.33E+00 | 1.67E+01 | 11.0000 | 8.893E+05 |
| Pa-231 | 2.8688E-06 | 50,784.46 | 101,568.92 | 0.00E+00 | 1.46E-01 | 2.91E-01 | | |
| Pb-210 | 4.7312E-08 | 50,784.46 | 101,568.92 | 0.00E+00 | 2.40E-03 | 4.81E-03 | | |
| Pm-147 | 3.2198E-04 | 50,784.46 | 101,568.92 | 0.00E+00 | 1.64E+01 | 3.27E+01 | | |
| Pu-238 | -1.1924E+00 | 50,784.46 | 0.00 | 1.27E+05 | 6.61E+04 | 1.27E+05 | | |
| Pu-239 | -4.8600E-02 | 50,784.46 | 0.00 | 1.53E+04 | 1.29E+04 | 1.53E+04 | | |
| Pu-240 | -3.0127E-01 | 50,784.46 | 0.00 | 1.96E+04 | 4.28E+03 | 1.96E+04 | | |
| Pu-241 | -1.2917E+02 | 50,784.46 | 0.00 | 5.04E+06 | 0.00E+00 | 5.04E+06 | | |
| Pu-242 | -1.1381E-04 | 50,784.46 | 0.00 | 8.47E+01 | 7.90E+01 | 8.47E+01 | | |
| Ra-226 | 1.0760E-07 | 50,784.46 | 101,568.92 | 0.00E+00 | 5.46E-03 | 1.09E-02 | | |
| Ra-228 | 6.0160E-07 | 50,784.46 | 101,568.92 | 0.00E+00 | 3.06E-02 | 6.11E-02 | | |
| Ru-106 | 1.3388E-13 | 50,784.46 | 101,568.92 | 0.00E+00 | 6.80E-09 | 1.36E-08 | | |
| Se-79 | 1.9179E-04 | 50,784.46 | 101,568.92 | 0.00E+00 | 9.74E+00 | 1.95E+01 | | |
| Sn-126 | 1.6689E-04 | 50,784.46 | 101,568.92 | 0.00E+00 | 8.47E+00 | 1.69E+01 | | |
| Sr-90 | 1.3859E+01 | 50,784.46 | 101,568.92 | 0.00E+00 | 7.04E+05 | 1.41E+06 | | |
| Tc-99 | 6.7678E-03 | 50,784.46 | 101,568.92 | 0.00E+00 | 3.44E+02 | 6.87E+02 | | |
| Th-229 | 2.2592E-06 | 50,784.46 | 101,568.92 | 0.00E+00 | 1.15E-01 | 2.29E-01 | | |
| Th-230 | 7.5955E-08 | 50,784.46 | 101,568.92 | 0.00E+00 | 3.86E-01 | 7.71E-01 | | |
| Th-232 | 6.0208E-07 | 50,784.46 | 101,568.92 | 0.00E+00 | 3.06E-02 | 6.12E-02 | | |
| Ti-208 | 7.5795E-05 | 50,784.46 | 101,568.92 | 0.00E+00 | 3.85E+00 | 7.70E+00 | | |
| U-232 | 2.0521E-04 | 50,784.46 | 101,568.92 | 0.00E+00 | 1.04E+01 | 2.08E+01 | | |
| U-233 | 3.6128E-04 | 50,784.46 | 101,568.92 | 0.00E+00 | 1.83E+01 | 3.67E+01 | | |
| U-234 | 1.2788E-02 | 50,784.46 | 101,568.92 | 0.00E+00 | 6.49E+02 | 1.30E+03 | | |
| U-235 | 5.7486E-04 | 50,784.46 | 101,568.92 | 4.24E-01 | 2.96E+01 | 5.88E+01 | | |
| U-236 | 2.3485E-04 | 50,784.46 | 101,568.92 | 0.00E+00 | 1.19E+01 | 2.39E+01 | | |
| U-238 | 1.1581E-04 | 50,784.46 | 101,568.92 | 5.28E-02 | 5.93E+00 | 1.18E+01 | | |
| Y-90 | 1.3861E+01 | 50,784.46 | 101,568.92 | 0.00E+00 | 7.04E+05 | 1.41E+06 | | |
| Other Radionuclides | | | | | 2.61E+06 | 5.22E+06 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences: |
|---------------------|-------------|--------------|--|
| Reactor Moderator | LIGHT WATER | (Worst Case) | This fuel didn't closely match any existing templates, therefore the worst case template was used. |
| Fuel Cladding | ZIRC | SST/Inconel | |
| BOL HM Constituents | Pu and U | U, Th, & Pu | |
| BOL Enrichment % | 0.22222216 | 0 to 100 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|----------|------------|--|
| Nominal | | 50,784.46 | Nominal burnup calculated from the heavy metal mass destroyed. |
| Bounding | | 101,568.92 | Bounding burnup assumed to be twice nominal burnup |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 1.54 | | 34.51 |
| Bounding | 3.08 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name EBWR (NORMAL UO2)
SNF ID #: 60
Fuel Units & Descr: 51 - 6 FLAT PLATES
Heavy Metal Mass BOL=1358 64kg; EOL=1357.824kg
ROD Storage Site INEEL

Fuel decay start date 1966
Estimates as of 2030
Template PWR (Light Water Zirc 0 to 5%, U)
Template Burnup(MWd) 61.92
Template BOL Heavy Metal Mass (MT) 0.00176911
Template Decay Time 50 years

Estimated
Canister usage
18"x10"
4 25

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| | m | x _a | x _b | b | y _a | y _b | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Avg MeV | |
| Ac-227 | 1.0733E-09 | 775.98 | 1,551.95 | 0.00E+00 | 8.33E-07 | 1.67E-06 | 0.0150 | 5.906E+13 |
| Am-241 | 1.4751E-01 | 775.98 | 1,551.95 | 0.00E+00 | 1.14E+02 | 2.29E+02 | 0.0250 | 1.183E+13 |
| Am-242m | 2.6809E-04 | 775.98 | 1,551.95 | 0.00E+00 | 2.08E-01 | 4.16E-01 | 0.0375 | 1.115E+13 |
| Am-243 | 6.2484E-04 | 775.98 | 1,551.95 | 0.00E+00 | 4.85E-01 | 9.70E-01 | 0.0575 | 1.395E+13 |
| C-14 | 4.7820E-05 | 775.98 | 1,551.95 | 0.00E+00 | 3.71E-02 | 7.42E-02 | 0.0850 | 6.520E+12 |
| Cl-36 | 8.0297E-07 | 775.98 | 1,551.95 | 0.00E+00 | 6.23E-04 | 1.25E-03 | 0.1250 | 4.338E+12 |
| Cm-243 | 1.7426E-04 | 775.98 | 1,551.95 | 0.00E+00 | 1.35E-01 | 2.70E-01 | 0.2250 | 5.567E+12 |
| Cm-244 | 2.7616E-02 | 775.98 | 1,551.95 | 0.00E+00 | 2.14E+01 | 4.29E+01 | 0.3750 | 2.404E+12 |
| Co-60 | 3.5610E-04 | 775.98 | 1,551.95 | 0.00E+00 | 2.76E-01 | 5.53E-01 | 0.5750 | 5.661E+13 |
| Cs-134 | 2.6260E-07 | 775.98 | 1,551.95 | 0.00E+00 | 2.04E-04 | 4.08E-04 | 0.8500 | 5.528E+11 |
| Cs-135 | 1.4433E-05 | 775.98 | 1,551.95 | 0.00E+00 | 1.12E-02 | 2.24E-02 | 1.2500 | 3.518E+11 |
| Cs-137 | 9.8870E-01 | 775.98 | 1,551.95 | 0.00E+00 | 7.67E+02 | 1.53E+03 | 1.7500 | 1.547E+10 |
| Eu-154 | 6.0320E-03 | 775.98 | 1,551.95 | 0.00E+00 | 4.68E+00 | 9.36E+00 | 2.2500 | 2.546E+06 |
| Eu-155 | 2.1770E-04 | 775.98 | 1,551.95 | 0.00E+00 | 1.69E-01 | 3.38E-01 | 2.7500 | 8.962E+06 |
| Fe-55 | 7.9296E-07 | 775.98 | 1,551.95 | 0.00E+00 | 6.15E-04 | 1.23E-03 | 3.5000 | 6.416E+05 |
| H-3 | 8.9486E-03 | 775.98 | 1,551.95 | 0.00E+00 | 6.94E+00 | 1.39E+01 | 5.0000 | 2.742E+05 |
| I-129 | 9.8288E-07 | 775.98 | 1,551.95 | 0.00E+00 | 7.63E-04 | 1.53E-03 | 7.0000 | 3.159E+04 |
| Kr-85 | 1.0707E-02 | 775.98 | 1,551.95 | 0.00E+00 | 8.31E+00 | 1.66E+01 | 11.0000 | 3.627E+03 |
| Np-237 | 1.1927E-05 | 775.98 | 1,551.95 | 0.00E+00 | 9.25E-03 | 1.85E-02 | | |
| Pa-231 | 1.4703E-09 | 775.98 | 1,551.95 | 0.00E+00 | 1.14E-06 | 2.28E-06 | | |
| Pb-210 | 1.6828E-10 | 775.98 | 1,551.95 | 0.00E+00 | 1.31E-07 | 2.61E-07 | | |
| Pm-147 | 6.9606E-06 | 775.98 | 1,551.95 | 0.00E+00 | 5.40E-03 | 1.08E-02 | | |
| Pu-238 | 6.6263E-02 | 775.98 | 1,551.95 | 0.00E+00 | 5.14E+01 | 1.03E+02 | | |
| Pu-239 | 1.1618E-02 | 775.98 | 1,551.95 | 0.00E+00 | 9.02E+00 | 1.80E+01 | | |
| Pu-240 | 1.5142E-02 | 775.98 | 1,551.95 | 0.00E+00 | 1.17E+01 | 2.35E+01 | | |
| Pu-241 | 4.3766E-01 | 775.98 | 1,551.95 | 0.00E+00 | 3.40E+02 | 6.79E+02 | | |
| Pu-242 | 6.4260E-05 | 775.98 | 1,551.95 | 0.00E+00 | 4.99E-02 | 9.97E-02 | | |
| Ra-226 | 3.8501E-10 | 775.98 | 1,551.95 | 0.00E+00 | 2.99E-07 | 5.98E-07 | | |
| Ra-228 | 5.2955E-12 | 775.98 | 1,551.95 | 0.00E+00 | 4.11E-09 | 8.22E-09 | | |
| Ru-106 | 2.0413E-14 | 775.98 | 1,551.95 | 0.00E+00 | 1.58E-11 | 3.17E-11 | | |
| Se-79 | 1.2376E-05 | 775.98 | 1,551.95 | 0.00E+00 | 9.60E-03 | 1.92E-02 | | |
| Sn-126 | 2.5210E-05 | 775.98 | 1,551.95 | 0.00E+00 | 1.96E-02 | 3.91E-02 | | |
| Sr-90 | 6.4163E-01 | 775.98 | 1,551.95 | 0.00E+00 | 4.98E+02 | 9.96E+02 | | |
| Tc-99 | 3.9357E-04 | 775.98 | 1,551.95 | 0.00E+00 | 3.05E-01 | 6.11E-01 | | |
| Th-229 | 1.5644E-10 | 775.98 | 1,551.95 | 0.00E+00 | 1.21E-07 | 2.43E-07 | | |
| Th-230 | 2.7972E-08 | 775.98 | 1,551.95 | 0.00E+00 | 2.17E-05 | 4.34E-05 | | |
| Th-232 | 5.3036E-12 | 775.98 | 1,551.95 | 0.00E+00 | 4.12E-09 | 8.23E-09 | | |
| Ti-208 | 1.5136E-07 | 775.98 | 1,551.95 | 0.00E+00 | 1.17E-04 | 2.35E-04 | | |
| U-232 | 4.1005E-07 | 775.98 | 1,551.95 | 0.00E+00 | 3.18E-04 | 6.36E-04 | Thermal Power | |
| U-233 | 2.5856E-08 | 775.98 | 1,551.95 | 0.00E+00 | 2.01E-05 | 4.01E-05 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 5.2665E-05 | 775.98 | 1,551.95 | 0.00E+00 | 4.09E-02 | 8.17E-02 | 1.40E+01 | 2.81E+01 |
| U-235 | -1.4487E-06 | 775.98 | 0.00 | 2.09E-02 | 1.98E-02 | 2.09E-02 | Total | Total |
| U-236 | 7.5888E-06 | 775.98 | 1,551.95 | 0.00E+00 | 5.89E-03 | 1.18E-02 | | |
| U-238 | -2.6129E-07 | 775.98 | 0.00 | 4.53E-01 | 4.53E-01 | 4.53E-01 | | |
| Y-90 | 6.4180E-01 | 775.98 | 1,551.95 | 0.00E+00 | 4.98E+02 | 9.96E+02 | | |
| Other Radionuclides | | | | | 7.39E+02 | 1.48E+03 | | |

Other Radionuclides

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| Reactor Moderator: Fuel Cladding BOL HM Constituents BOL Enrichment % | From SFD | Used | Basis for Parameter Differences* |
|--|-------------|-------------|----------------------------------|
| | LIGHT WATER | LIGHT WATER | |
| | ZIRC | ZIRC | |
| | U | U | |
| | 0.711000016 | 0 to 5 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate* |
|----------|----------|-----------|---|
| Nominal | | 775.98 | |
| Bounding | | 1,551.95 | |
| | | | Nominal burnup calculated from the heavy metal mass destroyed |
| | | | Bounding burnup assumed to be twice nominal burnup |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0.02 | | |
| Bounding | 0.03 | | |
| | | | 1.00 |

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

*Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: EBWR (SPIKES)
SNF ID #: 891
Fuel Units & Descr: 31 - 7 X 7 ROD ARRAY
Heavy Metal Mass: BOL=29.205kg, EOL=26.989kg
ROD Storage Site: INEEL

¹Fuel decay start date: 1966
Estimates as of: 2030
Template: Pathfinder (Light Water, SST, 60 to 100%, U)
²Template Burnup (MWd), 6.01
Template BOL Heavy Metal Mass (MT): 0.00012882
Template Decay Time: 50 years

Estimated
Canister usage:
18"x10"
2.58

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 3.4276E-08 | 2,093.81 | 4,187.62 | 0.00E+00 | 7.18E-05 | 1.44E-04 | Avg. MeV | |
| Am-241 | 1.1458E-04 | 2,093.81 | 4,187.62 | 0.00E+00 | 2.40E-01 | 4.80E-01 | 0.0150 | 2.184E+14 |
| Am-242m | 7.9468E-09 | 2,093.81 | 4,187.62 | 0.00E+00 | 1.66E-05 | 3.33E-05 | 0.0250 | 4.538E+13 |
| Am-243 | 9.8386E-10 | 2,093.81 | 4,187.62 | 0.00E+00 | 2.06E-06 | 4.12E-06 | 0.0375 | 3.934E+13 |
| C-14 | 2.2978E-04 | 2,093.81 | 4,187.62 | 0.00E+00 | 4.81E-01 | 9.62E-01 | 0.0575 | 4.232E+13 |
| Cl-36 | 1.2261E-06 | 2,093.81 | 4,187.62 | 0.00E+00 | 2.57E-03 | 5.13E-03 | 0.0850 | 2.556E+13 |
| Co-243 | 1.7271E-10 | 2,093.81 | 4,187.62 | 0.00E+00 | 3.62E-07 | 7.23E-07 | 0.1250 | 1.658E+13 |
| Co-244 | 1.3058E-09 | 2,093.81 | 4,187.62 | 0.00E+00 | 2.73E-06 | 5.47E-06 | 0.2250 | 2.203E+13 |
| Co-60 | 9.8636E-03 | 2,093.81 | 4,187.62 | 0.00E+00 | 2.07E+01 | 4.13E+01 | 0.3750 | 9.609E+12 |
| Cs-134 | 1.9617E-08 | 2,093.81 | 4,187.62 | 0.00E+00 | 4.11E-05 | 8.21E-05 | 0.5750 | 1.600E+14 |
| Cs-135 | 3.0316E-05 | 2,093.81 | 4,187.62 | 0.00E+00 | 6.35E-02 | 1.27E-01 | 0.8500 | 1.580E+12 |
| Cs-137 | 1.0263E+00 | 2,093.81 | 4,187.62 | 0.00E+00 | 2.15E+03 | 4.30E+03 | 1.2500 | 3.597E+12 |
| Eu-154 | 2.0017E-04 | 2,093.81 | 4,187.62 | 0.00E+00 | 4.19E-01 | 8.38E-01 | 1.7500 | 4.067E+10 |
| Eu-155 | 8.5957E-05 | 2,093.81 | 4,187.62 | 0.00E+00 | 1.80E-01 | 3.60E-01 | 2.2500 | 2.061E+07 |
| Fe-55 | 2.2646E-05 | 2,093.81 | 4,187.62 | 0.00E+00 | 4.74E-02 | 9.48E-02 | 2.7500 | 2.808E+06 |
| H-3 | 1.0835E-03 | 2,093.81 | 4,187.62 | 0.00E+00 | 2.27E+00 | 4.54E+00 | 3.5000 | 2.493E+02 |
| I-129 | 7.3195E-07 | 2,093.81 | 4,187.62 | 0.00E+00 | 1.53E-03 | 3.07E-03 | 5.0000 | 1.029E+02 |
| Kr-85 | 1.5661E-02 | 2,093.81 | 4,187.62 | 0.00E+00 | 3.28E+01 | 6.56E+01 | 7.0000 | 1.138E+01 |
| Np-237 | 1.1494E-06 | 2,093.81 | 4,187.62 | 0.00E+00 | 2.41E-03 | 4.81E-03 | 11.0000 | 1.277E+00 |
| Pa-231 | 5.8070E-08 | 2,093.81 | 4,187.62 | 0.00E+00 | 1.22E-04 | 2.43E-04 | | |
| Pb-210 | 1.2985E-12 | 2,093.81 | 4,187.62 | 0.00E+00 | 2.72E-09 | 5.44E-09 | | |
| Pm-147 | 2.2196E-05 | 2,093.81 | 4,187.62 | 0.00E+00 | 4.65E-02 | 9.29E-02 | | |
| Pu-238 | 2.6223E-04 | 2,093.81 | 4,187.62 | 0.00E+00 | 5.49E-01 | 1.10E+00 | | |
| Pu-239 | 6.6739E-04 | 2,093.81 | 4,187.62 | 0.00E+00 | 1.40E+00 | 2.79E+00 | | |
| Pu-240 | 8.6705E-05 | 2,093.81 | 4,187.62 | 0.00E+00 | 1.82E-01 | 3.63E-01 | | |
| Pu-241 | 3.4759E-04 | 2,093.81 | 4,187.62 | 0.00E+00 | 7.28E-01 | 1.46E+00 | | |
| Pu-242 | 1.9717E-09 | 2,093.81 | 4,187.62 | 0.00E+00 | 4.13E-06 | 8.26E-06 | | |
| Ra-226 | 3.0000E-12 | 2,093.81 | 4,187.62 | 0.00E+00 | 6.28E-09 | 1.26E-08 | | |
| Ra-228 | 8.3328E-12 | 2,093.81 | 4,187.62 | 0.00E+00 | 1.74E-08 | 3.49E-08 | | |
| Ru-106 | 6.1464E-15 | 2,093.81 | 4,187.62 | 0.00E+00 | 1.29E-11 | 2.57E-11 | | |
| Se-79 | 1.3221E-05 | 2,093.81 | 4,187.62 | 0.00E+00 | 2.77E-02 | 5.54E-02 | | |
| Sn-126 | 1.1491E-05 | 2,093.81 | 4,187.62 | 0.00E+00 | 2.41E-02 | 4.81E-02 | | |
| Sr-90 | 9.5541E-01 | 2,093.81 | 4,187.62 | 0.00E+00 | 2.00E+03 | 4.00E+03 | | |
| Tc-99 | 4.6656E-04 | 2,093.81 | 4,187.62 | 0.00E+00 | 9.77E-01 | 1.95E+00 | | |
| Th-229 | 1.9085E-11 | 2,093.81 | 4,187.62 | 0.00E+00 | 4.00E-08 | 7.99E-08 | | |
| Th-230 | 2.1913E-10 | 2,093.81 | 4,187.62 | 0.00E+00 | 4.59E-07 | 9.18E-07 | | |
| Th-232 | 8.3478E-12 | 2,093.81 | 4,187.62 | 0.00E+00 | 1.75E-08 | 3.50E-08 | | |
| Ti-208 | 1.8752E-08 | 2,093.81 | 4,187.62 | 0.00E+00 | 3.93E-05 | 7.85E-05 | | |
| U-232 | 5.0782E-08 | 2,093.81 | 4,187.62 | 0.00E+00 | 1.06E-04 | 2.13E-04 | | |
| U-233 | 3.2596E-09 | 2,093.81 | 4,187.62 | 0.00E+00 | 6.82E-06 | 1.36E-05 | | |
| U-234 | 3.9817E-07 | 2,093.81 | 4,187.62 | 0.00E+00 | 8.34E-04 | 1.67E-03 | | |
| U-235 | 2.7761E-06 | 2,093.81 | 0.00 | 5.88E-02 | 5.30E-02 | 5.88E-02 | | |
| U-236 | 1.6190E-05 | 2,093.81 | 4,187.62 | 0.00E+00 | 3.39E-02 | 6.78E-02 | | |
| U-238 | 2.8547E-09 | 2,093.81 | 0.00 | 6.68E-04 | 6.62E-04 | 6.68E-04 | | |
| Y-90 | 9.5557E-01 | 2,093.81 | 4,187.62 | 0.00E+00 | 2.00E+03 | 4.00E+03 | | |
| Other Radionuclides | | | | | 2.55E+03 | 5.11E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences: |
|---------------------|-------------|-------------|--|
| Reactor Moderator | LIGHT WATER | LIGHT WATER | This Template was used for the following reasons |
| Fuel Cladding | ZIRC | SST | This fuel matches Pathfinder Template on all but one parameter (cladding, but substituting Stainless Steel is a good conservative assumption). |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 93.18999022 | 60 to 100 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|----------|-----------|--|
| Nominal | 1,233.24 | 2,093.81 | Nominal burnup calculated from the heavy metal mass destroyed. |
| Bounding | 1,767.05 | 4,187.62 | Bounding burnup assumed to be twice nominal burnup |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 1.54 | 1.70 | 1.00 |
| Bounding | 3.07 | 2.37 | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name EBWR (U METAL) ENRICHED HEAVY
SNF ID # 64
Fuel Units & Descr 53 - 6 FLAT PLATES
Heavy Metal Mass BOL=2989.2kg EOL=2982 962kg
ROD Storage Site INEEL

Fuel decay start date 1966
Estimates as of 2030
Template PWR (Light Water, Zirc. 0 to 5% O)
Template Burnup(MWd) 61.92
Template BOL Heavy Metal Mass (MT) 0.00176911
Template Decay Time 50 years

Estimated
Canister usage
18"x10"
4 42

| II. Estimates | m | X ₀ | X ₁ | b | Y ₀ | Y ₁ | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 1.0733E-09 | 5,932.14 | 11,864.28 | 0.00E+00 | 6.37E-06 | 1.27E-05 | Avg MeV | |
| Am-241 | 1.4751E-01 | 5,932.14 | 11,864.28 | 0.00E+00 | 8.75E+02 | 1.75E+03 | 0.0150 | 4.515E+14 |
| Am-242m | 2.6809E-04 | 5,932.14 | 11,864.28 | 0.00E+00 | 1.59E+00 | 3.18E+00 | 0.0250 | 9.047E+13 |
| Am-243 | 6.2484E-04 | 5,932.14 | 11,864.28 | 0.00E+00 | 3.71E+00 | 7.41E+00 | 0.0375 | 8.525E+13 |
| C-14 | 4.7820E-05 | 5,932.14 | 11,864.28 | 0.00E+00 | 2.84E-01 | 5.67E-01 | 0.0575 | 1.067E+14 |
| Cl-36 | 8.0297E-07 | 5,932.14 | 11,864.28 | 0.00E+00 | 4.76E-03 | 9.53E-03 | 0.0850 | 4.984E+13 |
| Cm-243 | 1.7426E-04 | 5,932.14 | 11,864.28 | 0.00E+00 | 1.03E+00 | 2.07E+00 | 0.1250 | 3.316E+13 |
| Cm-244 | 2.7616E-02 | 5,932.14 | 11,864.28 | 0.00E+00 | 1.64E+02 | 3.28E+02 | 0.2250 | 4.256E+13 |
| Co-60 | 3.5610E-04 | 5,932.14 | 11,864.28 | 0.00E+00 | 2.11E+00 | 4.22E+00 | 0.3750 | 1.838E+13 |
| Cs-134 | 2.6260E-07 | 5,932.14 | 11,864.28 | 0.00E+00 | 1.56E-03 | 3.12E-03 | 0.5750 | 4.328E+14 |
| Cs-135 | 1.4433E-05 | 5,932.14 | 11,864.28 | 0.00E+00 | 8.56E-02 | 1.71E-01 | 0.8500 | 4.226E+12 |
| Cs-137 | 9.8870E-01 | 5,932.14 | 11,864.28 | 0.00E+00 | 5.87E+03 | 1.17E+04 | 1.2500 | 2.689E+12 |
| Eu-154 | 6.0320E-03 | 5,932.14 | 11,864.28 | 0.00E+00 | 3.58E+01 | 7.16E+01 | 1.7500 | 1.182E+11 |
| Eu-155 | 2.1770E-04 | 5,932.14 | 11,864.28 | 0.00E+00 | 1.29E+00 | 2.58E+00 | 2.2500 | 1.944E+07 |
| Fe-55 | 7.9296E-07 | 5,932.14 | 11,864.28 | 0.00E+00 | 4.70E-03 | 9.41E-03 | 2.7500 | 6.850E+07 |
| H-3 | 8.9486E-03 | 5,932.14 | 11,864.28 | 0.00E+00 | 5.31E+01 | 1.06E+02 | 3.5000 | 4.891E+06 |
| I-129 | 9.8288E-07 | 5,932.14 | 11,864.28 | 0.00E+00 | 5.83E-03 | 1.17E-02 | 5.0000 | 2.090E+06 |
| Kr-85 | 1.0707E-02 | 5,932.14 | 11,864.28 | 0.00E+00 | 6.35E+01 | 1.27E+02 | 7.0000 | 2.408E+05 |
| Np-237 | 1.1927E-05 | 5,932.14 | 11,864.28 | 0.00E+00 | 7.08E-02 | 1.42E-01 | 11.0000 | 2.765E+04 |
| Pa-231 | 1.4703E-09 | 5,932.14 | 11,864.28 | 0.00E+00 | 8.72E-06 | 1.74E-05 | | |
| Pb-210 | 1.6828E-10 | 5,932.14 | 11,864.28 | 0.00E+00 | 9.98E-07 | 2.00E-06 | | |
| Pm-147 | 6.9606E-06 | 5,932.14 | 11,864.28 | 0.00E+00 | 4.13E-02 | 8.26E-02 | | |
| Pu-238 | 6.6263E-02 | 5,932.14 | 11,864.28 | 0.00E+00 | 3.93E+02 | 7.86E+02 | | |
| Pu-239 | 1.1618E-02 | 5,932.14 | 11,864.28 | 0.00E+00 | 6.89E+01 | 1.38E+02 | | |
| Pu-240 | 1.5142E-02 | 5,932.14 | 11,864.28 | 0.00E+00 | 8.98E+01 | 1.80E+02 | | |
| Pu-241 | 4.3766E-01 | 5,932.14 | 11,864.28 | 0.00E+00 | 2.60E+03 | 5.19E+03 | | |
| Pu-242 | 6.4260E-05 | 5,932.14 | 11,864.28 | 0.00E+00 | 3.81E-01 | 7.62E-01 | | |
| Ra-226 | 3.8501E-10 | 5,932.14 | 11,864.28 | 0.00E+00 | 2.28E-06 | 4.57E-06 | | |
| Ra-228 | 5.2955E-12 | 5,932.14 | 11,864.28 | 0.00E+00 | 3.14E-08 | 6.28E-08 | | |
| Ru-106 | 2.0413E-14 | 5,932.14 | 11,864.28 | 0.00E+00 | 1.21E-10 | 2.42E-10 | | |
| Se-79 | 1.2376E-05 | 5,932.14 | 11,864.28 | 0.00E+00 | 7.34E-02 | 1.47E-01 | | |
| Sn-126 | 2.5210E-05 | 5,932.14 | 11,864.28 | 0.00E+00 | 1.50E-01 | 2.99E-01 | | |
| Sr-90 | 6.4163E-01 | 5,932.14 | 11,864.28 | 0.00E+00 | 3.81E+03 | 7.61E+03 | | |
| Tc-99 | 3.9357E-04 | 5,932.14 | 11,864.28 | 0.00E+00 | 2.33E+00 | 4.67E+00 | | |
| Th-229 | 1.5644E-10 | 5,932.14 | 11,864.28 | 0.00E+00 | 9.28E-07 | 1.86E-06 | | |
| Th-230 | 2.7972E-08 | 5,932.14 | 11,864.28 | 0.00E+00 | 1.66E-04 | 3.32E-04 | | |
| Th-232 | 5.3036E-12 | 5,932.14 | 11,864.28 | 0.00E+00 | 3.15E-08 | 6.29E-08 | | |
| Ti-208 | 1.5136E-07 | 5,932.14 | 11,864.28 | 0.00E+00 | 8.98E-04 | 1.80E-03 | | |
| U-232 | 4.1005E-07 | 5,932.14 | 11,864.28 | 0.00E+00 | 2.43E-03 | 4.86E-03 | Thermal Power | |
| U-233 | 2.5856E-08 | 5,932.14 | 11,864.28 | 0.00E+00 | 1.53E-04 | 3.07E-04 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 5.2665E-05 | 5,932.14 | 11,864.28 | 0.00E+00 | 3.12E-01 | 6.25E-01 | 1.07E+02 | 2.15E+02 |
| U-235 | -1.4487E-06 | 5,932.14 | 0.00 | 9.28E-02 | 8.42E-02 | 9.28E-02 | Total | Total |
| U-236 | 7.5888E-06 | 5,932.14 | 11,864.28 | 0.00E+00 | 4.50E-02 | 9.00E-02 | | |
| U-238 | -2.6129E-07 | 5,932.14 | 0.00 | 9.90E-01 | 9.89E-01 | 9.90E-01 | | |
| Y-90 | 6.4180E-01 | 5,932.14 | 11,864.28 | 0.00E+00 | 3.81E+03 | 7.61E+03 | | |
| Other Radionuclides | | | | | 5.65E+03 | 1.13E+04 | | |

Other Radionuclides

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences: |
|---------------------|-------------|-------------|----------------------------------|
| Reactor Moderator: | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding | ZIRC | ZIRC | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 1.436170175 | 0 to 5 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|----------|-----------|------------------------------------|
| Nominal | | 5,932.14 | |
| Bounding | 4,782.72 | 11,864.28 | |

Nominal burnup calculated from the heavy metal mass destroyed
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0.06 | | |
| Bounding | 0.11 | 2.48 | |

1.00

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: EBWR (U METAL) ENRICHED THIN
SNF ID #: 887
Fuel Units & Descr: 54 - 6 FLAT PLATES
Heavy Metal Mass BOL: ; EOL=2194 101kg
ROD Storage Site: INEEL

Fuel decay start date: 1966
Estimates as of: 2030
Template: PWR (Light Water, Zirc, 0 to 5%, U)
Template Burnup (MWd): 61.92
Template BOL Heavy Metal Mass (MT): 0.00176911
Template Decay Time: 50 years

Estimated
Canister usage:
18"x10"
4.50

II. Estimates

| | m | X _a | X _b | b | Y _a | Y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 1.0733E-09 | 3,516.48 | 3,516.48 | 0.00E+00 | 3.77E-06 | 3.77E-06 | Avg. MeV | |
| Am-241 | 1.4751E-01 | 3,516.48 | 3,516.48 | 0.00E+00 | 5.19E+02 | 5.19E+02 | 0.0150 | 1.338E+14 |
| Am-242m | 2.6809E-04 | 3,516.48 | 3,516.48 | 0.00E+00 | 9.43E-01 | 9.43E-01 | 0.0250 | 2.681E+13 |
| Am-243 | 6.2484E-04 | 3,516.48 | 3,516.48 | 0.00E+00 | 2.20E+00 | 2.20E+00 | 0.0375 | 2.527E+13 |
| C-14 | 4.7820E-05 | 3,516.48 | 3,516.48 | 0.00E+00 | 1.68E-01 | 1.68E-01 | 0.0575 | 3.162E+13 |
| Cl-36 | 8.0297E-07 | 3,516.48 | 3,516.48 | 0.00E+00 | 2.82E-03 | 2.82E-03 | 0.0850 | 1.477E+13 |
| Cm-243 | 1.7426E-04 | 3,516.48 | 3,516.48 | 0.00E+00 | 6.13E-01 | 6.13E-01 | 0.1250 | 9.829E+12 |
| Cm-244 | 2.7616E-02 | 3,516.48 | 3,516.48 | 0.00E+00 | 9.71E+01 | 9.71E+01 | 0.2250 | 1.262E+13 |
| Co-60 | 3.5610E-04 | 3,516.48 | 3,516.48 | 0.00E+00 | 1.25E+00 | 1.25E+00 | 0.3750 | 5.447E+12 |
| Cs-134 | 2.6260E-07 | 3,516.48 | 3,516.48 | 0.00E+00 | 9.23E-04 | 9.23E-04 | 0.5750 | 1.283E+14 |
| Cs-135 | 1.4433E-05 | 3,516.48 | 3,516.48 | 0.00E+00 | 5.08E-02 | 5.08E-02 | 0.8500 | 1.253E+12 |
| Cs-137 | 9.8870E-01 | 3,516.48 | 3,516.48 | 0.00E+00 | 3.48E+03 | 3.48E+03 | 1.2500 | 7.970E+11 |
| Eu-154 | 6.0320E-03 | 3,516.48 | 3,516.48 | 0.00E+00 | 2.12E+01 | 2.12E+01 | 1.7500 | 3.504E+10 |
| Eu-155 | 2.1770E-04 | 3,516.48 | 3,516.48 | 0.00E+00 | 7.66E-01 | 7.66E-01 | 2.2500 | 5.766E+06 |
| Fe-55 | 7.9296E-07 | 3,516.48 | 3,516.48 | 0.00E+00 | 2.79E-03 | 2.79E-03 | 2.7500 | 2.030E+07 |
| H-3 | 8.9486E-03 | 3,516.48 | 3,516.48 | 0.00E+00 | 3.15E+01 | 3.15E+01 | 3.5000 | 1.452E+06 |
| I-129 | 9.8288E-07 | 3,516.48 | 3,516.48 | 0.00E+00 | 3.46E-03 | 3.46E-03 | 5.0000 | 6.206E+05 |
| Kr-85 | 1.0707E-02 | 3,516.48 | 3,516.48 | 0.00E+00 | 3.77E+01 | 3.77E+01 | 7.0000 | 7.149E+04 |
| Np-237 | 1.1927E-05 | 3,516.48 | 3,516.48 | 0.00E+00 | 4.19E-02 | 4.19E-02 | 11.0000 | 8.209E+03 |
| Pa-231 | 1.4703E-09 | 3,516.48 | 3,516.48 | 0.00E+00 | 5.17E-06 | 5.17E-06 | | |
| Pb-210 | 1.6828E-10 | 3,516.48 | 3,516.48 | 0.00E+00 | 5.92E-07 | 5.92E-07 | | |
| Pm-147 | 6.9606E-06 | 3,516.48 | 3,516.48 | 0.00E+00 | 2.45E-02 | 2.45E-02 | | |
| Pu-238 | 6.6263E-02 | 3,516.48 | 3,516.48 | 0.00E+00 | 2.33E+02 | 2.33E+02 | | |
| Pu-239 | 1.1618E-02 | 3,516.48 | 3,516.48 | 0.00E+00 | 4.09E+01 | 4.09E+01 | | |
| Pu-240 | 1.5142E-02 | 3,516.48 | 3,516.48 | 0.00E+00 | 5.32E+01 | 5.32E+01 | | |
| Pu-241 | 4.3766E-01 | 3,516.48 | 3,516.48 | 0.00E+00 | 1.54E+03 | 1.54E+03 | | |
| Pu-242 | 6.4260E-05 | 3,516.48 | 3,516.48 | 0.00E+00 | 2.26E-01 | 2.26E-01 | | |
| Ra-226 | 3.8501E-10 | 3,516.48 | 3,516.48 | 0.00E+00 | 1.35E-06 | 1.35E-06 | | |
| Ra-228 | 5.2955E-12 | 3,516.48 | 3,516.48 | 0.00E+00 | 1.86E-08 | 1.86E-08 | | |
| Ru-106 | 2.0413E-14 | 3,516.48 | 3,516.48 | 0.00E+00 | 7.18E-11 | 7.18E-11 | | |
| Se-79 | 1.2376E-05 | 3,516.48 | 3,516.48 | 0.00E+00 | 4.35E-02 | 4.35E-02 | | |
| Sn-126 | 2.5210E-05 | 3,516.48 | 3,516.48 | 0.00E+00 | 8.87E-02 | 8.87E-02 | | |
| Sr-90 | 6.4163E-01 | 3,516.48 | 3,516.48 | 0.00E+00 | 2.26E+03 | 2.26E+03 | | |
| Tc-99 | 3.9357E-04 | 3,516.48 | 3,516.48 | 0.00E+00 | 1.38E+00 | 1.38E+00 | | |
| Th-229 | 1.5644E-10 | 3,516.48 | 3,516.48 | 0.00E+00 | 5.50E-07 | 5.50E-07 | | |
| Th-230 | 2.7972E-08 | 3,516.48 | 3,516.48 | 0.00E+00 | 9.84E-05 | 9.84E-05 | | |
| Th-232 | 5.3036E-12 | 3,516.48 | 3,516.48 | 0.00E+00 | 1.87E-08 | 1.87E-08 | | |
| Ti-208 | 1.5136E-07 | 3,516.48 | 3,516.48 | 0.00E+00 | 5.32E-04 | 5.32E-04 | | |
| U-232 | 4.1005E-07 | 3,516.48 | 3,516.48 | 0.00E+00 | 1.44E-03 | 1.44E-03 | | |
| U-233 | 2.5856E-08 | 3,516.48 | 3,516.48 | 0.00E+00 | 9.09E-05 | 9.09E-05 | | |
| U-234 | 5.2665E-05 | 3,516.48 | 3,516.48 | 0.00E+00 | 1.85E-01 | 1.85E-01 | | |
| U-235 | -1.4487E-06 | 3,516.48 | 0.00 | 1.52E-01 | 1.47E-01 | 1.52E-01 | | |
| U-236 | 7.5888E-06 | 3,516.48 | 3,516.48 | 0.00E+00 | 2.67E-02 | 2.67E-02 | | |
| U-238 | -2.6129E-07 | 3,516.48 | 0.00 | 7.15E-01 | 7.14E-01 | 7.15E-01 | | |
| Y-90 | 6.4180E-01 | 3,516.48 | 3,516.48 | 0.00E+00 | 2.26E+03 | 2.26E+03 | | |
| Other Radionuclides | | | | | 3.35E+03 | 3.35E+03 | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 6.36E+01 | 6.36E+01 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences: |
|----------------------|-------------|-------------|---|
| Reactor Moderator: | LIGHT WATER | LIGHT WATER | This Template was used for the following reasons. |
| Fuel Cladding: | ZIRC | ZIRC | This fuel matches on all parameters except enrichment (unknown) |
| BOL HM Constituents: | U | U | |
| BOL Enrichment %: | | 0 to 5 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|----------|-----------|--|
| Nominal | | 3.516.48 | Nominal burnup set equal to bounding burnup |
| Bounding | | 3,516.48 | Bounding burnup assumed to be twice nominal burnup |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/ Given EOL HM |
|----------|-------------------|--------------------------------|--------------------------------|
| Nominal | 0.05 | | 1.00 |
| Bounding | 0.05 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name EBWR (U METAL) ET-11
SNF ID # 888

Fuel Units & Descr: 1 - 6 FLAT PLATES

Heavy Metal Mass: BOL=40.2kg EOL=38.365kg

ROD Storage Site INEEL

Fuel decay start date 1966

Estimates as of 2030

Template: PWR (Light Water, Zirc, 0 to 5%, U)

*Template Burnup(MWd) 61.92

Template BOL Heavy Metal Mass (MT) 0.00176911

Template Decay Time 50 years

Estimated
Canister usage
18"x10"
0.08

II. Estimates

| | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 1.0733E-09 | 1,745.00 | 3,490.00 | 0.00E+00 | 1.87E-06 | 3.75E-06 | Avg MeV | |
| Am-241 | 1.4751E-01 | 1,745.00 | 3,490.00 | 0.00E+00 | 2.57E+02 | 5.15E+02 | 0.0150 | 1.328E+14 |
| Am-242m | 2.6809E-04 | 1,745.00 | 3,490.00 | 0.00E+00 | 4.68E-01 | 9.36E-01 | 0.0250 | 2.661E+13 |
| Am-243 | 6.2484E-04 | 1,745.00 | 3,490.00 | 0.00E+00 | 1.09E+00 | 2.18E+00 | 0.0375 | 2.508E+13 |
| C-14 | 4.7820E-05 | 1,745.00 | 3,490.00 | 0.00E+00 | -8.34E-02 | 1.67E-01 | 0.0575 | 3.138E+13 |
| Cl-36 | 8.0297E-07 | 1,745.00 | 3,490.00 | 0.00E+00 | 1.40E-03 | 2.80E-03 | 0.0850 | 1.466E+13 |
| Cm-243 | 1.7426E-04 | 1,745.00 | 3,490.00 | 0.00E+00 | 3.04E-01 | 6.08E-01 | 0.1250 | 9.755E+12 |
| Cm-244 | 2.7616E-02 | 1,745.00 | 3,490.00 | 0.00E+00 | 4.82E+01 | 9.64E+01 | 0.2250 | 1.252E+13 |
| Co-60 | 3.5610E-04 | 1,745.00 | 3,490.00 | 0.00E+00 | 6.21E-01 | 1.24E+00 | 0.3750 | 5.406E+12 |
| Cs-134 | 2.6260E-07 | 1,745.00 | 3,490.00 | 0.00E+00 | 4.58E-04 | 9.16E-04 | 0.5750 | 1.273E+14 |
| Cs-135 | 1.4433E-05 | 1,745.00 | 3,490.00 | 0.00E+00 | 2.52E-02 | 5.04E-02 | 0.8500 | 1.243E+12 |
| Cs-137 | 9.8870E-01 | 1,745.00 | 3,490.00 | 0.00E+00 | 1.73E+03 | 3.45E+03 | 1.2500 | 7.910E+11 |
| Eu-154 | 6.0320E-03 | 1,745.00 | 3,490.00 | 0.00E+00 | 1.05E+01 | 2.11E+01 | 1.7500 | 3.478E+10 |
| Eu-155 | 2.1770E-04 | 1,745.00 | 3,490.00 | 0.00E+00 | 3.80E-01 | 7.60E-01 | 2.2500 | 5.716E+06 |
| Fe-55 | 7.9296E-07 | 1,745.00 | 3,490.00 | 0.00E+00 | 1.38E-03 | 2.77E-03 | 2.7500 | 2.015E+07 |
| H-3 | 8.9486E-03 | 1,745.00 | 3,490.00 | 0.00E+00 | 1.56E+01 | 3.12E+01 | 3.5000 | 1.437E+06 |
| I-129 | 9.8288E-07 | 1,745.00 | 3,490.00 | 0.00E+00 | 1.72E-03 | 3.43E-03 | 5.0000 | 6.143E+05 |
| Kr-85 | 1.0707E-02 | 1,745.00 | 3,490.00 | 0.00E+00 | 1.87E+01 | 3.74E+01 | 7.0000 | 7.077E+04 |
| Np-237 | 1.1927E-05 | 1,745.00 | 3,490.00 | 0.00E+00 | 2.08E-02 | 4.16E-02 | 11.0000 | 8.126E+03 |
| Pa-231 | 1.4703E-09 | 1,745.00 | 3,490.00 | 0.00E+00 | 2.57E-06 | 5.13E-06 | | |
| Pb-210 | 1.6828E-10 | 1,745.00 | 3,490.00 | 0.00E+00 | 2.94E-07 | 5.87E-07 | | |
| Pm-147 | 6.9606E-06 | 1,745.00 | 3,490.00 | 0.00E+00 | 1.21E-02 | 2.43E-02 | | |
| Pu-238 | 6.6263E-02 | 1,745.00 | 3,490.00 | 0.00E+00 | 1.16E+02 | 2.31E+02 | | |
| Pu-239 | 1.1618E-02 | 1,745.00 | 3,490.00 | 0.00E+00 | 2.03E+01 | 4.05E+01 | | |
| Pu-240 | 1.5142E-02 | 1,745.00 | 3,490.00 | 0.00E+00 | 2.64E+01 | 5.28E+01 | | |
| Pu-241 | 4.3766E-01 | 1,745.00 | 3,490.00 | 0.00E+00 | 7.64E+02 | 1.53E+03 | | |
| Pu-242 | 6.4260E-05 | 1,745.00 | 3,490.00 | 0.00E+00 | 1.12E-01 | 2.24E-01 | | |
| Ra-226 | 3.8501E-10 | 1,745.00 | 3,490.00 | 0.00E+00 | 6.72E-07 | 1.34E-06 | | |
| Ra-228 | 5.2955E-12 | 1,745.00 | 3,490.00 | 0.00E+00 | 9.24E-09 | 1.85E-08 | | |
| Ru-106 | 2.0413E-14 | 1,745.00 | 3,490.00 | 0.00E+00 | 3.56E-11 | 7.12E-11 | | |
| Se-79 | 1.2376E-05 | 1,745.00 | 3,490.00 | 0.00E+00 | 2.16E-02 | 4.32E-02 | | |
| Sn-126 | 2.5210E-05 | 1,745.00 | 3,490.00 | 0.00E+00 | 4.40E-02 | 8.80E-02 | | |
| Sr-90 | 6.4163E-01 | 1,745.00 | 3,490.00 | 0.00E+00 | 1.12E+03 | 2.24E+03 | | |
| Tc-99 | 3.9357E-04 | 1,745.00 | 3,490.00 | 0.00E+00 | 6.87E-01 | 1.37E+00 | | |
| Th-229 | 1.5644E-10 | 1,745.00 | 3,490.00 | 0.00E+00 | 2.73E-07 | 5.46E-07 | | |
| Th-230 | 2.7972E-08 | 1,745.00 | 3,490.00 | 0.00E+00 | 4.88E-05 | 9.76E-05 | | |
| Th-232 | 5.3036E-12 | 1,745.00 | 3,490.00 | 0.00E+00 | 9.25E-09 | 1.85E-08 | | |
| Ti-208 | 1.5136E-07 | 1,745.00 | 3,490.00 | 0.00E+00 | 2.64E-04 | 5.28E-04 | | |
| U-232 | 4.1005E-07 | 1,745.00 | 3,490.00 | 0.00E+00 | 7.16E-04 | 1.43E-03 | | |
| U-233 | 2.5856E-08 | 1,745.00 | 3,490.00 | 0.00E+00 | 4.51E-05 | 9.02E-05 | | |
| U-234 | 5.2665E-05 | 1,745.00 | 3,490.00 | 0.00E+00 | 9.19E-02 | 1.84E-01 | | |
| U-235 | -1.4487E-06 | 1,745.00 | 0.00 | 1.26E-03 | 0.00E+00 | 1.26E-03 | | |
| U-236 | 7.5888E-06 | 1,745.00 | 3,490.00 | 0.00E+00 | 1.32E-02 | 2.65E-02 | | |
| U-238 | -2.6129E-07 | 1,745.00 | 0.00 | 1.33E-02 | 1.29E-02 | 1.33E-02 | | |
| Y-90 | 6.4180E-01 | 1,745.00 | 3,490.00 | 0.00E+00 | 1.12E+03 | 2.24E+03 | | |
| Other Radionuclides | | | | | 1.66E+03 | 3.33E+03 | | |

Other Radionuclides

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-------------|-------------|
| Reactor Moderator | LIGHT WATER | LIGHT WATER |
| Fuel Cladding | ZIRC | ZIRC |
| BOL HM Constituents | U | U |
| BOL Enrichment %: | 1.447761185 | 0 to 5 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | | 1,745.00 |
| Bounding | 64.32 | 3,490.00 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed.
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|-----------------------------------|
| Nominal | 1.24 | |
| Bounding | 2.48 | 54.26 |

Estimated EOL HM/Given EOL HM

1.02

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: EBWR (U METAL) NORMAL HEAVY
 SNF ID #: 889
 Fuel Units & Descr: 11 - 6 FLAT PLATES
 Heavy Metal Mass: BOL=620 4kg, EOL=566 145kg
 ROD Storage Site: INEEL

Fuel decay start date: 1966
 Estimates as of: 2030
 Template: PWR (Light Water, Zirc, 0 to 5% U)
 Template Burnup(MWd), 61 92
 Template BOL Heavy Metal Mass (MT) 0 00176911
 Template Decay Time: 50 years

Estimated
 Canister usage:
 18"x10"
 0 92

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | CvMWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 1 0733E-09 | 51,594 22 | 103,188 45 | 0 00E+00 | 5 54E-05 | 1.11E-04 | Avg. MeV | |
| Am-241 | 1 4751E-01 | 51,594 22 | 103,188 45 | 0 00E+00 | 7 61E+03 | 1.52E+04 | 0 0150 | 3 926E+15 |
| Am-242m | 2 6809E-04 | 51,594 22 | 103,188 45 | 0 00E+00 | 1 38E+01 | 2 77E+01 | 0 0250 | 7 869E+14 |
| Am-243 | 6 2484E-04 | 51,594 22 | 103,188 45 | 0 00E+00 | 3.22E+01 | 6 45E+01 | 0 0375 | 7 414E+14 |
| C-14 | 4 7820E-05 | 51,594 22 | 103,188 45 | 0 00E+00 | 2 47E+00 | 4 93E+00 | 0 0575 | 9 278E+14 |
| Cl-36 | 8 0297E-07 | 51,594 22 | 103,188 45 | 0 00E+00 | 4 14E-02 | 8.29E-02 | 0 0850 | 4 335E+14 |
| Cm-243 | 1 7426E-04 | 51,594 22 | 103,188 45 | 0 00E+00 | 8 99E+00 | 1 80E+01 | 0 1250 | 2 884E+14 |
| Cm-244 | 2 7616E-02 | 51,594 22 | 103,188 45 | 0 00E+00 | 1 42E+03 | 2 85E+03 | 0 2250 | 3 701E+14 |
| Co-60 | 3 5610E-04 | 51,594 22 | 103,188 45 | 0 00E+00 | 1 84E+01 | 3 67E+01 | 0 3750 | 1 598E+14 |
| Cs-134 | 2 6260E-07 | 51,594 22 | 103,188 45 | 0 00E+00 | 1 35E-02 | 2 71E-02 | 0 5750 | 3 764E+15 |
| Cs-135 | 1 4433E-05 | 51,594 22 | 103,188 45 | 0 00E+00 | 7 45E-01 | 1 49E+00 | 0 8500 | 3 676E+13 |
| Cs-137 | 9 8870E-01 | 51,594 22 | 103,188 45 | 0 00E+00 | 5.10E+04 | 1 02E+05 | 1 2500 | 2 339E+13 |
| Eu-154 | 6 0320E-03 | 51,594 22 | 103,188 45 | 0 00E+00 | 3.11E+02 | 6 22E+02 | 1 7500 | 1 028E+12 |
| Eu-155 | 2 1770E-04 | 51,594 22 | 103,188 45 | 0 00E+00 | 1.12E+01 | 2 25E+01 | 2 2500 | 1 690E+08 |
| Fe-55 | 7 9296E-07 | 51,594 22 | 103,188 45 | 0 00E+00 | 4 09E-02 | 8 18E-02 | 2 7500 | 5 957E+08 |
| H-3 | 8 9486E-03 | 51,594 22 | 103,188 45 | 0 00E+00 | 4 62E+02 | 9 23E+02 | 3 5000 | 4 250E+07 |
| I-129 | 9 8288E-07 | 51,594 22 | 103,188 45 | 0 00E+00 | 5 07E-02 | 1 01E-01 | 5 0000 | 1 816E+07 |
| Kr-85 | 1 0707E-02 | 51,594 22 | 103,188 45 | 0 00E+00 | 5.52E+02 | 1 10E+03 | 7 0000 | 2 092E+06 |
| Np-237 | 1 1927E-05 | 51,594 22 | 103,188 45 | 0 00E+00 | 6.15E-01 | 1 23E+00 | 11 0000 | 2 403E+05 |
| Pa-231 | 1 4703E-09 | 51,594 22 | 103,188 45 | 0 00E+00 | 7.59E-05 | 1 52E-04 | | |
| Pb-210 | 1 6828E-10 | 51,594 22 | 103,188 45 | 0 00E+00 | 8 68E-06 | 1 74E-05 | | |
| Pm-147 | 6 9606E-06 | 51,594 22 | 103,188 45 | 0 00E+00 | 3 59E-01 | 7 18E-01 | | |
| Pu-238 | 6 6263E-02 | 51,594 22 | 103,188 45 | 0 00E+00 | 3 42E+03 | 6 84E+03 | | |
| Pu-239 | 1 1618E-02 | 51,594 22 | 103,188 45 | 0 00E+00 | 5 99E+02 | 1 20E+03 | | |
| Pu-240 | 1 5142E-02 | 51,594 22 | 103,188 45 | 0 00E+00 | 7 81E+02 | 1 56E+03 | | |
| Pu-241 | 4 3766E-01 | 51,594 22 | 103,188 45 | 0 00E+00 | 2 26E+04 | 4 52E+04 | | |
| Pu-242 | 6 4260E-05 | 51,594 22 | 103,188 45 | 0 00E+00 | 3 32E+00 | 6 63E+00 | | |
| Ra-226 | 3 8501E-10 | 51,594 22 | 103,188 45 | 0 00E+00 | 1 99E-05 | 3 97E-05 | | |
| Ra-228 | 5 2955E-12 | 51,594 22 | 103,188 45 | 0 00E+00 | 2 73E-07 | 5 46E-07 | | |
| Ru-106 | 2 0413E-14 | 51,594 22 | 103,188 45 | 0 00E+00 | 1 05E-09 | 2 11E-09 | | |
| Se-79 | 1 2376E-05 | 51,594 22 | 103,188 45 | 0 00E+00 | 6 39E-01 | 1 28E+00 | | |
| Sn-126 | 2 5210E-05 | 51,594 22 | 103,188 45 | 0 00E+00 | 1 30E+00 | 2 60E+00 | | |
| Sr-90 | 6 4163E-01 | 51,594 22 | 103,188 45 | 0 00E+00 | 3 31E+04 | 6 62E+04 | | |
| Tc-99 | 3 9357E-04 | 51,594 22 | 103,188 45 | 0 00E+00 | 2 03E+01 | 4 06E+01 | | |
| Th-229 | 1 5644E-10 | 51,594 22 | 103,188 45 | 0 00E+00 | 8 07E-06 | 1 61E-05 | | |
| Th-230 | 2 7972E-08 | 51,594 22 | 103,188 45 | 0 00E+00 | 1 44E-03 | 2 89E-03 | | |
| Th-232 | 5 3036E-12 | 51,594 22 | 103,188 45 | 0 00E+00 | 2 74E-07 | 5 47E-07 | | |
| Th-208 | 1 5136E-07 | 51,594 22 | 103,188 45 | 0 00E+00 | 7 81E-03 | 1 56E-02 | | |
| U-232 | 4 1005E-07 | 51,594 22 | 103,188 45 | 0 00E+00 | 2 12E-02 | 4 23E-02 | | |
| U-233 | 2 5856E-08 | 51,594 22 | 103,188 45 | 0 00E+00 | 1 33E-03 | 2 67E-03 | | |
| U-234 | 5 2665E-05 | 51,594 22 | 103,188 45 | 0 00E+00 | 2 72E+00 | 5 43E+00 | | |
| U-235 | -1 4487E-06 | 51,594 22 | 0 00 | 9 56E-03 | 0 00E+00 | 9 56E-03 | | |
| U-236 | 7 5888E-06 | 51,594 22 | 103,188 45 | 0 00E+00 | 3 92E-01 | 7 83E-01 | | |
| U-238 | -2 6129E-07 | 51,594 22 | 0 00 | 2 07E-01 | 1 94E-01 | 2 07E-01 | | |
| Y-90 | 6 4180E-01 | 51,594 22 | 103,188 45 | 0 00E+00 | 3.31E+04 | 6 62E+04 | | |
| Other Radionuclides | | | | | 4.92E+04 | 9 83E+04 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-------------|-------------|
| Reactor Moderator | LIGHT WATER | LIGHT WATER |
| Fuel Cladding | ZIRC | ZIRC |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 0 712765938 | 0 to 5 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|------------|
| Nominal | | 51,594 22 |
| Bounding | 992.64 | 103 188 45 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed.
 Bounding burnup assumed to be twice nominal burnup.

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|-----------------------------------|
| Nominal | 2 38 | |
| Bounding | 4 75 | 103 95 |

Estimated EOL HM/Given EOL HM

1 05

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name EBWR (U METAL) NORMAL THIN
SNF ID # 890
Fuel Units & Descr 7 - 6 FLAT PLATES
Heavy Metal Mass BOL=281.4kg EOL=279.076kg
ROD Storage Site: INEEL

¹Fuel decay start date 1966
Estimates as of 2030
Template PWR (Light Water Zirc 0 to 5% U)
²Template Burnup(MWd) 61.92
Template BOL Heavy Metal Mass (MT) 0.00176911
Template Decay Time 50 years

Estimated
Canister usage
18"x10"
0.58

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| | | | | | | | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Avg MeV | |
| Ac-227 | 1.0733E-09 | 2,210.01 | 4,420.01 | 0.00E+00 | 2.37E-06 | 4.74E-06 | 0.0150 | 1.682E+14 |
| Am-241 | 1.4751E-01 | 2,210.01 | 4,420.01 | 0.00E+00 | 3.26E+02 | 6.52E+02 | 0.0250 | 3.370E+13 |
| Am-242m | 2.6809E-04 | 2,210.01 | 4,420.01 | 0.00E+00 | 5.92E-01 | 1.18E+00 | 0.0375 | 3.176E+13 |
| Am-243 | 6.2484E-04 | 2,210.01 | 4,420.01 | 0.00E+00 | 1.38E+00 | 2.76E+00 | 0.0575 | 3.974E+13 |
| C-14 | 4.7820E-05 | 2,210.01 | 4,420.01 | 0.00E+00 | 1.06E-01 | 2.11E-01 | 0.0850 | 1.857E+13 |
| Cl-36 | 8.0297E-07 | 2,210.01 | 4,420.01 | 0.00E+00 | 1.77E-03 | 3.55E-03 | 0.1250 | 1.235E+13 |
| Cm-243 | 1.7426E-04 | 2,210.01 | 4,420.01 | 0.00E+00 | 3.85E-01 | 7.70E-01 | 0.2250 | 1.585E+13 |
| Cm-244 | 2.7616E-02 | 2,210.01 | 4,420.01 | 0.00E+00 | 6.10E+01 | 1.22E+02 | 0.3750 | 6.847E+12 |
| Co-60 | 3.5610E-04 | 2,210.01 | 4,420.01 | 0.00E+00 | 7.87E-01 | 1.57E+00 | 0.5750 | 1.612E+14 |
| Cs-134 | 2.6260E-07 | 2,210.01 | 4,420.01 | 0.00E+00 | 5.80E-04 | 1.16E-03 | 0.8500 | 1.574E+12 |
| Cs-135 | 1.4433E-05 | 2,210.01 | 4,420.01 | 0.00E+00 | 3.19E-02 | 6.38E-02 | 1.2500 | 1.002E+12 |
| Cs-137 | 9.8870E-01 | 2,210.01 | 4,420.01 | 0.00E+00 | 2.19E+03 | 4.37E+03 | 1.7500 | 4.405E+10 |
| Eu-154 | 6.0320E-03 | 2,210.01 | 4,420.01 | 0.00E+00 | 1.33E-01 | 2.67E-01 | 2.2500 | 7.240E+06 |
| Eu-155 | 2.1770E-04 | 2,210.01 | 4,420.01 | 0.00E+00 | 4.81E-01 | 9.62E-01 | 2.7500 | 2.552E+07 |
| Fe-55 | 7.9296E-07 | 2,210.01 | 4,420.01 | 0.00E+00 | 1.75E-03 | 3.50E-03 | 3.5000 | 1.821E+06 |
| H-3 | 8.9486E-03 | 2,210.01 | 4,420.01 | 0.00E+00 | 1.98E+01 | 3.96E+01 | 5.0000 | 7.782E+05 |
| I-129 | 9.8288E-07 | 2,210.01 | 4,420.01 | 0.00E+00 | 2.17E-03 | 4.34E-03 | 7.0000 | 8.965E+04 |
| Kr-85 | 1.0707E-02 | 2,210.01 | 4,420.01 | 0.00E+00 | 2.37E+01 | 4.73E+01 | 11.0000 | 1.029E+04 |
| Np-237 | 1.1927E-05 | 2,210.01 | 4,420.01 | 0.00E+00 | 2.64E-02 | 5.27E-02 | | |
| Pa-231 | 1.4703E-09 | 2,210.01 | 4,420.01 | 0.00E+00 | 3.25E-06 | 6.50E-06 | | |
| Pb-210 | 1.6828E-10 | 2,210.01 | 4,420.01 | 0.00E+00 | 3.72E-07 | 7.44E-07 | | |
| Pm-147 | 6.9606E-06 | 2,210.01 | 4,420.01 | 0.00E+00 | 1.54E-02 | 3.08E-02 | | |
| Pu-238 | 6.6263E-02 | 2,210.01 | 4,420.01 | 0.00E+00 | 1.46E+02 | 2.93E+02 | | |
| Pu-239 | 1.1618E-02 | 2,210.01 | 4,420.01 | 0.00E+00 | 2.57E+01 | 5.14E+01 | | |
| Pu-240 | 1.5142E-02 | 2,210.01 | 4,420.01 | 0.00E+00 | 3.35E+01 | 6.69E+01 | | |
| Pu-241 | 4.3766E-01 | 2,210.01 | 4,420.01 | 0.00E+00 | 9.67E+02 | 1.93E+03 | | |
| Pu-242 | 6.4260E-05 | 2,210.01 | 4,420.01 | 0.00E+00 | 1.42E-01 | 2.84E-01 | | |
| Ra-226 | 3.8501E-10 | 2,210.01 | 4,420.01 | 0.00E+00 | 8.51E-07 | 1.70E-06 | | |
| Ra-228 | 5.2955E-12 | 2,210.01 | 4,420.01 | 0.00E+00 | 1.17E-08 | 2.34E-08 | | |
| Ru-106 | 2.0413E-14 | 2,210.01 | 4,420.01 | 0.00E+00 | 4.51E-11 | 9.02E-11 | | |
| Se-79 | 1.2376E-05 | 2,210.01 | 4,420.01 | 0.00E+00 | 2.74E-02 | 5.47E-02 | | |
| Sn-126 | 2.5210E-05 | 2,210.01 | 4,420.01 | 0.00E+00 | 5.57E-02 | 1.11E-01 | | |
| Sr-90 | 6.4163E-01 | 2,210.01 | 4,420.01 | 0.00E+00 | 1.42E+03 | 2.84E+03 | | |
| Tc-99 | 3.9357E-04 | 2,210.01 | 4,420.01 | 0.00E+00 | 8.70E-01 | 1.74E+00 | | |
| Th-229 | 1.5644E-10 | 2,210.01 | 4,420.01 | 0.00E+00 | 3.46E-07 | 6.91E-07 | | |
| Th-230 | 2.7972E-08 | 2,210.01 | 4,420.01 | 0.00E+00 | 6.18E-05 | 1.24E-04 | | |
| Th-232 | 5.3036E-12 | 2,210.01 | 4,420.01 | 0.00E+00 | 1.17E-08 | 2.34E-08 | | |
| Ti-208 | 1.5136E-07 | 2,210.01 | 4,420.01 | 0.00E+00 | 3.34E-04 | 6.69E-04 | | |
| U-232 | 4.1005E-07 | 2,210.01 | 4,420.01 | 0.00E+00 | 9.06E-04 | 1.81E-03 | | |
| U-233 | 2.5856E-08 | 2,210.01 | 4,420.01 | 0.00E+00 | 5.71E-05 | 1.14E-04 | | |
| U-234 | 5.2665E-05 | 2,210.01 | 4,420.01 | 0.00E+00 | 1.16E-01 | 2.33E-01 | | |
| U-235 | -1.4487E-06 | 2,210.01 | 0.00 | 4.36E-03 | 1.15E-03 | 4.36E-03 | | |
| U-236 | 7.5888E-06 | 2,210.01 | 4,420.01 | 0.00E+00 | 1.68E-02 | 3.35E-02 | | |
| U-238 | -2.6129E-07 | 2,210.01 | 0.00 | 9.39E-02 | 9.33E-02 | 9.39E-02 | | |
| Y-90 | 6.4180E-01 | 2,210.01 | 4,420.01 | 0.00E+00 | 1.42E+03 | 2.84E+03 | | |
| Other Radionuclides | | | | | 2.11E+03 | 4.21E+03 | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 4.00E+01 | 7.99E+01 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences: |
|----------------------|-------------|-------------|----------------------------------|
| Reactor Moderator: | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding: | ZIRC | ZIRC | |
| BOL HM Constituents: | U | U | |
| BOL Enrichment % | 0.716417866 | 0 to 5 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|----------|-----------|------------------------------------|
| Nominal | | 2,210.01 | |
| Bounding | 450.24 | 4,420.01 | |

Nominal burnup calculated from the heavy metal mass destroyed.
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|--------------------------------|-------------------------------|
| Nominal | 0.22 | | |
| Bounding | 0.45 | 9.82 | |

Estimated EOL HM/Given EOL HM
1.00

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: ENEA (LEU UALX) SALUGGIA ITALY
SNF ID #: 760
Fuel Units & Descr: 32 - MTR TYPE
Heavy Metal Mass: BOL=22.4kg; EOL=21.568kg
ROD Storage Site: SRS

¹Fuel decay start date: 1996
Estimates as of: 2030
Template: ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup(MWd): 367.2
Template BOL Heavy Metal Mass (MT): 0.0016689
Template Decay Time: 25 years

Estimated
Canister usage:
18"x10"
0.89

| II. Estimates | m | X _a | X _b | b | Y _a | Y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Cu/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 1.1465E-09 | 787.92 | 1,575.84 | 0.00E+00 | 9.03E-07 | 1.81E-06 | Avg MeV | |
| Am-241 | 2.3056E-03 | 787.92 | 1,575.84 | 0.00E+00 | 1.82E+00 | 3.63E+00 | 0.0150 | 1.475E+14 |
| Am-242m | 4.1476E-07 | 787.92 | 1,575.84 | 0.00E+00 | 3.27E-04 | 6.54E-04 | 0.0250 | 3.063E+13 |
| Am-243 | 1.4894E-06 | 787.92 | 1,575.84 | 0.00E+00 | 1.17E-03 | 2.35E-03 | 0.0375 | 2.668E+13 |
| C-14 | 5.7108E-09 | 787.92 | 1,575.84 | 0.00E+00 | 4.50E-06 | 9.00E-06 | 0.0575 | 2.865E+13 |
| Cl-36 | 1.3124E-32 | 787.92 | 1,575.84 | 0.00E+00 | 1.03E-29 | 2.07E-29 | 0.0850 | 1.729E+13 |
| Cm-243 | 1.4562E-07 | 787.92 | 1,575.84 | 0.00E+00 | 1.15E-04 | 2.29E-04 | 0.1250 | 1.158E+13 |
| Cm-244 | 2.4221E-05 | 787.92 | 1,575.84 | 0.00E+00 | 1.91E-02 | 3.82E-02 | 0.2250 | 1.492E+13 |
| Co-60 | 2.7560E-06 | 787.92 | 1,575.84 | 0.00E+00 | 2.17E-03 | 4.34E-03 | 0.3750 | 6.488E+12 |
| Cs-134 | 5.8851E-04 | 787.92 | 1,575.84 | 0.00E+00 | 4.64E-01 | 9.27E-01 | 0.5750 | 1.064E+14 |
| Cs-135 | 3.4477E-06 | 787.92 | 1,575.84 | 0.00E+00 | 2.72E-03 | 5.43E-03 | 0.8500 | 1.533E+12 |
| Cs-137 | 1.8099E+00 | 787.92 | 1,575.84 | 0.00E+00 | 1.43E+03 | 2.85E+03 | 1.2500 | 8.523E+11 |
| Eu-154 | 1.6386E-02 | 787.92 | 1,575.84 | 0.00E+00 | 1.29E+01 | 2.58E+01 | 1.7500 | 4.211E+10 |
| Eu-155 | 2.3957E-03 | 787.92 | 1,575.84 | 0.00E+00 | 1.89E+00 | 3.78E+00 | 2.2500 | 3.001E+08 |
| Fe-55 | 3.2707E-05 | 787.92 | 1,575.84 | 0.00E+00 | 2.58E-02 | 5.15E-02 | 2.7500 | 2.458E+06 |
| H-3 | 3.4504E-03 | 787.92 | 1,575.84 | 0.00E+00 | 2.72E+00 | 5.44E+00 | 3.5000 | 1.886E+03 |
| I-129 | 7.5300E-07 | 787.92 | 1,575.84 | 0.00E+00 | 5.93E-04 | 1.19E-03 | 5.0000 | 6.375E+02 |
| Kr-85 | 7.8540E-02 | 787.92 | 1,575.84 | 0.00E+00 | 6.19E+01 | 1.24E+02 | 7.0000 | 7.021E+01 |
| Np-237 | 9.5615E-06 | 787.92 | 1,575.84 | 0.00E+00 | 7.53E-03 | 1.51E-02 | 11.0000 | 7.859E+00 |
| Pa-231 | 2.7968E-09 | 787.92 | 1,575.84 | 0.00E+00 | 2.20E-06 | 4.41E-06 | | |
| Pb-210 | 1.2612E-10 | 787.92 | 1,575.84 | 0.00E+00 | 9.94E-08 | 1.99E-07 | | |
| Pm-147 | 1.2952E-02 | 787.92 | 1,575.84 | 0.00E+00 | 1.02E+01 | 2.04E+01 | | |
| Pu-238 | 1.7549E-02 | 787.92 | 1,575.84 | 0.00E+00 | 1.38E+01 | 2.77E+01 | | |
| Pu-239 | 4.2810E-04 | 787.92 | 1,575.84 | 0.00E+00 | 3.37E-01 | 6.75E-01 | | |
| Pu-240 | 2.4357E-04 | 787.92 | 1,575.84 | 0.00E+00 | 1.92E-01 | 3.84E-01 | | |
| Pu-241 | 2.6277E-02 | 787.92 | 1,575.84 | 0.00E+00 | 2.07E+01 | 4.14E+01 | | |
| Pu-242 | 3.6329E-07 | 787.92 | 1,575.84 | 0.00E+00 | 2.86E-04 | 5.72E-04 | | |
| Ra-226 | 4.4444E-10 | 787.92 | 1,575.84 | 0.00E+00 | 3.50E-07 | 7.00E-07 | | |
| Ra-228 | 1.9714E-14 | 787.92 | 1,575.84 | 0.00E+00 | 1.55E-11 | 3.11E-11 | | |
| Ru-106 | 2.0477E-07 | 787.92 | 1,575.84 | 0.00E+00 | 1.61E-04 | 3.23E-04 | | |
| Se-79 | 1.2933E-05 | 787.92 | 1,575.84 | 0.00E+00 | 1.02E-02 | 2.04E-02 | | |
| Sn-126 | 1.1574E-05 | 787.92 | 1,575.84 | 0.00E+00 | 9.12E-03 | 1.82E-02 | | |
| Sr-90 | 1.7092E+00 | 787.92 | 1,575.84 | 0.00E+00 | 1.35E+03 | 2.69E+03 | | |
| Tc-99 | 4.2239E-04 | 787.92 | 1,575.84 | 0.00E+00 | 3.33E-01 | 6.66E-01 | | |
| Th-229 | 7.7260E-12 | 787.92 | 1,575.84 | 0.00E+00 | 6.09E-09 | 1.22E-08 | | |
| Th-230 | 5.8497E-08 | 787.92 | 1,575.84 | 0.00E+00 | 4.61E-05 | 9.22E-05 | | |
| Th-232 | 2.6906E-14 | 787.92 | 1,575.84 | 0.00E+00 | 2.12E-11 | 4.24E-11 | | |
| Ti-208 | 4.4336E-08 | 787.92 | 1,575.84 | 0.00E+00 | 3.49E-05 | 6.99E-05 | | |
| U-232 | 1.2037E-07 | 787.92 | 1,575.84 | 0.00E+00 | 9.48E-05 | 1.90E-04 | | |
| U-233 | 3.0011E-09 | 787.92 | 1,575.84 | 0.00E+00 | 2.36E-06 | 4.73E-06 | | |
| U-234 | 1.8497E-04 | 787.92 | 1,575.84 | 0.00E+00 | 1.46E-01 | 2.91E-01 | | |
| U-235 | 2.7235E-06 | 787.92 | 0.00 | 9.68E-03 | 7.54E-03 | 9.68E-03 | | |
| U-236 | 1.5493E-05 | 787.92 | 1,575.84 | 0.00E+00 | 1.22E-02 | 2.44E-02 | | |
| U-238 | 4.2851E-09 | 787.92 | 0.00 | 6.02E-03 | 6.02E-03 | 6.02E-03 | | |
| Y-90 | 1.7094E+00 | 787.92 | 1,575.84 | 0.00E+00 | 1.35E+03 | 2.69E+03 | | |
| Other Radionuclides | | | | | 1.36E+03 | 2.71E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-------------|-------------|---|
| Reactor Moderator | From SFD | Used | |
| | LIGHT WATER | LIGHT WATER | This Template was used for the following reasons: |
| Fuel Cladding | ALUM | ALUM | This fuel matches ATR Template on all but one parameter (enrichment) making ATR a reasonable match. |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 | 60 to 100 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | | 787.92 | Nominal burnup calculated from the heavy metal mass destroyed. |
| Bounding | | 1,575.84 | Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 0.11 | | 1.00 |
| Bounding | 0.22 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: ENEA (UALX HEU) SALUGGIA ITALY
 SNF ID #: 574
 Fuel Units & Descr: 116 - MTR TYPE
 Heavy Metal Mass: BOL=18.56kg EOL=17.226kg
 ROD Storage Site: SRS

Fuel decay start date: 1996
 Estimates as of: 2030
 Template: ATR (Light Water, Alum., 60 to 100%, U)
 Template Burnup (MWd): 367.2
 Template BOL Heavy Metal Mass (MT): 0.00116689
 Template Decay Time: 25 years

Estimated
 Canister usage:
 18"x10"
 322

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|-----------------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 1.1465E-09 | 1.263 32 | 2.526 65 | 0.00E+00 | 1.45E-06 | 2.90E-06 | Avg MeV | |
| Am-241 | 2.3056E-03 | 1.263 32 | 2.526 65 | 0.00E+00 | 2.91E+00 | 5.83E+00 | 0.0150 | 2.364E+14 |
| Am-242m | 4.1476E-07 | 1.263 32 | 2.526 65 | 0.00E+00 | 5.24E-04 | 1.05E-03 | 0.0250 | 4.912E+13 |
| Am-243 | 1.4894E-06 | 1.263 32 | 2.526 65 | 0.00E+00 | 1.88E-03 | 3.76E-03 | 0.0375 | 4.278E+13 |
| C-14 | 5.7108E-09 | 1.263 32 | 2.526 65 | 0.00E+00 | 7.21E-06 | 1.44E-05 | 0.0575 | 4.593E+13 |
| Cl-36 | 1.3124E-32 | 1.263 32 | 2.526 65 | 0.00E+00 | 1.66E-29 | 3.32E-29 | 0.0850 | 2.772E+13 |
| Cm-243 | 1.4562E-07 | 1.263 32 | 2.526 65 | 0.00E+00 | 1.84E-04 | 3.68E-04 | 0.1250 | 1.856E+13 |
| Cm-244 | 2.4221E-05 | 1.263 32 | 2.526 65 | 0.00E+00 | 3.06E-02 | 6.12E-02 | 0.2250 | 2.393E+13 |
| Co-60 | 2.7560E-06 | 1.263 32 | 2.526 65 | 0.00E+00 | 3.48E-03 | 6.96E-03 | 0.3750 | 1.040E+13 |
| Cs-134 | 5.8851E-04 | 1.263 32 | 2.526 65 | 0.00E+00 | 7.43E-01 | 1.49E+00 | 0.5750 | 1.705E+14 |
| Cs-135 | 3.4477E-06 | 1.263 32 | 2.526 65 | 0.00E+00 | 4.36E-03 | 8.71E-03 | 0.8500 | 2.457E+12 |
| Cs-137 | 1.8099E+00 | 1.263 32 | 2.526 65 | 0.00E+00 | 2.29E+03 | 4.57E+03 | 1.2500 | 1.367E+12 |
| Eu-154 | 1.6386E-02 | 1.263 32 | 2.526 65 | 0.00E+00 | 2.07E+01 | 4.14E+01 | 1.7500 | 6.752E+10 |
| Eu-155 | 2.3957E-03 | 1.263 32 | 2.526 65 | 0.00E+00 | 3.03E+00 | 6.05E+00 | 2.2500 | 4.812E+06 |
| Fe-55 | 3.2707E-05 | 1.263 32 | 2.526 65 | 0.00E+00 | 4.13E-02 | 8.26E-02 | 2.7500 | 3.940E+06 |
| H-3 | 3.4504E-03 | 1.263 32 | 2.526 65 | 0.00E+00 | 4.36E+00 | 8.72E+00 | 3.5000 | 2.976E+03 |
| I-129 | 7.5300E-07 | 1.263 32 | 2.526 65 | 0.00E+00 | 9.51E-04 | 1.90E-03 | 5.0000 | 1.001E+03 |
| Kr-85 | 7.8540E-02 | 1.263 32 | 2.526 65 | 0.00E+00 | 9.92E+01 | 1.98E+02 | 7.0000 | 1.102E+02 |
| Np-237 | 9.5615E-06 | 1.263 32 | 2.526 65 | 0.00E+00 | 1.21E-02 | 2.42E-02 | 11.0000 | 1.232E+01 |
| Pa-231 | 2.7968E-09 | 1.263 32 | 2.526 65 | 0.00E+00 | 3.53E-06 | 7.07E-06 | | |
| Pb-210 | 1.2612E-10 | 1.263 32 | 2.526 65 | 0.00E+00 | 1.59E-07 | 3.19E-07 | | |
| Pm-147 | 1.2952E-02 | 1.263 32 | 2.526 65 | 0.00E+00 | 1.64E+01 | 3.27E+01 | | |
| Pu-238 | 1.7549E-02 | 1.263 32 | 2.526 65 | 0.00E+00 | 2.22E+01 | 4.43E+01 | | |
| Pu-239 | 4.2810E-04 | 1.263 32 | 2.526 65 | 0.00E+00 | 5.41E-01 | 1.08E+00 | | |
| Pu-240 | 2.4357E-04 | 1.263 32 | 2.526 65 | 0.00E+00 | 3.08E-01 | 6.15E-01 | | |
| Pu-241 | 2.6277E-02 | 1.263 32 | 2.526 65 | 0.00E+00 | 3.32E+01 | 6.64E+01 | | |
| Pu-242 | 3.6329E-07 | 1.263 32 | 2.526 65 | 0.00E+00 | 4.59E-04 | 9.18E-04 | | |
| Ra-226 | 4.4444E-10 | 1.263 32 | 2.526 65 | 0.00E+00 | 5.61E-07 | 1.12E-06 | | |
| Ra-228 | 1.9714E-14 | 1.263 32 | 2.526 65 | 0.00E+00 | 2.49E-11 | 4.98E-11 | | |
| Ru-106 | 2.0477E-07 | 1.263 32 | 2.526 65 | 0.00E+00 | 2.59E-04 | 5.17E-04 | | |
| Se-79 | 1.2933E-05 | 1.263 32 | 2.526 65 | 0.00E+00 | 1.63E-02 | 3.27E-02 | | |
| Sn-126 | 1.1574E-05 | 1.263 32 | 2.526 65 | 0.00E+00 | 1.46E-02 | 2.92E-02 | | |
| Sr-90 | 1.7092E+00 | 1.263 32 | 2.526 65 | 0.00E+00 | 2.16E+03 | 4.32E+03 | | |
| Tc-99 | 4.2239E-04 | 1.263 32 | 2.526 65 | 0.00E+00 | 5.34E-01 | 1.07E+00 | | |
| Th-229 | 7.7260E-12 | 1.263 32 | 2.526 65 | 0.00E+00 | 9.76E-09 | 1.95E-08 | | |
| Th-230 | 5.8497E-08 | 1.263 32 | 2.526 65 | 0.00E+00 | 7.39E-05 | 1.48E-04 | | |
| Th-232 | 2.6906E-14 | 1.263 32 | 2.526 65 | 0.00E+00 | 3.40E-11 | 6.80E-11 | | |
| Ti-208 | 4.4336E-08 | 1.263 32 | 2.526 65 | 0.00E+00 | 5.60E-05 | 1.12E-04 | | |
| U-232 | 1.2037E-07 | 1.263 32 | 2.526 65 | 0.00E+00 | 1.52E-04 | 3.04E-04 | Thermal Power | |
| U-233 | 3.0011E-09 | 1.263 32 | 2.526 65 | 0.00E+00 | 3.79E-06 | 7.58E-06 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 1.8497E-04 | 1.263 32 | 2.526 65 | 0.00E+00 | 2.34E-01 | 4.67E-01 | 2.67E+01 | 5.34E+01 |
| U-235 | -2.7235E-06 | 1.263 32 | 0.00 | 3.74E-02 | 3.39E-02 | 3.74E-02 | Total | Total |
| U-236 | 1.5493E-05 | 1.263 32 | 2.526 65 | 0.00E+00 | 1.96E-02 | 3.91E-02 | | |
| U-238 | -4.2851E-09 | 1.263 32 | 0.00 | 4.29E-04 | 4.23E-04 | 4.29E-04 | | |
| Y-90 | 1.7094E+00 | 1.263 32 | 2.526 65 | 0.00E+00 | 2.16E+03 | 4.32E+03 | | |
| Other Radionuclides | | | | | 2.18E+03 | 4.35E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences |
|----------------------------|-------------|-------------|---------------------------------|
| Reactor Moderator: | From SFD | Used | |
| Fuel Cladding: | LIGHT WATER | LIGHT WATER | |
| BOL HM Constituents | ALUM | ALUM | |
| BOL Enrichment % | U | U | |
| | 93.125 | 60 to 100 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|--|-----------|------------------------------------|
| Nominal | From SFD | Estimated | |
| Bounding | 1.263 32 | 2.526 65 | |
| | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup | | |

| Checks | | |
|----------|-------------------|-----------------------------------|
| Nominal | Burnup Multiplier | Estimated Burnup/ Given Burnup |
| Bounding | 0.22 | 1.00 |
| | 0.43 | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: EPRI
SNF ID #: 67
Fuel Units & Descr: 1 - CANISTER OF SCRAP
Heavy Metal Mass: BOL= , EOL=0.02kg
ROD Storage Site: INEEL

¹Fuel decay start date: 1966
Estimates as of: 2030
Template: (Worst Case)
²Template Burnup(MWd): 62.5
Template BOL Heavy Metal Mass (MT): 0.00186865
Template Decay Time: 50 years

Estimated
Canister usage
18"x10"
0.03

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Cv/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.5200E-06 | 19.01 | 19.01 | 0.00E+00 | 4.79E-05 | 4.79E-05 | Avg. MeV | |
| Am-241 | 8.6432E+00 | 19.01 | 19.01 | 0.00E+00 | 1.64E+02 | 1.64E+02 | 0.0150 | 1.611E+13 |
| Am-242m | 1.5728E-02 | 19.01 | 19.01 | 0.00E+00 | 2.99E-01 | 2.99E-01 | 0.0250 | 3.182E+12 |
| Am-243 | 1.6288E-02 | 19.01 | 19.01 | 0.00E+00 | 3.10E-01 | 3.10E-01 | 0.0375 | 2.690E+12 |
| C-14 | 1.2068E-01 | 19.01 | 19.01 | 0.00E+00 | 2.29E+00 | 2.29E+00 | 0.0575 | 5.081E+12 |
| Cl-36 | 2.2849E-03 | 19.01 | 19.01 | 0.00E+00 | 4.34E-02 | 4.34E-02 | 0.0850 | 1.703E+12 |
| Cm-243 | 6.0144E-04 | 19.01 | 19.01 | 0.00E+00 | 1.14E-02 | 1.14E-02 | 0.1250 | 1.205E+12 |
| Cm-244 | 9.4880E-02 | 19.01 | 19.01 | 0.00E+00 | 1.80E+00 | 1.80E+00 | 0.2250 | 1.474E+12 |
| Co-60 | 3.9052E+00 | 19.01 | 19.01 | 0.00E+00 | 7.42E+01 | 7.42E+01 | 0.3750 | 6.380E+11 |
| Cs-134 | 2.2139E-06 | 19.01 | 19.01 | 0.00E+00 | 4.21E-05 | 4.21E-05 | 0.5750 | 1.056E+13 |
| Cs-135 | 4.3976E-04 | 19.01 | 19.01 | 0.00E+00 | 8.36E-03 | 8.36E-03 | 0.8500 | 2.313E+11 |
| Cs-137 | 1.4887E+01 | 19.01 | 19.01 | 0.00E+00 | 2.83E+02 | 2.83E+02 | 1.2500 | 5.668E+12 |
| Eu-154 | 3.7342E-01 | 19.01 | 19.01 | 0.00E+00 | 7.10E+00 | 7.10E+00 | 1.7500 | 6.812E+09 |
| Eu-155 | 8.4893E-03 | 19.01 | 19.01 | 0.00E+00 | 1.61E-01 | 1.61E-01 | 2.2500 | 2.946E+07 |
| Fe-55 | 5.3750E-03 | 19.01 | 19.01 | 0.00E+00 | 1.02E-01 | 1.02E-01 | 2.7500 | 5.071E+07 |
| H-3 | 1.0472E-01 | 19.01 | 19.01 | 0.00E+00 | 1.99E+00 | 1.99E+00 | 3.5000 | 2.761E+04 |
| I-129 | 1.0618E-05 | 19.01 | 19.01 | 0.00E+00 | 2.02E-04 | 2.02E-04 | 5.0000 | 1.167E+04 |
| Kr-85 | 2.2717E-01 | 19.01 | 19.01 | 0.00E+00 | 4.32E+00 | 4.32E+00 | 7.0000 | 1.329E+03 |
| Np-237 | 1.6400E-04 | 19.01 | 19.01 | 0.00E+00 | 3.12E-03 | 3.12E-03 | 11.0000 | 1.516E+02 |
| Pa-231 | 2.8688E-06 | 19.01 | 19.01 | 0.00E+00 | 5.45E-05 | 5.45E-05 | | |
| Pb-210 | 4.7312E-08 | 19.01 | 19.01 | 0.00E+00 | 8.99E-07 | 8.99E-07 | | |
| Pm-147 | 3.2198E-04 | 19.01 | 19.01 | 0.00E+00 | 6.12E-03 | 6.12E-03 | | |
| Pu-238 | -1.1924E+00 | 19.01 | 0.00 | 5.14E+00 | 0.00E+00 | 5.14E+00 | | |
| Pu-239 | -4.8600E-02 | 19.01 | 0.00 | 6.22E-01 | 0.00E+00 | 6.22E-01 | | |
| Pu-240 | -3.0127E-01 | 19.01 | 0.00 | 7.94E-01 | 0.00E+00 | 7.94E-01 | | |
| Pu-241 | -1.2917E+02 | 19.01 | 0.00 | 2.04E+02 | 0.00E+00 | 2.04E+02 | | |
| Pu-242 | -1.1381E-04 | 19.01 | 0.00 | 3.44E-03 | 1.27E-03 | 3.44E-03 | | |
| Ra-226 | 1.0760E-07 | 19.01 | 19.01 | 0.00E+00 | 2.05E-06 | 2.05E-06 | | |
| Ra-228 | 6.0160E-07 | 19.01 | 19.01 | 0.00E+00 | 1.14E-05 | 1.14E-05 | | |
| Ru-106 | 1.3388E-13 | 19.01 | 19.01 | 0.00E+00 | 2.54E-12 | 2.54E-12 | | |
| Se-79 | 1.9179E-04 | 19.01 | 19.01 | 0.00E+00 | 3.65E-03 | 3.65E-03 | | |
| Sn-126 | 1.6669E-04 | 19.01 | 19.01 | 0.00E+00 | 3.17E-03 | 3.17E-03 | | |
| Sr-90 | 1.3859E+01 | 19.01 | 19.01 | 0.00E+00 | 2.63E+02 | 2.63E+02 | | |
| Tc-99 | 6.7678E-03 | 19.01 | 19.01 | 0.00E+00 | 1.29E-01 | 1.29E-01 | | |
| Th-229 | 2.2592E-06 | 19.01 | 19.01 | 0.00E+00 | 4.29E-05 | 4.29E-05 | | |
| Th-230 | 7.5955E-06 | 19.01 | 19.01 | 0.00E+00 | 1.44E-04 | 1.44E-04 | | |
| Th-232 | 6.0208E-07 | 19.01 | 19.01 | 0.00E+00 | 1.14E-05 | 1.14E-05 | | |
| Th-208 | 7.5795E-05 | 19.01 | 19.01 | 0.00E+00 | 1.44E-03 | 1.44E-03 | | |
| U-232 | 2.0521E-04 | 19.01 | 19.01 | 0.00E+00 | 3.90E-03 | 3.90E-03 | | |
| U-233 | 3.6128E-04 | 19.01 | 19.01 | 0.00E+00 | 6.87E-03 | 6.87E-03 | | |
| U-234 | 1.2788E-02 | 19.01 | 19.01 | 0.00E+00 | 2.43E-01 | 2.43E-01 | | |
| U-235 | 5.8772E-04 | 19.01 | 19.01 | 0.00E+00 | 1.12E-02 | 1.12E-02 | | |
| U-236 | 2.3485E-04 | 19.01 | 19.01 | 0.00E+00 | 4.46E-03 | 4.46E-03 | | |
| U-238 | 1.1741E-04 | 19.01 | 19.01 | 0.00E+00 | 2.23E-03 | 2.23E-03 | | |
| Y-90 | 1.3861E+01 | 19.01 | 19.01 | 0.00E+00 | 2.63E+02 | 2.63E+02 | | |
| Other Radionuclides | | | | | 9.77E+02 | 9.77E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| Reactor Moderator: | From SFD | Used | Basis for Parameter Differences: |
|---------------------|-------------|--------------|--|
| Fuel Cladding | LIGHT WATER | (Worst Case) | |
| BOL HM Constituents | SST | SST/Inconel | |
| BOL Enrichment % | Pu | U, Th & Pu | |
| | | 0 to 100 | This fuel didn't closely match any existing templates, therefore the worst case template was used. |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|-----------|----------|-----------|---|
| Nominal: | | 19.01 | |
| Bounding: | | 19.01 | Nominal burnup set equal to bounding burnup. Bounding burnup estimated by assuming BOL heavy metal mass was twice EOL. |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 14.21 | | |
| Bounding | 14.21 | | 601.11 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: ERR (ASSEMBLIES)
SNF ID #: 68
Fuel Units & Descr: 190 - 5 X 5 ROD ARRAY
Heavy Metal Mass: BOL=5056 66kg EOL=5041 023kg
ROD Storage Site: INEEL

Fuel decay start date: 1966
Estimates as of: 2030
Template: LWBR (Light Water, Zirc 60 to 100% Th and U)
Template Burnup(MWd): 10269 14
Template BOL Heavy Metal Mass (MT): 0 45991251
Template Decay Time: 50 years

Estimated
Canister usage
18"x10"
10 56

| II. Estimates | | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|----------------|---------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Avg MeV | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 1 0595E-04 | 27,366 64 | 65,736 58 | 0 00E+00 | 2 90E+00 | 6 96E+00 | 0 0150 | 3 807E+15 | |
| Am-241 | 2 4968E-04 | 27,366 64 | 65,736 58 | 0 00E+00 | 6 83E+00 | 1 64E+01 | 0 0250 | 7 815E+14 | |
| Am-242m | 1 3847E-06 | 27,366 64 | 65,736 58 | 0 00E+00 | 3 79E-02 | 9 10E-02 | 0 0375 | 6 678E+14 | |
| Am-243 | 3 1103E-07 | 27,366 64 | 65,736 58 | 0 00E+00 | 8 51E-03 | 2 04E-02 | 0 0575 | 7 299E+14 | |
| C-14 | 9 2267E-05 | 27,366 64 | 65,736 58 | 0 00E+00 | 2 53E+00 | 6 07E+00 | 0 0850 | 4 723E+14 | |
| Cl-36 | 1 8103E-06 | 27,366 64 | 65,736 58 | 0 00E+00 | 4 95E-02 | 1 19E-01 | 0 1250 | 2 889E+14 | |
| Cm-243 | 2 1248E-07 | 27,366 64 | 65,736 58 | 0 00E+00 | 5 81E-03 | 1 40E-02 | 0 2250 | 4 266E+14 | |
| Cm-244 | 7 9666E-06 | 27,366 64 | 65,736 58 | 0 00E+00 | 2 18E-01 | 5 24E-01 | 0 3750 | 1 685E+14 | |
| Co-60 | 1 2143E-04 | 27,366 64 | 65,736 58 | 0 00E+00 | 3 32E+00 | 7 98E+00 | 0 5750 | 2 595E+15 | |
| Cs-134 | 1 6535E-07 | 27,366 64 | 65,736 58 | 0 00E+00 | 4 53E-03 | 1 09E-02 | 0 8500 | 4 464E+13 | |
| Cs-135 | 2 8639E-05 | 27,366 64 | 65,736 58 | 0 00E+00 | 7 84E-01 | 1 88E+00 | 1 2500 | 1 358E+13 | |
| Cs-137 | 1 0449E+00 | 27,366 64 | 65,736 58 | 0 00E+00 | 2 86E+04 | 6 87E+04 | 1 7500 | 3 553E+12 | |
| Eu-154 | 2 5679E-03 | 27,366 64 | 65,736 58 | 0 00E+00 | 7 03E+01 | 1 69E+02 | 2 2500 | 7 916E+07 | |
| Eu-155 | 8 1175E-05 | 27,366 64 | 65,736 58 | 0 00E+00 | 2 22E+00 | 5 34E+00 | 2 7500 | 2 789E+13 | |
| Fe-55 | 4 2194E-08 | 27,366 64 | 65,736 58 | 0 00E+00 | 1 15E-03 | 2 77E-03 | 3 5000 | 1 074E+05 | |
| H-3 | 9 1673E-04 | 27,366 64 | 65,736 58 | 0 00E+00 | 2 51E+01 | 6 03E+01 | 5 0000 | 3 313E+04 | |
| I-129 | 1 5853E-06 | 27,366 64 | 65,736 58 | 0 00E+00 | 4 34E-02 | 1 04E-01 | 7 0000 | 2 338E+03 | |
| Kr-85 | 2 3741E-02 | 27,366 64 | 65,736 58 | 0 00E+00 | 6 50E+02 | 1 56E+03 | 11 0000 | 1 701E+02 | |
| Np-237 | 1 2747E-07 | 27,366 64 | 65,736 58 | 0 00E+00 | 3 49E-03 | 8 38E-03 | | | |
| Pa-231 | 1 2007E-04 | 27,366 64 | 65,736 58 | 0 00E+00 | 3 29E+00 | 7 89E+00 | | | |
| Pb-210 | 1 8424E-08 | 27,366 64 | 65,736 58 | 0 00E+00 | 5 04E-04 | 1 21E-03 | | | |
| Pm-147 | 4 9829E-06 | 27,366 64 | 65,736 58 | 0 00E+00 | 1 36E-01 | 3 28E-01 | | | |
| Pu-238 | 3 7744E-04 | 27,366 64 | 65,736 58 | 0 00E+00 | 1 03E+01 | 2 48E+01 | | | |
| Pu-239 | 2 7510E-05 | 27,366 64 | 65,736 58 | 0 00E+00 | 7 53E-01 | 1 81E+00 | | | |
| Pu-240 | 1 6175E-05 | 27,366 64 | 65,736 58 | 0 00E+00 | 4 43E-01 | 1 06E+00 | | | |
| Pu-241 | 7 1379E-04 | 27,366 64 | 65,736 58 | 0 00E+00 | 1 95E+01 | 4 69E+01 | | | |
| Pu-242 | 4 0831E-08 | 27,366 64 | 65,736 58 | 0 00E+00 | 1 12E-03 | 2 68E-03 | | | |
| Ra-226 | 2 9038E-08 | 27,366 64 | 65,736 58 | 0 00E+00 | 7 95E-04 | 1 91E-03 | | | |
| Ra-228 | 4 6352E-06 | 27,366 64 | 65,736 58 | 0 00E+00 | 1 27E-01 | 3 05E-01 | | | |
| Ru-106 | 1 3321E-15 | 27,366 64 | 65,736 58 | 0 00E+00 | 3 65E-11 | 8 76E-11 | | | |
| Se-79 | 3 5407E-05 | 27,366 64 | 65,736 58 | 0 00E+00 | 9 69E-01 | 2 33E+00 | | | |
| Sn-126 | 3 9838E-05 | 27,366 64 | 65,736 58 | 0 00E+00 | 1 09E+00 | 2 62E+00 | | | |
| Sr-90 | 1 0449E+00 | 27,366 64 | 65,736 58 | 0 00E+00 | 2 86E+04 | 6 87E+04 | | | |
| Tc-99 | 3 2525E-04 | 27,366 64 | 65,736 58 | 0 00E+00 | 8 90E+00 | 2 14E+01 | | | |
| Th-229 | 8 2305E-05 | 27,366 64 | 65,736 58 | 0 00E+00 | 2 25E+00 | 5 41E+00 | | | |
| Th-230 | 1 2533E-06 | 27,366 64 | 65,736 58 | 0 00E+00 | 3 43E-02 | 8 24E-02 | | | |
| Th-232 | 9 0328E-08 | 27,366 64 | 0 00 | 5 34E-01 | 5 32E-01 | 5 34E-01 | | | |
| Ti-208 | 1 2085E-02 | 27,366 64 | 65,736 58 | 0 00E+00 | 3 31E+02 | 7 94E+02 | | | |
| U-232 | 3 2729E-02 | 27,366 64 | 65,736 58 | 0 00E+00 | 8 96E+02 | 2 15E+03 | | | |
| U-233 | 3 3244E-03 | 27,366 64 | 0 00 | 1 80E+03 | 1 70E+03 | 1 80E+03 | | | |
| U-234 | 8 1769E-04 | 27,366 64 | 65,736 58 | 0 00E+00 | 2 24E+01 | 5 38E+01 | | | |
| U-235 | 5 7813E-08 | 27,366 64 | 65,736 58 | 3 67E-04 | 1 95E-03 | 4 17E-03 | | | |
| U-236 | 1 3273E-07 | 27,366 64 | 65,736 58 | 0 00E+00 | 3 63E-03 | 8 73E-03 | | | |
| U-238 | 3 1121E-10 | 27,366 64 | 0 00 | 2 35E-04 | 2 26E-04 | 2 35E-04 | | | |
| Y-90 | 1 0449E+00 | 27,366 64 | 65,736 58 | 0 00E+00 | 2 86E+04 | 6 87E+04 | | | |
| Other Radionuclides | | | | | 3 35E+04 | 8 04E+04 | | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 6.02E+02 | 1.38E+03 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences* |
|---------------------|-------------|-------------|--|
| | LIGHT WATER | LIGHT WATER | |
| Reactor Moderator | | | This Template was used for the following reasons: This fuel matches LWBR Template on all but one parameter (cladding) making LWBR a reasonable match. |
| Fuel Cladding | SST | ZIRC | |
| BOL HM Constituents | Th and U | Th and U | |
| BOL Enrichment % | 92 94902719 | 60 to 100 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|-----------|-----------|---|
| Nominal | 27,366 64 | 15,217 35 | |
| Bounding | 65,736 58 | 30 434 70 | Nominal burnup taken directly from SFD (converted to MWd) Bounding burnup taken directly from SFD (converted to MWd) |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0.24 | 0.56 | 1.00 |
| Bounding | 0.58 | 0.46 | |

*Reactor shutdown, core removal, storage shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: ERR (RODS)

SNF ID #: 1057

Fuel Units & Descr: 4 - ROD

Heavy Metal Mass: BOL=4.293kg, EOL=4.242kg

ROD Storage Site INEEL

¹Fuel decay start date 1966

Estimates as of: 2030

Template: LWBR (Light Water, Zirc. 60 to 100%, Th and U)

²Template Burnup(MWd): 10269 14

Template BOL Heavy Metal Mass (MT): 0.45991251

Template Decay Time: 50 years

Estimated
Canister usage
18"x10"
0.17

II. Estimates

| | m | X _a | X _b | b | Y _a | Y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Cu/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 1.059E-04 | 49.83 | 99.65 | 0.00E+00 | 5.28E-03 | 1.06E-02 | Avg. MeV | |
| Am-241 | 2.4968E-04 | 49.83 | 99.65 | 0.00E+00 | 1.24E-02 | 2.49E-02 | 0.0150 | 5.787E+12 |
| Am-242m | 1.3847E-06 | 49.83 | 99.65 | 0.00E+00 | 6.90E-05 | 1.38E-04 | 0.0250 | 1.185E+12 |
| Am-243 | 3.1103E-07 | 49.83 | 99.65 | 0.00E+00 | 1.55E-05 | 3.10E-05 | 0.0375 | 1.012E+12 |
| C-14 | 9.2267E-05 | 49.83 | 99.65 | 0.00E+00 | 4.60E-03 | 9.19E-03 | 0.0575 | 1.107E+12 |
| Cl-36 | 1.8103E-06 | 49.83 | 99.65 | 0.00E+00 | 9.02E-05 | 1.80E-04 | 0.0850 | 7.160E+11 |
| Cm-243 | 2.1248E-07 | 49.83 | 99.65 | 0.00E+00 | 1.06E-05 | 2.12E-05 | 0.1250 | 4.380E+11 |
| Cm-244 | 7.9666E-06 | 49.83 | 99.65 | 0.00E+00 | 3.97E-04 | 7.94E-04 | 0.2250 | 6.467E+11 |
| Co-60 | 1.2143E-04 | 49.83 | 99.65 | 0.00E+00 | 6.05E-03 | 1.21E-02 | 0.3750 | 2.554E+11 |
| Cs-134 | 1.6535E-07 | 49.83 | 99.65 | 0.00E+00 | 8.24E-06 | 1.65E-05 | 0.5750 | 3.935E+12 |
| Cs-135 | 2.8639E-05 | 49.83 | 99.65 | 0.00E+00 | 1.43E-03 | 2.85E-03 | 0.8500 | 6.768E+10 |
| Cs-137 | 1.0449E+00 | 49.83 | 99.65 | 0.00E+00 | 5.21E+01 | 1.04E+02 | 1.2500 | 2.059E+10 |
| Eu-154 | 2.5679E-03 | 49.83 | 99.65 | 0.00E+00 | 1.28E-01 | 2.56E-01 | 1.7500 | 5.386E+09 |
| Eu-155 | 8.1175E-05 | 49.83 | 99.65 | 0.00E+00 | 4.04E-03 | 8.09E-03 | 2.2500 | 1.200E+05 |
| Fe-55 | 4.2194E-08 | 49.83 | 99.65 | 0.00E+00 | 2.10E-06 | 4.20E-06 | 2.7500 | 4.229E+10 |
| H-3 | 9.1673E-04 | 49.83 | 99.65 | 0.00E+00 | 4.57E-02 | 9.14E-02 | 3.5000 | 1.550E+02 |
| I-129 | 1.5853E-06 | 49.83 | 99.65 | 0.00E+00 | 7.90E-05 | 1.58E-04 | 5.0000 | 4.789E+01 |
| Kr-85 | 2.3741E-02 | 49.83 | 99.65 | 0.00E+00 | 1.18E+00 | 2.37E+00 | 7.0000 | 3.393E+00 |
| Np-237 | 1.2747E-02 | 49.83 | 99.65 | 0.00E+00 | 6.35E-06 | 1.27E-05 | 11.0000 | 2.483E-01 |
| Pa-231 | 1.2007E-04 | 49.83 | 99.65 | 0.00E+00 | 5.98E-03 | 1.20E-02 | | |
| Pb-210 | 1.8424E-08 | 49.83 | 99.65 | 0.00E+00 | 9.18E-07 | 1.84E-06 | | |
| Pm-147 | 4.9829E-06 | 49.83 | 99.65 | 0.00E+00 | 2.48E-04 | 4.97E-04 | | |
| Pu-238 | 3.7744E-04 | 49.83 | 99.65 | 0.00E+00 | 1.88E-02 | 3.76E-02 | | |
| Pu-239 | 2.7510E-05 | 49.83 | 99.65 | 0.00E+00 | 1.37E-03 | 2.74E-03 | | |
| Pu-240 | 1.6175E-05 | 49.83 | 99.65 | 0.00E+00 | 8.06E-04 | 1.61E-03 | | |
| Pu-241 | 7.1379E-04 | 49.83 | 99.65 | 0.00E+00 | 3.56E-02 | 7.11E-02 | | |
| Pu-242 | 4.0831E-08 | 49.83 | 99.65 | 0.00E+00 | 2.03E-06 | 4.07E-06 | | |
| Ra-226 | 2.9038E-08 | 49.83 | 99.65 | 0.00E+00 | 1.45E-06 | 2.89E-06 | | |
| Ra-228 | 4.6352E-06 | 49.83 | 99.65 | 0.00E+00 | 2.31E-04 | 4.62E-04 | | |
| Ru-106 | 1.3321E-15 | 49.83 | 99.65 | 0.00E+00 | 6.64E-14 | 1.33E-13 | | |
| Se-79 | 3.5407E-05 | 49.83 | 99.65 | 0.00E+00 | 1.76E-03 | 3.53E-03 | | |
| Sn-126 | 3.9838E-05 | 49.83 | 99.65 | 0.00E+00 | 1.98E-03 | 3.97E-03 | | |
| Sr-90 | 1.0449E+00 | 49.83 | 99.65 | 0.00E+00 | 5.21E+01 | 1.04E+02 | | |
| Tc-99 | 3.2525E-04 | 49.83 | 99.65 | 0.00E+00 | 1.62E-02 | 3.24E-02 | | |
| Th-229 | 8.2305E-05 | 49.83 | 99.65 | 0.00E+00 | 4.10E-03 | 8.20E-03 | | |
| Th-230 | 1.2533E-06 | 49.83 | 99.65 | 0.00E+00 | 6.24E-05 | 1.25E-04 | | |
| Th-232 | -9.0328E-08 | 49.83 | 0.00 | 4.53E-04 | 4.49E-04 | 4.53E-04 | | |
| Ti-208 | 1.2085E-02 | 49.83 | 99.65 | 0.00E+00 | 6.02E-01 | 1.20E+00 | | |
| U-232 | 3.2729E-02 | 49.83 | 99.65 | 0.00E+00 | 1.63E+00 | 3.26E+00 | | |
| U-233 | -3.3244E-03 | 49.83 | 0.00 | 1.52E+00 | 1.36E+00 | 1.52E+00 | | |
| U-234 | 8.1769E-04 | 49.83 | 99.65 | 0.00E+00 | 4.07E-02 | 8.15E-02 | | |
| U-235 | 5.7813E-08 | 49.83 | 99.65 | 3.12E-07 | 3.19E-06 | 6.07E-06 | | |
| U-236 | 1.3273E-07 | 49.83 | 99.65 | 0.00E+00 | 6.61E-06 | 1.32E-05 | | |
| U-238 | -3.1121E-10 | 49.83 | 0.00 | 1.99E-07 | 1.84E-07 | 1.99E-07 | | |
| Y-90 | 1.0449E+00 | 49.83 | 99.65 | 0.00E+00 | 5.21E+01 | 1.04E+02 | | |
| Other Radionuclides | | | | | 6.09E+01 | 1.22E+02 | | |

| Thermal Power | | |
|-----------------------------|------------------------------|--|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) | |
| 1.05E+00 | 2.06E+00 | |
| Total | Total | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| Reactor Moderator: Fuel Cladding BOL HM Constituents BOL Enrichment % | From SFD | Used | Basis for Parameter Differences: This Template was used for the following reasons. This fuel matches LWBR Template on all but one parameter (cladding) making LWBR a reasonable match. |
|--|-------------|-------------|--|
| | LIGHT WATER | LIGHT WATER | |
| | SST | ZIRC | |
| | Th and U | Th and U | |
| | 93.0868939 | 60 to 100 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |
|----------|----------|-----------|--|
| | 28.26 | 49.83 | |
| Nominal | | | |
| Bounding | 45.49 | 99.65 | |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | 0.52 | 1.76 | |
| Nominal | | | |
| Bounding | 1.04 | 2.19 | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name ESSOR (UALX-HEU) ITALY
SNF ID #: 762
Fuel Units & Descr: 12 - 18 CURVED PLATES
Heavy Metal Mass: BOL=7.8kg EOL=5.73kg
ROD Storage Site SRS

¹Fuel decay start date 2006
Estimates as of: 2030
Template ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup(MWd) 367.2
Template BOL Heavy Metal Mass (MT) 0.00116689
Template Decay Time 20 years

Estimated
Canister usage
18"x10"
1.00

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| | m | x _a | x _b | b | y _a | y _b | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Avg MeV | |
| Ac-227 | 6.6313E-10 | 1,960.33 | 3,920.66 | 0.00E+00 | 1.30E-06 | 2.60E-06 | 0.0150 | 4.139E+14 |
| Am-241 | 2.0060E-03 | 1,960.33 | 3,920.66 | 0.00E+00 | 3.93E+00 | 7.86E+00 | 0.0250 | 8.606E+13 |
| Am-242m | 4.2429E-07 | 1,960.33 | 3,920.66 | 0.00E+00 | 8.32E-04 | 1.66E-03 | 0.0375 | 7.506E+13 |
| Am-243 | 1.4899E-06 | 1,960.33 | 3,920.66 | 0.00E+00 | 2.92E-03 | 5.84E-03 | 0.0575 | 8.040E+13 |
| C-14 | 5.7135E-09 | 1,960.33 | 3,920.66 | 0.00E+00 | 1.12E-05 | 2.24E-05 | 0.0850 | 4.858E+13 |
| Cl-36 | 1.3124E-32 | 1,960.33 | 3,920.66 | 0.00E+00 | 2.57E-29 | 5.15E-29 | 0.1250 | 3.288E+13 |
| Cm-243 | 1.6443E-07 | 1,960.33 | 3,920.66 | 0.00E+00 | 3.22E-04 | 6.45E-04 | 0.2250 | 4.192E+13 |
| Cm-244 | 2.9330E-05 | 1,960.33 | 3,920.66 | 0.00E+00 | 5.75E-02 | 1.15E-01 | 0.3750 | 1.825E+13 |
| Co-60 | 5.3186E-06 | 1,960.33 | 3,920.66 | 0.00E+00 | 1.04E-02 | 2.09E-02 | 0.5750 | 2.977E+14 |
| Cs-134 | 3.1563E-03 | 1,960.33 | 3,920.66 | 0.00E+00 | 6.19E+00 | 1.24E+01 | 0.8500 | 5.032E+12 |
| Cs-135 | 3.4477E-06 | 1,960.33 | 3,920.66 | 0.00E+00 | 6.76E-03 | 1.35E-02 | 1.2500 | 2.874E+12 |
| Cs-137 | 2.0313E+00 | 1,960.33 | 3,920.66 | 0.00E+00 | 3.98E+03 | 7.96E+03 | 1.7500 | 1.319E+11 |
| Eu-154 | 2.4513E-02 | 1,960.33 | 3,920.66 | 0.00E+00 | 4.81E+01 | 9.61E+01 | 2.2500 | 1.157E+07 |
| Eu-155 | 4.8175E-03 | 1,960.33 | 3,920.66 | 0.00E+00 | 9.44E+00 | 1.89E+01 | 2.7500 | 6.541E+06 |
| Fe-55 | 1.2397E-04 | 1,960.33 | 3,920.66 | 0.00E+00 | 2.43E-01 | 4.86E-01 | 3.5000 | 3.005E+04 |
| H-3 | 4.5697E-03 | 1,960.33 | 3,920.66 | 0.00E+00 | 8.96E+00 | 1.79E+01 | 5.0000 | 1.699E+03 |
| I-129 | 7.5300E-07 | 1,960.33 | 3,920.66 | 0.00E+00 | 1.48E-03 | 2.95E-03 | 7.0000 | 1.875E+02 |
| Kr-85 | 1.0850E-01 | 1,960.33 | 3,920.66 | 0.00E+00 | 2.13E+02 | 4.25E+02 | 11.0000 | 2.102E+01 |
| Np-237 | 9.5561E-06 | 1,960.33 | 3,920.66 | 0.00E+00 | 1.87E-02 | 3.75E-02 | | |
| Pa-231 | 2.0359E-09 | 1,960.33 | 3,920.66 | 0.00E+00 | 3.99E-06 | 7.98E-06 | | |
| Pb-210 | 4.9728E-11 | 1,960.33 | 3,920.66 | 0.00E+00 | 9.75E-08 | 1.95E-07 | | |
| Pm-147 | 4.8502E-02 | 1,960.33 | 3,920.66 | 0.00E+00 | 9.51E+01 | 1.90E+02 | | |
| Pu-238 | 1.8254E-02 | 1,960.33 | 3,920.66 | 0.00E+00 | 3.58E+01 | 7.16E+01 | | |
| Pu-239 | 4.2810E-04 | 1,960.33 | 3,920.66 | 0.00E+00 | 8.39E-01 | 1.68E+00 | | |
| Pu-240 | 2.4368E-04 | 1,960.33 | 3,920.66 | 0.00E+00 | 4.78E-01 | 9.55E-01 | | |
| Pu-241 | 3.3415E-02 | 1,960.33 | 3,920.66 | 0.00E+00 | 6.55E+01 | 1.31E+02 | | |
| Pu-242 | 3.6329E-07 | 1,960.33 | 3,920.66 | 0.00E+00 | 7.12E-04 | 1.42E-03 | | |
| Ra-226 | 2.2854E-10 | 1,960.33 | 3,920.66 | 0.00E+00 | 4.48E-07 | 8.96E-07 | | |
| Ra-228 | 1.2426E-14 | 1,960.33 | 3,920.66 | 0.00E+00 | 2.44E-11 | 4.87E-11 | | |
| Ru-106 | 6.3589E-06 | 1,960.33 | 3,920.66 | 0.00E+00 | 1.25E-02 | 2.49E-02 | | |
| Se-79 | 1.2933E-05 | 1,960.33 | 3,920.66 | 0.00E+00 | 2.54E-02 | 5.07E-02 | | |
| Sn-126 | 1.1574E-05 | 1,960.33 | 3,920.66 | 0.00E+00 | 2.27E-02 | 4.54E-02 | | |
| Sr-90 | 1.9248E+00 | 1,960.33 | 3,920.66 | 0.00E+00 | 3.77E+03 | 7.55E+03 | | |
| Tc-99 | 4.2239E-04 | 1,960.33 | 3,920.66 | 0.00E+00 | 8.28E-01 | 1.66E+00 | | |
| Th-229 | 5.0953E-12 | 1,960.33 | 3,920.66 | 0.00E+00 | 9.99E-09 | 2.00E-08 | | |
| Th-230 | 4.1885E-08 | 1,960.33 | 3,920.66 | 0.00E+00 | 8.21E-05 | 1.64E-04 | | |
| Th-232 | 1.9270E-14 | 1,960.33 | 3,920.66 | 0.00E+00 | 3.78E-11 | 7.56E-11 | | |
| Ti-208 | 4.6024E-08 | 1,960.33 | 3,920.66 | 0.00E+00 | 9.02E-05 | 1.80E-04 | | |
| U-232 | 1.2582E-07 | 1,960.33 | 3,920.66 | 0.00E+00 | 2.47E-04 | 4.93E-04 | | |
| U-233 | 2.5825E-09 | 1,960.33 | 3,920.66 | 0.00E+00 | 5.06E-06 | 1.01E-05 | | |
| U-234 | 1.8450E-04 | 1,960.33 | 3,920.66 | 0.00E+00 | 3.62E-01 | 7.23E-01 | | |
| U-235 | -2.7235E-06 | 1,960.33 | 0.00 | 1.56E-02 | 1.03E-02 | 1.56E-02 | | |
| U-236 | 1.5493E-05 | 1,960.33 | 3,920.66 | 0.00E+00 | 3.04E-02 | 6.07E-02 | | |
| U-238 | -4.2851E-09 | 1,960.33 | 0.00 | 1.96E-04 | 1.87E-04 | 1.96E-04 | | |
| Y-90 | 1.9254E+00 | 1,960.33 | 3,920.66 | 0.00E+00 | 3.77E+03 | 7.55E+03 | | |
| Other Radionuclides | | | | | 3.79E+03 | 7.58E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences: |
|---------------------|-------------|-------------|----------------------------------|
| Reactor Moderator | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 92.52628863 | 60 to 100 | |

Burnup Summary (MWd)¹

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|----------|-----------|--|
| Nominal | | 1.960.33 | |
| Bounding | | 3.920.66 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0.80 | | |
| Bounding | 1.60 | | 1.02 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FMRB (GERMANY)
SNF ID #: 577
Fuel Units & Descr: 92 - MTR TYPE
Heavy Metal Mass: BOL=13 138kg, EOL=11 666kg
ROD Storage Site: SRS

¹Fuel decay start date: 1994
Estimates as of: 2030
Template ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup(MWd): 367.2
Template BOL Heavy Metal Mass (MT): 0 00116689
Template Decay Time: 35 years

Estimated
Canister usage
18"x10"
3 83

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Cu/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2 0068E-09 | 1,394 01 | 2,788 03 | 0 00E+00 | 2 80E-06 | 5 60E-06 | Avg MeV | |
| Am-241 | 2 5251E-03 | 1,394 01 | 2,788 03 | 0 00E+00 | 3 52E+00 | 7 04E+00 | 0 0150 | 2 053E+14 |
| Am-242m | 3 9624E-07 | 1,394 01 | 2,788 03 | 0 00E+00 | 5 52E-04 | 1 10E-03 | 0 0250 | 4 264E+13 |
| Am-243 | 1 4880E-06 | 1,394 01 | 2,788 03 | 0 00E+00 | 2 07E-03 | 4 15E-03 | 0 0375 | 3 706E+13 |
| C-14 | 5 7053E-09 | 1,394 01 | 2,788 03 | 0 00E+00 | 7 95E-06 | 1 59E-05 | 0 0575 | 3 989E+13 |
| Cl-36 | 1 3124E-32 | 1,394 01 | 2,788 03 | 0 00E+00 | 1 83E-29 | 3 66E-29 | 0 0850 | 2 404E+13 |
| Cm-243 | 1 1419E-07 | 1,394 01 | 2,788 03 | 0 00E+00 | 1 59E-04 | 3 18E-04 | 0 1250 | 1 588E+13 |
| Cm-244 | 1 6522E-05 | 1,394 01 | 2,788 03 | 0 00E+00 | 2 30E-02 | 4 61E-02 | 0 2250 | 2 075E+13 |
| Co-60 | 7 4047E-07 | 1,394 01 | 2,788 03 | 0 00E+00 | 1 03E-03 | 2 06E-03 | 0 3750 | 9 028E+12 |
| Cs-134 | 2 0455E-05 | 1,394 01 | 2,788 03 | 0 00E+00 | 2 85E-02 | 5 70E-02 | 0 5750 | 1 492E+14 |
| Cs-135 | 3 4477E-06 | 1,394 01 | 2,788 03 | 0 00E+00 | 4 81E-03 | 9 61E-03 | 0 8500 | 1 822E+12 |
| Cs-137 | 1 4365E+00 | 1,394 01 | 2,788 03 | 0 00E+00 | 2 00E+03 | 4 01E+03 | 1 2500 | 8 814E+11 |
| Eu-154 | 7 3230E-03 | 1,394 01 | 2,788 03 | 0 00E+00 | 1 02E+01 | 2 04E+01 | 1 7500 | 4 961E+10 |
| Eu-155 | 5 9259E-04 | 1,394 01 | 2,788 03 | 0 00E+00 | 8 26E-01 | 1 65E+00 | 2 2500 | 4 148E+06 |
| Fe-55 | 2 2791E-06 | 1,394 01 | 2,788 03 | 0 00E+00 | 3 18E-03 | 6 35E-03 | 2 7500 | 3 959E+06 |
| H-3 | 1 9698E-03 | 1,394 01 | 2,788 03 | 0 00E+00 | 2 75E+00 | 5 49E+00 | 3 5000 | 2 296E+03 |
| I-129 | 7 5300E-07 | 1,394 01 | 2,788 03 | 0 00E+00 | 1 05E-03 | 2 10E-03 | 5 0000 | 9 381E+02 |
| Kr-85 | 4 1176E-02 | 1,394 01 | 2,788 03 | 0 00E+00 | 5 74E+01 | 1 15E+02 | 7 0000 | 1 027E+02 |
| Np-237 | 9 5752E-06 | 1,394 01 | 2,788 03 | 0 00E+00 | 1 33E-02 | 2 67E-02 | 11.0000 | 1 145E+01 |
| Pa-231 | 3 9379E-09 | 1,394 01 | 2,788 03 | 0 00E+00 | 5 49E-06 | 1 10E-05 | | |
| Pb-210 | 3 3115E-10 | 1,394 01 | 2,788 03 | 0 00E+00 | 4 62E-07 | 9 23E-07 | | |
| Pm-147 | 9 2402E-04 | 1,394 01 | 2,788 03 | 0 00E+00 | 1 29E+00 | 2 58E+00 | | |
| Pu-238 | 1 6217E-02 | 1,394 01 | 2,788 03 | 0 00E+00 | 2 26E+01 | 4 52E+01 | | |
| Pu-239 | 4 2810E-04 | 1,394 01 | 2,788 03 | 0 00E+00 | 5 97E-01 | 1 19E+00 | | |
| Pu-240 | 2 4333E-04 | 1,394 01 | 2,788 03 | 0 00E+00 | 3 39E-01 | 6 78E-01 | | |
| Pu-241 | 1 6242E-02 | 1,394 01 | 2,788 03 | 0 00E+00 | 2 26E+01 | 4 53E+01 | | |
| Pu-242 | 3 6329E-07 | 1,394 01 | 2,788 03 | 0 00E+00 | 5 06E-04 | 1 01E-03 | | |
| Ra-226 | 9 0114E-10 | 1,394 01 | 2,788 03 | 0 00E+00 | 1 26E-06 | 2 51E-06 | | |
| Ra-228 | 3 1019E-14 | 1,394 01 | 2,788 03 | 0 00E+00 | 4 32E-11 | 8 65E-11 | | |
| Ru-106 | 2 1225E-10 | 1,394 01 | 2,788 03 | 0 00E+00 | 2 96E-07 | 5 92E-07 | | |
| Se-79 | 1 2930E-05 | 1,394 01 | 2,788 03 | 0 00E+00 | 1 80E-02 | 3 60E-02 | | |
| Sn-126 | 1 1571E-05 | 1,394 01 | 2,788 03 | 0 00E+00 | 1 61E-02 | 3 23E-02 | | |
| Sr-90 | 1 3472E+00 | 1,394 01 | 2,788 03 | 0 00E+00 | 1 88E+03 | 3 76E+03 | | |
| Tc-99 | 4 2239E-04 | 1,394 01 | 2,788 03 | 0 00E+00 | 5 89E-01 | 1 18E+00 | | |
| Th-229 | 1 2407E-11 | 1,394 01 | 2,788 03 | 0 00E+00 | 1 73E-08 | 3 46E-08 | | |
| Th-230 | 8 3497E-08 | 1,394 01 | 2,788 03 | 0 00E+00 | 1 16E-04 | 2 33E-04 | | |
| Th-232 | 3 8371E-14 | 1,394 01 | 2,788 03 | 0 00E+00 | 5 35E-11 | 1 07E-10 | | |
| Th-208 | 4 0414E-08 | 1,394 01 | 2,788 03 | 0 00E+00 | 5 63E-05 | 1 13E-04 | | |
| U-232 | 1 0948E-07 | 1,394 01 | 2,788 03 | 0 00E+00 | 1 53E-04 | 3 05E-04 | | |
| U-233 | 3 6275E-09 | 1,394 01 | 2,788 03 | 0 00E+00 | 5 06E-06 | 1 01E-05 | | |
| U-234 | 1 8562E-04 | 1,394 01 | 2,788 03 | 0 00E+00 | 2 59E-01 | 5 18E-01 | | |
| U-235 | -2 7235E-06 | 1,394 01 | 0 00 | 2 59E-02 | 2 21E-02 | 2 59E-02 | | |
| U-236 | 1 5493E-05 | 1,394 01 | 2,788 03 | 0 00E+00 | 2 16E-02 | 4 32E-02 | | |
| U-238 | -4 2851E-09 | 1,394 01 | 0 00 | 3 86E-04 | 3 80E-04 | 3 86E-04 | | |
| Y-90 | 1 3475E+00 | 1,394 01 | 2,788 03 | 0 00E+00 | 1 88E+03 | 3 76E+03 | | |
| Other Radionuclides | | | | | 1 91E+03 | 3 82E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-------------|-------------|
| Reactor Moderator | LIGHT WATER | LIGHT WATER |
| Fuel Cladding | ALUM | ALUM |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 91 25787542 | 60 to 100 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | | 1,394 01 |
| Bounding | | 2,788 03 |

Basis for burnup used in estimate:
Nominal burnup calculated from the heavy metal mass destroyed.
Bounding burnup assumed to be twice nominal burnup.

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|-----------------------------------|
| Nominal | 0 34 | |
| Bounding | 0 67 | |

Estimated EOL HM/Given EOL HM

1 01

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRG-1 (U3O8 LEU) GERMANY
SNF ID #: 581
Fuel Units & Descr: 7 - MTR TYPE
Heavy Metal Mass: BOL=9.566kg EOL=8.635kg
ROD Storage Site: SRS

¹Fuel decay start date: 1994
Estimates as of: 2030
Template: ATR (Light Water, Alum, 60 to 100% U)
²Template Burnup (MWd): 367.2
Template BOL Heavy Metal Mass (MT): 0.00116689
Template Decay Time: 35 years

Estimated
Canister usage
18"x10"
0.29

| II. Estimates | | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|----------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Avg MeV | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.0068E-09 | 881.01 | 1,762.02 | 0.00E+00 | 1.77E-06 | 3.54E-06 | 0.0150 | 1.298E+14 | |
| Am-241 | 2.5251E-03 | 881.01 | 1,762.02 | 0.00E+00 | 2.22E+00 | 4.45E+00 | 0.0250 | 2.695E+13 | |
| Am-242m | 3.9624E-07 | 881.01 | 1,762.02 | 0.00E+00 | 3.49E-04 | 6.98E-04 | 0.0375 | 2.342E+13 | |
| Am-243 | 1.4880E-06 | 881.01 | 1,762.02 | 0.00E+00 | 1.31E-03 | 2.62E-03 | 0.0575 | 2.521E+13 | |
| C-14 | 5.7053E-09 | 881.01 | 1,762.02 | 0.00E+00 | 5.03E-06 | 1.01E-05 | 0.0850 | 1.519E+13 | |
| Cl-36 | 1.3124E-32 | 881.01 | 1,762.02 | 0.00E+00 | 1.16E-29 | 2.31E-29 | 0.1250 | 1.003E+13 | |
| Cm-243 | 1.1419E-07 | 881.01 | 1,762.02 | 0.00E+00 | 1.01E-04 | 2.01E-04 | 0.2250 | 1.311E+13 | |
| Cm-244 | 1.6522E-05 | 881.01 | 1,762.02 | 0.00E+00 | 1.46E-02 | 2.91E-02 | 0.3750 | 5.705E+12 | |
| Co-60 | 7.4047E-07 | 881.01 | 1,762.02 | 0.00E+00 | 6.52E-04 | 1.30E-03 | 0.5750 | 9.429E+13 | |
| Cs-134 | 2.0455E-05 | 881.01 | 1,762.02 | 0.00E+00 | 1.80E-02 | 3.60E-02 | 0.8500 | 1.152E+12 | |
| Cs-135 | 3.4477E-06 | 881.01 | 1,762.02 | 0.00E+00 | 3.04E-03 | 6.07E-03 | 1.2500 | 5.571E+11 | |
| Cs-137 | 1.4365E+00 | 881.01 | 1,762.02 | 0.00E+00 | 1.27E+03 | 2.53E+03 | 1.7500 | 3.135E+10 | |
| Eu-154 | 7.3230E-03 | 881.01 | 1,762.02 | 0.00E+00 | 6.45E+00 | 1.29E+01 | 2.2500 | 2.61E+06 | |
| Eu-155 | 5.9259E-04 | 881.01 | 1,762.02 | 0.00E+00 | 5.22E-01 | 1.04E+00 | 2.7500 | 2.502E+06 | |
| Fe-55 | 2.2791E-06 | 881.01 | 1,762.02 | 0.00E+00 | 2.01E-03 | 4.02E-03 | 3.5000 | 1.463E+03 | |
| H-3 | 1.9698E-03 | 881.01 | 1,762.02 | 0.00E+00 | 1.74E+00 | 3.47E+00 | 5.0000 | 5.981E+02 | |
| I-129 | 7.5300E-07 | 881.01 | 1,762.02 | 0.00E+00 | 6.63E-04 | 1.33E-03 | 7.0000 | 6.548E+01 | |
| Kr-85 | 4.1176E-02 | 881.01 | 1,762.02 | 0.00E+00 | 3.63E+01 | 7.26E+01 | 11.0000 | 7.303E+00 | |
| Np-237 | 9.5752E-06 | 881.01 | 1,762.02 | 0.00E+00 | 8.44E-03 | 1.69E-02 | | | |
| Pa-231 | 3.9379E-09 | 881.01 | 1,762.02 | 0.00E+00 | 3.47E-06 | 6.94E-06 | | | |
| Pb-210 | 3.3115E-10 | 881.01 | 1,762.02 | 0.00E+00 | 2.92E-07 | 5.84E-07 | | | |
| Pm-147 | 9.2402E-04 | 881.01 | 1,762.02 | 0.00E+00 | 8.14E-01 | 1.63E+00 | | | |
| Pu-238 | 1.6217E-02 | 881.01 | 1,762.02 | 0.00E+00 | 1.43E+01 | 2.86E+01 | | | |
| Pu-239 | 4.2810E-04 | 881.01 | 1,762.02 | 0.00E+00 | 3.77E-01 | 7.54E-01 | | | |
| Pu-240 | 2.4333E-04 | 881.01 | 1,762.02 | 0.00E+00 | 2.14E-01 | 4.29E-01 | | | |
| Pu-241 | 1.6242E-02 | 881.01 | 1,762.02 | 0.00E+00 | 1.43E+01 | 2.86E+01 | | | |
| Pu-242 | 3.6329E-07 | 881.01 | 1,762.02 | 0.00E+00 | 3.20E-04 | 6.40E-04 | | | |
| Ra-226 | 9.0114E-10 | 881.01 | 1,762.02 | 0.00E+00 | 7.94E-07 | 1.59E-06 | | | |
| Ra-228 | 3.1019E-14 | 881.01 | 1,762.02 | 0.00E+00 | 2.73E-11 | 5.47E-11 | | | |
| Ru-106 | 2.1225E-10 | 881.01 | 1,762.02 | 0.00E+00 | 1.87E-07 | 3.74E-07 | | | |
| Se-79 | 1.2930E-05 | 881.01 | 1,762.02 | 0.00E+00 | 1.14E-02 | 2.28E-02 | | | |
| Sn-126 | 1.1571E-05 | 881.01 | 1,762.02 | 0.00E+00 | 1.02E-02 | 2.04E-02 | | | |
| Sr-90 | 1.3472E+00 | 881.01 | 1,762.02 | 0.00E+00 | 1.19E+03 | 2.37E+03 | | | |
| Tc-99 | 4.2239E-04 | 881.01 | 1,762.02 | 0.00E+00 | 3.72E-01 | 7.44E-01 | | | |
| Th-229 | 1.2407E-11 | 881.01 | 1,762.02 | 0.00E+00 | 1.09E-08 | 2.19E-08 | | | |
| Th-230 | 8.3497E-08 | 881.01 | 1,762.02 | 0.00E+00 | 7.36E-05 | 1.47E-04 | | | |
| Th-232 | 3.8371E-14 | 881.01 | 1,762.02 | 0.00E+00 | 3.38E-11 | 6.76E-11 | | | |
| Th-208 | 4.0414E-08 | 881.01 | 1,762.02 | 0.00E+00 | 3.56E-05 | 7.12E-05 | | | |
| U-232 | 1.0948E-07 | 881.01 | 1,762.02 | 0.00E+00 | 9.65E-05 | 1.93E-04 | | | |
| U-233 | 3.6275E-09 | 881.01 | 1,762.02 | 0.00E+00 | 3.20E-06 | 6.39E-06 | | | |
| U-234 | 1.8562E-04 | 881.01 | 1,762.02 | 0.00E+00 | 1.64E-01 | 3.27E-01 | | | |
| U-235 | -2.7235E-06 | 881.01 | 0.00 | 4.08E-03 | 1.68E-03 | 4.08E-03 | | | |
| U-236 | -1.5493E-05 | 881.01 | 1,762.02 | 0.00E+00 | 1.36E-02 | 2.73E-02 | | | |
| U-238 | -4.2851E-09 | 881.01 | 0.00 | 2.58E-03 | 2.58E-03 | 2.58E-03 | | | |
| Y-90 | 1.3475E+00 | 881.01 | 1,762.02 | 0.00E+00 | 1.19E+03 | 2.37E+03 | | | |
| Other Radionuclides | | | | | 1.21E+03 | 2.41E+03 | | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: This Template was used for the following reasons: This fuel matches ATR Template on all but one parameter (enrichment) making ATR a reasonable match. |
|----------------------------|-------------|-------------|--|
| Reactor Moderator | From SFD | - Used | |
| Fuel Cladding | LIGHT WATER | LIGHT WATER | |
| BOL HM Constituents | ALUM | ALUM | |
| BOL Enrichment % | U | U | |
| | 19.73077542 | 60 to 100 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | | 881.01 | |
| Bounding | | 1,762.02 | |

| Checks | | | Estimated EOL HM/Given EOL HM 1.01 |
|----------|-------------------|--------------------------------|---------------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0.29 | | |
| Bounding | 0.59 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRG-1 (U3Si2 LEU) GERMANY
 SNF ID #: 741
 Fuel Units & Descr: 109 - MTR TYPE
 Heavy Metal Mass: BOL=161.56kg EOL=150.932kg
 ROD Storage Site: SRS

¹Fuel decay start date: 1994
 Estimates as of: 2030
 Template: ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup(MWd): 367.2
 Template BOL Heavy Metal Mass (MT): 0.00116689
 Template Decay Time: 35 years

Estimated
 Canister usage:
 18"x10"
 4.54

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | CuMWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.0068E-09 | 10,064.45 | 20,128.90 | 0.00E+00 | 2.02E-05 | 4.04E-05 | Avg. MeV | |
| Am-241 | 2.5251E-03 | 10,064.45 | 20,128.90 | 0.00E+00 | 2.54E+01 | 5.08E+01 | 0.0150 | 1.483E+15 |
| Am-242m | 3.9624E-07 | 10,064.45 | 20,128.90 | 0.00E+00 | 3.99E-03 | 7.98E-03 | 0.0250 | 3.078E+14 |
| Am-243 | 1.4880E-06 | 10,064.45 | 20,128.90 | 0.00E+00 | 1.50E-02 | 3.00E-02 | 0.0375 | 2.676E+14 |
| C-14 | 5.7053E-09 | 10,064.45 | 20,128.90 | 0.00E+00 | 5.74E-05 | 1.15E-04 | 0.0575 | 2.880E+14 |
| Cl-36 | 1.3124E-32 | 10,064.45 | 20,128.90 | 0.00E+00 | 1.32E-28 | 2.64E-28 | 0.0850 | 1.735E+14 |
| Cm-243 | 1.1419E-07 | 10,064.45 | 20,128.90 | 0.00E+00 | 1.15E-03 | 2.30E-03 | 0.1250 | 1.146E+14 |
| Cm-244 | 1.6522E-05 | 10,064.45 | 20,128.90 | 0.00E+00 | 1.66E-01 | 3.33E-01 | 0.2250 | 1.498E+14 |
| Co-60 | 7.4047E-07 | 10,064.45 | 20,128.90 | 0.00E+00 | 7.45E-03 | 1.49E-02 | 0.3750 | 6.518E+13 |
| Cs-134 | 2.0455E-05 | 10,064.45 | 20,128.90 | 0.00E+00 | 2.06E-01 | 4.12E-01 | 0.5750 | 1.077E+15 |
| Cs-135 | 3.4477E-06 | 10,064.45 | 20,128.90 | 0.00E+00 | 3.47E-02 | 6.94E-02 | 0.8500 | 1.316E+13 |
| Cs-137 | 1.4365E+00 | 10,064.45 | 20,128.90 | 0.00E+00 | 1.45E+04 | 2.89E+04 | 1.2500 | 6.364E+12 |
| Eu-154 | 7.3230E-03 | 10,064.45 | 20,128.90 | 0.00E+00 | 7.37E+01 | 1.47E+02 | 1.7500 | 3.582E+11 |
| Eu-155 | 5.9259E-04 | 10,064.45 | 20,128.90 | 0.00E+00 | 5.96E+00 | 1.19E+01 | 2.2500 | 2.995E+07 |
| Fe-55 | 2.2791E-06 | 10,064.45 | 20,128.90 | 0.00E+00 | 2.29E-02 | 4.59E-02 | 2.7500 | 2.858E+07 |
| H-3 | 1.9698E-03 | 10,064.45 | 20,128.90 | 0.00E+00 | 1.98E+01 | 3.96E+01 | 3.5000 | 1.679E+04 |
| I-129 | 7.5300E-07 | 10,064.45 | 20,128.90 | 0.00E+00 | 7.58E-03 | 1.52E-02 | 5.0000 | 6.865E+03 |
| Kr-85 | 4.1176E-02 | 10,064.45 | 20,128.90 | 0.00E+00 | 4.14E+02 | 8.29E+02 | 7.0000 | 7.518E+02 |
| Np-237 | 9.5752E-06 | 10,064.45 | 20,128.90 | 0.00E+00 | 9.64E-02 | 1.93E-01 | 11.0000 | 8.386E+01 |
| Pa-231 | 3.9379E-09 | 10,064.45 | 20,128.90 | 0.00E+00 | 3.96E-05 | 7.93E-05 | | |
| Pb-210 | 3.3115E-10 | 10,064.45 | 20,128.90 | 0.00E+00 | 3.33E-06 | 6.67E-06 | | |
| Pm-147 | 9.2402E-04 | 10,064.45 | 20,128.90 | 0.00E+00 | 9.30E+00 | 1.86E+01 | | |
| Pu-238 | 1.6217E-02 | 10,064.45 | 20,128.90 | 0.00E+00 | 1.63E+02 | 3.26E+02 | | |
| Pu-239 | 4.2810E-04 | 10,064.45 | 20,128.90 | 0.00E+00 | 4.31E+00 | 8.62E+00 | | |
| Pu-240 | 2.4333E-04 | 10,064.45 | 20,128.90 | 0.00E+00 | 2.45E+00 | 4.90E+00 | | |
| Pu-241 | 1.6242E-02 | 10,064.45 | 20,128.90 | 0.00E+00 | 1.63E+02 | 3.27E+02 | | |
| Pu-242 | 3.6329E-07 | 10,064.45 | 20,128.90 | 0.00E+00 | 3.66E-03 | 7.31E-03 | | |
| Ra-226 | 9.0114E-10 | 10,064.45 | 20,128.90 | 0.00E+00 | 9.07E-06 | 1.81E-05 | | |
| Ra-228 | 3.1019E-14 | 10,064.45 | 20,128.90 | 0.00E+00 | 3.12E-10 | 6.24E-10 | | |
| Ru-106 | 2.1225E-10 | 10,064.45 | 20,128.90 | 0.00E+00 | 2.14E-06 | 4.27E-06 | | |
| Se-79 | 1.2930E-05 | 10,064.45 | 20,128.90 | 0.00E+00 | 1.30E-01 | 2.60E-01 | | |
| Sn-126 | 1.1571E-05 | 10,064.45 | 20,128.90 | 0.00E+00 | 1.16E-01 | 2.33E-01 | | |
| Sr-90 | 1.3472E+00 | 10,064.45 | 20,128.90 | 0.00E+00 | 1.36E+04 | 2.71E+04 | | |
| Tc-99 | 4.2239E-04 | 10,064.45 | 20,128.90 | 0.00E+00 | 4.25E+00 | 8.50E+00 | | |
| Th-229 | 1.2407E-11 | 10,064.45 | 20,128.90 | 0.00E+00 | 1.25E-07 | 2.50E-07 | | |
| Th-230 | 8.3497E-08 | 10,064.45 | 20,128.90 | 0.00E+00 | 8.40E-04 | 1.68E-03 | | |
| Th-232 | 3.8371E-14 | 10,064.45 | 20,128.90 | 0.00E+00 | 3.86E-10 | 7.72E-10 | | |
| Th-208 | 4.0414E-08 | 10,064.45 | 20,128.90 | 0.00E+00 | 4.07E-04 | 8.13E-04 | | |
| U-232 | 1.0948E-07 | 10,064.45 | 20,128.90 | 0.00E+00 | 1.10E-03 | 2.20E-03 | | |
| U-233 | 3.6275E-09 | 10,064.45 | 20,128.90 | 0.00E+00 | 3.65E-05 | 7.30E-05 | | |
| U-234 | 1.8562E-04 | 10,064.45 | 20,128.90 | 0.00E+00 | 1.87E+00 | 3.74E+00 | | |
| U-235 | -2.7235E-06 | 10,064.45 | 0.00 | 6.92E-02 | 4.18E-02 | 6.92E-02 | | |
| U-236 | 1.5493E-05 | 10,064.45 | 20,128.90 | 0.00E+00 | 1.56E-01 | 3.12E-01 | | |
| U-238 | -4.2851E-09 | 10,064.45 | 0.00 | 4.35E-02 | 4.35E-02 | 4.35E-02 | | |
| Y-90 | 1.3475E+00 | 10,064.45 | 20,128.90 | 0.00E+00 | 1.36E+04 | 2.71E+04 | | |
| Other Radionuclides | | | | | 1.38E+04 | 2.75E+04 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences: |
|---------------------|-------------|-------------|---|
| Reactor Moderator | LIGHT WATER | LIGHT WATER | This Template was used for the following reasons. |
| Fuel Cladding | ALUM | ALUM | This fuel matches ATR Template on all but one parameter (enrichment) making ATR a reasonable match. |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19.81106509 | 60 to 100 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|----------|-----------|--|
| Nominal | | 10.064.45 | Nominal burnup calculated from the heavy metal mass destroyed. |
| Bounding | | 20,128.90 | Bounding burnup assumed to be twice nominal burnup |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0.20 | | 1.00 |
| Bounding | 0.40 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name FRG-1 (JALX HEU) GERMANY
SNF ID # 742
Fuel Units & Descr 141 - MTR TYPE
Heavy Metal Mass BOL=23 42kg EOL=16 539kg
ROD Storage Site SRS

Fuel decay start date 1995
Estimates as of 2030
Template ATR (Light Water, Alum, 60 to 100%, U)
Template Burnup(MWd) 367.2
Template BOL Heavy Metal Mass (MT) 0 00116689
Template Decay Time 35 years

Estimated
Canister usage
18"x10"
5 88

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| | m | x _n | x _b | b | y _n | y _b | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Avg MeV | |
| Ac-227 | 2 0068E-09 | 6,516 25 | 13,032 50 | 0 00E+00 | 1 31E-05 | 2 62E-05 | 0 0150 | 9 599E+14 |
| Am-241 | 2 5251E-03 | 6,516 25 | 13,032 50 | 0 00E+00 | 1 65E+01 | 3 29E+01 | 0 0250 | 1 993E+14 |
| Am-242m | 3 9624E-07 | 6,516 25 | 13,032 50 | 0 00E+00 | 2 58E-03 | 5.16E-03 | 0 0375 | 1 732E+14 |
| Am-243 | 1 4880E-06 | 6,516 25 | 13,032 50 | 0 00E+00 | 9 70E-03 | 1.94E-02 | 0 0575 | 1.865E+14 |
| C-14 | 5 7053E-09 | 6,516 25 | 13,032 50 | 0 00E+00 | 3 72E-05 | 7.44E-05 | 0 0850 | 1 124E+14 |
| Cl-36 | 1 3124E-32 | 6,516 25 | 13,032 50 | 0 00E+00 | 8 55E-29 | 1 71E-28 | 0 1250 | 7 421E+13 |
| Cm-243 | 1 1419E-07 | 6,516 25 | 13,032 50 | 0 00E+00 | 7 44E-04 | 1 49E-03 | 0.2250 | 9 700E+13 |
| Cm-244 | 1 6522E-05 | 6,516 25 | 13,032 50 | 0 00E+00 | 1 08E-01 | 2 15E-01 | 0 3750 | 4.220E+13 |
| Co-60 | 7 4047E-07 | 6,516 25 | 13,032 50 | 0 00E+00 | 4.83E-03 | 9 65E-03 | 0 5750 | 6.974E+14 |
| Cs-134 | 2 0455E-05 | 6,516 25 | 13,032 50 | 0 00E+00 | 1.33E-01 | 2 67E-01 | 0 8500 | 8.519E+12 |
| Cs-135 | 3 4477E-06 | 6,516 25 | 13,032 50 | 0 00E+00 | 2.25E-02 | 4 49E-02 | 1 2500 | 4 120E+12 |
| Cs-137 | 1 4365E+00 | 6,516 25 | 13,032 50 | 0 00E+00 | 9 36E+03 | 1 87E+04 | 1 7500 | 2 319E+11 |
| Eu-154 | 7.3230E-03 | 6,516 25 | 13,032 50 | 0 00E+00 | 4.77E+01 | 9 54E+01 | 2.2500 | 1 939E+07 |
| Eu-155 | 5 9259E-04 | 6,516 25 | 13,032 50 | 0 00E+00 | 3 86E+00 | 7 72E+00 | 2.7500 | 1 851E+07 |
| Fe-55 | 2.2791E-06 | 6,516 25 | 13,032 50 | 0 00E+00 | 1 49E-02 | 2 97E-02 | 3 5000 | 1 072E+04 |
| H-3 | 1 9698E-03 | 6,516 25 | 13,032 50 | 0 00E+00 | 1.28E+01 | 2 57E+01 | 5 0000 | 4 381E+03 |
| I-129 | 7.5300E-07 | 6,516 25 | 13,032 50 | 0 00E+00 | 4 91E-03 | 9 81E-03 | 7 0000 | 4 794E+02 |
| Kr-85 | 4 1176E-02 | 6,516 25 | 13,032 50 | 0 00E+00 | 2 68E+02 | 5 37E+02 | 11.0000 | 5 346E+01 |
| Np-237 | 9 5752E-06 | 6,516 25 | 13,032 50 | 0 00E+00 | 6 24E-02 | 1.25E-01 | | |
| Pa-231 | 3 9379E-09 | 6,516 25 | 13,032 50 | 0 00E+00 | 2 57E-05 | 5 13E-05 | | |
| Pb-210 | 3 3115E-10 | 6,516 25 | 13,032 50 | 0 00E+00 | 2 16E-06 | 4.32E-06 | | |
| Pm-147 | 9.2402E-04 | 6,516 25 | 13,032 50 | 0 00E+00 | 6 02E+00 | 1.20E+01 | | |
| Pu-238 | 1 6217E-02 | 6,516 25 | 13,032 50 | 0 00E+00 | 1 06E+02 | 2.11E+02 | | |
| Pu-239 | 4 2810E-04 | 6,516 25 | 13,032 50 | 0 00E+00 | 2 79E+00 | 5 58E+00 | | |
| Pu-240 | 2 4333E-04 | 6,516 25 | 13,032 50 | 0 00E+00 | 1.59E+00 | 3 17E+00 | | |
| Pu-241 | 1 6242E-02 | 6,516 25 | 13,032 50 | 0 00E+00 | 1 06E+02 | 2 12E+02 | | |
| Pu-242 | 3 6329E-07 | 6,516 25 | 13,032 50 | 0 00E+00 | 2.37E-03 | 4 73E-03 | | |
| Ra-226 | 9 0114E-10 | 6,516 25 | 13,032 50 | 0 00E+00 | 5 87E-06 | 1 17E-05 | | |
| Ra-228 | 3 1019E-14 | 6,516 25 | 13,032 50 | 0 00E+00 | 2 02E-10 | 4 04E-10 | | |
| Ru-106 | 2 1225E-10 | 6,516 25 | 13,032 50 | 0 00E+00 | 1.38E-06 | 2.77E-06 | | |
| Se-79 | 1.2930E-05 | 6,516 25 | 13,032 50 | 0 00E+00 | 8 43E-02 | 1.69E-01 | | |
| Sn-126 | 1 1571E-05 | 6,516 25 | 13,032 50 | 0 00E+00 | 7 54E-02 | 1.51E-01 | | |
| Sr-90 | 1.3472E+00 | 6,516 25 | 13,032 50 | 0 00E+00 | 8 78E+03 | 1.76E+04 | | |
| Tc-99 | 4.2239E-04 | 6,516 25 | 13,032 50 | 0 00E+00 | 2 75E+00 | 5.50E+00 | | |
| Th-229 | 1.2407E-11 | 6,516 25 | 13,032 50 | 0 00E+00 | 8 08E-08 | 1 62E-07 | | |
| Th-230 | 8.3497E-08 | 6,516 25 | 13,032 50 | 0 00E+00 | 5 44E-04 | 1 09E-03 | | |
| Th-232 | 3 8371E-14 | 6,516 25 | 13,032 50 | 0 00E+00 | 2.50E-10 | 5 00E-10 | | |
| Ti-208 | 4 0414E-08 | 6,516 25 | 13,032 50 | 0 00E+00 | 2 63E-04 | 5 27E-04 | | |
| U-232 | 1 0948E-07 | 6,516 25 | 13,032 50 | 0 00E+00 | 7.13E-04 | 1 43E-03 | | |
| U-233 | 3 6275E-09 | 6,516 25 | 13,032 50 | 0 00E+00 | 2.36E-05 | 4 73E-05 | | |
| U-234 | 1 8562E-04 | 6,516 25 | 13,032 50 | 0 00E+00 | 1.21E+00 | 2 42E+00 | | |
| U-235 | -2 7235E-06 | 6,516 25 | 0 00 | 4 70E-02 | 2.92E-02 | 4 70E-02 | | |
| U-236 | 1 5493E-05 | 6,516 25 | 13,032 50 | 0 00E+00 | 1 01E-01 | 2.02E-01 | | |
| U-238 | -4.2851E-09 | 6,516 25 | 0 00 | 5 63E-04 | 5 35E-04 | 5 63E-04 | | |
| Y-90 | 1 3475E+00 | 6,516 25 | 13,032 50 | 0 00E+00 | 8 78E+03 | 1.76E+04 | | |
| Other Radionuclides | | | | | 8 92E+03 | 1 78E+04 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences |
|----------------------------|-------------|-------------|---------------------------------|
| | From SFD | Used | |
| Reactor Moderator | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 92.84381755 | 60 to 100 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | | 6,516.25 | Nominal burnup calculated from the heavy metal mass destroyed. |
| Bounding | | 13 032.50 | Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 0.88 | | 1.02 |
| Bounding | 1.77 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRJ (UALX-HEU) GERMANY
SNF ID #: 933
Fuel Units & Descr: 195 - CONCENTRIC TUBES
Heavy Metal Mass: BOL=39 312kg, EOL=26 871kg
ROD Storage Site: SRS

¹Fuel decay start date: 1995
Estimates as of: 2030
Template: HFBR (Heavy Water, Alum, 40 to 100%, U)
²Template Burnup(MWd): 164 6
Template BOL Heavy Metal Mass (MT): 0 000377
Template Decay Time: 35 years

Estimated
Canister usage
18"x10"
5 42

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 9 5869E-10 | 11,459 44 | 22,918 88 | 0 00E+00 | 1 10E-05 | 2 20E-05 | Avg. MeV | |
| Am-241 | 1 0109E-02 | 11,459 44 | 22,918 88 | 0 00E+00 | 1.16E+02 | 2 32E+02 | 0 0150 | 1 693E+15 |
| Am-242m | 1 2789E-06 | 11,459 44 | 22,918 88 | 0 00E+00 | 1 47E-02 | 2 93E-02 | 0 0250 | 3 478E+14 |
| Am-243 | 3 7047E-05 | 11,459 44 | 22,918 88 | 0 00E+00 | 4.25E-01 | 8 49E-01 | 0 0375 | 3 049E+14 |
| C-14 | 2 6416E-08 | 11,459 44 | 22,918 88 | 0 00E+00 | 3 03E-04 | 6 05E-04 | 0 0575 | 3 280E+14 |
| Cl-36 | 4 4441E-31 | 11,459 44 | 22,918 88 | 0 00E+00 | 5 09E-27 | 1 02E-26 | 0 0850 | 1 963E+14 |
| Cm-243 | 3 9605E-06 | 11,459 44 | 22,918 88 | 0 00E+00 | 4.54E-02 | 9 08E-02 | 0 1250 | 1 324E+14 |
| Cm-244 | 2 6227E-03 | 11,459 44 | 22,918 88 | 0 00E+00 | 3 01E+01 | 6 01E+01 | 0 2250 | 1 696E+14 |
| Co-60 | 6 7740E-06 | 11,459 44 | 22,918 88 | 0 00E+00 | 7 76E-02 | 1 55E-01 | 0 3750 | 7.361E+13 |
| Cs-134 | 6 8894E-05 | 11,459 44 | 22,918 88 | 0 00E+00 | 7 89E-01 | 1 58E+00 | 0.5750 | 1.230E+15 |
| Cs-135 | 4 2564E-06 | 11,459 44 | 22,918 88 | 0 00E+00 | 4 88E-02 | 9 76E-02 | 0 8500 | 1 821E+13 |
| Cs-137 | 1 4399E+00 | 11,459 44 | 22,918 88 | 0 00E+00 | 1 65E+04 | 3 30E+04 | 1.2500 | 1 088E+13 |
| Eu-154 | 1 5522E-02 | 11,459 44 | 22,918 88 | 0 00E+00 | 1 78E+02 | 3 56E+02 | 1 7500 | 5 147E+11 |
| Eu-155 | 1 7588E-03 | 11,459 44 | 22,918 88 | 0 00E+00 | 2 02E+01 | 4 03E+01 | 2.2500 | 3.563E+07 |
| Fe-55 | 2 4933E-05 | 11,459 44 | 22,918 88 | 0 00E+00 | 2 86E-01 | 5 71E-01 | 2.7500 | 3.582E+07 |
| H-3 | 1 9945E-03 | 11,459 44 | 22,918 88 | 0 00E+00 | 2 29E+01 | 4 57E+01 | 3.5000 | 9.523E+05 |
| I-129 | 6 6403E-07 | 11,459 44 | 22,918 88 | 0 00E+00 | 7 61E-03 | 1.52E-02 | 5 0000 | 4 047E+05 |
| Kr-85 | 4 1002E-02 | 11,459 44 | 22,918 88 | 0 00E+00 | 4 70E+02 | 9 40E+02 | 7 0000 | 4 633E+04 |
| Np-237 | 3 1610E-05 | 11,459 44 | 22,918 88 | 0 00E+00 | 3 62E-01 | 7.24E-01 | 11 0000 | 5.302E+03 |
| Pa-231 | 1 8876E-09 | 11,459 44 | 22,918 88 | 0 00E+00 | 2 16E-05 | 4.33E-05 | | |
| Pb-210 | 8.3840E-11 | 11,459 44 | 22,918 88 | 0 00E+00 | 9 61E-07 | 1 92E-06 | | |
| Pm-147 | 4 6501E-04 | 11,459 44 | 22,918 88 | 0 00E+00 | 5 33E+00 | 1 07E+01 | | |
| Pu-238 | 1 3645E-01 | 11,459 44 | 22,918 88 | 0 00E+00 | 1 56E+03 | 3.13E+03 | | |
| Pu-239 | 6 9502E-04 | 11,459 44 | 22,918 88 | 0 00E+00 | 7 96E+00 | 1 59E+01 | | |
| Pu-240 | 3 8183E-04 | 11,459 44 | 22,918 88 | 0 00E+00 | 4 38E+00 | 8 75E+00 | | |
| Pu-241 | 6 5310E-02 | 11,459 44 | 22,918 88 | 0 00E+00 | 7.48E+02 | 1 50E+03 | | |
| Pu-242 | 3 0911E-06 | 11,459 44 | 22,918 88 | 0 00E+00 | 3 54E-02 | 7 08E-02 | | |
| Ra-226 | 2 3512E-10 | 11,459 44 | 22,918 88 | 0 00E+00 | 2 69E-06 | 5 39E-06 | | |
| Ra-228 | 3 3366E-14 | 11,459 44 | 22,918 88 | 0 00E+00 | 3 82E-10 | 7 65E-10 | | |
| Ru-106 | 2 4490E-10 | 11,459 44 | 22,918 88 | 0 00E+00 | 2 81E-06 | 5 61E-06 | | |
| Se-79 | 1 2333E-05 | 11,459 44 | 22,918 88 | 0 00E+00 | 1 41E-01 | 2 83E-01 | | |
| Sn-126 | 1 0194E-05 | 11,459 44 | 22,918 88 | 0 00E+00 | 1.17E-01 | 2 34E-01 | | |
| Sr-90 | 1 3348E+00 | 11,459 44 | 22,918 88 | 0 00E+00 | 1.53E+04 | 3 06E+04 | | |
| Tc-99 | 3 8056E-04 | 11,459 44 | 22,918 88 | 0 00E+00 | 4 36E+00 | 8 72E+00 | | |
| Th-229 | 1 7868E-11 | 11,459 44 | 22,918 88 | 0 00E+00 | 2.05E-07 | 4 10E-07 | | |
| Th-230 | 2 3348E-08 | 11,459 44 | 22,918 88 | 0 00E+00 | 2 68E-04 | 5 35E-04 | | |
| Th-232 | 4 1288E-14 | 11,459 44 | 22,918 88 | 0 00E+00 | 4.73E-10 | 9 46E-10 | | |
| Ti-208 | 4 3190E-08 | 11,459 44 | 22,918 88 | 0 00E+00 | 4.95E-04 | 9 90E-04 | | |
| U-232 | 1 1707E-07 | 11,459 44 | 22,918 88 | 0 00E+00 | 1.34E-03 | 2 68E-03 | | |
| U-233 | 7.2175E-09 | 11,459 44 | 22,918 88 | 0 00E+00 | 8.27E-05 | 1 65E-04 | | |
| U-234 | 6.1543E-05 | 11,459 44 | 22,918 88 | 0 00E+00 | 7 05E-01 | 1 41E+00 | | |
| U-235 | -2 8661E-06 | 11,459 44 | 0 00 | 6 79E-02 | 3 50E-02 | 6 79E-02 | | |
| U-236 | 1 6701E-05 | 11,459 44 | 22,918.88 | 0 00E+00 | 1 91E-01 | 3 83E-01 | | |
| U-238 | -9 4194E-09 | 11,459 44 | 0 00 | 2.66E-03 | 2 55E-03 | 2 66E-03 | | |
| Y-90 | 1.3348E+00 | 11,459 44 | 22,918 88 | 0 00E+00 | 1 53E+04 | 3 06E+04 | | |
| Other Radionuclides | | | | | 1 58E+04 | 3 16E+04 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-------------|-------------|
| Reactor Moderator: | HEAVY WATER | HEAVY WATER |
| Fuel Cladding | ALUM | ALUM |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 79 89992512 | 40 to 100 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|-----------|----------|-----------|
| Nominal | | 11 459 44 |
| Bounding: | | 22.918.88 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed.
Bounding burnup assumed to be twice nominal burnup.

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|-----------------------------------|
| Nominal | 0 67 | |
| Bounding | 1 34 | |

Estimated EOL HM/Given EOL HM

1 01

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name FRJ (UALX-MEU) GERMANY
SNF ID # 1000
Fuel Units & Descr 10 - CONCENTRIC TUBES
Heavy Metal Mass: BOL=3 781kg EOL=3 338kg
ROD Storage Site SRS

¹Fuel decay start date 1993
Estimates as of 2030
Template HFBR (Heavy Water, Alum, 40 to 100% U)
²Template Burnup(MWd) 164.6
Template BOL Heavy Metal Mass (MT) 0.000377
Template Decay Time 35 years

Estimated
Canister usage
18"x10"
0.28

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 9.5869E-10 | 408.05 | 816.10 | 0.00E+00 | 3.91E-07 | 7.82E-07 | Avg MeV | |
| Am-241 | 1.0109E-02 | 408.05 | 816.10 | 0.00E+00 | 4.13E+00 | 8.25E+00 | 0.0150 | 6.028E+13 |
| Am-242m | 1.2789E-06 | 408.05 | 816.10 | 0.00E+00 | 5.22E-04 | 1.04E-03 | 0.0250 | 1.239E+13 |
| Am-243 | 3.7047E-05 | 408.05 | 816.10 | 0.00E+00 | 1.51E-02 | 3.02E-02 | 0.0375 | 1.086E+13 |
| C-14 | 2.6416E-08 | 408.05 | 816.10 | 0.00E+00 | 1.08E-05 | 2.16E-05 | 0.0575 | 1.168E+13 |
| Ck-36 | 4.4441E-31 | 408.05 | 816.10 | 0.00E+00 | 1.81E-28 | 3.63E-28 | 0.0850 | 6.989E+12 |
| Cm-243 | 3.9605E-06 | 408.05 | 816.10 | 0.00E+00 | 1.62E-03 | 3.23E-03 | 0.1250 | 4.713E+12 |
| Cm-244 | 2.6227E-03 | 408.05 | 816.10 | 0.00E+00 | 1.07E+00 | 2.14E+00 | 0.2250 | 6.039E+12 |
| Co-60 | 6.7740E-06 | 408.05 | 816.10 | 0.00E+00 | 2.76E-03 | 5.53E-03 | 0.3750 | 2.621E+12 |
| Cs-134 | 6.8894E-05 | 408.05 | 816.10 | 0.00E+00 | 2.81E-02 | 5.62E-02 | 0.5750 | 4.378E+13 |
| Cs-135 | 4.2564E-06 | 408.05 | 816.10 | 0.00E+00 | 1.74E-03 | 3.47E-03 | 0.8500 | 6.484E+11 |
| Cs-137 | 1.4399E+00 | 408.05 | 816.10 | 0.00E+00 | 5.88E+02 | 1.18E+03 | 1.2500 | 3.874E+11 |
| Eu-154 | 1.5522E-02 | 408.05 | 816.10 | 0.00E+00 | 6.33E+00 | 1.27E+01 | 1.7500 | 1.833E+10 |
| Eu-155 | 1.7588E-03 | 408.05 | 816.10 | 0.00E+00 | 7.18E-01 | 1.44E+00 | 2.2500 | 1.269E+06 |
| Fe-55 | 2.4933E-05 | 408.05 | 816.10 | 0.00E+00 | 1.02E-02 | 2.03E-02 | 2.7500 | 1.275E+06 |
| H-3 | 1.9945E-03 | 408.05 | 816.10 | 0.00E+00 | 8.14E-01 | 1.63E+00 | 3.5000 | 3.391E+04 |
| I-129 | 6.6403E-07 | 408.05 | 816.10 | 0.00E+00 | 2.71E-04 | 5.42E-04 | 5.0000 | 1.441E+04 |
| Kr-85 | 4.1002E-02 | 408.05 | 816.10 | 0.00E+00 | 1.67E+01 | 3.35E+01 | 7.0000 | 1.650E+03 |
| Np-237 | 3.1610E-05 | 408.05 | 816.10 | 0.00E+00 | 1.29E-02 | 2.58E-02 | 11.0000 | 1.888E+02 |
| Pa-231 | 1.8876E-09 | 408.05 | 816.10 | 0.00E+00 | 7.70E-07 | 1.54E-06 | | |
| Pb-210 | 8.3840E-11 | 408.05 | 816.10 | 0.00E+00 | 3.42E-08 | 6.84E-08 | | |
| Pm-147 | 4.6501E-04 | 408.05 | 816.10 | 0.00E+00 | 1.90E-01 | 3.79E-01 | | |
| Pu-238 | 1.3645E-01 | 408.05 | 816.10 | 0.00E+00 | 5.57E+01 | 1.11E+02 | | |
| Pu-239 | 6.9502E-04 | 408.05 | 816.10 | 0.00E+00 | 2.84E-01 | 5.67E-01 | | |
| Pu-240 | 3.8183E-04 | 408.05 | 816.10 | 0.00E+00 | 1.56E-01 | 3.12E-01 | | |
| Pu-241 | 6.5310E-02 | 408.05 | 816.10 | 0.00E+00 | 2.66E+01 | 5.33E+01 | | |
| Pu-242 | 3.0911E-06 | 408.05 | 816.10 | 0.00E+00 | 1.26E-03 | 2.52E-03 | | |
| Ra-226 | 2.3512E-10 | 408.05 | 816.10 | 0.00E+00 | 9.59E-08 | 1.92E-07 | | |
| Ra-228 | 3.3366E-14 | 408.05 | 816.10 | 0.00E+00 | 1.36E-11 | 2.72E-11 | | |
| Ru-106 | 2.4490E-10 | 408.05 | 816.10 | 0.00E+00 | 9.99E-08 | 2.00E-07 | | |
| Se-79 | 1.2333E-05 | 408.05 | 816.10 | 0.00E+00 | 5.03E-03 | 1.01E-02 | | |
| Sn-126 | 1.0194E-05 | 408.05 | 816.10 | 0.00E+00 | 4.16E-03 | 8.32E-03 | | |
| Sr-90 | 1.3348E+00 | 408.05 | 816.10 | 0.00E+00 | 5.45E+02 | 1.09E+03 | | |
| Tc-99 | 3.8056E-04 | 408.05 | 816.10 | 0.00E+00 | 1.55E-01 | 3.11E-01 | | |
| Th-229 | 1.7868E-11 | 408.05 | 816.10 | 0.00E+00 | 7.29E-09 | 1.46E-08 | | |
| Th-230 | 2.3348E-08 | 408.05 | 816.10 | 0.00E+00 | 9.53E-06 | 1.91E-05 | | |
| Th-232 | 4.1288E-14 | 408.05 | 816.10 | 0.00E+00 | 1.68E-11 | 3.37E-11 | | |
| Th-208 | 4.3190E-08 | 408.05 | 816.10 | 0.00E+00 | 1.76E-05 | 3.52E-05 | | |
| U-232 | 1.1707E-07 | 408.05 | 816.10 | 0.00E+00 | 4.78E-05 | 9.55E-05 | | |
| U-233 | 7.2175E-09 | 408.05 | 816.10 | 0.00E+00 | 2.95E-06 | 5.89E-06 | | |
| U-234 | 6.1543E-05 | 408.05 | 816.10 | 0.00E+00 | 2.51E-02 | 5.02E-02 | | |
| U-235 | -2.8661E-06 | 408.05 | 0.00 | 3.67E-03 | 2.50E-03 | 3.67E-03 | | |
| U-236 | 1.6701E-05 | 408.05 | 816.10 | 0.00E+00 | 6.81E-03 | 1.36E-02 | | |
| U-238 | -9.4194E-09 | 408.05 | 0.00 | 7.00E-04 | 6.97E-04 | 7.00E-04 | | |
| Y-90 | 1.3348E+00 | 408.05 | 816.10 | 0.00E+00 | 5.45E+02 | 1.09E+03 | | |
| Other Radionuclides | | | | | 5.63E+02 | 1.13E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-------------------------|---------------------|----------------------------------|
| Reactor Moderator | From SFD HEAVY WATER | Used HEAVY WATER | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 44.88296013 | 40 to 100 | |

| Burnup Summary (MWd) ¹ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|---------------------|---|
| Nominal | From SFD | Estimated 408.05 | |
| Bounding | | 816.10 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|---------------------------|-----------------------------------|-------------------------------|
| Nominal | Burnup Multiplier 0.25 | Estimated Burnup/ Given Burnup | |
| Bounding | 0.49 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRJ TUBES (U308 LEU) GERMANY
 SNF ID #: 999
 Fuel Units & Descr: 3 - CONCENTRIC TUBES
 Heavy Metal Mass: BOL=3.038kg, EOL=3.008kg
 ROD Storage Site: SRS

¹Fuel decay start date, 1998
 Estimates as of 2030
 Template: HFBR (Heavy Water Alum, 10 to 20%, U)
²Template Burnup(MWd), 15
 Template BOL Heavy Metal Mass (MT)* 0.00034251
 Template Decay Time 25 years

Estimated
 Canister usage
 18"x10"
 0 13

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 1.4973E-09 | 28.23 | 56.46 | 0.00E+00 | 4.23E-08 | 8.45E-08 | Avg MeV | |
| Am-241 | 2.6120E-02 | 28.23 | 56.46 | 0.00E+00 | 7.37E-01 | 1.47E+00 | 0.0150 | 5.075E+12 |
| Am-242m | 8.7133E-06 | 28.23 | 56.46 | 0.00E+00 | 2.46E-04 | 4.92E-04 | 0.0250 | 1.053E+12 |
| Am-243 | 6.3980E-06 | 28.23 | 56.46 | 0.00E+00 | 1.81E-04 | 3.61E-04 | 0.0375 | 9.236E+11 |
| C-14 | 2.9600E-08 | 28.23 | 56.46 | 0.00E+00 | 8.36E-07 | 1.67E-06 | 0.0575 | 1.001E+12 |
| Cl-36 | 5.9507E-35 | 28.23 | 56.46 | 0.00E+00 | 1.68E-33 | 3.36E-33 | 0.0850 | 5.928E+11 |
| Cm-243 | 1.9560E-06 | 28.23 | 56.46 | 0.00E+00 | 5.52E-05 | 1.10E-04 | 0.1250 | 3.955E+11 |
| Cm-244 | 9.0867E-05 | 28.23 | 56.46 | 0.00E+00 | 2.57E-03 | 5.13E-03 | 0.2250 | 5.112E+11 |
| Co-60 | 8.4667E-06 | 28.23 | 56.46 | 0.00E+00 | 2.39E-04 | 4.78E-04 | 0.3750 | 2.222E+11 |
| Cs-134 | 3.9760E-04 | 28.23 | 56.46 | 0.00E+00 | 1.12E-02 | 2.24E-02 | 0.5750 | 3.788E+12 |
| Cs-135 | 4.8607E-06 | 28.23 | 56.46 | 0.00E+00 | 1.37E-04 | 2.74E-04 | 0.8500 | 5.049E+10 |
| Cs-137 | 1.8020E+00 | 28.23 | 56.46 | 0.00E+00 | 5.09E+01 | 1.02E+02 | 1.2500 | 2.731E+10 |
| Eu-154 | 1.3960E-02 | 28.23 | 56.46 | 0.00E+00 | 3.94E-01 | 7.88E-01 | 1.7500 | 1.386E+09 |
| Eu-155 | 2.0313E-03 | 28.23 | 56.46 | 0.00E+00 | 5.73E-02 | 1.15E-01 | 2.2500 | 1.035E+05 |
| Fe-55 | 3.7360E-04 | 28.23 | 56.46 | 0.00E+00 | 1.05E-02 | 2.11E-02 | 2.7500 | 1.491E+04 |
| H-3 | 3.5233E-03 | 28.23 | 56.46 | 0.00E+00 | 9.95E-02 | 1.99E-01 | 3.5000 | 2.861E+02 |
| I-129 | 7.1600E-07 | 28.23 | 56.46 | 0.00E+00 | 2.02E-05 | 4.04E-05 | 5.0000 | 1.136E+02 |
| Kr-85 | 7.4133E-02 | 28.23 | 56.46 | 0.00E+00 | 2.09E+00 | 4.19E+00 | 7.0000 | 1.283E+01 |
| Np-237 | 3.8020E-06 | 28.23 | 56.46 | 0.00E+00 | 1.07E-04 | 2.15E-04 | 11.0000 | 1.458E+00 |
| Pa-231 | 3.7020E-09 | 28.23 | 56.46 | 0.00E+00 | 1.05E-07 | 2.09E-07 | | |
| Pb-210 | 1.4067E-13 | 28.23 | 56.46 | 0.00E+00 | 3.97E-12 | 7.94E-12 | | |
| Pm-147 | 1.2360E-02 | 28.23 | 56.46 | 0.00E+00 | 3.49E-01 | 6.98E-01 | | |
| Pu-238 | 5.3133E-03 | 28.23 | 56.46 | 0.00E+00 | 1.50E-01 | 3.00E-01 | | |
| Pu-239 | 1.0313E-02 | 28.23 | 56.46 | 0.00E+00 | 2.91E-01 | 5.82E-01 | | |
| Pu-240 | 5.4153E-03 | 28.23 | 56.46 | 0.00E+00 | 1.53E-01 | 3.06E-01 | | |
| Pu-241 | 2.9540E-01 | 28.23 | 56.46 | 0.00E+00 | 8.34E+00 | 1.67E+01 | | |
| Pu-242 | 3.0713E-06 | 28.23 | 56.46 | 0.00E+00 | 8.67E-05 | 1.73E-04 | | |
| Ra-226 | 5.9440E-13 | 28.23 | 56.46 | 0.00E+00 | 1.68E-11 | 3.36E-11 | | |
| Ra-228 | 1.6733E-14 | 28.23 | 56.46 | 0.00E+00 | 4.72E-13 | 9.45E-13 | | |
| Ru-106 | 2.7233E-07 | 28.23 | 56.46 | 0.00E+00 | 7.69E-06 | 1.54E-05 | | |
| Se-79 | 1.2533E-05 | 28.23 | 56.46 | 0.00E+00 | 3.54E-04 | 7.08E-04 | | |
| Sn-126 | 1.1393E-05 | 28.23 | 56.46 | 0.00E+00 | 3.22E-04 | 6.43E-04 | | |
| Sr-90 | 1.6333E+00 | 28.23 | 56.46 | 0.00E+00 | 4.61E+01 | 9.22E+01 | | |
| Tc-99 | 4.3533E-04 | 28.23 | 56.46 | 0.00E+00 | 1.23E-02 | 2.46E-02 | | |
| Th-229 | 1.0827E-12 | 28.23 | 56.46 | 0.00E+00 | 3.06E-11 | 6.11E-11 | | |
| Th-230 | 1.0793E-10 | 28.23 | 56.46 | 0.00E+00 | 3.05E-09 | 6.09E-09 | | |
| Th-232 | 2.2773E-14 | 28.23 | 56.46 | 0.00E+00 | 6.43E-13 | 1.29E-12 | | |
| Ti-208 | 7.3067E-09 | 28.23 | 56.46 | 0.00E+00 | 2.06E-07 | 4.13E-07 | | |
| U-232 | 1.9833E-08 | 28.23 | 56.46 | 0.00E+00 | 5.60E-07 | 1.12E-06 | | |
| U-233 | 6.0453E-10 | 28.23 | 56.46 | 0.00E+00 | 1.71E-08 | 3.41E-08 | | |
| U-234 | 6.1000E-07 | 28.23 | 56.46 | 0.00E+00 | 1.72E-05 | 3.44E-05 | | |
| U-235 | -2.5335E-06 | 28.23 | 0.00 | 1.30E-03 | 1.22E-03 | 1.30E-03 | | |
| U-236 | 1.3000E-05 | 28.23 | 56.46 | 0.00E+00 | 3.67E-04 | 7.34E-04 | | |
| U-238 | -1.4207E-08 | 28.23 | 0.00 | 8.20E-04 | 8.19E-04 | 8.20E-04 | | |
| Y-90 | 1.6340E+00 | 28.23 | 56.46 | 0.00E+00 | 4.61E+01 | 9.23E+01 | | |
| Other Radionuclides | | | | | | | | |
| | | | | | | | Thermal Power | |
| | | | | | | | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| | | | | | | | 6.05E-01 | 1.21E+00 |
| | | | | | | | Total | Total |
| | | | | | | | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-------------|-------------|----------------------------------|
| Reactor Moderator | From SFD | Used | |
| | HEAVY WATER | HEAVY WATER | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19.73 | 10 to 20 | |

| Burnup Summary (MWd) ¹ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | 0.25 | 28.23 | |
| Bounding | | 56.46 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 0.21 | 113.31 | |
| Bounding | 0.42 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name FRM (UALX HEU 45%) GERMANY
SNF ID # 805
Fuel Units & Descr 50 - MTR TYPE
Heavy Metal Mass BOL=28 18kg EOL=23 47kg
ROD Storage Site SRS

¹Fuel decay start date 1995
Estimates as of 2030
Template ATR (Light Water, Alum, 60 to 100% U)
²Template Burnup(MWd) 367.2
Template BOL Heavy Metal Mass (MT) 0.00116689
Template Decay Time 35 years

Estimated
Canister usage:
18"x10"
2.08

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.0068E-09 | 4,460.46 | 8,920.92 | 0.00E+00 | 8.95E-06 | 1.79E-05 | Avg MeV | |
| Am-241 | 2.5251E-03 | 4,460.46 | 8,920.92 | 0.00E+00 | 1.13E+01 | 2.25E+01 | 0.0150 | 6.570E+14 |
| Am-242m | 3.9624E-07 | 4,460.46 | 8,920.92 | 0.00E+00 | 1.77E-03 | 3.53E-03 | 0.0250 | 1.364E+14 |
| Am-243 | 1.4880E-06 | 4,460.46 | 8,920.92 | 0.00E+00 | 6.64E-03 | 1.33E-02 | 0.0375 | 1.186E+14 |
| C-14 | 5.7053E-09 | 4,460.46 | 8,920.92 | 0.00E+00 | 2.54E-05 | 5.09E-05 | 0.0575 | 1.276E+14 |
| Cl-36 | 1.3124E-32 | 4,460.46 | 8,920.92 | 0.00E+00 | 5.85E-29 | 1.17E-28 | 0.0850 | 7.691E+13 |
| Cm-243 | 1.1419E-07 | 4,460.46 | 8,920.92 | 0.00E+00 | 5.09E-04 | 1.02E-03 | 0.1250 | 5.080E+13 |
| Cm-244 | 1.6522E-05 | 4,460.46 | 8,920.92 | 0.00E+00 | 7.37E-02 | 1.47E-01 | 0.2250 | 6.640E+13 |
| Co-60 | 7.4047E-07 | 4,460.46 | 8,920.92 | 0.00E+00 | 3.30E-03 | 6.61E-03 | 0.3750 | 2.889E+13 |
| Cs-134 | 2.0455E-05 | 4,460.46 | 8,920.92 | 0.00E+00 | 9.12E-02 | 1.82E-01 | 0.5750 | 4.774E+14 |
| Cs-135 | 3.4477E-06 | 4,460.46 | 8,920.92 | 0.00E+00 | 1.54E-02 | 3.08E-02 | 0.8500 | 5.831E+12 |
| Cs-137 | 1.4365E+00 | 4,460.46 | 8,920.92 | 0.00E+00 | 6.41E+03 | 1.28E+04 | 1.2500 | 2.820E+12 |
| Eu-154 | 7.3230E-03 | 4,460.46 | 8,920.92 | 0.00E+00 | 3.27E+01 | 6.53E+01 | 1.7500 | 1.587E+11 |
| Eu-155 | 5.9259E-04 | 4,460.46 | 8,920.92 | 0.00E+00 | 2.64E+00 | 5.29E+00 | 2.2500 | 1.327E+07 |
| Fe-55 | 2.2791E-06 | 4,460.46 | 8,920.92 | 0.00E+00 | 1.02E-02 | 2.03E-02 | 2.7500 | 1.267E+07 |
| H-3 | 1.9698E-03 | 4,460.46 | 8,920.92 | 0.00E+00 | 8.79E+00 | 1.76E+01 | 3.5000 | 7.365E+03 |
| I-129 | 7.5300E-07 | 4,460.46 | 8,920.92 | 0.00E+00 | 3.36E-03 | 6.72E-03 | 5.0000 | 3.010E+03 |
| Kr-85 | 4.1176E-02 | 4,460.46 | 8,920.92 | 0.00E+00 | 1.84E+02 | 3.67E+02 | 7.0000 | 3.294E+02 |
| Np-237 | 9.5752E-06 | 4,460.46 | 8,920.92 | 0.00E+00 | 4.27E-02 | 8.54E-02 | 11.0000 | 3.674E+01 |
| Pa-231 | 3.9379E-09 | 4,460.46 | 8,920.92 | 0.00E+00 | 1.76E-05 | 3.51E-05 | | |
| Pb-210 | 3.3115E-10 | 4,460.46 | 8,920.92 | 0.00E+00 | 1.48E-06 | 2.95E-06 | | |
| Pm-147 | 9.2402E-04 | 4,460.46 | 8,920.92 | 0.00E+00 | 4.12E+00 | 8.24E+00 | | |
| Pu-238 | 1.6217E-02 | 4,460.46 | 8,920.92 | 0.00E+00 | 7.23E+01 | 1.45E+02 | | |
| Pu-239 | 4.2810E-04 | 4,460.46 | 8,920.92 | 0.00E+00 | 1.91E+00 | 3.82E+00 | | |
| Pu-240 | 2.4333E-04 | 4,460.46 | 8,920.92 | 0.00E+00 | 1.09E+00 | 2.17E+00 | | |
| Pu-241 | 1.6242E-02 | 4,460.46 | 8,920.92 | 0.00E+00 | 7.24E+01 | 1.45E+02 | | |
| Pu-242 | 3.6329E-07 | 4,460.46 | 8,920.92 | 0.00E+00 | 1.62E-03 | 3.24E-03 | | |
| Ra-226 | 9.0114E-10 | 4,460.46 | 8,920.92 | 0.00E+00 | 4.02E-06 | 8.04E-06 | | |
| Ra-228 | 3.1019E-14 | 4,460.46 | 8,920.92 | 0.00E+00 | 1.38E-10 | 2.77E-10 | | |
| Ru-106 | 2.1225E-10 | 4,460.46 | 8,920.92 | 0.00E+00 | 9.47E-07 | 1.89E-06 | | |
| Se-79 | 1.2930E-05 | 4,460.46 | 8,920.92 | 0.00E+00 | 5.77E-02 | 1.15E-01 | | |
| Sn-126 | 1.1571E-05 | 4,460.46 | 8,920.92 | 0.00E+00 | 5.16E-02 | 1.03E-01 | | |
| Sr-90 | 1.3472E+00 | 4,460.46 | 8,920.92 | 0.00E+00 | 6.01E+03 | 1.20E+04 | | |
| Tc-99 | 4.2239E-04 | 4,460.46 | 8,920.92 | 0.00E+00 | 1.88E+00 | 3.77E+00 | | |
| Th-229 | 1.2407E-11 | 4,460.46 | 8,920.92 | 0.00E+00 | 5.53E-08 | 1.11E-07 | | |
| Th-230 | 8.3497E-08 | 4,460.46 | 8,920.92 | 0.00E+00 | 3.72E-04 | 7.45E-04 | | |
| Th-232 | 3.8371E-14 | 4,460.46 | 8,920.92 | 0.00E+00 | 1.71E-10 | 3.42E-10 | | |
| Th-208 | 4.0414E-08 | 4,460.46 | 8,920.92 | 0.00E+00 | 1.80E-04 | 3.61E-04 | | |
| U-232 | 1.0948E-07 | 4,460.46 | 8,920.92 | 0.00E+00 | 4.88E-04 | 9.77E-04 | | |
| U-233 | 3.6275E-09 | 4,460.46 | 8,920.92 | 0.00E+00 | 1.62E-05 | 3.24E-05 | | |
| U-234 | 1.8562E-04 | 4,460.46 | 8,920.92 | 0.00E+00 | 8.28E-01 | 1.66E+00 | | |
| U-235 | -2.7235E-06 | 4,460.46 | 0.00 | 2.74E-02 | 1.52E-02 | 2.74E-02 | | |
| U-236 | 1.5493E-05 | 4,460.46 | 8,920.92 | 0.00E+00 | 6.91E-02 | 1.38E-01 | | |
| U-238 | -4.2851E-09 | 4,460.46 | 0.00 | 5.21E-03 | 5.19E-03 | 5.21E-03 | | |
| Y-90 | 1.3475E+00 | 4,460.46 | 8,920.92 | 0.00E+00 | 6.01E+03 | 1.20E+04 | | |
| Other Radionuclides | | | | | 6.10E+03 | 1.22E+04 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| Reactor Moderator | From SFD | Used | Basis for Parameter Differences* |
|---------------------|-------------|-------------|----------------------------------|
| Fuel Cladding | LIGHT WATER | LIGHT WATER | |
| BOL HM Constituents | ALUM | ALUM | |
| BOL Enrichment % | U | U | |
| | 44.97952648 | 60 to 100 | |

Burnup Summary (MWd)¹

| | From SFD | Estimated | Basis for burnup used in estimate |
|----------|----------|-----------|-----------------------------------|
| Nominal | 686.61 | 4,460.46 | |
| Bounding | | 8,920.92 | |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0.50 | 6.50 | |
| Bounding | 1.01 | | |

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRM (UALX HEU) GERMANY
 SNF ID #: 806
 Fuel Units & Descr: 31 - MTR TYPE
 Heavy Metal Mass: BOL=6.395kg, EOL=3 171kg
 ROD Storage Site: SRS

¹Fuel decay start date: 1995
 Estimates as of: 2030
 Template: ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup(MWd): 367.2
 Template BOL Heavy Metal Mass (MT): 0 0016689
 Template Decay Time: 35 years

Estimated
 Canister usage:
 18"x10"
 1 29

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2 0068E-09 | 3,053 19 | 6,056 47 | 0 00E+00 | 6 13E-06 | 1 22E-05 | Avg MeV | |
| Am-241 | 2 5251E-03 | 3,053 19 | 6,056 47 | 0 00E+00 | 7 71E+00 | 1 53E+01 | 0 0150 | 4 461E+14 |
| Am-242m | 3 9624E-07 | 3,053 19 | 6,056 47 | 0 00E+00 | 1 21E-03 | 2 40E-03 | 0 0250 | 9 263E+13 |
| Am-243 | 1 4880E-06 | 3,053 19 | 6,056 47 | 0 00E+00 | 4 54E-03 | 9 01E-03 | 0 0375 | 8 051E+13 |
| C-14 | 5 7053E-09 | 3,053 19 | 6,056 47 | 0 00E+00 | 1 74E-05 | 3 46E-05 | 0 0575 | 8 666E+13 |
| Cl-38 | 1 3124E-32 | 3,053 19 | 6,056 47 | 0 00E+00 | 4 01E-29 | 7 95E-29 | 0 0850 | 5 221E+13 |
| Cm-243 | 1 1419E-07 | 3,053 19 | 6,056 47 | 0 00E+00 | 3 49E-04 | 6 92E-04 | 0 1250 | 3 449E+13 |
| Cm-244 | 1 6522E-05 | 3,053 19 | 6 056 47 | 0 00E+00 | 5 04E-02 | 1 00E-01 | 0 2250 | 4 508E+13 |
| Co-60 | 7 4047E-07 | 3,053 19 | 6 056 47 | 0 00E+00 | 2 26E-03 | 4 48E-03 | 0 3750 | 1 961E+13 |
| Cs-134 | 2 0455E-05 | 3,053 19 | 6,056 47 | 0 00E+00 | 6 25E-02 | 1 24E-01 | 0 5750 | 3 241E+14 |
| Cs-135 | 3 4477E-06 | 3,053 19 | 6,056 47 | 0 00E+00 | 1 05E-02 | 2 09E-02 | 0 8500 | 3 959E+12 |
| Cs-137 | 1 4365E+00 | 3,053 19 | 6,056 47 | 0 00E+00 | 4 39E+03 | 8 70E+03 | 1 2500 | 1 915E+12 |
| Eu-154 | 7 3230E-03 | 3,053 19 | 6,056 47 | 0 00E+00 | 2 24E+01 | 4 44E+01 | 1 7500 | 1 078E+11 |
| Eu-155 | 5 9259E-04 | 3,053 19 | 6,056 47 | 0 00E+00 | 1 81E+00 | 3 59E+00 | 2 2500 | 9 010E+06 |
| Fe-55 | 2 2791E-06 | 3,053 19 | 6,056 47 | 0 00E+00 | 6 96E-03 | 1 38E-02 | 2 7500 | 8 600E+06 |
| H-3 | 1 9698E-03 | 3,053 19 | 6,056 47 | 0 00E+00 | 6 01E+00 | 1 19E+01 | 3 5000 | 4 982E+03 |
| I-129 | 7 5300E-07 | 3,053 19 | 6,056 47 | 0 00E+00 | 2 30E-03 | 4 56E-03 | 5 0000 | 2 036E+03 |
| Kr-85 | 4 1176E-02 | 3,053 19 | 6,056 47 | 0 00E+00 | 1 26E+02 | 2 49E+02 | 7 0000 | 2 228E+02 |
| Np-237 | 9 5752E-06 | 3,053 19 | 6,056 47 | 0 00E+00 | 2 92E-02 | 5 80E-02 | 11 0000 | 2 484E+01 |
| Pa-231 | 3 9379E-09 | 3,053 19 | 6,056 47 | 0 00E+00 | 1 20E-05 | 2 38E-05 | | |
| Pb-210 | 3 3115E-10 | 3,053 19 | 6,056 47 | 0 00E+00 | 1 01E-06 | 2 01E-06 | | |
| Pm-147 | 9 2402E-04 | 3,053 19 | 6,056 47 | 0 00E+00 | 2 82E+00 | 5 60E+00 | | |
| Pu-238 | 1 6217E-02 | 3,053 19 | 6,056 47 | 0 00E+00 | 4 95E+01 | 9 82E+01 | | |
| Pu-239 | 4 2810E-04 | 3,053 19 | 6,056 47 | 0 00E+00 | 1 31E+00 | 2 59E+00 | | |
| Pu-240 | 2 4333E-04 | 3,053 19 | 6,056 47 | 0 00E+00 | 7 43E-01 | 1 47E+00 | | |
| Pu-241 | 1 6242E-02 | 3,053 19 | 6,056 47 | 0 00E+00 | 4 96E+01 | 9 84E+01 | | |
| Pu-242 | 3 6329E-07 | 3,053 19 | 6,056 47 | 0 00E+00 | 1 11E-03 | 2 20E-03 | | |
| Ra-226 | 9 0114E-10 | 3,053 19 | 6,056 47 | 0 00E+00 | 2 75E-06 | 5 46E-06 | | |
| Ra-228 | 3 1019E-14 | 3,053 19 | 6,056 47 | 0 00E+00 | 9 47E-11 | 1 88E-10 | | |
| Ru-106 | 2 1225E-10 | 3,053 19 | 6,056 47 | 0 00E+00 | 6 48E-07 | 1 29E-06 | | |
| Se-79 | 1 2930E-05 | 3,053 19 | 6,056 47 | 0 00E+00 | 3 95E-02 | 7 83E-02 | | |
| Sn-126 | 1 1571E-05 | 3,053 19 | 6,056 47 | 0 00E+00 | 3 53E-02 | 7 01E-02 | | |
| Sr-90 | 1 3472E+00 | 3,053 19 | 6,056 47 | 0 00E+00 | 4 11E+03 | 8 16E+03 | | |
| Tc-99 | 4 2239E-04 | 3,053 19 | 6,056 47 | 0 00E+00 | 1 29E+00 | 2 56E+00 | | |
| Th-229 | 1 2407E-11 | 3,053 19 | 6,056 47 | 0 00E+00 | 3 79E-08 | 7 51E-08 | | |
| Th-230 | 8 3497E-08 | 3,053 19 | 6,056 47 | 0 00E+00 | 2 55E-04 | 5 06E-04 | | |
| Th-232 | 3 8371E-14 | 3,053 19 | 6,056 47 | 0 00E+00 | 1 17E-10 | 2 32E-10 | | |
| Th-208 | 4 0414E-08 | 3,053 19 | 6,056 47 | 0 00E+00 | 1 23E-04 | 2 45E-04 | | |
| U-232 | 1 0948E-07 | 3,053 19 | 6 056 47 | 0 00E+00 | 3 34E-04 | 6 63E-04 | | |
| U-233 | 3 6275E-09 | 3,053 19 | 6,056 47 | 0 00E+00 | 1 11E-05 | 2 20E-05 | | |
| U-234 | 1 8562E-04 | 3,053 19 | 6,056 47 | 0 00E+00 | 5 67E-01 | 1 12E+00 | | |
| U-235 | -2 7235E-06 | 3,053 19 | 0 00 | 1 26E-02 | 4 28E-03 | 1 26E-02 | | |
| U-236 | 1 5493E-05 | 3,053 19 | 6,056 47 | 0 00E+00 | 4 73E-02 | 9 38E-02 | | |
| U-238 | -4 2851E-09 | 3,053 19 | 0 00 | 1 91E-04 | 1 78E-04 | 1 91E-04 | | |
| Y-90 | 1 3475E+00 | 3,053 19 | 6,056 47 | 0 00E+00 | 4 11E+03 | 8 16E+03 | | |
| Other Radionuclides | | | | | 4 18E+03 | 8 29E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-------------|-------------|----------------------------------|
| Reactor Moderator | From SFD | Used | |
| | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 91 10863593 | 60 to 100 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | | 3,053 19 | |
| Bounding | | 6 056 47 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup calculated assuming all BOL heavy metal burned. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|--------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 1 52 | | |
| Bounding | 3 01 | | 1 06 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name FRR ASTRA (U308-LEU) AUSTRIA
SNF ID # 556
Fuel Units & Descr 4 - MTR TYPE
Heavy Metal Mass BOL= , EOL=6 96kg
ROD Storage Site SRS

¹Fuel decay start date 2010
Estimates as of 2030
Template ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup(MWd). 367.2
Template BOL Heavy Metal Mass (MT): 0.00116689
Template Decay Time 20 years

Estimated
Canister usage:
18"x10"
0 11

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(CI) | Bounding Fuel Inventories(CI) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6.6313E-10 | 6,591.26 | 6,591.26 | 0.00E+00 | 4.37E-06 | 4.37E-06 | Avg MeV | |
| Am-241 | 2.0060E-03 | 6,591.26 | 6,591.26 | 0.00E+00 | 1.32E+01 | 1.32E+01 | 0.0150 | 6.958E+14 |
| Am-242m | 4.2429E-07 | 6,591.26 | 6,591.26 | 0.00E+00 | 2.80E-03 | 2.80E-03 | 0.0250 | 1.447E+14 |
| Am-243 | 1.4899E-06 | 6,591.26 | 6,591.26 | 0.00E+00 | 9.82E-03 | 9.82E-03 | 0.0375 | 1.262E+14 |
| C-14 | 5.7135E-09 | 6,591.26 | 6,591.26 | 0.00E+00 | 3.77E-05 | 3.77E-05 | 0.0575 | 1.352E+14 |
| Cl-36 | 1.3124E-32 | 6,591.26 | 6,591.26 | 0.00E+00 | 8.65E-29 | 8.65E-29 | 0.0850 | 8.168E+13 |
| Cm-243 | 1.6443E-07 | 6,591.26 | 6,591.26 | 0.00E+00 | 1.08E-03 | 1.08E-03 | 0.1250 | 5.527E+13 |
| Cm-244 | 2.9330E-05 | 6,591.26 | 6,591.26 | 0.00E+00 | 1.93E-01 | 1.93E-01 | 0.2250 | 7.048E+13 |
| Co-60 | 5.3186E-06 | 6,591.26 | 6,591.26 | 0.00E+00 | 3.51E-02 | 3.51E-02 | 0.3750 | 3.068E+13 |
| Cs-134 | 3.1563E-03 | 6,591.26 | 6,591.26 | 0.00E+00 | 2.08E+01 | 2.08E+01 | 0.5750 | 5.004E+14 |
| Cs-135 | 3.4477E-06 | 6,591.26 | 6,591.26 | 0.00E+00 | 2.27E-02 | 2.27E-02 | 0.8500 | 8.460E+12 |
| Cs-137 | 2.0313E+00 | 6,591.26 | 6,591.26 | 0.00E+00 | 1.34E+04 | 1.34E+04 | 1.2500 | 4.831E+12 |
| Eu-154 | 2.4513E-02 | 6,591.26 | 6,591.26 | 0.00E+00 | 1.62E+02 | 1.62E+02 | 1.7500 | 2.217E+11 |
| Eu-155 | 4.8175E-03 | 6,591.26 | 6,591.26 | 0.00E+00 | 3.18E+01 | 3.18E+01 | 2.2500 | 1.945E+07 |
| Fe-55 | 1.2397E-04 | 6,591.26 | 6,591.26 | 0.00E+00 | 8.17E-01 | 8.17E-01 | 2.7500 | 1.100E+07 |
| H-3 | 4.5697E-03 | 6,591.26 | 6,591.26 | 0.00E+00 | 3.01E+01 | 3.01E+01 | 3.5000 | 5.051E+04 |
| I-129 | 7.5300E-07 | 6,591.26 | 6,591.26 | 0.00E+00 | 4.96E-03 | 4.96E-03 | 5.0000 | 2.856E+03 |
| Kr-85 | 1.0850E-01 | 6,591.26 | 6,591.26 | 0.00E+00 | 7.15E+02 | 7.15E+02 | 7.0000 | 3.153E+02 |
| Np-237 | 9.5561E-06 | 6,591.26 | 6,591.26 | 0.00E+00 | 6.30E-02 | 6.30E-02 | 11.0000 | 3.534E+01 |
| Pa-231 | 2.0359E-09 | 6,591.26 | 6,591.26 | 0.00E+00 | 1.34E-05 | 1.34E-05 | | |
| Pb-210 | 4.9728E-11 | 6,591.26 | 6,591.26 | 0.00E+00 | 3.28E-07 | 3.28E-07 | | |
| Pm-147 | 4.8502E-02 | 6,591.26 | 6,591.26 | 0.00E+00 | 3.20E+02 | 3.20E+02 | | |
| Pu-238 | 1.8254E-02 | 6,591.26 | 6,591.26 | 0.00E+00 | 1.20E+02 | 1.20E+02 | | |
| Pu-239 | 4.2810E-04 | 6,591.26 | 6,591.26 | 0.00E+00 | 2.82E+00 | 2.82E+00 | | |
| Pu-240 | 2.4368E-04 | 6,591.26 | 6,591.26 | 0.00E+00 | 1.61E+00 | 1.61E+00 | | |
| Pu-241 | 3.3415E-02 | 6,591.26 | 6,591.26 | 0.00E+00 | 2.20E+02 | 2.20E+02 | | |
| Pu-242 | 3.6329E-07 | 6,591.26 | 6,591.26 | 0.00E+00 | 2.39E-03 | 2.39E-03 | | |
| Ra-226 | 2.2854E-10 | 6,591.26 | 6,591.26 | 0.00E+00 | 1.51E-06 | 1.51E-06 | | |
| Ra-228 | 1.2426E-14 | 6,591.26 | 6,591.26 | 0.00E+00 | 8.19E-11 | 8.19E-11 | | |
| Ru-106 | 6.3589E-06 | 6,591.26 | 6,591.26 | 0.00E+00 | 4.19E-02 | 4.19E-02 | | |
| Se-79 | 1.2933E-05 | 6,591.26 | 6,591.26 | 0.00E+00 | 8.52E-02 | 8.52E-02 | | |
| Sn-126 | 1.1574E-05 | 6,591.26 | 6,591.26 | 0.00E+00 | 7.63E-02 | 7.63E-02 | | |
| Sr-90 | 1.9248E+00 | 6,591.26 | 6,591.26 | 0.00E+00 | 1.27E+04 | 1.27E+04 | | |
| Tc-99 | 4.2239E-04 | 6,591.26 | 6,591.26 | 0.00E+00 | 2.78E+00 | 2.78E+00 | | |
| Th-229 | 5.0953E-12 | 6,591.26 | 6,591.26 | 0.00E+00 | 3.36E-08 | 3.36E-08 | | |
| Th-230 | 4.1885E-08 | 6,591.26 | 6,591.26 | 0.00E+00 | 2.76E-04 | 2.76E-04 | | |
| Th-232 | 1.9270E-14 | 6,591.26 | 6,591.26 | 0.00E+00 | 1.27E-10 | 1.27E-10 | | |
| Th-208 | 4.6024E-08 | 6,591.26 | 6,591.26 | 0.00E+00 | 3.03E-04 | 3.03E-04 | | |
| U-232 | 1.2582E-07 | 6,591.26 | 6,591.26 | 0.00E+00 | 8.29E-04 | 8.29E-04 | | |
| U-233 | 2.5825E-09 | 6,591.26 | 6,591.26 | 0.00E+00 | 1.70E-05 | 1.70E-05 | | |
| U-234 | 1.8450E-04 | 6,591.26 | 6,591.26 | 0.00E+00 | 1.22E+00 | 1.22E+00 | | |
| U-235 | -2.7235E-06 | 6,591.26 | 0.00 | 2.77E-02 | 9.76E-03 | 2.77E-02 | | |
| U-236 | 1.5493E-05 | 6,591.26 | 6,591.26 | 0.00E+00 | 1.02E-01 | 1.02E-01 | | |
| U-238 | -4.2851E-09 | 6,591.26 | 0.00 | 2.80E-04 | 2.52E-04 | 2.80E-04 | | |
| Y-90 | 1.9254E+00 | 6,591.26 | 6,591.26 | 0.00E+00 | 1.27E+04 | 1.27E+04 | | |
| Other Radionuclides | | | | | 1.27E+04 | 1.27E+04 | | |

Other Radionuclides

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences ¹ |
|---------------------|-------------|-------------|---|
| Reactor Moderator | LIGHT WATER | LIGHT WATER | This Template was used for the following reasons |
| Fuel Cladding | ALUM | ALUM | This fuel matches on all parameters except enrichment (unknown) |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | | 60 to 100 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate ² |
|----------|----------|-----------|--|
| Nominal | | 6,591.26 | Nominal burnup set equal to bounding burnup |
| Bounding | | 6,591.26 | Bounding burnup estimated by assuming BOL heavy metal mass was twice EOL |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 1.50 | | 1.02 |
| Bounding | 1.50 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRR ASTRA (U3Si2 LEU) AUSTRIA
SNF ID #: 515
Fuel Units & Descr: 49 - MTR TYPE
Heavy Metal Mass: BOL=78 4kg; EOL=74 602kg
ROD Storage Site: SRS

¹Fuel decay start date: 2010
Estimates as of: 2030
Template: ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup(MWd): 367 2
Template BOL Heavy Metal Mass (MT): 0 00116689
Template Decay Time: 20 years

Estimated
Canister usage:
18"x10"
2 04

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6 6313E-10 | 3,596 31 | 7,192 61 | 0 00E+00 | 2 38E-06 | 4 77E-06 | Avg. MeV | |
| Am-241 | 2 0060E-03 | 3,596 31 | 7,192 61 | 0 00E+00 | 7 21E+00 | 1 44E+01 | 0 0150 | 7.592E+14 |
| Am-242m | 4 2429E-07 | 3,596 31 | 7,192 61 | 0 00E+00 | 1 53E-03 | 3 05E-03 | 0 0250 | 1.579E+14 |
| Am-243 | 1 4899E-06 | 3,596 31 | 7,192 61 | 0 00E+00 | 5 36E-03 | 1 07E-02 | 0 0375 | 1.377E+14 |
| C-14 | 5 7135E-09 | 3,596 31 | 7,192 61 | 0 00E+00 | 2 05E-05 | 4 11E-05 | 0 0575 | 1 475E+14 |
| Cl-36 | 1 3124E-32 | 3,596 31 | 7,192 61 | 0 00E+00 | 4 72E-29 | 9 44E-29 | 0 0850 | 8.913E+13 |
| Cm-243 | 1 6443E-07 | 3,596 31 | 7,192 61 | 0 00E+00 | 5 91E-04 | 1 18E-03 | 0 1250 | 6.031E+13 |
| Cm-244 | 2 9330E-05 | 3,596 31 | 7,192 61 | 0 00E+00 | 1 05E-01 | 2 11E-01 | 0 2250 | 7 690E+13 |
| Co-60 | 5 3186E-06 | 3,596 31 | 7,192 61 | 0 00E+00 | 1 91E-02 | 3 83E-02 | 0 3750 | 3 348E+13 |
| Cs-134 | 3 1563E-03 | 3,596 31 | 7,192 61 | 0 00E+00 | 1 14E+01 | 2 27E+01 | 0 5750 | 5 461E+14 |
| Cs-135 | 3 4477E-06 | 3,596 31 | 7,192 61 | 0 00E+00 | 1 24E-02 | 2 48E-02 | 0 8500 | 9 232E+12 |
| Cs-137 | 2 0313E+00 | 3,596 31 | 7,192 61 | 0 00E+00 | 7 31E+03 | 1 46E+04 | 1 2500 | 5 272E+12 |
| Eu-154 | 2 4513E-02 | 3,596 31 | 7,192 61 | 0 00E+00 | 8 82E+01 | 1 76E+02 | 1 7500 | 2 420E+11 |
| Eu-155 | 4 8175E-03 | 3,596 31 | 7,192 61 | 0 00E+00 | 1 73E+01 | 3 47E+01 | 2 2500 | 2 122E+07 |
| Fe-55 | 1 2397E-04 | 3,596 31 | 7,192 61 | 0 00E+00 | 4 46E-01 | 8 92E-01 | 2 7500 | 1 200E+07 |
| H-3 | 4 5697E-03 | 3,596 31 | 7,192 61 | 0 00E+00 | 1 64E+01 | 3 29E+01 | 3 5000 | 5 525E+04 |
| I-129 | 7 5300E-07 | 3,596 31 | 7,192 61 | 0 00E+00 | 2 71E-03 | 5 42E-03 | 5 0000 | 3 171E+03 |
| Kr-85 | 1 0850E-01 | 3,596 31 | 7,192 61 | 0 00E+00 | 3 90E+02 | 7 80E+02 | 7 0000 | 3 503E+02 |
| Np-237 | 9 5561E-06 | 3,596 31 | 7,192 61 | 0 00E+00 | 3 44E-02 | 6 87E-02 | 11 0000 | 3 928E+01 |
| Pa-231 | 2 0359E-09 | 3,596 31 | 7,192 61 | 0 00E+00 | 7 32E-06 | 1 46E-05 | | |
| Pb-210 | 4 9728E-11 | 3,596 31 | 7,192 61 | 0 00E+00 | 1 79E-07 | 3 58E-07 | | |
| Pm-147 | 4 8502E-02 | 3,596 31 | 7,192 61 | 0 00E+00 | 1 74E+02 | 3 49E+02 | | |
| Pu-238 | 1 8254E-02 | 3,596 31 | 7,192 61 | 0 00E+00 | 6 56E+01 | 1 31E+02 | | |
| Pu-239 | 4 2810E-04 | 3,596 31 | 7,192 61 | 0 00E+00 | 1 54E+00 | 3 08E+00 | | |
| Pu-240 | 2 4368E-04 | 3,596 31 | 7,192 61 | 0 00E+00 | 8 76E-01 | 1 75E+00 | | |
| Pu-241 | 3 3415E-02 | 3,596 31 | 7,192 61 | 0 00E+00 | 1 20E+02 | 2 40E+02 | | |
| Pu-242 | 3 6329E-07 | 3,596 31 | 7,192 61 | 0 00E+00 | 1 31E-03 | 2 61E-03 | | |
| Ra-226 | 2 2854E-10 | 3,596 31 | 7,192 61 | 0 00E+00 | 8 22E-07 | 1 64E-06 | | |
| Ra-228 | 1 2426E-14 | 3,596 31 | 7,192 61 | 0 00E+00 | 4 47E-11 | 8 94E-11 | | |
| Ru-106 | 6 3589E-06 | 3,596 31 | 7,192 61 | 0 00E+00 | 2 29E-02 | 4 57E-02 | | |
| Se-79 | 1 2933E-05 | 3,596 31 | 7,192 61 | 0 00E+00 | 4 65E-02 | 9 30E-02 | | |
| Sn-126 | 1 1574E-05 | 3,596 31 | 7,192 61 | 0 00E+00 | 4 16E-02 | 8 32E-02 | | |
| Sr-90 | 1 9248E+00 | 3,596 31 | 7,192 61 | 0 00E+00 | 6 92E+03 | 1 38E+04 | | |
| Tc-99 | 4 2239E-04 | 3,596 31 | 7,192 61 | 0 00E+00 | 1 52E+00 | 3 04E+00 | | |
| Th-229 | 5 0953E-12 | 3,596 31 | 7,192 61 | 0 00E+00 | 1 83E-08 | 3 66E-08 | | |
| Th-230 | 4 1885E-08 | 3,596 31 | 7,192 61 | 0 00E+00 | 1 51E-04 | 3 01E-04 | | |
| Th-232 | 1 9270E-14 | 3,596 31 | 7,192 61 | 0 00E+00 | 6 93E-11 | 1 39E-10 | | |
| Ti-208 | 4 6024E-08 | 3,596 31 | 7,192 61 | 0 00E+00 | 1 66E-04 | 3 31E-04 | | |
| U-232 | 1 2582E-07 | 3,596 31 | 7,192 61 | 0 00E+00 | 4 52E-04 | 9 05E-04 | | |
| U-233 | 2 5825E-09 | 3,596 31 | 7,192 61 | 0 00E+00 | 9 29E-06 | 1 86E-05 | | |
| U-234 | 1 8450E-04 | 3,596 31 | 7,192 61 | 0 00E+00 | 6 64E-01 | 1 33E+00 | | |
| U-235 | -2 7235E-06 | 3,596 31 | 0 00 | 1 43E-02 | 4 50E-03 | 1 43E-02 | | |
| U-236 | 1 5493E-05 | 3,596 31 | 7,192 61 | 0 00E+00 | 5 57E-02 | 1 11E-01 | | |
| U-238 | -4 2851E-09 | 3,596 31 | 0 00 | 2 41E-02 | 2 41E-02 | 2 41E-02 | | |
| Y-90 | 1 9254E+00 | 3,596 31 | 7,192 61 | 0 00E+00 | 6 92E+03 | 1 38E+04 | | |
| Other Radionuclides | | | | | 6 96E+03 | 1 39E+04 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| Reactor Moderator: | From SFD | Used | Basis for Parameter Differences: This Template was used for the following reasons. This fuel matches on all parameters except enrichment. |
|---------------------|-------------|-------------|---|
| Fuel Cladding | LIGHT WATER | LIGHT WATER | |
| BOL HM Constituents | ALUM | ALUM | |
| BOL Enrichment % | U | U | |
| | 8 4375 | 60 to 100 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup. |
|----------|----------|-----------|--|
| Nominal | | 3,596 31 | |
| Bounding | | 7,192 61 | |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0 15 | | |
| Bounding | 0 29 | | 1 00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRR ASTRA (UALX-HEU) AUSTRIA
 SNF ID #: 654
 Fuel Units & Descr: 2 - MTR TYPE
 Heavy Metal Mass: BOL=0.14kg EOL=0.12kg
 ROD Storage Site: SRS

¹Fuel decay start date: 2010
 Estimates as of: 2030
 Template: ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup (MWd): 367.2
 Template BOL Heavy Metal Mass (MT): 0.00116689
 Template Decay Time: 20 years

Estimated
 Canister usage
 18"x10"
 0.08

| II. Estimates | m | X _a | X _b | b | Y _a | Y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|---------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6.6313E-10 | 18.94 | 37.88 | 0.00E+00 | 1.26E-08 | 2.51E-08 | Avg MeV | |
| Am-241 | 2.0060E-03 | 18.94 | 37.88 | 0.00E+00 | 3.80E-02 | 7.60E-02 | 0.0150 | 3.999E+12 |
| Am-242m | 4.2429E-07 | 18.94 | 37.88 | 0.00E+00 | 8.04E-06 | 1.61E-05 | 0.0250 | 8.315E+11 |
| Am-243 | 1.4899E-06 | 18.94 | 37.88 | 0.00E+00 | 2.82E-05 | 5.64E-05 | 0.0375 | 7.253E+11 |
| C-14 | 5.7135E-09 | 18.94 | 37.88 | 0.00E+00 | 1.08E-07 | 2.16E-07 | 0.0575 | 7.768E+11 |
| Cl-36 | 1.3124E-32 | 18.94 | 37.88 | 0.00E+00 | 2.49E-31 | 4.97E-31 | 0.0850 | 4.694E+11 |
| Cm-243 | 1.6443E-07 | 18.94 | 37.88 | 0.00E+00 | 3.11E-06 | 6.23E-06 | 0.1250 | 3.176E+11 |
| Cm-244 | 2.9330E-05 | 18.94 | 37.88 | 0.00E+00 | 5.56E-04 | 1.11E-03 | 0.2250 | 4.050E+11 |
| Co-60 | 5.3186E-06 | 18.94 | 37.88 | 0.00E+00 | 1.01E-04 | 2.01E-04 | 0.3750 | 1.763E+11 |
| Cs-134 | 3.1563E-03 | 18.94 | 37.88 | 0.00E+00 | 5.98E-02 | 1.20E-01 | 0.5750 | 2.876E+12 |
| Cs-135 | 3.4477E-06 | 18.94 | 37.88 | 0.00E+00 | 6.53E-05 | 1.31E-04 | 0.8500 | 4.862E+10 |
| Cs-137 | 2.0313E+00 | 18.94 | 37.88 | 0.00E+00 | 3.85E+01 | 7.69E+01 | 1.2500 | 2.776E+10 |
| Eu-154 | 2.4513E-02 | 18.94 | 37.88 | 0.00E+00 | 4.64E-01 | 9.29E-01 | 1.7500 | 1.274E+09 |
| Eu-155 | 4.8175E-03 | 18.94 | 37.88 | 0.00E+00 | 9.12E-02 | 1.82E-01 | 2.2500 | 1.118E+05 |
| Fe-55 | 1.2397E-04 | 18.94 | 37.88 | 0.00E+00 | 2.35E-03 | 4.70E-03 | 2.7500 | 6.320E+04 |
| H-3 | 4.5697E-03 | 18.94 | 37.88 | 0.00E+00 | 8.66E-02 | 1.73E-01 | 3.5000 | 2.903E+02 |
| I-129 | 7.5300E-07 | 18.94 | 37.88 | 0.00E+00 | 1.43E-05 | 2.85E-05 | 5.0000 | 1.642E+01 |
| Kr-85 | 1.0850E-01 | 18.94 | 37.88 | 0.00E+00 | 2.05E+00 | 4.11E+00 | 7.0000 | 1.813E+00 |
| Np-237 | 9.5561E-06 | 18.94 | 37.88 | 0.00E+00 | 1.81E-04 | 3.62E-04 | 11.0000 | 2.032E-01 |
| Pa-231 | 2.0359E-09 | 18.94 | 37.88 | 0.00E+00 | 3.86E-08 | 7.71E-08 | | |
| Pb-210 | 4.9728E-11 | 18.94 | 37.88 | 0.00E+00 | 9.42E-10 | 1.88E-09 | | |
| Pm-147 | 4.8502E-02 | 18.94 | 37.88 | 0.00E+00 | 9.19E-01 | 1.84E+00 | | |
| Pu-238 | 1.8254E-02 | 18.94 | 37.88 | 0.00E+00 | 3.46E-01 | 6.91E-01 | | |
| Pu-239 | 4.2810E-04 | 18.94 | 37.88 | 0.00E+00 | 8.11E-03 | 1.62E-02 | | |
| Pu-240 | 2.4368E-04 | 18.94 | 37.88 | 0.00E+00 | 4.62E-03 | 9.23E-03 | | |
| Pu-241 | 3.3415E-02 | 18.94 | 37.88 | 0.00E+00 | 6.33E-01 | 1.27E+00 | | |
| Pu-242 | 3.6329E-07 | 18.94 | 37.88 | 0.00E+00 | 6.88E-06 | 1.38E-05 | | |
| Ra-226 | 2.2854E-10 | 18.94 | 37.88 | 0.00E+00 | 4.33E-09 | 8.66E-09 | | |
| Ra-228 | 1.2426E-14 | 18.94 | 37.88 | 0.00E+00 | 2.35E-13 | 4.71E-13 | | |
| Ru-106 | 6.3589E-06 | 18.94 | 37.88 | 0.00E+00 | 1.20E-04 | 2.41E-04 | | |
| Se-79 | 1.2933E-05 | 18.94 | 37.88 | 0.00E+00 | 2.45E-04 | 4.90E-04 | | |
| Sn-126 | 1.1574E-05 | 18.94 | 37.88 | 0.00E+00 | 2.19E-04 | 4.38E-04 | | |
| Sr-90 | 1.9248E+00 | 18.94 | 37.88 | 0.00E+00 | 3.65E+01 | 7.29E+01 | | |
| Tc-99 | 4.2239E-04 | 18.94 | 37.88 | 0.00E+00 | 8.00E-03 | 1.60E-02 | | |
| Th-229 | 5.0953E-12 | 18.94 | 37.88 | 0.00E+00 | 9.65E-11 | 1.93E-10 | | |
| Th-230 | 4.1885E-08 | 18.94 | 37.88 | 0.00E+00 | 7.93E-07 | 1.59E-06 | | |
| Th-232 | 1.9270E-14 | 18.94 | 37.88 | 0.00E+00 | 3.65E-13 | 7.30E-13 | | |
| Th-208 | 4.6024E-08 | 18.94 | 37.88 | 0.00E+00 | 8.72E-07 | 1.74E-06 | | |
| U-232 | 1.2582E-07 | 18.94 | 37.88 | 0.00E+00 | 2.38E-06 | 4.77E-06 | | |
| U-233 | 2.5825E-09 | 18.94 | 37.88 | 0.00E+00 | 4.89E-08 | 9.78E-08 | | |
| U-234 | 1.8450E-04 | 18.94 | 37.88 | 0.00E+00 | 3.49E-03 | 6.99E-03 | | |
| U-235 | -2.7235E-06 | 18.94 | 0.00 | 2.82E-04 | 2.30E-04 | 2.82E-04 | | |
| U-236 | 1.5493E-05 | 18.94 | 37.88 | 0.00E+00 | 2.93E-04 | 5.87E-04 | | |
| U-238 | -4.2851E-09 | 18.94 | 0.00 | 3.22E-06 | 3.14E-06 | 3.22E-06 | | |
| Y-90 | 1.9254E+00 | 18.94 | 37.88 | 0.00E+00 | 3.65E+01 | 7.29E+01 | | |
| Other Radionuclides | | | | | 3.66E+01 | 7.33E+01 | | |

Other Radionuclides

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences: |
|---------------------|-------------|-------------|----------------------------------|
| Reactor Moderator: | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding: | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 93.15 | 60 to 100 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|----------|-----------|--|
| Nominal | | 18.94 | |
| Bounding | | 37.88 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0.43 | | |
| Bounding | 0.86 | | 1.01 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRR ASTRA (UALX-HEU) AUSTRIA
SNF ID #: 738
Fuel Units & Descr: 14 - MTR TYPE
Heavy Metal Mass: BOL=5.6kg, EOL=4.858kg
ROD Storage Site: SRS

¹Fuel decay start date: 2010
Estimates as of: 2030
Template: ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup(MWd): 367.2
Template BOL Heavy Metal Mass (MT): 0.00116689
Template Decay Time: 20 years

Estimated
Canister usage:
18"x10"
0.58

II. Estimates

| | m | X _n | X _b | b | Y _n | Y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6.6313E-10 | 702.69 | 1,405.38 | 0.00E+00 | 4.66E-07 | 9.32E-07 | Avg. MeV | |
| Am-241 | 2.0060E-03 | 702.69 | 1,405.38 | 0.00E+00 | 1.41E+00 | 2.82E+00 | 0.0150 | 1.484E+14 |
| Am-242m | 4.2429E-07 | 702.69 | 1,405.38 | 0.00E+00 | 2.98E-04 | 5.96E-04 | 0.0250 | 3.085E+13 |
| Am-243 | 1.4899E-06 | 702.69 | 1,405.38 | 0.00E+00 | 1.05E-03 | 2.09E-03 | 0.0375 | 2.691E+13 |
| C-14 | 5.7135E-09 | 702.69 | 1,405.38 | 0.00E+00 | 4.01E-06 | 8.03E-06 | 0.0575 | 2.882E+13 |
| Cl-36 | 1.3124E-32 | 702.69 | 1,405.38 | 0.00E+00 | 9.22E-30 | 1.84E-29 | 0.0850 | 1.741E+13 |
| Cm-243 | 1.6443E-07 | 702.69 | 1,405.38 | 0.00E+00 | 1.16E-04 | 2.31E-04 | 0.1250 | 1.178E+13 |
| Cm-244 | 2.9330E-05 | 702.69 | 1,405.38 | 0.00E+00 | 2.06E-02 | 4.12E-02 | 0.2250 | 1.503E+13 |
| Co-60 | 5.3186E-06 | 702.69 | 1,405.38 | 0.00E+00 | 3.74E-03 | 7.47E-03 | 0.3750 | 6.541E+12 |
| Cs-134 | 3.1563E-03 | 702.69 | 1,405.38 | 0.00E+00 | 2.22E+00 | 4.44E+00 | 0.5750 | 1.067E+14 |
| Cs-135 | 3.4477E-06 | 702.69 | 1,405.38 | 0.00E+00 | 2.42E-03 | 4.85E-03 | 0.8500 | 1.804E+12 |
| Cs-137 | 2.0313E+00 | 702.69 | 1,405.38 | 0.00E+00 | 1.43E+03 | 2.85E+03 | 1.2500 | 1.030E+12 |
| Eu-154 | 2.4513E-02 | 702.69 | 1,405.38 | 0.00E+00 | 1.72E+01 | 3.44E+01 | 1.7500 | 4.728E+10 |
| Eu-155 | 4.8175E-03 | 702.69 | 1,405.38 | 0.00E+00 | 3.39E+00 | 6.77E+00 | 2.2500 | 4.147E+06 |
| Fe-55 | 1.2397E-04 | 702.69 | 1,405.38 | 0.00E+00 | 8.71E-02 | 1.74E-01 | 2.7500 | 2.345E+06 |
| H-3 | 4.5697E-03 | 702.69 | 1,405.38 | 0.00E+00 | 3.21E+00 | 6.42E+00 | 3.5000 | 1.077E+04 |
| I-129 | 7.5300E-07 | 702.69 | 1,405.38 | 0.00E+00 | 5.29E-04 | 1.06E-03 | 5.0000 | 6.092E+02 |
| Kr-85 | 1.0850E-01 | 702.69 | 1,405.38 | 0.00E+00 | 7.62E+01 | 1.52E+02 | 7.0000 | 6.725E+01 |
| Np-237 | 9.5581E-06 | 702.69 | 1,405.38 | 0.00E+00 | 6.71E-03 | 1.34E-02 | 11.0000 | 7.537E+00 |
| Pa-231 | 2.0359E-09 | 702.69 | 1,405.38 | 0.00E+00 | 1.43E-06 | 2.86E-06 | | |
| Pb-210 | 4.9728E-11 | 702.69 | 1,405.38 | 0.00E+00 | 3.49E-08 | 6.99E-08 | | |
| Pm-147 | 4.8502E-02 | 702.69 | 1,405.38 | 0.00E+00 | 3.41E+01 | 6.82E+01 | | |
| Pu-238 | 1.8254E-02 | 702.69 | 1,405.38 | 0.00E+00 | 1.28E+01 | 2.57E+01 | | |
| Pu-239 | 4.2810E-04 | 702.69 | 1,405.38 | 0.00E+00 | 3.01E-01 | 6.02E-01 | | |
| Pu-240 | 2.4368E-04 | 702.69 | 1,405.38 | 0.00E+00 | 1.71E-01 | 3.42E-01 | | |
| Pu-241 | 3.3415E-02 | 702.69 | 1,405.38 | 0.00E+00 | 2.35E+01 | 4.70E+01 | | |
| Pu-242 | 3.6329E-07 | 702.69 | 1,405.38 | 0.00E+00 | 2.55E-04 | 5.11E-04 | | |
| Ra-226 | 2.2854E-10 | 702.69 | 1,405.38 | 0.00E+00 | 1.61E-07 | 3.21E-07 | | |
| Ra-228 | 1.2426E-14 | 702.69 | 1,405.38 | 0.00E+00 | 8.73E-12 | 1.75E-11 | | |
| Ru-106 | 6.3589E-06 | 702.69 | 1,405.38 | 0.00E+00 | 4.47E-03 | 8.94E-03 | | |
| Se-79 | 1.2933E-05 | 702.69 | 1,405.38 | 0.00E+00 | 9.09E-03 | 1.82E-02 | | |
| Sn-126 | 1.1574E-05 | 702.69 | 1,405.38 | 0.00E+00 | 8.13E-03 | 1.63E-02 | | |
| Sr-90 | 1.9248E+00 | 702.69 | 1,405.38 | 0.00E+00 | 1.35E+03 | 2.71E+03 | | |
| Tc-99 | 4.2239E-04 | 702.69 | 1,405.38 | 0.00E+00 | 2.97E-01 | 5.94E-01 | | |
| Th-229 | 5.0953E-12 | 702.69 | 1,405.38 | 0.00E+00 | 3.58E-09 | 7.16E-09 | | |
| Th-230 | 4.1885E-08 | 702.69 | 1,405.38 | 0.00E+00 | 2.94E-05 | 5.89E-05 | | |
| Th-232 | 1.9270E-14 | 702.69 | 1,405.38 | 0.00E+00 | 1.35E-11 | 2.71E-11 | | |
| Th-208 | 4.6024E-08 | 702.69 | 1,405.38 | 0.00E+00 | 3.23E-05 | 6.47E-05 | | |
| U-232 | 1.2582E-07 | 702.69 | 1,405.38 | 0.00E+00 | 8.84E-05 | 1.77E-04 | | |
| U-233 | 2.5825E-09 | 702.69 | 1,405.38 | 0.00E+00 | 1.81E-06 | 3.63E-06 | | |
| U-234 | 1.8450E-04 | 702.69 | 1,405.38 | 0.00E+00 | 1.30E-01 | 2.59E-01 | | |
| U-235 | 2.7235E-06 | 702.69 | 0.00 | 1.13E-02 | 9.36E-03 | 1.13E-02 | | |
| U-236 | 1.5493E-05 | 702.69 | 1,405.38 | 0.00E+00 | 1.09E-02 | 2.18E-02 | | |
| U-238 | 4.2851E-09 | 702.69 | 0.00 | 1.29E-04 | 1.26E-04 | 1.29E-04 | | |
| Y-90 | 1.9254E+00 | 702.69 | 1,405.38 | 0.00E+00 | 1.35E+03 | 2.71E+03 | | |
| Other Radionuclides | | | | | 1.36E+03 | 2.72E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences: |
|---------------------|-------------|-------------|----------------------------------|
| Reactor Moderator | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 93.15 | 60 to 100 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|----------|-----------|------------------------------------|
| Nominal | | 702.69 | |
| Bounding | | 1,405.38 | |

Nominal burnup calculated from the heavy metal mass destroyed.
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0.40 | | |
| Bounding | 0.80 | | |

1.01

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name FRR FMRB (GERMANY)
SNF ID # 1066
Fuel Units & Descr 18 - MTR TYPE
Heavy Metal Mass BOL=2.57kg EOL=2.282kg
ROD Storage Site SRS

¹Fuel decay start date 1994
Estimates as of 2030
Template ATR (Light Water Alum, 60 to 100%, U)
²Template Burnup(MWd) 367.2
Template BOL Heavy Metal Mass (MT) 0.00116689
Template Decay Time 35 years

Estimated
Canister usage
18"x10"
0.75

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.0068E-09 | 272.74 | 545.48 | 0.00E+00 | 5.47E-07 | 1.09E-06 | Avg MeV | |
| Am-241 | 2.5251E-03 | 272.74 | 545.48 | 0.00E+00 | 6.89E-01 | 1.38E+00 | 0.0150 | 4.018E+13 |
| Am-242m | 3.9624E-07 | 272.74 | 545.48 | 0.00E+00 | 1.08E-04 | 2.16E-04 | 0.0250 | 8.342E+12 |
| Am-243 | 1.4880E-06 | 272.74 | 545.48 | 0.00E+00 | 4.06E-04 | 8.12E-04 | 0.0375 | 7.251E+12 |
| C-14 | 5.7053E-09 | 272.74 | 545.48 | 0.00E+00 | 1.56E-06 | 3.11E-06 | 0.0575 | 7.805E+12 |
| Cl-36 | 1.3124E-32 | 272.74 | 545.48 | 0.00E+00 | 3.58E-30 | 7.16E-30 | 0.0850 | 4.703E+12 |
| Cm-243 | 1.1419E-07 | 272.74 | 545.48 | 0.00E+00 | 3.11E-05 | 6.23E-05 | 0.1250 | 3.106E+12 |
| Cm-244 | 1.6522E-05 | 272.74 | 545.48 | 0.00E+00 | 4.51E-03 | 9.01E-03 | 0.2250 | 4.060E+12 |
| Co-60 | 7.4047E-07 | 272.74 | 545.48 | 0.00E+00 | 2.02E-04 | 4.04E-04 | 0.3750 | 1.766E+12 |
| Cs-134 | 2.0455E-05 | 272.74 | 545.48 | 0.00E+00 | 5.58E-03 | 1.12E-02 | 0.5750 | 2.919E+13 |
| Cs-135 | 3.4477E-06 | 272.74 | 545.48 | 0.00E+00 | 9.40E-04 | 1.88E-03 | 0.8500 | 3.566E+11 |
| Cs-137 | 1.4365E+00 | 272.74 | 545.48 | 0.00E+00 | 3.92E+02 | 7.84E+02 | 1.2500 | 1.725E+11 |
| Eu-154 | 7.3230E-03 | 272.74 | 545.48 | 0.00E+00 | 2.00E+00 | 3.99E+00 | 1.7500 | 9.706E+09 |
| Eu-155 | 5.9259E-04 | 272.74 | 545.48 | 0.00E+00 | 1.62E-01 | 3.23E-01 | 2.2500 | 8.115E+05 |
| Fe-55 | 2.2791E-06 | 272.74 | 545.48 | 0.00E+00 | 6.22E-04 | 1.24E-03 | 2.7500 | 7.746E+05 |
| H-3 | 1.9698E-03 | 272.74 | 545.48 | 0.00E+00 | 5.37E-01 | 1.07E+00 | 3.5000 | 4.492E+02 |
| I-129 | 7.5300E-07 | 272.74 | 545.48 | 0.00E+00 | 2.05E-04 | 4.11E-04 | 5.0000 | 1.835E+02 |
| Kr-85 | 4.1176E-02 | 272.74 | 545.48 | 0.00E+00 | 1.12E+01 | 2.25E+01 | 7.0000 | 2.009E+01 |
| Np-237 | 9.5752E-06 | 272.74 | 545.48 | 0.00E+00 | 2.61E-03 | 5.22E-03 | 11.0000 | 2.239E+00 |
| Pa-231 | 3.9379E-09 | 272.74 | 545.48 | 0.00E+00 | 1.07E-06 | 2.15E-06 | | |
| Pb-210 | 3.3115E-10 | 272.74 | 545.48 | 0.00E+00 | 9.03E-08 | 1.81E-07 | | |
| Pm-147 | 9.2402E-04 | 272.74 | 545.48 | 0.00E+00 | 2.52E-01 | 5.04E-01 | | |
| Pu-238 | 1.6217E-02 | 272.74 | 545.48 | 0.00E+00 | 4.42E+00 | 8.85E+00 | | |
| Pu-239 | 4.2810E-04 | 272.74 | 545.48 | 0.00E+00 | 1.17E-01 | 2.34E-01 | | |
| Pu-240 | 2.4333E-04 | 272.74 | 545.48 | 0.00E+00 | 6.64E-02 | 1.33E-01 | | |
| Pu-241 | 1.6242E-02 | 272.74 | 545.48 | 0.00E+00 | 4.43E+00 | 8.86E+00 | | |
| Pu-242 | 3.6329E-07 | 272.74 | 545.48 | 0.00E+00 | 9.91E-05 | 1.98E-04 | | |
| Ra-226 | 9.0114E-10 | 272.74 | 545.48 | 0.00E+00 | 2.46E-07 | 4.92E-07 | | |
| Ra-228 | 3.1019E-14 | 272.74 | 545.48 | 0.00E+00 | 8.46E-12 | 1.69E-11 | | |
| Ru-106 | 2.1225E-10 | 272.74 | 545.48 | 0.00E+00 | 5.79E-08 | 1.16E-07 | | |
| Se-79 | 1.2930E-05 | 272.74 | 545.48 | 0.00E+00 | 3.53E-03 | 7.06E-03 | | |
| Sn-126 | 1.1571E-05 | 272.74 | 545.48 | 0.00E+00 | 3.16E-03 | 6.31E-03 | | |
| Sr-90 | 1.3472E+00 | 272.74 | 545.48 | 0.00E+00 | 3.67E+02 | 7.35E+02 | | |
| Tc-99 | 4.2239E-04 | 272.74 | 545.48 | 0.00E+00 | 1.15E-01 | 2.30E-01 | | |
| Th-229 | 1.2407E-11 | 272.74 | 545.48 | 0.00E+00 | 3.38E-09 | 6.77E-09 | | |
| Th-230 | 8.3497E-08 | 272.74 | 545.48 | 0.00E+00 | 2.28E-05 | 4.55E-05 | | |
| Th-232 | 3.8371E-14 | 272.74 | 545.48 | 0.00E+00 | 1.05E-11 | 2.09E-11 | | |
| Tl-208 | 4.0414E-08 | 272.74 | 545.48 | 0.00E+00 | 1.10E-05 | 2.20E-05 | | |
| U-232 | 1.0948E-07 | 272.74 | 545.48 | 0.00E+00 | 2.99E-05 | 5.97E-05 | | |
| U-233 | 3.6275E-09 | 272.74 | 545.48 | 0.00E+00 | 9.89E-07 | 1.98E-06 | | |
| U-234 | 1.8562E-04 | 272.74 | 545.48 | 0.00E+00 | 5.06E-02 | 1.01E-01 | | |
| U-235 | -2.7235E-06 | 272.74 | 0.00 | 5.07E-03 | 4.33E-03 | 5.07E-03 | | |
| U-236 | 1.5493E-05 | 272.74 | 545.48 | 0.00E+00 | 4.23E-03 | 8.45E-03 | | |
| U-238 | -4.2851E-09 | 272.74 | 0.00 | 7.55E-05 | 7.44E-05 | 7.55E-05 | | |
| Y-90 | 1.3475E+00 | 272.74 | 545.48 | 0.00E+00 | 3.68E+02 | 7.35E+02 | | |
| Other Radionuclides | | | | | 3.73E+02 | 7.46E+02 | | |

Other Radionuclides

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences: |
|---------------------|-------------|-------------|----------------------------------|
| Reactor Moderator | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 91.25787542 | 60 to 100 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|----------|-----------|------------------------------------|
| Nominal | | 272.74 | |
| Bounding | | 545.48 | |

Nominal burnup calculated from the heavy metal mass destroyed
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0.34 | | |
| Bounding | 0.67 | | |

1.01

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT).

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRR MTR (UALX HEU) AUSTRALIA
SNF ID #: 649
Fuel Units & Descr: 12 - ASSEMBLY
Heavy Metal Mass: BOL=3 32kg, EOL=3 317kg
ROD Storage Site: SRS

Fuel decay start date: 2010
Estimates as of: 2030
Template: ATR (Light Water, Alum, 60 to 100%, U)
Template Burnup (MWd): 367.2
Template BOL Heavy Metal Mass (MT): 0.00116689
Template Decay Time: 20 years

Estimated
Canister usage:
18"x10"
0.50

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|---------------------|------------------------------|
| Radionuclide | Cv/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6.6313E-10 | 3.41 | 6.82 | 0.00E+00 | 2.26E-09 | 4.52E-09 | Avg. MeV | |
| Am-241 | 2.0060E-03 | 3.41 | 6.82 | 0.00E+00 | 6.84E-03 | 1.37E-02 | 0.0150 | 7.199E+11 |
| Am-242m | 4.2429E-07 | 3.41 | 6.82 | 0.00E+00 | 1.45E-06 | 2.89E-06 | 0.0250 | 1.497E+11 |
| Am-243 | 1.4899E-06 | 3.41 | 6.82 | 0.00E+00 | 5.08E-06 | 1.02E-05 | 0.0375 | 1.305E+11 |
| C-14 | 5.7135E-09 | 3.41 | 6.82 | 0.00E+00 | 1.95E-08 | 3.90E-08 | 0.0575 | 1.398E+11 |
| Cl-36 | 1.3124E-32 | 3.41 | 6.82 | 0.00E+00 | 4.47E-32 | 8.95E-32 | 0.0850 | 8.451E+10 |
| Cm-243 | 1.6443E-07 | 3.41 | 6.82 | 0.00E+00 | 5.61E-07 | 1.12E-06 | 0.1250 | 5.721E+10 |
| Cm-244 | 2.9330E-05 | 3.41 | 6.82 | 0.00E+00 | 1.00E-04 | 2.00E-04 | 0.2250 | 7.304E+10 |
| Co-60 | 5.3186E-06 | 3.41 | 6.82 | 0.00E+00 | 1.81E-05 | 3.63E-05 | 0.3750 | 3.174E+10 |
| Cs-134 | 3.1563E-03 | 3.41 | 6.82 | 0.00E+00 | 1.08E-02 | 2.15E-02 | 0.5750 | 5.177E+11 |
| Cs-135 | 3.4477E-06 | 3.41 | 6.82 | 0.00E+00 | 1.18E-05 | 2.35E-05 | 0.8500 | 8.752E+09 |
| Cs-137 | 2.0313E+00 | 3.41 | 6.82 | 0.00E+00 | 6.93E+00 | 1.39E+01 | 1.2500 | 4.997E+09 |
| Eu-154 | 2.4513E-02 | 3.41 | 6.82 | 0.00E+00 | 8.36E-02 | 1.67E-01 | 1.7500 | 2.294E+08 |
| Eu-155 | 4.8175E-03 | 3.41 | 6.82 | 0.00E+00 | 1.64E-02 | 3.28E-02 | 2.2500 | 2.012E+04 |
| Fe-55 | 1.2397E-04 | 3.41 | 6.82 | 0.00E+00 | 4.23E-04 | 8.45E-04 | 2.7500 | 1.138E+04 |
| H-3 | 4.5697E-03 | 3.41 | 6.82 | 0.00E+00 | 1.56E-02 | 3.12E-02 | 3.5000 | 5.307E+01 |
| I-129 | 7.5300E-07 | 3.41 | 6.82 | 0.00E+00 | 2.57E-06 | 5.13E-06 | 5.0000 | 3.297E+00 |
| Kr-85 | 1.0850E-01 | 3.41 | 6.82 | 0.00E+00 | 3.70E-01 | 7.40E-01 | 7.0000 | 3.650E-01 |
| Np-237 | 9.5561E-06 | 3.41 | 6.82 | 0.00E+00 | 3.26E-05 | 6.52E-05 | 11.0000 | 4.098E-02 |
| Pa-231 | 2.0359E-09 | 3.41 | 6.82 | 0.00E+00 | 6.94E-09 | 1.39E-08 | | |
| Pb-210 | 4.9728E-11 | 3.41 | 6.82 | 0.00E+00 | 1.70E-10 | 3.39E-10 | | |
| Pm-147 | 4.8502E-02 | 3.41 | 6.82 | 0.00E+00 | 1.65E-01 | 3.31E-01 | | |
| Pu-238 | 1.8254E-02 | 3.41 | 6.82 | 0.00E+00 | 6.22E-02 | 1.24E-01 | | |
| Pu-239 | 4.2810E-04 | 3.41 | 6.82 | 0.00E+00 | 1.46E-03 | 2.92E-03 | | |
| Pu-240 | 2.4368E-04 | 3.41 | 6.82 | 0.00E+00 | 8.31E-04 | 1.66E-03 | | |
| Pu-241 | 3.3415E-02 | 3.41 | 6.82 | 0.00E+00 | 1.14E-01 | 2.28E-01 | | |
| Pu-242 | 3.6329E-07 | 3.41 | 6.82 | 0.00E+00 | 1.24E-06 | 2.48E-06 | | |
| Ra-226 | 2.2854E-10 | 3.41 | 6.82 | 0.00E+00 | 7.79E-10 | 1.56E-09 | | |
| Ra-228 | 1.2426E-14 | 3.41 | 6.82 | 0.00E+00 | 4.24E-14 | 8.47E-14 | | |
| Ru-106 | 6.3589E-06 | 3.41 | 6.82 | 0.00E+00 | 2.17E-05 | 4.34E-05 | | |
| Se-79 | 1.2933E-05 | 3.41 | 6.82 | 0.00E+00 | 4.41E-05 | 8.82E-05 | | |
| Sn-126 | 1.1574E-05 | 3.41 | 6.82 | 0.00E+00 | 3.95E-05 | 7.89E-05 | | |
| Sr-90 | 1.9248E+00 | 3.41 | 6.82 | 0.00E+00 | 6.56E+00 | 1.31E+01 | | |
| Tc-99 | 4.2239E-04 | 3.41 | 6.82 | 0.00E+00 | 1.44E-03 | 2.88E-03 | | |
| Th-229 | 5.0953E-12 | 3.41 | 6.82 | 0.00E+00 | 1.74E-11 | 3.47E-11 | | |
| Th-230 | 4.1885E-08 | 3.41 | 6.82 | 0.00E+00 | 1.43E-07 | 2.86E-07 | | |
| Th-232 | 1.9270E-14 | 3.41 | 6.82 | 0.00E+00 | 6.57E-14 | 1.31E-13 | | |
| Th-208 | 4.6024E-08 | 3.41 | 6.82 | 0.00E+00 | 1.57E-07 | 3.14E-07 | | |
| U-232 | 1.2582E-07 | 3.41 | 6.82 | 0.00E+00 | 4.29E-07 | 8.58E-07 | | |
| U-233 | 2.5825E-09 | 3.41 | 6.82 | 0.00E+00 | 8.80E-09 | 1.76E-08 | | |
| U-234 | 1.8450E-04 | 3.41 | 6.82 | 0.00E+00 | 6.29E-04 | 1.26E-03 | | |
| U-235 | -2.7235E-06 | 3.41 | 0.00 | 6.46E-03 | 6.45E-03 | 6.46E-03 | | |
| U-236 | 1.5493E-05 | 3.41 | 6.82 | 0.00E+00 | 5.28E-05 | 1.06E-04 | | |
| U-238 | -4.2851E-09 | 3.41 | 0.00 | 1.12E-04 | 1.12E-04 | 1.12E-04 | | |
| Y-90 | 1.9254E+00 | 3.41 | 6.82 | 0.00E+00 | 6.56E+00 | 1.31E+01 | | |
| Other Radionuclides | | | | | 6.59E+00 | 1.32E+01 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-------------|-------------|----------------------------------|
| Reactor Moderator | From SFD | Used | |
| | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 89.99998815 | 60 to 100 | |

| Burnup Summary (MWd) ³ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | | 3.41 | |
| Bounding | | 6.82 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 0.00 | | |
| Bounding | 0.01 | | 1.00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRR MTR (UALX-HEU) JAPAN
 SNF ID #: 603
 Fuel Units & Descr: 12 - MTR TYPE
 Heavy Metal Mass: BOL=3.553kg EOL=3.553kg
 ROD Storage Site: SRS
 Fuel decay start date: 2010
 Estimates as of: 2030
 Template: ATR (Light Water Alum, 60 to 100%, U)
 Template Burnup(MWd): 367.2
 Template BOL Heavy Metal Mass (MT): 0.00116689
 Template Decay Time: 20 years

Estimated
 Canister usage
 18"x10"
 0.33

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(CI) | Bounding Fuel Inventories(CI) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6.6313E-10 | 67.30 | 134.60 | 0.00E+00 | 4.46E-08 | 8.93E-08 | Avg MeV | |
| Am-241 | 2.0060E-03 | 67.30 | 134.60 | 0.00E+00 | 1.35E-01 | 2.70E-01 | 0.0150 | 1.421E+13 |
| Am-242m | 4.2429E-07 | 67.30 | 134.60 | 0.00E+00 | 2.86E-05 | 5.71E-05 | 0.0250 | 2.954E+12 |
| Am-243 | 1.4899E-06 | 67.30 | 134.60 | 0.00E+00 | 1.00E-04 | 2.01E-04 | 0.0375 | 2.577E+12 |
| C-14 | 5.7135E-09 | 67.30 | 134.60 | 0.00E+00 | 3.85E-07 | 7.69E-07 | 0.0575 | 2.760E+12 |
| Cl-36 | 1.3124E-32 | 67.30 | 134.60 | 0.00E+00 | 8.83E-31 | 1.77E-30 | 0.0850 | 1.668E+12 |
| Cm-243 | 1.6443E-07 | 67.30 | 134.60 | 0.00E+00 | 1.11E-05 | 2.21E-05 | 0.1250 | 1.129E+12 |
| Cm-244 | 2.9330E-05 | 67.30 | 134.60 | 0.00E+00 | 1.97E-03 | 3.95E-03 | 0.2250 | 1.439E+12 |
| Co-60 | 5.3186E-06 | 67.30 | 134.60 | 0.00E+00 | 3.58E-04 | 7.16E-04 | 0.3750 | 6.265E+11 |
| Cs-134 | 3.1563E-03 | 67.30 | 134.60 | 0.00E+00 | 2.12E-01 | 4.25E-01 | 0.5750 | 1.022E+13 |
| Cs-135 | 3.4477E-06 | 67.30 | 134.60 | 0.00E+00 | 2.32E-04 | 4.64E-04 | 0.8500 | 1.728E+11 |
| Cs-137 | 2.0313E+00 | 67.30 | 134.60 | 0.00E+00 | 1.37E+02 | 2.73E+02 | 1.2500 | 9.865E+10 |
| Eu-154 | 2.4513E-02 | 67.30 | 134.60 | 0.00E+00 | 1.65E+00 | 3.30E+00 | 1.7500 | 4.528E+09 |
| Eu-155 | 4.8175E-03 | 67.30 | 134.60 | 0.00E+00 | 3.24E-01 | 6.48E-01 | 2.2500 | 3.972E+05 |
| Fe-55 | 1.2397E-04 | 67.30 | 134.60 | 0.00E+00 | 8.34E-03 | 1.67E-02 | 2.7500 | 2.245E+05 |
| H-3 | 4.5697E-03 | 67.30 | 134.60 | 0.00E+00 | 3.08E-01 | 6.15E-01 | 3.5000 | 1.032E+03 |
| I-129 | 7.5300E-07 | 67.30 | 134.60 | 0.00E+00 | 5.07E-05 | 1.01E-04 | 5.0000 | 5.867E+01 |
| Kr-85 | 1.0850E-01 | 67.30 | 134.60 | 0.00E+00 | 7.30E+00 | 1.46E+01 | 7.0000 | 6.478E+00 |
| Np-237 | 9.5561E-06 | 67.30 | 134.60 | 0.00E+00 | 6.43E-04 | 1.29E-03 | 11.0000 | 7.261E-01 |
| Pa-231 | 2.0359E-09 | 67.30 | 134.60 | 0.00E+00 | 1.37E-07 | 2.74E-07 | | |
| Pb-210 | 4.9728E-11 | 67.30 | 134.60 | 0.00E+00 | 3.35E-09 | 6.69E-09 | | |
| Pm-147 | 4.8502E-02 | 67.30 | 134.60 | 0.00E+00 | 3.26E+00 | 6.53E+00 | | |
| Pu-238 | 1.8254E-02 | 67.30 | 134.60 | 0.00E+00 | 1.23E+00 | 2.46E+00 | | |
| Pu-239 | 4.2810E-04 | 67.30 | 134.60 | 0.00E+00 | 2.88E-02 | 5.76E-02 | | |
| Pu-240 | 2.4368E-04 | 67.30 | 134.60 | 0.00E+00 | 1.64E-02 | 3.28E-02 | | |
| Pu-241 | 3.3415E-02 | 67.30 | 134.60 | 0.00E+00 | 2.25E+00 | 4.50E+00 | | |
| Pu-242 | 3.6329E-07 | 67.30 | 134.60 | 0.00E+00 | 2.44E-05 | 4.89E-05 | | |
| Ra-226 | 2.2854E-10 | 67.30 | 134.60 | 0.00E+00 | 1.54E-08 | 3.08E-08 | | |
| Ra-228 | 1.2426E-14 | 67.30 | 134.60 | 0.00E+00 | 8.36E-13 | 1.67E-12 | | |
| Ru-106 | 6.3589E-06 | 67.30 | 134.60 | 0.00E+00 | 4.28E-04 | 8.56E-04 | | |
| Se-79 | 1.2933E-05 | 67.30 | 134.60 | 0.00E+00 | 8.70E-04 | 1.74E-03 | | |
| Sn-126 | 1.1574E-05 | 67.30 | 134.60 | 0.00E+00 | 7.79E-04 | 1.56E-03 | | |
| Sr-90 | 1.9248E+00 | 67.30 | 134.60 | 0.00E+00 | 1.30E+02 | 2.59E+02 | | |
| Tc-99 | 4.2239E-04 | 67.30 | 134.60 | 0.00E+00 | 2.84E-02 | 5.69E-02 | | |
| Th-229 | 5.0953E-12 | 67.30 | 134.60 | 0.00E+00 | 3.43E-10 | 6.86E-10 | | |
| Th-230 | 4.1885E-08 | 67.30 | 134.60 | 0.00E+00 | 2.82E-06 | 5.64E-06 | | |
| Th-232 | 1.9270E-14 | 67.30 | 134.60 | 0.00E+00 | 1.30E-12 | 2.59E-12 | | |
| Ti-208 | 4.6024E-08 | 67.30 | 134.60 | 0.00E+00 | 3.10E-06 | 6.19E-06 | | |
| U-232 | 1.2582E-07 | 67.30 | 134.60 | 0.00E+00 | 8.47E-06 | 1.69E-05 | | |
| U-233 | 2.5825E-09 | 67.30 | 134.60 | 0.00E+00 | 1.74E-07 | 3.48E-07 | | |
| U-234 | 1.8450E-04 | 67.30 | 134.60 | 0.00E+00 | 1.24E-02 | 2.48E-02 | | |
| U-235 | 2.7235E-06 | 67.30 | 0.00 | 6.90E-03 | 6.71E-03 | 6.90E-03 | | |
| U-236 | 1.5493E-05 | 67.30 | 134.60 | 0.00E+00 | 1.04E-03 | 2.09E-03 | | |
| U-238 | 4.2851E-09 | 67.30 | 0.00 | 1.22E-04 | 1.21E-04 | 1.22E-04 | | |
| Y-90 | 1.9254E+00 | 67.30 | 134.60 | 0.00E+00 | 1.30E+02 | 2.59E+02 | | |
| Other Radionuclides | | | | | 1.30E+02 | 2.60E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-------------|-------------|----------------------------------|
| Reactor Moderator: | From SFD | Used | |
| Fuel Cladding | LIGHT WATER | LIGHT WATER | |
| BOL HM Constituents | ALUM | ALUM | |
| BOL Enrichment % | U | U | |
| | 89.81998522 | 60 to 100 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | | 67.30 | |
| Bounding | | 134.60 | Nominal burnup assumed to be 2% of BOL heavy metal mass Bounding burnup assumed to be twice nominal burnup |

| Checks | | |
|----------|-------------------|-----------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
| Nominal | 0.06 | |
| Bounding | 0.12 | |
| | | Estimated EOL HM/Given EOL HM |
| | | 0.98 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRR MTR (UALX-HEU) JAPAN
 SNF ID #: 605
 Fuel Units & Descr: 81 - MTR TYPE
 Heavy Metal Mass: BOL=24 818kg EOL=24 786kg
 ROD Storage Site: SRS

¹Fuel decay start date: 2010
 Estimates as of: 2030
 Template: ATR (Light Water, Alum., 60 to 100%, U)
²Template Burnup(MWd): 367.2
 Template BOL Heavy Metal Mass (MT): 0 00116689
 Template Decay Time: 20 years

Estimated
 Canister usage:
 18"x10"
 3 38

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| | m | x _a | x _b | b | y _a | y _b | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | | |
| Ac-227 | 6 6313E-10 | 30 68 | 61 37 | 0 00E+00 | 2 03E-08 | 4 07E-08 | Avg MeV | |
| Am-241 | 2 0060E-03 | 30 68 | 61 37 | 0 00E+00 | 6 16E-02 | 1 23E-01 | 0 0150 | 6 479E+12 |
| Am-242m | 4 2429E-07 | 30 68 | 61 37 | 0 00E+00 | 1 30E-05 | 2 60E-05 | 0 0250 | 1 347E+12 |
| Am-243 | 1 4899E-06 | 30 68 | 61 37 | 0 00E+00 | 4 57E-05 | 9 14E-05 | 0 0375 | 1 175E+12 |
| C-14 | 5 7135E-09 | 30 68 | 61 37 | 0 00E+00 | 1 75E-07 | 3 51E-07 | 0 0575 | 1 258E+12 |
| Cl-36 | 1 3124E-32 | 30 68 | 61 37 | 0 00E+00 | 4 03E-31 | 8 05E-31 | 0 0850 | 7 606E+11 |
| Cm-243 | 1 6443E-07 | 30 68 | 61 37 | 0 00E+00 | 5 05E-06 | 1 01E-05 | 0 1250 | 5 149E+11 |
| Cm-244 | 2 9330E-05 | 30 68 | 61 37 | 0 00E+00 | 9 00E-04 | 1 80E-03 | 0 2250 | 6 572E+11 |
| Co-60 | 5 3186E-06 | 30 68 | 61 37 | 0 00E+00 | 1 63E-04 | 3 26E-04 | 0 3750 | 2 856E+11 |
| Cs-134 | 3 1563E-03 | 30 68 | 61 37 | 0 00E+00 | 9 68E-02 | 1 94E-01 | 0 5750 | 4 659E+12 |
| Cs-135 | 3 4477E-06 | 30 68 | 61 37 | 0 00E+00 | 1 06E-04 | 2 12E-04 | 0 8500 | 7 877E+10 |
| Cs-137 | 2 0313E+00 | 30 68 | 61 37 | 0 00E+00 | 6 23E+01 | 1 25E+02 | 1 2500 | 4 498E+10 |
| Eu-154 | 2 4513E-02 | 30 68 | 61 37 | 0 00E+00 | 7 52E-01 | 1 50E+00 | 1 7500 | 2 064E+09 |
| Eu-155 | 4 8175E-03 | 30 68 | 61 37 | 0 00E+00 | 1 48E-01 | 2 96E-01 | 2 2500 | 1 811E+05 |
| Fe-55 | 1 2397E-04 | 30 68 | 61 37 | 0 00E+00 | 3 80E-03 | 7 61E-03 | 2 7500 | 1 024E+05 |
| H-3 | 4 5697E-03 | 30 68 | 61 37 | 0 00E+00 | 1 40E-01 | 2 80E-01 | 3 5000 | 4 751E+02 |
| I-129 | 7 5300E-07 | 30 68 | 61 37 | 0 00E+00 | 2 31E-05 | 4 62E-05 | 5 0000 | 2 860E+01 |
| Kr-85 | 1 0850E-01 | 30 68 | 61 37 | 0 00E+00 | 3 33E+00 | 6 66E+00 | 7 0000 | 3 162E+00 |
| Np-237 | 9 5561E-06 | 30 68 | 61 37 | 0 00E+00 | 2 93E-04 | 5 86E-04 | 11 0000 | 3 547E-01 |
| Pa-231 | 2 0359E-09 | 30 68 | 61 37 | 0 00E+00 | 6 25E-08 | 1 25E-07 | | |
| Pb-210 | 4 9728E-11 | 30 68 | 61 37 | 0 00E+00 | 1 53E-09 | 3 05E-09 | | |
| Pm-147 | 4 8502E-02 | 30 68 | 61 37 | 0 00E+00 | 1 49E+00 | 2 98E+00 | | |
| Pu-238 | 1 8254E-02 | 30 68 | 61 37 | 0 00E+00 | 5 60E-01 | 1 12E+00 | | |
| Pu-239 | 4 2810E-04 | 30 68 | 61 37 | 0 00E+00 | 1 31E-02 | 2 63E-02 | | |
| Pu-240 | 2 4368E-04 | 30 68 | 61 37 | 0 00E+00 | 7 48E-03 | 1 50E-02 | | |
| Pu-241 | 3 3415E-02 | 30 68 | 61 37 | 0 00E+00 | 1 03E+00 | 2 05E+00 | | |
| Pu-242 | 3 6329E-07 | 30 68 | 61 37 | 0 00E+00 | 1 11E-05 | 2 23E-05 | | |
| Ra-226 | 2 2854E-10 | 30 68 | 61 37 | 0 00E+00 | 7 01E-09 | 1 40E-08 | | |
| Ra-228 | 1 2426E-14 | 30 68 | 61 37 | 0 00E+00 | 3 81E-13 | 7 63E-13 | | |
| Ru-106 | 6 3589E-06 | 30 68 | 61 37 | 0 00E+00 | 1 95E-04 | 3 90E-04 | | |
| Se-79 | 1 2933E-05 | 30 68 | 61 37 | 0 00E+00 | 3 97E-04 | 7 94E-04 | | |
| Sn-126 | 1 1574E-05 | 30 68 | 61 37 | 0 00E+00 | 3 55E-04 | 7 10E-04 | | |
| Sr-90 | 1 9248E+00 | 30 68 | 61 37 | 0 00E+00 | 5 91E+01 | 1 18E+02 | | |
| Tc-99 | 4 2239E-04 | 30 68 | 61 37 | 0 00E+00 | 1 30E-02 | 2 59E-02 | | |
| Th-229 | 5 0953E-12 | 30 68 | 61 37 | 0 00E+00 | 1 56E-10 | 3 13E-10 | | |
| Th-230 | 4 1885E-08 | 30 68 | 61 37 | 0 00E+00 | 1 29E-06 | 2 57E-06 | | |
| Th-232 | 1 9270E-14 | 30 68 | 61 37 | 0 00E+00 | 5 91E-13 | 1 18E-12 | | |
| Ti-208 | 4 6024E-08 | 30 68 | 61 37 | 0 00E+00 | 1 41E-06 | 2 82E-06 | | |
| U-232 | 1 2582E-07 | 30 68 | 61 37 | 0 00E+00 | 3 86E-06 | 7 72E-06 | Thermal Power | |
| U-233 | 2 5825E-09 | 30 68 | 61 37 | 0 00E+00 | 7 92E-08 | 1 58E-07 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 1 8450E-04 | 30 68 | 61 37 | 0 00E+00 | 5 66E-03 | 1 13E-02 | 7 33E-01 | 1 46E+00 |
| U-235 | -2 7235E-06 | 30 68 | 0 00 | 4 99E-02 | 4 98E-02 | 4 99E-02 | Total | Total |
| U-236 | 1 5493E-05 | 30 68 | 61 37 | 0 00E+00 | 4 75E-04 | 9 51E-04 | | |
| U-238 | -4 2851E-09 | 30 68 | 0 00 | 5 84E-04 | 5 84E-04 | 5 84E-04 | | |
| Y-90 | 1 9254E+00 | 30 68 | 61 37 | 0 00E+00 | 5 91E+01 | 1 18E+02 | | |
| Other Radionuclides | | | | | 5 93E+01 | 1 19E+02 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-------------|-------------|----------------------------------|
| Reactor Moderator | From SFD | Used | |
| | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 93 0000613 | 60 to 100 | |

| Burnup Summary (MWd) ¹ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | | 30 68 | |
| Bounding | | 61 37 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 0 00 | | |
| Bounding | 0 01 | | 1 00 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRR MTR (UALX-HEU) NETHERLANDS

SNF ID # 609

Fuel Units & Descr: 14 - MTR TYPE

Heavy Metal Mass BOL=3 192kg EOL=3 188kg

ROD Storage Site SRS

¹Fuel decay start date 2010

Estimates as of: 2030

Template: ATR (Light Water, Alum, 60 to 100%, U)

²Template Burnup(MWd) 367.2

Template BOL Heavy Metal Mass (MT) 0.00116689

Template Decay Time 20 years

Estimated

Canister usage

18"x10"

0.58

II. Estimates

| | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6.6313E-10 | 3.98 | 7.96 | 0.00E+00 | 2.64E-09 | 5.28E-09 | Avg MeV | |
| Am-241 | 2.0060E-03 | 3.98 | 7.96 | 0.00E+00 | 7.98E-03 | 1.60E-02 | 0.0150 | 8.399E+11 |
| Am-242m | 4.2429E-07 | 3.98 | 7.96 | 0.00E+00 | 1.69E-06 | 3.38E-06 | 0.0250 | 1.746E+11 |
| Am-243 | 1.4899E-06 | 3.98 | 7.96 | 0.00E+00 | 5.93E-06 | 1.19E-05 | 0.0375 | 1.523E+11 |
| C-14 | 5.7135E-09 | 3.98 | 7.96 | 0.00E+00 | 2.27E-08 | 4.55E-08 | 0.0575 | 1.631E+11 |
| Cl-36 | 1.3124E-32 | 3.98 | 7.96 | 0.00E+00 | 5.22E-32 | 1.04E-31 | 0.0850 | 9.859E+10 |
| Cm-243 | 1.6443E-07 | 3.98 | 7.96 | 0.00E+00 | 6.54E-07 | 1.31E-06 | 0.1250 | 6.674E+10 |
| Cm-244 | 2.9330E-05 | 3.98 | 7.96 | 0.00E+00 | 1.17E-04 | 2.33E-04 | 0.2250 | 8.519E+10 |
| Co-60 | 5.3186E-06 | 3.98 | 7.96 | 0.00E+00 | 2.12E-05 | 4.23E-05 | 0.3750 | 3.703E+10 |
| Cs-134 | 3.1563E-03 | 3.98 | 7.96 | 0.00E+00 | 1.26E-02 | 2.51E-02 | 0.5750 | 6.040E+11 |
| Cs-135 | 3.4477E-06 | 3.98 | 7.96 | 0.00E+00 | 1.37E-05 | 2.74E-05 | 0.8500 | 1.021E+10 |
| Cs-137 | 2.0313E+00 | 3.98 | 7.96 | 0.00E+00 | 8.08E+00 | 1.62E+01 | 1.2500 | 5.830E+09 |
| Eu-154 | 2.4513E-02 | 3.98 | 7.96 | 0.00E+00 | 9.75E-02 | 1.95E-01 | 1.7500 | 2.676E+08 |
| Eu-155 | 4.8175E-03 | 3.98 | 7.96 | 0.00E+00 | 1.92E-02 | 3.83E-02 | 2.2500 | 2.348E+04 |
| Fe-55 | 1.2397E-04 | 3.98 | 7.96 | 0.00E+00 | 4.93E-04 | 9.86E-04 | 2.7500 | 1.327E+04 |
| H-3 | 4.5697E-03 | 3.98 | 7.96 | 0.00E+00 | 1.82E-02 | 3.64E-02 | 3.5000 | 6.158E+01 |
| I-129 | 7.5300E-07 | 3.98 | 7.96 | 0.00E+00 | 3.00E-06 | 5.99E-06 | 5.0000 | 3.705E+00 |
| Kr-85 | 1.0850E-01 | 3.98 | 7.96 | 0.00E+00 | 4.32E-01 | 8.63E-01 | 7.0000 | 4.096E-01 |
| Np-237 | 9.5561E-06 | 3.98 | 7.96 | 0.00E+00 | 3.80E-05 | 7.60E-05 | 11.0000 | 4.595E-02 |
| Pa-231 | 2.0359E-09 | 3.98 | 7.96 | 0.00E+00 | 8.10E-09 | 1.62E-08 | | |
| Pb-210 | 4.9728E-11 | 3.98 | 7.96 | 0.00E+00 | 1.98E-10 | 3.96E-10 | | |
| Pm-147 | 4.8502E-02 | 3.98 | 7.96 | 0.00E+00 | 1.93E-01 | 3.86E-01 | | |
| Pu-238 | 1.8254E-02 | 3.98 | 7.96 | 0.00E+00 | 7.26E-02 | 1.45E-01 | | |
| Pu-239 | 4.2810E-04 | 3.98 | 7.96 | 0.00E+00 | 1.70E-03 | 3.41E-03 | | |
| Pu-240 | 2.4368E-04 | 3.98 | 7.96 | 0.00E+00 | 9.69E-04 | 1.94E-03 | | |
| Pu-241 | 3.3415E-02 | 3.98 | 7.96 | 0.00E+00 | 1.33E-01 | 2.66E-01 | | |
| Pu-242 | 3.6329E-07 | 3.98 | 7.96 | 0.00E+00 | 1.44E-06 | 2.89E-06 | | |
| Ra-226 | 2.2854E-10 | 3.98 | 7.96 | 0.00E+00 | 9.09E-10 | 1.82E-09 | | |
| Ra-228 | 1.2426E-14 | 3.98 | 7.96 | 0.00E+00 | 4.94E-14 | 9.89E-14 | | |
| Ru-106 | 6.3589E-06 | 3.98 | 7.96 | 0.00E+00 | 2.53E-05 | 5.06E-05 | | |
| Se-79 | 1.2933E-05 | 3.98 | 7.96 | 0.00E+00 | 5.14E-05 | 1.03E-04 | | |
| Sn-126 | 1.1574E-05 | 3.98 | 7.96 | 0.00E+00 | 4.60E-05 | 9.21E-05 | | |
| Sr-90 | 1.9248E+00 | 3.98 | 7.96 | 0.00E+00 | 7.66E+00 | 1.53E+01 | | |
| Tc-99 | 4.2239E-04 | 3.98 | 7.96 | 0.00E+00 | 1.68E-03 | 3.36E-03 | | |
| Th-229 | 5.0953E-12 | 3.98 | 7.96 | 0.00E+00 | 2.03E-11 | 4.05E-11 | | |
| Th-230 | 4.1885E-08 | 3.98 | 7.96 | 0.00E+00 | 1.67E-07 | 3.33E-07 | | |
| Th-232 | 1.9270E-14 | 3.98 | 7.96 | 0.00E+00 | 7.66E-14 | 1.53E-13 | | |
| Ti-208 | 4.6024E-08 | 3.98 | 7.96 | 0.00E+00 | 1.83E-07 | 3.66E-07 | | |
| U-232 | 1.2582E-07 | 3.98 | 7.96 | 0.00E+00 | 5.00E-07 | 1.00E-06 | | |
| U-233 | 2.5825E-09 | 3.98 | 7.96 | 0.00E+00 | 1.03E-08 | 2.05E-08 | | |
| U-234 | 1.8450E-04 | 3.98 | 7.96 | 0.00E+00 | 7.34E-04 | 1.47E-03 | | |
| U-235 | -2.7235E-06 | 3.98 | 0.00 | 6.42E-03 | 6.40E-03 | 6.42E-03 | | |
| U-236 | 1.5493E-05 | 3.98 | 7.96 | 0.00E+00 | 6.16E-05 | 1.23E-04 | | |
| U-238 | -4.2851E-09 | 3.98 | 0.00 | 7.51E-05 | 7.51E-05 | 7.51E-05 | | |
| Y-90 | 1.9254E+00 | 3.98 | 7.96 | 0.00E+00 | 7.66E+00 | 1.53E+01 | | |
| Other Radionuclides | | | | | 7.69E+00 | 1.54E+01 | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 9.50E-02 | 1.90E-01 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-------------|-------------|----------------------------------|
| Reactor Moderator | From SFD | Used | |
| Fuel Cladding | LIGHT WATER | LIGHT WATER | |
| BOL HM Constituents | ALUM | ALUM | |
| BOL Enrichment % | U | U | |
| | 92.999964 | 60 to 100 | |

| Burnup Summary (MWd) ² | | Basis for burnup used in estimate: |
|-----------------------------------|-----------|--|
| Nominal | Estimated | |
| | 3.98 | Nominal burnup calculated from the heavy metal mass destroyed. |
| Bounding | 7.96 | Bounding burnup assumed to be twice nominal burnup |

| Checks | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|
| Nominal | Burnup Multiplier | |
| | 0.00 | 1.00 |
| Bounding | 0.01 | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT).

Fuel Radionuclide Inventory Worksheet

I: Fuel and Template Information

Fuel Name: FRR MTR (UALX-HEU) TAIWAN
SNF ID #: 628
Fuel Units & Descr: 35 - MTR TYPE
Heavy Metal Mass: BOL=4 764kg; EOL=4 76kg
ROD Storage Site: SRS

¹Fuel decay start date: 2010
Estimates as of: 2030
Template: ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup(MWd): 367.2
Template BOL Heavy Metal Mass (MT): 0 00116689
Template Decay Time: 20 years

Estimated
Canister usage:
18"x10"
1 46

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | Cu/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6 6313E-10 | 3.31 | 6 63 | 0 00E+00 | 2.20E-09 | 4 40E-09 | Avg. MeV | |
| Am-241 | 2 0060E-03 | 3.31 | 6 63 | 0 00E+00 | 6 65E-03 | 1 33E-02 | 0 0150 | 7 000E+11 |
| Am-242m | 4 2429E-07 | 3.31 | 6 63 | 0 00E+00 | 1 41E-06 | 2 81E-06 | 0 0250 | 1 455E+11 |
| Am-243 | 1 4899E-06 | 3.31 | 6 63 | 0 00E+00 | 4 94E-06 | 9 88E-06 | 0 0375 | 1 269E+11 |
| C-14 | 5 7135E-09 | 3.31 | 6 63 | 0 00E+00 | 1 89E-08 | 3 79E-08 | 0 0575 | 1 359E+11 |
| Cf-252 | 1 3124E-32 | 3.31 | 6 63 | 0 00E+00 | 4 35E-32 | 8 70E-32 | 0 0850 | 8 217E+10 |
| Cm-243 | 1 6443E-07 | 3.31 | 6 63 | 0 00E+00 | 5 45E-07 | 1 09E-06 | 0 1250 | 5 564E+10 |
| Cm-244 | 2 9330E-05 | 3.31 | 6 63 | 0 00E+00 | 9 72E-05 | 1 94E-04 | 0 2250 | 7 107E+10 |
| Co-60 | 5 3186E-06 | 3.31 | 6 63 | 0 00E+00 | 1 76E-05 | 3 53E-05 | 0 3750 | 3 086E+10 |
| Cs-134 | 3 1563E-03 | 3.31 | 6 63 | 0 00E+00 | 1 05E-02 | 2 09E-02 | 0 5750 | 5 033E+11 |
| Cs-135 | 3 4477E-06 | 3.31 | 6 63 | 0 00E+00 | 1 14E-05 | 2 29E-05 | 0 8500 | 8 509E+09 |
| Cs-137 | 2 0313E+00 | 3.31 | 6 63 | 0 00E+00 | 6 73E+00 | 1 35E+01 | 1 2500 | 4 859E+09 |
| Eu-154 | 2 4513E-02 | 3.31 | 6 63 | 0 00E+00 | 8 12E-02 | 1 62E-01 | 1 7500 | 2 230E+08 |
| Eu-155 | 4 8175E-03 | 3.31 | 6 63 | 0 00E+00 | 1 60E-02 | 3 19E-02 | 2 2500 | 1 956E+04 |
| Fe-55 | 1 2397E-04 | 3.31 | 6 63 | 0 00E+00 | 4 11E-04 | 8 22E-04 | 2 7500 | 1 106E+04 |
| H-3 | 4 5697E-03 | 3.31 | 6 63 | 0 00E+00 | 1 51E-02 | 3 03E-02 | 3 5000 | 5 171E+01 |
| I-129 | 7 5300E-07 | 3.31 | 6 63 | 0 00E+00 | 2 50E-06 | 4 99E-06 | 5 0000 | 3 252E+00 |
| Kr-85 | 1 0850E-01 | 3.31 | 6 63 | 0 00E+00 | 3 60E-01 | 7 19E-01 | 7 0000 | 3 598E-01 |
| Np-237 | 9 5561E-06 | 3.31 | 6 63 | 0 00E+00 | 3 17E-05 | 6 33E-05 | 11 0000 | 4 039E-02 |
| Pa-231 | 2 0359E-09 | 3.31 | 6 63 | 0 00E+00 | 6 75E-09 | 1 35E-08 | | |
| Pb-210 | 4 9728E-11 | 3.31 | 6 63 | 0 00E+00 | 1 65E-10 | 3 30E-10 | | |
| Pm-147 | 4 8502E-02 | 3.31 | 6 63 | 0 00E+00 | 1 61E-01 | 3 22E-01 | | |
| Pu-238 | 1 8254E-02 | 3.31 | 6 63 | 0 00E+00 | 6 05E-02 | 1 21E-01 | | |
| Pu-239 | 4 2810E-04 | 3.31 | 6 63 | 0 00E+00 | 1 42E-03 | 2 84E-03 | | |
| Pu-240 | 2 4368E-04 | 3.31 | 6 63 | 0 00E+00 | 8 08E-04 | 1 62E-03 | | |
| Pu-241 | 3 3415E-02 | 3.31 | 6 63 | 0 00E+00 | 1 11E-01 | 2 22E-01 | | |
| Pu-242 | 3 6329E-07 | 3.31 | 6 63 | 0 00E+00 | 1 20E-06 | 2 41E-06 | | |
| Ra-226 | 2 2854E-10 | 3.31 | 6 63 | 0 00E+00 | 7 58E-10 | 1 52E-09 | | |
| Ra-228 | 1 2426E-14 | 3.31 | 6 63 | 0 00E+00 | 4 12E-14 | 8 24E-14 | | |
| Ru-106 | 6 3589E-06 | 3.31 | 6 63 | 0 00E+00 | 2 11E-05 | 4 22E-05 | | |
| Se-79 | 1 2933E-05 | 3.31 | 6 63 | 0 00E+00 | 4 29E-05 | 8 57E-05 | | |
| Sn-126 | 1 1574E-05 | 3.31 | 6 63 | 0 00E+00 | 3 84E-05 | 7 67E-05 | | |
| Sr-90 | 1 9248E+00 | 3.31 | 6 63 | 0 00E+00 | 6 38E+00 | 1 28E+01 | | |
| Tc-99 | 4 2239E-04 | 3.31 | 6 63 | 0 00E+00 | 1 40E-03 | 2 80E-03 | | |
| Th-229 | 5 0953E-12 | 3.31 | 6 63 | 0 00E+00 | 1 69E-11 | 3 38E-11 | | |
| Th-230 | 4 1885E-08 | 3.31 | 6 63 | 0 00E+00 | 1 39E-07 | 2 78E-07 | | |
| Th-232 | 1 9270E-14 | 3.31 | 6 63 | 0 00E+00 | 6 39E-14 | 1 28E-13 | | |
| Ti-208 | 4 6024E-08 | 3.31 | 6 63 | 0 00E+00 | 1 53E-07 | 3 05E-07 | | |
| U-232 | 1 2582E-07 | 3.31 | 6 63 | 0 00E+00 | 4 17E-07 | 8 34E-07 | | |
| U-233 | 2 5825E-09 | 3.31 | 6 63 | 0 00E+00 | 8 56E-09 | 1 71E-08 | | |
| U-234 | 1 8450E-04 | 3.31 | 6 63 | 0 00E+00 | 6 12E-04 | 1 22E-03 | | |
| U-235 | -2 7235E-06 | 3.31 | 0.00 | 9.59E-03 | 9 58E-03 | 9 59E-03 | | |
| U-236 | 1 5493E-05 | 3.31 | 6 63 | 0 00E+00 | 5 14E-05 | 1 03E-04 | | |
| U-238 | -4 2851E-09 | 3.31 | 0.00 | 1 09E-04 | 1 09E-04 | 1 09E-04 | | |
| Y-90 | 1 9254E+00 | 3.31 | 6 63 | 0 00E+00 | 6 38E+00 | 1 28E+01 | | |
| Other Radionuclides | | | | | 6 41E+00 | 1 28E+01 | | |
| | | | | | | | Thermal Power | |
| | | | | | | | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| | | | | | | | 7 93E-02 | 1 58E-01 |
| | | | | | | | Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-------------|-------------|
| Reactor Moderator | LIGHT WATER | LIGHT WATER |
| Fuel Cladding | ALUM | ALUM |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 93 19000561 | 60 to 100 |

Basis for Parameter Differences:

Burnup Summary (MWd)¹

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | | 3.31 |
| Bounding | | 6 63 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed.
Bounding burnup assumed to be twice nominal burnup.

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|--------------------------------|
| Nominal | 0.00 | |
| Bounding | 0.00 | |

Estimated EOL HM/Given EOL HM

1.00

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name FRR MTR (UALX-LEU) ARGENTINA
SNF ID # 547
Fuel Units & Descr 30 - ASSEMBLY
Heavy Metal Mass BOL=18 75kg, EOL=18 714kg
ROD Storage Site SRS

¹Fuel decay start date: 2010
Estimates as of 2030
Template ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup(MWd) 367.2
Template BOL Heavy Metal Mass (MT): 0.00116689
Template Decay Time³ 20 years

Estimated
Canister usage:
18"x10"
1.25

| II. Estimates | m | X _a | X _b | b | Y _a | Y _b | Gamma Sources | |
|---------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6.6313E-10 | 34.09 | 68.19 | 0.00E+00 | 2.26E-08 | 4.52E-08 | Avg MeV | |
| Am-241 | 2.0060E-03 | 34.09 | 68.19 | 0.00E+00 | 6.84E-02 | 1.37E-01 | 0.0150 | 7.198E+12 |
| Am-242m | 4.2429E-07 | 34.09 | 68.19 | 0.00E+00 | 1.45E-05 | 2.89E-05 | 0.0250 | 1.497E+12 |
| Am-243 | 1.4899E-06 | 34.09 | 68.19 | 0.00E+00 | 5.08E-05 | 1.02E-04 | 0.0375 | 1.305E+12 |
| C-14 | 5.7135E-09 | 34.09 | 68.19 | 0.00E+00 | 1.95E-07 | 3.90E-07 | 0.0575 | 1.398E+12 |
| Cl-36 | 1.3124E-32 | 34.09 | 68.19 | 0.00E+00 | 4.47E-31 | 8.95E-31 | 0.0850 | 8.450E+11 |
| Cm-243 | 1.6443E-07 | 34.09 | 68.19 | 0.00E+00 | 5.61E-06 | 1.12E-05 | 0.1250 | 5.718E+11 |
| Cm-244 | 2.9330E-05 | 34.09 | 68.19 | 0.00E+00 | 1.00E-03 | 2.00E-03 | 0.2250 | 7.292E+11 |
| Co-60 | 5.3186E-06 | 34.09 | 68.19 | 0.00E+00 | 1.81E-04 | 3.63E-04 | 0.3750 | 3.174E+11 |
| Cs-134 | 3.1563E-03 | 34.09 | 68.19 | 0.00E+00 | 1.08E-01 | 2.15E-01 | 0.5750 | 5.177E+12 |
| Cs-135 | 3.4477E-06 | 34.09 | 68.19 | 0.00E+00 | 1.18E-04 | 2.35E-04 | 0.8500 | 8.752E+10 |
| Cs-137 | 2.0313E+00 | 34.09 | 68.19 | 0.00E+00 | 6.93E+01 | 1.39E+02 | 1.2500 | 4.997E+10 |
| Eu-154 | 2.4513E-02 | 34.09 | 68.19 | 0.00E+00 | 8.36E-01 | 1.67E+00 | 1.7500 | 2.294E+09 |
| Eu-155 | 4.8175E-03 | 34.09 | 68.19 | 0.00E+00 | 1.64E-01 | 3.28E-01 | 2.2500 | 2.013E+05 |
| Fe-55 | 1.2397E-04 | 34.09 | 68.19 | 0.00E+00 | 4.23E-03 | 8.45E-03 | 2.7500 | 1.138E+05 |
| H-3 | 4.5697E-03 | 34.09 | 68.19 | 0.00E+00 | 1.56E-01 | 3.12E-01 | 3.5000 | 5.497E+02 |
| I-129 | 7.5300E-07 | 34.09 | 68.19 | 0.00E+00 | 2.57E-05 | 5.13E-05 | 5.0000 | 4.119E+01 |
| Kr-85 | 1.0850E-01 | 34.09 | 68.19 | 0.00E+00 | 3.70E+00 | 7.40E+00 | 7.0000 | 4.602E+00 |
| Np-237 | 9.5561E-06 | 34.09 | 68.19 | 0.00E+00 | 3.26E-04 | 6.52E-04 | 11.0000 | 5.197E-01 |
| Pa-231 | 2.0359E-09 | 34.09 | 68.19 | 0.00E+00 | 6.94E-08 | 1.39E-07 | | |
| Pb-210 | 4.9728E-11 | 34.09 | 68.19 | 0.00E+00 | 1.70E-09 | 3.39E-09 | | |
| Pm-147 | 4.8502E-02 | 34.09 | 68.19 | 0.00E+00 | 1.65E+00 | 3.31E+00 | | |
| Pu-238 | 1.8254E-02 | 34.09 | 68.19 | 0.00E+00 | 6.22E-01 | 1.24E+00 | | |
| Pu-239 | 4.2810E-04 | 34.09 | 68.19 | 0.00E+00 | 1.46E-02 | 2.92E-02 | | |
| Pu-240 | 2.4368E-04 | 34.09 | 68.19 | 0.00E+00 | 8.31E-03 | 1.66E-02 | | |
| Pu-241 | 3.3415E-02 | 34.09 | 68.19 | 0.00E+00 | 1.14E+00 | 2.28E+00 | | |
| Pu-242 | 3.6329E-07 | 34.09 | 68.19 | 0.00E+00 | 1.24E-05 | 2.48E-05 | | |
| Ra-226 | 2.2854E-10 | 34.09 | 68.19 | 0.00E+00 | 7.79E-09 | 1.56E-08 | | |
| Ra-228 | 1.2426E-14 | 34.09 | 68.19 | 0.00E+00 | 4.24E-13 | 8.47E-13 | | |
| Ru-106 | 6.3589E-06 | 34.09 | 68.19 | 0.00E+00 | 2.17E-04 | 4.34E-04 | | |
| Se-79 | 1.2933E-05 | 34.09 | 68.19 | 0.00E+00 | 4.41E-04 | 8.82E-04 | | |
| Sn-126 | 1.1574E-05 | 34.09 | 68.19 | 0.00E+00 | 3.95E-04 | 7.89E-04 | | |
| Sr-90 | 1.9248E+00 | 34.09 | 68.19 | 0.00E+00 | 6.56E+01 | 1.31E+02 | | |
| Tc-99 | 4.2239E-04 | 34.09 | 68.19 | 0.00E+00 | 1.44E-02 | 2.88E-02 | | |
| Th-229 | 5.0953E-12 | 34.09 | 68.19 | 0.00E+00 | 1.74E-10 | 3.47E-10 | | |
| Th-230 | 4.1885E-08 | 34.09 | 68.19 | 0.00E+00 | 1.43E-06 | 2.86E-06 | | |
| Th-232 | 1.9270E-14 | 34.09 | 68.19 | 0.00E+00 | 6.57E-13 | 1.31E-12 | | |
| Ti-208 | 4.6024E-08 | 34.09 | 68.19 | 0.00E+00 | 1.57E-06 | 3.14E-06 | | |
| U-232 | 1.2582E-07 | 34.09 | 68.19 | 0.00E+00 | 4.29E-06 | 8.58E-06 | | |
| U-233 | 2.5825E-09 | 34.09 | 68.19 | 0.00E+00 | 8.80E-08 | 1.76E-07 | | |
| U-234 | 1.8450E-04 | 34.09 | 68.19 | 0.00E+00 | 6.29E-03 | 1.26E-02 | | |
| U-235 | -2.7235E-06 | 34.09 | 0.00 | 8.10E-03 | 8.01E-03 | 8.10E-03 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-236 | 1.5493E-05 | 34.09 | 68.19 | 0.00E+00 | 5.28E-04 | 1.06E-03 | 8.13E-01 | 1.63E+00 |
| U-238 | -4.2851E-09 | 34.09 | 0.00 | 5.04E-03 | 5.04E-03 | 5.04E-03 | Total | Total |
| Y-90 | 1.9254E+00 | 34.09 | 68.19 | 0.00E+00 | 6.56E+01 | 1.32E+02 | | |

Other Radionuclides

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences: |
|---------------------|-------------|-------------|---|
| Reactor Moderator | LIGHT WATER | LIGHT WATER | This Template was used for the following reasons |
| Fuel Cladding | ALUM | ALUM | This fuel matches ATR Template on all but one parameter (enrichment) making ATR a reasonable match. |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 | 60 to 100 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate |
|----------|----------|-----------|---|
| Nominal | | 34.09 | Nominal burnup calculated from the heavy metal mass destroyed |
| Bounding | | 68.19 | Bounding burnup assumed to be twice nominal burnup |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/ Given EOL HM |
|----------|-------------------|--------------------------------|--------------------------------|
| Nominal | 0.01 | | 1.00 |
| Bounding | 0.01 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRR MTR (UALX-LEU) JAPAN
SNF ID #: 551
Fuel Units & Descr: 27 - ASSEMBLY
Heavy Metal Mass: BOL=17 482kg, EOL=17 469kg
ROD Storage Site: SRS

¹Fuel decay start date: 2010
Estimates as of: 2030
Template: ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup(MWD): 367.2
Template BOL Heavy Metal Mass (MT): 0 00116689
Template Decay Time: 20 years

Estimated
Canister usage
18"x10"
1 13

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-----------------------------|------------------------------|-----------------------------|------------------------------|
| Radionuclide | CI/MWD From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventones(Ci) | Bounding Fuel Inventones(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6 6313E-10 | 12 78 | 25 57 | 0 00E+00 | 8 48E-09 | 1 70E-08 | Avg MeV | |
| Am-241 | 2 0060E-03 | 12 78 | 25 57 | 0 00E+00 | 2 56E-02 | 5 13E-02 | 0 0150 | 2 699E+12 |
| Am-242m | 4 2429E-07 | 12 78 | 25 57 | 0 00E+00 | 5 42E-06 | 1 08E-05 | 0 0250 | 5 613E+11 |
| Am-243 | 1 4899E-06 | 12 78 | 25 57 | 0 00E+00 | 1 90E-05 | 3 81E-05 | 0 0375 | 4 896E+11 |
| C-14 | 5 7135E-09 | 12 78 | 25 57 | 0 00E+00 | 7 30E-08 | 1 46E-07 | 0 0575 | 5 243E+11 |
| Cl-36 | 1 3124E-32 | 12 78 | 25 57 | 0 00E+00 | 1 68E-31 | 3 36E-31 | 0 0850 | 3 169E+11 |
| Cm-243 | 1 6443E-07 | 12 78 | 25 57 | 0 00E+00 | 2 10E-06 | 4 20E-06 | 0 1250 | 2 145E+11 |
| Cm-244 | 2 9330E-05 | 12 78 | 25 57 | 0 00E+00 | 3 75E-04 | 7 50E-04 | 0 2250 | 2 735E+11 |
| Co-60 | 5 3186E-06 | 12 78 | 25 57 | 0 00E+00 | 6 80E-05 | 1 36E-04 | 0 3750 | 1 190E+11 |
| Cs-134 | 3 1563E-03 | 12 78 | 25 57 | 0 00E+00 | 4 04E-02 | 8 07E-02 | 0 5750 | 1 941E+12 |
| Cs-135 | 3 4477E-06 | 12 78 | 25 57 | 0 00E+00 | 4 41E-05 | 8 82E-05 | 0 8500 | 3 282E+10 |
| Cs-137 | 2 0313E+00 | 12 78 | 25 57 | 0 00E+00 | 2 60E+01 | 5 19E+01 | 1 2500 | 1 874E+10 |
| Eu-154 | 2 4517E-02 | 12 78 | 25 57 | 0 00E+00 | 3 13E-01 | 6 27E-01 | 1 7500 | 8 602E+08 |
| Eu-155 | 4 8175E-03 | 12 78 | 25 57 | 0 00E+00 | 6 16E-02 | 1 23E-01 | 2 2500 | 7 550E+04 |
| Fe-55 | 1 2397E-04 | 12 78 | 25 57 | 0 00E+00 | 1 58E-03 | 3 17E-03 | 2 7500 | 4 269E+04 |
| H-3 | 4 5697E-03 | 12 78 | 25 57 | 0 00E+00 | 5 84E-02 | 1 17E-01 | 3 5000 | 2 212E+02 |
| I-129 | 7 5300E-07 | 12 78 | 25 57 | 0 00E+00 | 9 63E-06 | 1 93E-05 | 5 0000 | 2 194E+01 |
| Kr-85 | 1 0850E-01 | 12 78 | 25 57 | 0 00E+00 | 1 39E+00 | 2 77E+00 | 7 0000 | 2 474E+00 |
| Np-237 | 9 5561E-06 | 12 78 | 25 57 | 0 00E+00 | 1 22E-04 | 2 44E-04 | 11.0000 | 2 809E-01 |
| Pa-231 | 2 0359E-09 | 12 78 | 25 57 | 0 00E+00 | 2 60E-08 | 5 21E-08 | | |
| Pb-210 | 4 9728E-11 | 12 78 | 25 57 | 0 00E+00 | 6 36E-10 | 1 27E-09 | | |
| Pm-147 | 4 8502E-02 | 12 78 | 25 57 | 0 00E+00 | 6 20E-01 | 1 24E+00 | | |
| Pu-238 | 1 8254E-02 | 12 78 | 25 57 | 0 00E+00 | 2 33E-01 | 4 67E-01 | | |
| Pu-239 | 4 2810E-04 | 12 78 | 25 57 | 0 00E+00 | 5 47E-03 | 1 09E-02 | | |
| Pu-240 | 2 4368E-04 | 12 78 | 25 57 | 0 00E+00 | 3 12E-03 | 6 23E-03 | | |
| Pu-241 | 3 3415E-02 | 12 78 | 25 57 | 0 00E+00 | 4 27E-01 | 8 54E-01 | | |
| Pu-242 | 3 6329E-07 | 12 78 | 25 57 | 0 00E+00 | 4 64E-06 | 9 29E-06 | | |
| Ra-226 | 2 2854E-10 | 12 78 | 25 57 | 0 00E+00 | 2 92E-09 | 5 84E-09 | | |
| Ra-228 | 1 2426E-14 | 12 78 | 25 57 | 0 00E+00 | 1 59E-13 | 3 18E-13 | | |
| Ru-106 | 6 3589E-06 | 12 78 | 25 57 | 0 00E+00 | 8 13E-05 | 1 63E-04 | | |
| Se-79 | 1 2933E-05 | 12 78 | 25 57 | 0 00E+00 | 1 65E-04 | 3 31E-04 | | |
| Sn-126 | 1 1574E-05 | 12 78 | 25 57 | 0 00E+00 | 1 48E-04 | 2 96E-04 | | |
| Sr-90 | 1 9248E+00 | 12 78 | 25 57 | 0 00E+00 | 2 46E+01 | 4 92E+01 | | |
| Tc-99 | 4 2239E-04 | 12 78 | 25 57 | 0 00E+00 | 5 40E-03 | 1 08E-02 | | |
| Th-229 | 5 0953E-12 | 12 78 | 25 57 | 0 00E+00 | 6 51E-11 | 1 30E-10 | | |
| Th-230 | 4 1885E-08 | 12 78 | 25 57 | 0 00E+00 | 5 35E-07 | 1 07E-06 | | |
| Th-232 | 1 9270E-14 | 12 78 | 25 57 | 0 00E+00 | 2 46E-13 | 4 93E-13 | | |
| Ti-208 | 4 6024E-08 | 12 78 | 25 57 | 0 00E+00 | 5 88E-07 | 1 18E-06 | | |
| U-232 | 1 2582E-07 | 12 78 | 25 57 | 0 00E+00 | 1 61E-06 | 3 22E-06 | Thermal Power | |
| U-233 | 2 5825E-09 | 12 78 | 25 57 | 0 00E+00 | 3 30E-08 | 6 60E-08 | Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| U-234 | 1 8450E-04 | 12 78 | 25 57 | 0 00E+00 | 2 36E-03 | 4 72E-03 | 3 05E-01 | 6.10E-01 |
| U-235 | -2 7235E-06 | 12 78 | 0 00 | 7 56E-03 | 7 52E-03 | 7 56E-03 | Total | Total |
| U-236 | 1 5493E-05 | 12 78 | 25 57 | 0 00E+00 | 1 98E-04 | 3 96E-04 | | |
| U-238 | -4 2851E-09 | 12 78 | 0 00 | 4 70E-03 | 4 70E-03 | 4 70E-03 | | |
| Y-90 | 1 9254E+00 | 12 78 | 25 57 | 0 00E+00 | 2 46E+01 | 4 92E+01 | | |
| Other Radionuclides | | | | | 2 47E+01 | 4 95E+01 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-------------|-------------|---|
| | From SFD | Used | |
| Reactor Moderator | LIGHT WATER | LIGHT WATER | This Template was used for the following reasons: This fuel matches on all parameters except enrichment. |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 00000092 | 60 to 100 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | | 12 78 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |
| Bounding | | 25 57 | |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 0.00 | | 1.00 |
| Bounding | 0.00 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRR MTR (UALX-LEU) TAIWAN
SNF ID #: 555
Fuel Units & Descr: 23 - ASSEMBLY
Heavy Metal Mass BOL=34 797kg EOL=34 797kg
ROD Storage Site: SRS

¹Fuel decay start date: 2010
Estimates as of 2030
Template ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup(MWd): 367.2
Template BOL Heavy Metal Mass (MT) 0 00116689
Template Decay Time 20 years

Estimated
Canister usage
18"x10"
0 96

| II. Estimates | m | X _a | X _b | b | Y _a | Y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6 6313E-10 | 659 06 | 1,318 13 | 0 00E+00 | 4 37E-07 | 8 74E-07 | Avg MeV | |
| Am-241 | 2 0060E-03 | 659 06 | 1,318 13 | 0 00E+00 | 1 32E+00 | 2 64E+00 | 0 0150 | 1 391E+14 |
| Am-242m | 4 2429E-07 | 659 06 | 1,318 13 | 0 00E+00 | 2 80E-04 | 5 59E-04 | 0 0250 | 2 893E+13 |
| Am-243 | 1 4899E-06 | 659 06 | 1,318 13 | 0 00E+00 | 9 82E-04 | 1 96E-03 | 0 0375 | 2 524E+13 |
| C-14 | 5 7135E-09 | 659 06 | 1,318 13 | 0 00E+00 | 3 77E-06 | 7 53E-06 | 0 0575 | 2 703E+13 |
| Cl-36 | 1 3124E-32 | 659 06 | 1,318 13 | 0 00E+00 | 8 65E-30 | 1 73E-29 | 0 0850 | 1 633E+13 |
| Cm-243 | 1 6443E-07 | 659 06 | 1,318 13 | 0 00E+00 | 1 08E-04 | 2 17E-04 | 0 1250 | 1 105E+13 |
| Cm-244 | 2 9330E-05 | 659 06 | 1,318 13 | 0 00E+00 | 1 93E-02 | 3 87E-02 | 0 2250 | 1 409E+13 |
| Co-60 | 5 3186E-06 | 659 06 | 1,318 13 | 0 00E+00 | 3 51E-03 | 7 01E-03 | 0 3750 | 6 135E+12 |
| Cs-134 | 3 1563E-03 | 659 06 | 1,318 13 | 0 00E+00 | 2 08E+00 | 4 16E+00 | 0 5750 | 1 001E+14 |
| Cs-135 | 3 4477E-06 | 659 06 | 1,318 13 | 0 00E+00 | 2 27E-03 | 4 54E-03 | 0 8500 | 1 692E+12 |
| Cs-137 | 2 0313E+00 | 659 06 | 1,318 13 | 0 00E+00 | 1 34E+03 | 2 68E+03 | 1 2500 | 9 661E+11 |
| Eu-154 | 2 4513E-02 | 659 06 | 1,318 13 | 0 00E+00 | 1 62E+01 | 3 23E+01 | 1 7500 | 4 434E+10 |
| Eu-155 | 4 8175E-03 | 659 06 | 1,318 13 | 0 00E+00 | 3 18E+00 | 6 35E+00 | 2 2500 | 3 890E+06 |
| Fe-55 | 1 2397E-04 | 659 06 | 1,318 13 | 0 00E+00 | 8 17E-02 | 1 63E-01 | 2 7500 | 2 199E+06 |
| H-3 | 4 5697E-03 | 659 06 | 1,318 13 | 0 00E+00 | 3 01E+00 | 6 02E+00 | 3 5000 | 1 015E+04 |
| I-129 | 7 5300E-07 | 659 06 | 1,318 13 | 0 00E+00 | 4 96E-04 | 9 93E-04 | 5 0000 | 5 926E+02 |
| Kr-85 | 1 0850E-01 | 659 06 | 1,318 13 | 0 00E+00 | 7 15E+01 | 1 43E+02 | 7 0000 | 6 552E+01 |
| Np-237 | 9 5561E-06 | 659 06 | 1,318 13 | 0 00E+00 | 6 30E-03 | 1 26E-02 | 11 0000 | 7 351E+00 |
| Pa-231 | 2 0359E-09 | 659 06 | 1,318 13 | 0 00E+00 | 1 34E-06 | 2 68E-06 | | |
| Pb-210 | 4 9728E-11 | 659 06 | 1,318 13 | 0 00E+00 | 3 28E-08 | 6 55E-08 | | |
| Pm-147 | 4 8502E-02 | 659 06 | 1,318 13 | 0 00E+00 | 3 20E+01 | 6 39E+01 | | |
| Pu-238 | 1 8254E-02 | 659 06 | 1,318 13 | 0 00E+00 | 1 20E+01 | 2 41E+01 | | |
| Pu-239 | 4 2810E-04 | 659 06 | 1,318 13 | 0 00E+00 | 2 82E-01 | 5 64E-01 | | |
| Pu-240 | 2 4368E-04 | 659 06 | 1,318 13 | 0 00E+00 | 1 61E-01 | 3 21E-01 | | |
| Pu-241 | 3 3415E-02 | 659 06 | 1,318 13 | 0 00E+00 | 2 20E+01 | 4 40E+01 | | |
| Pu-242 | 3 6329E-07 | 659 06 | 1,318 13 | 0 00E+00 | 2 39E-04 | 4 79E-04 | | |
| Ra-226 | 2 2854E-10 | 659 06 | 1,318 13 | 0 00E+00 | 1 51E-07 | 3 01E-07 | | |
| Ra-228 | 1 2426E-14 | 659 06 | 1,318 13 | 0 00E+00 | 8 19E-12 | 1 64E-11 | | |
| Ru-106 | 6 3589E-06 | 659 06 | 1,318 13 | 0 00E+00 | 4 19E-03 | 8 38E-03 | | |
| Se-79 | 1 2933E-05 | 659 06 | 1,318 13 | 0 00E+00 | 8 52E-03 | 1 70E-02 | | |
| Sn-126 | 1 1574E-05 | 659 06 | 1,318 13 | 0 00E+00 | 7 63E-03 | 1 53E-02 | | |
| Sr-90 | 1 9248E+00 | 659 06 | 1,318 13 | 0 00E+00 | 1 27E+03 | 2 54E+03 | | |
| Tc-99 | 4 2239E-04 | 659 06 | 1,318 13 | 0 00E+00 | 2 78E-01 | 5 57E-01 | | |
| Th-229 | 5 0953E-12 | 659 06 | 1,318 13 | 0 00E+00 | 3 36E-09 | 6 72E-09 | | |
| Th-230 | 4 1885E-08 | 659 06 | 1,318 13 | 0 00E+00 | 2 76E-05 | 5 52E-05 | | |
| Th-232 | 1 9270E-14 | 659 06 | 1,318 13 | 0 00E+00 | 1 27E-11 | 2 54E-11 | | |
| Th-208 | 4 6024E-08 | 659 06 | 1,318 13 | 0 00E+00 | 3 03E-05 | 6 07E-05 | | |
| U-232 | 1 2582E-07 | 659 06 | 1,318 13 | 0 00E+00 | 8 29E-05 | 1 66E-04 | | |
| U-233 | 2 5825E-09 | 659 06 | 1,318 13 | 0 00E+00 | 1 70E-06 | 3 40E-06 | | |
| U-234 | 1 8450E-04 | 659 06 | 1,318 13 | 0 00E+00 | 1 22E-01 | 2 43E-01 | | |
| U-235 | -2 7235E-06 | 659 06 | 0 00 | 1 49E-02 | 1 31E-02 | 1 49E-02 | | |
| U-236 | 1 5493E-05 | 659 06 | 1,318 13 | 0 00E+00 | 1 02E-02 | 2 04E-02 | | |
| U-238 | -4 2851E-09 | 659 06 | 0 00 | 9 38E-03 | 9 37E-03 | 9 38E-03 | | |
| Y-90 | 1 9254E+00 | 659 06 | 1,318 13 | 0 00E+00 | 1 27E+03 | 2 54E+03 | | |
| Other Radionuclides | | | | | 1 27E+03 | 2 55E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences: |
|---------------------|-------------|-------------|---|
| Reactor Moderator | LIGHT WATER | LIGHT WATER | This Template was used for the following reasons This fuel matches ATR Template on all but one parameter (enrichment) making ATR a reasonable match. |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19 83000026 | 60 to 100 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|----------|-----------|---|
| Nominal | | 659 06 | Nominal burnup assumed to be 2% of BOL heavy metal mass |
| Bounding | | 1,318 13 | Bounding burnup assumed to be twice nominal burnup |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0 06 | | 0 98 |
| Bounding | 0 12 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRR MTR (UALX-LEU) VENEZUELA
SNF ID #: 559
Fuel Units & Descr: 64 - ASSEMBLY
Heavy Metal Mass: BOL=43.2kg, EOL=39 046kg
ROD Storage Site: SRS

Fuel decay start date: 2010
Estimates as of: 2030
Template: ATR (Light Water, Alum, 60 to 100%, U)
Template Burnup(MWd): 367.2
Template BOL Heavy Metal Mass (MT): 0 00116689
Template Decay Time: 20 years

Estimated
Canister usage
18"x10"
2 67

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6 6313E-10 | 3,933 54 | 7,867 08 | 0 00E+00 | 2 61E-06 | 5,22E-06 | Avg MeV | |
| Am-241 | 2 0060E-03 | 3,933 54 | 7,867 08 | 0 00E+00 | 7 89E+00 | 1 58E+01 | 0 0150 | 8 304E+14 |
| Am-242m | 4 2429E-07 | 3,933 54 | 7,867 08 | 0 00E+00 | 1 67E-03 | 3 34E-03 | 0 0250 | 1 727E+14 |
| Am-243 | 1 4899E-06 | 3,933 54 | 7,867 08 | 0 00E+00 | 5 86E-03 | 1 17E-02 | 0 0375 | 1 506E+14 |
| C-14 | 5 7135E-09 | 3,933 54 | 7,867 08 | 0 00E+00 | 2 25E-05 | 4 49E-05 | 0 0575 | 1 613E+14 |
| Cl-36 | 1 3124E-32 | 3,933 54 | 7,867 08 | 0 00E+00 | 5 16E-29 | 1 03E-28 | 0 0850 | 9 749E+13 |
| Cm-243 | 1 6443E-07 | 3,933 54 | 7,867 08 | 0 00E+00 | 6 47E-04 | 1 29E-03 | 0 1250 | 6 597E+13 |
| Cm-244 | 2 9330E-05 | 3,933 54 | 7,867 08 | 0 00E+00 | 1 15E-01 | 2 31E-01 | 0 2250 | 8 412E+13 |
| Co-60 | 5 3186E-06 | 3,933 54 | 7,867 08 | 0 00E+00 | 2 09E-02 | 4 18E-02 | 0 3750 | 3 662E+13 |
| Cs-134 | 3 1563E-03 | 3,933 54 | 7,867 08 | 0 00E+00 | 1 24E+01 | 2 48E+01 | 0 5750 | 5 973E+14 |
| Cs-135 | 3 4477E-06 | 3,933 54 | 7,867 08 | 0 00E+00 | 1 36E-02 | 2 71E-02 | 0 8500 | 1 010E+13 |
| Cs-137 | 2 0313E+00 | 3,933 54 | 7,867 08 | 0 00E+00 | 7 99E+03 | 1 60E+04 | 1 2500 | 5 766E+12 |
| Eu-154 | 2 4513E-02 | 3,933 54 | 7,867 08 | 0 00E+00 | 9 64E+01 | 1 93E+02 | 1 7500 | 2 646E+11 |
| Eu-155 | 4 8175E-03 | 3,933 54 | 7,867 08 | 0 00E+00 | 1 89E+01 | 3 79E+01 | 2 2500 | 2 321E+07 |
| Fe-55 | 1 2397E-04 | 3,933 54 | 7,867 08 | 0 00E+00 | 4 88E-01 | 9 75E-01 | 2 7500 | 1 312E+07 |
| H-3 | 4 5697E-03 | 3,933 54 | 7,867 08 | 0 00E+00 | 1 80E+01 | 3 60E+01 | 3 5000 | 6 035E+04 |
| I-129 | 7 5300E-07 | 3,933 54 | 7,867 08 | 0 00E+00 | 2 96E-03 | 5 92E-03 | 5 0000 | 3 434E+03 |
| Kr-85 | 1 0850E-01 | 3,933 54 | 7,867 08 | 0 00E+00 | 4 27E+02 | 8 54E+02 | 7 0000 | 3 793E+02 |
| Np-237 | 9 5561E-06 | 3,933 54 | 7,867 08 | 0 00E+00 | 3 76E-02 | 7 52E-02 | 11 0000 | 4 252E+01 |
| Pb-210 | 4 9728E-11 | 3,933 54 | 7,867 08 | 0 00E+00 | 1 96E-07 | 3 91E-07 | | |
| Pm-147 | 4 8502E-02 | 3,933 54 | 7,867 08 | 0 00E+00 | 1 91E+02 | 3 82E+02 | | |
| Pu-238 | 1 8254E-02 | 3,933 54 | 7,867 08 | 0 00E+00 | 7 18E+01 | 1 44E+02 | | |
| Pu-239 | 4 2810E-04 | 3,933 54 | 7,867 08 | 0 00E+00 | 1 68E+00 | 3 37E+00 | | |
| Pu-240 | 2 4368E-04 | 3,933 54 | 7,867 08 | 0 00E+00 | 9 59E-01 | 1 92E+00 | | |
| Pu-241 | 3 3415E-02 | 3,933 54 | 7,867 08 | 0 00E+00 | 1 31E+02 | 2 63E+02 | | |
| Pu-242 | 3 6329E-07 | 3,933 54 | 7,867 08 | 0 00E+00 | 1 43E-03 | 2 86E-03 | | |
| Ra-226 | 2 2854E-10 | 3,933 54 | 7,867 08 | 0 00E+00 | 8 99E-07 | 1 80E-06 | | |
| Ra-228 | 1 2426E-14 | 3,933 54 | 7,867 08 | 0 00E+00 | 4 89E-11 | 9 78E-11 | | |
| Ru-106 | 6 3589E-06 | 3,933 54 | 7,867 08 | 0 00E+00 | 2 50E-02 | 5 00E-02 | | |
| Se-79 | 1 2933E-05 | 3,933 54 | 7,867 08 | 0 00E+00 | 5 09E-02 | 1 02E-01 | | |
| Sn-126 | 1 1574E-05 | 3,933 54 | 7,867 08 | 0 00E+00 | 4 55E-02 | 9 11E-02 | | |
| Sr-90 | 1 9248E+00 | 3,933 54 | 7,867 08 | 0 00E+00 | 7 57E+03 | 1 51E+04 | | |
| Tc-99 | 4 2239E-04 | 3,933 54 | 7,867 08 | 0 00E+00 | 1 66E+00 | 3 32E+00 | | |
| Th-229 | 5 0953E-12 | 3,933 54 | 7,867 08 | 0 00E+00 | 2 00E-08 | 4 01E-08 | | |
| Th-230 | 4 1885E-08 | 3,933 54 | 7,867 08 | 0 00E+00 | 1 65E-04 | 3 30E-04 | | |
| Th-232 | 1 9270E-14 | 3,933 54 | 7,867 08 | 0 00E+00 | 7 58E-11 | 1 52E-10 | | |
| Ti-208 | 4 6024E-08 | 3,933 54 | 7,867 08 | 0 00E+00 | 1 81E-04 | 3 62E-04 | | |
| U-232 | 1 2582E-07 | 3,933 54 | 7,867 08 | 0 00E+00 | 4 95E-04 | 9 90E-04 | | |
| U-233 | 2 5825E-09 | 3,933 54 | 7,867 08 | 0 00E+00 | 1 02E-05 | 2 03E-05 | | |
| U-234 | 1 8450E-04 | 3,933 54 | 7,867 08 | 0 00E+00 | 7 26E-01 | 1 45E+00 | | |
| U-235 | 2 7235E-06 | 3,933 54 | 0 00 | 1 87E-02 | 7 96E-03 | 1 87E-02 | | |
| U-236 | 1 5493E-05 | 3,933 54 | 7,867 08 | 0 00E+00 | 6 09E-02 | 1 22E-01 | | |
| U-238 | 4 2851E-09 | 3,933 54 | 0 00 | 1 16E-02 | 1 16E-02 | 1 16E-02 | | |
| Y-90 | 1 9254E+00 | 3,933 54 | 7,867 08 | 0 00E+00 | 7 57E+03 | 1 51E+04 | | |
| Other Radionuclides | | | | | 7 61E+03 | 1 52E+04 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences: |
|----------------------|-------------|-------------|---|
| Reactor Moderator: | LIGHT WATER | LIGHT WATER | This Template was used for the following reasons. |
| Fuel Cladding: | ALUM | ALUM | This fuel matches ATR Template on all but one parameter (enrichment) making ATR a reasonable match. |
| BOL HM Constituents: | U | U | |
| BOL Enrichment %: | 20 | 60 to 100 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|----------|-----------|--|
| Nominal | | 3,933.54 | Nominal burnup calculated from the heavy metal mass destroyed. |
| Bounding | | 7 867 08 | Bounding burnup assumed to be twice nominal burnup. |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0.29 | | 1 01 |
| Bounding | 0.58 | | |

¹Reactor shutdown, core removal storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name FRR MTR (UALX-MEU) JAPAN
SNF ID # 565
Fuel Units & Descr 30 - MTR TYPE
Heavy Metal Mass BOL=21.543kg EOL=21.525kg
ROD Storage Site SRS

Fuel decay start date: 2010
Estimates as of: 2030
Template ATR (Light Water Alum, 60 to 100%, U)
Template Burnup(MWd) 367.2
Template BOL Heavy Metal Mass (MT) 0.00116689
Template Decay Time 20 years

Estimated
Canister usage
18"x10"
125

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6.6313E-10 | 17.05 | 34.09 | 0.00E+00 | 1.13E-08 | 2.26E-08 | Avg MeV | |
| Am-241 | 2.0600E-03 | 17.05 | 34.09 | 0.00E+00 | 3.42E-02 | 6.84E-02 | 0.0150 | 3.599E+12 |
| Am-242m | 4.2429E-07 | 17.05 | 34.09 | 0.00E+00 | 7.23E-06 | 1.45E-05 | 0.0250 | 7.484E+11 |
| Am-243 | 1.4899E-06 | 17.05 | 34.09 | 0.00E+00 | 2.54E-05 | 5.08E-05 | 0.0375 | 6.527E+11 |
| C-14 | 5.7135E-09 | 17.05 | 34.09 | 0.00E+00 | 9.74E-08 | 1.95E-07 | 0.0575 | 6.991E+11 |
| Cl-36 | 1.3124E-32 | 17.05 | 34.09 | 0.00E+00 | 2.24E-31 | 4.47E-31 | 0.0850 | 4.225E+11 |
| Cm-243 | 1.6443E-07 | 17.05 | 34.09 | 0.00E+00 | 2.80E-06 | 5.61E-06 | 0.1250 | 2.860E+11 |
| Cm-244 | 2.9330E-05 | 17.05 | 34.09 | 0.00E+00 | 5.00E-04 | 1.00E-03 | 0.2250 | 3.649E+11 |
| Co-60 | 5.3186E-06 | 17.05 | 34.09 | 0.00E+00 | 9.07E-05 | 1.81E-04 | 0.3750 | 1.587E+11 |
| Cs-134 | 3.1563E-03 | 17.05 | 34.09 | 0.00E+00 | 5.38E-02 | 1.08E-01 | 0.5750 | 2.588E+12 |
| Cs-135 | 3.4477E-06 | 17.05 | 34.09 | 0.00E+00 | 5.88E-05 | 1.18E-04 | 0.8500 | 4.376E+10 |
| Cs-137 | 2.0313E+00 | 17.05 | 34.09 | 0.00E+00 | 3.46E+01 | 6.93E+01 | 1.2500 | 2.499E+10 |
| Eu-154 | 2.4513E-02 | 17.05 | 34.09 | 0.00E+00 | 4.18E-01 | 8.36E-01 | 1.7500 | 1.147E+09 |
| Eu-155 | 4.8175E-03 | 17.05 | 34.09 | 0.00E+00 | 8.21E-02 | 1.64E-01 | 2.2500 | 1.006E+05 |
| Fe-55 | 1.2397E-04 | 17.05 | 34.09 | 0.00E+00 | 2.11E-03 | 4.23E-03 | 2.7500 | 5.690E+04 |
| H-3 | 4.5697E-03 | 17.05 | 34.09 | 0.00E+00 | 7.79E-02 | 1.56E-01 | 3.5000 | 2.832E+02 |
| I-129 | 7.5300E-07 | 17.05 | 34.09 | 0.00E+00 | 1.28E-05 | 2.57E-05 | 5.0000 | 2.418E+01 |
| Kr-85 | 1.0850E-01 | 17.05 | 34.09 | 0.00E+00 | 1.85E+00 | 3.70E+00 | 7.0000 | 2.712E+00 |
| Np-237 | 9.5561E-06 | 17.05 | 34.09 | 0.00E+00 | 1.63E-04 | 3.26E-04 | 11.0000 | 3.070E-01 |
| Pa-231 | 2.0359E-09 | 17.05 | 34.09 | 0.00E+00 | 3.47E-08 | 6.94E-08 | | |
| Pb-210 | 4.9728E-11 | 17.05 | 34.09 | 0.00E+00 | 8.48E-10 | 1.70E-09 | | |
| Pm-147 | 4.8502E-02 | 17.05 | 34.09 | 0.00E+00 | 8.27E-01 | 1.65E+00 | | |
| Pu-238 | 1.8254E-02 | 17.05 | 34.09 | 0.00E+00 | 3.11E-01 | 6.22E-01 | | |
| Pu-239 | 4.2810E-04 | 17.05 | 34.09 | 0.00E+00 | 7.30E-03 | 1.46E-02 | | |
| Pu-240 | 2.4368E-04 | 17.05 | 34.09 | 0.00E+00 | 4.15E-03 | 8.31E-03 | | |
| Pu-241 | 3.3415E-02 | 17.05 | 34.09 | 0.00E+00 | 5.70E-01 | 1.14E+00 | | |
| Pu-242 | 3.6329E-07 | 17.05 | 34.09 | 0.00E+00 | 6.19E-06 | 1.24E-05 | | |
| Ra-226 | 2.2854E-10 | 17.05 | 34.09 | 0.00E+00 | 3.90E-09 | 7.79E-09 | | |
| Ra-228 | 1.2426E-14 | 17.05 | 34.09 | 0.00E+00 | 2.12E-13 | 4.24E-13 | | |
| Ru-106 | 6.3589E-06 | 17.05 | 34.09 | 0.00E+00 | 1.08E-04 | 2.17E-04 | | |
| Se-79 | 1.2933E-05 | 17.05 | 34.09 | 0.00E+00 | 2.20E-04 | 4.41E-04 | | |
| Sn-126 | 1.1574E-05 | 17.05 | 34.09 | 0.00E+00 | 1.97E-04 | 3.95E-04 | | |
| Sr-90 | 1.9248E+00 | 17.05 | 34.09 | 0.00E+00 | 3.28E+01 | 6.56E+01 | | |
| Tc-99 | 4.2239E-04 | 17.05 | 34.09 | 0.00E+00 | 7.20E-03 | 1.44E-02 | | |
| Th-229 | 5.0953E-12 | 17.05 | 34.09 | 0.00E+00 | 8.69E-11 | 1.74E-10 | | |
| Th-230 | 4.1885E-08 | 17.05 | 34.09 | 0.00E+00 | 7.14E-07 | 1.43E-06 | | |
| Th-232 | 1.9270E-14 | 17.05 | 34.09 | 0.00E+00 | 3.28E-13 | 6.57E-13 | | |
| Th-208 | 4.6024E-08 | 17.05 | 34.09 | 0.00E+00 | 7.85E-07 | 1.57E-06 | | |
| U-232 | 1.2582E-07 | 17.05 | 34.09 | 0.00E+00 | 2.14E-06 | 4.29E-06 | | |
| U-233 | 2.5825E-09 | 17.05 | 34.09 | 0.00E+00 | 4.40E-08 | 8.80E-08 | | |
| U-234 | 1.8450E-04 | 17.05 | 34.09 | 0.00E+00 | 3.15E-03 | 6.29E-03 | | |
| U-235 | 2.7235E-06 | 17.05 | 0.00 | 2.09E-02 | 2.09E-02 | 2.09E-02 | | |
| U-236 | 1.5493E-05 | 17.05 | 34.09 | 0.00E+00 | 2.64E-04 | 5.28E-04 | | |
| U-238 | 4.2851E-09 | 17.05 | 0.00 | 3.98E-03 | 3.98E-03 | 3.98E-03 | | |
| Y-90 | 1.9254E+00 | 17.05 | 34.09 | 0.00E+00 | 3.28E+01 | 6.56E+01 | | |
| Other Radionuclides | | | | | 3.30E+01 | 6.59E+01 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: This Template was used for the following reasons: This fuel matches ATR Template on all but one parameter (enrichment) making ATR a reasonable match. |
|----------------------------|-------------|-------------|--|
| Reactor Moderator | From SFD | Used | |
| Fuel Cladding | LIGHT WATER | LIGHT WATER | |
| BOL HM Constituents | ALUM | ALUM | |
| BOL Enrichment % | U | U | |
| | 44.97911463 | 60 to 100 | |

| Burnup Summary (MWd) ² | | Basis for burnup used in estimate: Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup. |
|-----------------------------------|-------|--|
| | | |
| Nominal | 17.05 | |
| Bounding | 34.09 | |

| Checks | | Estimated EOL HM/Given EOL HM 1.00 |
|----------|------------------------------------|---------------------------------------|
| | | |
| Nominal | Burnup Multiplier 0.00 | |
| Bounding | Estimated Burnup/Given Burnup 0.01 | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRM MTR UALX HEU CANADA
SNF ID #: 294
Fuel Units & Descr. 14 - MULTI-PIN CLUSTER
Heavy Metal Mass. BOL=2.204kg, EOL=2.192kg
ROD Storage Site SRS

¹Fuel decay start date: 2010
Estimates as of 2030
Template: ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup(MWd): 367.2
Template BOL Heavy Metal Mass (MT): 0.00116689
Template Decay Time 20 years

Estimated
Canister usage*
18"x10"
0.58

| II. Estimates* | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6.6313E-10 | 10.61 | 21.21 | 0.00E+00 | 7.03E-09 | 1.41E-08 | Avg MeV | |
| Am-241 | 2.0060E-03 | 10.61 | 21.21 | 0.00E+00 | 2.13E-02 | 4.26E-02 | 0.0150 | 2.239E+12 |
| Am-242m | 4.2429E-07 | 10.61 | 21.21 | 0.00E+00 | 4.50E-06 | 9.00E-06 | 0.0250 | 4.656E+11 |
| Am-243 | 1.4899E-06 | 10.61 | 21.21 | 0.00E+00 | 1.58E-05 | 3.16E-05 | 0.0375 | 4.062E+11 |
| C-14 | 5.7135E-09 | 10.61 | 21.21 | 0.00E+00 | 6.06E-08 | 1.21E-07 | 0.0575 | 4.350E+11 |
| Cl-36 | 1.3124E-32 | 10.61 | 21.21 | 0.00E+00 | 1.39E-31 | 2.78E-31 | 0.0850 | 2.629E+11 |
| Cm-243 | 1.6443E-07 | 10.61 | 21.21 | 0.00E+00 | 1.74E-06 | 3.49E-06 | 0.1250 | 1.779E+11 |
| Cm-244 | 2.9330E-05 | 10.61 | 21.21 | 0.00E+00 | 3.11E-04 | 6.22E-04 | 0.2250 | 2.269E+11 |
| Co-60 | 5.3186E-06 | 10.61 | 21.21 | 0.00E+00 | 5.64E-05 | 1.13E-04 | 0.3750 | 9.874E+10 |
| Cs-134 | 3.1563E-03 | 10.61 | 21.21 | 0.00E+00 | 3.35E-02 | 6.70E-02 | 0.5750 | 1.611E+12 |
| Cs-135 | 3.4477E-06 | 10.61 | 21.21 | 0.00E+00 | 3.66E-05 | 7.31E-05 | 0.8500 | 2.723E+10 |
| Cs-137 | 2.0313E+00 | 10.61 | 21.21 | 0.00E+00 | 2.15E+01 | 4.31E+01 | 1.2500 | 1.555E+10 |
| Eu-154 | 2.4513E-02 | 10.61 | 21.21 | 0.00E+00 | 2.60E-01 | 5.20E-01 | 1.7500 | 7.136E+08 |
| Eu-155 | 4.8175E-03 | 10.61 | 21.21 | 0.00E+00 | 5.11E-02 | 1.02E-01 | 2.2500 | 6.260E+04 |
| Fe-55 | 1.2397E-04 | 10.61 | 21.21 | 0.00E+00 | 1.31E-03 | 2.63E-03 | 2.7500 | 3.539E+04 |
| H-3 | 4.5697E-03 | 10.61 | 21.21 | 0.00E+00 | 4.85E-02 | 9.69E-02 | 3.5000 | 1.630E+02 |
| I-129 | 7.5300E-07 | 10.61 | 21.21 | 0.00E+00 | 7.99E-06 | 1.60E-05 | 5.0000 | 9.366E+00 |
| Kr-85 | 1.0850E-01 | 10.61 | 21.21 | 0.00E+00 | 1.15E+00 | 2.30E+00 | 7.0000 | 1.034E+00 |
| Np-237 | 9.5561E-06 | 10.61 | 21.21 | 0.00E+00 | 1.01E-04 | 2.03E-04 | 11.0000 | 1.160E-01 |
| Pa-231 | 2.0359E-09 | 10.61 | 21.21 | 0.00E+00 | 2.16E-08 | 4.32E-08 | | |
| Pb-210 | 4.9728E-11 | 10.61 | 21.21 | 0.00E+00 | 5.27E-10 | 1.05E-09 | | |
| Pm-147 | 4.8502E-02 | 10.61 | 21.21 | 0.00E+00 | 5.14E-01 | 1.03E+00 | | |
| Pu-238 | 1.8254E-02 | 10.61 | 21.21 | 0.00E+00 | 1.94E-01 | 3.87E-01 | | |
| Pu-239 | 4.2810E-04 | 10.61 | 21.21 | 0.00E+00 | 4.54E-03 | 9.08E-03 | | |
| Pu-240 | 2.4368E-04 | 10.61 | 21.21 | 0.00E+00 | 2.58E-03 | 5.17E-03 | | |
| Pu-241 | 3.3415E-02 | 10.61 | 21.21 | 0.00E+00 | 3.54E-01 | 7.09E-01 | | |
| Pu-242 | 3.6329E-07 | 10.61 | 21.21 | 0.00E+00 | 3.85E-06 | 7.71E-06 | | |
| Ra-226 | 2.2854E-10 | 10.61 | 21.21 | 0.00E+00 | 2.42E-09 | 4.85E-09 | | |
| Ra-228 | 1.2426E-14 | 10.61 | 21.21 | 0.00E+00 | 1.32E-13 | 2.64E-13 | | |
| Ru-106 | 6.3589E-06 | 10.61 | 21.21 | 0.00E+00 | 6.74E-05 | 1.35E-04 | | |
| Se-79 | 1.2933E-05 | 10.61 | 21.21 | 0.00E+00 | 1.37E-04 | 2.74E-04 | | |
| Sn-126 | 1.1574E-05 | 10.61 | 21.21 | 0.00E+00 | 1.23E-04 | 2.46E-04 | | |
| Sr-90 | 1.9248E+00 | 10.61 | 21.21 | 0.00E+00 | 2.04E+01 | 4.08E+01 | | |
| Tc-99 | 4.2239E-04 | 10.61 | 21.21 | 0.00E+00 | 4.48E-03 | 8.96E-03 | | |
| Th-229 | 5.0953E-12 | 10.61 | 21.21 | 0.00E+00 | 5.40E-11 | 1.08E-10 | | |
| Th-230 | 4.1885E-08 | 10.61 | 21.21 | 0.00E+00 | 4.44E-07 | 8.89E-07 | | |
| Th-232 | 1.9270E-14 | 10.61 | 21.21 | 0.00E+00 | 2.04E-13 | 4.09E-13 | | |
| Ti-208 | 4.6024E-08 | 10.61 | 21.21 | 0.00E+00 | 4.88E-07 | 9.76E-07 | | |
| U-232 | 1.2582E-07 | 10.61 | 21.21 | 0.00E+00 | 1.33E-06 | 2.67E-06 | | |
| U-233 | 2.5825E-09 | 10.61 | 21.21 | 0.00E+00 | 2.74E-08 | 5.48E-08 | | |
| U-234 | 1.8450E-04 | 10.61 | 21.21 | 0.00E+00 | 1.96E-03 | 3.91E-03 | | |
| U-235 | -2.7235E-06 | 10.61 | 0.00 | 4.43E-03 | 4.40E-03 | 4.43E-03 | | |
| U-236 | 1.5493E-05 | 10.61 | 21.21 | 0.00E+00 | 1.64E-04 | 3.29E-04 | | |
| U-238 | -4.2851E-09 | 10.61 | 0.00 | 5.11E-05 | 5.11E-05 | 5.11E-05 | | |
| Y-90 | 1.9254E+00 | 10.61 | 21.21 | 0.00E+00 | 2.04E+01 | 4.08E+01 | | |
| Other Radionuclides | | | | | 2.05E+01 | 4.10E+01 | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 2.53E-01 | 5.06E-01 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences* |
|----------------------------|-------------|-------------|----------------------------------|
| | From SFD | Used | |
| Reactor Moderator | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 93.09999644 | 60 to 100 | |

| Burnup Summary (MWd) ³ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | | 10.61 | |
| Bounding | | 21.21 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 0.02 | | |
| Bounding | 0.03 | | 1.00 |

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

³Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name FRR MTR-C (U308-LEU) PERU
 SNF ID # 503
 Fuel Units & Descr 6 - ASSEMBLY
 Heavy Metal Mass BOL=6kg, EOL=5.67kg
 ROD Storage Site SRS
 Fuel decay start date 2010
 Estimates as of 2030
 Template ATR (Light Water, Alum, 60 to 100%, U)
 Template Burnup(MWd) 367.2
 Template BOL Heavy Metal Mass (MT). 0.00116689
 Template Decay Time* 20 years

Estimated
 Canister usage
 18"x10"
 0.25

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| | m | x _a | x _b | b | y _a | y _b | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Avg MeV | |
| Ac-227 | 6.6313E-10 | 312.52 | 625.03 | 0.00E+00 | 2.07E-07 | 4.14E-07 | 0.0150 | 6.598E+13 |
| Am-241 | 2.0060E-03 | 312.52 | 625.03 | 0.00E+00 | 6.27E-01 | 1.25E+00 | 0.0250 | 1.372E+13 |
| Am-242m | 4.2429E-07 | 312.52 | 625.03 | 0.00E+00 | 1.33E-04 | 2.65E-04 | 0.0375 | 1.197E+13 |
| Am-243 | 1.4899E-06 | 312.52 | 625.03 | 0.00E+00 | 4.66E-04 | 9.31E-04 | 0.0575 | 1.282E+13 |
| C-14 | 5.7135E-09 | 312.52 | 625.03 | 0.00E+00 | 1.79E-06 | 3.57E-06 | 0.0850 | 7.745E+12 |
| Cl-36 | 1.3124E-32 | 312.52 | 625.03 | 0.00E+00 | 4.10E-30 | 8.20E-30 | 0.1250 | 5.241E+12 |
| Cm-243 | 1.6443E-07 | 312.52 | 625.03 | 0.00E+00 | 5.14E-05 | 1.03E-04 | 0.2250 | 6.683E+12 |
| Cm-244 | 2.9330E-05 | 312.52 | 625.03 | 0.00E+00 | 9.17E-03 | 1.83E-02 | 0.3750 | 2.909E+12 |
| Co-60 | 5.3186E-06 | 312.52 | 625.03 | 0.00E+00 | 1.66E-03 | 3.32E-03 | 0.5750 | 4.745E+13 |
| Cs-134 | 3.1563E-03 | 312.52 | 625.03 | 0.00E+00 | 9.86E-01 | 1.97E+00 | 0.8500 | 8.023E+11 |
| Cs-135 | 3.4477E-06 | 312.52 | 625.03 | 0.00E+00 | 1.08E-03 | 2.15E-03 | 1.2500 | 4.581E+11 |
| Cs-137 | 2.0313E+00 | 312.52 | 625.03 | 0.00E+00 | 6.35E+02 | 1.27E+03 | 1.7500 | 2.103E+10 |
| Eu-154 | 2.4513E-02 | 312.52 | 625.03 | 0.00E+00 | 7.66E+00 | 1.53E+01 | 2.2500 | 1.844E+06 |
| Eu-155 | 4.8175E-03 | 312.52 | 625.03 | 0.00E+00 | 1.51E+00 | 3.01E+00 | 2.7500 | 1.043E+06 |
| Fe-55 | 1.2397E-04 | 312.52 | 625.03 | 0.00E+00 | 3.87E-02 | 7.75E-02 | 3.5000 | 4.799E+03 |
| H-3 | 4.5697E-03 | 312.52 | 625.03 | 0.00E+00 | 1.43E+00 | 2.86E+00 | 5.0000 | 2.745E+02 |
| I-129 | 7.5300E-07 | 312.52 | 625.03 | 0.00E+00 | 2.35E-04 | 4.71E-04 | 7.0000 | 3.032E+01 |
| Kr-85 | 1.0850E-01 | 312.52 | 625.03 | 0.00E+00 | 3.39E+01 | 6.78E+01 | 11.0000 | 3.399E+00 |
| Np-237 | 9.5561E-06 | 312.52 | 625.03 | 0.00E+00 | 2.99E-03 | 5.97E-03 | | |
| Pa-231 | 2.0359E-09 | 312.52 | 625.03 | 0.00E+00 | 6.36E-07 | 1.27E-06 | | |
| Pb-210 | 4.9728E-11 | 312.52 | 625.03 | 0.00E+00 | 1.55E-08 | 3.11E-08 | | |
| Pm-147 | 4.8502E-02 | 312.52 | 625.03 | 0.00E+00 | 1.52E+01 | 3.03E+01 | | |
| Pu-238 | 1.8254E-02 | 312.52 | 625.03 | 0.00E+00 | 5.70E+00 | 1.14E+01 | | |
| Pu-239 | 4.2810E-04 | 312.52 | 625.03 | 0.00E+00 | 1.34E-01 | 2.68E-01 | | |
| Pu-240 | 2.4368E-04 | 312.52 | 625.03 | 0.00E+00 | 7.62E-02 | 1.52E-01 | | |
| Pu-241 | 3.3415E-02 | 312.52 | 625.03 | 0.00E+00 | 1.04E+01 | 2.09E+01 | | |
| Pu-242 | 3.6329E-07 | 312.52 | 625.03 | 0.00E+00 | 1.14E-04 | 2.27E-04 | | |
| Ra-226 | 2.2854E-10 | 312.52 | 625.03 | 0.00E+00 | 7.14E-08 | 1.43E-07 | | |
| Ra-228 | 1.2426E-14 | 312.52 | 625.03 | 0.00E+00 | 3.88E-12 | 7.77E-12 | | |
| Ru-106 | 6.3589E-06 | 312.52 | 625.03 | 0.00E+00 | 1.99E-03 | 3.97E-03 | | |
| Se-79 | 1.2933E-05 | 312.52 | 625.03 | 0.00E+00 | 4.04E-03 | 8.08E-03 | | |
| Sn-126 | 1.1574E-05 | 312.52 | 625.03 | 0.00E+00 | 3.62E-03 | 7.23E-03 | | |
| Sr-90 | 1.9248E+00 | 312.52 | 625.03 | 0.00E+00 | 6.02E+02 | 1.20E+03 | | |
| Tc-99 | 4.2239E-04 | 312.52 | 625.03 | 0.00E+00 | 1.32E-01 | 2.64E-01 | | |
| Th-229 | 5.0953E-12 | 312.52 | 625.03 | 0.00E+00 | 1.59E-09 | 3.18E-09 | | |
| Th-230 | 4.1885E-08 | 312.52 | 625.03 | 0.00E+00 | 1.31E-05 | 2.62E-05 | | |
| Th-232 | 1.9270E-14 | 312.52 | 625.03 | 0.00E+00 | 6.02E-12 | 1.20E-11 | | |
| Ti-208 | 4.6024E-08 | 312.52 | 625.03 | 0.00E+00 | 1.44E-05 | 2.88E-05 | | |
| U-232 | 1.2582E-07 | 312.52 | 625.03 | 0.00E+00 | 3.93E-05 | 7.86E-05 | | |
| U-233 | 2.5825E-09 | 312.52 | 625.03 | 0.00E+00 | 8.07E-07 | 1.61E-06 | | |
| U-234 | 1.8450E-04 | 312.52 | 625.03 | 0.00E+00 | 5.77E-02 | 1.15E-01 | | |
| U-235 | 2.7235E-06 | 312.52 | 0.00 | 2.59E-03 | 1.74E-03 | 2.59E-03 | | |
| U-236 | 1.5493E-05 | 312.52 | 625.03 | 0.00E+00 | 4.84E-03 | 9.68E-03 | | |
| U-238 | 4.2851E-09 | 312.52 | 0.00 | 1.61E-03 | 1.61E-03 | 1.61E-03 | | |
| Y-90 | 1.9254E+00 | 312.52 | 625.03 | 0.00E+00 | 6.02E+02 | 1.20E+03 | | |
| Other Radionuclides | | | | | 6.04E+02 | 1.21E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences* This Template was used for the following reasons This fuel matches ATR Template on all but one parameter (enrichment) making ATR a reasonable match. |
|-----------------------------------|-------------------|-------------------------------|---|
| Reactor Moderator | From SFD | Used | |
| Fuel Cladding | LIGHT WATER | LIGHT WATER | |
| BOL HM Constituents | ALUM | ALUM | |
| BOL Enrichment % | 20 | 60 to 100 | |
| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup |
| Nominal | From SFD | Estimated | |
| Bounding | | 312.52 | |
| | | 625.03 | |
| Checks | | | Estimated EOL HM/Given EOL HM 1.00 |
| Nominal | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Bounding | 0.17 | 0.33 | |

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRR MTR-C (U3Si2 LEU) CANADA
SNF ID #: 512
Fuel Units & Descr: 8 - ASSEMBLY
Heavy Metal Mass: BOL=6 52kg EOL=5 868kg
ROD Storage Site: SRS

¹Fuel decay start date: 2010
Estimates as of: 2030
Template: ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup(MWd): 367.2
Template BOL Heavy Metal Mass (MT): 0.00116689
Template Decay Time: 20 years

Estimated
Canister usage
18"x10"
0.33

| II. Estimates | m | x _n | x _s | b | y _n | y _s | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6.6313E-10 | 617.46 | 1,234.91 | 0.00E+00 | 4.09E-07 | 8.19E-07 | Avg MeV | |
| Am-241 | 2.0060E-03 | 617.46 | 1,234.91 | 0.00E+00 | 1.24E+00 | 2.48E+00 | 0.0150 | 1.304E+14 |
| Am-242m | 4.2429E-07 | 617.46 | 1,234.91 | 0.00E+00 | 2.62E-04 | 5.24E-04 | 0.0250 | 2.711E+13 |
| Am-243 | 1.4899E-06 | 617.46 | 1,234.91 | 0.00E+00 | 9.20E-04 | 1.84E-03 | 0.0375 | 2.364E+13 |
| C-14 | 5.7135E-09 | 617.46 | 1,234.91 | 0.00E+00 | 3.53E-06 | 7.06E-06 | 0.0575 | 2.532E+13 |
| Cl-36 | 1.3124E-32 | 617.46 | 1,234.91 | 0.00E+00 | 8.10E-30 | 1.62E-29 | 0.0850 | 1.530E+13 |
| Cm-243 | 1.6443E-07 | 617.46 | 1,234.91 | 0.00E+00 | 1.02E-04 | 2.03E-04 | 0.1250 | 1.036E+13 |
| Cm-244 | 2.9330E-05 | 617.46 | 1,234.91 | 0.00E+00 | 1.81E-02 | 3.62E-02 | 0.2250 | 1.320E+13 |
| Co-60 | 5.3186E-06 | 617.46 | 1,234.91 | 0.00E+00 | 3.28E-03 | 6.57E-03 | 0.3750 | 5.748E+12 |
| Cs-134 | 3.1563E-03 | 617.46 | 1,234.91 | 0.00E+00 | 1.95E+00 | 3.90E+00 | 0.6750 | 9.376E+13 |
| Cs-135 | 3.4477E-06 | 617.46 | 1,234.91 | 0.00E+00 | 2.13E-03 | 4.26E-03 | 0.8500 | 1.585E+12 |
| Cs-137 | 2.0313E+00 | 617.46 | 1,234.91 | 0.00E+00 | 1.25E+03 | 2.51E+03 | 1.2500 | 9.051E+11 |
| Eu-154 | 2.4513E-02 | 617.46 | 1,234.91 | 0.00E+00 | 1.51E+01 | 3.03E+01 | 1.7500 | 4.154E+10 |
| Eu-155 | 4.8175E-03 | 617.46 | 1,234.91 | 0.00E+00 | 2.97E+00 | 5.95E+00 | 2.2500 | 3.644E+06 |
| Fe-55 | 1.2397E-04 | 617.46 | 1,234.91 | 0.00E+00 | 7.65E-02 | 1.53E-01 | 2.7500 | 2.060E+06 |
| H-3 | 4.5697E-03 | 617.46 | 1,234.91 | 0.00E+00 | 2.82E+00 | 5.64E+00 | 3.5000 | 9.473E+03 |
| I-129 | 7.5300E-07 | 617.46 | 1,234.91 | 0.00E+00 | 4.65E-04 | 9.30E-04 | 5.0000 | 5.390E+02 |
| Kr-85 | 1.0850E-01 | 617.46 | 1,234.91 | 0.00E+00 | 6.70E+01 | 1.34E+02 | 7.0000 | 5.952E+01 |
| Np-237 | 9.5561E-06 | 617.46 | 1,234.91 | 0.00E+00 | 5.90E-03 | 1.18E-02 | 11.0000 | 6.672E+00 |
| Pa-231 | 2.0359E-09 | 617.46 | 1,234.91 | 0.00E+00 | 1.26E-06 | 2.51E-06 | | |
| Pb-210 | 4.9728E-11 | 617.46 | 1,234.91 | 0.00E+00 | 3.07E-08 | 6.14E-08 | | |
| Pm-147 | 4.8502E-02 | 617.46 | 1,234.91 | 0.00E+00 | 2.99E+01 | 5.99E+01 | | |
| Pu-238 | 1.8254E-02 | 617.46 | 1,234.91 | 0.00E+00 | 1.13E+01 | 2.25E+01 | | |
| Pu-239 | 4.2810E-04 | 617.46 | 1,234.91 | 0.00E+00 | 2.64E-01 | 5.29E-01 | | |
| Pu-240 | 2.4368E-04 | 617.46 | 1,234.91 | 0.00E+00 | 1.50E-01 | 3.01E-01 | | |
| Pu-241 | 3.3415E-02 | 617.46 | 1,234.91 | 0.00E+00 | 2.06E+01 | 4.13E+01 | | |
| Pu-242 | 3.6329E-07 | 617.46 | 1,234.91 | 0.00E+00 | 2.24E-04 | 4.49E-04 | | |
| Ra-226 | 2.2854E-10 | 617.46 | 1,234.91 | 0.00E+00 | 1.41E-07 | 2.82E-07 | | |
| Ra-228 | 1.2426E-14 | 617.46 | 1,234.91 | 0.00E+00 | 7.67E-12 | 1.53E-11 | | |
| Ru-106 | 6.3589E-06 | 617.46 | 1,234.91 | 0.00E+00 | 3.93E-03 | 7.85E-03 | | |
| Se-79 | 1.2933E-05 | 617.46 | 1,234.91 | 0.00E+00 | 7.99E-03 | 1.60E-02 | | |
| Sn-126 | 1.1574E-05 | 617.46 | 1,234.91 | 0.00E+00 | 7.15E-03 | 1.43E-02 | | |
| Sr-90 | 1.9248E+00 | 617.46 | 1,234.91 | 0.00E+00 | 1.19E+03 | 2.38E+03 | | |
| Tc-99 | 4.2239E-04 | 617.46 | 1,234.91 | 0.00E+00 | 2.61E-01 | 5.22E-01 | | |
| Th-229 | 5.0953E-12 | 617.46 | 1,234.91 | 0.00E+00 | 3.15E-09 | 6.29E-09 | | |
| Th-230 | 4.1885E-08 | 617.46 | 1,234.91 | 0.00E+00 | 2.59E-05 | 5.17E-05 | | |
| Th-232 | 1.9270E-14 | 617.46 | 1,234.91 | 0.00E+00 | 1.19E-11 | 2.38E-11 | | |
| Th-208 | 4.6024E-08 | 617.46 | 1,234.91 | 0.00E+00 | 2.84E-05 | 5.68E-05 | | |
| U-232 | 1.2582E-07 | 617.46 | 1,234.91 | 0.00E+00 | 7.77E-05 | 1.55E-04 | | |
| U-233 | 2.5825E-09 | 617.46 | 1,234.91 | 0.00E+00 | 1.59E-06 | 3.19E-06 | | |
| U-234 | 1.8450E-04 | 617.46 | 1,234.91 | 0.00E+00 | 1.14E-01 | 2.28E-01 | | |
| U-235 | -2.7235E-06 | 617.46 | 0.00 | 2.82E-03 | 1.14E-03 | 2.82E-03 | | |
| U-236 | 1.5493E-05 | 617.46 | 1,234.91 | 0.00E+00 | 9.57E-03 | 1.91E-02 | | |
| U-238 | -4.2851E-09 | 617.46 | 0.00 | 1.75E-03 | 1.75E-03 | 1.75E-03 | | |
| Y-90 | 1.9254E+00 | 617.46 | 1,234.91 | 0.00E+00 | 1.19E+03 | 2.38E+03 | | |
| Other Radionuclides | | | | | 1.19E+03 | 2.39E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| Reactor Moderator: | From SFD | Used | Basis for Parameter Differences: |
|---------------------|-------------|-------------|---|
| | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding | ALUM | ALUM | This Template was used for the following reasons: This fuel matches on all parameters except enrichment. |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20.00000037 | 60 to 100 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|----------|-----------|---|
| | | 617.46 | |
| Nominal | | | Nominal burnup calculated from the heavy metal mass destroyed |
| Bounding | | 1,234.91 | Bounding burnup assumed to be twice nominal burnup |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | 0.30 | | |
| Nominal | | | 1.01 |
| Bounding | 0.60 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name FRR MTR-C (U3Si2 LEU) GERMANY
SNF ID # 517
Fuel Units & Descr. 26 - ASSEMBLY
Heavy Metal Mass: BOL=30 94kg EOL=26 114kg
ROD Storage Site: SRS

¹Fuel decay start date 2010
Estimates as of 2030
Template TRIGA-AI (LW/U-Zrx Alum, 10 to 20% U)
²Template Burnup(MWd) 6 65
Template BOL Heavy Metal Mass (MT) 0.00018
Template Decay Time 20 years

Estimated
Canister usage
18"x10"
1.08

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 2.4556E-09 | 4,606.13 | 9,212.25 | 0.00E+00 | 1.13E-05 | 2.26E-05 | Avg MeV | |
| Am-241 | 3.8752E-03 | 4,606.13 | 9,212.25 | 0.00E+00 | 1.78E+01 | 3.57E+01 | 0.0150 | 9.454E+14 |
| Am-242m | 1.8617E-06 | 4,606.13 | 9,212.25 | 0.00E+00 | 8.58E-03 | 1.72E-02 | 0.0250 | 1.952E+14 |
| Am-243 | 2.3293E-07 | 4,606.13 | 9,212.25 | 0.00E+00 | 1.07E-03 | 2.15E-03 | 0.0375 | 2.043E+14 |
| C-14 | 4.3233E-05 | 4,606.13 | 9,212.25 | 0.00E+00 | 1.99E-01 | 3.98E-01 | 0.0575 | 1.889E+14 |
| Cl-36 | 4.3023E-08 | 4,606.13 | 9,212.25 | 0.00E+00 | 1.98E-04 | 3.96E-04 | 0.0850 | 1.150E+14 |
| Cm-243 | 1.9053E-07 | 4,606.13 | 9,212.25 | 0.00E+00 | 8.78E-04 | 1.76E-03 | 0.1250 | 1.291E+14 |
| Cm-244 | 1.7744E-06 | 4,606.13 | 9,212.25 | 0.00E+00 | 8.17E-03 | 1.63E-02 | 0.2250 | 1.042E+14 |
| Co-60 | 4.3188E-03 | 4,606.13 | 9,212.25 | 0.00E+00 | 1.99E+01 | 3.98E+01 | 0.3750 | 4.282E+13 |
| Cs-134 | 6.7188E-04 | 4,606.13 | 9,212.25 | 0.00E+00 | 3.09E+00 | 6.19E+00 | 0.5750 | 6.821E+14 |
| Cs-135 | 3.1549E-05 | 4,606.13 | 9,212.25 | 0.00E+00 | 1.45E-01 | 2.91E-01 | 0.8500 | 7.258E+13 |
| Cs-137 | 1.9489E+00 | 4,606.13 | 9,212.25 | 0.00E+00 | 8.98E+03 | 1.80E+04 | 1.2500 | 7.818E+13 |
| Eu-154 | 4.0301E-01 | 4,606.13 | 9,212.25 | 0.00E+00 | 1.86E+03 | 3.71E+03 | 1.7500 | 2.342E+12 |
| Eu-155 | 5.4000E-02 | 4,606.13 | 9,212.25 | 0.00E+00 | 2.49E+02 | 4.97E+02 | 2.2500 | 3.712E+07 |
| Fe-55 | 1.5955E-04 | 4,606.13 | 9,212.25 | 0.00E+00 | 7.35E-01 | 1.47E+00 | 2.7500 | 6.179E+06 |
| H-3 | 4.6571E-03 | 4,606.13 | 9,212.25 | 0.00E+00 | -2.15E+01 | 4.29E+01 | 3.5000 | 4.231E+04 |
| I-129 | 7.3805E-07 | 4,606.13 | 9,212.25 | 0.00E+00 | 3.40E-03 | 6.80E-03 | 5.0000 | 5.197E+03 |
| Kr-85 | 9.5684E-02 | 4,606.13 | 9,212.25 | 0.00E+00 | 4.41E+02 | 8.81E+02 | 7.0000 | 5.866E+02 |
| Np-237 | 1.4618E-06 | 4,606.13 | 9,212.25 | 0.00E+00 | 6.73E-03 | 1.35E-02 | 11.0000 | 6.671E+01 |
| Pa-231 | 6.4782E-09 | 4,606.13 | 9,212.25 | 0.00E+00 | 2.98E-05 | 5.97E-05 | | |
| Pb-210 | 6.3158E-14 | 4,606.13 | 9,212.25 | 0.00E+00 | 2.91E-10 | 5.82E-10 | | |
| Pm-147 | 3.9564E-02 | 4,606.13 | 9,212.25 | 0.00E+00 | 1.82E+02 | 3.64E+02 | | |
| Pu-238 | 1.2008E-03 | 4,606.13 | 9,212.25 | 0.00E+00 | 5.53E+00 | 1.11E+01 | | |
| Pu-239 | 5.6917E-03 | 4,606.13 | 9,212.25 | 0.00E+00 | 2.62E+01 | 5.24E+01 | | |
| Pu-240 | 2.2617E-03 | 4,606.13 | 9,212.25 | 0.00E+00 | 1.04E+01 | 2.08E+01 | | |
| Pu-241 | 6.1113E-02 | 4,606.13 | 9,212.25 | 0.00E+00 | 2.81E+02 | 5.63E+02 | | |
| Pu-242 | 3.0602E-07 | 4,606.13 | 9,212.25 | 0.00E+00 | 1.41E-03 | 2.82E-03 | | |
| Ra-226 | 2.6707E-13 | 4,606.13 | 9,212.25 | 0.00E+00 | 1.23E-09 | 2.46E-09 | | |
| Ra-228 | 2.2556E-10 | 4,606.13 | 9,212.25 | 0.00E+00 | 1.04E-06 | 2.08E-06 | | |
| Ru-106 | 3.1293E-06 | 4,606.13 | 9,212.25 | 0.00E+00 | 1.44E-02 | 2.88E-02 | | |
| Se-79 | 1.2935E-05 | 4,606.13 | 9,212.25 | 0.00E+00 | 5.96E-02 | 1.19E-01 | | |
| Sn-126 | 1.2238E-05 | 4,606.13 | 9,212.25 | 0.00E+00 | 5.64E-02 | 1.13E-01 | | |
| Sr-90 | 1.8195E+00 | 4,606.13 | 9,212.25 | 0.00E+00 | 8.38E+03 | 1.68E+04 | | |
| Tc-99 | 4.4120E-04 | 4,606.13 | 9,212.25 | 0.00E+00 | 2.03E+00 | 4.06E+00 | | |
| Th-229 | 3.3308E-10 | 4,606.13 | 9,212.25 | 0.00E+00 | 1.53E-06 | 3.07E-06 | | |
| Th-230 | 4.6526E-11 | 4,606.13 | 9,212.25 | 0.00E+00 | 2.14E-07 | 4.29E-07 | | |
| Th-232 | 2.3744E-10 | 4,606.13 | 9,212.25 | 0.00E+00 | 1.09E-06 | 2.19E-06 | | |
| Ti-208 | 1.8195E-08 | 4,606.13 | 9,212.25 | 0.00E+00 | 8.38E-05 | 1.68E-04 | | |
| U-232 | 4.9098E-08 | 4,606.13 | 9,212.25 | 0.00E+00 | 2.26E-04 | 4.52E-04 | | |
| U-233 | 1.3140E-07 | 4,606.13 | 9,212.25 | 0.00E+00 | 6.05E-04 | 1.21E-03 | | |
| U-234 | 2.2571E-07 | 4,606.13 | 9,212.25 | 0.00E+00 | 1.04E-03 | 2.08E-03 | | |
| U-235 | -2.6159E-06 | 4,606.13 | 0.00 | 1.34E-02 | 1.32E-03 | 1.34E-02 | | |
| U-236 | 1.2719E-05 | 4,606.13 | 9,212.25 | 0.00E+00 | 5.86E-02 | 1.17E-01 | | |
| U-238 | -3.8857E-08 | 4,606.13 | 0.00 | 8.32E-03 | 8.14E-03 | 8.32E-03 | | |
| Y-90 | 1.8211E+00 | 4,606.13 | 9,212.25 | 0.00E+00 | 8.39E+03 | 1.68E+04 | | |
| Other Radionuclides | | | | | 9.65E+03 | 1.93E+04 | | |

Other Radionuclides

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences |
|---------------------|-----------------------|-----------------------|---------------------------------|
| Reactor Moderator | LW AND U ZIRC HYDRIDE | LW AND U ZIRC HYDRIDE | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 19.9999995 | 10 to 20.1 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate |
|----------|----------|-----------|--|
| Nominal | | 4.606.13 | Nominal burnup calculated from the heavy metal mass destroyed. |
| Bounding | | 9,212.25 | Bounding burnup assumed to be twice nominal burnup |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 4.03 | | 1.00 |
| Bounding | 8.06 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name FRR MTR-C (U3Si2 LEU) GREECE
SNF ID # 531
Fuel Units & Descr 18 - ASSEMBLY
Heavy Metal Mass BOL=11 07kg; EOL=10.294kg
ROD Storage Site SRS

¹Fuel decay start date: 2010
Estimates as of: 2030
Template: ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup(MWd), 367.2
Template BOL Heavy Metal Mass (MT): 0.00116689
Template Decay Time: 20 years

Estimated
Canister usage*
18"x10"
0.75

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6.6313E-10 | 734.70 | 1,469.40 | 0.00E+00 | 4.87E-07 | 9.74E-07 | Avg MeV | |
| Am-241 | 2.0060E-03 | 734.70 | 1,469.40 | 0.00E+00 | 1.47E+00 | 2.95E+00 | 0.0150 | 1.551E+14 |
| Am-242m | 4.2429E-07 | 734.70 | 1,469.40 | 0.00E+00 | 3.12E-04 | 6.23E-04 | 0.0250 | 3.225E+13 |
| Am-243 | 1.4899E-06 | 734.70 | 1,469.40 | 0.00E+00 | 1.09E-03 | 2.19E-03 | 0.0375 | 2.813E+13 |
| C-14 | 5.7135E-09 | 734.70 | 1,469.40 | 0.00E+00 | 4.20E-06 | 8.40E-06 | 0.0575 | 3.013E+13 |
| Cl-36 | 1.3124E-32 | 734.70 | 1,469.40 | 0.00E+00 | 9.64E-30 | 1.93E-29 | 0.0850 | 1.821E+13 |
| Cm-243 | 1.6443E-07 | 734.70 | 1,469.40 | 0.00E+00 | 1.21E-04 | 2.42E-04 | 0.1250 | 1.232E+13 |
| Cm-244 | 2.9330E-05 | 734.70 | 1,469.40 | 0.00E+00 | 2.15E-02 | 4.31E-02 | 0.2250 | 1.571E+13 |
| Co-60 | 5.3186E-06 | 734.70 | 1,469.40 | 0.00E+00 | 3.91E-03 | 7.82E-03 | 0.3750 | 6.839E+12 |
| Cs-134 | 3.1563E-03 | 734.70 | 1,469.40 | 0.00E+00 | 2.32E+00 | 4.64E+00 | 0.5750 | 1.116E+14 |
| Cs-135 | 3.4477E-06 | 734.70 | 1,469.40 | 0.00E+00 | 2.53E-03 | 5.07E-03 | 0.8500 | 1.886E+12 |
| Cs-137 | 2.0313E+00 | 734.70 | 1,469.40 | 0.00E+00 | 1.49E+03 | 2.98E+03 | 1.2500 | 1.077E+12 |
| Eu-154 | 2.4513E-02 | 734.70 | 1,469.40 | 0.00E+00 | 1.80E+01 | 3.60E+01 | 1.7500 | 4.943E+10 |
| Eu-155 | 4.8175E-03 | 734.70 | 1,469.40 | 0.00E+00 | 3.54E+00 | 7.08E+00 | 2.2500 | 4.336E+06 |
| Fe-55 | 1.2397E-04 | 734.70 | 1,469.40 | 0.00E+00 | 9.11E-02 | 1.82E-01 | 2.7500 | 2.451E+06 |
| H-3 | 4.5697E-03 | 734.70 | 1,469.40 | 0.00E+00 | 3.36E+00 | 6.71E+00 | 3.5000 | 1.128E+04 |
| I-129 | 7.5300E-07 | 734.70 | 1,469.40 | 0.00E+00 | 5.53E-04 | 1.11E-03 | 5.0000 | 6.434E+02 |
| Kr-85 | 1.0850E-01 | 734.70 | 1,469.40 | 0.00E+00 | 7.97E+01 | 1.59E+02 | 7.0000 | 7.105E+01 |
| Np-237 | 9.5561E-06 | 734.70 | 1,469.40 | 0.00E+00 | 7.02E-03 | 1.40E-02 | 11.0000 | 7.966E+00 |
| Pa-231 | 2.0359E-09 | 734.70 | 1,469.40 | 0.00E+00 | 1.50E-06 | 2.99E-06 | | |
| Pb-210 | 4.9728E-11 | 734.70 | 1,469.40 | 0.00E+00 | 3.65E-08 | 7.31E-08 | | |
| Pm-147 | 4.8502E-02 | 734.70 | 1,469.40 | 0.00E+00 | 3.56E+01 | 7.13E+01 | | |
| Pu-238 | 1.8254E-02 | 734.70 | 1,469.40 | 0.00E+00 | 1.34E+01 | 2.68E+01 | | |
| Pu-239 | 4.2810E-04 | 734.70 | 1,469.40 | 0.00E+00 | 3.15E-01 | 6.29E-01 | | |
| Pu-240 | 2.4368E-04 | 734.70 | 1,469.40 | 0.00E+00 | 1.79E-01 | 3.58E-01 | | |
| Pu-241 | 3.3415E-02 | 734.70 | 1,469.40 | 0.00E+00 | 2.45E+01 | 4.91E+01 | | |
| Pu-242 | 3.6329E-07 | 734.70 | 1,469.40 | 0.00E+00 | 2.67E-04 | 5.34E-04 | | |
| Ra-226 | 2.2854E-10 | 734.70 | 1,469.40 | 0.00E+00 | 1.68E-07 | 3.36E-07 | | |
| Ra-228 | 1.2426E-14 | 734.70 | 1,469.40 | 0.00E+00 | 9.13E-12 | 1.83E-11 | | |
| Ru-106 | 6.3589E-06 | 734.70 | 1,469.40 | 0.00E+00 | 4.67E-03 | 9.34E-03 | | |
| Se-79 | 1.2933E-05 | 734.70 | 1,469.40 | 0.00E+00 | 9.50E-03 | 1.90E-02 | | |
| Sn-126 | 1.1574E-05 | 734.70 | 1,469.40 | 0.00E+00 | 8.50E-03 | 1.70E-02 | | |
| Sr-90 | 1.9248E+00 | 734.70 | 1,469.40 | 0.00E+00 | 1.41E+03 | 2.83E+03 | | |
| Tc-99 | 4.2239E-04 | 734.70 | 1,469.40 | 0.00E+00 | 3.10E-01 | 6.21E-01 | | |
| Th-229 | 5.0953E-12 | 734.70 | 1,469.40 | 0.00E+00 | 3.74E-09 | 7.49E-09 | | |
| Th-230 | 4.1885E-08 | 734.70 | 1,469.40 | 0.00E+00 | 3.08E-05 | 6.15E-05 | | |
| Th-232 | 1.9270E-14 | 734.70 | 1,469.40 | 0.00E+00 | 1.42E-11 | 2.83E-11 | | |
| Ti-208 | 4.6024E-08 | 734.70 | 1,469.40 | 0.00E+00 | 3.38E-05 | 6.76E-05 | | |
| U-232 | 1.2582E-07 | 734.70 | 1,469.40 | 0.00E+00 | 9.24E-05 | 1.85E-04 | | |
| U-233 | 2.5825E-09 | 734.70 | 1,469.40 | 0.00E+00 | 1.90E-06 | 3.79E-06 | | |
| U-234 | 1.8450E-04 | 734.70 | 1,469.40 | 0.00E+00 | 1.36E-01 | 2.71E-01 | | |
| U-235 | 2.7235E-06 | 734.70 | 0.00 | 4.78E-03 | 2.78E-03 | 4.78E-03 | | |
| U-236 | 1.5493E-05 | 734.70 | 1,469.40 | 0.00E+00 | 1.14E-02 | 2.28E-02 | | |
| U-238 | 4.2851E-09 | 734.70 | 0.00 | 2.98E-03 | 2.97E-03 | 2.98E-03 | | |
| Y-90 | 1.9254E+00 | 734.70 | 1,469.40 | 0.00E+00 | 1.41E+03 | 2.83E+03 | | |
| Other Radionuclides | | | | | 1.42E+03 | 2.84E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences: |
|---------------------|-------------|-------------|---|
| Reactor Moderator: | LIGHT WATER | LIGHT WATER | This Template was used for the following reasons: This fuel matches on all parameters except enrichment. |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20.00000024 | 60 to 100 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|----------|-----------|--|
| Nominal | | 734.70 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |
| Bounding | | 1,469.40 | |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0.21 | | 1.00 |
| Bounding | 0.42 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name FRR MTR-C (U3Si2 LEU) JAPAN
SNF ID #: 289
Fuel Units & Descr: 17 - ASSEMBLY
Heavy Metal Mass BOL=8 925kg EOL=8 6kg
ROD Storage Site SRS

¹Fuel decay start date 2010
Estimates as of 2030
Template² ATR (Light Water, Alum, 60 to 100% U)
²Template Burnup(MWd) 367.2
Template BOL Heavy Metal Mass (MT) 0 00116689
Template Decay Time 20 years

Estimated
Canister usage:
18"x10"
0 71

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| | m | x _n | x _b | b | y _n | y _b | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | | |
| Ac-227 | 6 6313E-10 | 307 50 | 614 99 | 0 00E+00 | 2 04E-07 | 4 08E-07 | Avg MeV | |
| Am-241 | 2 0060E-03 | 307 50 | 614 99 | 0 00E+00 | 6 17E-01 | 1 23E+00 | 0 0150 | 6 492E+13 |
| Am-242m | 4 2429E-07 | 307 50 | 614 99 | 0 00E+00 | 1 30E-04 | 2 61E-04 | 0 0250 | 1 350E+13 |
| Am-243 | 1 4899E-06 | 307 50 | 614 99 | 0 00E+00 | 4 58E-04 | 9 16E-04 | 0 0375 | 1 177E+13 |
| C-14 | 5 7135E-09 | 307 50 | 614 99 | 0 00E+00 | 1 76E-06 | 3 51E-06 | 0 0575 | 1 261E+13 |
| Cl-36 | 1 3124E-32 | 307 50 | 614 99 | 0 00E+00 | 4 04E-30 | 8 07E-30 | 0 0850 | 7 621E+12 |
| Cm-243 | 1 6443E-07 | 307 50 | 614 99 | 0 00E+00 | 5 06E-05 | 1 01E-04 | 0 1250 | 5 157E+12 |
| Cm-244 | 2 9330E-05 | 307 50 | 614 99 | 0 00E+00 | 9 02E-03 | 1 80E-02 | 0 2250 | 6 576E+12 |
| Co-60 | 5 3186E-06 | 307 50 | 614 99 | 0 00E+00 | 1 64E-03 | 3 27E-03 | 0 3750 | 2 862E+12 |
| Cs-134 | 3 1563E-03 | 307 50 | 614 99 | 0 00E+00 | 9 71E-01 | 1 94E+00 | 0 5750 | 4 669E+13 |
| Cs-135 | 3 4477E-06 | 307 50 | 614 99 | 0 00E+00 | 1 06E-03 | 2 12E-03 | 0 8500 | 7 894E+11 |
| Cs-137 | 2 0313E+00 | 307 50 | 614 99 | 0 00E+00 | 6 25E+02 | 1 25E+03 | 1 2500 | 4 507E+11 |
| Eu-154 | 2 4513E-02 | 307 50 | 614 99 | 0 00E+00 | 7 54E+00 | 1 51E+01 | 1 7500 | 2 069E+10 |
| Eu-155 | 4 8175E-03 | 307 50 | 614 99 | 0 00E+00 | 1 48E+00 | 2 96E+00 | 2 2500 | 1 815E+06 |
| Fe-55 | 1 2397E-04 | 307 50 | 614 99 | 0 00E+00 | 3 81E-02 | 7 62E-02 | 2 7500 | 1 026E+06 |
| H-3 | 4 5697E-03 | 307 50 | 614 99 | 0 00E+00 | 1 41E+00 | 2 81E+00 | 3 5000 | 4 726E+03 |
| I-129 | 7 5300E-07 | 307 50 | 614 99 | 0 00E+00 | 2 32E-04 | 4 63E-04 | 5 0000 | 2 719E+02 |
| Kr-85 | 1 0850E-01 | 307 50 | 614 99 | 0 00E+00 | 3 34E+01 | 6 67E+01 | 7 0000 | 3 005E+01 |
| Np-237 | 9 5561E-06 | 307 50 | 614 99 | 0 00E+00 | 2 94E-03 | 5 88E-03 | 11 0000 | 3 369E+00 |
| Pa-231 | 2 0359E-09 | 307 50 | 614 99 | 0 00E+00 | 6 26E-07 | 1 25E-06 | | |
| Pb-210 | 4 9728E-11 | 307 50 | 614 99 | 0 00E+00 | 1 53E-08 | 3 06E-08 | | |
| Pm-147 | 4 8502E-02 | 307 50 | 614 99 | 0 00E+00 | 1 49E+01 | 2 98E+01 | | |
| Pu-238 | 1 8254E-02 | 307 50 | 614 99 | 0 00E+00 | 5 61E+00 | 1 12E+01 | | |
| Pu-239 | 4 2810E-04 | 307 50 | 614 99 | 0 00E+00 | 1 32E-01 | 2 63E-01 | | |
| Pu-240 | 2 4368E-04 | 307 50 | 614 99 | 0 00E+00 | 7 49E-02 | 1 50E-01 | | |
| Pu-241 | 3 3415E-02 | 307 50 | 614 99 | 0 00E+00 | 1 03E+01 | 2 06E+01 | | |
| Pu-242 | 3 6329E-07 | 307 50 | 614 99 | 0 00E+00 | 1 12E-04 | 2 23E-04 | | |
| Ra-226 | 2 2854E-10 | 307 50 | 614 99 | 0 00E+00 | 7 03E-08 | 1 41E-07 | | |
| Ra-228 | 1 2426E-14 | 307 50 | 614 99 | 0 00E+00 | 3 82E-12 | 7 64E-12 | | |
| Ru-106 | 6 3589E-06 | 307 50 | 614 99 | 0 00E+00 | 1 96E-03 | 3 91E-03 | | |
| Se-79 | 1 2933E-05 | 307 50 | 614 99 | 0 00E+00 | 3 98E-03 | 7 95E-03 | | |
| Sn-126 | 1 1574E-05 | 307 50 | 614 99 | 0 00E+00 | 3 56E-03 | 7 12E-03 | | |
| Sr-90 | 1 9248E+00 | 307 50 | 614 99 | 0 00E+00 | 5 92E+02 | 1 18E+03 | | |
| Tc-99 | 4 2239E-04 | 307 50 | 614 99 | 0 00E+00 | 1 30E-01 | 2 60E-01 | | |
| Th-229 | 5 0953E-12 | 307 50 | 614 99 | 0 00E+00 | 1 57E-09 | 3 13E-09 | | |
| Th-230 | 4 1885E-08 | 307 50 | 614 99 | 0 00E+00 | 1 29E-05 | 2 58E-05 | | |
| Th-232 | 1 9270E-14 | 307 50 | 614 99 | 0 00E+00 | 5 93E-12 | 1 19E-11 | | |
| Ti-208 | 4 6024E-08 | 307 50 | 614 99 | 0 00E+00 | 1 42E-05 | 2 83E-05 | | |
| U-232 | 1 2582E-07 | 307 50 | 614 99 | 0 00E+00 | 3 87E-05 | 7 74E-05 | | |
| U-233 | 2 5825E-09 | 307 50 | 614 99 | 0 00E+00 | 7 94E-07 | 1 59E-06 | | |
| U-234 | 1 8450E-04 | 307 50 | 614 99 | 0 00E+00 | 5 67E-02 | 1 13E-01 | | |
| U-235 | -2 7235E-06 | 307 50 | 0 00 | 3 86E-03 | 3 02E-03 | 3 86E-03 | | |
| U-236 | 1 5493E-05 | 307 50 | 614 99 | 0 00E+00 | 4 76E-03 | 9 53E-03 | | |
| U-238 | -4 2851E-09 | 307 50 | 0 00 | 2 40E-03 | 2 40E-03 | 2 40E-03 | | |
| Y-90 | 1 9254E+00 | 307 50 | 614 99 | 0 00E+00 | 5 92E+02 | 1 18E+03 | | |
| Other Radionuclides | | | | | 5 95E+02 | 1 19E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: This Template was used for the following reasons: This fuel matches on all parameters except enrichment. |
|-----------------------------------|-------------------|-----------------------------------|---|
| | From SFD | Used | |
| Reactor Moderator: | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding: | ALUM | ALUM | |
| BOL HM Constituents: | U | U | |
| BOL Enrichment %: | 20 00000028 | 60 to 100 | |
| Burnup Summary (MWd) ¹ | | | Basis for burnup used in estimate: Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup |
| | From SFD | Estimated | |
| Nominal | | 307.50 | |
| Bounding | | 614.99 | |
| Checks | | | Estimated EOL HM/Given EOL HM 1 00 |
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0.11 | | |
| Bounding | 0.22 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRR MTR-C (U3Si2 LEU) NETHERLANDS
SNF ID #: 509
Fuel Units & Descr: 7 - ASSEMBLY
Heavy Metal Mass: BOL=5.53kg, EOL=4.866kg
ROD Storage Site: SRS

¹Fuel decay start date: 2010
Estimates as of: 2030
Template ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup(MWd): 367.2
Template BOL Heavy Metal Mass (MT): 0.00116689
Template Decay Time: 20 years

Estimated
Canister usage:
18"x10"
0.29

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6.6313E-10 | 628.44 | 1,256.88 | 0.00E+00 | 4.17E-07 | 8.33E-07 | Avg MeV | |
| Am-241 | 2.0060E-03 | 628.44 | 1,256.88 | 0.00E+00 | 1.26E+00 | 2.52E+00 | 0.0150 | 1.327E+14 |
| Am-242m | 4.2429E-07 | 628.44 | 1,256.88 | 0.00E+00 | 2.67E-04 | 5.33E-04 | 0.0250 | 2.759E+13 |
| Am-243 | 1.4899E-06 | 628.44 | 1,256.88 | 0.00E+00 | 9.36E-04 | 1.87E-03 | 0.0375 | 2.406E+13 |
| C-14 | 5.7135E-09 | 628.44 | 1,256.88 | 0.00E+00 | 3.59E-06 | 7.18E-06 | 0.0575 | 2.577E+13 |
| Cl-36 | 1.3124E-32 | 628.44 | 1,256.88 | 0.00E+00 | 8.25E-30 | 1.65E-29 | 0.0850 | 1.557E+13 |
| Cm-243 | 1.6443E-07 | 628.44 | 1,256.88 | 0.00E+00 | 1.03E-04 | 2.07E-04 | 0.1250 | 1.054E+13 |
| Cm-244 | 2.9330E-05 | 628.44 | 1,256.88 | 0.00E+00 | 1.84E-02 | 3.69E-02 | 0.2250 | 1.344E+13 |
| Co-60 | 5.3186E-06 | 628.44 | 1,256.88 | 0.00E+00 | 3.34E-03 | 6.68E-03 | 0.3750 | 5.850E+12 |
| Cs-134 | 3.1563E-03 | 628.44 | 1,256.88 | 0.00E+00 | 1.98E+00 | 3.97E+00 | 0.5750 | 9.543E+12 |
| Cs-135 | 3.4477E-06 | 628.44 | 1,256.88 | 0.00E+00 | 2.17E-03 | 4.33E-03 | 0.8500 | 1.613E+12 |
| Cs-137 | 2.0313E+00 | 628.44 | 1,256.88 | 0.00E+00 | 1.28E+03 | 2.56E+03 | 1.2500 | 9.212E+11 |
| Eu-154 | 2.4513E-02 | 628.44 | 1,256.88 | 0.00E+00 | 1.54E+01 | 3.08E+01 | 1.7500 | 4.228E+10 |
| Eu-155 | 4.8175E-03 | 628.44 | 1,256.88 | 0.00E+00 | 3.03E+00 | 6.06E+00 | 2.2500 | 3.709E+08 |
| Fe-55 | 1.2397E-04 | 628.44 | 1,256.88 | 0.00E+00 | 7.79E-02 | 1.56E-01 | 2.7500 | 2.097E+06 |
| H-3 | 4.5697E-03 | 628.44 | 1,256.88 | 0.00E+00 | 2.87E+00 | 5.74E+00 | 3.5000 | 9.640E+03 |
| I-129 | 7.5300E-07 | 628.44 | 1,256.88 | 0.00E+00 | 4.73E-04 | 9.46E-04 | 5.0000 | 5.479E+02 |
| Kr-85 | 1.0850E-01 | 628.44 | 1,256.88 | 0.00E+00 | 6.82E+01 | 1.36E+02 | 7.0000 | 6.050E+01 |
| Np-237 | 9.5561E-06 | 628.44 | 1,256.88 | 0.00E+00 | 6.01E-03 | 1.20E-02 | 11.0000 | 6.781E+00 |
| Pa-231 | 2.0359E-09 | 628.44 | 1,256.88 | 0.00E+00 | 1.28E-06 | 2.56E-06 | | |
| Pb-210 | 4.9728E-11 | 628.44 | 1,256.88 | 0.00E+00 | 3.13E-08 | 6.25E-08 | | |
| Pm-147 | 4.8502E-02 | 628.44 | 1,256.88 | 0.00E+00 | 3.05E+01 | 6.10E+01 | | |
| Pu-238 | 1.8254E-02 | 628.44 | 1,256.88 | 0.00E+00 | 1.15E+01 | 2.29E+01 | | |
| Pu-239 | 4.2810E-04 | 628.44 | 1,256.88 | 0.00E+00 | 2.69E-01 | 5.38E-01 | | |
| Pu-240 | 2.4368E-04 | 628.44 | 1,256.88 | 0.00E+00 | 1.53E-01 | 3.06E-01 | | |
| Pu-241 | 3.3415E-02 | 628.44 | 1,256.88 | 0.00E+00 | 2.10E+01 | 4.20E+01 | | |
| Pu-242 | 3.6329E-07 | 628.44 | 1,256.88 | 0.00E+00 | 2.28E-04 | 4.57E-04 | | |
| Ra-226 | 2.2854E-10 | 628.44 | 1,256.88 | 0.00E+00 | 1.44E-07 | 2.87E-07 | | |
| Ra-228 | 1.2426E-14 | 628.44 | 1,256.88 | 0.00E+00 | 7.81E-12 | 1.56E-11 | | |
| Ru-106 | 6.3589E-06 | 628.44 | 1,256.88 | 0.00E+00 | 4.00E-03 | 7.99E-03 | | |
| Se-79 | 1.2933E-05 | 628.44 | 1,256.88 | 0.00E+00 | 8.13E-03 | 1.63E-02 | | |
| Sn-126 | 1.1574E-05 | 628.44 | 1,256.88 | 0.00E+00 | 7.27E-03 | 1.45E-02 | | |
| Sr-90 | 1.9248E+00 | 628.44 | 1,256.88 | 0.00E+00 | 1.21E+03 | 2.42E+03 | | |
| Tc-99 | 4.2239E-04 | 628.44 | 1,256.88 | 0.00E+00 | 2.65E-01 | 5.31E-01 | | |
| Th-229 | 5.0953E-12 | 628.44 | 1,256.88 | 0.00E+00 | 3.20E-09 | 6.40E-09 | | |
| Th-230 | 4.1885E-08 | 628.44 | 1,256.88 | 0.00E+00 | 2.63E-05 | 5.26E-05 | | |
| Th-232 | 1.9270E-14 | 628.44 | 1,256.88 | 0.00E+00 | 1.21E-11 | 2.42E-11 | | |
| Th-208 | 4.6024E-08 | 628.44 | 1,256.88 | 0.00E+00 | 2.89E-05 | 5.78E-05 | | |
| U-232 | 1.2582E-07 | 628.44 | 1,256.88 | 0.00E+00 | 7.91E-05 | 1.58E-04 | | |
| U-233 | 2.5825E-09 | 628.44 | 1,256.88 | 0.00E+00 | 1.62E-06 | 3.25E-06 | | |
| U-234 | 1.8450E-04 | 628.44 | 1,256.88 | 0.00E+00 | 1.16E-01 | 2.32E-01 | | |
| U-235 | -2.7235E-06 | 628.44 | 0.00 | 2.39E-03 | 6.78E-04 | 2.39E-03 | | |
| U-236 | 1.5493E-05 | 628.44 | 1,256.88 | 0.00E+00 | 9.74E-03 | 1.95E-02 | | |
| U-238 | -4.2851E-09 | 628.44 | 0.00 | 1.49E-03 | 1.48E-03 | 1.49E-03 | | |
| Y-90 | 1.9254E+00 | 628.44 | 1,256.88 | 0.00E+00 | 1.21E+03 | 2.42E+03 | | |
| Other Radionuclides | | | | | 1.22E+03 | 2.43E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: This Template was used for the following reasons: This fuel matches on all parameters except enrichment. |
|----------------------------|-------------|-------------|---|
| Reactor Moderator: | From SFD | Used | |
| | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20.0000038 | 60 to 100 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup. |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | | 628.44 | |
| Bounding | | 1,256.88 | |

| Checks | | | Estimated EOL HM/Given EOL HM 1.01 |
|----------|-------------------|-----------------------------------|---------------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 0.36 | | |
| Bounding | 0.72 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel.

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT).

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRR MTR-C (UALX LEU) SWEDEN
SNF ID #: 523
Fuel Units & Descr: 480 - ASSEMBLY
Heavy Metal Mass: BOL=960kg, EOL=789.888kg
ROD Storage Site: SRS

¹Fuel decay start date: 2010
Estimates as of: 2030
Template: ATR (Light Water, Alum., 60 to 100%, U)
²Template Burnup(MWd): 367.2
Template BOL Heavy Metal Mass (MT): 0.00116689
Template Decay Time: 20 years

Estimated
Canister usage
18"x10"
20.00

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6.6313E-10 | 161,099.36 | 322,198.73 | 0.00E+00 | 1.07E-04 | 2.14E-04 | Avg MeV | |
| Am-241 | 2.0060E-03 | 161,099.36 | 322,198.73 | 0.00E+00 | 3.23E+02 | 6.46E+02 | 0.0150 | 3.401E+16 |
| Am-242m | 4.2429E-07 | 161,099.36 | 322,198.73 | 0.00E+00 | 6.84E-02 | 1.37E-01 | 0.0250 | 7.072E+15 |
| Am-243 | 1.4899E-06 | 161,099.36 | 322,198.73 | 0.00E+00 | 2.40E-01 | 4.80E-01 | 0.0375 | 6.169E+15 |
| C-14 | 5.7135E-09 | 161,099.36 | 322,198.73 | 0.00E+00 | 9.20E-04 | 1.84E-03 | 0.0575 | 6.607E+15 |
| Cl-36 | 1.3124E-32 | 161,099.36 | 322,198.73 | 0.00E+00 | 2.11E-27 | 4.23E-27 | 0.0850 | 3.993E+15 |
| Cm-243 | 1.6443E-07 | 161,099.36 | 322,198.73 | 0.00E+00 | 2.65E-02 | 5.30E-02 | 0.1250 | 2.702E+15 |
| Cm-244 | 2.9330E-05 | 161,099.36 | 322,198.73 | 0.00E+00 | 4.73E+00 | 9.45E+00 | 0.2250 | 3.445E+15 |
| Co-60 | 5.3186E-06 | 161,099.36 | 322,198.73 | 0.00E+00 | 8.57E-01 | 1.71E+00 | 0.3750 | 1.500E+15 |
| Cs-134 | 3.1563E-03 | 161,099.36 | 322,198.73 | 0.00E+00 | 5.08E+02 | 1.02E+03 | 0.5750 | 2.446E+16 |
| Cs-135 | 3.4477E-06 | 161,099.36 | 322,198.73 | 0.00E+00 | 5.55E-01 | 1.11E+00 | 0.8500 | 4.136E+14 |
| Cs-137 | 2.0313E+00 | 161,099.36 | 322,198.73 | 0.00E+00 | 3.27E+05 | 6.54E+05 | 1.2500 | 2.361E+14 |
| Eu-154 | 2.4513E-02 | 161,099.36 | 322,198.73 | 0.00E+00 | 3.95E+03 | 7.90E+03 | 1.7500 | 1.084E+13 |
| Eu-155 | 4.8175E-03 | 161,099.36 | 322,198.73 | 0.00E+00 | 7.76E+02 | 1.55E+03 | 2.2500 | 9.508E+08 |
| Fe-55 | 1.2397E-04 | 161,099.36 | 322,198.73 | 0.00E+00 | 2.00E+01 | 3.99E+01 | 2.7500 | 5.375E+08 |
| H-3 | 4.5697E-03 | 161,099.36 | 322,198.73 | 0.00E+00 | 7.36E+02 | 1.47E+03 | 3.5000 | 2.471E+06 |
| I-129 | 7.5300E-07 | 161,099.36 | 322,198.73 | 0.00E+00 | 1.21E-01 | 2.43E-01 | 5.0000 | 1.402E+05 |
| Kr-85 | 1.0850E-01 | 161,099.36 | 322,198.73 | 0.00E+00 | 1.75E+04 | 3.50E+04 | 7.0000 | 1.548E+04 |
| Np-237 | 9.5561E-06 | 161,099.36 | 322,198.73 | 0.00E+00 | 1.54E+00 | 3.08E+00 | 11.0000 | 1.735E+03 |
| Pa-231 | 2.0359E-09 | 161,099.36 | 322,198.73 | 0.00E+00 | 3.28E-04 | 6.56E-04 | | |
| Pb-210 | 4.9728E-11 | 161,099.36 | 322,198.73 | 0.00E+00 | 8.01E-06 | 1.60E-05 | | |
| Pm-147 | 4.8502E-02 | 161,099.36 | 322,198.73 | 0.00E+00 | 7.81E+03 | 1.56E+04 | | |
| Pu-238 | 1.8254E-02 | 161,099.36 | 322,198.73 | 0.00E+00 | 2.94E+03 | 5.88E+03 | | |
| Pu-239 | 4.2810E-04 | 161,099.36 | 322,198.73 | 0.00E+00 | 6.90E+01 | 1.38E+02 | | |
| Pu-240 | 2.4368E-04 | 161,099.36 | 322,198.73 | 0.00E+00 | 3.93E+01 | 7.85E+01 | | |
| Pu-241 | 3.3415E-02 | 161,099.36 | 322,198.73 | 0.00E+00 | 5.38E+03 | 1.08E+04 | | |
| Pu-242 | 3.6329E-07 | 161,099.36 | 322,198.73 | 0.00E+00 | 5.85E-02 | 1.17E-01 | | |
| Ra-226 | 2.2854E-10 | 161,099.36 | 322,198.73 | 0.00E+00 | 3.68E-05 | 7.36E-05 | | |
| Ra-228 | 1.2426E-14 | 161,099.36 | 322,198.73 | 0.00E+00 | 2.00E-09 | 4.00E-09 | | |
| Ru-106 | 6.3589E-06 | 161,099.36 | 322,198.73 | 0.00E+00 | 1.02E+00 | 2.05E+00 | | |
| Se-79 | 1.2933E-05 | 161,099.36 | 322,198.73 | 0.00E+00 | 2.08E+00 | 4.17E+00 | | |
| Sn-126 | 1.1574E-05 | 161,099.36 | 322,198.73 | 0.00E+00 | 1.86E+00 | 3.73E+00 | | |
| Sr-90 | 1.9248E+00 | 161,099.36 | 322,198.73 | 0.00E+00 | 3.10E+05 | 6.20E+05 | | |
| Tc-99 | 4.2239E-04 | 161,099.36 | 322,198.73 | 0.00E+00 | 6.80E+01 | 1.36E+02 | | |
| Th-229 | 5.0953E-12 | 161,099.36 | 322,198.73 | 0.00E+00 | 8.21E-07 | 1.64E-06 | | |
| Th-230 | 4.1885E-08 | 161,099.36 | 322,198.73 | 0.00E+00 | 6.75E-03 | 1.35E-02 | | |
| Th-232 | 1.9270E-14 | 161,099.36 | 322,198.73 | 0.00E+00 | 3.10E-09 | 6.21E-09 | | |
| Th-208 | 4.6024E-08 | 161,099.36 | 322,198.73 | 0.00E+00 | 7.41E-03 | 1.48E-02 | | |
| U-232 | 1.2582E-07 | 161,099.36 | 322,198.73 | 0.00E+00 | 2.03E-02 | 4.05E-02 | | |
| U-233 | 2.5825E-09 | 161,099.36 | 322,198.73 | 0.00E+00 | 4.16E-04 | 8.32E-04 | | |
| U-234 | 1.8450E-04 | 161,099.36 | 322,198.73 | 0.00E+00 | 2.97E+01 | 5.94E+01 | | |
| U-235 | -2.7235E-06 | 161,099.36 | 0.00 | 4.15E-01 | 0.00E+00 | 4.15E-01 | | |
| U-236 | 1.5493E-05 | 161,099.36 | 322,198.73 | 0.00E+00 | 2.50E+00 | 4.99E+00 | | |
| U-238 | -4.2851E-09 | 161,099.36 | 0.00 | 2.58E-01 | 2.57E-01 | 2.58E-01 | | |
| Y-90 | 1.9254E+00 | 161,099.36 | 322,198.73 | 0.00E+00 | 3.10E+05 | 6.20E+05 | | |
| Other Radionuclides | | | | | 3.12E+05 | 6.23E+05 | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 3.84E+03 | 7.88E+03 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences* |
|---------------------|-------------|-------------|--|
| Reactor Moderator | LIGHT WATER | LIGHT WATER | This Template was used for the following reasons This fuel matches ATR Template on all but one parameter (enrichment) making ATR a reasonable match |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 | 60 to 100 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate* |
|----------|----------|------------|--|
| Nominal | | 161,099.36 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |
| Bounding | | 322,198.73 | |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 0.53 | | 1.03 |
| Bounding | 1.07 | | |

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

*Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRR MTR-C (UALX-HEU) ARGENTINA
SNF ID #: 635
Fuel Units & Descr: 14 - MTR TYPE
Heavy Metal Mass: BOL=2.395kg; EOL=1.749kg
ROD Storage Site: SRS

Fuel decay start date: 2010
Estimates as of: 2030
Template: ATR (Light Water, Alum., 60 to 100%, U)
Template Burnup (MWd): 367.2
Template BOL Heavy Metal Mass (MT): 0.00116689
Template Decay Time: 20 years

Estimated
Canister usage,
18"x10"
0.58

| II. Estimates | m | X _a | X _b | b | Y _a | Y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ¹ | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6.6313E-10 | 612.53 | 1,225.06 | 0.00E+00 | 4.06E-07 | 8.12E-07 | Avg MeV | |
| Am-241 | 2.0060E-03 | 612.53 | 1,225.06 | 0.00E+00 | 1.23E+00 | 2.46E+00 | 0.0150 | 1.293E+14 |
| Am-242m | 4.2429E-07 | 612.53 | 1,225.06 | 0.00E+00 | 2.60E-04 | 5.20E-04 | 0.0250 | 2.689E+13 |
| Am-243 | 1.4899E-06 | 612.53 | 1,225.06 | 0.00E+00 | 9.13E-04 | 1.83E-03 | 0.0375 | 2.345E+13 |
| C-14 | 5.7135E-09 | 612.53 | 1,225.06 | 0.00E+00 | 3.50E-06 | 7.00E-06 | 0.0575 | 2.512E+13 |
| Cl-36 | 1.3124E-32 | 612.53 | 1,225.06 | 0.00E+00 | 8.04E-30 | 1.61E-29 | 0.0850 | 1.518E+13 |
| Cm-243 | 1.6443E-07 | 612.53 | 1,225.06 | 0.00E+00 | 1.01E-04 | 2.01E-04 | 0.1250 | 1.027E+13 |
| Cm-244 | 2.9330E-05 | 612.53 | 1,225.06 | 0.00E+00 | 1.80E-02 | 3.59E-02 | 0.2250 | 1.310E+13 |
| Co-60 | 5.3186E-06 | 612.53 | 1,225.06 | 0.00E+00 | 3.26E-03 | 6.52E-03 | 0.3750 | 5.702E+12 |
| Cs-134 | 3.1563E-03 | 612.53 | 1,225.06 | 0.00E+00 | 1.93E+00 | 3.87E+00 | 0.5750 | 9.301E+13 |
| Cs-135 | 3.4477E-06 | 612.53 | 1,225.06 | 0.00E+00 | 2.11E-03 | 4.22E-03 | 0.8500 | 1.572E+12 |
| Cs-137 | 2.0313E+00 | 612.53 | 1,225.06 | 0.00E+00 | 1.24E+03 | 2.49E+03 | 1.2500 | 8.979E+11 |
| Eu-154 | 2.4513E-02 | 612.53 | 1,225.06 | 0.00E+00 | 1.50E+01 | 3.00E+01 | 1.7500 | 4.121E+10 |
| Eu-155 | 4.8175E-03 | 612.53 | 1,225.06 | 0.00E+00 | 2.95E+00 | 5.90E+00 | 2.2500 | 3.615E+06 |
| Fe-55 | 1.2397E-04 | 612.53 | 1,225.06 | 0.00E+00 | 7.59E-02 | 1.52E-01 | 2.7500 | 2.044E+06 |
| H-3 | 4.5697E-03 | 612.53 | 1,225.06 | 0.00E+00 | 2.80E+00 | 5.60E+00 | 3.5000 | 9.389E+03 |
| I-129 | 7.5300E-07 | 612.53 | 1,225.06 | 0.00E+00 | 4.61E-04 | 9.22E-04 | 5.0000 | 5.309E+02 |
| Kr-85 | 1.0850E-01 | 612.53 | 1,225.06 | 0.00E+00 | 6.65E+01 | 1.33E+02 | 7.0000 | 5.861E+01 |
| Np-237 | 9.5561E-06 | 612.53 | 1,225.06 | 0.00E+00 | 5.85E-03 | 1.17E-02 | 11.0000 | 6.569E+00 |
| Pa-231 | 2.0359E-09 | 612.53 | 1,225.06 | 0.00E+00 | 1.25E-06 | 2.49E-06 | | |
| Pb-210 | 4.9728E-11 | 612.53 | 1,225.06 | 0.00E+00 | 3.05E-08 | 6.09E-08 | | |
| Pm-147 | 4.8502E-02 | 612.53 | 1,225.06 | 0.00E+00 | 2.97E+01 | 5.94E+01 | | |
| Pu-238 | 1.8254E-02 | 612.53 | 1,225.06 | 0.00E+00 | 1.12E+01 | 2.24E+01 | | |
| Pu-239 | 4.2810E-04 | 612.53 | 1,225.06 | 0.00E+00 | 2.62E-01 | 5.24E-01 | | |
| Pu-240 | 2.4368E-04 | 612.53 | 1,225.06 | 0.00E+00 | 1.49E-01 | 2.99E-01 | | |
| Pu-241 | 3.3415E-02 | 612.53 | 1,225.06 | 0.00E+00 | 2.05E+01 | 4.09E+01 | | |
| Pu-242 | 3.6329E-07 | 612.53 | 1,225.06 | 0.00E+00 | 2.23E-04 | 4.45E-04 | | |
| Ra-226 | 2.2854E-10 | 612.53 | 1,225.06 | 0.00E+00 | 1.40E-07 | 2.80E-07 | | |
| Ra-228 | 1.2426E-14 | 612.53 | 1,225.06 | 0.00E+00 | 7.61E-12 | 1.52E-11 | | |
| Ru-106 | 6.3589E-06 | 612.53 | 1,225.06 | 0.00E+00 | 3.90E-03 | 7.79E-03 | | |
| Se-79 | 1.2933E-05 | 612.53 | 1,225.06 | 0.00E+00 | 7.92E-03 | 1.58E-02 | | |
| Sn-126 | 1.1574E-05 | 612.53 | 1,225.06 | 0.00E+00 | 7.09E-03 | 1.42E-02 | | |
| Sr-90 | 1.9248E+00 | 612.53 | 1,225.06 | 0.00E+00 | 1.18E+03 | 2.36E+03 | | |
| Tc-99 | 4.2239E-04 | 612.53 | 1,225.06 | 0.00E+00 | 2.59E-01 | 5.17E-01 | | |
| Th-229 | 5.0953E-12 | 612.53 | 1,225.06 | 0.00E+00 | 3.12E-09 | 6.24E-09 | | |
| Th-230 | 4.1885E-08 | 612.53 | 1,225.06 | 0.00E+00 | 2.57E-05 | 5.13E-05 | | |
| Th-232 | 1.9270E-14 | 612.53 | 1,225.06 | 0.00E+00 | 1.18E-11 | 2.36E-11 | | |
| Th-208 | 4.6024E-08 | 612.53 | 1,225.06 | 0.00E+00 | 2.82E-05 | 5.64E-05 | | |
| U-232 | 1.2582E-07 | 612.53 | 1,225.06 | 0.00E+00 | 7.71E-05 | 1.54E-04 | | |
| U-233 | 2.5825E-09 | 612.53 | 1,225.06 | 0.00E+00 | 1.58E-06 | 3.16E-06 | | |
| U-234 | 1.8450E-04 | 612.53 | 1,225.06 | 0.00E+00 | 1.13E-01 | 2.26E-01 | | |
| U-235 | -2.7235E-06 | 612.53 | 0.00 | 4.66E-03 | 2.99E-03 | 4.66E-03 | | |
| U-236 | 1.5493E-05 | 612.53 | 1,225.06 | 0.00E+00 | 9.49E-03 | 1.90E-02 | | |
| U-238 | -4.2851E-09 | 612.53 | 0.00 | 8.05E-05 | 7.79E-05 | 8.05E-05 | | |
| Y-90 | 1.9254E+00 | 612.53 | 1,225.06 | 0.00E+00 | 1.18E+03 | 2.36E+03 | | |
| Other Radionuclides | | | | | 1.18E+03 | 2.37E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences* |
|----------------------------|-------------|-------------|----------------------------------|
| | From SFD | Used | |
| Reactor Moderator | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 90.00000174 | 60 to 100 | |

| Burnup Summary (MWd) ³ | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | | 612.53 | |
| Bounding | | 1,225.06 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 0.81 | | |
| Bounding | 1.63 | | 1.02 |

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

³Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT).

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name FRR MTR-C (UALX-HEU) CANADA
SNF ID #: 612
Fuel Units & Descr: 23 - MTR TYPE
Heavy Metal Mass: BOL=2721kg EOL=176kg
ROD Storage Site SRS

Fuel decay start date 2010
Estimates as of 2030
Template ATR (Light Water, Akum, 60 to 100%, U)
*Template Burnup(MWd) 367.2
Template BOL Heavy Metal Mass (MT) 0.00116689
Template Decay Time 20 years

Estimated
Canister usage
18"x10"
0.96

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Cu/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6.6313E-10 | 910.46 | 1,820.93 | 0.00E+00 | 6.04E-07 | 1.21E-06 | Avg MeV | |
| Am-241 | 2.0060E-03 | 910.46 | 1,820.93 | 0.00E+00 | 1.83E+00 | 3.65E+00 | 0.0150 | 1.922E+14 |
| Am-242m | 4.2429E-07 | 910.46 | 1,820.93 | 0.00E+00 | 3.86E-04 | 7.73E-04 | 0.0250 | 3.997E+13 |
| Am-243 | 1.4899E-06 | 910.46 | 1,820.93 | 0.00E+00 | 1.36E-03 | 2.71E-03 | 0.0375 | 3.486E+13 |
| C-14 | 5.7135E-09 | 910.46 | 1,820.93 | 0.00E+00 | 5.20E-06 | 1.04E-05 | 0.0575 | 3.734E+13 |
| Cl-36 | 1.3124E-32 | 910.46 | 1,820.93 | 0.00E+00 | 1.19E-29 | 2.39E-29 | 0.0850 | 2.256E+13 |
| Cm-243 | 1.6443E-07 | 910.46 | 1,820.93 | 0.00E+00 | 1.50E-04 | 2.99E-04 | 0.1250 | 1.527E+13 |
| Cm-244 | 2.9330E-05 | 910.46 | 1,820.93 | 0.00E+00 | 2.67E-02 | 5.34E-02 | 0.2250 | 1.947E+13 |
| Co-60 | 5.3186E-06 | 910.46 | 1,820.93 | 0.00E+00 | 4.84E-03 | 9.68E-03 | 0.3750 | 8.475E+12 |
| Cs-134 | 3.1563E-03 | 910.46 | 1,820.93 | 0.00E+00 | 2.87E+00 | 5.75E+00 | 0.5750 | 1.382E+14 |
| Cs-135 | 3.4477E-06 | 910.46 | 1,820.93 | 0.00E+00 | 3.14E-03 | 6.28E-03 | 0.8500 | 2.337E+12 |
| Cs-137 | 2.0313E+00 | 910.46 | 1,820.93 | 0.00E+00 | 1.85E+03 | 3.70E+03 | 1.2500 | 1.335E+12 |
| Eu-154 | 2.4513E-02 | 910.46 | 1,820.93 | 0.00E+00 | 2.23E+01 | 4.46E+01 | 1.7500 | 6.126E+10 |
| Eu-155 | 4.8175E-03 | 910.46 | 1,820.93 | 0.00E+00 | 4.39E+00 | 8.77E+00 | 2.2500 | 5.373E+06 |
| Fe-55 | 1.2397E-04 | 910.46 | 1,820.93 | 0.00E+00 | 1.13E-01 | 2.26E-01 | 2.7500 | 3.038E+06 |
| H-3 | 4.5697E-03 | 910.46 | 1,820.93 | 0.00E+00 | 4.16E+00 | 8.32E+00 | 3.5000 | 1.395E+04 |
| I-129 | 7.5300E-07 | 910.46 | 1,820.93 | 0.00E+00 | 6.86E-04 | 1.37E-03 | 5.0000 | 7.890E+02 |
| Kr-85 | 1.0850E-01 | 910.46 | 1,820.93 | 0.00E+00 | 9.88E+01 | 1.98E+02 | 7.0000 | 8.710E+01 |
| Np-237 | 9.5561E-06 | 910.46 | 1,820.93 | 0.00E+00 | 8.70E-03 | 1.74E-02 | 11.0000 | 9.762E+00 |
| Pa-231 | 2.0359E-09 | 910.46 | 1,820.93 | 0.00E+00 | 1.85E-06 | 3.71E-06 | | |
| Pb-210 | 4.9728E-11 | 910.46 | 1,820.93 | 0.00E+00 | 4.53E-08 | 9.06E-08 | | |
| Pm-147 | 4.8502E-02 | 910.46 | 1,820.93 | 0.00E+00 | 4.42E+01 | 8.83E+01 | | |
| Pu-238 | 1.8254E-02 | 910.46 | 1,820.93 | 0.00E+00 | 1.66E+01 | 3.32E+01 | | |
| Pu-239 | 4.2810E-04 | 910.46 | 1,820.93 | 0.00E+00 | 3.90E-01 | 7.80E-01 | | |
| Pu-240 | 2.4368E-04 | 910.46 | 1,820.93 | 0.00E+00 | 2.22E-01 | 4.44E-01 | | |
| Pu-241 | 3.3415E-02 | 910.46 | 1,820.93 | 0.00E+00 | 3.04E+01 | 6.08E+01 | | |
| Pu-242 | 3.6329E-07 | 910.46 | 1,820.93 | 0.00E+00 | 3.31E-04 | 6.62E-04 | | |
| Ra-226 | 2.2854E-10 | 910.46 | 1,820.93 | 0.00E+00 | 2.08E-07 | 4.16E-07 | | |
| Ra-228 | 1.2426E-14 | 910.46 | 1,820.93 | 0.00E+00 | 1.13E-11 | 2.26E-11 | | |
| Ru-106 | 6.3589E-06 | 910.46 | 1,820.93 | 0.00E+00 | 5.79E-03 | 1.16E-02 | | |
| Se-79 | 1.2933E-05 | 910.46 | 1,820.93 | 0.00E+00 | 1.18E-02 | 2.36E-02 | | |
| Sn-126 | 1.1574E-05 | 910.46 | 1,820.93 | 0.00E+00 | 1.05E-02 | 2.11E-02 | | |
| Sr-90 | 1.9248E+00 | 910.46 | 1,820.93 | 0.00E+00 | 1.75E+03 | 3.50E+03 | | |
| Tc-99 | 4.2239E-04 | 910.46 | 1,820.93 | 0.00E+00 | 3.85E-01 | 7.69E-01 | | |
| Th-229 | 5.0953E-12 | 910.46 | 1,820.93 | 0.00E+00 | 4.64E-09 | 9.28E-09 | | |
| Th-230 | 4.1885E-08 | 910.46 | 1,820.93 | 0.00E+00 | 3.81E-05 | 7.63E-05 | | |
| Th-232 | 1.9270E-14 | 910.46 | 1,820.93 | 0.00E+00 | 1.75E-11 | 3.51E-11 | | |
| Ti-208 | 4.6024E-08 | 910.46 | 1,820.93 | 0.00E+00 | 4.19E-05 | 8.38E-05 | | |
| U-232 | 1.2582E-07 | 910.46 | 1,820.93 | 0.00E+00 | 1.15E-04 | 2.29E-04 | | |
| U-233 | 2.5825E-09 | 910.46 | 1,820.93 | 0.00E+00 | 2.35E-06 | 4.70E-06 | | |
| U-234 | 1.8450E-04 | 910.46 | 1,820.93 | 0.00E+00 | 1.68E-01 | 3.36E-01 | | |
| U-235 | -2.7235E-06 | 910.46 | 0.00 | 5.47E-03 | 2.99E-03 | 5.47E-03 | | |
| U-236 | 1.5493E-05 | 910.46 | 1,820.93 | 0.00E+00 | 1.41E-02 | 2.82E-02 | | |
| U-238 | -4.2851E-09 | 910.46 | 0.00 | 6.40E-05 | 6.01E-05 | 6.40E-05 | | |
| Y-90 | 1.9254E+00 | 910.46 | 1,820.93 | 0.00E+00 | 1.75E+03 | 3.51E+03 | | |
| Other Radionuclides | | | | | 1.76E+03 | 3.52E+03 | | |

Other Radionuclides

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences: |
|---------------------|-------------|-------------|----------------------------------|
| Reactor Moderator: | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding: | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 92.99997633 | 60 to 100 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|----------|-----------|--|
| Nominal | | 910.46 | |
| Bounding | | 1,820.93 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 1.06 | | |
| Bounding | 2.13 | | 1.03 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRR MTR-C (UALX-HEU) GERMANY
SNF ID #: 579
Fuel Units & Descr: 33 - MTR TYPE
Heavy Metal Mass: BOL=3.336kg, EOL=2.062kg
ROD Storage Site: SRS

¹Fuel decay start date: 2010
Estimates as of: 2030
Template: ATR (Light Water, Alum, 60 to 100% U)
²Template Burnup(MWd): 367.2
Template BOL Heavy Metal Mass (MT): 0.00116689
Template Decay Time: 20 years

Estimated
Canister usage:
18"x10"
1.38

| II. Estimates | m | X _n | X _b | b | Y _n | Y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6.6313E-10 | 1.206 31 | 2.412 63 | 0.00E+00 | 8.00E-07 | 1.60E-06 | Avg MeV | |
| Am-241 | 2.0060E-03 | 1.206 31 | 2.412 63 | 0.00E+00 | 2.42E+00 | 4.84E+00 | 0.0150 | 2.547E+14 |
| Am-242m | 4.2429E-07 | 1.206 31 | 2.412 63 | 0.00E+00 | 5.12E-04 | 1.02E-03 | 0.0250 | 5.296E+13 |
| Am-243 | 1.4899E-06 | 1.206 31 | 2.412 63 | 0.00E+00 | 1.80E-03 | 3.59E-03 | 0.0375 | 4.619E+13 |
| C-14 | 5.7135E-09 | 1.206 31 | 2.412 63 | 0.00E+00 | 6.89E-06 | 1.38E-05 | 0.0575 | 4.947E+13 |
| Cl-36 | 1.3124E-32 | 1.206 31 | 2.412 63 | 0.00E+00 | 1.58E-29 | 3.17E-29 | 0.0850 | 2.990E+13 |
| Cm-243 | 1.6443E-07 | 1.206 31 | 2.412 63 | 0.00E+00 | 1.98E-04 | 3.97E-04 | 0.1250 | 2.023E+13 |
| Cm-244 | 2.9330E-05 | 1.206 31 | 2.412 63 | 0.00E+00 | 3.54E-02 | 7.08E-02 | 0.2250 | 2.580E+13 |
| Co-60 | 5.3186E-06 | 1.206 31 | 2.412 63 | 0.00E+00 | 6.42E-03 | 1.28E-02 | 0.3750 | 1.123E+13 |
| Cs-134 | 3.1563E-03 | 1.206 31 | 2.412 63 | 0.00E+00 | 3.81E+00 | 7.62E+00 | 0.5750 | 1.832E+14 |
| Cs-135 | 3.4477E-06 | 1.206 31 | 2.412 63 | 0.00E+00 | 4.16E-03 | 8.32E-03 | 0.8500 | 3.097E+12 |
| Cs-137 | 2.0313E+00 | 1.206 31 | 2.412 63 | 0.00E+00 | 2.45E+03 | 4.90E+03 | 1.2500 | 1.768E+12 |
| Eu-154 | 2.4513E-02 | 1.206 31 | 2.412 63 | 0.00E+00 | 2.96E+01 | 5.91E+01 | 1.7500 | 8.116E+10 |
| Eu-155 | 4.8175E-03 | 1.206 31 | 2.412 63 | 0.00E+00 | 5.81E+00 | 1.16E+01 | 2.2500 | 7.119E+06 |
| Fe-55 | 1.2397E-04 | 1.206 31 | 2.412 63 | 0.00E+00 | 1.50E-01 | 2.99E-01 | 2.7500 | 4.025E+06 |
| H-3 | 4.5697E-03 | 1.206 31 | 2.412 63 | 0.00E+00 | 5.51E+00 | 1.10E+01 | 3.5000 | 1.849E+04 |
| I-129 | 7.5300E-07 | 1.206 31 | 2.412 63 | 0.00E+00 | 9.08E-04 | 1.82E-03 | 5.0000 | 1.045E+03 |
| Kr-85 | 1.0850E-01 | 1.206 31 | 2.412 63 | 0.00E+00 | 1.31E+02 | 2.62E+02 | 7.0000 | 1.154E+02 |
| Np-237 | 9.5561E-06 | 1.206 31 | 2.412 63 | 0.00E+00 | 1.15E-02 | 2.31E-02 | 11.0000 | 1.293E+01 |
| Pa-231 | 2.0359E-09 | 1.206 31 | 2.412 63 | 0.00E+00 | 2.46E-06 | 4.91E-06 | | |
| Pb-210 | 4.9728E-11 | 1.206 31 | 2.412 63 | 0.00E+00 | 6.00E-08 | 1.20E-07 | | |
| Pm-147 | 4.8502E-02 | 1.206 31 | 2.412 63 | 0.00E+00 | 5.85E+01 | 1.17E+02 | | |
| Pu-238 | 1.8254E-02 | 1.206 31 | 2.412 63 | 0.00E+00 | 2.20E+01 | 4.40E+01 | | |
| Pu-239 | 4.2810E-04 | 1.206 31 | 2.412 63 | 0.00E+00 | 5.16E-01 | 1.03E+00 | | |
| Pu-240 | 2.4368E-04 | 1.206 31 | 2.412 63 | 0.00E+00 | 2.94E-01 | 5.88E-01 | | |
| Pu-241 | 3.3415E-02 | 1.206 31 | 2.412 63 | 0.00E+00 | 4.03E+01 | 8.06E+01 | | |
| Pu-242 | 3.6329E-07 | 1.206 31 | 2.412 63 | 0.00E+00 | 4.38E-04 | 8.76E-04 | | |
| Ra-226 | 2.2854E-10 | 1.206 31 | 2.412 63 | 0.00E+00 | 2.76E-07 | 5.51E-07 | | |
| Ra-228 | 1.2426E-14 | 1.206 31 | 2.412 63 | 0.00E+00 | 1.50E-11 | 3.00E-11 | | |
| Ru-106 | 6.3589E-06 | 1.206 31 | 2.412 63 | 0.00E+00 | 7.67E-03 | 1.53E-02 | | |
| Se-79 | 1.2933E-05 | 1.206 31 | 2.412 63 | 0.00E+00 | 1.56E-02 | 3.12E-02 | | |
| Sn-126 | 1.1574E-05 | 1.206 31 | 2.412 63 | 0.00E+00 | 1.40E-02 | 2.79E-02 | | |
| Sr-90 | 1.9248E+00 | 1.206 31 | 2.412 63 | 0.00E+00 | 2.32E+03 | 4.64E+03 | | |
| Tc-99 | 4.2239E-04 | 1.206 31 | 2.412 63 | 0.00E+00 | 5.10E-01 | 1.02E+00 | | |
| Th-229 | 5.0953E-12 | 1.206 31 | 2.412 63 | 0.00E+00 | 6.15E-09 | 1.23E-08 | | |
| Th-230 | 4.1885E-08 | 1.206 31 | 2.412 63 | 0.00E+00 | 5.05E-05 | 1.01E-04 | | |
| Th-232 | 1.9270E-14 | 1.206 31 | 2.412 63 | 0.00E+00 | 2.32E-11 | 4.65E-11 | | |
| Ti-208 | 4.6024E-08 | 1.206 31 | 2.412 63 | 0.00E+00 | 5.55E-05 | 1.11E-04 | | |
| U-232 | 1.2582E-07 | 1.206 31 | 2.412 63 | 0.00E+00 | 1.52E-04 | 3.04E-04 | | |
| U-233 | 2.5825E-09 | 1.206 31 | 2.412 63 | 0.00E+00 | 3.12E-06 | 6.23E-06 | | |
| U-234 | 1.8450E-04 | 1.206 31 | 2.412 63 | 0.00E+00 | 2.23E-01 | 4.45E-01 | | |
| U-235 | -2.7235E-06 | 1.206 31 | 0.00 | 6.71E-03 | 3.42E-03 | 6.71E-03 | | |
| U-236 | 1.5493E-05 | 1.206 31 | 2.412 63 | 0.00E+00 | 1.87E-02 | 3.74E-02 | | |
| U-238 | -4.2851E-09 | 1.206 31 | 0.00 | 7.85E-05 | 7.33E-05 | 7.85E-05 | | |
| Y-90 | 1.9254E+00 | 1.206 31 | 2.412 63 | 0.00E+00 | 2.32E+03 | 4.65E+03 | | |
| Other Radionuclides | | | | | 2.33E+03 | 4.67E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used | Basis for Parameter Differences: |
|---------------------|-------------|-------------|----------------------------------|
| Reactor Moderator | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 92.99997131 | 60 to 100 | |

Burnup Summary (MWd)²

| | From SFD | Estimated | Basis for burnup used in estimate: |
|----------|----------|-----------|------------------------------------|
| Nominal | | 1.206.31 | |
| Bounding | | 2.412.63 | |

Nominal burnup calculated from the heavy metal mass destroyed.
Bounding burnup assumed to be twice nominal burnup.

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| Nominal | 1.15 | | |
| Bounding | 2.30 | | |

1.04

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT).

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name FRR MTR-C (UALX-HEU) JAPAN
SNF ID # 600
Fuel Units & Descr 54 - MTR TYPE
Heavy Metal Mass BOL=5.227kg EOL=4.158kg
ROD Storage Site SRS

Fuel decay start date: 2010
Estimates as of 2030
Template ATR (Light Water, Alum., 60 to 100%, U)
Template Burnup (MWd) 367.2
Template BOL Heavy Metal Mass (MT) 0.00116689
Template Decay Time 20 years

Estimated
Canister usage
18"x10"
225

| II. Estimates | | | | | | | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|---------------------|------------------------------|
| | m | x _n | x _b | b | y _n | y _b | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | Cu/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Avg MeV | |
| Ac-227 | 6.6313E-10 | 1,012.55 | 2,025.11 | 0.00E+00 | 6.71E-07 | 1.34E-06 | 0.0150 | 2.138E+14 |
| Am-241 | 2.0060E-03 | 1,012.55 | 2,025.11 | 0.00E+00 | 2.03E+00 | 4.06E+00 | 0.0250 | 4.445E+13 |
| Am-242m | 4.2429E-07 | 1,012.55 | 2,025.11 | 0.00E+00 | 4.30E-04 | 8.59E-04 | 0.0375 | 3.877E+13 |
| Am-243 | 1.4899E-06 | 1,012.55 | 2,025.11 | 0.00E+00 | 1.51E-03 | 3.02E-03 | 0.0575 | 4.153E+13 |
| C-14 | 5.7135E-09 | 1,012.55 | 2,025.11 | 0.00E+00 | 5.79E-06 | 1.16E-05 | 0.0850 | 2.509E+13 |
| Cl-36 | 1.3124E-32 | 1,012.55 | 2,025.11 | 0.00E+00 | 1.33E-29 | 2.66E-29 | 0.1250 | 1.698E+13 |
| Cm-243 | 1.6443E-07 | 1,012.55 | 2,025.11 | 0.00E+00 | 1.66E-04 | 3.33E-04 | 0.2250 | 2.165E+13 |
| Cm-244 | 2.9330E-05 | 1,012.55 | 2,025.11 | 0.00E+00 | 2.97E-02 | 5.94E-02 | 0.3750 | 9.426E+12 |
| Co-60 | 5.3186E-06 | 1,012.55 | 2,025.11 | 0.00E+00 | 5.39E-03 | 1.08E-02 | 0.5750 | 1.538E+14 |
| Cs-134 | 3.1563E-03 | 1,012.55 | 2,025.11 | 0.00E+00 | 3.20E+00 | 6.39E+00 | 0.8500 | 2.599E+12 |
| Cs-135 | 3.4477E-06 | 1,012.55 | 2,025.11 | 0.00E+00 | 3.49E-03 | 6.98E-03 | 1.2500 | 1.484E+12 |
| Cs-137 | 2.0313E+00 | 1,012.55 | 2,025.11 | 0.00E+00 | 2.06E+03 | 4.11E+03 | 1.7500 | 6.812E+10 |
| Eu-154 | 2.4513E-02 | 1,012.55 | 2,025.11 | 0.00E+00 | 2.48E+01 | 4.96E+01 | 2.2500 | 5.976E+06 |
| Eu-155 | 4.8175E-03 | 1,012.55 | 2,025.11 | 0.00E+00 | 4.88E+00 | 9.76E+00 | 2.7500 | 3.378E+06 |
| Fe-55 | 1.2397E-04 | 1,012.55 | 2,025.11 | 0.00E+00 | 1.26E-01 | 2.51E-01 | 3.5000 | 1.552E+04 |
| H-3 | 4.5697E-03 | 1,012.55 | 2,025.11 | 0.00E+00 | 4.63E+00 | 9.25E+00 | 5.0000 | 8.776E+02 |
| I-129 | 7.5300E-07 | 1,012.55 | 2,025.11 | 0.00E+00 | 7.62E-04 | 1.52E-03 | 7.0000 | 9.688E+01 |
| Kr-85 | 1.0850E-01 | 1,012.55 | 2,025.11 | 0.00E+00 | 1.10E+02 | 2.20E+02 | 11.0000 | 1.086E+01 |
| Np-237 | 9.5561E-06 | 1,012.55 | 2,025.11 | 0.00E+00 | 9.68E-03 | 1.94E-02 | | |
| Pa-231 | 2.0359E-09 | 1,012.55 | 2,025.11 | 0.00E+00 | 2.06E-06 | 4.12E-06 | | |
| Pb-210 | 4.9728E-11 | 1,012.55 | 2,025.11 | 0.00E+00 | 5.04E-08 | 1.01E-07 | | |
| Pm-147 | 4.8502E-02 | 1,012.55 | 2,025.11 | 0.00E+00 | 4.91E+01 | 9.82E+01 | | |
| Pu-238 | 1.8254E-02 | 1,012.55 | 2,025.11 | 0.00E+00 | 1.85E+01 | 3.70E+01 | | |
| Pu-239 | 4.2810E-04 | 1,012.55 | 2,025.11 | 0.00E+00 | 4.33E-01 | 8.67E-01 | | |
| Pu-240 | 2.4368E-04 | 1,012.55 | 2,025.11 | 0.00E+00 | 2.47E-01 | 4.93E-01 | | |
| Pu-241 | 3.3415E-02 | 1,012.55 | 2,025.11 | 0.00E+00 | 3.38E+01 | 6.77E+01 | | |
| Pu-242 | 3.6329E-07 | 1,012.55 | 2,025.11 | 0.00E+00 | 3.68E-04 | 7.36E-04 | | |
| Ra-226 | 2.2854E-10 | 1,012.55 | 2,025.11 | 0.00E+00 | 2.31E-07 | 4.63E-07 | | |
| Ra-228 | 1.2426E-14 | 1,012.55 | 2,025.11 | 0.00E+00 | 1.26E-11 | 2.52E-11 | | |
| Ru-106 | 6.3589E-06 | 1,012.55 | 2,025.11 | 0.00E+00 | 6.44E-03 | 1.29E-02 | | |
| Se-79 | 1.2933E-05 | 1,012.55 | 2,025.11 | 0.00E+00 | 1.31E-02 | 2.62E-02 | | |
| Sn-126 | 1.1574E-05 | 1,012.55 | 2,025.11 | 0.00E+00 | 1.17E-02 | 2.34E-02 | | |
| Sr-90 | 1.9248E+00 | 1,012.55 | 2,025.11 | 0.00E+00 | 1.95E+03 | 3.90E+03 | | |
| Tc-99 | 4.2239E-04 | 1,012.55 | 2,025.11 | 0.00E+00 | 4.28E-01 | 8.55E-01 | | |
| Th-229 | 5.0953E-12 | 1,012.55 | 2,025.11 | 0.00E+00 | 5.16E-09 | 1.03E-08 | | |
| Th-230 | 4.1885E-08 | 1,012.55 | 2,025.11 | 0.00E+00 | 4.24E-05 | 8.48E-05 | | |
| Th-232 | 1.9270E-14 | 1,012.55 | 2,025.11 | 0.00E+00 | 1.95E-11 | 3.90E-11 | | |
| Ti-208 | 4.6024E-08 | 1,012.55 | 2,025.11 | 0.00E+00 | 4.66E-05 | 9.32E-05 | | |
| U-232 | 1.2582E-07 | 1,012.55 | 2,025.11 | 0.00E+00 | 1.27E-04 | 2.55E-04 | | |
| U-233 | 2.5825E-09 | 1,012.55 | 2,025.11 | 0.00E+00 | 2.61E-06 | 5.23E-06 | | |
| U-234 | 1.8450E-04 | 1,012.55 | 2,025.11 | 0.00E+00 | 1.87E-01 | 3.74E-01 | | |
| U-235 | 2.7235E-06 | 1,012.55 | 0.00 | 1.05E-02 | 7.75E-03 | 1.05E-02 | | |
| U-236 | 1.5493E-05 | 1,012.55 | 2,025.11 | 0.00E+00 | 1.57E-02 | 3.14E-02 | | |
| U-238 | 4.2851E-09 | 1,012.55 | 0.00 | 1.23E-04 | 1.19E-04 | 1.23E-04 | | |
| Y-90 | 1.9254E+00 | 1,012.55 | 2,025.11 | 0.00E+00 | 1.95E+03 | 3.90E+03 | | |
| Other Radionuclides | | | | | 1.96E+03 | 3.92E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-------------|-------------|----------------------------------|
| Reactor Moderator: | From SFD | Used | |
| Fuel Cladding: | LIGHT WATER | LIGHT WATER | |
| BOL HM Constituents | ALUM | ALUM | |
| BOL Enrichment % | U | U | |
| | 92.99999931 | 60 to 100 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|------------------------------------|
| | From SFD | Estimated | |
| Nominal | | 1,012.55 | |
| Bounding | | 2,025.11 | |

Nominal burnup calculated from the heavy metal mass destroyed.
Bounding burnup assumed to be twice nominal burnup

| Checks | | |
|----------|-------------------|-----------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
| Nominal | 0.62 | |
| Bounding | 1.23 | |

Estimated EOL HM/Given EOL HM 1.01

¹ Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

² Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRR MTR-C (UALX-HEU) PORTUGAL
SNF ID #: 631
Fuel Units & Descr: 9 - MTR TYPE
Heavy Metal Mass: BOL=1 423kg; EOL=0 894kg
ROD Storage Site: SRS

¹Fuel decay start date: 2010
Estimates as of: 2030
Template: ATR (Light Water, Alum., 60 to 100%, U)
²Template Burnup(MWd): 367.2
Template BOL Heavy Metal Mass (MT): 0 00116689
Template Decay Time: 20 years

Estimated
Canister usage:
18"x10"
0 38

| II. Estimates | m | X _a | X _b | b | Y _a | Y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Cu/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6 6313E-10 | 501 16 | 1,002 33 | 0 00E+00 | 3 32E-07 | 6 65E-07 | Avg MeV | |
| Am-241 | 2 0060E-03 | 501 16 | 1,002 33 | 0 00E+00 | 1 01E+00 | 2 01E+00 | 0 0150 | 1 058E+14 |
| Am-242m | 4 2429E-07 | 501 16 | 1,002 33 | 0 00E+00 | 2 13E-04 | 4 25E-04 | 0 0250 | 2 200E+13 |
| Am-243 | 1 4899E-06 | 501 16 | 1,002 33 | 0 00E+00 | 7 47E-04 | 1 49E-03 | 0 0375 | 1 919E+13 |
| C-14 | 5 7135E-09 | 501 16 | 1,002 33 | 0 00E+00 | 2 86E-06 | 5 73E-06 | 0 0575 | 2 055E+13 |
| Cl-36 | 1 3124E-32 | 501 16 | 1,002 33 | 0 00E+00 | 6 58E-30 | 1 32E-29 | 0 0850 | 1 242E+13 |
| Cm-243 | 1 6443E-07 | 501 16 | 1,002 33 | 0 00E+00 | 8 24E-05 | 1 65E-04 | 0 1250 | 8 405E+12 |
| Cm-244 | 2 9330E-05 | 501 16 | 1,002 33 | 0 00E+00 | 1 47E-02 | 2 94E-02 | 0 2250 | 1 072E+13 |
| Co-60 | 5 3186E-06 | 501 16 | 1,002 33 | 0 00E+00 | 2 67E-03 | 5 33E-03 | 0 3750 | 4 665E+12 |
| Cs-134 | 3 1563E-03 | 501 16 | 1,002 33 | 0 00E+00 | 1 58E+00 | 3 16E+00 | 0 5750 | 7 610E+13 |
| Cs-135 | 3 4477E-06 | 501 16 | 1,002 33 | 0 00E+00 | 1 73E-03 | 3 46E-03 | 0 8500 | 1 287E+12 |
| Cs-137 | 2 0313E+00 | 501 16 | 1,002 33 | 0 00E+00 | 1 02E+03 | 2 04E+03 | 1 2500 | 7 346E+11 |
| Eu-154 | 2 4513E-02 | 501 16 | 1,002 33 | 0 00E+00 | 1 23E+01 | 2 46E+01 | 1 7500 | 3 372E+10 |
| Eu-155 | 4 8175E-03 | 501 16 | 1,002 33 | 0 00E+00 | 2 41E+00 | 4 83E+00 | 2 2500 | 2 958E+06 |
| Fe-55 | 1 2397E-04 | 501 16 | 1,002 33 | 0 00E+00 | 6 21E-02 | 1 24E-01 | 2 7500 | 1 672E+06 |
| H-3 | 4 5697E-03 | 501 16 | 1,002 33 | 0 00E+00 | 2 29E+00 | 4 58E+00 | 3 5000 | 7 681E+03 |
| I-129 | 7 5300E-07 | 501 16 | 1,002 33 | 0 00E+00 | 3 77E-04 | 7 55E-04 | 5 0000 | 4 343E+02 |
| Kr-85 | 1 0850E-01 | 501 16 | 1,002 33 | 0 00E+00 | 5 44E+01 | 1 09E+02 | 7 0000 | 4 794E+01 |
| Np-237 | 9 5561E-06 | 501 16 | 1,002 33 | 0 00E+00 | 4 79E-03 | 9 58E-03 | 11 0000 | 5 373E+00 |
| Pa-231 | 2 0359E-09 | 501 16 | 1,002 33 | 0 00E+00 | 1 02E-06 | 2 04E-06 | | |
| Pb-210 | 4 9728E-11 | 501 16 | 1,002 33 | 0 00E+00 | 2 49E-08 | 4 98E-08 | | |
| Pm-147 | 4 8502E-02 | 501 16 | 1,002 33 | 0 00E+00 | 2 43E+01 | 4 86E+01 | | |
| Pu-238 | 1 8254E-02 | 501 16 | 1,002 33 | 0 00E+00 | 9 15E+00 | 1 83E+01 | | |
| Pu-239 | 4 2810E-04 | 501 16 | 1,002 33 | 0 00E+00 | 2 15E-01 | 4 29E-01 | | |
| Pu-240 | 2 4368E-04 | 501 16 | 1,002 33 | 0 00E+00 | 1 22E-01 | 2 44E-01 | | |
| Pu-241 | 3 3415E-02 | 501 16 | 1,002 33 | 0 00E+00 | 1 67E+01 | 3 35E+01 | | |
| Pu-242 | 3 6329E-07 | 501 16 | 1,002 33 | 0 00E+00 | 1 82E-04 | 3 64E-04 | | |
| Ra-226 | 2 2854E-10 | 501 16 | 1,002 33 | 0 00E+00 | 1 15E-07 | 2 29E-07 | | |
| Ra-228 | 1 2426E-14 | 501 16 | 1,002 33 | 0 00E+00 | 6 23E-12 | 1 25E-11 | | |
| Ru-106 | 6 3589E-06 | 501 16 | 1,002 33 | 0 00E+00 | 3 19E-03 | 6 37E-03 | | |
| Se-79 | 1 2933E-05 | 501 16 | 1,002 33 | 0 00E+00 | 6 48E-03 | 1 30E-02 | | |
| Sn-126 | 1 1574E-05 | 501 16 | 1,002 33 | 0 00E+00 | 5 80E-03 | 1 16E-02 | | |
| Sr-90 | 1 9248E+00 | 501 16 | 1,002 33 | 0 00E+00 | 9 65E+02 | 1 93E+03 | | |
| Tc-99 | 4 2239E-04 | 501 16 | 1,002 33 | 0 00E+00 | 2 12E-01 | 4 23E-01 | | |
| Th-229 | 5 0953E-12 | 501 16 | 1,002 33 | 0 00E+00 | 2 55E-09 | 5 11E-09 | | |
| Th-230 | 4 1885E-08 | 501 16 | 1,002 33 | 0 00E+00 | 2 10E-05 | 4 20E-05 | | |
| Th-232 | 1 9270E-14 | 501 16 | 1,002 33 | 0 00E+00 | 9 66E-12 | 1 93E-11 | | |
| Ti-208 | 4 6024E-08 | 501 16 | 1,002 33 | 0 00E+00 | 2 31E-05 | 4 61E-05 | | |
| U-232 | 1 2582E-07 | 501 16 | 1,002 33 | 0 00E+00 | 6 31E-05 | 1 26E-04 | | |
| U-233 | 2 5825E-09 | 501 16 | 1,002 33 | 0 00E+00 | 1 29E-06 | 2 59E-06 | | |
| U-234 | 1 8450E-04 | 501 16 | 1,002 33 | 0 00E+00 | 9 25E-02 | 1 85E-01 | | |
| U-235 | -2 7235E-06 | 501 16 | 0 00 | 2 86E-03 | 1 49E-03 | 2 86E-03 | | |
| U-236 | 1 5493E-05 | 501 16 | 1,002 33 | 0 00E+00 | 7 76E-03 | 1 55E-02 | | |
| U-238 | -4 2851E-09 | 501 16 | 0 00 | 3 35E-05 | 3 13E-05 | 3 35E-05 | | |
| Y-90 | 1 9254E+00 | 501 16 | 1,002 33 | 0 00E+00 | 9 65E+02 | 1 93E+03 | | |
| Other Radionuclides | | | | | 9 69E+02 | 1 94E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-------------|-------------|
| Reactor Moderator | LIGHT WATER | LIGHT WATER |
| Fuel Cladding | ALUM | ALUM |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 93 00000971 | 60 to 100 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | | 501 16 |
| Bounding | | 1,002 33 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed.
Bounding burnup assumed to be twice nominal burnup

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|-----------------------------------|
| Nominal | 1 12 | |
| Bounding | 2 24 | |

Estimated EOL HM/Given EOL HM

1 03

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel.

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT).

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name FRR MTR-C (UALX-HEU) TURKEY
SNF ID #: 643
Fuel Units & Descr: 8 - MTR TYPE
Heavy Metal Mass: BOL=1781kg EOL=0.953kg
ROD Storage Site: SRS

¹Fuel decay start date 2010
Estimates as of 2030
Template ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup(MWd) 367.2
Template BOL Heavy Metal Mass (MT) 0.00116689
Template Decay Time 20 years

Estimated
Canister usage
18"x10"
0.33

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|---------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6.6313E-10 | 784.13 | 1,568.26 | 0.00E+00 | 5.20E-07 | 1.04E-06 | Avg MeV | |
| Am-241 | 2.0060E-03 | 784.13 | 1,568.26 | 0.00E+00 | 1.57E+00 | 3.15E+00 | 0.0150 | 1.655E+14 |
| Am-242m | 4.2429E-07 | 784.13 | 1,568.26 | 0.00E+00 | 3.33E-04 | 6.65E-04 | 0.0250 | 3.442E+13 |
| Am-243 | 1.4899E-06 | 784.13 | 1,568.26 | 0.00E+00 | 1.17E-03 | 2.34E-03 | 0.0375 | 3.003E+13 |
| C-14 | 5.7135E-09 | 784.13 | 1,568.26 | 0.00E+00 | 4.48E-06 | 8.96E-06 | 0.0575 | 3.216E+13 |
| Cl-36 | 1.3124E-32 | 784.13 | 1,568.26 | 0.00E+00 | 1.03E-29 | 2.06E-29 | 0.0850 | 1.943E+13 |
| Cm-243 | 1.6443E-07 | 784.13 | 1,568.26 | 0.00E+00 | 1.29E-04 | 2.58E-04 | 0.1250 | 1.315E+13 |
| Cm-244 | 2.9330E-05 | 784.13 | 1,568.26 | 0.00E+00 | 2.30E-02 | 4.60E-02 | 0.2250 | 1.677E+13 |
| Co-60 | 5.3186E-06 | 784.13 | 1,568.26 | 0.00E+00 | 4.17E-03 | 8.34E-03 | 0.3750 | 7.299E+12 |
| Cs-134 | 3.1563E-03 | 784.13 | 1,568.26 | 0.00E+00 | 2.47E+00 | 4.95E+00 | 0.5750 | 1.191E+14 |
| Cs-135 | 3.4477E-06 | 784.13 | 1,568.26 | 0.00E+00 | 2.70E-03 | 5.41E-03 | 0.8500 | 2.013E+12 |
| Cs-137 | 2.0313E+00 | 784.13 | 1,568.26 | 0.00E+00 | 1.59E+03 | 3.19E+03 | 1.2500 | 1.149E+12 |
| Eu-154 | 2.4513E-02 | 784.13 | 1,568.26 | 0.00E+00 | 1.92E+01 | 3.84E+01 | 1.7500 | 5.276E+10 |
| Eu-155 | 4.8175E-03 | 784.13 | 1,568.26 | 0.00E+00 | 3.78E+00 | 7.56E+00 | 2.2500 | 4.628E+06 |
| Fe-55 | 1.2397E-04 | 784.13 | 1,568.26 | 0.00E+00 | 9.72E-02 | 1.94E-01 | 2.7500 | 2.616E+06 |
| H-3 | 4.5697E-03 | 784.13 | 1,568.26 | 0.00E+00 | 3.58E+00 | 7.17E+00 | 3.5000 | 1.202E+04 |
| I-129 | 7.5300E-07 | 784.13 | 1,568.26 | 0.00E+00 | 5.90E-04 | 1.18E-03 | 5.0000 | 6.794E+02 |
| Kr-85 | 1.0850E-01 | 784.13 | 1,568.26 | 0.00E+00 | 8.51E+01 | 1.70E+02 | 7.0000 | 7.501E+01 |
| Np-237 | 9.5561E-06 | 784.13 | 1,568.26 | 0.00E+00 | 7.49E-03 | 1.50E-02 | 11.0000 | 8.407E+00 |
| Pa-231 | 2.0359E-09 | 784.13 | 1,568.26 | 0.00E+00 | 1.60E-06 | 3.19E-06 | | |
| Pb-210 | 4.9728E-11 | 784.13 | 1,568.26 | 0.00E+00 | 3.90E-08 | 7.80E-08 | | |
| Pm-147 | 4.8502E-02 | 784.13 | 1,568.26 | 0.00E+00 | 3.80E+01 | 7.61E+01 | | |
| Pu-238 | 1.8254E-02 | 784.13 | 1,568.26 | 0.00E+00 | 1.43E+01 | 2.86E+01 | | |
| Pu-239 | 4.2810E-04 | 784.13 | 1,568.26 | 0.00E+00 | 3.36E-01 | 6.71E-01 | | |
| Pu-240 | 2.4368E-04 | 784.13 | 1,568.26 | 0.00E+00 | 1.91E-01 | 3.82E-01 | | |
| Pu-241 | 3.3415E-02 | 784.13 | 1,568.26 | 0.00E+00 | 2.62E+01 | 5.24E+01 | | |
| Pu-242 | 3.6329E-07 | 784.13 | 1,568.26 | 0.00E+00 | 2.85E-04 | 5.70E-04 | | |
| Ra-226 | 2.2854E-10 | 784.13 | 1,568.26 | 0.00E+00 | 1.79E-07 | 3.58E-07 | | |
| Ra-228 | 1.2426E-14 | 784.13 | 1,568.26 | 0.00E+00 | 9.74E-12 | 1.95E-11 | | |
| Ru-106 | 6.3589E-06 | 784.13 | 1,568.26 | 0.00E+00 | 4.99E-03 | 9.97E-03 | | |
| Se-79 | 1.2933E-05 | 784.13 | 1,568.26 | 0.00E+00 | 1.01E-02 | 2.03E-02 | | |
| Sn-126 | 1.1574E-05 | 784.13 | 1,568.26 | 0.00E+00 | 9.08E-03 | 1.82E-02 | | |
| Sr-90 | 1.9248E+00 | 784.13 | 1,568.26 | 0.00E+00 | 1.51E+03 | 3.02E+03 | | |
| Tc-99 | 4.2239E-04 | 784.13 | 1,568.26 | 0.00E+00 | 3.31E-01 | 6.62E-01 | | |
| Th-229 | 5.0953E-12 | 784.13 | 1,568.26 | 0.00E+00 | 4.00E-09 | 7.99E-09 | | |
| Th-230 | 4.1885E-08 | 784.13 | 1,568.26 | 0.00E+00 | 3.28E-05 | 6.57E-05 | | |
| Th-232 | 1.9270E-14 | 784.13 | 1,568.26 | 0.00E+00 | 1.51E-11 | 3.02E-11 | | |
| Th-208 | 4.6024E-08 | 784.13 | 1,568.26 | 0.00E+00 | 3.61E-05 | 7.22E-05 | | |
| U-232 | 1.2582E-07 | 784.13 | 1,568.26 | 0.00E+00 | 9.87E-05 | 1.97E-04 | | |
| U-233 | 2.5825E-09 | 784.13 | 1,568.26 | 0.00E+00 | 2.03E-06 | 4.05E-06 | | |
| U-234 | 1.8450E-04 | 784.13 | 1,568.26 | 0.00E+00 | 1.45E-01 | 2.89E-01 | | |
| U-235 | -2.7235E-06 | 784.13 | 0.00 | 3.58E-03 | 1.44E-03 | 3.58E-03 | | |
| U-236 | 1.5493E-05 | 784.13 | 1,568.26 | 0.00E+00 | 1.21E-02 | 2.43E-02 | | |
| U-238 | -4.2851E-09 | 784.13 | 0.00 | 4.19E-05 | 3.85E-05 | 4.19E-05 | | |
| Y-90 | 1.9254E+00 | 784.13 | 1,568.26 | 0.00E+00 | 1.51E+03 | 3.02E+03 | | |
| Other Radionuclides | | | | | 1.52E+03 | 3.03E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-------------|-------------|----------------------------------|
| Reactor Moderator | From SFD | Used | |
| Fuel Cladding | LIGHT WATER | LIGHT WATER | |
| BOL HM Constituents | ALUM | ALUM | |
| BOL Enrichment % | 93.00002122 | 60 to 100 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|--|
| Nominal | From SFD | Estimated | |
| Bounding | | 784.13 | |
| | | 1,568.26 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|--------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 1.40 | | |
| Bounding | 2.80 | | 1.05 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRR MTR-C (JALX-LEU) JAPAN
 SNF ID #: 552
 Fuel Units & Descr: 99 - ASSEMBLY
 Heavy Metal Mass: BOL=94.05kg EOL=84.645kg
 ROD Storage Site: SRS

¹Fuel decay start date.
 Estimates as of:

2010
 2030

Template: HFBR (Heavy Water, Alum, 10 to 20% U)

²Template Burnup(MWd)

15

Template BOL Heavy Metal Mass (MT):

0.00034251

Template Decay Time:

20 years

Estimated
 Canister usage.
 18"x10"
 4 13

II. Estimates

| | m | X _n | X _s | b | Y _n | Y _s | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 8.533E-10 | 8,939.12 | 17,878.25 | 0.00E+00 | 7.63E-06 | 1.53E-05 | Avg MeV | |
| Am-241 | 2.275E-02 | 8,939.12 | 17,878.25 | 0.00E+00 | 2.03E+02 | 4.07E+02 | 0.0150 | 1.812E+15 |
| Am-242m | 8.913E-06 | 8,939.12 | 17,878.25 | 0.00E+00 | 7.97E-02 | 1.59E-01 | 0.0250 | 3.763E+14 |
| Am-243 | 6.400E-06 | 8,939.12 | 17,878.25 | 0.00E+00 | 5.72E-02 | 1.14E-01 | 0.0375 | 3.306E+14 |
| C-14 | 2.962E-08 | 8,939.12 | 17,878.25 | 0.00E+00 | 2.65E-04 | 5.30E-04 | 0.0575 | 3.561E+14 |
| Cl-36 | 5.951E-35 | 8,939.12 | 17,878.25 | 0.00E+00 | 5.32E-31 | 1.06E-30 | 0.0850 | 2.120E+14 |
| Cm-243 | 2.208E-06 | 8,939.12 | 17,878.25 | 0.00E+00 | 1.97E-02 | 3.95E-02 | 0.1250 | 1.427E+14 |
| Cm-244 | 1.100E-04 | 8,939.12 | 17,878.25 | 0.00E+00 | 9.84E-01 | 1.97E+00 | 0.2250 | 1.827E+14 |
| Co-60 | 1.634E-05 | 8,939.12 | 17,878.25 | 0.00E+00 | 1.46E-01 | 2.92E-01 | 0.3750 | 7.952E+13 |
| Cs-134 | 2.135E-03 | 8,939.12 | 17,878.25 | 0.00E+00 | 1.91E+01 | 3.82E+01 | 0.5750 | 1.349E+15 |
| Cs-135 | 4.860E-06 | 8,939.12 | 17,878.25 | 0.00E+00 | 4.35E-02 | 8.69E-02 | 0.8500 | 2.062E+13 |
| Cs-137 | 2.022E+00 | 8,939.12 | 17,878.25 | 0.00E+00 | 1.81E+04 | 3.62E+04 | 1.2500 | 1.162E+13 |
| Eu-154 | 2.088E-02 | 8,939.12 | 17,878.25 | 0.00E+00 | 1.87E+02 | 3.73E+02 | 1.7500 | 5.482E+11 |
| Eu-155 | 4.066E-03 | 8,939.12 | 17,878.25 | 0.00E+00 | 3.65E+01 | 7.31E+01 | 2.2500 | 5.141E+07 |
| Fe-55 | 1.416E-03 | 8,939.12 | 17,878.25 | 0.00E+00 | 1.27E+01 | 2.53E+01 | 2.7500 | 6.084E+06 |
| H-3 | 4.665E-03 | 8,939.12 | 17,878.25 | 0.00E+00 | 4.17E+01 | 8.34E+01 | 3.5000 | 2.465E+05 |
| I-129 | 7.160E-07 | 8,939.12 | 17,878.25 | 0.00E+00 | 6.40E-03 | 1.28E-02 | 5.0000 | 3.744E+04 |
| Kr-85 | 1.024E-01 | 8,939.12 | 17,878.25 | 0.00E+00 | 9.15E+02 | 1.83E+03 | 7.0000 | 4.237E+03 |
| Np-237 | 3.722E-06 | 8,939.12 | 17,878.25 | 0.00E+00 | 3.33E-02 | 6.66E-02 | 11.0000 | 4.821E+02 |
| Pa-231 | 2.672E-09 | 8,939.12 | 17,878.25 | 0.00E+00 | 2.39E-05 | 4.78E-05 | | |
| Pb-210 | 4.331E-14 | 8,939.12 | 17,878.25 | 0.00E+00 | 3.87E-10 | 7.74E-10 | | |
| Pm-147 | 4.630E-02 | 8,939.12 | 17,878.25 | 0.00E+00 | 4.14E+02 | 8.28E+02 | | |
| Pu-238 | 5.527E-03 | 8,939.12 | 17,878.25 | 0.00E+00 | 4.94E+01 | 9.88E+01 | | |
| Pu-239 | 1.031E-02 | 8,939.12 | 17,878.25 | 0.00E+00 | 9.22E+01 | 1.84E+02 | | |
| Pu-240 | 5.418E-03 | 8,939.12 | 17,878.25 | 0.00E+00 | 4.84E+01 | 9.69E+01 | | |
| Pu-241 | 3.757E-01 | 8,939.12 | 17,878.25 | 0.00E+00 | 3.36E+03 | 6.72E+03 | | |
| Pu-242 | 3.071E-06 | 8,939.12 | 17,878.25 | 0.00E+00 | 2.75E-02 | 5.49E-02 | | |
| Ra-226 | 2.380E-13 | 8,939.12 | 17,878.25 | 0.00E+00 | 2.13E-09 | 4.26E-09 | | |
| Ra-228 | 1.060E-14 | 8,939.12 | 17,878.25 | 0.00E+00 | 9.48E-11 | 1.90E-10 | | |
| Ru-106 | 8.480E-06 | 8,939.12 | 17,878.25 | 0.00E+00 | 7.58E-02 | 1.52E-01 | | |
| Se-79 | 1.253E-05 | 8,939.12 | 17,878.25 | 0.00E+00 | 1.12E-01 | 2.24E-01 | | |
| Sn-126 | 1.139E-05 | 8,939.12 | 17,878.25 | 0.00E+00 | 1.02E-01 | 2.04E-01 | | |
| Sr-90 | 1.840E+00 | 8,939.12 | 17,878.25 | 0.00E+00 | 1.64E+04 | 3.29E+04 | | |
| Tc-99 | 4.353E-04 | 8,939.12 | 17,878.25 | 0.00E+00 | 3.89E+00 | 7.78E+00 | | |
| Th-229 | 5.894E-13 | 8,939.12 | 17,878.25 | 0.00E+00 | 5.27E-09 | 1.05E-08 | | |
| Th-230 | 5.950E-11 | 8,939.12 | 17,878.25 | 0.00E+00 | 5.32E-07 | 1.06E-06 | | |
| Th-232 | 1.636E-14 | 8,939.12 | 17,878.25 | 0.00E+00 | 1.46E-10 | 2.92E-10 | | |
| Tl-208 | 7.600E-09 | 8,939.12 | 17,878.25 | 0.00E+00 | 6.79E-05 | 1.36E-04 | | |
| U-232 | 2.074E-08 | 8,939.12 | 17,878.25 | 0.00E+00 | 1.85E-04 | 3.71E-04 | | |
| U-233 | 4.401E-10 | 8,939.12 | 17,878.25 | 0.00E+00 | 3.93E-06 | 7.87E-06 | | |
| U-234 | 4.650E-07 | 8,939.12 | 17,878.25 | 0.00E+00 | 4.16E-03 | 8.31E-03 | | |
| U-235 | -2.533E-06 | 8,939.12 | 0.00 | 4.06E-02 | 1.80E-02 | 4.06E-02 | | |
| U-236 | 1.300E-05 | 8,939.12 | 17,878.25 | 0.00E+00 | 1.16E-01 | 2.32E-01 | | |
| U-238 | -1.420E-08 | 8,939.12 | 0.00 | 2.53E-02 | 2.52E-02 | 2.53E-02 | | |
| Y-90 | 1.840E+00 | 8,939.12 | 17,878.25 | 0.00E+00 | 1.64E+04 | 3.29E+04 | | |
| Other Radionuclides | | | | | 1.72E+04 | 3.44E+04 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-------------|-------------|----------------------------------|
| Reactor Moderator | From SFD | Used | |
| | HEAVY WATER | HEAVY WATER | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | |
| BOL Enrichment % | 20 | 10 to 20 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | | 8.939.12 | |
| Bounding | | 17.878.25 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup assumed to be twice nominal burnup. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 2.17 | | |
| Bounding | 4.34 | | 1.02 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRR MTR-C (UALX-LEU) PORTUGAL
 SNF ID #: 540
 Fuel Units & Descr: 9 - ASSEMBLY
 Heavy Metal Mass: BOL=4.05kg EOL=3.912kg
 ROD Storage Site: SRS

¹Fuel decay start date: 2010
 Estimates as of: 2030
 Template: ATR (Light Water, Alum, 60 to 100% U)
²Template Burnup(MWd): 367.2
 Template BOL Heavy Metal Mass (MT): 0.00116689
 Template Decay Time: 20 years

Estimated
 Canister usage
 18"x10"
 0.38

| II. Estimates | | | | | | | Gamma Sources | |
|---------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| | m | x _a | x _b | b | y _a | y _b | Photon Energy Group | Total Photons/sec (bounding) |
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Avg MeV | |
| Ac-227 | 6.6313E-10 | 130.40 | 260.81 | 0.00E+00 | 8.65E-08 | 1.73E-07 | 0.0150 | 2.753E+13 |
| Am-241 | 2.0060E-03 | 130.40 | 260.81 | 0.00E+00 | 2.62E-01 | 5.23E-01 | 0.0250 | 5.725E+12 |
| Am-242m | 4.2429E-07 | 130.40 | 260.81 | 0.00E+00 | 5.53E-05 | 1.11E-04 | 0.0375 | 4.993E+12 |
| Am-243 | 1.4899E-06 | 130.40 | 260.81 | 0.00E+00 | 1.94E-04 | 3.89E-04 | 0.0575 | 5.348E+12 |
| C-14 | 5.7135E-09 | 130.40 | 260.81 | 0.00E+00 | 7.45E-07 | 1.49E-06 | 0.0850 | 3.232E+12 |
| Cl-36 | 1.3124E-32 | 130.40 | 260.81 | 0.00E+00 | 1.71E-30 | 3.42E-30 | 0.1250 | 2.187E+12 |
| Cm-243 | 1.6443E-07 | 130.40 | 260.81 | 0.00E+00 | 2.14E-05 | 4.29E-05 | 0.2250 | 2.789E+12 |
| Cm-244 | 2.9330E-05 | 130.40 | 260.81 | 0.00E+00 | 3.82E-03 | 7.65E-03 | 0.3750 | 1.214E+12 |
| Co-60 | 5.3186E-06 | 130.40 | 260.81 | 0.00E+00 | 6.94E-04 | 1.39E-03 | 0.5750 | 1.980E+13 |
| Cs-134 | 3.1563E-03 | 130.40 | 260.81 | 0.00E+00 | 4.12E-01 | 8.23E-01 | 0.8500 | 3.348E+11 |
| Cs-135 | 3.4477E-06 | 130.40 | 260.81 | 0.00E+00 | 4.50E-04 | 8.99E-04 | 1.2500 | 1.912E+11 |
| Cs-137 | 2.0313E+00 | 130.40 | 260.81 | 0.00E+00 | 2.65E+02 | 5.30E+02 | 1.7500 | 8.774E+09 |
| Eu-154 | 2.4513E-02 | 130.40 | 260.81 | 0.00E+00 | 3.20E+00 | 6.39E+00 | 2.2500 | 7.696E+05 |
| Eu-155 | 4.8175E-03 | 130.40 | 260.81 | 0.00E+00 | 6.28E-01 | 1.26E+00 | 2.7500 | 4.351E+05 |
| Fe-55 | 1.2397E-04 | 130.40 | 260.81 | 0.00E+00 | 1.62E-02 | 3.23E-02 | 3.5000 | 2.005E+03 |
| H-3 | 4.5697E-03 | 130.40 | 260.81 | 0.00E+00 | 5.96E-01 | 1.19E+00 | 5.0000 | 1.155E+02 |
| I-129 | 7.5300E-07 | 130.40 | 260.81 | 0.00E+00 | 9.82E-05 | 1.96E-04 | 7.0000 | 1.276E+01 |
| Kr-85 | 1.0850E-01 | 130.40 | 260.81 | 0.00E+00 | 1.41E+01 | 2.83E+01 | 11.0000 | 1.431E+00 |
| Np-237 | 9.5561E-06 | 130.40 | 260.81 | 0.00E+00 | 1.25E-03 | 2.49E-03 | | |
| Pa-231 | 2.0359E-09 | 130.40 | 260.81 | 0.00E+00 | 2.65E-07 | 5.31E-07 | | |
| Pb-210 | 4.9728E-11 | 130.40 | 260.81 | 0.00E+00 | 6.48E-09 | 1.30E-08 | | |
| Pm-147 | 4.8502E-02 | 130.40 | 260.81 | 0.00E+00 | 6.32E+00 | 1.26E+01 | | |
| Pu-238 | 1.8254E-02 | 130.40 | 260.81 | 0.00E+00 | 2.38E+00 | 4.76E+00 | | |
| Pu-239 | 4.2810E-04 | 130.40 | 260.81 | 0.00E+00 | 5.58E-02 | 1.12E-01 | | |
| Pu-240 | 2.4368E-04 | 130.40 | 260.81 | 0.00E+00 | 3.18E-02 | 6.36E-02 | | |
| Pu-241 | 3.3415E-02 | 130.40 | 260.81 | 0.00E+00 | 4.36E+00 | 8.71E+00 | | |
| Pu-242 | 3.6329E-07 | 130.40 | 260.81 | 0.00E+00 | 4.74E-05 | 9.47E-05 | | |
| Ra-226 | 2.2854E-10 | 130.40 | 260.81 | 0.00E+00 | 2.98E-08 | 5.96E-08 | | |
| Ra-228 | 1.2426E-14 | 130.40 | 260.81 | 0.00E+00 | 1.62E-12 | 3.24E-12 | | |
| Ru-106 | 6.3589E-06 | 130.40 | 260.81 | 0.00E+00 | 8.29E-04 | 1.66E-03 | | |
| Se-79 | 1.2933E-05 | 130.40 | 260.81 | 0.00E+00 | 1.69E-03 | 3.37E-03 | | |
| Sn-126 | 1.1574E-05 | 130.40 | 260.81 | 0.00E+00 | 1.51E-03 | 3.02E-03 | | |
| Sr-90 | 1.9248E+00 | 130.40 | 260.81 | 0.00E+00 | 2.51E+02 | 5.02E+02 | | |
| Tc-99 | 4.2239E-04 | 130.40 | 260.81 | 0.00E+00 | 5.51E-02 | 1.10E-01 | | |
| Th-229 | 5.0953E-12 | 130.40 | 260.81 | 0.00E+00 | 6.64E-10 | 1.33E-09 | | |
| Th-230 | 4.1885E-08 | 130.40 | 260.81 | 0.00E+00 | 5.46E-06 | 1.09E-05 | | |
| Th-232 | 1.9270E-14 | 130.40 | 260.81 | 0.00E+00 | 2.51E-12 | 5.03E-12 | | |
| Ti-208 | 4.6024E-08 | 130.40 | 260.81 | 0.00E+00 | 6.00E-06 | 1.20E-05 | | |
| U-232 | 1.2582E-07 | 130.40 | 260.81 | 0.00E+00 | 1.64E-05 | 3.28E-05 | | |
| U-233 | 2.5825E-09 | 130.40 | 260.81 | 0.00E+00 | 3.37E-07 | 6.74E-07 | | |
| U-234 | 1.8450E-04 | 130.40 | 260.81 | 0.00E+00 | 2.41E-02 | 4.81E-02 | | |
| U-235 | -2.7235E-06 | 130.40 | 0.00 | 1.75E-03 | 1.40E-03 | 1.75E-03 | | |
| U-236 | 1.5493E-05 | 130.40 | 260.81 | 0.00E+00 | 2.02E-03 | 4.04E-03 | | |
| U-238 | -4.2851E-09 | 130.40 | 0.00 | 1.09E-03 | 1.09E-03 | 1.09E-03 | | |
| Y-90 | 1.9254E+00 | 130.40 | 260.81 | 0.00E+00 | 2.51E+02 | 5.02E+02 | | |
| Y-90 | | | | | 2.52E+02 | 5.04E+02 | | |

Other Radionuclides

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: This Template was used for the following reasons: This fuel matches on all parameters except enrichment. |
|----------------------------|-------------|-------------|---|
| Reactor Moderator: | From SFD | Used | |
| | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding: | ALUM | ALUM | |
| BOL HM Constituents: | U | U | |
| BOL Enrichment %: | 20.0000132 | 60 to 100 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup. |
|-----------------------------------|----------|-----------|--|
| | From SFD | Estimated | |
| Nominal | | 130.40 | |
| Bounding: | | 260.81 | |

| Checks | | | Estimated EOL HM/Given EOL HM 1.00 |
|-----------|-------------------|-------------------------------|---------------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 0.10 | | |
| Bounding: | 0.20 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRR MTR-C1 (UALX-HEU) SWITZERLAND
SNF ID #: 656
Fuel Units & Descr: 7 - MTR TYPE
Heavy Metal Mass: BOL=1.28kg, EOL=0.518kg
ROD Storage Site: SRS

Fuel decay start date: 2010
Estimates as of: 2030
Template: ATR (Light Water Alum 60 to 100%, U)
Template Burnup (MWd): 367.2
Template BOL Heavy Metal Mass (MT): 0.00116689
Template Decay Time: 20 years

Estimated
Canister usage
18"x10"
0.29

II. Estimates

| Radionuclide | C/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
|---------------------|---------------------|--|---|-----------------------|-------------------------------|--------------------------------|---------------------|------------------------------|
| Ac-227 | 6.6313E-10 | 721.25 | 1,211.81 | 0.00E+00 | 4.78E-07 | 8.04E-07 | Avg. MeV | |
| Am-241 | 2.0060E-03 | 721.25 | 1,211.81 | 0.00E+00 | 1.45E+00 | 2.43E+00 | 0.0150 | 1.279E+14 |
| Am-242m | 4.2429E-07 | 721.25 | 1,211.81 | 0.00E+00 | 3.06E-04 | 5.14E-04 | 0.0250 | 2.660E+13 |
| Am-243 | 1.4899E-06 | 721.25 | 1,211.81 | 0.00E+00 | 1.07E-03 | 1.81E-03 | 0.0375 | 2.320E+13 |
| C-14 | 5.7135E-09 | 721.25 | 1,211.81 | 0.00E+00 | 4.12E-06 | 6.92E-06 | 0.0575 | 2.485E+13 |
| Cl-36 | 1.3124E-32 | 721.25 | 1,211.81 | 0.00E+00 | 9.47E-30 | 1.59E-29 | 0.0850 | 1.502E+13 |
| Cm-243 | 1.6443E-07 | 721.25 | 1,211.81 | 0.00E+00 | 1.19E-04 | 1.99E-04 | 0.1250 | 1.016E+13 |
| Cm-244 | 2.9330E-05 | 721.25 | 1,211.81 | 0.00E+00 | 2.12E-02 | 3.55E-02 | 0.2250 | 1.296E+13 |
| Co-60 | 5.3186E-06 | 721.25 | 1,211.81 | 0.00E+00 | 3.84E-03 | 6.45E-03 | 0.3750 | 5.640E+12 |
| Cs-134 | 3.1563E-03 | 721.25 | 1,211.81 | 0.00E+00 | 2.28E+00 | 3.82E+00 | 0.5750 | 9.200E+13 |
| Cs-135 | 3.4477E-06 | 721.25 | 1,211.81 | 0.00E+00 | 2.49E-03 | 4.18E-03 | 0.8500 | 1.555E+12 |
| Cs-137 | 2.0313E+00 | 721.25 | 1,211.81 | 0.00E+00 | 1.47E+03 | 2.46E+03 | 1.2500 | 8.882E+11 |
| Eu-154 | 2.4513E-02 | 721.25 | 1,211.81 | 0.00E+00 | 1.77E+01 | 2.97E+01 | 1.7500 | 4.076E+10 |
| Eu-155 | 4.8175E-03 | 721.25 | 1,211.81 | 0.00E+00 | 3.47E+00 | 5.84E+00 | 2.2500 | 3.576E+06 |
| Fe-55 | 1.2397E-04 | 721.25 | 1,211.81 | 0.00E+00 | 8.94E-02 | 1.50E-01 | 2.7500 | 2.022E+06 |
| H-3 | 4.5697E-03 | 721.25 | 1,211.81 | 0.00E+00 | 3.30E+00 | 5.54E+00 | 3.5000 | 9.287E+03 |
| I-129 | 7.5300E-07 | 721.25 | 1,211.81 | 0.00E+00 | 5.43E-04 | 9.12E-04 | 5.0000 | 5.250E+02 |
| Kr-85 | 1.0850E-01 | 721.25 | 1,211.81 | 0.00E+00 | 7.83E+01 | 1.31E+02 | 7.0000 | 5.796E+01 |
| Np-237 | 9.5561E-06 | 721.25 | 1,211.81 | 0.00E+00 | 6.89E-03 | 1.16E-02 | 11.0000 | 6.496E+00 |
| Pa-231 | 2.0359E-09 | 721.25 | 1,211.81 | 0.00E+00 | 1.47E-06 | 2.47E-06 | | |
| Pb-210 | 4.9728E-11 | 721.25 | 1,211.81 | 0.00E+00 | 3.59E-08 | 6.03E-08 | | |
| Pm-147 | 4.8502E-02 | 721.25 | 1,211.81 | 0.00E+00 | 3.50E+01 | 5.88E+01 | | |
| Pu-238 | 1.8254E-02 | 721.25 | 1,211.81 | 0.00E+00 | 1.32E+01 | 2.21E+01 | | |
| Pu-239 | 4.2810E-04 | 721.25 | 1,211.81 | 0.00E+00 | 3.09E-01 | 5.19E-01 | | |
| Pu-240 | 2.4368E-04 | 721.25 | 1,211.81 | 0.00E+00 | 1.76E-01 | 2.95E-01 | | |
| Pu-241 | 3.3415E-02 | 721.25 | 1,211.81 | 0.00E+00 | 2.41E+01 | 4.05E+01 | | |
| Pu-242 | 3.6329E-07 | 721.25 | 1,211.81 | 0.00E+00 | 2.62E-04 | 4.40E-04 | | |
| Ra-226 | 2.2854E-10 | 721.25 | 1,211.81 | 0.00E+00 | 1.65E-07 | 2.77E-07 | | |
| Ra-228 | 1.2426E-14 | 721.25 | 1,211.81 | 0.00E+00 | 8.96E-12 | 1.51E-11 | | |
| Ru-106 | 6.3589E-06 | 721.25 | 1,211.81 | 0.00E+00 | 4.59E-03 | 7.71E-03 | | |
| Se-79 | 1.2933E-05 | 721.25 | 1,211.81 | 0.00E+00 | 9.33E-03 | 1.57E-02 | | |
| Sn-126 | 1.1574E-05 | 721.25 | 1,211.81 | 0.00E+00 | 8.35E-03 | 1.40E-02 | | |
| Sr-90 | 1.9248E+00 | 721.25 | 1,211.81 | 0.00E+00 | 1.39E+03 | 2.33E+03 | | |
| Tc-99 | 4.2239E-04 | 721.25 | 1,211.81 | 0.00E+00 | 3.05E-01 | 5.12E-01 | | |
| Th-229 | 5.0953E-12 | 721.25 | 1,211.81 | 0.00E+00 | 3.67E-09 | 6.17E-09 | | |
| Th-230 | 4.1885E-08 | 721.25 | 1,211.81 | 0.00E+00 | 3.02E-05 | 5.08E-05 | | |
| Th-232 | 1.9270E-14 | 721.25 | 1,211.81 | 0.00E+00 | 1.39E-11 | 2.34E-11 | | |
| Ti-208 | 4.6024E-08 | 721.25 | 1,211.81 | 0.00E+00 | 3.32E-05 | 5.58E-05 | | |
| U-232 | 1.2582E-07 | 721.25 | 1,211.81 | 0.00E+00 | 9.07E-05 | 1.52E-04 | | |
| U-233 | 2.5825E-09 | 721.25 | 1,211.81 | 0.00E+00 | 1.86E-06 | 3.13E-06 | | |
| U-234 | 1.8450E-04 | 721.25 | 1,211.81 | 0.00E+00 | 1.33E-01 | 2.24E-01 | | |
| U-235 | -2.7235E-06 | 721.25 | 0.00 | 2.57E-03 | 6.07E-04 | 2.57E-03 | | |
| U-236 | 1.5493E-05 | 721.25 | 1,211.81 | 0.00E+00 | 1.12E-02 | 1.88E-02 | | |
| U-238 | -4.2851E-09 | 721.25 | 0.00 | 3.01E-05 | 2.70E-05 | 3.01E-05 | | |
| Y-90 | 1.9254E+00 | 721.25 | 1,211.81 | 0.00E+00 | 1.39E+03 | 2.33E+03 | | |
| Other Radionuclides | | | | | 1.39E+03 | 2.34E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

Template Selection Summary

| | From SFD | Used |
|---------------------|-------------|-------------|
| Reactor Moderator | LIGHT WATER | LIGHT WATER |
| Fuel Cladding | ALUM | ALUM |
| BOL HM Constituents | U | U |
| BOL Enrichment % | 92.9999987 | 60 to 100 |

Basis for Parameter Differences:

Burnup Summary (MWd)²

| | From SFD | Estimated |
|----------|----------|-----------|
| Nominal | | 721.25 |
| Bounding | | 1,211.81 |

Basis for burnup used in estimate:

Nominal burnup calculated from the heavy metal mass destroyed.
Bounding burnup calculated assuming all BOL heavy metal burned.

Checks

| | Burnup Multiplier | Estimated Burnup/ Given Burnup |
|----------|-------------------|-----------------------------------|
| Nominal | 1.79 | |
| Bounding | 3.01 | |

Estimated EOL HM/Given EOL HM

1.09

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name FRR MTR-C2 (U3Si2 LEU) TURKEY
SNF ID # 527
Fuel Units & Descr 9 - ASSEMBLY
Heavy Metal Mass BOL=13 95kg EOL=12.276kg
ROD Storage Site SRS

¹Fuel decay start date. 2010
Estimates as of 2030
Template ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup(MWd): 367.2
Template BOL Heavy Metal Mass (MT) 0.00116689
Template Decay Time: 20 years

Estimated
Canister usage
18"x10"
0.38

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | CI/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6.6313E-10 | 1,585.31 | 3,170.62 | 0.00E+00 | 1.05E-06 | 2.10E-06 | Avg MeV | |
| Am-241 | 2.0060E-03 | 1,585.31 | 3,170.62 | 0.00E+00 | 3.18E+00 | 6.36E+00 | 0.0150 | 3.347E+14 |
| Am-242m | 4.2429E-07 | 1,585.31 | 3,170.62 | 0.00E+00 | 6.73E-04 | 1.35E-03 | 0.0250 | 6.960E+13 |
| Am-243 | 1.4899E-06 | 1,585.31 | 3,170.62 | 0.00E+00 | 2.36E-03 | 4.72E-03 | 0.0375 | 6.070E+13 |
| C-14 | 5.7135E-09 | 1,585.31 | 3,170.62 | 0.00E+00 | 9.06E-06 | 1.81E-05 | 0.0575 | 6.502E+13 |
| Cl-36 | 1.3124E-32 | 1,585.31 | 3,170.62 | 0.00E+00 | 2.08E-29 | 4.16E-29 | 0.0850 | 3.829E+13 |
| Cm-243 | 1.6443E-07 | 1,585.31 | 3,170.62 | 0.00E+00 | 2.61E-04 | 5.21E-04 | 0.1250 | 2.659E+13 |
| Cm-244 | 2.9330E-05 | 1,585.31 | 3,170.62 | 0.00E+00 | 4.65E-02 | 9.30E-02 | 0.2250 | 3.390E+13 |
| Co-60 | 5.3186E-06 | 1,585.31 | 3,170.62 | 0.00E+00 | 8.43E-03 | 1.69E-02 | 0.3750 | 1.476E+13 |
| Cs-134 | 3.1563E-03 | 1,585.31 | 3,170.62 | 0.00E+00 | 5.00E+00 | 1.00E+01 | 0.5750 | 2.407E+14 |
| Cs-135 | 3.4477E-06 | 1,585.31 | 3,170.62 | 0.00E+00 | 5.47E-03 | 1.09E-02 | 0.8500 | 4.070E+12 |
| Cs-137 | 2.0313E+00 | 1,585.31 | 3,170.62 | 0.00E+00 | 3.22E+03 | 6.44E+03 | 1.2500 | 2.324E+12 |
| Eu-154 | 2.4513E-02 | 1,585.31 | 3,170.62 | 0.00E+00 | 3.89E+01 | 7.77E+01 | 1.7500 | 1.067E+11 |
| Eu-155 | 4.8175E-03 | 1,585.31 | 3,170.62 | 0.00E+00 | 7.64E+00 | 1.53E+01 | 2.2500 | 9.356E+06 |
| Fe-55 | 1.2397E-04 | 1,585.31 | 3,170.62 | 0.00E+00 | 1.97E-01 | 3.93E-01 | 2.7500 | 5.289E+06 |
| H-3 | 4.5697E-03 | 1,585.31 | 3,170.62 | 0.00E+00 | 7.24E+00 | 1.45E+01 | 3.5000 | 2.432E+04 |
| I-129 | 7.5300E-07 | 1,585.31 | 3,170.62 | 0.00E+00 | 1.19E-03 | 2.39E-03 | 5.0000 | 1.382E+03 |
| Kr-85 | 1.0850E-01 | 1,585.31 | 3,170.62 | 0.00E+00 | 1.72E+02 | 3.44E+02 | 7.0000 | 1.526E+02 |
| Np-237 | 9.5561E-06 | 1,585.31 | 3,170.62 | 0.00E+00 | 1.51E-02 | 3.03E-02 | 11.0000 | 1.711E+01 |
| Pa-231 | 2.0359E-09 | 1,585.31 | 3,170.62 | 0.00E+00 | 3.23E-06 | 6.46E-06 | | |
| Pb-210 | 4.9728E-11 | 1,585.31 | 3,170.62 | 0.00E+00 | 7.88E-08 | 1.58E-07 | | |
| Pm-147 | 4.8502E-02 | 1,585.31 | 3,170.62 | 0.00E+00 | 7.69E+01 | 1.54E+02 | | |
| Pu-238 | 1.8254E-02 | 1,585.31 | 3,170.62 | 0.00E+00 | 2.89E+01 | 5.79E+01 | | |
| Pu-239 | 4.2810E-04 | 1,585.31 | 3,170.62 | 0.00E+00 | 6.79E-01 | 1.36E+00 | | |
| Pu-240 | 2.4368E-04 | 1,585.31 | 3,170.62 | 0.00E+00 | 3.86E-01 | 7.73E-01 | | |
| Pu-241 | 3.3415E-02 | 1,585.31 | 3,170.62 | 0.00E+00 | 5.30E+01 | 1.06E+02 | | |
| Pu-242 | 3.6329E-07 | 1,585.31 | 3,170.62 | 0.00E+00 | 5.76E-04 | 1.15E-03 | | |
| Ra-226 | 2.2854E-10 | 1,585.31 | 3,170.62 | 0.00E+00 | 3.62E-07 | 7.25E-07 | | |
| Ra-228 | 1.2426E-14 | 1,585.31 | 3,170.62 | 0.00E+00 | 1.97E-11 | 3.94E-11 | | |
| Ru-106 | 6.3589E-06 | 1,585.31 | 3,170.62 | 0.00E+00 | 1.01E-02 | 2.02E-02 | | |
| Se-79 | 1.2933E-05 | 1,585.31 | 3,170.62 | 0.00E+00 | 2.05E-02 | 4.10E-02 | | |
| Sn-126 | 1.1574E-05 | 1,585.31 | 3,170.62 | 0.00E+00 | 1.83E-02 | 3.67E-02 | | |
| Sr-90 | 1.9248E+00 | 1,585.31 | 3,170.62 | 0.00E+00 | 3.05E+03 | 6.10E+03 | | |
| Tc-99 | 4.2239E-04 | 1,585.31 | 3,170.62 | 0.00E+00 | 6.70E-01 | 1.34E+00 | | |
| Th-229 | 5.0953E-12 | 1,585.31 | 3,170.62 | 0.00E+00 | 8.08E-09 | 1.62E-08 | | |
| Th-230 | 4.1885E-08 | 1,585.31 | 3,170.62 | 0.00E+00 | 6.64E-05 | 1.33E-04 | | |
| Th-232 | 1.9270E-14 | 1,585.31 | 3,170.62 | 0.00E+00 | 3.05E-11 | 6.11E-11 | | |
| Ti-208 | 4.6024E-08 | 1,585.31 | 3,170.62 | 0.00E+00 | 7.30E-05 | 1.46E-04 | | |
| U-232 | 1.2582E-07 | 1,585.31 | 3,170.62 | 0.00E+00 | 1.99E-04 | 3.99E-04 | | |
| U-233 | 2.5825E-09 | 1,585.31 | 3,170.62 | 0.00E+00 | 4.09E-06 | 8.19E-06 | | |
| U-234 | 1.8450E-04 | 1,585.31 | 3,170.62 | 0.00E+00 | 2.92E-01 | 5.85E-01 | | |
| U-235 | 2.7235E-06 | 1,585.31 | 0.00 | 6.03E-03 | 1.71E-03 | 6.03E-03 | | |
| U-236 | 1.5493E-05 | 1,585.31 | 3,170.62 | 0.00E+00 | 2.46E-02 | 4.91E-02 | | |
| U-238 | 4.2851E-09 | 1,585.31 | 0.00 | 3.75E-03 | 3.74E-03 | 3.75E-03 | | |
| Y-90 | 1.9254E+00 | 1,585.31 | 3,170.62 | 0.00E+00 | 3.05E+03 | 6.10E+03 | | |
| Other Radionuclides | | | | | 3.07E+03 | 6.13E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences* |
|----------------------------|-------------|-------------|--|
| | From SFD | Used | |
| Reactor Moderator | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding | ALUM | ALUM | |
| BOL HM Constituents | U | U | This fuel matches on all parameters except enrichment. |
| BOL Enrichment % | 20.00000077 | 60 to 100 | |

| Burnup Summary (MWd) ¹ | | | Basis for burnup used in estimate* |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | | 1,585.31 | |
| Bounding | | 3,170.62 | Nominal burnup calculated from the heavy metal mass destroyed Bounding burnup assumed to be twice nominal burnup |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 0.36 | | |
| Bounding | 0.72 | | 1.01 |

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

*Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRR MTR-C2 (UALX-HEU) SWITZERLAND
SNF ID #: 657
Fuel Units & Descr: 11 - MTR TYPE
Heavy Metal Mass: BOL=2 461kg, EOL=0 995kg
ROD Storage Site: SRS

Fuel decay start date: 2010
Estimates as of: 2030
Template: ATR (Light Water, Alum, 60 to 100%, U)
Template Burnup(MWd): 367.2
Template BOL Heavy Metal Mass (MT): 0 00116689
Template Decay Time: 20 years

Estimated
Canister usage:
18"x10"
0 46

| II. Estimates | m | x _a | x _b | b | y _a | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|----------------------------------|------------------------------|
| Radionuclide | Cv/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group ³ | Total Photons/sec (bounding) |
| Ac-227 | 6 6313E-10 | 1,387 57 | 2,330 33 | 0 00E+00 | 9 20E-07 | 1 55E-06 | Avg. MeV | |
| Am-241 | 2 0060E-03 | 1,387 57 | 2,330 33 | 0 00E+00 | 2 78E+00 | 4 67E+00 | 0.0150 | 2 460E+14 |
| Am-242m | 4 2429E-07 | 1,387 57 | 2,330 33 | 0 00E+00 | 5 89E-04 | 9 89E-04 | 0.0250 | 5 115E+13 |
| Am-243 | 1 4899E-06 | 1,387 57 | 2,330 33 | 0 00E+00 | 2 07E-03 | 3 47E-03 | 0.0375 | 4 462E+13 |
| C-14 | 5 7135E-09 | 1,387 57 | 2,330 33 | 0 00E+00 | 7 93E-06 | 1 33E-05 | 0.0575 | 4 779E+13 |
| Cl-36 | 1 3124E-32 | 1,387 57 | 2,330 33 | 0 00E+00 | 1 82E-29 | 3 06E-29 | 0.0850 | 2 888E+13 |
| Cm-243 | 1 6443E-07 | 1,387 57 | 2,330 33 | 0 00E+00 | 2 28E-04 | 3 83E-04 | 0 1250 | 1 954E+13 |
| Cm-244 | 2 9330E-05 | 1,387 57 | 2,330 33 | 0 00E+00 | 4 07E-02 | 6 83E-02 | 0.2250 | 2 492E+13 |
| Co-60 | 5 3186E-06 | 1,387 57 | 2,330 33 | 0 00E+00 | 7 38E-03 | 1 24E-02 | 0.3750 | 1 085E+13 |
| Cs-134 | 3 1563E-03 | 1,387 57 | 2,330 33 | 0 00E+00 | 4 38E+00 | 7 36E+00 | 0.5750 | 1 769E+14 |
| Cs-135 | 3 4477E-06 | 1,387 57 | 2,330 33 | 0 00E+00 | 4 78E-03 | 8 03E-03 | 0.8500 | 2 991E+12 |
| Cs-137 | 2 0313E+00 | 1,387 57 | 2,330 33 | 0 00E+00 | 2 82E+03 | 4 73E+03 | 1.2500 | 1 708E+12 |
| Eu-154 | 2 4513E-02 | 1,387 57 | 2,330 33 | 0 00E+00 | 3 40E+01 | 5 71E+01 | 1.7500 | 7 839E+10 |
| Eu-155 | 4 8175E-03 | 1,387 57 | 2,330 33 | 0 00E+00 | 6 68E+00 | 1 12E+01 | 2.2500 | 6 877E+06 |
| Fe-55 | 1 2397E-04 | 1,387 57 | 2,330 33 | 0 00E+00 | 1 72E-01 | 2 89E-01 | 2.7500 | 3 888E+06 |
| H-3 | 4 5697E-03 | 1,387 57 | 2,330 33 | 0 00E+00 | 6 34E+00 | 1 06E+01 | 3.5000 | 1 786E+04 |
| I-129 | 7 5300E-07 | 1,387 57 | 2,330 33 | 0 00E+00 | 1 04E-03 | 1 75E-03 | 5 0000 | 1 010E+03 |
| Kr-85 | 1 0850E-01 | 1,387 57 | 2,330 33 | 0 00E+00 | 1 51E+02 | 2 53E+02 | 7 0000 | 1 115E+02 |
| Np-237 | 9 5561E-06 | 1,387 57 | 2,330 33 | 0 00E+00 | 1 33E-02 | 2 23E-02 | 11 0000 | 1 249E+01 |
| Pa-231 | 2 0359E-09 | 1,387 57 | 2,330 33 | 0 00E+00 | 2 83E-06 | 4 74E-06 | | |
| Pb-210 | 4 9728E-11 | 1,387 57 | 2,330 33 | 0 00E+00 | 6 90E-08 | 1 16E-07 | | |
| Pm-147 | 4 8502E-02 | 1,387 57 | 2,330 33 | 0 00E+00 | 6 73E+01 | 1 13E+02 | | |
| Pu-238 | 1 8254E-02 | 1,387 57 | 2,330 33 | 0 00E+00 | 2 53E+01 | 4 25E+01 | | |
| Pu-239 | 4 2810E-04 | 1,387 57 | 2,330 33 | 0 00E+00 | 5 94E-01 | 9 98E-01 | | |
| Pu-240 | 2 4368E-04 | 1,387 57 | 2,330 33 | 0 00E+00 | 3 38E-01 | 5 68E-01 | | |
| Pu-241 | 3 3415E-02 | 1,387 57 | 2,330 33 | 0 00E+00 | 4 64E+01 | 7 79E+01 | | |
| Pu-242 | 3 6329E-07 | 1,387 57 | 2,330 33 | 0 00E+00 | 5 04E-04 | 8 47E-04 | | |
| Ra-226 | 2 2854E-10 | 1,387 57 | 2,330 33 | 0 00E+00 | 3 17E-07 | 5 33E-07 | | |
| Ra-228 | 1 2426E-14 | 1,387 57 | 2,330 33 | 0 00E+00 | 1 72E-11 | 2 90E-11 | | |
| Ru-106 | 6 3589E-06 | 1,387 57 | 2,330 33 | 0 00E+00 | 8 82E-03 | 1 48E-02 | | |
| Se-79 | 1 2933E-05 | 1,387 57 | 2,330 33 | 0 00E+00 | 1 79E-02 | 3 01E-02 | | |
| Sn-126 | 1 1574E-05 | 1,387 57 | 2,330 33 | 0 00E+00 | 1 61E-02 | 2 70E-02 | | |
| Sr-90 | 1 9248E+00 | 1,387 57 | 2,330 33 | 0 00E+00 | 2 67E+03 | 4 49E+03 | | |
| Tc-99 | 4 2239E-04 | 1,387 57 | 2,330 33 | 0 00E+00 | 5 86E-01 | 9 84E-01 | | |
| Th-229 | 5 0953E-12 | 1,387 57 | 2,330 33 | 0 00E+00 | 7 07E-09 | 1 19E-08 | | |
| Th-230 | 4 1885E-08 | 1,387 57 | 2,330 33 | 0 00E+00 | 5 81E-05 | 9 76E-05 | | |
| Th-232 | 1 9270E-14 | 1,387 57 | 2,330 33 | 0 00E+00 | 2 67E-11 | 4 49E-11 | | |
| Ti-208 | 4 6024E-08 | 1,387 57 | 2,330 33 | 0 00E+00 | 6 39E-05 | 1 07E-04 | | |
| U-232 | 1 2582E-07 | 1,387 57 | 2,330 33 | 0 00E+00 | 1 75E-04 | 2 93E-04 | | |
| U-233 | 2 5825E-09 | 1,387 57 | 2,330 33 | 0 00E+00 | 3 58E-06 | 6 02E-06 | | |
| U-234 | 1 8450E-04 | 1,387 57 | 2,330 33 | 0 00E+00 | 2 56E-01 | 4 30E-01 | | |
| U-235 | -2 7235E-06 | 1,387 57 | 0 00 | 4 95E-03 | 1 17E-03 | 4 95E-03 | | |
| U-236 | 1 5493E-05 | 1,387 57 | 2,330 33 | 0 00E+00 | 2 15E-02 | 3 61E-02 | | |
| U-238 | -4 2851E-09 | 1,387 57 | 0 00 | 5 79E-05 | 5 19E-05 | 5 79E-05 | | |
| Y-90 | 1 9254E+00 | 1,387 57 | 2,330 33 | 0 00E+00 | 2 67E+03 | 4 49E+03 | | |
| Other Radionuclides | | | | | 2 68E+03 | 4 51E+03 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: |
|----------------------------|-------------|-------------|----------------------------------|
| Reactor Moderator | From SFD | Used | |
| Fuel Cladding | LIGHT WATER | LIGHT WATER | |
| BOL HM Constituents | ALUM | ALUM | |
| BOL Enrichment % | U | U | |
| | 93 00001006 | 60 to 100 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | | 1 387 57 | |
| Bounding | | 2,330 33 | Nominal burnup calculated from the heavy metal mass destroyed. Bounding burnup calculated assuming all BOL heavy metal burned. |

| Checks | | | Estimated EOL HM/Given EOL HM |
|----------|-------------------|-----------------------------------|-------------------------------|
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 1 79 | | |
| Bounding | 3.01 | | 1 09 |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name FRR MTR-O (UALX-HEU) TURKEY
SNF ID # 642
Fuel Units & Descr. 2 - MTR TYPE
Heavy Metal Mass: BOL=0.366kg EOL=0.196kg
ROD Storage Site SRS

¹Fuel decay start date 2010
Estimates as of 2030
Template ATR (Light Water, Alum, 60 to 100% U)
²Template Burnup (MWd) 367.2
Template BOL Heavy Metal Mass (MT) 0.00116689
Template Decay Time 20 years

Estimated
Canister usage
18"x10"
0.08

| III. Estimates | m | X _n | X _b | b | Y _n | Y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|-------------------------------|--------------------------------|---------------------|------------------------------|
| Radionuclide | Cu/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories (Ci) | Bounding Fuel Inventories (Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6.6313E-10 | 160.99 | 321.99 | 0.00E+00 | 1.07E-07 | 2.14E-07 | Avg MeV | |
| Am-241 | 2.0060E-03 | 160.99 | 321.99 | 0.00E+00 | 3.23E-01 | 6.46E-01 | 0.0150 | 3.399E+13 |
| Am-242m | 4.2429E-07 | 160.99 | 321.99 | 0.00E+00 | 6.83E-05 | 1.37E-04 | 0.0250 | 7.068E+12 |
| Am-243 | 1.4899E-06 | 160.99 | 321.99 | 0.00E+00 | 2.40E-04 | 4.80E-04 | 0.0375 | 6.165E+12 |
| C-14 | 5.7135E-09 | 160.99 | 321.99 | 0.00E+00 | 9.20E-07 | 1.84E-06 | 0.0575 | 6.603E+12 |
| Cl-36 | 1.3124E-32 | 160.99 | 321.99 | 0.00E+00 | 2.11E-30 | 4.23E-30 | 0.0850 | 3.990E+12 |
| Cm-243 | 1.6443E-07 | 160.99 | 321.99 | 0.00E+00 | 2.65E-05 | 5.29E-05 | 0.1250 | 2.700E+12 |
| Cm-244 | 2.9330E-05 | 160.99 | 321.99 | 0.00E+00 | 4.72E-03 | 9.44E-03 | 0.2250 | 3.443E+12 |
| Co-60 | 5.3186E-06 | 160.99 | 321.99 | 0.00E+00 | 8.56E-04 | 1.71E-03 | 0.3750 | 1.499E+12 |
| Cs-134 | 3.1563E-03 | 160.99 | 321.99 | 0.00E+00 | 5.08E-01 | 1.02E+00 | 0.5750 | 2.445E+13 |
| Cs-135 | 3.4477E-06 | 160.99 | 321.99 | 0.00E+00 | 5.55E-04 | 1.11E-03 | 0.8500 | 4.133E+11 |
| Cs-137 | 2.0313E+00 | 160.99 | 321.99 | 0.00E+00 | 3.27E+02 | 6.54E+02 | 1.2500 | 2.360E+11 |
| Eu-154 | 2.4513E-02 | 160.99 | 321.99 | 0.00E+00 | 3.95E+00 | 7.89E+00 | 1.7500 | 1.083E+10 |
| Eu-155 | 4.8175E-03 | 160.99 | 321.99 | 0.00E+00 | 7.76E-01 | 1.55E+00 | 2.2500 | 9.501E+05 |
| Fe-55 | 1.2397E-04 | 160.99 | 321.99 | 0.00E+00 | 2.00E-02 | 3.99E-02 | 2.7500 | 5.372E+05 |
| H-3 | 4.5697E-03 | 160.99 | 321.99 | 0.00E+00 | 7.36E-01 | 1.47E+00 | 3.5000 | 2.468E+03 |
| I-129 | 7.5300E-07 | 160.99 | 321.99 | 0.00E+00 | 1.21E-04 | 2.42E-04 | 5.0000 | 1.395E+02 |
| Kr-85 | 1.0850E-01 | 160.99 | 321.99 | 0.00E+00 | 1.75E+01 | 3.49E+01 | 7.0000 | 1.540E+01 |
| Np-237 | 9.5561E-06 | 160.99 | 321.99 | 0.00E+00 | 1.54E-03 | 3.08E-03 | 11.0000 | 1.726E+00 |
| Pa-231 | 2.0359E-09 | 160.99 | 321.99 | 0.00E+00 | 3.28E-07 | 6.56E-07 | | |
| Pb-210 | 4.9728E-11 | 160.99 | 321.99 | 0.00E+00 | 8.01E-09 | 1.60E-08 | | |
| Pm-147 | 4.8502E-02 | 160.99 | 321.99 | 0.00E+00 | 7.81E+00 | 1.56E+01 | | |
| Pu-238 | 1.8254E-02 | 160.99 | 321.99 | 0.00E+00 | 2.94E+00 | 5.88E+00 | | |
| Pu-239 | 4.2810E-04 | 160.99 | 321.99 | 0.00E+00 | 6.89E-02 | 1.38E-01 | | |
| Pu-240 | 2.4368E-04 | 160.99 | 321.99 | 0.00E+00 | 3.92E-02 | 7.85E-02 | | |
| Pu-241 | 3.3415E-02 | 160.99 | 321.99 | 0.00E+00 | 5.38E+00 | 1.08E+01 | | |
| Pu-242 | 3.6329E-07 | 160.99 | 321.99 | 0.00E+00 | 5.85E-05 | 1.17E-04 | | |
| Ra-226 | 2.2854E-10 | 160.99 | 321.99 | 0.00E+00 | 3.68E-08 | 7.36E-08 | | |
| Ra-228 | 1.2426E-14 | 160.99 | 321.99 | 0.00E+00 | 2.00E-12 | 4.00E-12 | | |
| Ru-106 | 6.3589E-06 | 160.99 | 321.99 | 0.00E+00 | 1.02E-03 | 2.05E-03 | | |
| Se-79 | 1.2933E-05 | 160.99 | 321.99 | 0.00E+00 | 2.08E-03 | 4.16E-03 | | |
| Sn-126 | 1.1574E-05 | 160.99 | 321.99 | 0.00E+00 | 1.86E-03 | 3.73E-03 | | |
| Sr-90 | 1.9248E+00 | 160.99 | 321.99 | 0.00E+00 | 3.10E+02 | 6.20E+02 | | |
| Tc-99 | 4.2239E-04 | 160.99 | 321.99 | 0.00E+00 | 6.80E-02 | 1.36E-01 | | |
| Th-229 | 5.0953E-12 | 160.99 | 321.99 | 0.00E+00 | 8.20E-10 | 1.64E-09 | | |
| Th-230 | 4.1885E-08 | 160.99 | 321.99 | 0.00E+00 | 6.74E-06 | 1.35E-05 | | |
| Th-232 | 1.9270E-14 | 160.99 | 321.99 | 0.00E+00 | 3.10E-12 | 6.20E-12 | | |
| Ti-208 | 4.6024E-08 | 160.99 | 321.99 | 0.00E+00 | 7.41E-06 | 1.48E-05 | | |
| U-232 | 1.2582E-07 | 160.99 | 321.99 | 0.00E+00 | 2.03E-05 | 4.05E-05 | | |
| U-233 | 2.5825E-09 | 160.99 | 321.99 | 0.00E+00 | 4.16E-07 | 8.32E-07 | | |
| U-234 | 1.8450E-04 | 160.99 | 321.99 | 0.00E+00 | 2.97E-02 | 5.94E-02 | | |
| U-235 | -2.7235E-06 | 160.99 | 0.00 | 7.35E-04 | 2.96E-04 | 7.35E-04 | | |
| U-236 | 1.5493E-05 | 160.99 | 321.99 | 0.00E+00 | 2.49E-03 | 4.99E-03 | | |
| U-238 | -4.2851E-09 | 160.99 | 0.00 | 8.60E-06 | 7.91E-06 | 8.60E-06 | | |
| Y-90 | 1.9254E+00 | 160.99 | 321.99 | 0.00E+00 | 3.10E+02 | 6.20E+02 | | |
| Other Radionuclides | | | | | 3.11E+02 | 6.23E+02 | | |

| Thermal Power | |
|-----------------------------|------------------------------|
| Nominal Heat Output (Watts) | Bounding Heat Output (Watts) |
| 3.84E+00 | 7.68E+00 |
| Total | Total |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences* |
|-----------------------------------|-------------------|--------------------------------|---|
| Reactor Moderator | From SFD | Used | |
| Fuel Cladding | LIGHT WATER | LIGHT WATER | |
| BOL HM Constituents: | ALUM | ALUM | |
| BOL Enrichment % | U | U | |
| | 92.999987 | 60 to 100 | |
| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate |
| | From SFD | Estimated | |
| Nominal | | 160.99 | Nominal burnup calculated from the heavy metal mass destroyed |
| Bounding | | 321.99 | Bounding burnup assumed to be twice nominal burnup |
| Checks | | | Estimated EOL HM/Given EOL HM |
| | Burnup Multiplier | Estimated Burnup/ Given Burnup | |
| Nominal | 1.40 | | 1.05 |
| Bounding | 2.80 | | |

*Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel

*Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT)

Fuel Radionuclide Inventory Worksheet

I. Fuel and Template Information

Fuel Name: FRR MTR-O (UALX-LEU) PORTUGAL
 SNF ID #: 541
 Fuel Units & Descr: 3 - ASSEMBLY
 Heavy Metal Mass BOL=1.35kg; EOL=1.35kg
 ROD Storage Site SRS

¹Fuel decay start date: 2010
 Estimates as of: 2030
 Template: ATR (Light Water, Alum, 60 to 100%, U)
²Template Burnup(MWd): 367.2
 Template BOL Heavy Metal Mass (MT): 0.00116689
 Template Decay Time: 20 years

Estimated
 Canister usage:
 18"x10"
 0 13

| II. Estimates | m | x _n | x _b | b | y _n | y _b | Gamma Sources | |
|---------------------|----------------------|--|---|-----------------------|------------------------------|-------------------------------|---------------------|------------------------------|
| Radionuclide | Ci/MWd From Template | Nominal Fuel Burnup (MWd) ² | Bounding Fuel Burnup (MWd) ² | Initial Activity (Ci) | Nominal Fuel Inventories(Ci) | Bounding Fuel Inventories(Ci) | Photon Energy Group | Total Photons/sec (bounding) |
| Ac-227 | 6.6313E-10 | 25.57 | 51.14 | 0.00E+00 | 1.70E-08 | 3.39E-08 | Avg. MeV | |
| Am-241 | 2.0060E-03 | 25.57 | 51.14 | 0.00E+00 | 5.13E-02 | 1.03E-01 | 0.0150 | 5.398E+12 |
| Am-242m | 4.2429E-07 | 25.57 | 51.14 | 0.00E+00 | 1.08E-05 | 2.17E-05 | 0.0250 | 1.123E+12 |
| Am-243 | 1.4899E-06 | 25.57 | 51.14 | 0.00E+00 | 3.81E-05 | 7.62E-05 | 0.0375 | 9.791E+11 |
| C-14 | 5.7135E-09 | 25.57 | 51.14 | 0.00E+00 | 1.46E-07 | 2.92E-07 | 0.0575 | 1.049E+12 |
| Cl-36 | 1.3124E-32 | 25.57 | 51.14 | 0.00E+00 | 3.36E-31 | 6.71E-31 | 0.0850 | 6.337E+11 |
| Cm-243 | 1.6443E-07 | 25.57 | 51.14 | 0.00E+00 | 4.20E-06 | 8.41E-06 | 0.1250 | 4.288E+11 |
| Cm-244 | 2.9330E-05 | 25.57 | 51.14 | 0.00E+00 | 7.50E-04 | 1.50E-03 | 0.2250 | 5.468E+11 |
| Co-60 | 5.3186E-06 | 25.57 | 51.14 | 0.00E+00 | 1.36E-04 | 2.72E-04 | 0.3750 | 2.380E+11 |
| Cs-134 | 3.1563E-03 | 25.57 | 51.14 | 0.00E+00 | 8.07E-02 | 1.61E-01 | 0.5750 | 3.883E+12 |
| Cs-135 | 3.4477E-06 | 25.57 | 51.14 | 0.00E+00 | 8.82E-05 | 1.76E-04 | 0.8500 | 6.564E+10 |
| Cs-137 | 2.0313E+00 | 25.57 | 51.14 | 0.00E+00 | 5.19E+01 | 1.04E+02 | 1.2500 | 3.748E+10 |
| Eu-154 | 2.4513E-02 | 25.57 | 51.14 | 0.00E+00 | 6.27E-01 | 1.25E+00 | 1.7500 | 1.720E+09 |
| Eu-155 | 4.8175E-03 | 25.57 | 51.14 | 0.00E+00 | 1.23E-01 | 2.46E-01 | 2.2500 | 1.509E+05 |
| Fe-55 | 1.2397E-04 | 25.57 | 51.14 | 0.00E+00 | 3.17E-03 | 6.34E-03 | 2.7500 | 8.532E+04 |
| H-3 | 4.5697E-03 | 25.57 | 51.14 | 0.00E+00 | 1.17E-01 | 2.34E-01 | 3.5000 | 3.938E+02 |
| I-129 | 7.5300E-07 | 25.57 | 51.14 | 0.00E+00 | 1.93E-05 | 3.85E-05 | 5.0000 | 2.299E+01 |
| Kr-85 | 1.0850E-01 | 25.57 | 51.14 | 0.00E+00 | 2.77E+00 | 5.55E+00 | 7.0000 | 2.542E+00 |
| Np-237 | 9.5561E-06 | 25.57 | 51.14 | 0.00E+00 | 2.44E-04 | 4.89E-04 | 11.0000 | 2.852E-01 |
| Pa-231 | 2.0359E-09 | 25.57 | 51.14 | 0.00E+00 | 5.21E-08 | 1.04E-07 | | |
| Pb-210 | 4.9728E-11 | 25.57 | 51.14 | 0.00E+00 | 1.27E-09 | 2.54E-09 | | |
| Pm-147 | 4.8502E-02 | 25.57 | 51.14 | 0.00E+00 | 1.24E+00 | 2.48E+00 | | |
| Pu-238 | 1.8254E-02 | 25.57 | 51.14 | 0.00E+00 | 4.67E-01 | 9.34E-01 | | |
| Pu-239 | 4.2810E-04 | 25.57 | 51.14 | 0.00E+00 | 1.09E-02 | 2.19E-02 | | |
| Pu-240 | 2.4368E-04 | 25.57 | 51.14 | 0.00E+00 | 6.23E-03 | 1.25E-02 | | |
| Pu-241 | 3.3415E-02 | 25.57 | 51.14 | 0.00E+00 | 8.54E-01 | 1.71E+00 | | |
| Pu-242 | 3.6329E-07 | 25.57 | 51.14 | 0.00E+00 | 9.29E-06 | 1.86E-05 | | |
| Ra-226 | 2.2854E-10 | 25.57 | 51.14 | 0.00E+00 | 5.84E-09 | 1.17E-08 | | |
| Ra-228 | 1.2426E-14 | 25.57 | 51.14 | 0.00E+00 | 3.18E-13 | 6.35E-13 | | |
| Ru-106 | 6.3589E-06 | 25.57 | 51.14 | 0.00E+00 | 1.63E-04 | 3.25E-04 | | |
| Se-79 | 1.2933E-05 | 25.57 | 51.14 | 0.00E+00 | 3.31E-04 | 6.61E-04 | | |
| Sn-126 | 1.1574E-05 | 25.57 | 51.14 | 0.00E+00 | 2.96E-04 | 5.92E-04 | | |
| Sr-90 | 1.9248E+00 | 25.57 | 51.14 | 0.00E+00 | 4.92E+01 | 9.84E+01 | | |
| Tc-99 | 4.2239E-04 | 25.57 | 51.14 | 0.00E+00 | 1.08E-02 | 2.16E-02 | | |
| Th-229 | 5.0953E-12 | 25.57 | 51.14 | 0.00E+00 | 1.30E-10 | 2.61E-10 | | |
| Th-230 | 4.1885E-08 | 25.57 | 51.14 | 0.00E+00 | 1.07E-06 | 2.14E-06 | | |
| Th-232 | 1.9270E-14 | 25.57 | 51.14 | 0.00E+00 | 4.93E-13 | 9.85E-13 | | |
| Ti-208 | 4.6024E-08 | 25.57 | 51.14 | 0.00E+00 | 1.18E-06 | 2.35E-06 | | |
| U-232 | 1.2582E-07 | 25.57 | 51.14 | 0.00E+00 | 3.22E-06 | 6.43E-06 | | |
| U-233 | 2.5825E-09 | 25.57 | 51.14 | 0.00E+00 | 6.60E-08 | 1.32E-07 | | |
| U-234 | 1.8450E-04 | 25.57 | 51.14 | 0.00E+00 | 4.72E-03 | 9.44E-03 | | |
| U-235 | -2.7235E-06 | 25.57 | 0.00 | 5.83E-04 | 5.14E-04 | 5.83E-04 | | |
| U-236 | 1.5493E-05 | 25.57 | 51.14 | 0.00E+00 | 3.96E-04 | 7.92E-04 | | |
| U-238 | -4.2851E-09 | 25.57 | 0.00 | 3.63E-04 | 3.63E-04 | 3.63E-04 | | |
| Y-90 | 1.9254E+00 | 25.57 | 51.14 | 0.00E+00 | 4.92E+01 | 9.85E+01 | | |
| Other Radionuclides | | | | | 4.95E+01 | 9.89E+01 | | |

III. Template Selection Summary, Burnup Summary, and Checks

| Template Selection Summary | | | Basis for Parameter Differences: This Template was used for the following reasons. This fuel matches on all parameters except enrichment. |
|----------------------------|-------------|-------------|---|
| Reactor Moderator: | From SFD | Used | |
| | LIGHT WATER | LIGHT WATER | |
| Fuel Cladding: | ALUM | ALUM | |
| BOL HM Constituents: | U | U | |
| BOL Enrichment %: | 20.0000132 | 60 to 100 | |

| Burnup Summary (MWd) ² | | | Basis for burnup used in estimate: Nominal burnup assumed to be 2% of BOL heavy metal mass. Bounding burnup assumed to be twice nominal burnup. |
|-----------------------------------|----------|-----------|---|
| | From SFD | Estimated | |
| Nominal | | 25.57 | |
| Bounding | | 51.14 | |

| Checks | | | Estimated EOL HM/Given EOL HM 0.98 |
|----------|-------------------|-------------------------------|---------------------------------------|
| | Burnup Multiplier | Estimated Burnup/Given Burnup | |
| Nominal | 0.06 | | |
| Bounding | 0.12 | | |

¹Reactor shutdown, core removal, storage, shipping or other date confirming that irradiation ceased for fuel.

²Total burnup for all fuel associated with this worksheet must be divided by BOL heavy metal mass to get specific burnup values (MWd/MT).