# APPENDIX A

# RADIOACTIVE MATERIALS ASSOCIATED WITH ROCKY FLATS

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## A. RADIOACTIVE MATERIALS PRESENT IN KILOGRAM QUANTITIES

### 1. Plutonium

Isotopic Composition of Rocky Flats Plutonium

| Isotope | Relative Weight (percent) | Specific Alpha Activity (Curies/gram) | Specific Beta Activity (Curies/gram) | Relative Activity (Curies/gram)[a] |
|---|---|---|---|---|
| Pu-238 | 0.01 | 17.01 | --- | 0.00171 |
| Pu-239 | 93.79 | 0.0622 | --- | 0.05834 |
| Pu-240 | 5.80 | 0.228 | --- | 0.01322 |
| Pu-241 | 0.36 | --- | 103.5 | 0.37260 |
| Pu-242 | 0.03 | 0.00393 | --- | $1.18 \times 10^{-6}$ |
| Am-241 | [b] | 3.42 | --- | --- |

[a] Relative activity is obtained by multiplying the percent by weight by the specific activity. The total activity for the plutonium isotopes is: Alpha, 0.0732 curies/gram; and Alpha plus Beta, 0.446 curies/gram.

[b] Am-241 is a radioactive decay product of Pu-241.

### 2. Enriched Uranium

Common Name: Oralloy
Normal Isotopic Composition: >90% U-235

### 3. Depleted Uranium

Common Names: Tuballoy, D-38, U-238
Normal Isotopic Composition: <0.71% U-235

### 4. Americium (Am-241)

Am-241 is a radioactive decay product of Pu-241.

### 5. Natural Uranium (Thorium and Uranium-233)

Rocky Flats has historically had the capability to handle these in kilogram quantities and some of these materials have been handled in the past.

## B. RADIOACTIVE MATERIALS PRESENT IN GRAM QUANTITIES (<1Kg)

Curium-244
Neptunium-237
Uranium-233
Plutonium-238,-242

These radioisotopes have been used at Rocky Flats primarily for research and analytical activities.

## C. RADIOISOTOPES UTILIZED AT ROCKY FLATS AS ACCOUNTABLE AND/OR TRACEABLE/NONACCOUNTABLE SOURCES

### 1. Registered Sources (Twice-Yearly Leak Test and Physical Audit)

Sealed solids > Appendix E values.[1]
Plated solids > Appendix E values.
Liquids > $10^{-3}$ µCi

Americium (Am-241)

Cesium (Cs-137)

Plutonium (Pu-238,-239)

[1] Accountability is determined by 10 CFR 835, Appendix E. Sealed radioactive sources with activities equal to or greater than Appendix E values are accountable. The activities are individual for each isotope and are not all equal in value.

## 2. Traceable (Nonaccountable) Sources

Sealed solids < Appendix E values
Plated solids < Appendix E values
Liquids < $10^{-3}$ µCi

| | |
|---|---|
| Americium | (Am-241, 243) |
| Barium | (Ba-133) |
| Cadmium | (Cd-109) |
| Californium | (Cf-252, -250) |
| Carbon | (C-14) |
| Cesium | (Cs-137) |
| Chlorine | (Cl-36) |
| Cobalt | (Co-56, -57, -60) |
| Gadolinium | (Gd-148) |
| Hydrogen (Tritium) | (H-3) |
| Iridium | (Ir-192) |
| Nickel | (Ni-63) |
| Plutonium | (Pu-238, -239,240) |
| Promethium | (Pm-147) |
| Radium | (Ra-226) |
| Selenium | (Se-75) |
| Strontium | (Sr-85-90) |
| Thallium | (Tl-204) |
| Thorium | (Th-230) |
| Uranium | (U-232, -234, -235, -236, -238) |

## D. RADIUM SOURCES HANDLED AND STORED AT ROCKY FLATS

| Source* | RFETS ID | Nuclide | Location | Original Activity (µCi) |
|---|---|---|---|---|
| TS | 3938 | Ra-226 | T130B | 0.0315 |
| TS | 3939 | Ra-226 | T130B | 0.0135 |
| LS | 4305 | Ra-226 | 126 | 0.9 |
| LS | 4306 | Ra-226 | 126 | 0.9 |
| LS | 4307 | Ra-226 | 126 | 0.9 |
| LS | 4308 | Ra-226 | 126 | 0.9 |
| LS | 4309 | Ra-226 | 126 | 0.9 |
| LS | 4310 | Ra-226 | 126 | 0.9 |
| LS | 4311 | Ra-226 | 126 | 0.9 |
| LS | 4312 | Ra-226 | 126 | 0.9 |

Note -- The following Ra-226 source numbers, which have appeared in prior year reports, are no longer at RFETS: 138, 866, 1734.

*TS = Traceable Source
LS = Legacy Source, discovered 09/03/02