

# National Bureau of Standards

## Certificate of Analysis

### Standard Reference Material 948

#### Plutonium Isotopic Standard

This Standard Reference Material (SRM) is certified as an isotopic standard for use in isotopic measurements of plutonium. SRM 948 consists of approximately 250 mg of plutonium in the form of plutonium sulfate tetrahydrate packaged in a glass microbottle.

|               | $^{238}\text{Pu}$    | $^{239}\text{Pu}$     | $^{240}\text{Pu}$    | $^{241}\text{Pu}$    | $^{242}\text{Pu}$      |
|---------------|----------------------|-----------------------|----------------------|----------------------|------------------------|
| Atom Percent* | 0.010<br>$\pm 0.001$ | 91.736<br>$\pm 0.010$ | 7.922<br>$\pm 0.010$ | 0.299<br>$\pm 0.001$ | 0.0330<br>$\pm 0.0003$ |

\*As of January 1, 1982, refer to Table 1 for quarterly decay-adjusted values.

The plutonium isotopic distribution was determined by thermal ionization mass spectrometry at the National Bureau of Standards (NBS) on samples from which americium and uranium were removed. Because high-purity plutonium isotopes have not been used to prepare known synthetic mixtures, the accuracy is dependent on uranium and plutonium exhibiting similar behavior. The observed mass spectrometer data were corrected for mass discrimination effects using data from the analysis of uranium isotopic SRM's that had been analyzed under similar conditions. In addition, the value for  $^{238}\text{Pu}$  was checked by alpha-count of  $^{238}\text{Pu}$ , using the known value for  $^{239}\text{Pu}$  as a ratio check.

SRM 948 contains uranium and americium isotopes, including growing-in daughters of plutonium that are isobaric with the plutonium isotopes. In addition, there may be radiation damage to the glass bottle and teflon cap liner resulting in small glass slivers. Therefore, in its use, a chemical separation that provides a purified plutonium fraction is essential to the attainment of high accuracy.

Measurements leading to the certification of this SRM were made in the Inorganic Analytical Research Division by E.L. Garner, L.A. Machlan, and W.R. Shields.

The technical and support aspects involved in the revision of this Certificate were coordinated through the Office of Standard Reference Materials by T.E. Gills.

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George A. Uriano, Chief  
Office of Standard Reference Materials

(over)

The decay-adjusted values for the plutonium isotopic composition, in atom percent, are tabulated below in Table 1. The half-life values, in years, used for the decay-adjustment are:  $^{238}\text{Pu}$ , 87.74;  $^{239}\text{Pu}$ , 24,119;  $^{240}\text{Pu}$ , 6,560;  $^{241}\text{Pu}$ , 14.34; and  $^{242}\text{Pu}$ , 387,000.

Table 1  
Decay-Adjusted Plutonium Isotopic Composition  
Atom Percent

| Date                  | $^{238}\text{Pu}$ | $^{239}\text{Pu}$ | $^{240}\text{Pu}$ | $^{241}\text{Pu}$ | $^{242}\text{Pu}$ |
|-----------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| January 1, 1982       | 0.010             | 91.736            | 7.922             | 0.299             | 0.0330            |
| April 1, 1982         | .010              | 91.739            | 7.922             | .295              | .0330             |
| July 1, 1982          | .010              | 91.743            | 7.923             | .292              | .0330             |
| October 1, 1982       | .010              | 91.746            | 7.923             | .288              | .0330             |
| January 1, 1983       | .010              | 91.749            | 7.923             | .285              | .0330             |
| April 1, 1983         | .010              | 91.753            | 7.923             | .281              | .0330             |
| July 1, 1983          | .010              | 91.756            | 7.923             | .278              | .0330             |
| October 1, 1983       | .010              | 91.759            | 7.923             | .274              | .0330             |
| January 1, 1984       | .010              | 91.762            | 7.923             | .271              | .0330             |
| April 1, 1984         | .010              | 91.765            | 7.923             | .268              | .0330             |
| July 1, 1984          | .010              | 91.769            | 7.924             | .265              | .0330             |
| October 1, 1984       | .010              | 91.772            | 7.924             | .262              | .0330             |
| January 1, 1985       | .010              | 91.775            | 7.924             | .258              | .0330             |
| April 1, 1985         | .010              | 91.778            | 7.924             | .255              | .0330             |
| July 1, 1985          | .010              | 91.781            | 7.924             | .252              | .0330             |
| October 1, 1985       | .010              | 91.784            | 7.924             | .249              | .0330             |
| January 1, 1986       | .010              | 91.787            | 7.924             | .246              | .0330             |
| April 1, 1986         | .010              | 91.789            | 7.924             | .243              | .0330             |
| July 1, 1986          | .010              | 91.792            | 7.924             | .240              | .0330             |
| October 1, 1986       | .010              | 91.795            | 7.925             | .238              | .0330             |
| 95% Confidence Limit: | $\pm 0.001$       | $\pm 0.010$       | $\pm 0.010$       | $\pm 0.001$       | $\pm 0.0003$      |