206

UNITED STATES DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
Gaithersburg, Maryland 20899-0001

REPORT OF CALIBRATION

Neutron Source Strength Calibration Report

NIST Test Number: 261912

Calibration Performed for: Battelle
Pacific Northwest National Laboratory
902 Battelle Boulevard
P.O. Box 999
Richland, WA 99352

Neutron Source Description: Source Type: ^{252}Cf
Serial Number SR-Cf-258Z (Battelle No.: 318-038)

Calibration Results:

Calibrated neutron emission-rate:	3.88×10^7 neutrons per second
Expanded uncertainty:	$\pm$ 4.18 % (2σ)
Calibration date:	October 18, 1999
NBS-1 emission-rate on date of calibration:	1.236×10^6 neutrons per second

This calibration was performed by:

James M. Adams, Physicist
Neutron Interactions & Dosimetry Group

David M. Gilliam, Leader
Neutron Interactions & Dosimetry Group

For the Director:

Bert Coursey, Chief
Ionizing Radiation Division

REVIEWED BY:
DATE 12/14/99

Appendix for ^{252}Cf Neutron Source Strength Calibration Reports

Calibration Method

Neutron source strength measurements performed at NIST are accomplished at by comparing the emission rate of the source to be calibrated to that of the national primary Ra-Be photoneutron standard source, NBS-1, whose emission rate has been absolutely determined. The measurements of source strengths are made by activating a circulating, aqueous solution of manganous sulfate, and continuously counting the induced ^{56}Mn activity with a scintillation counter. During calibration, the neutron source is placed within a small Teflon cavity that is positioned at the center of the 1.3 m-diameter spherical bath; activity measurements are taken once the bath has reached saturation. The purpose of the cavity is to reduce the absorption of thermal neutrons by the source. Corrections to the measured source strength have been applied in order to account for the following effects: capture of fast neutrons by oxygen and sulfur in the bath, capture of fast and thermal neutrons by fluorine in the Teflon source holder, neutron escape from the bath, and thermal neutron absorption in the source. Typical values for these corrections are:

Fast neutron capture by oxygen and sulfur:	0.624 %
Fast and thermal neutron capture by fluorine:	0.170 %
Neutron escape from the bath:	0.045 %
Thermal neutron absorption in the source:	0.186 %

Uncertainties

The expanded uncertainty consists of components evaluated by statistical means (the so-called Type A uncertainties) and components determined on the basis of alternative (the so-called Type B uncertainties). The Type-A and Type-B uncertainty components relevant to this calibration are identified below.

Type A uncertainties: NBS-1 emission-rate (± 0.85 %)
Count-rate associated with NBS-1 (typically < 0.5 %)
Count-rate associated with the calibrated source (typically < 0.5 %)
Detector calibration (± 1.0 %)

Type B uncertainties: Uncertainty associated with the applied corrections for both NBS-1 and the calibrated source (± 0.3 %, and typically 1 to 2 %, respectively)

The expanded uncertainty reported corresponds to the quadrature-sum of the stated uncertainty components multiplied by a coverage factor equal to two (2). The expanded uncertainty, therefore, represents a two-standard-deviation (2σ) estimate of the overall uncertainty.