REPORT OF CALIBRATION

Neutron Source Strength Calibration Report

NIST Test Number: 272165

Calibration Performed for: Pacific Northwest National Laboratory
Richland, WA 99354

Neutron Source Description: Source Type: ^{252}Cf
Serial Number: NSD-103/PNNL ref: 318-167

Calibration Results:

Calibrated neutron emission-rate:	6.536×10^7 neutrons per second
Expanded uncertainty:	$\pm$ 1.9 % (2σ)
Calibration date:	August 23, 2005
NBS-1 emission-rate on date of calibration:	1.233×10^6 neutrons per second

This calibration was performed by:

Maynard S Dewey

Maynard S. Dewey, Physicist
Neutron Interactions & Dosimetry Group

For the Director:

Muhammad Arif, Leader
Neutron Interactions & Dosimetry Group

Lisa Karam, Acting Chief
Ionizing Radiation Division

REVIEWED BY:

DATE 10/4/2005

Appendix for AmBe Neutron Source Strength Calibration Reports

Calibration Method

Neutron source strength measurements performed at NIST are accomplished by comparing the emission rate of the source being calibrated to that of the national primary standard neutron source, NBS-1, whose emission rate has been determined absolutely. The measurements of source emission rate 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 techniques (the so-called Type B uncertainties). The Type-A and Type-B uncertainty components relevant to this calibration are identified below.

Type A uncertainties: Count-rate associated with NBS-1 (typically < 0.5 %)
Count-rate associated with the calibrated source (typically < 0.5 %)

Type B uncertainties: Uncertainty associated with the applied corrections for both NBS-1 and the calibrated source (± 0.3 %, and typically 0.25 to 1 %, respectively)
NBS-1 emission-rate (± 0.85 %)

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.