



Primary Standards Laboratory Nuclear Project

Fact Sheet

The Primary Standards Laboratory (PSL) maintains a variety of primary nuclear radiation standards to assure accurate and traceable measurements for their customers.

Primary nuclear standards (alpha, beta, gamma, and steady-state neutron) are directly traceable to the Systeme International through the National Institute of Standards and Technology (NIST).

SNL's nuclear radiation standards include alpha and beta sources, gamma ionization chambers used in conjunction with a gamma source range, steady-state and pulsed neutron sources, and a certified tritiated methane gas bottle. SNL also maintains a radiation dosimetry program for personnel and the environment.

Five steady-state, primary neutron sources (Pu-Be and Cf-252) are maintained covering the fluence range $10^6 - 2 \times 10^7$, which are calibrated by NIST, and are used on a low-scatter range to certify survey meters and to verify dosimeter response.

The PSL maintains the national standard for pulsed, 14-MeV neutron detection in the form of a lead-activation detector (lead probe). Primary calibration is accomplished using a gated accelerator and associated particle counting, and results, in the future, will be intercompared with the Atomic Weapons Establishment (United Kingdom).

Customer lead probes or other detectors and dosimeters are certified by comparison with the standard using a laboratory neutron generator as the

source. Certification is in terms of total neutrons produced at the source target.

SNL's dosimetry program covers gammas, high-energy betas, and neutrons up to 14-MeV. The program conforms to DOE Laboratory Accreditation Program requirements.



Lead Probe Calibration Station

A bottle of tritiated methane gas whose activity has been certified is used to set the response of tritium monitors.

Primary alpha and beta sources are calibrated periodically by NIST. The primary sources are used to certify similar sources that are used, in turn, to calibrate survey instruments. An internal gas proportional counter is used for calibration of the thin sources. Results are expressed in terms of emission into 2π rather than as absolute decay rates because the counter does not distinguish between direct and back-scattered particles. The primary source range of $10^3 - 10^6$ counts/min can be extended to $10^1 - 10^7$ counts/min with a slight increase in uncertainty.

Gamma ionization chambers covering the range 0.025–250 R are calibrated by NIST. Chambers are used to standardize the dose from a source range with Cs-137 energy. The range is used to provide known doses and dose rates (up to a present 100 R/hr) for certifying survey meters, verifying dosimeter response, and exposing items submitted by customers.



Capabilities

Below is a representative sample of PSL Alpha and Beta uncertainties. The PSL is NVLAP accredited under Lab Code 105002-0 by the NIST/National Voluntary Laboratory Accreditation Program (NIST/NVLAP) in most of its capabilities. For full details, see <http://ts.nist.gov/standards/scopes/1050020.pdf>

Neutrons	Uncertainty (k=2)
Total Pulsed 14 MeV	9%
Gamma Radiation	
Gamma Dose/Dose Rate	7%
Alpha/Beta Radiation	
Alpha Emission Rate	3%
Beta Emission Rate	5%
Dosimeters	
Beta, Gamma, Neutron Doses 10 mrem to 10 ⁴ rem	Variable

Major Resources

- Internal gas proportional counter for alpha counting
- Gamma source range; Cs-137 source
- Low-scatter neutron test bed; Pu-Be, Cf-252 sources
- Laboratory neutron generator and lead probe test system
- Gated ion accelerator and associated particle counting setup
- Tritium gas-handling system
- TLD counting facility
- Portable radiation monitoring instrument calibration laboratory

Contacts

Alan J. Nelson, Ph.D.

Project Lead

Sandia National Laboratories
P. O. Box 5800; M/S 0665
Albuquerque, NM 87185-0665
Phone: (505) 284-1720
FAX: (505) 844-4372
Email: anelso@sandia.gov

Meaghan Carpenter

Manager

Sandia National Laboratories
P. O. Box 5800; M/S 0665
Albuquerque, NM 87185-0665
Phone: (505) 284-8268
FAX: (505) 844-4372
Email: mscarpe@sandia.gov

