# NIST Certified Reference Materials for Environmental and Security Applications

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NIST
National Institute of Standards and Technology
U.S. Department of Commerce

# National Institute of Standards and Technology

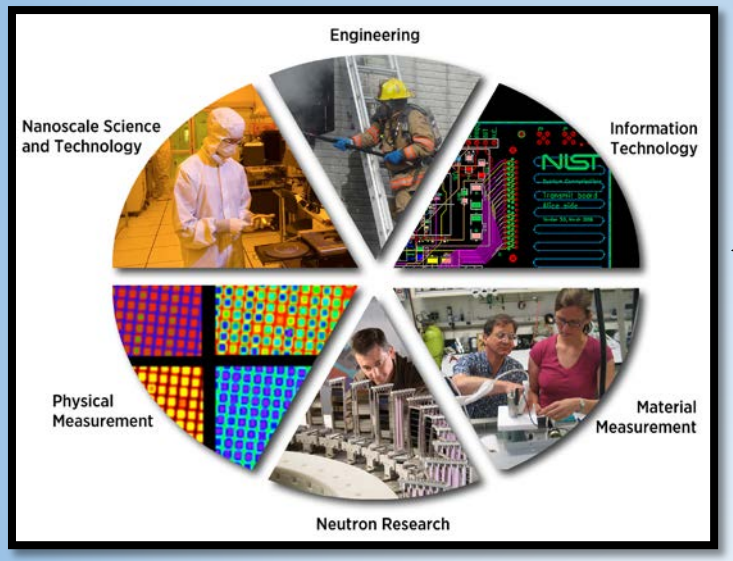
- NBS (1901): National Bureau of Standards was established as a non-regulatory federal agency within the U.S. Department of Commerce.
  **Name changed to NIST- 1988.**
- Mission… to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life.
- Primary Campuses in Gaithersburg, MD and Boulder, Co
- ~ 3,000 employees, 2,800 associates and facilities users, & 1,600 field staff in partner organizations.
- Impact: Facilitates trade and fair commerce,
  Improves public safety and security,
  Advances manufacturing and services,
  Improves quality, ensures uniformity.


G. Hoojer/shutterstocom


B. Gardner

# NIST Organization


- National Oceanic and Atmospheric Administration
- International Trade Administration
- US Patent and Trademark Office
- **National Institute of Standards & Technology**
- Economics and Statistics Administration
- other agencies ….




Laboratories within NIST

# NIST Products and Services

- Measurement Research
- Standard Reference Data
- Calibration Tests
- Laboratory Accreditation

- Standard Reference Materials and Reference materials

~ 1,300 products available

~ 31,000 units sold per year

# Reference Materials

- Reference Material

  *"material, sufficiently homogeneous and stable with reference to specified properties, which has been established to be fit for its intended use in measurement or in examination of nominal properties"* JCGM 200:2012

- Certified Reference Material

  *"reference material, accompanied by documentation issued by an authoritative body and providing one or more specified property values with associated uncertainties and traceabilities, using valid procedures."* JCGM 200:2012

- Standard Reference Materials®
  - NIST Trade-marked name.
  - NIST-specific rigorous requirements for production and certification.

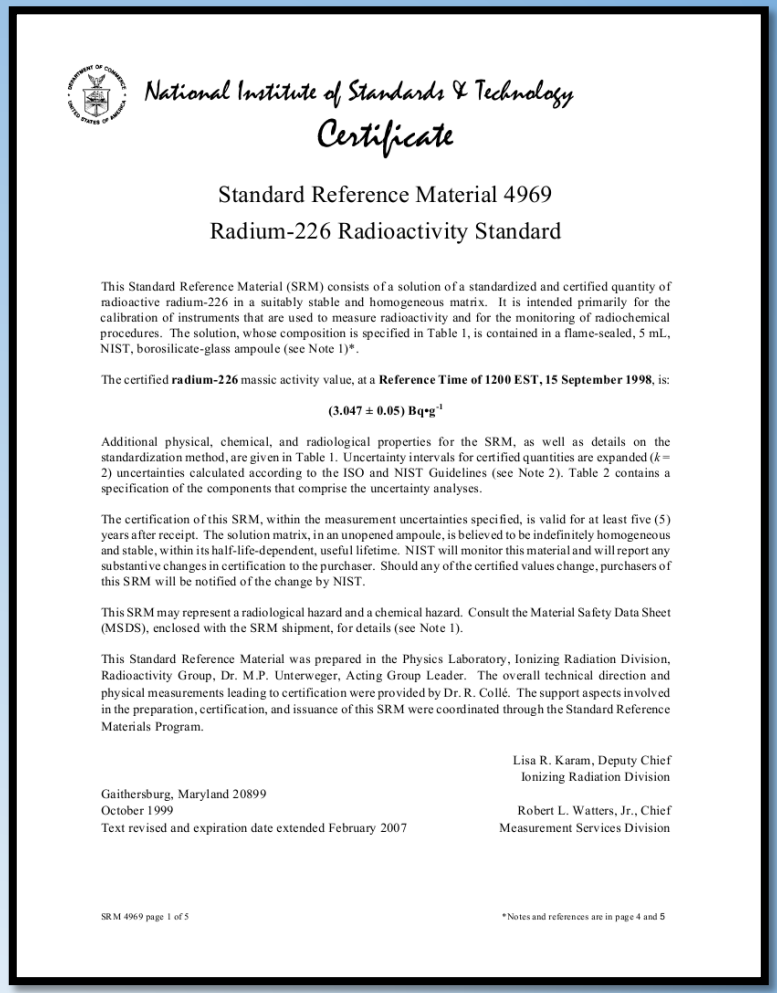
# Reference Materials

## Primary Types of NIST Reference Materials

- Engineering Materials
  - Sizing, Hardness, Surface Finish, Nanomaterials, etc…
- Physical Properties
  - Ion Activity, Optical Properties, Electrical Properties…
  - Radioactive Solutions
  - Radiopharmaceutcicals
  - Radioactive Natural Matrix Materials
- Chemical Composition
  - Ferrous Metals, Nonferrous Metals, Organics, Inorganics, Cement…
  - Single Element Standard Solutions
  - Stable Isotopic Materials
  - Light Stable Isotopic Materials

# Radioactive Solutions

- 26 Standard Reference Materials (solutions)
- Certified for massic activity ($Bq \cdot g^{-1}$).
- Material include: H-3 (4026-E), Nickel-63 (4226D), Tc-99 (4288B), Am-241 (4322C), Pu-242 (4334I)…
- Primary uses include counting standards for instrument calibration, isotopic tracers for analyses of radioactive materials, and method development.



National Institute of Standards & Technology

Certificate

Standard Reference Material 4969

Radium-226 Radioactivity Standard

This Standard Reference Material (SRM) consists of a solution of a standardized and certified quantity of radioactive radium-226 in a suitably stable and homogeneous matrix. It is intended primarily for the calibration of instruments that are used to measure radioactivity and for the monitoring of radiochemical procedures. The solution, whose composition is specified in Table 1, is contained in a flame-sealed, 5 mL, NIST, borosilicate-glass ampoule (see Note 1)*.

The certified **radium-226** massic activity value, at a **Reference Time of 1200 EST, 15 September 1998**, is:

**(3.047 ± 0.05) Bq•g$^{-1}$**

Additional physical, chemical, and radiological properties for the SRM, as well as details on the standardization method, are given in Table 1. Uncertainty intervals for certified quantities are expanded ($k$ = 2) uncertainties calculated according to the ISO and NIST Guidelines (see Note 2). Table 2 contains a specification of the components that comprise the uncertainty analyses.

The certification of this SRM, within the measurement uncertainties specified, is valid for at least five (5) years after receipt. The solution matrix, in an unopened ampoule, is believed to be indefinitely homogeneous and stable, within its half-life-dependent, useful lifetime. NIST will monitor this material and will report any substantive changes in certification to the purchaser. Should any of the certified values change, purchasers of this SRM will be notified of the change by NIST.

This SRM may represent a radiological hazard and a chemical hazard. Consult the Material Safety Data Sheet (MSDS), enclosed with the SRM shipment, for details (see Note 1).

This Standard Reference Material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, Dr. M.P. Unterweger, Acting Group Leader. The overall technical direction and physical measurements leading to certification were provided by Dr. R. Collé. The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program.

Lisa R. Karam, Deputy Chief
Ionizing Radiation Division

Gaithersburg, Maryland 20899
October 1999
Text revised and expiration date extended February 2007

Robert L. Watters, Jr., Chief
Measurement Services Division

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*Notes and references are in page 4 and 5

# Radioactive Natural Matrix Materials

- 9 Standard Reference Materials (Powders)
- Mixed Isotopes certified for massic activity ($Bq \cdot g^{-1}$).
- Materials include:
  Human liver (4351, 4352),
  Lake Sediment (4354),
  Seaweed (4359)…


- Primary uses include measurement QC and analytical method devopment/validation.

# Radiopharmaceutical Materials

- ~9 Standard Reference Materials (gas and solution)
- These material are short lived and produced annually or on a limited basis. Accordingly, Many of these material are out of stock and there is a relatively short timeframe for ordering when they are available.
- Certified for massic activity ($Bq \cdot g^{-1}$) or total activity ($Bq \cdot unit^{-1}$).
- Material include:, Y-90 (4427), I-131 (4401), Xe-133 (4415), Tl-201 (4404)…
- Primary uses include counting standards for instrument calibration, method development, and measurement QC.

# Isotopic Reference Materials

- 17 Stable Isotopic Standard Reference Materials (solids & solutions)
  - Certified for concentration (mols▪$g^{-1}$) and/or isotopic ratios.
  - Include: Boron (951a), Lead (982), Magnesium (980) , Rubidium (984), Strontium (987)…
- 27 Light Stable Isotopic Reference Materials (gas, liquid, solid)
  - Certified primarily for isotopic composition (δ values).
  - Include: Carbon (8543), Nitrogen and Oxygen (8562, 8568, 8569), Sulfur (8556)…
- Primary uses include mass spectrometric calibration materials, method development, and tracers for isotopic analysis.

# Conclusion

- NIST supplies of broad range of well characterized reference materials for chemical, isotopic, and radioactivity analyses. These material are imperative for accurate and reliable use and characterization of isotopic materials.
- Standard Reference Material Purchases:

  http://www.nist.gov/srm/index.cfm
- For more information:

  Richard.Essex@nist.gov 301-975-5541