

A11105 850612

on 260

**NIST**  
PUBLICATIONS *Administration*  
of Standards  
and Technology

To Order

Phone: 301-975-6776

Fax: 301-948-3730

E Mail: SRMINFO@nist.gov

HTTP://ts.nist.gov/srm



**NIST**

**STANDARD  
REFERENCE  
MATERIALS  
CATALOG  
1998-1999**

**Zr**

**S**



**Mg**

**SRM®**

QC  
100  
.U57  
no.260  
1998-1999



# SRM<sup>®</sup>



Physical Property Standards



# Standard Reference Materials® Catalog 1998-99

*NIST Special Publication 260*

Nancy M. Trahey, Editor  
Ilse E. Putman, Electronic Composition

Standard Reference Materials Program  
Office of Measurement Services  
Technology Services  
National Institute of Standards and Technology  
Gaithersburg, MD 20899-0001



**For Information or To Order**

---

**Phone: (301) 975-6776**

---

**Fax: (301) 948-3730**

---

**E-Mail: [srminfo@nist.gov](mailto:srminfo@nist.gov)**

---

**URL <http://ts.nist.gov/srm>**

---

**See page 13 for *Ordering***

**U.S. DEPARTMENT OF COMMERCE**  
William M. Daley, Secretary

**Technology Administration**  
Gary R. Bachula, Acting Under Secretary for Technology

**National Institute of Standards and Technology**  
Raymond G. Kammer, Director

Issued January 1998

National Institute of Standards and Technology  
Special Publication 260  
Supersedes NIST Spec. Publ. 260, 1995-96  
172 pages (Jan. 1998)  
CODEN: NSPUE2

U.S. GOVERNMENT PRINTING OFFICE  
WASHINGTON: 1998

For sale by the Superintendent of Documents  
U.S. Government Printing Office, Washington, DC 20402



---

## Foreword

Historically, Standard Reference Materials (SRMs) have been used as vehicles for transferring National Institute of Standards and Technology (formerly National Bureau of Standards) measurement science and technology through channels of industry and commerce, to the country at large. Each new SRM is the result of collaboration between NIST and representatives of science and industry. SRMs are crucial reference points in establishing a comprehensive measurement system for the whole nation. Such a system, which has incrementally improved throughout the years, has met the needs of U.S. industry and commerce for nearly 100 years and continues to evolve as it is called upon to meet more increasing demands in measurements. The fast pace of technological change, coupled with increased demands on quality, traceability and SRM types, are making the perpetuation of the existing system into the future a very challenging proposition.

We must take advantage of new quality management concepts and scientific and technological opportunities which will lead to improvements in the transfer of NIST technology through SRMs. The SRM Program increasingly is using collaborations with industry that will enable NIST to expand the coverage of measurement needs by providing more new reference materials which have been coupled to a strategy of benchmarking a particular measurement system with fewer SRMs. Consequently, NIST will only renew existing SRMs that have been strategically planned and justified. This will allow NIST resources to be more effectively directed to measurement areas of anticipated high economic need or impact.

The SRMs available in this new 1998-99 catalog are reflections of some of the above strategies as well as our efforts to fill needs as rapidly as they can be identified. Increasingly, science and industry are calling for more units of existing SRMs for expanding fields such as optical radiation measurements, telecommunications, aerospace industries, and national problems such as air and water pollution, and health. This catalog contains new SRMs in all of these areas.

The Program's emphasis will continue to be on providing NIST SRMs —

- where attainment of needed measurement accuracy is not economically or technically feasible elsewhere,
- where industry-wide standards for commerce are needed from a neutral supplier not otherwise available,
- where continuing availability of a highly characterized material from a common source is important to science or industry.

The SRM Program invites you to review the 1998-99 catalog edition to see if any of the available SRMs can be of use to your measurement system. Also, take a moment to provide feedback to me as to your measurements and reference materials needs.

Thomas Earl Gills, Chief  
Standard Reference Materials Program  
National Institute of Standards and Technology  
E-Mail: [thomas.gills@nist.gov](mailto:thomas.gills@nist.gov)

---

# *NIST SRM Program*

**Mission** — to provide reference materials that are the definitive physical sources of measurement traceability in the United States. The Program promotes and supports the development and certification of NIST SRMs essential to industry, academia, and government in order to facilitate commerce and trade and to advance science and technology.

**Vision** — to provide and support NIST customers with affordable and readily available reference materials of the highest quality and metrological value.



---

## Contents

	Page
Foreword.....	iii
NIST SRM Program .....	iv
Abstract and Key Words .....	1
Terminology and Logo .....	1
NIST Policies	
Regarding Use of Metric (SI) Units.....	2
On Measurement Uncertainty Statements.....	3
Program Information	
Definitions.....	4
The SRM/RM Identification System.....	7
Preparation and Availability of SRMs.....	8
Guide for Requesting Development of SRMs .....	8
SRM Catalog .....	10
How to Use This Catalog .....	10
Ordering NIST Reference Materials	
General .....	13
Out-of-Stock Materials .....	13
Terms and Conditions.....	13
Late Charges.....	14
Proforma Invoice (Price Quotation).....	14
Domestic Shipments .....	14
Foreign Shipments (and shipments to Alaska and Hawaii).....	14
Restricted Shipments — Dangerous Goods (Hazardous Materials) .....	14
Restricted Shipments — Temperature Sensitive Materials .....	15
Documentation.....	15
SRM/RM Certificates and Material Safety Data Sheets.....	15
Rush Shipments.....	16
Returned Goods.....	16
Other Services of the National Institute of Standards and Technology	
Calibration and Related Measurement Services .....	17
Standard Reference Data Program .....	17
Accreditation of Laboratories .....	17
National Center for Standards and Certification Information.....	18
Weights and Measures Program.....	18
Proficiency Sample Programs.....	18
Guide to SRM/RM Technical Categories .....	25
SRMs/RMs by Category .....	29
Special Nuclear Materials.....	112
NIST Special Publications in the 260 Series .....	137
SRM/RM Indexes	
Subject.....	143
Numerical and Certificate .....	163
Numerical Material Safety Data Sheet (MSDS) .....	175





---

## *Abstract and Key Words*

This catalog provides technical and general ordering information for the Standard Reference Materials (SRMs) and Reference Materials (RMs) currently available from the National Institute of Standards and Technology (NIST) Standard Reference Materials (SRM) Program. The materials are arranged according to technical category and classified as follows:


- Standard Reference Materials for Chemical Composition;
- Standard Reference Materials for Physical Properties;
- Standard Reference Materials for Engineering Materials.

Technical descriptions are given for all materials and may include certified values. However, these values are incomplete as they appear in the catalog and therefore cannot be referenced for actual measurement purposes. The certificates issued by the SRM Program are the only legitimate sources of certified information for NIST reference materials.

**Key Words:** analysis, calibration, certified reference material (CRM), characterization, composition, concentration, material, measurement, property, quality assurance, quality control, reference material (RM), Standard Reference Material (SRM), standardization, traceability.

## *NIST Terminology and Logo*



The terms “Standard Reference Material” and “SRM”, and the logo “”, are Federally registered trademarks of the National Institute of Standards and Technology (NIST) and the U.S. Government, who retain exclusive rights to them. Permission to use the terms and/or logo is controlled by NIST as is the quality of the use of the terms and of the logo itself.

---

# *NIST Policy Regarding Use of Metric (SI) Units*

The following policy was established in February 1991:

In accordance with the Metric Conversion Act of 1975 as amended by Section 5164 of the Omnibus Trade and Competitiveness Act of 1988 and as required by related provisions of the Code of Federal Regulations, *the National Institute of Standards and Technology (NIST) will use the modern metric system of measurement units (International System of Units — SI) in all publications.* When the field of application or the special needs of users of NIST publications require the use of non-SI units, the values of quantities will be first stated in SI units and the corresponding values expressed in non-SI units will follow in parentheses.

The technical information contained in this catalog is consistent with the above policy. Only SI units and symbols have been used to describe the reference materials contained herein. Therefore, abrogated or obsolete quantifiers (e.g., the term, ppm), no longer appear, but rather have been replaced with the correct SI term, (mg/kg), and reference material values previously expressed in only in-lb units, have been converted to the appropriate SI units [1,2]. Due to space limitations, the non-SI units converted are not shown in the catalog.

In accordance with the above policy, this edition of the catalog no longer references the abrogated quantifier, “Wt. %.” This quantifier has been replaced with the appropriate SI quantifiers, such as “mass fraction, in %”, “amount-of-substance fraction, in %”, or “mole fraction, in %.” The exclusive use of SI quantifiers for expressing NIST SRM and RM certified, reference, and information values was instituted by the SRM Program and the NIST technical divisions in 1995 and apply to all SRM certificates and RM Reports of Investigation issued since that time. However, the certificates for SRMs issued before 1995 still show certified values expressed in “Wt. %.” These certificates will not be revised. Rather, the appropriate SI quantifiers will be referenced when new certificates are generated for future renewal issues of these SRMs.

**Note to SRM Users:** *Individual SRM certificates should be consulted to ascertain if certification data have been expressed in both SI and non-SI units.*

---

[1] The International System of Units (SI), NIST Special Publication 811, 1994 Edition.

[2] ANSI/IEEE/ASTM SI 10 Use of the International System of Units (SI) — The Modern Metric System, April 1997. (Available from IEEE or ASTM.)



---

# *NIST Policy On Measurement Uncertainty Statements*

The following policy was established in January 1993:

[ ] . . . . . All NIST measurement results are to be accompanied by quantitative statements of uncertainty [1]. To ensure that such statements are consistent with each other and with present international practice, this NIST policy adopts in substance the approach to expressing measurement uncertainty recommended by the International Committee for Weights and Measures (CIPM).

[The CIPM approach is based on Recommendation INC-1 (1980) of the Working Group on the Statements of Uncertainties. More recently, at the request of the CIPM, a joint BIPM/IEC/ISO/OIML working group developed a comprehensive reference document on the general application of the CIPM approach [2]. The development of this document is providing further impetus to the worldwide adoption of the CIPM approach.]

The uncertainty statements contained in certificates for SRMs produced after January 1993 are in compliance with the above policy. To the fullest extent possible, these certificates describe the uncertainty components associated with each certified value reported, in terms recommended by the CIPM approach. The NIST technical division(s) that approved the certification protocol, produced the SRM, and evaluated the certified value(s) and associated uncertainty(ies) resulting therein, are responsible for employing the statistical methods that are in accordance with this policy.

**Note to SRM Users:** *It is essential that all statistical information contained in a NIST SRM certificate be carefully reviewed before the certified value(s) and associated uncertainty(ies) are applied to a measurement process or program.*

---

[1] Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results, NIST Technical Note 1297, 1994 Edition.

[2] Guide to the Expression of Uncertainty of Measurement; First edition 1993; ISBN 92-67-10188-9; International Organization for Standardization (ISO), 1993.

---

## *Program Information*

Through the SRM Program, NIST provides more than 1200 different SRMs that are certified for their specific chemical or physical properties. SRMs are used for three main purposes: to help develop accurate methods of analysis (reference methods); to calibrate measurement systems; and to assure the long-term adequacy and integrity of measurement quality assurance programs. NIST SRMs also constitute part of the National Measurement System infrastructure of the United States and, as such, are essential transfer mechanisms for national and international measurement traceability.

The SRM Program itself is the central point at NIST for coordination of all reference materials services and related activities. In this capacity, the Program 1) performs continuous analysis and needs assessment of national reference materials and requirements 2) establishes and promotes uniform criteria for the development and certification of reference materials, 3) performs technical activities related to the preparation, packaging, and distribution of SRMs, 4) prepares and updates the SP 260 Standard Reference Materials Catalog and its price list supplement, 5) publishes and issues a variety of other documents and articles such as journal articles, brochures, and newsletters, 6) provides independent review of the SRM value assignment process, 7) establishes jointly with NIST technical divisions, vertical traceability links with the U.S. secondary reference materials producers, 8) provides customer support to purchasers and users of SRMs, 9) provides official NIST representation on national and international standards committees, 10) coordinates international activities involving reference materials intercomparisons and collaborative efforts to demonstrate reference material compatibility.

The SRM Program sponsors a series of publications, known as the SP 260 series, that is available to assist users in the application of SRMs. Some of these publications give practical guidance for using SRMs while others give additional information about the certification process of specific SRMs. Of special note is NIST Special Publication 260-100, Standard Reference Materials Handbook for SRM Users, by John K. Taylor, that was written to present general concepts of precision and accuracy as applied to SRMs and to discuss their impact on quality assurance and measurement processes.

### **Definitions**

The SRM Program references a number of definitions in connection with the production, certification, and use of its SRMs and RMs. Certain definitions, adopted for SRM use, are derived from international guides and standards on reference materials and measurements while others have been developed by the SRM Program to describe those activities unique to NIST operations. A listing of NIST-adopted and NIST-developed definitions follows.

**Accuracy** — (1) The closeness of agreement between a test result and the accepted reference value. [ISO 5725-1]  
(2) Closeness of the agreement between the result of a measurement and a true value of the measurand. "Accuracy" is a qualitative concept. [VIM:1993]

**Certified reference material** — Reference material, accompanied by a certificate, one or more of whose property values are certified by a procedure which establishes its traceability to an accurate realization of the unit in which the property values are expressed, and for which each certified value is accompanied by an uncertainty at a stated level of confidence. [ISO Guide 30:1992]



**Reference material** — Material or substance one or more of whose property values are sufficiently homogeneous, stable, and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. [ISO Guide 30:1992]

**Reference material certificate** — Document accompanying a certified reference material stating one or more property values and their uncertainties, and confirming that the necessary procedures have been carried out to ensure their validity and traceability. [ISO Guide 30:1992]

**Uncertainty of a certified value** — (1) Estimate attached to a certified value of a quantity which characterizes the range of values within which the “true value” is asserted to lie with a stated level of confidence. [ISO Guide 30:1992] (2) Parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand. [VIM:1993]

**Traceability** — Property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties.

1. The concept is often expressed by the adjective “traceable.”
2. The unbroken chain of comparisons is often called a “traceability chain”. [VIM:1993]
  - a. This definition applies both to physical and chemical measurements.
  - b. Traceability only exists when metrological evidence, appropriate for the application, is collected on a continuing basis to document the traceability chain and quantify its associated measurement uncertainties.
  - c. In most cases, the ultimate stated reference for a measurement result is the SI definition of the appropriate unit(s). [NORAMET Document No. 7 (1995-11-13)]

**NIST Standard Reference Material® (SRM®)** — Certified reference material (CRM) issued by NIST. A SRM is a well-characterized material produced in quantity to improve measurement science. It is certified for specific chemical or physical properties, and is issued by NIST with a certificate that reports the results of the characterization and indicates the intended use of the material. A SRM is prepared and used for three main purposes:

1. To help develop accurate methods of analysis;
2. To calibrate measurement systems used to
  - a. Facilitate exchange of goods,
  - b. Institute quality control,
  - c. Determine performance characteristics, or
  - d. Measure a property at the state-of-the-art limit; and
3. To assure the long-term adequacy and integrity of measurement quality assurance programs.

**NIST Reference Material (RM)** — Material issued by NIST with a report of investigation instead of a certificate to:

1. Further scientific or technical research;
2. Determine the efficacy of a prototype reference material;
3. Provide a homogeneous and stable material so that investigators in different laboratories can be assured that they are investigating the same material;
4. Assure availability when a material produced and certified by an organization other than NIST, is deemed to be in the public interest or when an alternate means of national distribution does not exist.

NOTE: A NIST RM meets the ISO definition for a RM and may meet the ISO definition for a CRM (depending on the organization that produced it).

---

**NIST Traceable Reference Material (NTRM)** — A commercially produced reference material with a well-defined traceability linkage to existing NIST standards for measurements. This traceability linkage is established via criteria and protocols defined by NIST to meet the needs of the metrological community to be served. (Commercial reference materials producers will be allowed to affix the “NTRM” trademark to materials produced according to these criteria and protocols.) NOTE: A NIST NTRM may be recognized by a regulatory authority as being equivalent to a CRM.

**NIST certified value** — Value and its uncertainty assigned by NIST in conformance with the NIST uncertainty policy. A NIST certified value is obtained by one or more of the following measurement modes:

1. A definitive (or primary) method using specialized instrumentation capable of high accuracy and precision and whose errors have been thoroughly investigated and corrected; or,
2. Two or more independent methods at NIST using commercial instrumentation that is calibration based and with differing sources of systematic errors; or,
3. Interlaboratory data from selected laboratories using multiple methods and NIST SRMs as controls.

NOTE: The sources of error with this mode will generally result in uncertainties greater than those for the other two modes.

**NIST noncertified values** — Values that do not meet the criteria for NIST certified values. Such values may be referred to as **NIST reference values** or **NIST information values**. NOTE: Noncertified values are often upgraded to certified values after additional measurements are performed and/or improved methodologies are applied.

- **NIST reference values** — Noncertified values with associated uncertainties that reflect only the precision of the measurement, do not include all sources of uncertainty, or reflect a lack of sufficient statistical agreement among multiple methods. Reference values may also be the results of analyses that are method-dependent.
- **NIST information values** — Noncertified values with no uncertainties reported or with estimated uncertainties for which there is insufficient information to make an assessment of the uncertainties. NOTE: Information values are often simply intended to provide additional descriptive information about a material.

**NIST SRM Certificate (and Certificate of Analysis)** — Document stating the intended purpose and application of a SRM, its certified property value(s) with associated uncertainty(ies), and any other technical information deemed necessary for its proper use. In accordance with *ISO Guide 31:1996*, a NIST SRM certificate bears the logo of the U.S. Department of Commerce, the name of NIST as certifying body, and the name and title of the NIST officer authorized to accept responsibility for its contents. NOTE 1: A SRM certified for one or more specific physical or engineering performance properties is issued with a Certificate; A SRM certified for one or more specific chemical properties is issued with a Certificate of Analysis. NOTE 2: A SRM certificate may contain NIST reference and/or information values in addition to certified values.

**NIST Certificate of Traceability** — Document stating the purpose, protocols, and measurement pathways that support claims by a NTRM to specific NIST standards or stated references. There are no NIST certified values provided in a certificate of traceability. Rather, the document references a specific NIST report of analysis. A NIST certificate of traceability bears the logo of the U.S. Department of Commerce, the name of NIST as certifying body, and the name and title of the NIST officer authorized to accept responsibility for its contents.

**NIST RM Report of Investigation** — Document issued with a RM and containing all the technical information necessary for proper use of the material. There are no NIST certified values provided in a report of investigation and authorship of a report's contents may be an organization other than NIST. A NIST RM Report of Investigation bears the logo of the U.S. Department of Commerce and the name and title of the NIST officer authorized to issue it.



## The SRM/RM Identification System

The SRM Program offers for sale over 1200 different materials and adds 20 to 30 new materials as well as over one hundred renewal materials to its inventory each year. These materials all bear distinguishing names, numbers, and letters by which they are permanently and uniquely identified. The purpose of such identifiers is to clearly describe each and every material and, at the same time, systematically differentiate one from the other. The following certificate headings illustrate "what's in the SRM or RM name."

### Certificate of Analysis

denotes a chemical composition SRM

Standard Reference Material® 3102a

primary SRM numerical identifier  
renewal letter identifier  
(a = first renewal issue)

intended use

Standard Solution

material description constituent certified

Antimony

Lot No. 791103

lot number (specific to batch lot produced units)

### Certificate

denotes a physical property SRM

Standard Reference Material® 2520

primary SRM numerical identifier

material description, intended use, and  
property certified

Optical Fiber Diameter Standard

Serial No: X10001Y

serial number (specific to individually certified units)

### Report of Investigation

denotes a NIST reference material

Reference Materials 8050, 8051, 8052

primary RM numerical identifier(s)

material(s) description

Fine Gold FAU6 Block, Wire and Turnings

ROYAL CANADIAN MINT

certifying organization

### Certificate of Traceability

denotes a NTRM

material description and intended use

Carbon Monoxide in Nitrogen

constituent certified

(Nominal Amount-of-Substance Fraction - 5000  $\mu\text{mol/mol}$ )

NIST Traceable Reference Material No. 82638

primary NTRM numerical  
identifier

Batch No.: 960901

batch number (specific to batch lot produced units)

For convenience, the acronyms "SRM®", "RM", and "NTRM" are preferentially used in conjunction with the primary numerical identifiers (including renewal letters - if applicable), to describe all NIST reference materials. This catalog and its supplement are no exceptions; thus, the reference materials described herein, are identified by their "short" titles (e.g., "SRM 3102a") rather than by their "long" titles (e.g., "Standard Reference Material® 3102a"). These short titles preserve the unique identifications of the materials involved and should be used in lieu of "catalog numbers" when ordering NIST reference materials.



---

## Preparation and Availability of SRMs

New and renewal SRMs are being prepared continually. While these SRMs are included in the next edition of the catalog and its supplements, prospective users whose names are on the SRM mailing list are also notified as soon as the new items become available. Requests for placement on the SRM mailing list can be submitted at any time to the SRM Program Sales Office.

Renewal SRMs are intended to be completed before the supply of an existing SRM is exhausted. However, this is not always possible and a SRM may be out of stock for a time. When this occurs, those ordering the material are so notified and possible substitute SRMs are suggested. When a renewal is issued, customers who have ordered the previous lot are promptly notified of the price and availability of the renewal. If little demand exists or if an alternate source of supply becomes available, production of a SRM may be discontinued permanently.

Renewal SRMs may not be identical to the preceding lot; however, they meet the same specifications and can be used for the same purpose. For example, the first 0.1% carbon Bessemer steel was prepared in 1909 (Standard Sample No. 8). Since then a number of renewals, 8a, 8b, 8c, etc., have been prepared. The current SRM 8j 0.1C, represents the eleventh issue of the material. Each issue differs somewhat in detailed analysis; thus the use of the specific certificate for SRM 8j is essential.

## Guide for Requesting Development of SRMs

NIST has the responsibility to develop, produce, and distribute SRMs that provide a basis for comparison of measurements on materials, and that aid in the control of production processes. To carry out this function, the SRM Program evaluates the needs and requirements of science, industry, and government for well-characterized reference materials, and directs the production and distribution of such materials. To become a SRM, a candidate material must meet one or more of the following criteria:

1. It would permit users to attain more accurate measurements.
2. Its production elsewhere would not be economically or technically feasible.
3. It would be an industry-wide standard for commerce from a neutral source not otherwise available to the public.
4. Its production by NIST would assure continued availability of a well-characterized material important to science, industry, or government.

NIST recognizes and responds to requests to enlarge the scope of the SRM Program to include all types of well-characterized materials for use in calibrating measurement systems, or for producing scientific data that can be referred to a common base. However, the requests for new SRMs greatly exceed NIST's capacity to produce and certify such materials. Consequently, requests for new SRMs of limited need or use are deferred in favor of requests that clearly show a critical technological or regulatory need and significant industrial and/or metrological impact. To determine which requests receive priority, NIST seeks and uses information supplied by industry, academia, governmental agencies, and such voluntary standards development organizations as the American Society for Testing and Materials (ASTM), etc., to objectively assess the urgency and importance of proposed new reference materials.

---

Requests to the SRM Program for the development of a new SRM should provide the following information:

1. Short title of the proposed SRM.
2. Purpose for which the SRM would be used.
3. Reasons why the SRM is needed.
4. Technical characteristics and requirements for the material. Additional requirements and reasons if more than one SRM is necessary for standardization in this area, should be included.
5. Estimates of the probable present and future (5 to 10 years) demand for such a SRM, nationally and internationally.
6. Justification for SRM preparation by NIST, particularly if a similar one could be produced or obtained from another source.
7. Pertinent information to aid justification for the SRM, such as: (a) an estimate of the potential range of application, monetary significance of the measurement(s) affected, scientific and technological significance including, when feasible, estimates of the impact upon industrial productivity, growth, quality assurance or control, and (b) supporting letters from industry leaders, trade organizations, interested standards committees, and others.

All such requests should be addressed to:

Standard Reference Materials Program  
National Institute of Standards and Technology  
Room 112, Building 202  
Gaithersburg, MD 20899-0001  
ATTN: SRM Development

---

# SRM Catalog

New catalogs of NIST SRMs and RMs are published approximately every 2 years, listing materials available and renewal materials in preparation, and deleting discontinued materials. The Catalog is supplemented by Price Lists issued simultaneously with each new catalog and annually to keep the catalog current between editions. These supplements list current prices, and reflect any changes in material availability—listing new and renewal materials and deleting discontinued ones.

A guide and three indexes are provided for user convenience. They are described in the following section, **How to Use This Catalog**.

## How to Use This Catalog

The *NIST Standard Reference Materials Catalog 1998–99* lists Standard Reference Materials (SRMs) and Reference Materials (RMs) issued by the NIST SRM Program. It consists of a guide and three indexes, each of which groups the SRMs and RMs according to a distinctive characteristic or descriptor. Selection of the guide or one index over another to locate the information desired will depend on the user's prior knowledge of a specific SRM or RM and intended SRM or RM application.

**Guide to SRM/RM Technical Categories** – This is a general listing based on the three major categories into which all the SRMs and RMs have been assigned. The *categories* are divided into sequentially numbered sections, each of which describes a material class or technical property class. The *sections* are further divided into subsections, each of which describes a specific type of material or technical property and the physical form(s) of the SRMs and RMs contained therein. The titles of the *subsections* are the descriptors for the tables comprising the catalog.

### EXAMPLE

Category – Standard Reference Materials  
for CHEMICAL COMPOSITION,  
31 through 96 (page nos.)  
Section – 102. **NONFERROUS METALS**, 44 through 52 (page nos.)  
Subsection (Descriptor) – Zinc Base Alloys (chip and disk forms), 52 (page no.)

**SRM/RM Subject Index** – This index is based on short word descriptors (one to four words) of the SRMs and RMs in the catalog. These descriptors may identify a section, subsection, a material class, a specific SRM property, a specific SRM application, or a measurement technique. Some descriptors may coincidentally also identify an individual SRM or RM; however, only a few SRMs or RMs will be so described. The index is arranged in *alphabetical order of the first word of the descriptor*. Because of the variety of descriptors used, some SRM and RM materials may be cross-referenced.

### EXAMPLE

Index Entry – **ALLOYS (NONFERROUS)**  
Descriptor (s) – See **NONFERROUS METALS**, 44 through 52 (page nos.)  
or  
Index Entry – **ZINC**  
Descriptor – Spelter (ZINC BASE ALLOYS), 52 (page no.)



**SRM/RM Numerical and Certificate Index** – This index is based on the unique numerical identifier (also referred to by purchasing agents as *the catalog number*) assigned to each and every SRM and RM issued by NIST. This identifier is the **SRM or RM Number**, an integral part of the reference material name which appears on each SRM certificate or RM report of investigation. The index lists all the SRMs and RMs sequentially by this number, beginning with SRM 1c and ending with RM 8761. A short word descriptor of the SRM or RM, the category subsection in which it is assigned, and the certificate or report of investigation *date of issue* are also provided for reference.

#### EXAMPLE

SRM – 3168a  
Descriptor – Zinc Standard Solution  
Certificate Date – Jun 96  
Section Code – 104  
Page – 58 (page no.)

**SRM/RM Material Safety Data Sheet (MSDS) Index** – The index is similar to the Numerical and Certificate Index but it lists *only* those SRMs/RMs for which *Material Safety Data Sheets (MSDSs)* are required. The identifier is the **SRM or RM Number** and the short word descriptor used in the Numerical Index. These are followed by the **MSDS Number**, which usually carries the same SRM/RM number identifier, *and its date of issue*. In accordance with applicable national and international regulations, a copy of the MSDS accompanies every shipment of its relevant SRM/RM.

#### EXAMPLE

SRM – 3168a  
Descriptor – Zinc Standard Solution  
MSDS Number – 3168a  
MSDS Date – Oct 93  
Numerical MSDS Index Page – 181 (page no.)

#### HOW TO LOCATE SPECIFIC INFORMATION

- **About an unknown SRM or RM material needed for a particular technical application** –  
Refer to the **Guide to SRM/RM Technical Categories**, select the most appropriate of the three categories, review all the sections and subsections therein and note the page numbers.
- **About a material from a specific class of materials and of known technical application** –  
Refer to the **SRM/RM Subject Index**, check for alternative descriptors and cross-references, and note page numbers.
- **About a material whose SRM or RM number is known** –  
Refer to the **SRM/RM Numerical and Certificate Index** (green pages) and note the page number.
- **Whether or not a SRM or RM has (or requires) a Material Safety Data Sheet** –  
Refer to the **SRM/RM Numerical MSDS Index**.



---

# Ordering NIST Reference Materials

## General

Purchase orders (in English) for all NIST SRMs/RMs should be directed to:

Standard Reference Materials Program  
National Institute of Standards and Technology  
Room 204, Building 202  
Gaithersburg, MD 20899-0001  
USA

Telephone: (301) 975-6776  
Fax: (301) 948-3730  
E-Mail: [srminfo@nist.gov](mailto:srminfo@nist.gov)

Each purchase order should give the number of units, catalog number, and name of each reference material requested.

Example: 1 each, SRM 79a, Fluorspar Customs Grade.

The following information must be included with each order: a billing address, a shipping address, name of customer, telephone number, fax number, purchase order number, a customer identification number, i.e., a social security number (SSN) for consumer customers, tax identification number (TIN) for commercial customers, or agency code (ALC) for U.S. Government customers.

**Note:** NIST SRMs/RMs are only distributed in the units of issue listed in this catalog and its supplement (price list). Also, purchase orders or inquiries submitted in a language other than English, will take several weeks to process.

**Acceptance of an order does not imply acceptance of any provisions set forth in the order that are contrary to the policies, practices, or regulations of the National Institute of Standards and Technology or the United States Government.**

## Out-of-Stock Materials

Orders for "out-of-stock" SRMs/RMs, are generally filled with the renewal reference materials — if available; otherwise the orders will be canceled. Customers are notified when an order is canceled and their names are placed on a notification list. This list is used to contact customers when the reference material (or its renewal) is again available. Upon notification, customers are told the price of the material and are asked to submit a new order if they still wish to purchase it.

For some SRMs/RMs, production lots are small and stock outages occur frequently. In these cases, the notification list is used to fill orders on a "*first come, first served*" basis. Customers are contacted when the reference materials are again available and are asked to confirm their original purchase orders.

## Terms and Conditions

Prices quoted for SRMs/RMs are in U.S. dollars (\$), and are published in the catalog supplement (price list). The prices shown therein are subject to change without notice and orders will be invoiced for the prices in effect at the time of shipment. Shipping and handling charges for regular and special (for SRMs in restricted categories) shipments are also applied to all orders. These charges will be added to the invoices.

**Note:** A 10% discount is given on individual purchase orders for 50 or more SRM units (single SRM, or combination of SRMs).



---

Payment of all invoices is expected within 30 days of receipt for domestic orders; 45 days of receipt for foreign orders, and may be made by any of the following:

- Banker's draft against U.S.A. bank,
- Bank to bank transfer to U.S.A. bank,
- Cash against documents,
- DISCOVER, MasterCard, and VISA,
- International money order.

## **Late Charges**

In accordance with U.S. Treasury regulations, late charges will be levied for each 30/45-day period, or portion thereof, that an invoice payment is overdue.

## **Proforma Invoice (Price Quotation)**

Proforma invoice service requires 3 to 4 weeks to process and is furnished **only** to those customers requiring such service.

## **Domestic Shipments**

SRM/RM shipments within the continental United States are shipped F.O.B. Gaithersburg, MD. There are several shipping modes which can be used, including UPS Ground, Federal Express, Air Freight, and Motor Freight (Collect). Unless otherwise instructed by the customer, the mode of shipment will be selected by NIST. Fewer shipping modes are available to SRMs/RMs in restricted categories and NIST reserves the exclusive right to select the proper shipping mode for these types of shipments. For restricted SRM/RM shipments, an additional charge is incurred for each shipping container used. This charge is added to the invoice.

## **Foreign Shipments (and shipments to Alaska and Hawaii)**

SRM/RM shipments outside the contiguous United States are also shipped F.O.B. Gaithersburg, MD by one of the following modes, including UPS International, Federal Express International (subject to size, weight, and category of material limitations), and Air Freight. Unless otherwise instructed by the customer, the mode of shipment will be selected by NIST. Any other mode of shipment requested by the customer must be paid by the customer. Fewer shipping modes are available to SRMs/RMs in restricted categories and NIST reserves the exclusive right to select the proper shipping mode for these types of shipments.

## **Restricted Shipments — Dangerous Goods (Hazardous Materials)**

Some SRMs/RMs are classified as "Dangerous Goods" by the U.S. Department of Transportation (DOT), the International Civil Aviation Organization (ICAO), or the International Air Transport Association (IATA). These organizations have published regulations and procedures for packaging and shipping dangerous (hazardous) goods which must be followed to safely transport these materials. Such regulations and procedures are very specific and do not allow exceptions. NIST reserves the exclusive right to select the proper packaging and shipping mode to assure that shipments comply with these regulations and procedures.

---

## Restricted Shipments — Temperature Sensitive Materials

Some SRMs are extremely temperature sensitive and will perish unless shipped by the most expedient mode available. To ensure the stability of these materials, they must be packaged with Cool Packs or dry ice which will maintain the necessary low temperatures for a short period of time. However, *several SRMs are so temperature sensitive that they are restricted to domestic sales only*, and must be shipped according to a set schedule.

## Documentation (All documents are printed in English)

The documentation NIST furnishes are:

- a. Commercial invoice(s),
- b. Packing slip(s),
- c. Air waybill for air shipments (provided UPON REQUEST ONLY),
- d. NAFTA Certificate(s) (when applicable),
- e. SRM/RM Certificate(s) — one for each unit ordered,
- f. Material Safety Data Sheet(s) — one for each type of ordered material requiring it.

## SRM/RM Certificates and Material Safety Data Sheets

Each SRM/RM shipment contains sufficient copies of Certificates and Material Safety Data Sheets (MSDSs) (if applicable) for the number of units ordered. However, if these documents are misplaced, NIST will provide additional copies free of charge upon request and when proof of purchase has been provided. Customers may call, fax, or use the following e-mail addresses to send in their requests:

for Certificates — [srmcert@nist.gov](mailto:srmcert@nist.gov)  
for MSDSs — [srmmsds@nist.gov](mailto:srmmsds@nist.gov)

Requests will usually be processed within 24 hours. Documents under or equalling ten pages will be faxed; documents exceeding ten pages will be mailed. If the documentation is urgently needed, the customer must provide a Federal Express account number.

NIST also provides copies of misplaced “Archive certificates” free of charge to customers who possess NIST SRMs/RMs that are no longer for sale. This service is available on a one-time-only basis.

**CUSTOMERS ARE REQUIRED TO INSPECT ALL PACKAGES AND DOCUMENTATION IMMEDIATELY UPON RECEIPT OF SHIPMENT. ANY DAMAGE, SHORTAGES OR DEFECTS MUST BE REPORTED TO SRM PROGRAM CUSTOMER SERVICE AT (301) 975-6776, WITHIN FIVE DAYS OF RECEIPT OF SHIPMENT.**

---

## Rush Shipments

Requests for rush shipments will be accommodated when possible. However, they will be made in compliance with existing regulations pertaining to the SRMs/RMs being shipped and when hazardous materials are involved, all regulations governing their transportation will take precedence. The following types of rush shipments are available:

- Same day shipping — Orders must be placed by **10:00 AM Eastern Standard Time (EST)**. In addition to the normal shipping fees, a processing fee of \$50.00 will be added to the customer's invoice.
- Next day shipping — In addition to the normal shipping fees, a processing fee of \$25.00 will be added to the customer's invoice.

**(Exception: Hazardous materials will not be shipped the same day.)**

## Returned Goods

NIST SRMs/RMs are generally not returnable — with the exception of defective goods or shipments made in error by NIST. However, normal transaction of business inevitably requires the occasional return of merchandise for exchange or credit. NIST has therefore instituted the following returned goods policy:

- Return shipments are accepted by NIST **only after** specific arrangements to do so have been made. To return a SRM/RM, contact the SRM Program Sales Office to **obtain a Return Authorization Number and shipping instructions**. REQUESTS FOR RETURN AUTHORIZATION MUST BE MADE WITHIN 30 DAYS OF RECEIPT OF SHIPMENT.
- Return shipments of hazardous SRMs/RMs authorized by SRM Program Sales Office, must be packed, marked, labeled, and shipped in accordance with national and international regulations governing their transportation. Opened, leaking or damaged hazardous SRM/RM units and/or their containers **CANNOT BE RETURNED TO NIST** but should be disposed of in accordance with applicable laws and regulations.

**Returns which will not be authorized or accepted UNDER ANY CIRCUMSTANCES include:**

- **Perishable SRM/RMs,**
- **Unsealed, partially used, modified or mutilated SRMs/RMs,**



---

# *Other Services of the National Institute of Standards and Technology*

## **Calibration and Related Measurement Services**

The fee based measurement services of the Calibration Program include calibrations, special tests, and Measurement Assurance Programs (MAPs). The calibrations and MAPs of NIST satisfy the most demanding and explicit measurement requirements, in that these services are carried out regularly under pre-established and well-defined conditions; the measurement processes involved are well-characterized, stable and in a state of statistical control; and quality control procedures are well-defined and strictly followed. These services are described in NIST Special Publication 250, *Calibration Services Users Guide*. For more information on available calibration services, or how to obtain a copy of Special Publication 250, inquiries should be directed to:

Calibration Program  
National Institute of Standards and Technology  
Room 232, Building 820  
Gaithersburg, MD 20899-0001

Telephone: (301) 975-2002  
Fax: (301) 869-3548  
E-Mail: [calibrations@nist.gov](mailto:calibrations@nist.gov)  
Internet: <http://ts.nist.gov/calibrations>

## **Standard Reference Data Program**

The Standard Reference Data Program provides well-documented numeric data to scientists and engineers for use in technical problem solving, research, and development. These recommended values are based on data which have been extracted from the world's literature, assessed for reliability, and then evaluated to select the preferred values. The primary vehicles for dissemination of this data are the *NIST Standard Reference Database Series* and the *Journal of Physical and Chemical Reference Data (JPCRD)*. For database and publication information, please contact the following:

Standard Reference Data Program  
National Institute of Standards and Technology  
Room 113, Building 820  
Gaithersburg, MD 20899-0001

Telephone: (301) 975-2208  
Fax: (301) 926-0416  
E-Mail: [srdata@nist.gov](mailto:srdata@nist.gov)  
Internet: <http://www.nist.gov/srd>

## **Accreditation of Laboratories**

The National Voluntary Laboratory Accreditation Program (NVLAP) accredits public and private calibration and/or testing laboratories, based on evaluation of their technical qualifications and competence for conducting specific tests or types of tests in specified fields of testing or calibration. Accreditation is based on criteria published in the Code of Federal Regulations as part of the NVLAP procedures. Accreditation is granted following successful completion of a process which includes submission of an application and payment of fees by the laboratory, an on-site assessment, resolution of any deficiencies identified during the on-site assessment, participation in proficiency testing, technical evaluation, and administrative review. The accreditation is formalized through issuance of a Certificate of Accreditation and Scope of Accreditation as publicized by announcement in various government and private media. Application packages may be obtained from:

National Voluntary Laboratory Accreditation Program  
National Institute of Standards and Technology  
Room 282, Building 820  
Gaithersburg, MD 20899-0001

Telephone: (301) 975-4016  
Fax: (301) 926-2884  
E-Mail: [nvlap@nist.gov](mailto:nvlap@nist.gov)  
Internet: <http://ts.nist.gov/nvlap>

---

## National Center for Standards and Certification Information

The National Center for Standards and Certification Information (NCSCI) provides information on U.S., foreign and international voluntary standards, government regulations, and conformity assessment procedures for non-agricultural products. NCSCI staff respond to inquiries by identifying relevant standards and/or regulations, maintain a reference collection of standards and standards-related documents (they do not provide copies), and serve as the U.S. inquiry point for information to and from foreign countries. Inquiries should be directed to:

National Center for Standards and  
Certification Information  
National Institute of Standards and Technology  
Room 164, Building 820  
Gaithersburg, MD 20899-0001

Telephone: (301) 975-4040  
Fax: (301) 926-1559  
E-Mail: [ncsci@nist.gov](mailto:ncsci@nist.gov)  
Internet: <http://ts.nist.gov/oss>

## Weights and Measures Program

The NIST Weights and Measures Program operates a Type Evaluation Program which provides for an evaluation of (1) prototype weighing and measuring devices to determine compliance with the requirements of NBS Handbook 44, "Specifications, Tolerances, and Other Technical Requirements for Commercial Weighing and Measuring Devices," (2) standards to determine compliance with the requirements of NBS Handbook 105-1, 105-2, 105-3, "Specifications and Tolerances for Reference Standard and Field Standard Weights and Measures." This program may be used by manufacturers and weights and measures officials in determining the acceptability of devices for commercial use or the suitability of reference and field standards. For information on programs of NIST and the States, write or telephone:

Weights and Measures Program  
National Institute of Standards and Technology  
Room 232, Building 820  
Gaithersburg, MD 20899-0001

Telephone: (301) 975-4004  
Fax: (301) 926-0647  
E-Mail: [owm@nist.gov](mailto:owm@nist.gov)  
Internet: <http://www.nist.gov/owm>

## Proficiency Sample Programs

General information on the Proficiency Sample Programs may be obtained from:

Construction Materials Reference Laboratories  
National Institute of Standards and Technology  
Room A365, Building 226  
Gaithersburg, MD 20899-0001

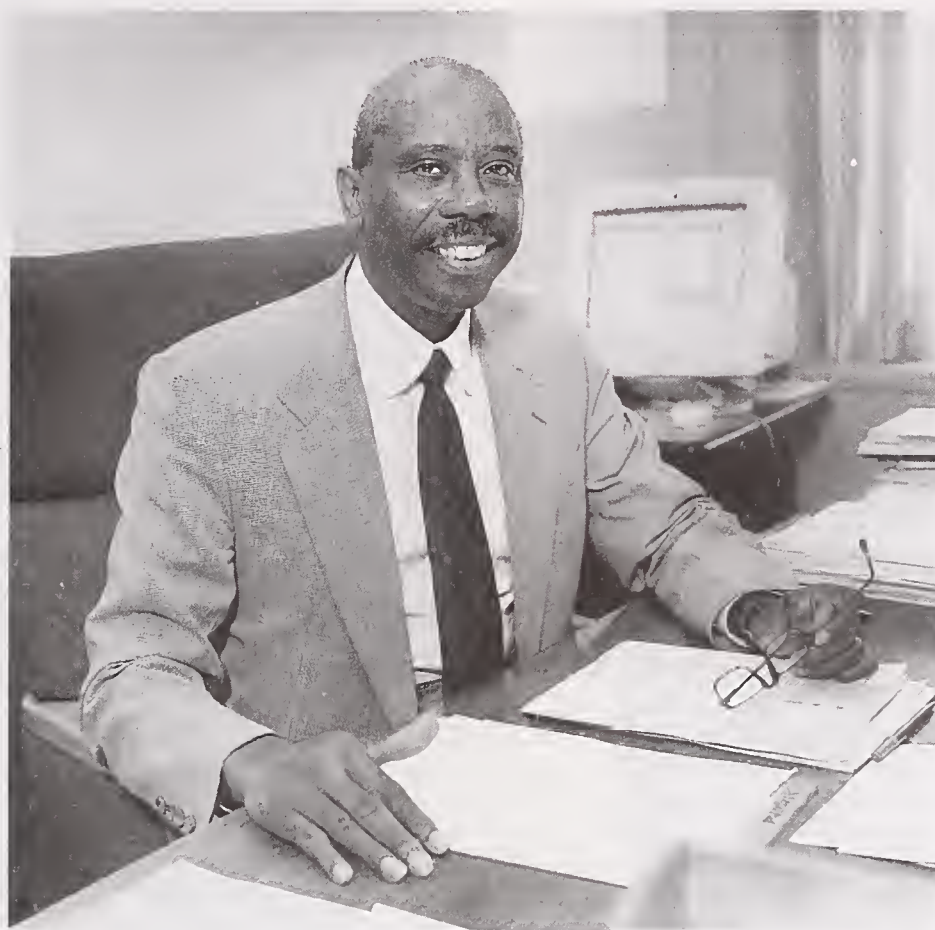
Telephone: (301) 975-6704  
Fax: (301) 330-1956  
E-Mail: [jpielert@nist.gov](mailto:jpielert@nist.gov)  
Internet: <http://www.bfrl.nist.gov/862/ccrl/front.htm>

Information is available on the following programs:

Proficiency Sample Programs for Hydraulic Cements, Pozzolans, and Portland Cement Concrete;  
Proficiency Sample Programs for Soils, Aggregates, and Bituminous Materials;  
Inspection of Cement and Concrete Testing Laboratories;  
Inspection of Soils and Bituminous Testing Laboratories.



# Standard Reference Materials Program



*Thomas E. Gills, Chief, Standard Reference Materials Program*



*Nancy M. Trahey, Catalog Editor, Deputy Chief*



*Delores J. Covey, Secretary*





**Julie M. Frum, *Administrative Officer***

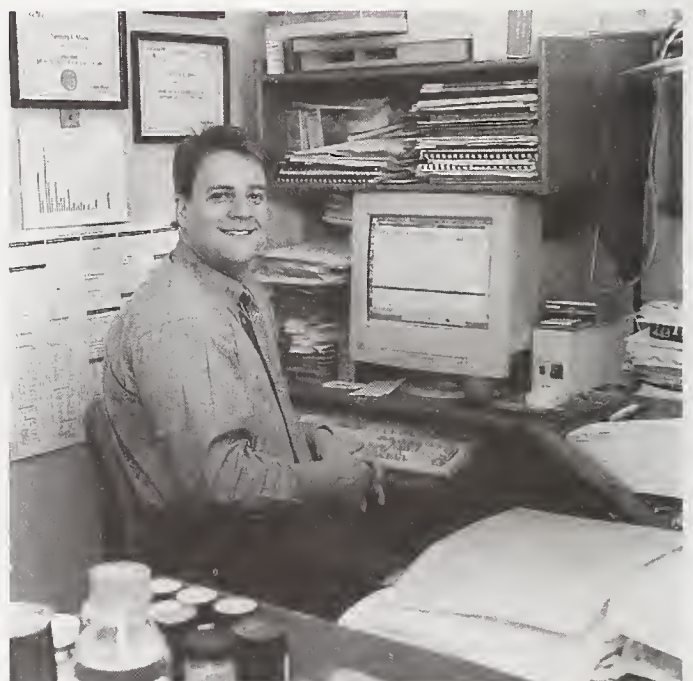


**Donna J. Clarke, *Computer Programmer Analyst***

## Marketing



**Lee T. Best, *Manager, Marketing, Sales & Customer Services***



**Channing L. Monti, *Business Specialist, Customer Service***



## Sales and Customer Service



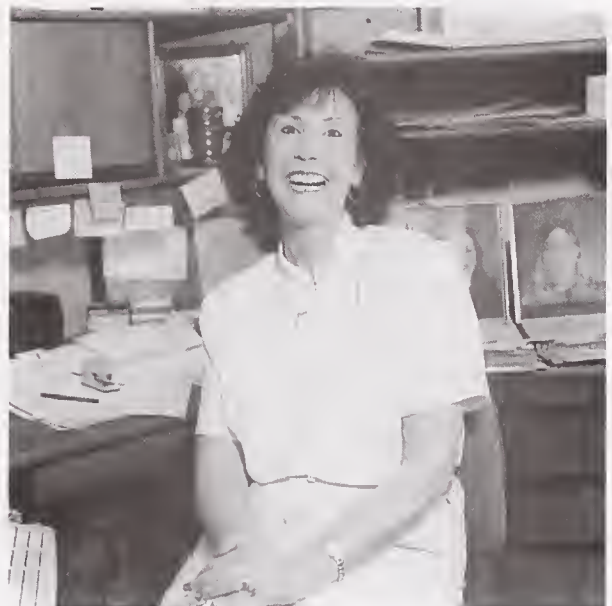
**Karen J. Applestein**, *Sales and Customer Service*



**Teresa A. Rush-Cover**, *Sales and Customer Service*



**Gina R. Montgomery**, *Sales and Customer Service*



**V. Beth Stotz**, *Sales and Customer Service*



**Gail M. McClellan**, *Sales and Customer Service*



**Rendy Smith**, *College Student*



## Document Development Coordination



**Sharon K. Maxwell**, Group Leader,  
*SRM Computer Assistant, Records Management*



**Robbin Howard-Frazier**, SRM Assistant,  
*Records Management*



**Anna D. Carroll**, SRM Assistant, *Records Management*



**Julie Reed**, Student Trainee, *Records Management*



**Carmen S. Davis**, SRM Assistant,  
*Hazardous Documentation Preparation*



**Michelle E. Brown**, SRM Assistant,  
*Records Management*



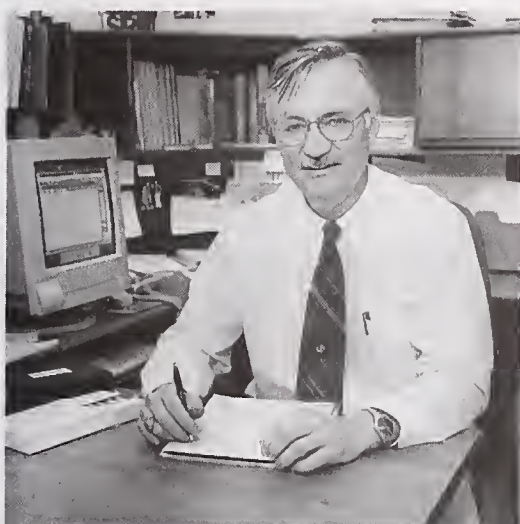
## Project Management



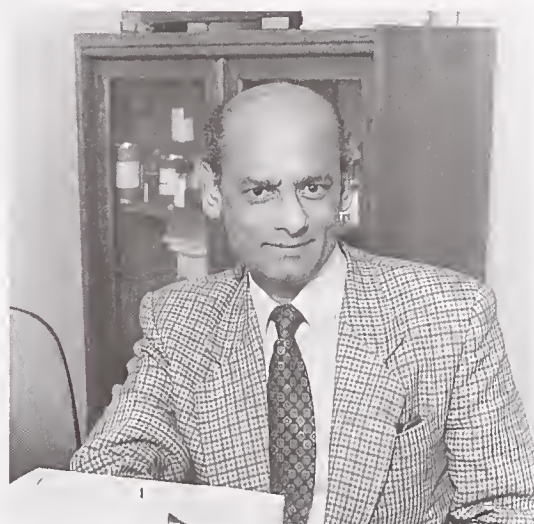
**Jennifer C. Colbert**, *Project Management,  
Chemical Composition, Biological, and Clinical*



**Robert J. Gettings**, *Project Management,  
Physical Property, and Engineering Materials*



**Bruce S. MacDonald**, *Project Management,  
Chemical Composition, and Environmental Materials*



**G. Venkatesh Iyengar**, *Special Programs  
Collaborations*

## Materials Production, Storage, and Distribution



**Dale G. Friend**, *Physical Science  
Technician Supervisor*



**Mark P. Cronise**, *Physical Science Technician,  
Materials Production & Packaging*



**Curtis N. Fales**, *Physical Science Technician,  
Materials Production & Packaging*



**Gary V. Proulx**, *Physical Science Technician,  
Materials Production & Packaging*

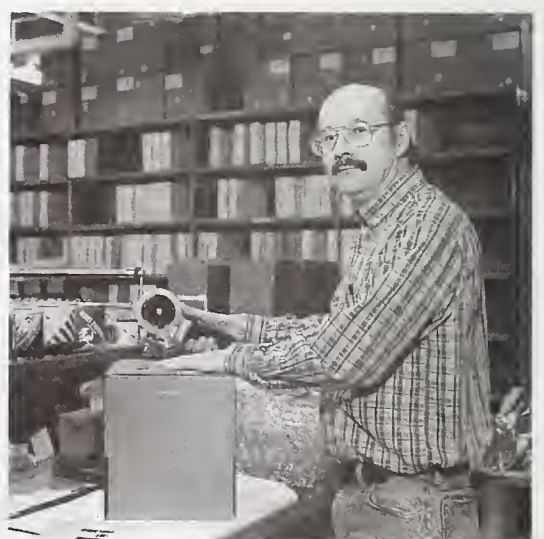


**Thomas E. Hotchkiss**, *Physical Science  
Technician, Materials Production & Packaging*

## Warehousing Storage and Distribution



**James T. Fort**, *Physical Science  
Technician, Distribution*



**Thomas P. Shuggars**, *Physical Science  
Technician, Distribution*



# Guide to SRM/RM Technical Categories

---

## *Standard Reference Materials for CHEMICAL COMPOSITION*

---

### **101. Ferrous Metals, 31–43**

Plain Carbon Steels (chip form), 31  
Low Alloy Steels (chip form), 32  
Special Low Alloy Steels (chip and pin forms), 33  
High Alloy Steels (chip form), 34  
Gases in Metals (rod form), 34  
Stainless Steels (chip form), 35  
Tool Steels (chip form), 35  
Low Alloy Steels (disk and rod forms), 36  
Low Alloy Steels (disk and rod forms) – Continued, 37  
Low Alloy Steels (disk and rod forms) – Continued, 38  
Low Alloy Steels (disk and rod forms) – Continued, 39  
High Temperature Alloys (disk form), 39  
Stainless Steels (disk form), 40  
Specialty Steels (disk form), 40  
Steelmaking Alloys (powder form), 41  
Cast Irons (chip form), 42  
Cast Steels, White Cast Irons, and Ductile Irons (disk form), 43

### **102. Nonferrous Metals, 44–52**

Aluminum Base Alloys (chip and disk forms), 44  
Cobalt Base Alloys (chip and disk forms), 44  
Copper Base Alloys (chip and rod forms), 45  
Copper Base Alloys (block and disk forms), 46  
Copper “Benchmark” (chip and rod forms), 47  
Naval Brass (disk form), 48  
Free Cutting Brass (disk form), 48  
Cartridge Brass (disk form), 48  
Gilding Metal (disk form), 49  
Lead Base Alloys (chip and disk forms), 49  
Lead Base Material (disk form), 49  
Nickel Base Alloys (chip and disk forms), 50  
Trace Elements in Nickel Base Superalloys (chip form), 50  
Nickel Oxides (powder form), 51  
Tin Base Alloys (chip form), 51  
Titanium Base Alloys (chip and disk forms), 51  
Zinc Base Alloys (chip and disk forms), 52  
Zirconium Base Alloys (chip and disk forms), 52  
Gases in Metals (platelet form), 52

### **103. Microanalysis, 53**

Metals (rod and wire forms), 53  
Synthetic Glasses (rod form), 53  
Thin Film for Transmission Electron Microscope, 53

### **104. High Purity Materials, 54–61**

High Purity Metals (solid forms), 54  
Royal Canadian Mint Reference Materials (solid forms), 54  
Royal Canadian Mint Reference Materials (solid forms)—Continued, 55  
Stoichiometry (powder form), 56  
Microchemistry (powder form), 56  
Spectrometry, Single Element Standard Solutions, 57  
Spectrometry, Single Element Standard Solutions – Continued, 58  
Spectrometry, Multielement Standard Solutions, 58  
Spectrometry, Multielement Standard Solutions – Continued, 59  
Chromium Speciation (solution form), 60  
Anion Chromatography (solution form), 60  
Stable Isotopic Materials (solid and solution forms), 60  
Light Stable Isotopic Materials (gas, liquid and solid forms), 61

### **105. Health and Industrial Hygiene, 62–67**

Clinical Laboratory Materials (gas liquid, and solid forms), 62  
Serum Materials (frozen, liquid, and lyophilized forms), 63  
Ethanol Solutions, 64  
Toxic Substances in Urine (powder form), 64  
Drugs of Abuse, Single Analyte (powder form), 64  
Drugs of Abuse, Multianalyte (powder form), 65  
Drugs of Abuse in Hair (solid forms), 65  
DNA Profiling (solid forms), 65  
Biomaterials (solid forms), 65  
Materials on Filter Media, 66  
Trace Constituent Elements in Blank Filters, 66  
Respirable Silica (powder form), 66  
Lead in Paint, Dust, and Soil (powder and sheet forms), 67  
Asbestos, 67

### **106. Inorganics, 68–69**

Metal Constituents in Natural Matrices (liquid and solid forms), 68  
Simulated Rainwaters (liquid form), 68  
Thin Films for X-ray Fluorescence, 68  
Carbon Modified Silica (powder form), 69  
Trace Elements (solid form), 69  
Used Auto Catalysts (powder form), 69

### **107. Primary Gas Mixtures, 70–71**

Primary Gas Mixtures, 70  
Primary Gas Mixtures – Continued, 71  
Permeation Devices, 71

### **108. Fossil Fuels, 72–74**

Alcohols and Ethers [Oxygenates] in Reference Fuels (liquid form), 72



Metal Constituents in Fossil Fuels (liquid and solid forms), 72  
Sulfur in Fossil Fuels (liquid and solid forms), 73  
Moisture in Oils and Alcohols (liquid form), 73  
Reference Liquids for Evaluating Fuels, 73  
Trace Elements (solid forms), 74

#### **109. Organics, 75–78**

GC/MS and LC System Performance (liquid form), 75  
Organic Constituents (liquid and solid forms), 75  
Organic Constituents (liquid and solid forms) – Continued, 76  
Organic Constituents (liquid and solid forms) – Continued, 77  
Organic Constituents (liquid and solid forms) – Continued, 78

#### **110. Food and Agriculture, 79–83**

Foods and Beverages (liquid and powder forms), 79  
Health Care and Nutrients (liquid and solid forms), 80  
USA/Canada Collaborative Materials (powder form), 80  
USA/Canada Collaborative Materials (powder form) – Continued, 81  
Agricultural Materials (powder form), 82  
Fertilizers (powder form), 83  
Wheat Hardness (kernel form), 83

#### **111. Geological Materials and Ores, 84–89**

Chinese Ores (powder form), 84  
Ores (powder form), 84  
Ores (powder form) – Continued, 85  
Ores (powder form) – Continued, 86  
Ore Bioleaching Substrate (powder form), 86  
Clays (powder form), 87  
Rocks and Minerals (powder form), 88  
Refractories (powder form), 88  
Soils, Sediments, and Sludges (powder form), 89

#### **112. Ceramics and Glasses, 90–92**

Carbides (powder form), 90  
Cemented Carbides (powder form), 90  
Glasses (powder and solid forms), 91  
Trace Elements (powder and wafer forms), 92

#### **113. Cement, 93–94**

Portland Cements (powder form), 93  
Portland Cement Clinkers (solid form), 94

#### **114. Engine Wear Materials, 95–96**

Metallo-Organic Compounds (solid form), 95  
Lubricating Base Oils (liquid form), 95  
Catalyst Characterization Material (liquid form), 95  
Catalyst Package for Lubricant Oxidation (liquid form), 96  
Wear-Metals in Oil (liquid form), 96

---

## ***Standard Reference Materials for PHYSICAL PROPERTIES***

---

#### **201. Ion Activity, 99–100**

pH Calibration (powder form), 99  
Biological Buffer Systems (powder form), 99  
pD Calibration (powder form), 99  
Ion-Selective Electrode Calibration (powder form), 100  
Electrolytic Conductivity (liquid form), 100

#### **202. Polymeric Properties, 101–102**

Molecular Weight and Melt Flow (liquid, pellet, and powder forms), 101  
Polyethylene Pipe Products, 102

#### **203. Thermodynamic Properties, 103–107**

Combustion Calorimetry (powder form), 103  
Solution Calorimetry, 103  
Flash Point Reference Materials (liquid form), 103  
Enthalpy and Heat Capacity (solid forms), 104  
Differential Scanning Calorimetry (solid forms), 104  
Differential Thermal Analysis (liquid and solid forms), 104  
Superconductive Thermometric Fixed Point Device, 104  
Defining Fixed Point, International Temperature Scale of 1990, ITS-90 (solid forms), 105  
Defining Fixed Point Cells, International Temperature Scale of 1990, ITS-90, 105  
Reference Points (solid forms), 105  
Freezing Point, Melting Point, and Triple Point Cells (liquid and powder forms), 105  
Laboratory Thermometer (mercury in glass), 106  
Thermoelement Material, Platinum (wire form), 106  
Vapor Pressure of Metals (rod and wire forms), 106  
Thermal Conductivity of Graphite and Metals (rod form), 107  
Thermal Expansion of Metal Glass and Silica (rod form), 107  
Thermal Resistance of Glass, Silica, and Polystyrene (solid forms), 107

#### **204. Optical Properties, 108–111**

Molecular Absorption (film, filter, solid, and solution forms), 108  
Molecular Absorption (film, filter, solid, and solution forms) – Continued, 110  
Molecular Luminescence (solid form), 110  
Specular Spectral Reflectance (plate form), 110  
Infrared Reflectance (solid form), 111  
Diffuse Spectral Reflectance (wafer form), 111  
Optical Rotation (powder form), 111  
X-ray and Photography (chart and step tablet forms), 111

#### **205. Radioactivity, 112–116**

Radiation Dosimetry (wire form), 112  
Fission Track Glass (wafer form), 112  
Special Nuclear Materials, 112  
Radioactive Solutions, 113

Radiopharmaceuticals (solution and gaseous forms), 114  
Alpha Particle Point Sources, 114  
Carbon-14 Dating (solid form), 114  
Accelerator Mass Spectrometry (solution form), 115  
Gamma Ray Point Sources, 115  
Radon Emanation (encapsulated solution form), 115  
Natural Matrix Materials (powder form), 116

## **206. Electrical Properties, 117**

Electrical Resistivity and Conductivity of Metals  
(rod form), 117  
Electrical Resistivity and Conductivity of Silicon  
(block and wafer forms), 117  
Residual Resistivity Ratio (rod form), 117  
Superconducting Critical Current (wire form), 117

## **207. Metrology, 118–120**

Scanning Electron Microscope (SEM), 118  
Optical Microscope Linewidth Measurement  
(photomask), 118  
Depth Profiling (wafer form), 118  
Optoelectronics (solid forms), 119  
Chromium over Copper on Steel (plate form), 119  
Solder Thickness (plate form), 119  
Ellipsometry (wafer form), 120  
Oxygen Concentration in Silicon (wafer form), 120

## **208. Ceramics and Glasses, 121–122**

Chemical Resistance (Durability) of Glass  
(solid form), 121  
Electrical Properties of Glass (bar form), 121  
Viscosity of Glass (bar form), 121  
Glass Liquidus Temperature (solid form), 121  
Viscosity Fixpoints (solid forms), 122  
Relative Stress Optical Coefficient (bar form), 122  
Density and Refractive Index (solid form), 122

## **209. X-Ray Spectrometry, 123**

X-Ray Diffraction (powder and solid forms), 123  
X-Ray Stage Calibration (solid forms), 123

---

# ***Standard Reference Materials*** ***for*** ***ENGINEERING MATERIALS***

---

## **301. Sizing, 127–128**

Particle Size (powder and solid forms), 127  
Cement Turbidimetry and Fineness, 127  
Electrophoretic Mobility,  $\mu_E$  (suspension form), 128  
Surface Area of Powders, 128  
Particle Count Materials (powder and suspension forms), 128

## **302. Surface Finish, 129**

Microhardness (block form), 129  
Abrasive Wear (block form), 129  
Corrosion (plate form), 129  
Surface Roughness (block form), 129

## **303. Nondestructive Evaluation, 130**

Dye Penetrant Test Blocks, 130  
Artificial Flaw for Eddy Current NDE, 130  
Magnetic Particle Inspection, 130

## **304. Automatic Data Processing, 130**

Discontinued

## **305. Fire Research, 131**

Surface Flammability (sheet form), 131  
Smoke Density Chamber (sheet form), 131  
Smoke Toxicity (granular and sheet forms), 131  
Flooring Radiant Panel (sheet form), 131

## **309. Miscellaneous Performance**

### **Engineering Materials, 132–133**

Charpy V-Notch Test Blocks, 132  
Socketed Ball Bar, 132  
Coordinate Measuring Machine (CMM)  
Probe Performance, 132  
Tape Adhesion Testing (sheet form), 132  
Bleached Kraft Pulps (sheet form), 133





# Chemical Composition





# SRMs/RMs (by Technical Category)

## Standard Reference Materials for Chemical Composition

### 101. Ferrous Metals

#### Plain Carbon Steels (chip form)

These SRMs are for checking chemical methods of analysis. They consist of steel alloys selected to provide a wide range of analytical values for elements. They are furnished in 150-g units (unless otherwise noted) as chips usually sized between 0.4 mm to 1.2 mm, prepared from selected portions of commercial ingots.

SRM	Type	Elemental Composition (mass fraction, in %)				
		C	Mn	P	S	Si
8j	0.1C	0.081	0.505	0.095	0.077	0.058
11h	0.2C	0.200	0.510	0.010	0.026	0.211
12h	0.4C	0.407	0.842	0.018	0.027	0.235
13g	0.6C	0.613	0.853	0.006	0.031	0.355
14g	AISI 1078	0.735	0.456	0.006	0.019	0.232
15h	0.1C	0.076	0.373	0.005	0.019	0.008
16f	1.1C	0.97	0.404	0.014	0.026	0.214
19h	0.2C	0.215	0.393	0.016	0.022	0.211
20g	AISI 1045	0.462	0.665	0.012	0.028	0.305
152a	0.5C (Tin bearing)	0.486	0.717	0.012	0.030	0.202
178	0.4C	0.395	0.824	0.012	0.014	0.163
337a	1.1C (Carbon & Sulfur) (300 g)	0.969			0.024	
368	AISI 1211	0.089	0.82	0.084	0.132	0.007

SRM	Cu	Ni	Cr	V	Mo	Co	Ti	Sn	Al (total)	N
8j	0.020	0.113	0.047	0.015	0.038					
11h	0.061	0.028	0.025	0.001			0.004			
12h	0.073	0.032	0.074	0.003	0.006				(0.038)	0.006
13g	0.066	0.061	0.050	0.001					0.048	
14g	0.047	0.030	0.081	0.0008	0.011				0.025	
15h	0.013	0.017	0.018	<0.001	0.009				0.061	
16f	0.006	0.008	0.020	0.002	0.003	0.003				
19h	0.466	0.248	0.173	0.003	0.038				0.002	
20g	0.034	0.034	0.036	0.002	0.008				0.040	
152a	0.023	0.056	0.046	0.001	0.036			0.032		
178	0.032	0.010	0.016	0.001	0.003					
368	0.010	0.008	0.030	0.001	0.003					0.010

Values in parentheses are not certified and are given for information only.



# 101. Low Alloy Steels (chip form) [150-g units (unless otherwise noted)]

SRM	Type	Elemental Composition (mass fraction, in %)						
		C	Mn	P	S	Si	Cu	
					Grav	Comb		
30f	Cr-V (SAE 6150)	0.490	0.79	0.011		0.009	0.283	0.074
32e	Ni-Cr (SAE 3140)	0.409	0.798	0.008	0.022	0.021	0.278	0.127
33e	Ni-Mo (SAE 4820)	0.186	0.525	0.005		0.009	0.262	0.070
36b	Cr-Mo	0.114	0.404	0.007		0.019	0.258	0.179
72g	AISI 4130	0.278	0.492	0.009		0.014	0.223	0.011
100b	Manganese (SAE 340)	0.397	1.89	0.023	0.029	0.028	0.210	0.064
106b	Cr-Mo-Al (Nitalloy™ G)	0.326	0.506	0.008	0.016	0.017	0.274	0.117
125b	High Silicon	0.028	0.278	0.029		0.008	2.89	0.071
129c	High Sulfur (SAE 112)	0.125	0.769	0.076		0.245	0.020	0.013
131f	High Silicon	0.0035				0.000434*		
139b	Cr-Ni-Mo (AISI 8640)	0.403	0.778	0.013		0.019	0.242	0.097
155	Cr-W	0.905	1.24	0.015	0.010	0.011	0.322	0.083
163	Cr (100 g)	0.933	0.897	0.007		0.027	0.488	0.087
179	High Silicon	0.027	0.094	0.006		0.026	3.19	0.056
291	Cr-Mo (ASTM A213)	0.177	0.550	0.008		0.020	0.230	0.047
293	Cr-Ni-Mo (AISI 8620)	0.222	0.960	0.018		0.022	0.300	0.032
2171	Ni-Cr-Cu-Mo (HSLA 100)	0.066	0.73	0.006		0.0012	0.338	1.47

SRM	Ni	Cr	V	Mo	Sn	Al (total)	N
30f	0.070	0.945	0.182				0.010
32e	1.19	0.678	0.002	0.023	(0.011)		0.009
33e	3.36	0.068	(0.001)	0.224	(0.002)	0.030	
36b	0.203	2.18	0.004	0.996			
72g	0.016	0.905	0.003	0.170		(0.041)	(0.008)
100b	0.030	0.063	0.003	0.237			0.004
106b	0.217	1.18	0.003	0.199		1.07	
125b	0.038	0.019		0.008	0.003	0.329	Ca 0.0051
129c	0.251	0.014	0.012	0.002			
139b	0.510	0.488	0.004	0.182			0.007
155	0.100	0.485	0.014	0.039			W 0.517
163	0.081	0.982		0.029			0.007
179	0.050	0.022	<0.01	0.014	0.004	0.0028	
291	0.065	1.33		0.538		0.002	
293	0.480	0.510	0.004	0.204		0.039	
2171	3.35	0.550	0.003	0.546		0.019	Nb 0.024

Values in parentheses are not certified and are given for information only.

\*Value determined by isotope dilution mass spectrometric (IDMS) analysis.

**101. Special Low Alloy Steels (chip and pin forms)**  
[150-g units (unless otherwise noted)]

SRM	Type	Elemental Composition (mass fraction, in %)							
		C	Mn	P	S	Si	Cu	Ni	Cr
361	AISI 4340	0.383	0.66	0.014	0.0143	0.222	0.042	2.00	0.694
362	AISI 94B17 (mod.)	0.160	1.04	0.041	0.0360	0.39	0.50	0.59	0.30
363	Cr-V (mod.)	0.62	1.50	0.029	0.0068	0.74	0.10	0.30	1.31
364	High Carbon (mod.)	0.87	0.255	0.01	0.0250	0.065	0.249	0.144	0.063
2159	Carbon & Sulfur only (pin - 200 g)	0.016			0.0023				
2160	Carbon & Sulfur only (pin - 200 g)	0.584			0.012				
2165	E	0.0059	0.144	0.0052	0.0038	(0.004)	0.0013	0.155	0.050
2166	F	0.015	0.066	0.0012	0.0023	0.010	0.015	0.022	0.024
2167	G	0.051	0.022	0.0031	0.0091	0.026	0.0014	0.002	0.0015
2168	High-Purity Iron	0.0007	0.0006	0.0015	0.0010	(<5.0)*	0.0005	0.0012	0.0003

SRM	V	Mo	W	Co	Ti	As	Sn	Al (total)	Nb	Ta	Zr	N	Ca
361	0.011	0.19	0.017	0.032	0.020	0.017	0.010	0.021	0.022	0.020	0.009	(0.0037)	0.00010
362	0.040	0.068	0.20	0.30	0.097	0.092	0.016	0.083	0.29	0.20	0.19	(0.00404)	0.00021
363	0.31	0.028	0.046	0.048	0.050	0.010	0.104	0.24	0.049	(0.053)	0.049	(0.0041)	0.00022
364	0.105	0.49	0.10	0.15	0.24	0.052	0.008	(0.008)	0.157	0.11	0.068	(0.0032)	0.00003
2165	0.0040	0.0055		0.0012	0.0051	0.0010	0.002	(0.006)	0.0004	(0.004)			
2166	0.009	0.0035		0.0022	0.0007	0.0035	0.0010	0.012	0.005	(0.011)	(0.0004)		
2167	0.033	0.020		0.0050	0.010	0.0005	0.006	0.0045	0.0095	(0.002)	(0.004)		
2168	(<1.0)*	(<7.0)*	(<7.0)*	0.0006	(<3.0)*	(<1.0)*	(<1.0)*	(<5.0)*	(<5.0)*	(<1.0)*	(<5.0)*	0.0007	(<2.0)*

SRM	B	Pb	Sb	Bi	Ag	Se	Te	Ce	La	Nd	Fe
361		0.000025	0.0042	(0.0004)	0.0004	(0.004)	(0.0006)	0.0040	(0.001)	0.00075	(95.6)
362	0.0025	0.00048	0.013	(0.002)	0.0011	(0.0012)	(0.0005)	0.0019	(0.001)	0.00075	(95.3)
363		0.00186	0.002	(0.0008)	0.0037	(0.00016)	(0.0009)	0.0030	(0.002)	0.0012	(94.4)
364	0.0106	0.0230	0.034	(0.009)	(0.00002)	(0.00021)	(0.0002)	0.00057	(0.0002)	0.00018	(96.7)
2165	(0.0009)	0.0003	0.0010	(<0.0001)	0.0002	(0.0035)	(0.003)				
2166	(0.0004)	0.003	0.0005	(<0.0001)	0.0005	(0.0035)	(0.003)				
2167	(0.001)	(<0.0001)	0.0020	(<0.0001)	0.0007		(0.0003)				
2168	(<1.0)*	(<1.0)*	(<3.0)*	(<3.0)*		(<2.0)*	(<1.0)*				

SRM	Mg	Zn	Pr	Ge	O	H	Au	Hf	Sr
361	0.00026	(0.0001)	(0.0003)	[0.006]	(0.0009)	(<0.0005)	(<0.00005)	(0.0002)	(<0.0005)
362	0.00068	(0.00012)	(0.0003)	[0.002]	(0.00107)	(<0.0005)	(<0.00005)	(0.0003)	(<0.0005)
363	0.00062	(0.0004)	(0.0004)	[0.010]	(0.00066)	(<0.0005)	0.0005	(0.0005)	(<0.0005)
364	0.00016	[0.001]	(0.0001)	[0.003]	(0.0010)	(<0.0005)	0.0001	(0.0013)	(0.001)
2165	(<0.0001)								
2166	(<0.0001)								
2167	(<0.0001)								
2168	(<5.0)*	(<5.0)*			0.010	Cd (<1.0)*			

Values in parentheses are not certified and are given for information only.

Values in brackets are approximate values from heat analysis and are given for information only.

\*Value is in mg/kg.

## 101. High Alloy Steels (chip form) [150-g units (unless otherwise noted)]

SRM	Type	Elemental Composition (mass fraction, in %)					
		C	Mn	P	S	Si	Cu
					Comb		
126c	High Nickel (36% Ni)	0.025	0.468	0.004	0.005	0.194	0.040
344	Cr-Ni (Mo Precipitation Hardening)	0.069	0.57	0.018	0.019	0.395	0.106
345a	Cr-Ni (Cu Precipitation Hardening)	0.040	0.79	0.024	0.012	0.61	3.39
346a	Valve Steel	0.502	9.16	0.031	0.002	0.219	0.375
348a	High Temperature Alloy (A286) Ni-Cr	0.044	0.64	0.023	0.0007	0.43	0.14
862	High Temperature Alloy L605 (100 g)	0.120	1.59	0.002	0.0008	0.017	0.0010
868	High Temperature Alloy Fe-Ni-Co (100 g)	0.022	0.052	<0.003	0.0025	0.097	0.022

SRM	Ni	Cr	V	Mo	Co	Ti	Al (total)	Nb	Ta	B	Fe
126c	36.05	0.062	0.001	0.011	0.008						
344	7.28	14.95	0.040	2.40		0.076	1.16				
345a	4.27	15.52	0.080	0.43	0.099	(<0.01)	(<0.01)	0.27	(<0.01)	(<0.001)	N 0.031
346a	3.43	21.08	0.096	0.237	(0.05)	(<0.001)	(0.001)	(0.01)	Sn (0.008)	(<0.001)	N 0.442
348a	24.2	14.8	0.23	1.18	0.15	2.12	0.24	(0.07)	W (0.07)	0.0055	(55.2)
862	9.74	20.0	0.005	N 0.026	51.5	W 15.1	(<0.01)	(<0.005)	(<0.01)	(<0.0001)	1.80
868	37.78	0.077	0.077	0.014	16.1	1.48	0.99	2.99	0.003	0.0078	40.5

Values in parentheses are not certified and are given for information only.

## 101. Gases in Metals (rod form)

These SRMs are for determining hydrogen, oxygen, and nitrogen by vacuum fusion, inert gas fusion, and neutron activation methods.

SRM	Type	Oxygen (in mg/kg)	Hydrogen (in mg/kg)	Nitrogen (in mg/kg*)
1090	Ingot Iron	491		(60)
1091a	Stainless Steel (AISI 431)	132.2		(876)
1093	Valve Steel	60		
1094	Maraging Steel	4.5		(71)
*1095	Steel (AISI 4340)	9	(<5)	(37)
*1096	Steel (AISI 94B17)	10.7	(<5)	40.4
*1097	Cr-V Steel (mod.)	6.6	(<5)	(<11)
*1098	Steel (High Carbon)	10	(<5)	32
*1099	Electrolytic Iron	61	(<5)	(13)
1754	Low Alloy Steel (AISI 4320)	24		81

Values in parentheses are not certified and are given for information only.

\*These SRMs are sold **only** as a set designated SRM 1089.



## 101. Stainless Steels (chip form) [150-g units (unless otherwise noted)]

SRM	Type	Elemental Composition (mass fraction, in %)					
		C	Mn	P	S	Si	Cu
73c	Cr (SAE 420)	0.310	0.330	0.018	0.036	0.181	0.080
101g	AISI 304 L (100 g)	0.0136	0.085	0.007	0.0078	1.08	0.029
121d	Cr-Ni-Ti (AISI 321)	0.067	1.80	0.019	0.013	0.54	0.121
123c	Cr-Ni-Nb (AISI 348)	0.056	1.75	0.024	0.014	0.59	0.103
133c	Cr-Mo	In Prep					
160b	Cr-Ni-Mo (AISI 316)	0.044	1.64	0.020	0.016	0.509	0.172
166c	Carbon Only (100 g)	0.0078					
339	Cr-Ni-Se (SAE 303Se)	0.052	0.738	0.129	0.013	0.654	0.199
343a	Cr-Ni (AISI 431)	0.149	0.42	0.026	0.001	0.545	0.162
367	Cr-Ni (AISI 446)	0.093	0.315	0.018	0.016	0.58	
893	Cr (SAE 405)	0.027	0.378	0.022	0.0003	0.326	0.261
895	Cr-Mn (SAE 201)	0.066	7.09	0.038	0.0033	0.399	0.439

SRM	Ni	Cr	V	Mo	Co	Ti	Nb	Ta	Pb	Se	N
73c	0.246	12.82	0.030	0.091							0.037
101g	10.00	18.46	0.041	0.004	0.09						
121d	11.17	17.43		0.165	0.10	0.342					
123c	11.34	17.40		0.22	0.12		0.65	<0.001			
160b	12.26	18.45	0.047	2.38	0.101				0.001		0.039
339	8.89	17.42	0.058	0.248	0.096					0.247	
343a	2.16	15.64	0.056	0.164	(0.04)	(<0.001)	(0.01)	Al (0.001)	(<0.0001)	B (<0.001)	0.078
367	0.29	24.19	0.08								0.168
893	0.192	13.55	0.080	0.023	0.020	(0.01)	(<0.0005)	(<0.001)	(0.0001)	(<0.0001)	Al (0.20)
895	5.34	16.72	0.079	0.337	0.126	(<0.0004)	(<0.009)	(<0.001)	(0.0001)	(<0.0001)	W (0.03)

Values in parentheses are not certified and are given for information only.

## 101. Tool Steels (chip form) [150-g units]

SRM	Type	Elemental Composition (mass fraction, in %)					
		C	Mn	P	S	Si	Cu
50c	W-Cr-V	0.719	0.342	0.022	Grav 0.010	Comb 0.009	0.311 0.079
132b	Tool Steel (AISI M2)	0.864	0.341	0.012		0.004	0.185 0.088
134a	Mo-W-Cr-V	0.808	0.218	0.018	0.007	0.007	0.323 0.101
2172	S-7 Tool Steel	0.480	0.61	0.008		0.0031	0.263 0.083

SRM	Ni	Cr	V	Mo	W	Co	Sn	As	N
50c	0.069	4.13	1.16	0.082	18.44		0.018	0.022	0.012
132b	0.230	4.38	1.83	4.90	6.28	0.029			
134a	0.088	3.67	1.25	8.35	2.00				
2172	1.04	3.11	0.234	1.37					

Steel SRMs described in this and the following three pages are furnished in various forms. The 600 series is for microchemical methods of analysis, such as electron probe microanalysis and laser probe analysis. The 1100, 1200, and 1700 series are for optical emission and x-ray spectrometric methods of analysis. These materials have been prepared to ensure high homogeneity.

#### Nominal Sizes for Solid Steel SRMs:

600 Series: 3.2 mm diameter and 51 mm long.

1100 and 1200 Series: 31 mm diameter and 19 mm thick.

1700 Series: 34 mm diameter and 19 mm thick.

A "C" preceding the SRM number indicates a chill cast sample; 31 mm diameter and 19 mm thick.

## 101. Low Alloy Steels (disk and rod forms)

SRM	Type	Elemental Composition (mass fraction, in %)				
		C	Mn	P	S	Si
661	AISI 4340	0.392	0.66	0.015	0.015	0.223
663	Cr-V (mod.)	0.57	1.50	0.029	0.0055	0.74
664	High Carbon (mod.)	0.871	0.258	0.010	0.025	0.066
665	Electrolytic Iron	0.008	0.0057	0.0025	0.0059	0.0080
1134	High Silicon	0.026	0.277	0.028	0.009	2.89
1135	High Silicon	0.027	0.094	0.006	0.026	3.19
1218	High Silicon, Low Carbon & Sulfur	0.0029	0.014	(0.002)	0.0011	(3.2)
C1221	Resulfurized/Rephosphorized AISI 1211 (mod.)	0.020	0.102	0.090	0.112	0.876
1222	Cr-Ni-Mo (AISI 8640)	0.43	0.78	0.013	0.022	0.24
1224	Carbon (AISI 1078)	0.75	0.41	0.009	0.039	0.173
1225	Low Alloy (AISI 4130)	0.274	0.48	0.007	0.014	0.221
1226	Low Alloy	0.085	0.274	0.0022	0.0044	0.231
1227	Basic Open Hearth, 1% C	0.97	0.402	0.014	0.026	0.215
1228	0.1% C	0.072	0.365	0.004	0.018	0.007
1254	Low Alloy (Calcium only)	Ca 0.0053				
1261a	AISI 4340	0.391	0.67	0.016	0.015	0.228
1262b	AISI 94B17	0.160	1.05	0.044	0.037	0.40
1263a	Cr-V (mod.)	0.57	1.50	0.029	0.0055	0.74
1264a	High Carbon (mod.)	0.871	0.258	0.010	0.025	0.066
1265a	Electrolytic Iron	0.0067	0.0057	0.0011	0.0055	0.0080
1269	Line Pipe (AISI 1526 mod.)	0.298	1.35	0.012	0.0061	0.189
1270	Cr-Mo Low Alloy, A336 (F-22)	0.077	0.626	0.0065	0.0065	0.247
1271	Ni-Cr-Cu-Mo (HSLA 100)	0.064	0.73	0.005	0.0013	0.334
C1285	Low Alloy (A242 mod.)	0.058	0.332	0.072	0.020	0.36
1286	Low Alloy (HY 80)	0.196	0.152	0.008	0.017	0.130
1761	Low Alloy Steel	1.03	0.678	0.040	0.035	0.18
1762	Low Alloy Steel	0.337	2.00	0.034	0.030	0.35
1763	Low Alloy Steel	0.203	1.58	0.012	0.023	0.63
1764	Low Alloy Steel	0.592	1.21	0.020	0.012	0.057
1765	Low Alloy Steel	0.006	0.144	0.0052	0.0038	(0.004)
1766	Low Alloy Steel	0.015	0.067	0.002	0.0024	0.010
1767	Low Alloy Steel	0.052	0.022	0.0031	0.0090	0.026
1768	High-Purity Iron	0.0010	0.0014	0.0013	0.0003	(<10.0)*

Values in parentheses are not certified and are given for information only.

\*Value is in mg/kg.

# 101. Low Alloy Steels (disk and rod forms) – Continued

SRM	As	Sn	Al (total)	B	Pb	Ag	Ge
661	0.017	0.011	0.021	0.0005	0.000025	0.0004	[0.006]
663	0.010	(0.095)	0.024	0.0009	0.0022	(0.0038)	[0.010]
664	0.052	[0.005]	(0.008)	0.011	0.024	(0.00002)	[0.003]
665	(0.0002)	(<0.0005)	(0.0007)	0.00013	0.000015	(<0.00002)	(<0.0050)
1134		0.003	0.329				
1135		0.004	0.0028				
1218			0.005				
C1221			0.111				
1222			(0.038)				
1224			0.060				
1226		(0.003)	0.054		(0.0001)		
1227			(0.028)				
1228			0.061				
1261a	0.017	0.010	0.021		0.000025	0.0004	[0.006]
1262b	0.096	0.016	0.081	0.0025	0.0004	0.0011	[0.002]
1263a	0.010	0.104	0.24		0.0022	0.0037	[0.010]
1264a	0.052	(0.008)	(0.0080)	(0.011)	0.024	(0.000002)	[0.003]
1265a	(0.0002)	<2	(0.0007)	0.00013	0.000015	<0.2	<50
1269	(0.006)	(0.039)	0.016	(<0.0001)	0.005	(0.0002)	
1270	(0.02)	(0.02)	(0.005)	(0.0033)	(0.0016)	(0.0001)	
1271			0.020				
C1285	(0.022)	0.35	(0.12)				
1286	0.019	0.012	0.109	(0.006)	(0.0002)		
1761	0.011	(0.05)	0.06	0.0020			
1762	0.018	0.046	0.069	0.0049			
1763	0.055	0.011	0.043	0.0054			
1764	0.010	(0.02)	0.009	0.0010			
1765	0.0010	0.002	(0.006)	0.0009	0.0003	0.0002	
1766	0.0035	0.0010	0.012	0.00012	0.003	0.0005	
1767	0.0005	0.006	0.004	0.0010	(0.0001)	0.0008	
1768	(<1.0)*	(<1.0)*	0.0024	(<2.0)*	(<1.0)*		
SRM	O	N	H	Nb	Se	Ta	Zr
661	(0.0009)	(0.0037)	[<0.0005]	0.022	0.004	0.020	0.009
663	(0.0007)	(0.0041)	[<0.0005]	0.049	[0.0001]	(0.053)	0.050
664	[0.0017]	[0.003]	[<0.0005]	0.157	[0.0003]	0.11	0.069
665	(<0.0070)	(<0.0020)	(<0.0005)				
1218							(0.002)
C1221							(0.0017)
1222		(0.007)		(0.002)			(0.001)
1226				(0.005)			(0.010)
1227							(0.0006)
1261a	(0.0009)	(0.0037)	(<0.0005)	0.022	0.004	0.021	0.009
1262b	(0.0011)	(0.0040)	(<0.0005)	0.30	(0.0012)	0.20	0.22
1263a	(0.00066)	(0.0041)	(<0.0005)	0.049	(0.00016)	(0.053)	0.050
1264a	(0.0010)	(0.0032)	(<0.0005)	0.157	(0.00021)	0.11	0.069
1265a	<70	<20	<5				
1271				0.025			
C1285							(0.02)
1286				(0.012)			(0.021)
1761		0.0044		0.02		0.05	0.01
1762		0.0022		0.07		0.02	0.03
1763		0.0044		0.10		0.01	0.04
1764		0.0023		0.042		0.029	0.0015
1765		0.0010		0.0004	(0.0035)	(0.004)	(0.0002)
1766		0.0033		0.005	(0.0035)	(0.006)	(0.0004)
1767		0.0008		0.010		(0.002)	(0.004)
1768	0.036	0.002	Cd (<1.0)*	(<5.0)*	(<1.0)*	(<1.0)*	(<1.0)*

Values in parentheses are not certified and are given for information only.

Values in brackets are approximate values from heat analysis and are given for information only.

\*Value is in mg/kg.



# 101. Low Alloy Steels (disk and rod forms) – Continued

SRM	Cu	Ni	Cr	V	Mo	W	Co	Ti
661	0.042	1.99	0.69	0.011	0.19	0.017	0.032	0.020
663	0.098	0.32	1.31	0.31	0.30	0.046	0.048	0.050
664	0.250	0.142	0.066	0.106	0.49	0.102	0.15	0.23
665	0.0058	0.041	0.007	0.0006	0.005	(<0.0001)	0.007	0.0006
1134	0.070	0.038	0.019		0.008			
1135	0.056	0.050	0.022	<0.01	0.014			
1218	0.003	(0.002)	0.006	(<0.001)	(0.003)		(0.002)	(0.004)
C1221	0.041	0.067	0.049	(0.0007)	0.038		(0.010)	(0.0014)
1222	0.097	0.51	0.48	0.005	0.18		(0.016)	(0.002)
1224	0.072	0.054	0.071	0.002	0.013			
1225		0.018	0.91	0.004	0.166			
1226	0.125	5.42	0.467	0.0018	0.446	(0.005)	0.029	0.0021
1227	0.006	0.007	0.019	0.002	0.003	0.003	(0.0008)	
1228	0.012	0.018	0.016	<0.001	0.009			
1261a	0.042	2.00	0.693	0.011	0.19	0.017	0.032	0.020
1262b	0.51	0.59	0.30	0.041	0.070	0.20	0.57	0.100
1263a	0.098	0.32	1.31	0.31	0.030	0.046	0.048	0.050
1264a	0.250	0.142	0.066	0.106	0.49	0.102	0.15	0.24
1265a	0.0058	0.041	0.0072	0.0006	0.0050	<1	0.0070	(0.0001)
1269	0.095	0.108	0.201	0.004	0.036	(0.001)	(0.014)	(0.009)
1270	0.114	0.174	2.34	0.013	0.956	(0.003)	0.038	(0.003)
1271	1.48	3.34	0.552	0.003	0.543			
C1285	0.37	1.17	0.80	0.150	0.164	(0.03)	0.036	Ce (0.0021)
1286	0.043	2.81	1.53	0.0057	0.334	(0.13)	0.116	0.040
1761	0.30	1.99	0.220	0.053	0.103	(0.02)	(0.028)	0.18
1762	0.120	1.15	0.92	0.200	0.35	(0.01)	0.062	0.095
1763	0.043	0.51	0.50	0.30	0.50	(0.03)	0.095	0.31
1764	0.51	0.202	1.48	0.106	0.200	(<0.01)	(0.01)	0.028
1765	0.0013	0.154	0.051	0.0040	0.005		0.0012	0.0055
1766	0.015	0.021	0.024	0.009	0.0035	(0.001)	0.0020	0.0005
1767	0.0014	0.002	0.0015	0.033	0.020		0.0050	0.011
1768	0.0006	0.0014	(<2.0)*	(<1.0)*	(<3.0)*	(<2.0)*	0.0025	(<10.0)*
SRM	Au	Ce	Hf	La	Nd	Pr	Fe	
661	(<0.0005)	0.013	[0.00002]	0.0004	0.0003	(0.00014)	(95.6)	
663	0.0005	(0.0016)	[0.0015]	0.0006	(0.0007)	(0.00018)	(94.4)	
664	0.0001	(0.00025)	[0.005]	0.00007	(0.00012)	(0.00003)	(96.7)	
665							99.9	
1261a	(<0.00005)	0.0014	(0.0002)	0.0004	0.00029	(0.00014)	(95.6)	
1262b	(0.00005)	0.0019	(0.0003)	(0.0004)	0.0006	(0.00012)	(95.3)	
1263a	0.0005	0.0014	(0.0005)	0.0006	0.00060	(0.00018)	(94.4)	
1264a	0.0001	0.00022	(0.0013)	0.00007	0.00007	(0.00003)	(96.7)	
1265a							99.9	
1764							(95.2)	
1766		(0.002)						

Values in parentheses are not certified and are given for information only.

Values in brackets are approximate values from heat analysis and are given for information only.

\*Value is in mg/kg.

## 101. Low Alloy Steels (disk and rod forms) – Continued

SRM	Sb	Bi	Ca	Mg	Te	Zn
661	0.0042	0.0004	(<0.0001)	(0.0001)	0.0006	(0.0001)
663	0.002	(0.0008)	(<0.0001)	(0.0005)	(0.0022)	(0.0004)
664	(0.035)	(0.0009)	(<0.0001)	(0.0001)	[0.0002]	[0.001]
665	(<0.00005)	(<0.00001)	(<0.00001)	(<0.00002)	(<0.00001)	(<0.0003)
1261a	0.0042	0.0004	0.00002	0.00018	0.0006	(0.0001)
1262b	0.012	(0.002)	(0.0001)	0.0006	(0.001)	(0.0005)
1263a	0.002	(0.0008)	0.00013	0.00049	0.0009	(0.0004)
1264a	0.034	(0.0009)	0.00004	0.00015	0.00018	[0.001]
1265a						<3
C1285	(0.04)					
1765	0.0010	(<0.0001)		(<0.0001)	(0.003)	
1766	0.0005	(<0.0001)		(<0.0005)	(0.003)	
1767		(<0.0001)	(0.0003)	(<0.0001)	(0.0003)	
1768	(<1.0)*	(<4.0)*	(<1.0)*	(<6.0)*	(<1.0)*	(<1.0)*

Values in parentheses are not certified and are given for information only.

Values in brackets are approximate values from heat analysis and are given for information only.

\*Value is in mg/kg.

## 101. High Temperature Alloys (chip and disk forms)

SRM	Type	Unit Size (in g)	Elemental Composition (mass fraction, in %)						
			C	Mn	P	S	Si	Cu	
866	Incoloy™ 800	100	0.082	0.92	0.017	0.001	0.17	0.49	
867	Incoloy™ 825	100	0.021	0.39	0.018	0.002	0.32	1.74	
1230	A 286	disk	0.044	0.64	0.023	0.0007	0.43	0.14	
1246	Incoloy™ 800	disk	0.082	0.91	0.018	0.001	0.18	0.49	
1247	Incoloy™ 825	disk	0.021	0.38	0.018	0.002	0.32	1.75	
1250	Fe–Ni–Co	disk	0.022	0.052	<0.003	0.0025	0.097	0.022	
C2400	High Alloy Steel, ACI (17/4 PH)	disk	0.036	0.71	0.013	0.003	0.61	2.63	
C2401	High Alloy Steel (ACI–CD–4M Cu)	disk	0.062	1.03	0.025	0.027	0.74	3.17	

SRM	Ni	Cr	Mo	Co	Ti	Al	Nb	Ta	Fe	W	B
866	30.8	20.1	0.36	0.075	0.31	0.29	(0.09)		46.1		<0.001
867	43.5	23.4	2.73	0.089	0.75	0.062	(0.45)		26.6		0.002
1230	24.2	14.8	1.18	0.15	2.12	0.24	(0.07)	V 0.23	(55)	(0.07)	0.0055
1246	30.8	20.1	0.36	0.076	0.32	0.30	(0.09)		46.2		<0.001
1247	43.5	23.4	2.73	0.089	0.75	0.060	(0.46)		26.5		0.002
1250	37.78	0.077	0.014	16.1	1.48	0.99	2.99	0.003	40.5	V 0.077	0.0078
C2400	4.07	17.06	0.23	0.10			0.15	V 0.092		(0.1)	(0.0004)
C2401	5.46	25.1	2.13	0.19			(0.002)	V 0.20		(0.18)	(0.0004)

Values in parentheses are not certified and are given for information only.

## 101. Stainless Steels (disk form)

SRM	Type	Elemental Composition (mass fraction, in %)								
		C	Mn	P	S	Si	Cu	Ni	Cr	
C1151a	23Cr-7Ni	0.034	2.39	0.017	0.038	0.29	0.385	7.25	22.59	
C1152a	18Cr-11Ni	0.142	0.95	0.023	0.0064	0.64	0.097	10.86	17.76	
C1153a	17Cr-9Ni	0.225	0.544	0.030	0.019	1.00	0.226	8.76	16.70	
C1154a	19Cr-13Ni	0.100	1.44	0.06	0.051	0.53	0.44	13.08	19.31	
1155	Cr-Ni-Mo (AISI 316)	0.046	1.63	0.020	0.018	0.502	0.169	12.18	18.45	
1171	Cr-Ni-Ti (AISI 321)	0.067	1.80	0.018	0.013	0.54	0.121	11.2	17.4	
1172	Cr-Ni-Nb (AISI 348)	0.056	1.76	0.025	0.014	0.59	0.105	11.35	17.40	
1219	Cr-Ni (AISI 431)	0.149	0.42	0.026	0.001	0.545	0.162	2.16	15.64	
1223	Chromium Steel	0.127	1.08	0.018	0.329	0.327	0.081	0.232	12.64	
C1287	High Alloy (AISI 310 mod.)	0.36	1.66	0.029	0.024	1.66	0.58	21.16	23.98	
C1288	High Alloy (A-743)	0.056	0.83	0.023	0.010	0.41	3.72	29.3	19.55	
1295	Cr (SAE 405)	0.027	0.387	0.022	0.0003	0.321	0.260	0.194	13.52	
C1296	28Cr-3Mo (SAE 460)	0.038	0.256	0.024	0.013	0.66	0.056	0.373	27.90	
1297	Cr-Ni-Mn (SAE 201)	0.066	7.11	0.038	0.0033	0.397	0.442	5.34	16.69	

SRM	V	Mo	Co	Ti	N	Al	Nb	Ta	W	Pb	Zr
C1151a	0.040	0.79	0.033		(0.21)	(0.003)	(0.015)	(0.004)		0.0039	
C1152a	0.033	0.44	0.22		(0.055)	(0.004)	(0.15)	(0.001)		0.0047	
C1153a	0.176	0.24	0.127	(0.013)	(0.11)	(0.004)	(0.48)	(0.03)		0.006	(0.0001)
C1154a	0.135	0.068	0.38	(0.004)	(0.077)		(0.22)	(0.045)		0.017	(0.001)
1155	0.047	2.38	0.101							0.001	
1171		0.165	0.10	0.34							
1172		0.22	0.12				0.65	<0.001			
1219	0.056	0.164	(0.04)	(<0.001)	0.078	(0.001)	(0.01)	Sn (0.008)	(0.02)	(<0.0001)	B (<0.001)
1223	0.068	0.053	Mg (<0.0005)	(0.05)	(0.05)	(<0.005)		Sn (0.004)	Ca (<0.0005)		(0.0001)
C1287	0.09	0.46	0.31	0.050	(0.034)	(0.06)	(0.07)	O (0.017)		0.008	(0.006)
C1288	0.086	2.83	0.10	0.012	(0.028)	(0.0025)	(0.22)	O (0.029)	(0.2)	0.0041	(0.002)
1295	0.082	0.023	0.020	(0.01)	Sn (0.02)	(0.20)	(<0.0005)	(<0.001)	(0.002)	(0.0001)	As (0.006)
C1296	0.134	3.43	0.026	0.23	Sn (<0.01)	0.035	0.20	(<0.001)	(<0.01)	(<0.001)	As (<0.01)
1297	0.080	0.331	0.127	(<0.0004)	Sn (<0.010)	(0.003)	(<0.009)	(<0.001)	(0.03)	(<0.0001)	As (0.005)

Values in parentheses are not certified and are given for information only.

## 101. Specialty Steels (disk form)

SRM	Type	Elemental Composition (mass fraction, in %)											
		C	Mn	P	S	Si	Cu	Ni	Cr	V	Mo	W	Co
1157	Tool (AISI M2)	0.836	0.34	0.011	0.004	0.18	0.088	0.228	4.36	1.82	4.86	6.28	0.028
1158	High Nickel (Ni 36)	0.025	0.468	0.004	0.005	0.194	0.039	36.03	0.062	0.001	0.010		0.008
1233	Valve Steel	0.502	9.16	0.031	0.002	0.219	0.375	3.43	21.08	0.096	0.237	(0.01)	
1772	Tool (S-7)	0.447	0.61	0.008	0.0031	0.264	0.083	0.105	3.10	0.236	1.38		



## 101. Steelmaking Alloys (powder form)

These SRMs are for checking chemical methods of analysis for major constituents and selected minor elements. They are furnished as fine powders (usually <0.1 mm).

SRM	Type			Unit Size (in g)	Elemental Composition (mass fraction, in %)							
					C	Mn	P	S	Si	Cu	Ni	O
57a	Silicon Metal			60	0.024	0.015	0.003	0.003	98.55	0.004	0.008	(~0.3)
58a	Ferrosilicon (73% Si- Regular Grade)			75	0.014	0.16	0.009	<0.002	73.20	0.024	0.012	(0.20)
59a	Ferrosilicon			50	0.046	0.75	0.016	0.002	48.10	0.052	0.033	
64c	Ferrochromium, High Carbon			100	4.68	0.16	0.020	0.067	1.22	0.005	0.43	
68c	Ferromanganese, High Carbon			100	6.72	80.04	0.19	0.008	0.225			
90	Ferrophosphorus			75			26.2					
195	Ferrosilicon (75% Si- High-Purity Grade)			75	0.034	0.17	0.017	0.001	75.3	0.047	0.032	(0.42)
196	Ferrochromium, Low Carbon			100	0.035	(0.282)	0.020	0.003	0.373			
347	Magnesium Ferrosilicon			100	0.017	0.53	0.023	0.005	47.6	0.065	0.082	
689	Ferrochromium Silicon			100	0.043	0.32	0.026	0.002	39.5	0.013	0.20	(0.06)
SRM	Cr	V	Mo	Ti	Al	Nb	Zr	Ca	Fe	B	As	
57a	0.024	0.013	Pb<0.001	0.040	0.47		0.002	0.17	0.50	0.001	<0.001	
58a	0.020	(0.002)	(0.01)	0.051	0.95	Co <0.01	0.002	0.30	25.23	0.0010	(0.0020)	
59a	0.080				0.35			0.042	50.05	0.058		
64c	68.00	0.15		0.02		Co 0.051		N 0.045	24.98			
68c	0.074								12.3		0.021	
90												
195	<0.01	(0.001)	(0.01)	0.037	0.046	Co <0.01	0.011	0.053	23.6	0.0010	(0.0024)	
196	70.83	(0.12)										
347	0.14			0.036	0.78		Co 0.004	0.81	Mg 4.49	Ce 0.45	La 0.26	
689	36.4	0.09	Pb(0.004)	0.40	0.049	Co 0.034	Bi (<0.003)	N (0.002)	23.2	0.0017	(0.009)	

Values in parentheses are not certified and are given for information only.

## 101. Cast Irons (chip form)

These SRMs are furnished in 150-g units (unless otherwise noted) for use in checking chemical methods of analysis.

SRM	Type	Elemental Composition (mass fraction, in %)							
		C	Mn	P	S	Si	Cu		
		Total	Graphitic			Grav	Comb		
4L	Cast	3.21	2.66	0.825	0.149		0.043	1.33	0.240
5m	Cast	2.59		0.74	0.32		0.133	1.83	0.89
6g	Cast	2.85	2.01	1.05	0.557		0.124	1.05	0.502
7g	Cast (High Phosphorus)	2.69	2.59	0.612	0.794	0.061	0.060	2.41	0.128
82b	Cast (Ni-Cr)	2.85	2.37	0.745	0.025		0.007	2.10	0.038
107c	Cast (Ni-Cr-Mo)	2.99	1.98	0.480	0.079		0.059	1.21	0.205
115a	Cast (Cu-Ni-Cr)	2.62	1.96	1.00	0.086	0.064	0.065	2.13	5.52
122i	Cast	3.47		0.530	0.28		0.087	0.89	0.033
334	Gray Cast (Carbon & Sulfur)	2.83					0.043		
338	White Cast (Carbon & Sulfur)	3.33					0.015		
341	Ductile	1.81	1.23	0.92	0.024	0.007	0.007	2.44	0.152
342a	Nodular	1.86	1.38	0.274	0.019		0.006	2.73	0.135
890	HC 250+V	2.91		0.62	0.025		0.015	0.67	0.055
891	Ni-Hard, Type I	2.71		0.55	0.038		0.029	0.56	0.150
892	Ni-Hard, Type IV	3.33		0.76	0.054		0.015	1.83	0.270

SRM	Ni	Cr	V	Mo	Co	Ti
4L	0.042	0.118	0.024	0.040	Zn(<0.001)	(0.03)
5m	0.041	0.080	0.033	0.029		0.097
6g	0.135	0.370	0.056	0.035		0.059
7g	0.120	0.048	0.010	0.012		0.044
82b	1.22	0.333	0.027	0.002		0.027
107c	2.20	0.693	0.015	0.83		0.019
115a	14.49	1.98	0.014	0.050		0.020
122i	0.047	0.151	0.012	0.008		0.024
341	20.32	1.98	0.012	0.010		0.018
342a	0.058	0.034		0.006		0.020
890	0.397	32.4	0.45	0.018	(0.03)	
891	4.48	2.23	0.039	0.27	0.19	(0.01)
892	5.53	10.18	0.041	0.20	0.31	(0.02)

SRM	As	Sn	Al (total)	Mg	N	Fe
4L	(0.03)	(0.004)	(0.004)	Sb (<0.001)	(0.0016)	Pb (0.001)
5m					0.006	
6g	0.042				0.005	
7g	0.014				0.004	
341				0.068		
342a				0.070		
890	(0.008)		(<0.01)		(0.089)	(61.8)
891	(0.004)	(<0.01)	(0.008)		(0.012)	(88.5)
892	(0.006)	(0.02)	(0.009)		(0.019)	(77.4)

Values in parentheses are not certified and are given for information only.

## 101. Cast Steels, White Cast Irons, and Ductile Irons (disk form)

These SRMs are for analysis of cast steels and cast irons by rapid instrumental methods.

SRM	Type	Elemental Composition (mass fraction, in %)							
		C	Mn	P	S	Si	Cu	Ni	Cr
C1137a	White Cast Iron	2.86	0.52	0.087	0.017	1.15	0.192	2.17	0.643
1138a	Cast Steel (No. 1)	0.118	0.35	0.035	0.056	0.25	0.09	0.10	0.13
1139a	Cast Steel (No. 2)	0.790	0.92	0.012	0.013	0.80	0.47	0.98	2.18
C1145a	White Cast Iron	2.92	0.187	0.215	0.191	0.271	0.46	0.62	0.63
C1173	Cast Steel 3	0.453	0.174	0.031	0.092	1.38	0.204	4.04	2.63
1173	Ni–Cr–Mo–V Steel	0.423	0.19	0.033	0.092	1.28	0.204	4.06	2.70
C1290	High Alloy (HC–250+V)	3.04	0.66	0.030	0.013	0.971	0.065	0.917	30.5
C1291	High Alloy (Ni–Hard, Type I)	2.67	1.14	0.028	0.032	1.34	0.26	4.34	2.78
C1292	High Alloy (Ni–Hard, Type IV)	3.47	0.55	0.049	0.016	0.59	0.36	5.04	11.4
C2423	Ductile Iron A	3.76	0.98	0.27	(0.0006)	1.67	1.55	0.146	0.322
C2423a	Ductile Iron B	3.66	0.91	0.246	(<0.001)	1.59	1.61	0.147	0.322
C2424	Ductile Iron C	2.68	0.268	0.041	0.024	3.37	0.125	0.061	0.13
C2424a	Ductile Iron D	2.76	0.207	0.034	0.016	3.30	0.099	0.045	0.15

SRM	V	Mo	Ti	As	Al	Co			
C1137a	0.019	0.86	(0.04)		(0.007)	Mg 0.032	Ce0.016		
1138a	0.020	0.05	(0.0012)	(<0.005)	(0.067)	Fe (98.7)			
1139a	0.26	0.51	(0.004)	(<0.005)	(0.13)	Fe (93.0)			
C1145a	0.112	0.48	0.012	(0.02)	(0.04)		0.058		
C1173	0.42	1.46	0.037	(0.02)	(0.005)	Pb (0.0006)	(0.064)		
1173	0.42	1.50	(0.015)			Nb (0.045)	(0.064)		
C1290	0.442	(0.041)							
C1291	0.031	0.32							
C1292	0.041	0.25							
C2423	0.048	0.155	0.10		(0.09)		(0.02)		
C2423a	0.043	0.159	0.10		(0.08)		(0.02)		
C2424	0.083	0.019	0.050		(<0.01)		(0.05)		
C2424a	0.081	0.019	0.045		(<0.01)		(0.05)		

SRM	Mg	Ce	La	B
C2423	0.058	0.036	0.011	(0.01)
C2423a	0.076	0.031	0.0042	(0.01)
C2424	0.006	0.0046	0.0011	(0.002)
C2424a	0.014	0.0053	0.0010	(0.001)

Values in parentheses are not certified and are given for information only.



## 102. Nonferrous Metals

### Aluminum Base Alloys (chip and disk forms)

These SRMs are for analyses of casting and other aluminum alloys by chemical and instrumental methods. SRMs 1710 through 1719 are specially prepared to include low levels of cadmium and lead encountered in the analysis of recycled aluminum.

SRM	Type	Unit Size (in g)	Elemental Composition (mass fraction, in %)						
			Mn	Si	Cu	Ni	Cr	V	Cd
87a	Al-Si	75	0.26	6.24	0.30	0.57	0.11	<0.01	
855a	Casting Alloy 356	30	0.057	7.07	0.13	0.016	0.013	(0.012)	Mn 0.060
856a	Casting Alloy 380 (fine millings)	30	0.35	9.21	3.51	0.37	0.055		
858	Alloy 6011	35	0.48	0.79	0.84	0.0006	0.0011	0.0030	
859	Alloy 7075	35	0.078	0.17	1.59	0.063	0.176	0.0082	
1258	Alloy 6011	disk	0.48	0.78	0.84	0.0006	0.0011		
1259	Alloy 7075	disk	0.079	0.18	1.60	0.063	0.173		
1710	Alloy 3004	disk							0.000843
1711	Alloy 3004	disk							0.002090
1712	Alloy 3004	disk							0.005165
1713	Alloy 5182	disk							0.000878
1714	Alloy 5182	disk							0.002013
1715	Alloy 5182	disk							0.00502

SRM	Ti	Sn	Ga	Fe	Pb	Mg	Zn	Zr	Be
87a	0.18	0.05	0.02	0.61	0.10	0.37	0.16		
855a	0.15	0.010	Sr 0.018	0.14	0.019	0.37	0.085	(0.003)	Ca (0.001)
856a	0.068	0.10		0.92	0.10	0.061	0.96		
858	0.042			0.078		1.01	1.04		<0.0001
859	0.041			0.202		2.45	5.46		0.0026
1258	(0.04)		(0.010)	0.079		0.98	1.03		<0.0001
1259	(0.04)		(0.022)	0.205		2.48	5.44		0.0025
1710					0.00177				
1711					0.00639				
1712					0.01559				
1713					0.001712				
1714					0.00653				
1715					0.01509				

Values in parentheses are not certified and are given for information only.

### 102. Cobalt Base Alloys (chip and disk forms)

SRM	Type	Elemental Composition (mass fraction, in %)							
		C	Mn	P	S	Si	Cu		
862	High Temperature Alloy L605—(chip) (100 g)	0.120	1.59	0.002	0.0008	0.017	0.0010		
1242	High Temperature Alloy L605—(disk)	0.126	1.58	0.002	0.0007	0.016	0.0010		

SRM	Ni	Cr	V	Fe	W	Co	N	Al	Ta	Nb	B
862	9.74	20.0	0.005	1.80	15.1	51.5	0.026	(<0.01)	(<0.01)	(<0.005)	(<0.0001)
1242	9.78	20.0	0.005	1.80	15.1	51.5	0.026	(<0.01)	(<0.01)	(<0.005)	(<0.0001)

Values in parentheses are not certified and are given for information only.

## 102. Copper Base Alloys (chip and rod forms)

SRM	Type	Unit Size (in g)	Elemental Composition (mass fraction, in %)				
			Cu	Ni	Fe	Zn	Pb
158a	Bronze, Silicon	150	90.93	0.001	1.23	2.08	0.097
458	Beryllium-Copper (17510)	50	(97.9)	1.60	0.060	0.002	0.002
459	Beryllium-Copper (17200)	50	(97.7)	0.039	0.079	0.002	0.001
460	Beryllium-Copper (17300)	50	(97.5)	0.031	0.098	0.004	0.258
871	Bronze, Phosphor (CDA 521)	100	91.68		<0.001	0.025	0.010
872	Bronze, Phosphor (CDA 544)	100	87.36		0.003	4.0	4.13
874	Cupro-Nickel, 10% (CDA 706) "High-Purity"	100	88.49	10.18	1.22	0.002	<0.0005
875	Cupro-Nickel, 10% (CDA 706) "Doped"	100	87.83	10.42	1.45	0.11	0.0092
879	Nickel Silver (CDA 762)	100	57.75	12.11	0.0020	30.04	0.002
880	Nickel Silver (CDA 770)	100	54.51	18.13	0.004	27.3	0.002
1034	Unalloyed Copper	rod	(99.96)	(0.6)*	(2.0)*	(<11)*	(0.5)*
1035	Leaded-Tin Bronze Alloy	50	(78.5)	(0.75)	(0.001)	(0.25)	(13.5)

SRM	Mn	Sb	Sn	Cr	P	Ag	Si	Al	Te	Cd	Se
158a	1.11		0.96		0.026		3.03	0.46			
458	(<0.002)	(<0.005)	0.004	0.004		(<0.01)	0.035	0.030			
459	(<0.003)	(<0.005)	0.005	0.005		(<0.003)	0.077	0.044			
460	(<0.003)	(<0.005)	0.006	0.005		(<0.002)	0.77	0.048			
871			8.14		0.082						
872			4.16		0.26						
874	0.0020	<0.001	0.007		0.002		(0.0006)			<0.0002	0.00015
875	<0.0007	<0.001	0.009		0.0020		(0.0008)		(<0.0001)	0.0022	0.0004
879	<0.001										
880	<0.001										
1034	(<0.1)*	(0.2)*	(<0.2)*	(0.3)*		(8.1)*	(<2)*	(<2)*	(0.5)*	(<1)*	(3.3)*
1035			(6.8)		(0.004)						

SRM	Bi	O	Co	C	Au	H	S	As	Mg	Ti
458			0.076	Be 0.360			(<0.002)	Zr (<0.002)	0.003	(<0.002)
459			0.221	Be 1.82			(<0.001)	Zr (<0.002)	0.007	(<0.003)
460			0.217	Be 1.86			(<0.001)	Zr (<0.002)	0.005	(<0.003)
874	<0.0002	(0.06)		(0.0023)		(0.0016)	(0.0011)	(<0.0006)	(0.0002)	(0.0001)
875	0.003	(0.14)		(0.0035)		(0.004)	(0.0011)	(0.0010)	(0.0010)	(<0.0002)
1034	(0.2)*	(363)*	(0.2)*		(<0.05)*		2.8*	(0.2)*	(<1*)	
1035		(0.64)					22.3**			

Values in parentheses are not certified and are given for information only.

\*Value is in mg/kg.

\*\*Sulfur value is in mg/kg.

## 102. Copper Base Alloys (block and disk forms)

The SRMs with a "C" prefix are chill-cast blocks, 31 mm square and 19 mm thick; the others are wrought disks, 31 mm in diameter and 19 mm thick. Both forms have nearly identical elemental compositions.

SRM	Type	Elemental Composition (mass fraction, in %)							
		Cu	Zn	Pb	Fe	Sn	Ni	Al	Sb
1104	Free-Cutting Brass	61.33	35.31	2.77	0.088	0.43	0.070		
1107	Naval Brass B	61.21	37.34	0.18	0.037	1.04	0.098		
1108	Naval Brass C	64.95	34.42	0.063	0.050	0.39	0.033		
1110	Red Brass B	84.59	15.20	0.033	0.033	0.051	0.053		
1111	Red Brass C	87.14	12.81	0.013	0.010	0.019	0.022		
1112 C1112	Gilding Metal A	93.38	6.30	0.057	0.070	0.12	0.100		
1113 C1113	Gilding Metal B	95.03	4.80	0.026	0.043	0.064	0.057		
1114 C1114	Gilding Metal C	96.45	3.47	0.012	0.017	0.027	0.021		
1115 C1115	Commercial Bronze A	87.96	11.73	0.013	0.13	0.10	0.074		
1116 C1116	Commercial Bronze B	90.37	9.44	0.042	0.046	0.044	0.048		
1117 C1117	Commercial Bronze C	93.01	6.87	0.069	0.014	0.021	0.020		
C1122	Beryllium-Copper	97.45	(0.01)	(0.003)	0.16	(0.01)	(0.01)	0.17	
1276a	Cupro-Nickel (CDA 715)	67.8	0.038	0.004	0.56	0.023	30.5		0.0004
SRM		Be	Cd	Mn	P	Si		Ag	
1104					0.005				
C1106				0.005					
1108 C1108				0.025					
1112 C1112					0.009				
1113 C1113					0.008				
1114 C1114					0.009				
1115 C1115					0.005				
1116 C1116						0.008			
1117 C1117					0.002				
C1122	1.75			(0.004)	(0.004)	0.17		(0.005)	
1276a			0.0002	1.01	0.006				
SRM		Co		Cr		Se		Mg	
C1122		0.220		(0.002)					
1276a		0.045				0.0005		0.12	

Values in parentheses are not certified and are given for information only.



**102. Copper “Benchmark” (chip and rod forms)**  
[150-g units (unless otherwise noted)]

SRM		Type	Cu (mass fraction, in %)	Elemental Composition (in mg/kg)							
Chip	Rod			Sb	As	Bi	Cr	Co	Fe	Pb	Mn
393		Unalloyed Copper “O”	99.998	0.25	0.41	<0.1	<0.5	0.02	<1	0.039	<0.01
	494	Unalloyed Copper I	99.908	4.5	2.6	0.35	2.0	0.5	147	26.5	3.7
395	495	Unalloyed Copper II	99.944	8.0	1.6	0.50	6.0		96	3.25	5.3
396	496	Unalloyed Copper III	99.955	<1	<0.2	0.07	4.3	0.4	143	0.41	7.5
	457	Unalloyed Copper IV	99.96	0.2	0.2	0.2	(0.3)	(0.2)	2.0	0.5	<0.1
398		Unalloyed	99.98	7.5	25	2.0	(0.3)	2.8	11.4	9.9	(0.3)
	498	Copper V	99.98	7.4	25	2.0	(0.3)	2.7	11	10	(0.3)
399	499	Unalloyed Copper VI	99.79	30	47	10.5	(0.5)	0.5	20.0	114	(0.3)
400	500	Unalloyed Copper VII	99.70	102	140	24.5	(0.5)	0.6	41	128	(0.2)
	C1252	Phosphorized Copper IX	99.89	42	115	21	7.4	90	(35)	60	(17)
454 (35 g)		Unalloyed Copper XI	99.84	24	46	19		(4)	(50)	66	

SRM		Ni	Se	Ag	S	Te	Sn	Zn	Al	Cd	Au	Mg
393		0.05	<0.05	0.10	<1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1
	494	11.7	2.00	50.5	15	0.58	70	405	(<2)	(0.5)	(0.07)	(<1)
395	495	5.4	0.63	12.2	13	0.32	1.5	12.2	(<2)	(0.4)	(0.13)	(<1)
396	496	4.2	0.62	3.30	9.5	(0.02)	0.8	5.0	(<2)	(0.6)	(<0.05)	(<1)
	457	0.6	4.2	8.1	(4)	0.29	<0.2	<11	(<2)	(<1)	(<0.05)	(<1)
398		7.0	17.5	20.1	(11)	10.1	4.8	24	(<2)	(22)	(0.1)	(<1)
	498	7.0	17.5	20.1	(11)	10.1	5	25	(<2)	(<22)	(0.1)	(<1)
399	499	506	95	117	(10)	50	(~90)	45	(<2)	(<1)	(4)	(<1)
400	500	603	214	181	(9)	153	(~200)	114	(<2)	(<1)	(10)	(<1)
	C1252	128	53.6	166.6	(29)	51	(110)	60	(7)	14	34.9	(20)
454	(150)	479	286			27	2.2	7			7.5	

SRM		Si	Be	B	Ca	Li	Pd	P	Ti	Zr
393	494	<0.5	<0.01	<0.01	<0.05	<0.01	<0.05	<0.05	<0.5	<0.5
	494	(<2)								
395	495	(<2)								
396	496	(<2)								
398		(<2)								
	498	(<2)								
399	499	(<2)								
400	500	(<2)								
	C1252	(13)	(<5)		(6)	(0.03)				
454							(0.1)			

Values in parentheses are not certified and are given for information only.

The following four series of SRMs were produced through a cooperative program between NIST and the Institute for Non-Ferrous Metals (IMN), Gliwice, Poland and funded under the auspices of the Second Maria Sklodowska-Curie Fund. Development, characterization and certification of these brasses were carried out by IMN; homogeneity testing was performed by NIST. SRMs 1776 through 1280 are in the form of disks approximately 39.5 mm diameter and 20 mm thick; SRMs 1781 through 1785 are in the form of disks 39 mm diameter and 19 mm thick; SRMs 1786 through 1790 are in the form of disks 39 mm diameter and 25 mm thick; SRMs 1791 through 1795 are in the form of disks 38 mm diameter and 24 mm thick.

**NOTE:** Certification data for the Free Cutting Brasses, and Gilding Metals are concurrently undergoing review at the IMN and NIST. Therefore, when the Certificates of Analysis for these materials are issued, the actual certified values may differ from the "projected" values listed below.

## 102. Naval Brass (disk form)

SRM	Type	Elemental Composition (mass fraction, in %)				
		Cu	Pb	Fe	Sn	Ni
1776	Naval Brass WK1	59.97	0.17	0.28	0.11	0.28
1777	Naval Brass WK2	60.56	0.33	0.16	1.34	0.21
1778	Naval Brass WK3	62.10	0.11	0.06	0.49	0.13
1779	Naval Brass WK4	63.28	0.05	0.08	1.04	0.07
1780	Naval Brass WK5	64.92	0.006	0.01	0.47	0.005

SRM	Al	Sb	Mn	P	Si	Bi
1776	0.11	0.024	0.12	0.030	0.30	0.014
1777	0.08	0.019	0.09	0.018	0.23	0.012
1778	0.04	0.013	0.04	0.018	0.15	0.009
1779	0.01	0.006	0.02	0.011	0.08	0.005
1780	0.004	0.002	0.006	0.006	0.006	0.001

## 102. Free Cutting Brass (disk form) [See Note above.]

SRM	Type	Elemental Composition (mass fraction, in %)					
		Pb	Sn	Mn	Al	Fe	Si
1781	Free Cutting Brass WN1	0.51	1.00	0.57	0.33	0.23	0.16
1782	Free Cutting Brass WN2	1.58	0.68	0.73	0.24	0.29	0.22
1783	Free Cutting Brass WN3	2.62	0.39	0.39	0.14	0.062	0.12
1784	Free Cutting Brass WN4	0.86	0.13	0.13	0.047	0.11	0.036
1785	Free Cutting Brass WN5	3.78	0.019	0.0020	(0.0004)	0.0085	(0.0013)

SRM	P	Sb	Bi	As	Ni	Cu
1781	0.031	0.099	0.023	0.035	0.050	57.97
1782	0.051	0.10	0.035	0.011	0.19	60.38
1783	0.034	0.020	0.020	0.032	0.098	62.32
1784	0.014	0.061	0.0094	0.021	0.050	57.97
1785	0.0051	0.0035	0.0028	0.030	0.0049	64.36

## 102. Cartridge Brass (disk form) [See Note above.]

SRM	Type	Elemental Composition (mass fraction, in %)							
		Fe	Pb	Ni	Mn	Cd	Sb	Sn	
1786	Cartridge Brass MH1	0.017	0.0065	0.26	0.035	0.026	0.0004	0.14	
1787	Cartridge Brass MH2	0.027	0.021	0.22	0.011	0.018	0.024	0.097	
1783	Cartridge Brass MH3	0.081	0.078	0.10	0.085	0.0089	0.013	0.024	
1788	Cartridge Brass MH4	0.13	0.33	0.052	0.0017	0.0029	0.017	0.011	
1780	Cartridge Brass MH5	0.19	0.20	0.0072	0.072	0.0012	0.0035	0.0021	

SRM	Ag	As	Bi	P	S	Al	Te	Be	Si	Cu
1786	0.0029	0.067	0.0037	0.016	(0.0020)	0.0010	0.0004	0.0088	0.074	65.93
1787	0.011	0.041	0.0022	0.0055	(0.0068)	0.019	0.0015	0.0015	0.054	68.25
1788	0.0065	0.016	0.0011	0.0035	(0.013)	0.0081	0.0046	0.0003	0.031	71.28
1789		0.0011	0.0006	0.0022	(0.0054)	0.0027	0.0035	0.0045	0.016	69.94
1790	0.025	0.0038		0.0011	(0.025)	0.014	0.0047	0.00004	0.0039	72.87



## 102. Gilding Metal (disk form) [See Note on previous page.]

SRM	Type	Elemental Composition (mass fraction, in %)							
		Fe	Pb	Ni	Mn	Cd	Sb	Sn	
1791	Gilding Metal MI1	0.25	0.0060	0.0059	0.0030	0.023	0.000044	0.15	
1792	Gilding Metal MI2	0.16	0.016	0.018	0.0081	0.016	0.0019	0.10	
1793	Gilding Metal MI3	0.086	0.042	0.073	0.035	0.011		0.067	
1794	Gilding Metal MI4	0.041	0.070	0.14	0.050	0.0054	0.00067	0.013	
1795	Gilding Metal MI5	0.015	0.096	0.25	0.069	0.0012	0.0096	0.0040	

SRM	Ag	As	Bi	P	S	Al	Te	Be	Si	Zn	Cu
1791	0.0038	0.072	0.00063	0.028	0.043	0.040	0.0065	0.000091	0.0032	3.57	95.69
1792	0.0090	0.054	0.00056	0.022	0.049	0.055	0.011	0.00085	0.012	6.19	93.35
1793	0.020	0.034	0.0026	0.015	0.023	0.015	0.0031	0.0019	0.031	8.01	91.46
1794	0.026	0.0031	0.0026	0.0073	0.012	0.0079	0.0021	0.0065	0.060	11.13	88.35
1795	0.033	0.015	0.0043	0.0026	0.0019	0.0021		0.0072	0.082	4.44	94.71

## 102. Lead Base Alloys (chip and disk forms) [150-g units (unless otherwise noted)]

SRM		Type	Elemental Composition (mass fraction, in %)							
Chip	Disk		Cu	Ni	As	Sn	Sb	Bi	Ag	Fe
1129 (200 g)		Solder 63Sn-37Pb	0.16	0.010	0.055	62.7	0.13	0.13	0.075	
127b	1131	Solder 40Sn-60Pb	0.011	0.012	0.01	39.3	0.43	0.06	0.01	
53e	1132	Bearing Metal(Pb-Sb-Sn)	0.054	0.003	0.057	5.84	10.26	0.052		<0.001

## 102. Lead Base Material (disk form)

These SRMs are issued in the form of disks, 50 mm in diameter and 16 mm thick. They are intended for use with optical emission spectrometric methods of analysis.

SRM	C2415		C2416	C2417		C2418
Type	Battery Lead		Bullet Lead	Lead Base Alloy		High Purity Lead
Elemental Composition (mass fraction, in %)						
Sb	2.95		0.79	0.010		(<0.0001)
As	0.20		0.056	0.011		(<0.0001)
Bi	0.054		0.10	0.010		(<0.0005)
Cu	0.095		0.065	0.010		(<0.0001)
S	0.0026		0.0015	(<0.0005)		
Ag	0.002		0.0044	0.010		0.0001
Sn	0.33		0.09	(<0.010)		(<0.0005)
Al	(<0.0003)		(<0.0001)	(<0.0001)		(<0.0001)
Cd	0.002		(0.0002)	(<0.0002)		0.0003
Ca	(<0.001)		(<0.001)	(<0.001)		(<0.0005)
Co			(<0.0002)	(<0.0002)		(<0.0005)
Fe	<0.001		(<0.0005)	(<0.0003)		(<0.0005)
Mn	<0.001		(<0.0005)	(<0.0003)		(<0.0005)
Ni	<0.001		(<0.0005)	(<0.0005)		(<0.0005)
Te	0.0045		(<0.0005)	(<0.0005)		(<0.0005)
Zn	<0.001		(<0.0005)	(<0.0005)		(<0.0005)

Values in parentheses are not certified and are given for information only.



## 102. Nickel Base Alloys (chip and disk forms)

SRM	Type	Unit Size (in g)	Elemental Composition (mass fraction, in %)							
			C	Mn	P	S	Si	Cu	Ni	Cr
349a	Waspaloy™ Ni-Co-Cr	150	0.035	0.019	0.003	0.0024	0.018	0.007	58.1	19.3
864	Inconel™ 600	100	0.064	0.29	0.010	0.003	0.12	0.26	73.1	15.7
865	Inconel™ 625	100	0.037	0.18	0.012	0.001	0.41	0.36	59.5	21.9
882	Ni-Cu-Al	100	0.006	0.0007		0.0014	0.006	31.02	65.25	
1159	Electronic and Magnetic Alloy Ni-Fe	disk	0.007	0.305	0.003	0.003	0.32	0.038	48.2	0.06
1160	Electronic and Magnetic Alloy Ni-Mo	disk	0.019	0.550	0.003	0.001	0.37	0.021	80.3	0.05
1243	Waspaloy™	disk	0.024	0.019	0.003	0.0018	0.018	0.007	58.78	19.20
1244	Inconel™ 600	disk	0.062	0.29	0.010	0.003	0.12	0.26	73.2	15.7
1245a	Inconel™ 625	disk	0.037	0.18	0.012	0.001	0.41	0.37	59.7	22.0
C1248	Ni-Cu	disk	0.266	0.31	0.002	0.0008	1.61	29.80	65.75	0.095
1249	Inconel™ 718	disk	0.038	0.109	0.013		0.106	0.145	53.3	18.5
C2402	Hastelloy™ C	disk	0.010	0.64	0.007	0.018	0.85	0.19	51.5	16.15

SRM	Mo	Co	Ti	Al	B	Fe	Ta	V	Nb	W
349a	4.25	12.46	3.06	1.23	0.005	1.15		0.12		
864	0.20	0.059	0.26	0.26	<0.005	9.6			(0.14)	
865	8.6	0.072	0.28	0.21	<0.001	4.5			3.5	
882			0.57	2.85		0.009				
1159	0.010	0.022				51.0				
1160	4.35	0.054				14.3				
1243	4.25	12.46	3.06	1.23	0.005	0.79		0.12		
1244	0.20	0.058	0.25	0.26	<0.05	9.6			(0.14)	
1245a	8.5	0.071	0.28	0.19		4.5	<0.01		3.5	<0.001
C1248	0.006	Pb 3.8 mg/kg	Sn 1.1 mg/kg	0.009		2.10			Zn 3 mg/kg	
1249	3.09	0.325	0.957	0.563				0.034	5.19	
C2402	17.1	1.50	Sn(0.001)		(0.0004)	7.3		0.22	(<0.01)	4.29

Values in parentheses are not certified and are given for information only.

## 102. Trace Elements in Nickel Base Superalloys (chip form)

SRM	Type	Unit Size (in g)	Trace Composition (in mg/kg)				
			Pb	Bi	Se	Te	Tl
897	"Tracealloy" A	35	11.7	(0.5)	9.1	1.05	0.51
898	"Tracealloy" B	35	2.5	(1.0)	2.00	0.54	2.75
899	"Tracealloy" C	35	3.9	(0.3)	9.5	5.9	0.252

SRM	Base Composition (mass fraction, in %)										
	C	Cr	Co	Ni	W	Nb	Al	Ti	B	Zr	Hf
897, 898, 899	(0.12)	(12.0)	(8.5)	(Bal)	(1.75)	(0.9)	(2.0)	(2.0)	(0.010)	(0.10)	(1.75)

Values in parentheses are not certified and are given for information only.

## 102. Nickel Oxides (powder form)

SRM	Type	Unit Size (in g)	Elemental Composition (mass fraction, in %)								
			Mn	Si	Cu	Cr	Co	Ti	Al	Fe	Mg
671	Oxide 1	25	0.13	0.047	0.20	0.025	0.31	0.024	0.009	0.39	0.030
672	Oxide 2	25	0.095	0.11	0.018	0.003	0.55	0.009	0.004	0.079	0.020
673	Oxide 3	25	0.0037	0.006	0.002	0.0003	0.016	0.003	0.001	0.029	0.003

SRM	Trace Composition (in mg/kg)											
	Pb	Se	Bi	As	Sn	Sb	Cd	Ga	Ag	Te	Tl	Zn
671	16	2.0	0.07	(59)	(2.7)	(0.4)	(0.7)	(0.8)	(0.5)	(<0.2)	(<0.1)	(160)
672	38	0.40	0.3	(74)	(4)	(0.5)	(1.7)	(0.4)	(0.3)	(<0.2)	(<0.1)	(140)
673	3.5	0.2	0.06	(0.4)	(<0.5)	(<0.5)	(0.05)	(<0.1)	(<0.1)	(0.4)	(<0.1)	(1.7)

Values in parentheses are not certified and are given for information only.

## 102. Tin Base Alloys (chip form)

SRM	Type	Unit Size (in g)	Elemental Composition (mass fraction, in %)								
			Pb	Sn	Sb	Bi	Cu	Fe	As	Ag	Ni
54d	Bearing Metal	170	0.62	88.57	7.04	0.044	3.62	0.027	0.088	0.0032	0.0027

## 102. Titanium Base Alloys (chip and disk forms)

SRM	Type	Unit Size (in g)	Elemental Composition (mass fraction, in %)				
			C	Mn	Cr	Cu	Mo
173b	Al-V	50	0.025			0.008	0.013
641	8 Mn (A)	disk		6.68			
642	8 Mn (B)	disk		9.08			
643	8 Mn (C)	disk		11.68			
647	Al-Mo-Sn-Zr	50	0.006				1.96
648	Al-Sn-Zr-Cr-Mo	50	0.011		3.84		3.75
649	V-Al-Cr-Sn	50	0.011	(<0.01)	2.96	(<0.001)	
650	Unalloyed A	30		0.016	0.002	0.033	0.002
651	Unalloyed B	30		0.005	0.037	0.032	0.031
652	Unalloyed C	30		0.046	0.082	0.081	0.039
654b	Al-V	disk			(0.025)	0.004	(0.013)
1128	V-Al-Cr-Sn	disk	0.011	(<0.01)	2.96	(<0.003)	(0.006)
2431	6Al-2Sn-4Zr-6Mo	50	0.006	(<0.01)	(<0.01)	(<0.01)	6.01
2432	10V-2Fe-3Al	50	0.008	(<0.01)	(<0.01)	(<0.005)	
2433	Al-Mo-V	50					0.99

SRM	Fe	Al	V	Sn	Si	N	W	Zr
173b	0.23	6.36	4.31	(0.03)	0.046	0.015		
647	0.075	5.88	(<0.02)	2.02		(<0.01)		3.90
648	0.15	5.13		1.98	0.027	(0.01)		1.84
649	0.133	3.08	15.1	3.04		(0.01)		
650	0.024	<0.01	0.009	0.03	0.004		1.55	
651	0.058	<0.006	0.021	0.026	0.011		0.39	
652	0.67	0.039	0.024	0.053	0.16		0.5	
654b	0.023	6.34	4.31	0.023	0.045		Ni 0.028	0.008
1128	0.134	3.06	15.13	3.04		(0.01)		
2431	0.056	5.73	(<0.01)	1.98	0.088	Ni (<0.01)	(<0.001)	4.06
2432	1.77	3.15	10.00	B (<0.001)	0.029	Ni (<0.01)	(<0.001)	(<0.01)
2433	0.063	7.63	0.98					

Values in parentheses are not certified and are given for information only.

## 102. Zinc Base Alloys (chip and disk forms)

SRM	Type	Unit Size (in g)	Elemental Composition (mass fraction, in %)							
			Cu	Al	Mg	Fe	Pb	Cd	Sn	Cr
94c	Die Casting Alloy	150	1.01	4.13	0.042	0.018	0.006	0.002	0.006	
625	Zinc-base A—ASTM AG 40A	disk	0.034	3.06	0.070	0.036	0.0014	0.0007	0.0006	0.0128
626	Zinc-base B—ASTM AG 40A	disk	0.056	3.56	0.020	0.103	0.0022	0.0016	0.0012	0.0395
627	Zinc-base C—ASTM AG 40A	disk	0.132	3.88	0.030	0.023	0.0082	0.0051	0.0042	0.0038
628	Zinc-base D—ASTM AC 41A	disk	0.611	4.59	0.0094	0.066	0.0045	0.0040	0.0017	0.0087
629	Zinc-base E—ASTM AC 41A	disk	1.50	5.15	0.094	0.017	0.0135	0.0155	0.012	0.0008
630	Zinc-base F—ASTM AC 41A	disk	0.976	4.30	0.030	0.023	0.0083	0.0048	0.0040	0.0031
631	Zinc spelter (mod.)	disk	0.0013	0.50 (<0.001)		0.005	(0.001)	0.0002	0.0001	0.0001

SRM	Mn	Ni	Si	In	Ga	Ca	Ag	Ge
94c	0.014	0.006						
625	0.031	0.0184	0.017					
626	0.048	0.047	0.042					
627	0.014	0.0029	0.021					
628	0.0091	0.030	0.008					
629	0.0017	0.0075	0.078					
630	0.0106	0.0027	0.022					
631	0.00015	(<0.0005)	(0.002)	0.0023	(0.002)	<0.001	(<0.0005)	(0.0002)

Values in parentheses are not certified and are given for information only.

## 102. Zirconium Base Alloys (chip and disk forms)

SRM	Type	Unit Size (in g)	Elemental Composition (mass fraction, in %)										
			C	Mn	Hf	Cu	Ni	Cr	Ti	Sn	Fe	N	Al
360b	Zircaloy-4	100	0.011	0.0010	0.008	0.002	0.0025	0.10	0.002	1.55	0.21	0.0045	0.004

## 102. Gases in Metals (platelet form)

SRM	Type	Hydrogen (in mg/kg)
352c	Unalloyed Titanium for Hydrogen	49



## 103. Microanalysis

### Metals (rod and wire forms)

SRM	Type	Elemental Composition (mass fraction, in %)				
		Au	Cu	Ag	W	Mo
480	Tungsten-20% Mo Alloy				78.5	21.5
481	Au 100 A	100.00				
	Au-20% Ag B	80.05		19.96		
	Au-40% Ag C	60.05		39.92		
	Au-60% Ag	40.03		59.93		
	Au-80% Ag E	22.43		77.58		
	Ag 100 F			100.00		
482	Au 100 A	100.00				
	Au-20% Cu B	80.15	19.83			
	Au-40% Cu C	60.36	39.64			
	Au-60% Cu	40.10	59.92			
	Au-80% Cu E	20.12	79.85			
	Cu 100 F		100.00			

### 103. Synthetic Glasses (rod form)

	SRM 1872			SRM 1873		
	Glass			Glass		
	K-453	K-491	K-968	K-458	K-489	K-963
Elemental Composition (mass fraction, in %)						
Pb	54.21	54.69	54.74		(1.32)	
Si		(0.11)		23.05	(22.23)	(21.96)
Ge	28.43	26.10	25.93			(0.47)
Ba			(0.46)	41.79	39.53	39.21
Zn				3.01	2.93	2.95
P			(0.21)			(0.33)
Mg			(0.22)			(0.34)
Al		(0.10)			(0.11)	
B						
Zr		(0.26)	(0.48)		(0.40)	(0.61)
Ti		(0.14)	(0.16)		(0.27)	(0.32)
Ce		(0.59)			(0.80)	
Ta		(0.52)			(0.95)	
Fe		(0.17)			(0.35)	
Li						
Ni			(0.20)			(0.33)
Eu			(0.64)			(0.95)
U			(0.05)			(0.16)
Th			(0.12)			(0.06)
Cr			(0.19)			(0.31)
O	(16.73)	(16.45)	(16.67)	(31.86)	(31.70)	(32.00)
Total	(99.37)	(99.13)	(100.07)	(99.71)	(100.59)	(100.00)

Values in parentheses are not certified and are given for information only.

### 103. Thin Film for Transmission Electron Microscope

SRM	Type	Elemental Composition (mass fraction, in %)					
		Mg	Si	Ca	Fe	O	Ar
2063a	Mineral glass	7.97	25.34	11.82	11.06	43.2	(0.4)

Values in parentheses are not certified and are given for information only.

## 104. High Purity Materials

### High Purity Metals (solid forms)

These SRMs are for determining impurity elements in high purity metals.

SRM	Type	Unit Size	Elemental Composition (in mg/kg)					Cu	Ni	Sn	Pb	Zr
680a	High Purity Platinum (Wire)	0.51 mm: L1 (10 cm)						0.1	<1		<1	<0.1
		0.51 mm; L2 (1 m)						0.1	<1		<1	<0.1
682	High Purity Zinc	semicirc 57 mm						0.042	(<0.1)	(0.02)		
683	Zinc Metal	semicirc 57 mm						5.9		(0.02)	11.1	
685R	High Purity Gold (Rod)	5.9 mm × 25 mm long						0.1	(<0.05)	(<0.07)		
685W	High Purity Gold (Wire)	1.4 mm × 102 mm long						0.1	(<0.05)	(<0.07)		
726	Selenium, Intermediate Purity	shot, 450 g						<1	<0.5	<1	<1	Mn<0.3
728	Zinc, Intermediate Purity	shot, 450 g						5.68	(0.45)	0.02	11.13	(<0.01)
*885	Refined Copper	pin, 200 g							<0.0001	<0.0001	0.0002	

SRM	Ag	Mg	In	Fe	O	Pd	Au	Rh	Ir	Cd	Tl
680a	<0.1	<1		1.3	4	0.2	<1	<0.2	<0.01		
682	(0.02)	(<0.1)		(0.1)	(<0.5)					(0.1)	
683	1.3			2.2						1.1	(0.2)
685R	[0.1]	(<0.2)	0.007	0.2	(<2)						
685W	[0.1]	(<0.2)	0.007	0.3	(2)						
726	<1	<1	S 12	1	Cr<1	Mo<0.3	Te 0.3	As<2	Al<1	B<1	Ca<1
728	1.08	(<0.001)	(<0.0005)	1.84		(<0.05)	(<0.02)	(<0.05)	(<0.005)	1.14	0.2
*885	0.0005			<0.0005	0.031		S 0.0018	Sb<0.0002	As<0.0002	Bi<0.0001	Zn<0.0001

Values in parentheses are not certified and are given for information only.

Values in brackets are subject to greater error since only one method of analysis was employed.

\*SRM 885 values are mass fractions, in %.

### 104. Royal Canadian Mint Reference Materials (solid forms)

These RMs are a series each of fine silver, fine gold, and gold bullion products developed and certified by the Royal Canadian Mint (RCM), Ottawa, Canada and distributed by NIST. The fine silver and fine gold RMs are primarily intended for use as calibration standards for the determination of trace elements by solid sample spectrometric methods; the gold bullion RMs are primarily intended for use as quality control check standards for fire assay. There are four RMs in the fine silver series, five RMs in the gold bullion series, and six RMs in the fine gold series. The RMs in the fine silver series are available only in block form (24 mm × 24 mm × 5 mm). The RMs in the gold bullion series are available in three forms—disc (25 mm dia. × 20 mm), wire (2 mm dia.), and foil (35 mm × 40+ mm × 1 mm). The RMs in the fine gold series are available in three forms—block (25 mm × 25 mm × 2.5 mm), wire (2 mm dia.), and turnings (25 g).

# 104. Royal Canadian Mint Reference Materials (solid forms) – Continued

RM Type Block Form Unit Size (in g)	8162 Fine Silver B 30	8165 Fine Silver B 30	8168 Fine Silver B 30	8171 Fine Silver B 30
Components (in mg/kg)				
Bi	65.3	83.5	28.9	75.1
Cu	40.1	61.6	101	65.2
Fe	25.0	35.6	15.4	48.9
Au	52	15.0	75.0	26.7
Pb	18.1	59.1	125	38.8
Ni	27.4	35.0	13.5	57.0
Pd	41.8	64.3	11.7	27.3
Pt	17.3	17.9	24.4	12.3
Se	55.8	32.2	3.9	44.4
Te	62.9	(41.8)	6.6	25.8
Sn	21.7	54.1	10.3	46.1
Zn	(3.8)	18.6	8.3	7.2

Values in parentheses are not certified and are given for information only.

RM Type Form (Disc, Wire, Foil) Unit Size (in g)	8068/8069/8070 Gold Bullion			8071/8072/8073 Gold Bullion			8074/8075/8076 Gold Bullion			8077/8078/8079 Gold Bullion			8080/8081/8082 Gold Bullion		
	D	W	F	D	W	F	D	W	F	D	W	F	D	W	F
	30	25	25	30	25	25	30	25	25	30	25	25	30	25	25
Components (mass fraction, in %)															
Au	94.847			89.928			84.905			79.962			74.988		
Ag	4.15			8.03			12.08			15.09			15.04		
Cu	(1)			(2)			(3)			(5)			(10)		

Values in parentheses are not certified and are given for information only.

RM Type Form (Block, Wire, Turnings) Unit Size (in g)	8050/8051/8052 Fine Gold			8053/8054/8055 Fine Gold			8056/8057/8058 Fine Gold			8059/8060/8061 Fine Gold			8062/8063/8064 Fine Gold			8065/8066/8067 Fine Gold		
	B	W	T	B	W	T	B	W	T	B	W	T	B	W	T	B	W	T
	30	25	25	30	25	25	30	25	25	30	25	25	30	25	25	30	25	25
Components (in mg/kg)																		
As	2.4			10.0			18.0			6.7			29.4			14.3		
Bi	3.4			24.0			34.0			6.8			53.9			11.0		
Cr	1.7			32.6			13.3			5.0			4.9			16.7		
Cu	1.6			98.1			46.9			5.7			9.8			13.8		
Fe	6.2			11.6			33.8			7.5			90.4			15.4		
Pb	1.9			21.9			30.5			6.4			49.7			11.5		
Mg	1.1			34.0			11.8			6.0			3.2			15.6		
Mn	1.1			58.9			22.5			10.8			64.3			20.5		
Ni	2.7			32.5			50.5			5.7			14.6			13.5		
Pd	1.3			43.1			19.8			5.0			119			13.1		
Pt				87.1			40.8			6.1			5.1			12.5		
Si				2.7			27.8			6.3			9.0			19.1		
Ag	9.5			20.3			81.7			7.1			49.7			15.1		
Sn	2.8			33.8			27.2			6.4			49.7			17.8		
Ti	0.7			12.7			25.3			5.9			2.6			16.5		
Zn	2.6			54.6			6.6			7.5			20.9			12.5		



## 104. Stoichiometry (powder form)

These SRMs are defined as primary, working, and secondary standards in accordance with recommendations of the Analytical Chemistry Section of the International Union of Pure and Applied Chemistry [Ref. Analyst 90, 251 (1965)]. These definitions are as follows:

**Primary Standard:**

a commercially available substance of purity  $100 \pm 0.02\%$  (Purity 99.98+ %).

**Working Standard:**

a commercially available substance of purity  $100 \pm 0.05\%$  (Purity 99.95+%).

**Secondary Standard:**

a substance of lower purity which can be standardized against a primary grade standard.

SRM	Type	Unit Size (in g)	Certified Use	Stoichiometric Purity (mass fraction, in %)
17e	Sucrose			In Prep
40h	Sodium Oxalate	60	Reductometric Value	99.972
41c	Dextrose (D-Glucose)	70	Polarimetric Value	99.9
83d	Arsenic Trioxide	60	Reductometric Value	99.9926
84j	Potassium Hydrogen Phthalate	60	Acidimetric Value	99.996
136e	Potassium Dichromate	60	Oxidimetric Value	99.984
350a	Benzoic Acid	30	Acidimetric Value	99.9958
351	Sodium Carbonate	50	Acidimetric Value for: Sodium Carbonate	99.9796
723c	Tris(hydroxymethyl)aminomethane			In Prep
951	Boric Acid	100	Acidimetric and Boron Isotopic Value	100.00
987	Strontium Carbonate	1	Assay and Isotopic Values	99.98
999a	Potassium Chloride	60	Assay Values for: Potassium Chloride Potassium Chloride	99.9817 52.4354 47.5463

Values in parentheses are not certified and are given for information only.

## 104. Microchemistry (powder form)

SRM	Type	Unit Size (in g)	Composition (mass fraction, in %)						
			C	H	N	Br	Cl	F	S
141d	Acetanilide	In Prep							
142	Anisic Acid	2							20.40
143d	Cystine	In Prep							
148	Nicotinic Acid	2	58.54	4.09	11.38				
2141	Urea	2			46.63				
2142	o-Bromobenzoic Acid	2				39.80			
2143	p-Fluorobenzoic Acid	2						13.54	
2144	m-Chlorobenzoic Acid	2					22.62		

## 104. Spectrometry, Single Element Standard Solutions

These SRMs are intended as standard solutions for use in calibrating instruments used in atomic spectrometry, including atomic absorption spectrometry, inductively coupled plasma optical spectrometry, and inductively coupled plasma mass spectrometry. They can also be used in conjunction with any other analytical technique or procedure where aqueous standard solutions are required. Each SRM is a single element solution of 50 mL with a nominal concentration of 10 mg/g, except where indicated. **NOTE:** The certified values for SRM standard solution lots produced after March 1997 are stated in mass units, **mg/g**, rather than *mg/mL*. For the convenience of the user, each certificate provides instructions for preparing SRM dilutions by volume as well as by mass.

SRM	Element	Nominal Acid Concentration
3101a	Aluminum	HNO <sub>3</sub> 10%
3102a	Antimony	HNO <sub>3</sub> 10% + HF 2%
3103a	Arsenic	HNO <sub>3</sub> 15%
3104a	Barium	HNO <sub>3</sub> 1%
3105a	Beryllium	HNO <sub>3</sub> 10%
3106	Bismuth	HNO <sub>3</sub> 10%
3107	Boron (5 mg/g)	H <sub>2</sub> O
3108	Cadmium	HNO <sub>3</sub> 10%
3109a	Calcium	HNO <sub>3</sub> 10%
3110	Cerium	HNO <sub>3</sub> 10%
3111a	Cesium	HNO <sub>3</sub> 1%
3112a	Chromium	HNO <sub>3</sub> 10%
3113	Cobalt	HNO <sub>3</sub> 10%
3114	Copper	HNO <sub>3</sub> 10%
3115a	Dysprosium	HNO <sub>3</sub> 10%
3116a	Erbium	HNO <sub>3</sub> 10%
3117a	Europium	HNO <sub>3</sub> 16%
3118a	Gadolinium	HNO <sub>3</sub> 10%
3119a	Gallium	HNO <sub>3</sub> 10%
3120	Germanium	Oxalic Acid 10%
3121	Gold	HNO <sub>3</sub> 5% + HF 2%
3122	Hafnium	HNO <sub>3</sub> 10% + HF 2%
3123a	Holmium	HNO <sub>3</sub> 16%
3124a	Indium	HNO <sub>3</sub> 10%
3126a	Iron	HNO <sub>3</sub> 10%
3127a	Lanthanum	HNO <sub>3</sub> 10%
3128	Lead	HNO <sub>3</sub> 10%
3129a	Lithium	HNO <sub>3</sub> 1%
3130a	Lutetium	HNO <sub>3</sub> 10%
3131a	Magnesium	HNO <sub>3</sub> 10%
3132	Manganese	HNO <sub>3</sub> 10%
3133	Mercury	HNO <sub>3</sub> 10%
3134	Molybdenum	HCl 10%
3135a	Neodymium	HNO <sub>3</sub> 10%
3136	Nickel	HNO <sub>3</sub> 10%
3137	Niobium	5% HNO <sub>3</sub> + HF 2%
3138	Palladium	HCl 10%
3139a	Phosphorus	HNO <sub>3</sub> 0.8%
3140	Platinum	HCl 10%
3141a	Potassium	HNO <sub>3</sub> 1%
3142a	Praseodymium	HNO <sub>3</sub> 10%
3143	Rhenium	HNO <sub>3</sub> 10%
3144	Rhodium (1 mg/g)	HCl 10%
3145a	Rubidium	HNO <sub>3</sub> 1%

## 104. Spectrometry, Single Element Standard Solutions – Continued

SRM	Element	Acid Concentration
3147a	Samarium	HNO <sub>3</sub> 10%
3148a	Scandium	HNO <sub>3</sub> 10%
3149	Selenium	HNO <sub>3</sub> 10%
3150	Silicon	H <sub>2</sub> O
3151	Silver	HNO <sub>3</sub> 10%
3152a	Sodium	HNO <sub>3</sub> 1%
3153a	Strontium	HNO <sub>3</sub> 10%
3154	Sulfur	H <sub>2</sub> SO <sub>4</sub> 0.1%
3155	Tantalum	HNO <sub>3</sub> 5% + HF 2%
3156	Tellurium	HCl 20%
3157a	Terbium	HNO <sub>3</sub> 16%
3158	Thallium	HNO <sub>3</sub> 10%
3159	Thorium	HNO <sub>3</sub> 10%
3160a	Thulium	HNO <sub>3</sub> 10%
3161a	Tin	HNO <sub>3</sub> 5% + HF 2%
3162a	Titanium	HNO <sub>3</sub> 10% + HF 2%
3163	Tungsten	HNO <sub>3</sub> 7% + HF 4%
3164	Uranium	HNO <sub>3</sub> 10%
3165	Vanadium (5 mg/g)	HNO <sub>3</sub> 10%
3166a	Ytterbium	HNO <sub>3</sub> 16%
3167a	Yttrium	HNO <sub>3</sub> 10%
3168a	Zinc	HNO <sub>3</sub> 10%
3169	Zirconium	HNO <sub>3</sub> 10% + HF 2%

## 104. Spectrometry, Multielement Standard Solutions

SRMs 3171a and 3172a each consists of a single 50 mL solution containing several elements in concentration ratios appropriate for natural water and similar type sample analysis. SRM 3179 consists of a set of three 50 mL solutions, (3179-I, 3179-II and 3179-III), designed to be combined, diluted (I, 1:100; II and III, 1:1000), and used immediately, as the full combination of elements is unstable over extended periods of time. The elemental concentration ratios in the final combined and diluted solution of SRM 3179 are appropriate for the analysis of soil, sediment, and sludge leachates.

SRM 3171a Multielement Mix A1 Standard Solution (in HNO<sub>3</sub> 5%)

Element	Nominal Concentration (in µg/g)
Aluminum	100
Antimony	100
Beryllium	10
Cadmium	100
Chromium	100
Iron	100
Magnesium	100
Manganese	100
Molybdenum	100
Nickel	100
Potassium	500
Sodium	100
Vanadium	100



## 104. Spectrometry, Multielement Standard Solutions – Continued

SRM 3172a Multielement Mix B1 Standard Solution (in HNO<sub>3</sub> 5%)

Element	Nominal Concentration (in µg/g)
Arsenic	200
Barium	10
Calcium	10
Cobalt	100
Copper	100
Lead	100
Selenium	500
Silver	100
Strontium	10
Thallium	100
Zinc	100

SRM 3179 Multielement Mixes I, II, and III Standard Solutions (in HNO<sub>3</sub> 5%)

Element	Nominal Concentration (in µg/g)
I Aluminum	100
Arsenic	200
Iron	200
Lead	100
Magnesium	100
Manganese	100
Phosphorus	100
Potassium	100
Sodium	100
Vanadium	50
Zinc	100
II Barium	100
Cadmium	100
Calcium	100
Chromium	100
Cobalt	100
Copper	100
Lanthanum	100
Lithium	100
Molybdenum	100
Nickel	100
Strontium	100
III Silver	100

#### 104. Chromium Speciation (solution form)

These SRMs are intended for use in conjunction with the measurement of specific species of chromium, and consist of 50 mL solutions.

SRM	Source, Purity, %	Diluent	Element Concentration (in mg/mL)	
			Cr (III)	Cr (VI)
2108	Metal, (99.999+)	HCl, 1%	In Prep	<0.001
2109	SRM 136e (99.984)	deionized H <sub>2</sub> O	<0.005	1.000±0.004

#### 104. Anion Chromatography (solution form)

These SRMs are single component solutions prepared gravimetrically for use in anion chromatography or any other technique that requires aqueous standard solutions for calibration of control materials.

SRM	Anion	Unit Size (in mL)	Nominal Concentration (in mg/kg)
3181	Sulfate	50	1000
3182	Chloride	50	1000
3183	Fluoride	50	1000
3184	Bromide	50	1000
3185	Nitrate	50	1000
3186	Phosphate	50	1000

#### 104. Stable Isotopic Materials (solid and solution forms)

The isotopic composition of these SRMs has been determined by mass spectrometry.

SRM	Type	Element/Isotopic Composition Certified	Unit Size (in g)
951	Boric Acid, assay and isotopic	Boron	100 powder
952	Boric Acid, 95% enriched <sup>10</sup> B, assay and isotopic	Boron	0.25 powder
975a	Sodium Chloride	Chlorine	In Prep
976	Copper Metal	Copper	0.4 disk
977	Sodium Bromide	Bromine	0.25 powder
978a	Silver Nitrate	Silver	0.25 powder
979	Chromium Nitrate	Chromium	0.25 powder
980	Magnesium Metal	Magnesium	0.25 chips
981	Lead Metal, natural	Lead	1.0 wire
*982	Lead Metal, equal atom ( <sup>208</sup> Pb/ <sup>206</sup> Pb)	Lead	1.0 wire
*983	Lead Metal, radiogenic (92% <sup>206</sup> Pb)	Lead	1.0 wire
984	Rubidium Chloride, assay and isotopic	Rubidium	0.25 powder
985	Potassium Chloride, assay and isotopic	Potassium	1.0 powder
986	Nickel Metal	Nickel	0.5 powder
987	Strontium Carbonate, assay and isotopic	Strontium	1.0 powder
989	Rhenium Metal, assay and isotopic	Rhenium	0.003 cm×0.0076 cm×1.90 cm ribbon
990	Silicon Metal, assay and isotopic	Silicon	3 cm×0.2 cm wafer
991	Lead-206 Nitrate Spike, assay and isotopic	Lead	15 solution
994	Gallium Metal, isotopic	Gallium	0.25 disk
997	Thallium Metal, isotopic	Thallium	0.25 rod

\*These SRMs are radioactive, containing Lead-210 of natural origin. All users and purchasers must comply with all national and international regulations regarding the use and disposal of these SRMs.

## 104. Light Stable Isotopic Materials (gas, liquid and solid forms)

These RMs are for calibration of isotope-ratio mass spectrometers and associated sample preparation systems. They are distributed by NIST on behalf of the International Atomic Energy Agency (IAEA). At the request of the IAEA, quantities of these materials are limited to *one unit of each RM per laboratory every 3 years*.

The isotopic compositions are given in parts per thousand difference from isotope-ratio standards—Vienna Standard Mean Ocean Water (VSMOW), Vienna PeeDee Belemnite (VPDB), atmospheric N<sub>2</sub> (Air), NBS28 Silica Sand (optical), and Canyon Diablo Troilite (CDT). The exception is Lithium (Li), which is expressed as an absolute isotopic ratio.

RM	Type (IAEA Designation)	Nominal Unit Size	Nominal Isotopic Composition (in parts per 1000)						
			$\delta D_{VSMOW}$	$^6Li/^7Li$	$\delta^{13}C_{VPDB}$	$\delta^{15}N_{Air}$	$\delta^{18}O_{VSMOW}$	$\delta^{30}Si_{NBS28}$	$\delta^{34}S_{CDT}$
8535	VSMOW–water	20 mL	0*				0 *		
8536	GISP–water	20 mL	–190				–24.8		
8537	SLAP–water	20 mL	–428*				–55.5*		
8538	NBS30–biotite	2 g	–66				+5.1		
8539	NBS22–oil	1 mL	–120		–29.7				
8540	PEFI–polyethylene foil	x mg	–100		–31.8				
8541	USGS24–graphite	0.8 g			–16				
8542	Sucrose ANU–sucrose	1 g			–10.5				
8543	NBS18–carbonatite	0.4 g			–5.0		+7.2		
8544	NBS19–limestone	0.4 g			+1.95*		+28.6		
8545	LSVEC–lithium carbonate	0.4 g		0.0814 <sup>†</sup>	–47		+3		
8546	NBS28–silica sand (optical)	0.4 g					+9.6	0*	
8547	IAEA-N1–ammonium sulfate	0.4 g				+0.4			
8548	IAEA-N2–ammonium sulfate	0.4 g				+20.3			
8549	IAEA-N3–potassium nitrate	0.4 g				+2			
8550	USGS25–ammonium sulfate	0.5 g				–30.4			
8551	USGS26–ammonium sulfate	0.5 g				+53.5			
8552	NSVEC–gaseous nitrogen	300 $\mu$ mol				–2.8			
8553	Soufre de Lacq–elemental sulfur	0.5 g							+16
8554	IAEA-S1–silver sulfide	0.5 g							–0.3
8555	IAEA-S2–silver sulfide	0.5 g							+21
8556	NBS123–sphalerite	0.5 g							+17
8557	NBS127–barium sulfate	0.5 g					+9.3		+20
8558	USGS32—potassium nitrate	0.5 g				+179.9			

\*Exactly defined isotopic abundances

<sup>†</sup> Absolute isotopic ratio



# 105. Health and Industrial Hygiene

## Clinical Laboratory Materials (gas, liquid, and solid forms)

The following SRMs are for calibrating apparatus and validating analytical methods used in clinical and pathology laboratories. Additional information on the serum materials is given in the table on the following page.

SRM	Type	Purity/Constituent (mass fraction, in %)	Unit Size
900	Antiepilepsy Drug Level Assay (phenytoin, ethosuximide, phenobarbital, and primidone)		Set of 4 ampules
909b	Human Serum		Set of 6 bottles
910	Sodium Pyruvate	98.7	25 g
911b	Cholesterol	99.8	2 g
912a	Urea	99.9	25 g
913	Uric Acid	99.7	10 g
914a	Creatinine	99.7	10 g
915a	Calcium Carbonate	99.9	20 g
916a	Bilirubin	98.3	100 mg
917a	D-Glucose (Dextrose)	99.7	25 g
918a	Potassium Chloride	99.9817	30 g
919a	Sodium Chloride	99.89	30 g
920	D-Mannitol	99.8	50 g
921	Cortisol (Hydrocortisone)	98.9	1 g
*924a	Lithium Carbonate	99.9	30 g
925	VMA (4-hydroxy-3-methoxymandelic acid)	99.4	1 g
927c	Bovine Serum Albumin		In Prep
928	Lead Nitrate	100.00	30 g
929	Magnesium Gluconate Dihydrate	<b>Mg 5.403</b>	5 g
937	Iron Metal (Clinical)	99.90	50 g
938	4-Nitrophenol	(99.75)	15 g
955b	Lead in Blood		Set of 4 ampules
*956a	Electrolytes in Frozen Human Serum		Set of 6 ampules
965	Glucose in Frozen Human Serum		Set of 4 ampules
966	Toxic Elements in Blood		In Prep
968b	Fat-Soluble Vitamins and Cholesterol in Human Serum		Set of 3 ampules
998	Angiotensin I (Human)	94.1	0.5 mg
1400	Bone Ash	8 elements	50 g
1486	Bone Meal	8 elements	50 g
1595	Tripalmitin	99.5	2 g
1598	Inorganic Constituents in Bovine Serum		Set of 2 ampules
1599	Anticonvulsant Drug Level Assay (valproic acid and carbamazepine)		Set of 4 ampules
1951a	Lipids in Frozen Human Serum		Set of 6 bottles
1952a	Cholesterol in Human Serum (Freeze-dried)		Set of 6 bottles
2389	Amino Acids in HCl	17 amino acids	Set of 5 ampules

Values in parentheses are not certified and are given for information only.

\*Conforms to National Committee for Clinical Laboratory Standards (NCCLS) specification ACC-1.

## 105. Serum Materials (frozen, liquid, and lyophilized forms)

These SRMs serve a variety of clinical measurement needs. SRM 909b is a lyophilized human serum for use in determining specified constituents. SRM 927b is a bovine serum albumin in a sterile 7% solution for use in the calibration and standardization of procedures to analyze total serum protein. SRM 956a is a frozen human serum for use in the calibration and standardization of procedures for the determination of specific electrolytes in either diluted or undiluted human serum or plasma. SRM 965 is a frozen human serum for evaluating the accuracy of procedures used to determine glucose in human serum and to validate secondary reference materials. SRM 968b is a lyophilized human serum for validating methods used to determine fat-soluble vitamins, carotenoids, and cholesterol in human serum and plasma. SRM 1951 is a frozen human serum for evaluating the accuracy of clinical procedures for the determination of total cholesterol, HDL-cholesterol, LDL-cholesterol and triglycerides (triglycerides and total glyceride species).

SRM	Type	Unit Size	Analyte Concentrations (in mmol/L)			
909b	Human Serum	909b-1; 3 bottles 909b-2; 3 bottles		909b-1	909b-2	
			Calcium	2.218	3.532	
			Chloride	89.11	119.43	
			Cholesterol	3.787	6.084	
			Creatinine	0.05681	0.4674	
			Lithium	0.6145	2.600	
			Magnesium	0.7634	1.918	
			Potassium	3.424	6.278	
			Sodium	120.76	141.0	
			Total Glycerides	0.949	1.529	
			Glycerides	0.804	1.271	
			Urea	5.51	30.75	
Uric Acid	2.809	0.7579				
927c	Bovine Serum Albumin		In Prep			
956a	Electrolytes in Frozen Human Serum	Level I; 2 ampules Level II; 2 ampules Level III; 2 ampules		Level I	Level II	Level III
			Calcium	3.025	2.570	2.127
			Lithium	2.083	1.34	0.570
			Magnesium	1.441	0.947	0.448
			Potassium	6.008	3.985	2.025
			Sodium	121.4	141.0	160.9
965	Glucose in Frozen Human Serum	Level I; 2 ampules Level II; 2 ampules Level III; 2 ampules		Level I	Level II	Level III
			Glucose	5.680	11.097	16.355
968b	Human Serum	Low; 1 vial Middle; 1 vial High; 1 vial		Low*	Middle*	High*
			Retinol	1.033	1.794	3.11
			Retinyl Palmitate	0.189	0.339	0.469
			α-Tocopherol	16.4	23.5	41.4
			trans-β-Carotene	0.417	1.06	2.10
			Total-β-Carotene	0.471	1.17	2.31
			Total α-Carotene	0.0410	0.070	0.099
			Lutein	0.108	0.111	0.0687
			Cholesterol	2240	3735	3300
1951a	Lipids in Frozen Human Serum	Level I; 2 bottles Level II; 2 bottles		Level I	Level II	
			Cholesterol	4.7109	7.1554	
			Total Glycerides	1.1357	1.9477	
			Triglycerides Only	1.0053	1.7462	

\*Analyte Concentrations are expressed in  $\mu\text{mol/L}$ .

## 105. Ethanol Solutions

This SRM is for use in the calibration of instruments and techniques for the determination of ethanol (ethyl alcohol) in breath and blood. SRM 1828a consists of four concentrations of ethanol-water solutions in a set of five ampules.

SRM	Type	Certified Constituent (mass fraction, in %)	Unit Size
1828a	Ethanol in Water Solutions	Ethanol: 95.60 Ethanol: 2.003 Ethanol: 0.0960 Ethanol: 0.02309	Set: 1, 20 mL ampules 2, 20 mL ampules 1, 5 mL ampules 1, 5 mL ampules

## 105. Toxic Substances in Urine (powder form)

SRMs 2670, 2671a and 2672a are for determining toxic substances in human urine. They consist of freeze-dried urine and are provided in sets of four 30 mL bottles—two each at low and elevated levels. **NOTE:** The values listed for these SRMs apply only to reconstituted urine.

SRM	Type	Low/Elevated Elemental Composition (in mg/L)				
		Al	As	Be	Cd	Ca
2670	Toxic Metals	(0.18)/(0.18)	(0.06)/0.48	(≤0.0005)/(0.033)	(0.00040)/0.088	0.105/0.105 g/L
2671a	Fluoride					
2672a	Mercury					

SRM	Cl	Cr	Cu	F	Au	Pb	Mg	Mn
2670	(4.4)/(4.4) g/L	(0.013)/0.085	0.13/0.37		(0.008)/(0.24)	(0.01)/0.109	0.063/0.063 g/L	(0.03)/(0.33)
2671a				0.55/5.7				
2672a								

SRM	Hg	Ni	Pt	K	Se	Na	V	SO <sub>4</sub>
2670	(0.002)/0.105	(0.07)/(0.30)	(0.008)/(0.12)	(1.5)/(1.5) g/L	0.030/0.46	2.62/2.62 g/L	—/(0.12)	(1.3)/(1.3) g/L
2671a								
2672a	(0.002)/0.105							

Values in parentheses are not certified and are given for information only.

\*Value is in µg/L.

## 105. Drugs of Abuse in Urine, Single Analyte (powder form)

These SRMs are for verifying the accuracy of methods used to determine marijuana, benzoylecgonine (cocaine metabolite), morphine glucuronide, and cotinine substances classed as drugs of abuse in humans or metabolites of drugs of abuse. SRMs 1507b, 1508a, and 2382 consist of freeze-dried urine and are provided in sets of four 20 mL bottles—three levels plus a blank. RM 8444 consists of freeze-dried urine in a set of four 5 mL vials—two levels and two blanks. Each SRM/RM consists of a single analyte drug of abuse.

SRM/RM	Type	Unit Size	Component (in µg/L)			
			I Blank	II Low	III Medium	IV High
1507b	THC-9-COOH	Set of 4 bottles	x <sub>D</sub> :<1	11.7	24.1	49.6
1508a	Benzoylecgonine	Set of 4 bottles	In Prep			
2382	Morphine Glucuronide	Set of 4 bottles	x <sub>D</sub> :<1	209	437	853
8444	Cotinine	Set of 4 vials	0.8	54		488



## 105. Drugs of Abuse in Urine, Multianalyte (powder form)

These SRMs are for verifying the accuracy of methods used to determine cocaine, morphine and codeine and opiate-based substances classed as drugs of abuse in humans. Each SRM consists of multianalyte drugs of abuse. SRM 1511 consists of a mixture of five substances—morphine, codeine, cocaine metabolite, marijuana metabolite and phencyclidine in freeze-dried urine and is provided as a set of three bottles, each containing all analytes (no blank). SRM 2381 consists of freeze-dried urine and is provided in a set of four 20 mL bottles—three levels plus a blank.

SRM	Type	Unit Size	Component (in µg/L)				
			Benzoyl-ecgonine	Morphine	Codeine	THC-9-COOH	Phen-cyclidine
1511	Multi-Drugs of Abuse	Set of 3 bottles	162	309	288	14.1	23.8
2381	Morphine and Codeine	Set of 4 bottles		134–580	130–560		

## 105. Drugs of Abuse in Hair (solid forms)

These SRMs were developed primarily to further research related to the accurate determination of drugs of abuse in human hair. The values provided on the Reports of Investigation are not certified. Rather they are “Best Estimates” based on proven NIST methods.

RM	Type	Unit Size (in mg)	Component (in mg/kg)			
			Cocaine	Benzoyl-ecgonine	Morphine	Codeine
8448	Human Hair Segments	110–125	7.3	1.6	11.9	6.7
8449	Powdered Human Hair	100–120	7.0	4.0	4.3	2.9

## 105. DNA Profiling (solid forms)

These SRMs are intended for use in the standardization of forensic and paternity quality assurance procedures and instructional law enforcement or non-clinical research purposes. SRM 2390 DNA Profiling Standard, based on Restriction Fragment Length Polymorphism (RFLP) testing, is certified for the sizes of each allelic band of five commonly used DNA probes of two human DNA samples; one is from a female cell line, and the other is from a male source. SRM 2391 [Polymerase Chain Reaction] PCR-Based DNA Profiling Standard is certified for allele assignment of D1S80 loci for eight human DNA samples plus two human cell lines. Both SRMs consist of 20 components. SRM 2392 DNA Standard for Mitochondrial Sequencing is currently under development.

SRM	Type	Unit of Issue
2390	DNA Profiling	20 components: boxes A, B, and C
2391	PCR-Based DNA Profiling	20 components: boxes A and B

## 105. Biomaterials (solid forms)

This SRM is intended for use in evaluating the physical and chemical properties of calcium apatites of biological, geological, and synthetic origins, that are used in the manufacture of medical implants made from biomaterials (materials used for medical purposes). SRM 2910 is certified for calcium and phosphorus contents, Ca/P molar ratio, specific surface area, and solubility product. Reference values are supplied for hydrogen phosphate, carbonate and water contents in addition to physical properties determined from x-ray powder diffraction data.

SRM	Type	Unit Size (in g)
2910	Calcium Hydroxyapatite	5

## 105. Materials on Filter Media

These SRMs consist of potentially hazardous materials deposited on filters to be used to determine the levels of these materials in industrial atmospheres. SRMs 2676d, 2677a, and 2679a provide element values at four different levels; SRM 3087a provides element values at one level only. SRMs 2676d, 2677a, and 3087a are each 37 mm diameter and 0.8  $\mu\text{m}$  pore size; SRM 2679a is 47 mm diameter and 0.45  $\mu\text{m}$  pore size.

SRM	Type	Unit Size		Element/Component (in $\mu\text{g}/\text{filter}$ )			
				I	II	III	IV
2676d	Metals on Filter Media	Set of 8	Cadmium	0.97	2.81	10.04	(<0.0005)
			Lead	7.44	14.82	29.77	(<0.0005)
			Manganese	2.09	9.83	19.83	(<0.0005)
			Zinc	10.17	49.47	99.31	(0.26)
2677a	Beryllium and Arsenic on Filter Media	2 Sets of 5	Beryllium	0.129	0.643	2.58	0.050 $\leq 0.0005$ Blank
			Arsenic	0.269	2.69	26.92	0.101 $\leq 0.0005$ Blank
2679a	Quartz on Filter Media	Set of 4	Quartz Clay	$\leq 2$ (370)	30.8 (370)	80.2 (370)	202.7 (370)
3087a	Metals on Filter Media	Set of 6 and 6 blanks	Arsenic	50.48			
			Barium	25.24			
			Cadmium	15.14			
			Chromium	10.10			
			Iron	25.24			
			Magnesium	25.24			
			Manganese	10.10			
			Nickel	25.24			
			Lead	40.38			
			Selenium	25.24			
			Vanadium	50.48			
			Zinc	100.94			

Values in parentheses are not certified and are given for information only.

## 105. Trace Constituent Elements in Blank Filters

SRMs 2678 and 2681 are for use in evaluating the performance of air sampling filter methods with two different filter types or sizes commonly used in air sampling of industrial atmospheres. For both SRMs, either certified values (in  $\mu\text{g}$ ), or limits of detection ( $X_D$ ), for each of 30 constituent elements as well as six leachable anions and cations are provided.

SRM	Type	Diameter (in mm)	Pore Size (in $\mu\text{m}$ )	Filter Weight (in g)
2678	Cellulose Acetate Membrane	47	0.45	0.09
2681	Ashless	42.5		0.14

## 105. Respirable Silica (powder form)

SRMs 1878a and 1879a are crystalline silica materials with particles in the respirable range. They are intended for use in determining by x-ray diffraction, the levels of respirable silica in an industrial atmosphere according to NIOSH Analytical Method P&CAM 259 or equivalent methods. **NOTE:** These SRMs are not certified for particle size.

SRM	Type	Unit Size	Component (mass fraction, in %)
1878a	Respirable Alpha Quartz	5 g	In Prep
1879a	Respirable Cristobalite	5 g	In Prep



## 105. Lead in Paint, Dust, and Soil (powder and sheet forms)

These SRMs and RM have been developed in conjunction with the U.S. EPA to monitor paint, soil, and dust sources of lead. SRMs 2570 through 2576 consist of one Mylar™ sheet per unit. Each sheet, 7.6 cm × 10.2 cm, is coated with a single uniform paint layer for use with portable x-ray fluorescence analyzers. SRM 2579a consists of a set of six Mylar™ sheets, one each of SRMs 2570 through 2575. SRMs 2580, 2581, 2582, and 2589 consist of paint that has been ground and homogenized into a powder, 99+ % of which passes a 100 µm sieve. SRM 2583 consists of dust, 99+ % of which passes a 100 µm sieve, that was collected in vacuum cleaner bags during routine cleaning of dwelling interiors. SRM 2583 is certified for arsenic, chromium, cadmium, lead, and mercury. [Also see Category 106.] SRMs 2584, 2586, and 2587 are dust or soil matrices containing lead from paint. RM 8680 consists of a 10.2 cm wide × 15.2 cm long × 1.3 cm thick section of painted fiberboard and is intended for use in the evaluation of destructive and nondestructive methods of measuring lead in paint on fiberboard.

SRM	Type	Unit Size	Lead Concentration
2570	Lead Paint Film, Blank	1 sheet	In Prep
2571	Lead Paint Film, Nominal 3.5 mg/cm <sup>2</sup>	1 sheet	In Prep
2572	Lead Paint Film, Nominal 1.6 mg/cm <sup>2</sup>	1 sheet	In Prep
2573	Lead Paint Film, Nominal 1.0 mg/cm <sup>2</sup>	1 sheet	In Prep
2574	Lead Paint Film, Nominal 0.7 mg/cm <sup>2</sup>	1 sheet	In Prep
2575	Lead Paint Film, Nominal 0.3 mg/cm <sup>2</sup>	1 sheet	In Prep
2576	Lead Paint Film, High Level	1 sheet	In Prep
2579a	Lead Paint Films for Portable X-ray Fluorescence Analyzers (SRMs 2570-2575)	6 sheets	3.5 to <0.0001 mg/cm <sup>2</sup>
2580	Powdered Paint, Nominal 4 % Lead	30 g	4.34 %
2581	Powdered Paint, Nominal 0.5 % Lead	35 g	0.449 %
2582	Powdered Paint, Nominal 200 mg/kg Lead	20 g	209.8 mg/kg
2583	Trace Elements in Indoor Dust	8 g	85.9 mg/kg
2584	Trace Elements in Indoor Dust, Nominal 1 % Lead	In Prep	
2586	Trace Elements in Soil Containing Lead from Paint, Nominal 500 mg/kg Lead	In Prep	
2587	Trace Elements in Soil Containing Lead from Paint, Nominal 3000 mg/kg Lead	In Prep	
2589	Powdered Paint, Nominal 10 % Lead	35 g	9.99 %
RM 8680	Paint on Fiberboard, Nominal 1 to 2 mg/cm <sup>2</sup>	1 sheet	individually value assigned

## 105. Asbestos

These SRMs are for use in identifying and quantifying asbestos types. SRM 1866a consists of a set of three common bulk mine-grade asbestos materials; chrysotile, grunerite (Amosite), riebeckite (Crocidolite), and one glass fiber sample. SRM 1867 consists of a set of three uncommon mine-grade asbestos materials; antophyllite, tremolite, and actinolite. The optical properties of SRMs 1866a and 1867 as observed by polarized light microscopy (PLM), have been characterized so that they may serve as primary calibration standards for the identification of asbestos types in building materials.

SRM 1868 consists of a set of two common bulk mine-grade asbestos materials; chrysotile and grunerite (Amosite), contained in matrices simulating building materials (calcium carbonate and glass fiber), in quantities at just below the U.S. EPA regulatory limit of 1%. This SRM is certified by weight for the quantity of each asbestos material present.

SRM 1876b is intended for use in evaluating the techniques used to identify and count chrysotile asbestos fibers by transmission electron microscopy (TEM). A unit consists of sections of mixed-cellulose-ester filters containing chrysotile asbestos fibers deposited by an aerosol generator.

RM 8411 consists of a section of collapsed mixed-cellulose-ester filters with a high concentration (138 fibers/0.01 mm<sup>2</sup>) of chrysotile asbestos and a medium concentration (43 fibers/0.01 mm<sup>2</sup>) of grunerite (Amosite) asbestos. It is intended for use in evaluating the techniques used to identify and count asbestos fibers by transmission electron microscopy (TEM).

SRM	Type	Unit Size
1866a	Common Commercial Asbestos	Set of 3: 4 g each
1867	Uncommon Commercial Asbestos	Set of 3: 5 to 10 g each
1868	Quantitative Asbestos in Building Materials	Set of 2: 5 to 10 g each
1876b	Chrysotile Asbestos for TEM	Set of 10: 3 mm × 3 mm
8411	Mixed Asbestos Research Filter	1 cm <sup>2</sup>



## 106. Inorganics

### 106. Metal Constituents in Natural Matrices (liquid and solid forms)

These SRMs and RM are for analysis of materials of health or environmental interest. [Also see Categories 105 and 111.]

SRM	Type	Unit Size	Elemental Composition
1640	Natural Water	250 mL	17 elements certified
1641c	Mercury in Water	6×20 mL	Hg: 1.47 mg/L
1643d	Trace Elements in Water	250 mL	26 elements certified
1646a	Estuarine Sediment	75 g	20 elements certified
1648	Urban Particulate Matter	2 g	14 elements certified
2583	Trace Elements in Indoor Dust	8 g	5 elements certified
2694b	Simulated Rainwater		In Prep
2704a	Buffalo River Sediment	50 g	In Prep
2709	San Joaquin Soil	50 g	26 elements certified
2710	Montana Soil Highly Elevated Trace Element Concentrations	50 g	21 elements certified
2711	Montana Soil Moderately Elevated Trace Element Concentrations	50 g	24 elements certified
2781	Domestic Sludge	40 g	10 elements certified
2782	Industrial Sludge		In Prep
RM 8407	Tennessee River Sediment	25 g	Hg: 0.50 mg/kg

### 106. Simulated Rainwaters (liquid form)

This SRM was developed to aid in the analysis of acidic rainwater by providing a stable, homogeneous material at two levels of acidity.

SRM	Type	Unit Size	
2694b	Simulated Rainwater	Set of 4: 2 × 50 mL at each of 2 levels	
Constituent Element/Parameter		2694b-I	2694b-II
pH, 25 °C		In Prep	In Prep
Electrolytic Conductivity (μS/cm, 25 °C)			
Acidity, meq/L			
Fluoride, mg/L			
Chloride, mg/L			
Nitrate, mg/L			
Sulfate, mg/L			
Sodium, mg/L			
Potassium, mg/L			
Ammonium, mg/L			
Calcium, mg/L			
Magnesium, mg/L			

Values in parentheses are not certified and are given for information only.

### 106. Thin Films for X-Ray Fluorescence

This SRM is for standardizing x-ray spectrometers. It may be useful in elemental analysis of particulate matter collected on filter media, and where x-ray spectrometer calibration functions are determined using thin film standards. Each SRM unit is individually certified and consists of a silica base glass film (0.5 μm thick) deposited on a 47 mm diameter polycarbonate filter mounted on an aluminum ring.

SRM	Type	Elemental Composition per area (in μg/cm <sup>2</sup> )					
		Fe	Pb	K	Si	Ti	Zn
1833	Thin Glass Film	— Out of Stock —					

## 106. Carbon Modified Silica (powder form)

This SRM is intended for the calibration of instruments used to measure total elemental carbon. The SRM consists of three, 1-g bottles of chemically modified microparticulate silica.

SRM	Type	Bottle	Carbon (mass fraction, in %)
1216	Carbon Modified Silica	I	0.70
		II	9.06
		III	17.04

## 106. Trace Elements (solid form)

This SRM is for analysis of trace elements in materials of environmental interest.

SRM	Type		Unit	Size	Trace Elements (in mg/kg unless noted as mass fraction, in %)									
					Al	Sb	As	Ba	Br	Cd	Ce	Cs	Cl	Cr
1648	Urban Particulate Matter			2 g										
								</						

Values in parentheses are not certified and are given for information only.

## 106. Used Auto Catalysts (powder form)

These SRMs are intended for use in the evaluation of methods for the analysis of the platinum group metals and lead in auto catalysts. They were produced in cooperation with the International Precious Metals Institute and are issued as fine (<74 µm) powders.

SRM	Type	Unit	Size	Elemental Composition (in mg/kg)			
				Pt	Pd	Rh	Pb
2556	Recycled Pellet	70 g		697.4	326.0	51.2	6228
2557	Recycled Monolith	70 g		1131	233.2	135.1	13931



## 107. Primary Gas Mixtures

These SRMs are for calibrating equipment and apparatus used to measure various components of gas mixtures and atmospheric pollutants. The typical gas mixture is supplied in a DOT 3AL specification aluminum (6061 alloy) cylinder with a nominal pressure exceeding 12.4 mPa that provides the user with approximately 0.73 m<sup>3</sup> of usable mixture. Due to increasing customer demand, these primary gas mixtures are in short supply and may not be readily available for sale. In such cases, a NIST traceable reference gas described below may be substituted.

A NIST Traceable Reference Material (NTRM) is a reference material produced by a commercial supplier with a well-defined *traceability* to NIST. This traceability is established via criteria and protocols defined by NIST that are tailored to meet the needs of the metrological community to be served. The NTRM concept was established to allow NIST to respond to the increasing needs for high quality reference materials by leveraging its relatively fixed human and financial resources with secondary reference material producers. Reference material producers adhering to NIST defined protocol requirements are allowed to use the "NTRM" trademark to identify their product.

The gas NTRM program was established in 1992 in partnership with the U.S. EPA and specialty gas companies as a means for providing end-users with the wide variety of certified gas standards needed to implement the "Emissions Trading" provision of the 1990 Clean Air Act. Gas NTRMs are produced and distributed by specialty gas companies with NIST oversight of the production and maintenance, and direct involvement in the analysis. NTRMs can be developed for any pollutant, concentration, and balance gas combination for which a NIST primary standard or SRM exists. The gas standards prepared according to this program are related, within known limits of *uncertainty*, to specific gaseous primary standards maintained by NIST.

Those SRMs that are marked "†" are available as NTRMs from commercial suppliers. A supplier list can be obtained upon request from the SRM Program Sales Office.

SRM	Type	Certified Component	Nominal Amount-of-substance fraction (in $\mu\text{mol/mol}$ )
1674b†	Carbon Dioxide in Nitrogen	CO <sub>2</sub>	7 mol %
1675b†	Carbon Dioxide in Nitrogen	CO <sub>2</sub>	14 mol %
2619a	Carbon Dioxide in Nitrogen	CO <sub>2</sub>	0.5 mol %
2620a	Carbon Dioxide in Nitrogen	CO <sub>2</sub>	1.0 mol %
2621a	Carbon Dioxide in Nitrogen	CO <sub>2</sub>	1.5 mol %
2622a	Carbon Dioxide in Nitrogen	CO <sub>2</sub>	2.0 mol %
2623a	Carbon Dioxide in Nitrogen	CO <sub>2</sub>	2.5 mol %
2624a	Carbon Dioxide in Nitrogen	CO <sub>2</sub>	3.0 mol %
2625a†	Carbon Dioxide in Nitrogen	CO <sub>2</sub>	3.5 mol %
2626a	Carbon Dioxide in Nitrogen	CO <sub>2</sub>	4.0 mol %
2745†	Carbon Dioxide in Nitrogen	CO <sub>2</sub>	16 mol %
2612a	Carbon Monoxide in Air	CO	10
2613a	Carbon Monoxide in Air	CO	20
2614a	Carbon Monoxide in Air	CO	45
1677c†	Carbon Monoxide in Nitrogen	CO	10
1678c†	Carbon Monoxide in Nitrogen	CO	50
1679c†	Carbon Monoxide in Nitrogen	CO	100
1680b†	Carbon Monoxide in Nitrogen	CO	500
1681b†	Carbon Monoxide in Nitrogen	CO	1000
2635a†	Carbon Monoxide in Nitrogen	CO	25
2636a†	Carbon Monoxide in Nitrogen	CO	250
2637a†	Carbon Monoxide in Nitrogen	CO	2500
2638a†	Carbon Monoxide in Nitrogen	CO	5000
2639a	Carbon Monoxide in Nitrogen	CO	1 mol %
2640a	Carbon Monoxide in Nitrogen	CO	2 mol %
2641a	Carbon Monoxide in Nitrogen	CO	4 mol %
2642a†	Carbon Monoxide in Nitrogen	CO	8 mol %
2740	Carbon Monoxide in Nitrogen	CO	10 mol %
2741	Carbon Monoxide in Nitrogen	CO	13 mol %



## 107. Primary Gas Mixtures – Continued

SRM	Type	Certified Component	Nominal Amount-of-Substance Fraction (in $\mu\text{mol/mol}$ )
1658a	Methane in Air	$\text{CH}_4$	1
1659a	Methane in Air	$\text{CH}_4$	10
1660a	Methane-Propane in Air	$\text{CH}_4$	4
		$\text{C}_3\text{H}_8$	1
2750	Methane in Air	$\text{CH}_4$	50
2751	Methane in Air	$\text{CH}_4$	100
1683b†	Nitric Oxide in Nitrogen	NO	50
1684b†	Nitric Oxide in Nitrogen	NO	100
1685b†	Nitric Oxide in Nitrogen	NO	250
1686b†	Nitric Oxide in Nitrogen	NO	500
1687b†	Nitric Oxide in Nitrogen	NO	1000
2627a	Nitric Oxide in Nitrogen	NO	5
2628a	Nitric Oxide in Nitrogen	NO	10
2629a†	Nitric Oxide in Nitrogen	NO	20
2630†	Nitric Oxide in Nitrogen	NO	1500
2631a†	Nitric Oxide in Nitrogen	NO	3000
2735	Nitric Oxide in Nitrogen	NO	800
2736	Nitric Oxide in Nitrogen	NO	2000
2656	Oxides of Nitrogen in Air	$\text{NO}_x$	2500
2660†	Oxides of Nitrogen in Air	$\text{NO}_x$	100
2657a†	Oxygen in Nitrogen	$\text{O}_2$	2 mol %
2658a†	Oxygen in Nitrogen	$\text{O}_2$	10 mol %
2659a†	Oxygen in Nitrogen	$\text{O}_2$	21 mol %
1665b	Propane in Air	$\text{C}_3\text{H}_8$	3
1666b	Propane in Air	$\text{C}_3\text{H}_8$	10
1667b	Propane in Air	$\text{C}_3\text{H}_8$	50
1668b†	Propane in Air	$\text{C}_3\text{H}_8$	100
1669b	Propane in Air	$\text{C}_3\text{H}_8$	500
2764	Propane in Air	$\text{C}_3\text{H}_8$	0.25
1671a	Carbon Dioxide in Air	$\text{CO}_2$	340
1672a	Carbon Dioxide in Air	$\text{CO}_2$	350
2643a	Propane in Nitrogen	$\text{C}_3\text{H}_8$	100
2644a	Propane in Nitrogen	$\text{C}_3\text{H}_8$	250
2645a	Propane in Nitrogen	$\text{C}_3\text{H}_8$	500
2646a	Propane in Nitrogen	$\text{C}_3\text{H}_8$	1000
2647a	Propane in Nitrogen	$\text{C}_3\text{H}_8$	2500
2648a	Propane in Nitrogen	$\text{C}_3\text{H}_8$	5000
2649a	Propane in Nitrogen	$\text{C}_3\text{H}_8$	1 mol %
2650	Propane in Nitrogen	$\text{C}_3\text{H}_8$	2 mol %
1661a†	Sulfur Dioxide in Nitrogen	$\text{SO}_2$	500
1662a†	Sulfur Dioxide in Nitrogen	$\text{SO}_2$	1000
1663a†	Sulfur Dioxide in Nitrogen	$\text{SO}_2$	1500
1664a†	Sulfur Dioxide in Nitrogen	$\text{SO}_2$	2500
1693a†	Sulfur Dioxide in Nitrogen	$\text{SO}_2$	50
1694a†	Sulfur Dioxide in Nitrogen	$\text{SO}_2$	100
1696a†	Sulfur Dioxide in Nitrogen	$\text{SO}_2$	3500
1800	Ambient Non-Methane Organics in Nitrogen	(Fifteen components in large cylinder)	5 nmol/mol
1800a	Ambient Non-Methane Organics in Nitrogen	(Fifteen components in small cylinder)	5 nmol/mol
1804a	Ambient Toxic Organics in Nitrogen	(Nineteen components)	5 nmol/mol
2730	Hydrogen Sulfide in Nitrogen	$\text{H}_2\text{S}$	5
2731	Hydrogen Sulfide in Nitrogen	$\text{H}_2\text{S}$	20

## 107. Permeation Devices

These SRMs are primarily intended for use in calibrating air pollution monitoring apparatus and for calibrating air pollution analytical methods and procedures. Each tube is individually calibrated and certified according to NIST procedures and protocols.

SRM	Type	Tube Length (in cm)	Permeation Rate at 30 °C (in $\mu\text{g/min}$ )	Amount-of-Substance Fraction (in $\mu\text{mol/mol}$ ) at Dilution Air Flow Rates of (L/min) @ 25 °C)		
				1	5	10
1625	Sulfur Dioxide Permeation Tube	10	2.8	1.1	0.21	0.11
1626	Sulfur Dioxide Permeation Tube	5	1.4	0.54	0.11	0.054

## 108. Fossil Fuels

### Alcohols and Ethers [Oxygenates] in Reference Fuels (liquid form)

SRMs 1829, 1837, 1838, and 1839 are for calibrating instruments and validating methods used to determine various alcohols in gasoline. SRM 1829 is issued as a set of six sealed 20 mL ampules; SRMs 1837, 1838 and 1839 are each issued as a set of five sealed 20 mL ampules.

SRMs 2286 through 2297 were produced in response to the U.S. EPA Final Rule on Reformulated Gasoline aimed at reducing the volatile organic compounds emitted from gasoline. They consist of varying quantities of alcohol and ether (oxygenate) solutions in gasoline. SRMs 2286 through 2293 will be certified for constituent oxygenate concentration and resultant oxygen concentration in gasoline. Each SRM unit is issued as a set of three sealed 20 mL ampules—two ampules contain oxygenate and one ampule contains base reference gasoline. SRMs 2294 through 2297 will be certified for total olefins, total aromatics, oxygenate, sulfur, and benzene. Each SRM unit is issued as a set of two sealed 20 mL ampules. [NOTE: See Section 203 for Flash Point RMs.]

SRM	Type	Concentration (mass fraction, in %)				
		Methanol	Ethanol	Methanol and t-Butanol	Oxygenate	Oxygen
1829	Alcohols in Reference Fuels	0.335	11.39	10.33 + 6.63		
1837	Methanol and t-Butanol			10.33 + 6.63		
1838	Ethanol		11.39			
1839	Methanol	0.335				
2286	Ethanol in Gasoline				5.73	2.02
2287	Ethanol in Gasoline				10.07	3.53
2288	t-Amyl Methyl Ether in Gasoline				12.78	2.02
2289	t-Amyl Methyl Ether in Gasoline				17.30	2.73
2290	Ethyl t-Butyl Ether in Gasoline				12.78	2.01
2291	Ethyl t-Butyl Ether in Gasoline				17.18	2.70
2292	Methyl t-Butyl Ether in Gasoline				10.96	2.00
2293	Methyl t-Butyl Ether in Gasoline				14.86	2.71
2294	Reformulated Gasoline (nominal 11% MTBE, 35 mg/kg sulfur)				In Prep	
2295	Reformulated Gasoline (nominal 15% MTBE, 300 mg/kg sulfur)				In Prep	
2296	Reformulated Gasoline (nominal 13% ETBE, 35 mg/kg sulfur)				In Prep	
2297	Reformulated Gasoline (nominal 10% Ethanol, 300 mg/kg sulfur)				In Prep	

### 108. Metal Constituents in Fossil Fuels (liquid and solid forms)

These SRMs and RM are for analysis of metal trace elements in fuel oil and reference fuels. [Also see Category 114.]

SRM	Type	Unit Size	Elemental Composition (mass fraction, in %*)						
			As	Co	Pb	Ni	S	Se	V
1618	Vanadium and Nickel in Residual Fuel Oil (No. 6)	100 mL				75*	(4.3)		423*
1634c	Trace Elements in Fuel Oil (No. 6)	100 mL	0.1426*	0.1510*		17.54*	(2)	0.1020*	28.19*
2712	Lead in Reference Fuel	6×20 mL			11.4*				
2713	Lead in Reference Fuel	6×20 mL			19.4*				
2714	Lead in Reference Fuel	6×20 mL			28.1*				
2715	Lead in Reference Fuel	6×20 mL			784*				
RM 8505	Vanadium in Crude Oil	250 mL							(390*)

Values in parentheses are not certified and are given for information only.

\*Values are in mg/kg.



## 108. Sulfur in Fossil Fuels (liquid and solid forms)

SRM	Type	Unit Size	Sulfur (mass fraction, in %)	Furnace Ash (mass fraction, in %)	Volatile Matter (mass fraction, in %)
1616a	Sulfur in Kerosine	100 mL	0.01462		
1617a	Sulfur in Kerosine	100 mL	0.17307		
1619a	Sulfur in Residual Fuel Oil	100 mL	0.725		
1620b	Sulfur in Residual Fuel Oil	100 mL	4.220		
1621e	Sulfur in Residual Fuel Oil	100 mL	0.9480		
1622e	Sulfur in Residual Fuel Oil	100 mL	2.1468		
1623c	Sulfur in Residual Fuel Oil	100 mL	0.0024		
1624c	Sulfur in Distillate Fuel Oil	100 mL	0.3970		
2717	Sulfur in Residual Fuel Oil	100 mL	3.022		
2723	Sulfur in Diesel Fuel Oil	100 mL	In Prep		
2724a	Sulfur in Diesel Fuel Oil	100 mL	0.04304		
1632b	Trace Elements in Coal (Bituminous)	50 g	1.89	6.8	(35)
1635	Trace Elements in Coal (Sub-bituminous)	50 g	0.33		
2718	Trace Elements in Green Petroleum Coke	50 g	In Prep		
2719	Trace Elements in Calcined Petroleum Coke	50 g	In Prep		
2682a	Coal (Sub-bituminous)	50 g	0.486	6.3	
2683b	Coal (Bituminous)	50 g	1.955	9.93	
2684a	Coal (Bituminous)	50 g	3.06	11.0	
2685a	Coal (Bituminous)	50 g	4.730	16.21	
2692a	Sulfur in Coal, 1%	50 g	1.184	7.94	
2775	Foundry Coke	50 g	0.5816	5.77	1.31
2776	Furnace Coke	In Prep			

Values in parentheses are not certified and are given for information only.

## 108. Moisture in Oils and Alcohols (liquid form)

These RMs are intended for use in developing and validating methods for the determination of moisture in oil and similar matrices. The water concentration values are not certified, but represent the "best estimate" of the moisture content determined by NIST.

RM	Type	Unit Size	Water Concentration (in mg/kg)
8506	Moisture in Transformer Oil	Set of 5 ampules: 10 mL each	(39.7)
8507	Moisture in Mineral Oil	Set of 5 ampules: 10 mL each	(76.8)
8509	Moisture in Methanol	Set of 5 ampules: 5 mL each	(93)
8510	Moisture in Methanol	Set of 5 ampules: 5 mL each	(325)

Values in parentheses are not certified and are given as recommended reference values only.

## 108. Reference Liquids for Evaluating Fuels

SRMs 1815a and 1816a are high purity liquids intended for use in maintaining the integrity of the octane rating of motor and aviation fuels as specified in the ASTM Manual for Rating Motor, Diesel, and Aviation Fuels.

SRM	Type	Unit Size	Purity (mass fraction, in %)
1815a	n-Heptane	100 mL	99.987
1816a	Iso octane (2,2,4-Trimethylpentane)	100 mL	99.987



## 108. Trace Elements (solid forms)

SRM	1632b	1633b	1635	2689	2690	2691	2718	2719
Type	Coal (Bituminous)	Coal Fly Ash	Coal (Subbitum- inous)	Coal Fly Ash	Coal Fly Ash	Coal Fly Ash	Green Petroleum Coke	Calcined Petroleum Coke
Unit Size	50 g	75 g	75 g	3×10 g	3×10 g	3×10 g	50 g	50 g
Element	(Concentrations are in mg/kg, unless noted by a single asterisk for mass fraction, in %.)							
Aluminum	0.855*	15.05*	(0.32*)	12.94*	12.35*	9.81*	In Prep	In Prep
Antimony	(0.24)	(6)	(0.14)	(9)	(6)	(3)		
Arsenic	3.72	136.2	0.42	(200)	(26)	(30)		
Barium	67.5	709		(800)	(5800)	(5900)		
Beryllium				(21)	(8)	(8)		
Bromine	(17)	(2.9)						
Cadmium	0.0573	0.784	0.03	(3)	(0.7)	(0.9)		
Calcium	0.204*	1.51*		2.18*	5.71*	18.45*		
Carbon	76.86*							
Cerium	(9)	(190)	(3.6)					
Cesium	(0.44)	(11)		(11)	(8)	(1)		
Chlorine	(1260)							
Chromium	(11)	198.2	2.5	(170)	(67)	(68)		
Cobalt	2.29	(50)	(0.65)	(48)	(19)	(26)		
Copper	6.28	112.8	3.6					
Dysprosium		(17)						
Europium	(0.17)	(4.1)	(0.06)	(3)	(2)	(2)		
Fluorine	41.7		25.9					
Gadolinium		(13)						
Gallium			(1.05)					
Hafnium	(0.43)	(6.8)	(0.29)	(7)	(8)	(10)		
Holmium		(3.5)						
Hydrogen	4.94*							
Iron (Total)	0.759*	7.78*	0.239*	9.32*	3.57*	4.42*		
Lanthanum	(5.1)	(94)						
Lead	3.67	68.2	1.9	(52)	(39)	(29)		
Lithium	(10)							
Lutetium		(1.2)						
Magnesium	0.0383*	0.482*		0.61*	1.53*	3.12*		
Manganese	12.4	131.8	21.4	(300)	(300)	(200)		
Mercury	(0.10)	0.141	(0.02)	(<0.003)	(<0.003)	(<0.003)		
Molybdenum	(0.9)							
Neodymium		(85)						
Nickel	6.10	120.6	1.74	(122)	(46)	(53)		
Nitrogen	1.56*							
Phosphorus		(2300)		0.10*	0.52*	0.51*		
Potassium	0.0748*	1.95*		2.20*	1.04*	0.34*		
Rubidium	5.50	(140)						
Samarium	(0.87)	(20)						
Scandium	(1.9)	(41)	(0.63)	(32)	(17)	(24)		
Selenium	1.29	10.26	0.9	(7)	(0.8)	(17)		
Silicon	(1.4*)	23.02*		24.06*	25.85*	16.83*		
Sodium	0.0515*	0.201*	(0.24*)	0.25*	0.24*	1.09*		
Strontium	(102)	1041		(700)	(2000)	(2700)		
Sulfur	1.89*	0.2075*	0.33*		0.15*	0.83*		
Tantalum		(1.8)						
Terbium		(2.6)						
Thallium		(5.9)						
Thorium	1.342	25.7	0.62	(25)	(25)	(26)		
Thulium		(2.1)						
Titanium	0.0454*	0.791*	(0.02*)	0.75*	0.52*	0.90*		
Tungsten	(0.48)	(5.6)						
Uranium	0.436	8.79	0.24					
Vanadium	(14)	295.7	5.2					
Ytterbium		(7.6)						
Zinc	11.89	(210)	4.7	(240)	(120)	(120)		

Values in parentheses are not certified and are given for information only.

## 109. Organics

### 109. GC/MS and LC System Performance (liquid form)

These SRMs and RM are for evaluating the sensitivity of gas chromatography/mass spectrometry (GC/MS) instrumentation and for characterizing liquid chromatography (LC) column selectivity.

SRM	Type	Unit Size	Selectivity (C18 phases)	Concentration (in mg/L) Low/High
869	LC Selectivity	Set of 5, 1.1 mL	BaP≤PhPh<TBN	
1543	GC/MS System	Set of 4, 1 mL		Methyl Stearate 0.99/4.98
RM 8443	Performance	Set of 20, 1 mL		Benzophenone 1.01/5.01

### 109. Organic Constituents (liquid and solid forms)

These SRMs and RMs are for calibrating or measuring organic contaminants found in a variety of environmental matrices. They are listed in the table below and further described in tables on this and the following three pages. The first three tables identify the SRMs for PAHs, Pesticides, PCBs, methylmercury, and mercury, respectively. The SRMs described therein are grouped according to application — calibration or natural matrix measurement. The calibration SRMs are useful for validating the chromatographic separation step while the natural matrix SRMs, which are similar to actual environmental samples, can be used to validate all the steps of an analytical procedure. The fourth table describes SRMs and RMs certified for organic components in such matrices as oil, *isooctane*, and methanol. **NOTE:** Due to space limitations, only selected components are listed for most SRMs in the tables. Also, due to the types of components certified, SRMs 1588a, 1941a, 1945, 1974a, and 2974, are listed in more than one table.

SRM	Type	Unit of Issue
1491	Aromatic Hydrocarbons in Hexane/Toluene	Set of 5 ampules
1492	Chlorinated Pesticides in Hexane	Set of 5 ampules
1493	Polychlorinated Biphenyl Congeners in <i>Isooctane</i>	Set of 5 ampules
1580	Shale Oil	Set of 5 ampules
1581	Polychlorinated Biphenyls in Oil	Set of 8 ampules
1582	Petroleum Crude Oil	Set of 5 ampules
1584	Phenols in Methanol	Set of 5 ampules
1586	Isotopically Labelled Priority Pollutants	Set of 6 ampules
1587	Nitro PAH in Methanol	Set of 4 ampules
1588a	Organics in Cod Liver Oil	In Prep
1589a	Polychlorinated Biphenyls (as Aroclor 1260) in Human Serum	In Prep
1596	Dinitropyrene Isomers and 1-Nitropyrene in Methylene Chloride	Set of 5 ampules
1597	Complex Mixture of Polycyclic Aromatic Hydrocarbons from Coal Tar	Set of 4 ampules
1614	Dioxin (2,3,7,8 TCDD) in <i>Isooctane</i>	Set of 6 ampules
1639	Halocarbons (in Methanol) for Water Analysis	In Prep
1647d	Priority Pollutant Polycyclic Aromatic Hydrocarbons (in Acetonitrile)	Set of 5 ampules
1649a	Urban Dust/Organics	10 g
1650a	Diesel Particulate Matter	In Prep
1939a	Polychlorinated Biphenyls in River Sediment A	50 g
1941a	Organics in Marine Sediment	50 g
1944	New York-New Jersey Waterway Sediment	In Prep
1945	Organics in Whale Blubber	Set of 2 bottles
1974a	Organics in Mussel Tissue (Frozen)	Set of 3 bottles
1975	Diesel Particulate Extract	In Prep
2260	Aromatic Hydrocarbons in Toluene	Set of 5 ampules
2261	Chlorinated Pesticides in Hexane	Set of 5 ampules
2262	Chlorinated Biphenyl Congeners in <i>Isooctane</i>	Set of 5 ampules
2974	Organics in Freeze-dried Mussel	8 g
2975	Diesel Particulate Matter (Industrial Forklift)	In Prep
RM 8466	γ-HCH (Lindane) (neat)	Vial, 100 mg
RM 8467	4,4'-DDE (neat)	Vial, 100 mg
RM 8469	4,4'-DDT (neat)	Vial, 100 mg



## 109. Organic Constituents (liquid and solid forms) – Continued

PAH SRM [No. of Components certified]	Calibration Solution			Natural Matrix										
	1491 [23]	2260 [23]	1647d [16]	1580 [9]	1582 [6]	1597 [12]	1649a [22]	1650a [23]	1941a [23]	1944 [20]	1974a [15]	1975 [23]	2974 [14]	2975 [23]
Component (in mg/kg)														
Naphthalene	10.30	76.3	25.84			1160		In Prep	1.010	In Prep	0.0235	In Prep	(0.00963)	In Prep
1-Methylnaphthalene	12.4	75.7				(47)					(0.0053)		(0.00347)	
2-Methylnaphthalene	(11.3)	(75.3)				(97)					(0.0102)		(0.00648)	
Biphenyl	10.46	76.14				(27)			(0.175)		(0.00511)		(0.00468)	
Acenaphthylene	10.40	73.09	19.89			(250)			(0.037)		(0.00525)		(0.00460)	
Acenaphthene	10.89	78.9	26.67						(0.041)		(0.00315)		(0.00274)	
Fluorene	10.87	75.62	6.09			(140)	(0.231)		0.973		(0.00572)		(0.00469)	
Phenanthrene	10.48	76.01	4.40		101	462	4.14		0.489		0.0222		0.0222	
Anthracene	11.69	57.54	1.02			101	0.432		0.184		0.0061		0.0061	
1-Methylphenanthrene	10.4	75.2					(0.366)		(0.101)		(0.0105)		(0.0105)	
Fluoranthene	8.84	76.31	9.81	54	2.5	322	6.45		0.981		0.1637		0.1637	
Pyrene	8.81	76.20	10.88	104		235	5.29		0.811		0.1516		0.1516	
Benz[a]anthracene	5.37	66.0	5.25		3.0	98.6	2.21		0.427		0.0325		0.0325	
Chrysene	10.50	76.6	4.71			71.7	3.049		0.380		0.0442		0.0442	
Triphenylene						12.1	1.357		0.197		0.0507		0.0507	
Benzo[b]fluoranthene	7.85	75.97	5.36			(66)	6.43		0.740		0.0464		0.0464	
Benzo[k]fluoranthene	8.33	75.67	6.06			(43)	1.907		0.361		0.02018		0.0202	
Benzo[a]fluoranthene							0.409		0.118		(0.0040)			
Benzo[e]pyrene	8.40	75.98		18		(57)	3.09		0.553		0.0840		0.0840	
Benzo[a]pyrene	10.14	68.61	6.31	21	1.1	95.8	2.509		0.628		0.01563		0.01563	
Perylene	10.65	57.48		3.4	31	26.1	0.646		0.452		0.00768		0.00768	
Indeno[1,2,3-cd]pyrene	9.40	67.4	5.49			60.2	3.08		0.501		0.0142		0.0142	
Dibenz[a,h]anthracene	7.74	57.1	4.54				0.299		0.0739					
Benzo[ghi]perylene	7.90	67.9	4.73			53.7	3.99		0.525		0.0220		0.0220	

Values in parentheses are not certified but are provided as reference values or are given for information only.

## 109. Organic Constituents (liquid and solid forms) – Continued

Pesticide SRM [No. of Components certified]	Calibration Solution		Natural Matrix					
	1492 [15]	2261 [15]	1588a [12]	1941a [6]	1944 [10]	1945 [15]	1974a [7]	2974 [7]
Component (in µg/kg)								
Hexachlorobenzene	308	3005	In Prep	70		32.9		
γ-HCH (Lindane)	310	3012				3.30		
Heptachlor	299	3020						
Aldrin	304	3029						
Heptachlor epoxide	307	3020				10.8		
cis-Chlordane	305	3012		2.33		46.9	17.2	17.2
trans-Nonachlor	297	3034		1.26		231	18.0	18.0
Dieldrin	307	3012		(1.26)		(37.5)	(6.2)	(6.2)
Mirex	306	3041				28.9		
2,4'-DDE	303	3019		0.73		12.28	(5.26)	(5.26)
4,4'-DDE	306	3019		6.59		445	51.2	51.2
2,4'-DDD	299	3013				18.1	(13.7)	(13.7)
4,4'-DDD	296	3043		5.06		133	43.0	43.0
2,4'-DDT	307	2993				106	(8.5)	(8.5)
4,4'-DDT	302	3004		(1.25)		245	3.91	3.91

Values in parentheses are not certified and are given for information only.



## 109. Organic Constituents (liquid and solid forms) – Continued

PCB SRM [No. of Components certified]	Calibration Solution		Natural Matrix							
	1493 [18]	2262 [25]	1588a [15]	1589a [tbd]*	1939a [16]	1941a [21]	1944 [20]	1945 [27]	1974a [20]	2974 [26]
Component (in µg/kg)										
Methylmercury									77.3	77.3
Mercury									176	176
PCB 1		2997	In Prep	In Prep	In Prep		In Prep			
PCB 3										
PCB 8	(277)	3110				(1.39)				
PCB 15										
PCB 18	290.8	2983				(1.15)		4.48	(33)	(26.8)
PCB 28	288.0	(3000)				(9.8)		(14.1)	(79)	(79)
PCB 29		2980								
PCB 44	289	2977				4.80		12.2	72.7	72.7
PCB 50		(3010)								
PCB 52	285.9	2996				6.89		43.6	115	115
PCB 66	291.9	2973				6.8		23.6	101.4	101.4
PCB 77	284.3	3040								
PCB 87		3000				6.70		16.7	(54)	
PCB 101	287.8	2950				11.0		65.2	128.3	128
PCB 104		3007								
PCB 105	286	2960				3.65		30.1	53.0	53.0
PCB 118	(289)	2992				10.0		74.6	130.8	130.8
PCB 126	287.4	3010								
PCB 128	290.0	2985				1.87		23.7	22.0	22.0
PCB 138	287.1	2939				13.38		131.5	133.5	134
PCB 153	287.5	2957				17.6		213	145.2	145.2
PCB 154		(2950)								
PCB 170	285.3	2964				3.00		40.6	5.5	5.5
PCB 180	289.2	2986				5.83		106.7	17.1	17.1
PCB 187	285.3	2967				(7.0)		105.1	34.0	34.0
PCB 188		3008								
PCB 195	289.0	2974						17.7		
PCB 201		3001						16.96		
PCB 206	259	2900				3.67		31.1		
PCB 209	289.6	2989				8.34		10.6		

Values in parentheses are not certified but are provided as reference values or are given for information only..

\*Components to be certified are yet to be determined.

## 109. Organic Constituents (liquid and solid forms) – Continued

Selected Matrices		1581	1584	1586-1	1586-2	1587	1596	1614	1639	RM 8466	RM 8467	RM 8469
SRM		[4]	[10]	[10]	[10]	[6]	[4]	[2]	[7]			
[No. of Components certified]												
Component (Concentrations are in mg/kg, unless noted by a single asterisk for µg/kg, a double asterisk for mg/L @ 25 °C, or a dagger for mass fraction, in %.)												
Motor Oil-Aroclor 1242		100										
Motor Oil-Aroclor 1260		100										
Transformer Oil-Aroclor 1242		100										
Transformer Oil-Aroclor 1260		100										
2-Chlorophenol			64.4**									
Phenol			29.7**	117.0	116.0							
2-Nitrophenol			25.2**	103.6	101.9							
2,4-Dimethylphenol			51.6**									
2,4-Dichlorophenol			35.6**	102.5	82.2							
4-Chloro-m-cresol			27.4**									
2,4,6-Trichlorophenol			20.4**									
4-Nitrophenol			20.7**									
4,6-Dinitro-o-cresol			20.1**									
Pentachlorophenol			15.4**									
2,4-Dinitrophenol			(22.4)**									
Carbon Tetrachloride				128.5	124.4				157.0**			
Benzene				101.1	99.0							
Chlorobenzene				133.0	144.0							
Nitrobenzene				126.0	134.5							
Naphthalene				126.5	126.6							
Bis(2-ethylhexyl)phthalate				63.9	60.4							
Benzo[a]pyrene				49.2	44.1							
2-Nitrofluorene						9.67						
9-Nitroanthracene						5.01						
3-Nitrofluoranthene						9.24						
1-Nitropyrene						8.95	4.38					
7-Nitrobenz[a]anthracene						9.27						
6-Nitrochrysene						8.13						
6-Nitrobenzo[a]pyrene						(6.1)						
1,3-Dinitropyrene							2.10					
1,6-Dinitropyrene							4.82					
1,8-Dinitropyrene							8.90					
2,3,7,8-TCDD								98.3*				
2,3,7,8-TCDD- <sup>13</sup> C								95.6*				
Chloroform									6235**			
Chlorodibromomethane									124.6**			
Bromodichloromethane									389.9**			
Bromoform									86.5**			
Trichloroethylene									85.8**			
Tetrachloroethylene									40.6**			
γ-Hexachlorocyclohexane (Lindane)										(99.9)†		
4,4'-DDE											(99.8)†	
4,4'-DDT												(99.8)†

Values in parentheses are not certified and are given for information only.

# 110. Food and Agriculture

These SRMs are for validation of analytical procedures and calibration of apparatus used in the analysis of trace elements in foods and related products.

## Foods and Beverages (liquid and powder forms)

SRM	1549	1566b	1567a	1568a	1577b
Type	Non-fat Milk Powder	Oyster Tissue	Wheat Flour	Rice Flour	Bovine Liver
Unit Size	100 g	25 g	80 g	80 g	50 g
Element	(Concentrations are in mg/kg, unless noted by a single asterisk for mass fraction, in %.)				
Aluminum	(2)	In Prep	5.7	4.4	(3)
Antimony	(0.00027)			(0.0005)	(0.003)
Arsenic	(0.0019)		(0.006)	0.29	(0.05)
Bromine	(12)		(6)	(8)	(9.7)
Cadmium	0.0005		0.026	0.022	0.50
Calcium	1.30*		0.0191*	0.011*	116
Chlorine	1.09*		(565)	(300)	0.278*
Chromium	0.0026				
Cobalt	(0.0041)		(0.006)	(0.018)	(0.25)
Copper	0.7		2.1	2.4	160
Fluorine	(0.20)				
Iodine	3.38		(0.0009)	(0.009)	
Iron	1.78		14.1	7.4	184
Lead	0.019		(<0.020)	(<0.010)	0.129
Magnesium	0.120*		0.040*	0.056*	601
Manganese	0.26		9.4	20.0	10.5
Mercury	0.0003		(0.0005)	0.0058	(0.003)
Molybdenum	(0.34)		0.48	1.46	3.5
Nickel				(0.16)	
Nitrogen					
Phosphorus	1.06*		0.134*	0.153*	1.10*
Potassium	1.69*		0.133*	0.1280*	0.994*
Rubidium	(11)		0.68	6.14	13.7
Selenium	0.11		1.1	0.38	0.73
Silicon	(<50)				
Silver	(<0.0003)				0.039
Sodium	0.497*		6.1	6.6	0.242*
Strontium					0.136
Sulfur	0.351*		0.165*	0.120*	0.785*
Tellurium				(<0.002)	
Thorium					
Tin	(<0.02)			(0.0033)	(0.0047)
Uranium			(0.0003)	(0.0003)	
Vanadium			(0.011)	(0.007)	(0.123)
Zinc	46.1		11.6	19.4	127

Values in parentheses are not certified and are given for information only.



## 110. Health Care and Nutrients (liquid and solid forms)

These SRMs and RMs are for use in determining the nutritional contents of foods. The SRMs are certified for such dietary constituents as proximates (solids, ash, protein, carbohydrate, fat and linoleate), vitamins, niacin, folic acid, pantothenic acid, biotin, choline, and selected minerals and trace elements. **NOTE:** Only selected constituent values are shown below for information. Consult the relevant certificate or report of investigation for all available certified and non-certified values.

SRM	Type	Certified Constituents Analytes	Values	Unit Size
<b>Nutritional Constituent</b> (Concentrations are in g/kg, unless noted by a single asterisk for mg/kg.)				
1544	Fatty Acids and Cholesterol in a Frozen Diet Composite	Cholesterol, Fatty Acids, Proximates	0.1483	4×15 g
1548a	Typical Diet	In Prep		2×6.5 g
1563	Cholesterol and Fat-Soluble Vitamins in Coconut Oil	Cholesterol	639.8	10 ampules; 5 fortified 5 natural
		Ergocalciferol	10.9*	
		dl- $\alpha$ -Tocopherol Acetate	158.0*	
1845	Whole Egg Powder	Cholesterol	19.0 g/kg	35 g
1846	Infant Formula (milk-based)	Proximates, Vitamins, Minerals		10×30 g
2383	Baby Food Composite	Carotenoids, Vitamins		4×70 g
RM 8036	BCR No 150 Spiked Skim Milk Powder	Trace Elements		30 g
RM 8435	Whole Milk	Minerals		40 g

## 110. USA/Canada Collaborative Materials (powder form)

These materials, developed by Agriculture Canada in collaboration with NIST, are for calibrating apparatus and validating methods applied to food/agricultural commodities.

RM	8412	8413	8414	8415	8416	8418
Type	Corn Stalk	Corn Kernel	Bovine Muscle Powder	Whole Egg Powder	Microcrystalline Cellulose	Wheat Gluten
Unit Size	34 g	47 g	50 g	35 g	35 g	50 g
<b>Element</b> (Best Estimate concentrations are in mg/kg, unless noted by a single asterisk for mass fraction, in %.)						
Aluminum	—	(4)	1.7	540	3.7	10.8
Antimony	—	—	(0.01)	(0.002)	—	(0.01)
Arsenic	—	—	0.009	(0.01)	(0.001)	(0.02)
Barium	—	—	(0.05)	(3)	(0.1)	1.53
Boron	—	—	0.6	0.41	(0.2)	(0.4)
Bromine	—	—	1.1	—	—	(3.6)
Cadmium	—	—	0.013	(0.005)	0.00002	0.064
Calcium	0.216*	42	145	0.248*	(5)	369
Cerium	—	—	—	—	—	—
Cesium	—	—	(0.05)	—	—	—
Chlorine	0.244*	(450)	0.188*	0.508*	80	0.362*
Chromium	—	—	0.071	0.37	(0.05)	0.053
Cobalt	—	—	0.007	0.012	0.0017	0.010
Copper	8	3.0	2.84	2.70	0.015	5.94
Fluorine	(0.65)	(0.24)	(0.22)	—	(0.005)	(0.43)
Iodine	—	—	0.035	1.97	(0.01)	0.060
Iron	139	23	71.2	112	(2)	54.3
Lanthanum	—	—	—	—	—	—
Lead	—	—	0.38	0.061	0.006	0.10
Magnesium	0.160*	0.0990*	960	305	—	510
Manganese	15	4.0	0.37	1.78	(0.03)	14.3
Mercury	—	—	0.005	0.004	(0.0002)	0.0019
Molybdenum	—	—	0.08	0.247	0.01	0.76
Nickel	—	—	0.05	—	0.05	0.13
Nitrogen	(6970)	(13750)	13.75	6.30	200	14.68
Phosphorus	—	—	0.836	1.001	(7)	0.219
Potassium	1.735	0.3570	1.517	0.319	—	472
Rubidium	—	28.7	—	—	—	(0.4)
Samarium	—	—	—	—	—	—

# 110. USA/Canada Collaborative Materials (powder form) — Continued

RM	8412	8413	8414	8415	8416	8418
Type	Corn Stalk	Corn Kernel	Bovine Muscle Powder	Whole Egg Powder	Microcrystalline Cellulose	Wheat Gluten
Unit Size	34 g	47 g	50 g	35 g	35 g	50 g
Element	(Best estimate concentrations are in mg/kg, unless noted by a single asterisk for mass fraction, in %.)					
Selenium	0.016	0.004	0.076	1.39	0.002	2.58
Sodium	28	—	0.210	0.377	(7)	0.142
Strontium	12	—	0.052	5.63	(0.02)	1.71
Sulfur	—	—	0.795	0.512	(10)	0.845
Titanium	—	—	—	—	—	(2)
Vanadium	—	—	(0.005)	0.459	(0.02)	(0.04)
Zinc	32	15.7	142	67.5	0.1	53.8

Values in parentheses are not certified and are given for information only.

RM	8432	8433	8435	8436	8437	8438
Type	Corn Starch	Corn Bran	Whole Milk Powder	Durum Wheat Flour	Hard Red Spring Wheat Flour	Soft Winter Wheat Flour
Unit Size	50 g	50 g	40 g	50 g	50 g	50 g
Element	(Best estimate concentrations are in mg/kg, unless noted by a single asterisk for mass fraction, in %.)					
Aluminum	1.9	1.01	0.9	11.7	2.1	2.3
Antimony	—	(0.004)	—	—	—	—
Arsenic	—	0.002	(0.001)	(0.03)	—	—
Barium	—	2.40	0.58	2.11	(0.04)	(1)
Boron	—	2.8	1.1	—	(0.2)	(0.1)
Bromine	—	2.3	20	6.6	—	—
Cadmium	0.0003	0.012	(0.0002)	0.11	(0.02)	(0.03)
Calcium	56	420	0.922	278	143	240
Chlorine	45	31	0.842*	680	500	640
Chromium	(0.02)	0.101	(0.5)	0.023	0.026	0.032
Cobalt	0.0012	0.006	(0.003)	0.008	—	—
Copper	0.06	2.47	0.46	4.30	2.01	1.2
Fluorine	(0.02)	—	(0.17)	(0.1)	(0.02)	(0.04)
Iodine	—	0.026	2.3	0.006	—	—
Iron	(5)	14.8	1.8	41.5	31	29
Lead	0.007	0.140	0.11	0.023	—	—
Magnesium	31	818	814	0.107*	365	214
Manganese	0.10	2.55	0.17	16.0	4.50	5.4
Mercury	0.0011	0.003	—	0.004	(0.004)	(0.002)
Molybdenum	0.02	0.252	0.29	0.70	0.55	0.29
Nickel	0.02	0.158	(0.01)	0.17	(0.2)	—
Nitrogen	670	0.884*	4.182*	2.707*	2.690*	1.756*
Phosphorus	178	171	0.780*	0.290*	0.137*	0.108
Potassium	45	566	1.363*	0.318*	0.115*	0.148*
Rubidium	—	0.5	(16)	2.0	—	—
Selenium	0.0009	0.045	0.131	1.23	0.56	0.076
Sodium	119	430	0.356*	16.0	7	7
Strontium	0.18	4.62	4.35	1.19	(4)	—
Sulfur	(200)	860	0.265*	0.193*	0.183*	0.126*
Titanium	—	—	(4)	(5)	—	—
Tungsten	(0.001)	—	(0.002)	—	(0.01)	—
Vanadium	—	0.005	—	0.021	0.02	(0.03)
Zinc	0.22	18.6	28.0	22.2	10.6	5.8

Values in parentheses are not certified and are given for information only.

## 110. Agricultural Materials (powder form)

SRM Type	1515 Apple Leaves	1547 Peach Leaves	1570a Spinach Leaves	1573a Tomato Leaves	1575 Pine Needles	2695 Fluoride, in Vegetation	RM 8030 BCR No 60 Aquatic Plant	RM 8031 BCR No 61 Aquatic Moss	RM 8412 Corn Stalk (Zea Mays)	RM8413 Corn Kernel (Zea Mays)
Unit Size	50 g	50 g	60 g	50 g	70 g	2 × 25 g	25 g	25 g	34 g	47 g
(Concentrations are in mg/kg, unless noted by a single asterisk for mass fraction, in %.)										
Aluminum	286	249	310	598	545					(4)
Antimony	(0.013)	(0.02)		0.063	(0.2)					
Arsenic	0.038	0.060	0.068	0.112	0.21					
Barium	49	124		(63)						
Boron	27	29	37.6	33.3						
Bromine	(1.8)	(11)		(1300)	(9)					
Cadmium	(0.013)	(0.026)	2.89	1.52	(<0.5)		(2.20)	(1.07)		
Calcium	1.526*	1.56*	1.527*	5.05*	0.41*				(0.216*)	(42)
Cerium	(3)	(10)		(2)	(0.4)					
Cesium				(53)						
Chlorine	579	360		(6600)					(0.244*)	(450)
Chromium	(0.3)	(1)		1.99	2.6					
Cobalt	(0.09)	(0.07)	0.39	0.57	(0.1)					
Copper	5.64	3.7	12.2	4.70	3.0		(51.2)	(720)	(8)	(3.0)
Europium	(0.2)	(0.17)	(0.0054)		(0.006)					
Fluorine						64/277			(0.65)	(0.24)
Gadolinium	(3)	(1)		(0.17)						
Gold	(0.001)									
Hydrogen		5.2*								
Iodine	(0.3)	(0.3)		(0.85)						
Iron	(83)	(218)		368	200				(139)	(23)
Lanthanum	(20)	(9)		(2.3)	(0.2)					
Lead	0.470	0.87	(0.20)		10.8		(63.8)	(64.4)		
Magnesium	0.271*	0.432*	(0.89*)	(1.2*)					(0.160*)	(0.0990*)
Manganese	54	98	75.9	246	675		(1759)	(3771)	(15)	(4.0)
Mercury	0.044	0.031	0.030	0.034	0.15		(0.34)	(0.23)		
Molybdenum	0.094	0.060		(0.46)						
Neodymium	(17)	(7)								
Nickel	0.91	0.69	2.14	1.59	(3.5)					
Nitrogen	2.25*	2.94*	5.90*	3.03*	(1.2*)				(6970)	(13750)
Phosphorus	0.159*	0.137*	0.518*	0.216*	0.12*					
Potassium	1.61*	2.43*	2.903*	2.70*	0.37*				(1.735*)	(0.357*)
Rubidium	10.2	19.7	(13)	14.89	11.7					
Samarium	(3)	(1)		(0.19)						
Scandium	(0.03)	(0.04)	(0.055)	(0.1)	(0.03)					
Selenium	0.050	0.120	0.117	0.054					(0.016)	(0.004)
Sodium	24.4	24	1.818*	136					(28)	
Strontium	25	53	55.6	(85)	4.8				(12)	
Sulfur	(0.18*)	(0.2*)	(0.46*)	(0.96*)						
Tellurium										
Terbium	(0.4)	(0.1)								
Thallium					(0.05)					
Thorium	(0.03)	(0.05)	0.48	(0.12)	0.037					
Tin	(<0.2)	(<0.2)								
Tungsten	(0.007)									
Uranium	(0.006)	(0.015)	(0.15)	(35)	0.020					
Vanadium	0.26	0.37	0.57	0.835						
Ytterbium	(0.3)	(0.02)								
Zinc	12.5	17.9	82	30.9			(313)	(566)	(32)	(15.7)

Values in parentheses are not certified and are given for information or as recommended values only.



## 110. Fertilizers (powder form)

These SRMs are intended for use in the fertilizer industry as working standards.

SRM	Type	Unit Size (in g)	Composition (mass fraction, in %)						
			N	P	K	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	CaO	
120c	Phosphate Rock (Florida)	90				33.34	0.147	48.02	
193	Potassium Nitrate	90	13.85		38.66				
194	Ammonium Dihydrogen Phosphate	90	12.15	26.92					
200a	Potassium Dihydrogen Phosphate	In Prep							
694	Phosphate Rock (Western)	90				30.2	0.51	43.6	

SRM	SiO <sub>2</sub>	F	Fe <sub>2</sub> O <sub>3</sub>	Al <sub>2</sub> O <sub>3</sub>	MgO	Na <sub>2</sub> O	MnO	TiO <sub>2</sub>	Cr <sub>2</sub> O <sub>3</sub>	CdO	U	V <sub>2</sub> O <sub>5</sub>
694	11.2	3.2	0.79	1.8	0.33	0.86	0.0116	(0.11)	(0.10)	0.015	0.01414	0.31

Values in parentheses are not certified and are given for information only.

## 110. Wheat Hardness (kernel form)

This RM is intended primarily for calibrating instruments used to determine the hardness of bulk or single kernel wheat. RM 8441 was prepared and analyzed by the Federal Grain Inspection Service program, Grain Inspection Packers and Stockyards Administration of the United States Department of Agriculture.

RM	Type	Unit Size
8441	Wheat Hardness	Hard-1 through Hard-5 5×5 pouches each (20 g/pouch) Soft-1 through Soft-5 5×5 pouches each (20 g/pouch)

# 111. Geological Materials and Ores

## 111. Chinese Ores (powder form)

These RMs are a series of skarn deposit ores developed and certified by the Hubei Geological Research Laboratory, Hubei Province, China. Skarn ores are common in the Pacific area and other parts of the world. These RMs can be used as control samples in geochemical exploration and in environmental monitoring programs.

**NOTE:** In addition to the listed constituent elements, elemental concentrations are given for all major rock-forming oxides and many trace elements, including the rare earth elements and toxic trace elements important to environmental assessment programs.

RM	8600	8601	8603	8604	8605	8606	8607	8608
Type	Copper	Copper	Lead	Zinc	Molybdenum	Molybdenum	Tungsten	Tungsten
Unit Size (in g)	100	100	100	100	100	100	100	100
Element (mass fraction, in %)								
Cu	1.15	0.19	0.035	0.71			0.079	0.096
Mo					1.51	0.11		
Pb			0.61	0.25				
S	0.72	0.14	0.38	2.87	1.64	0.48	3.12	1.90
W					0.36	0.10	0.015	0.22
Zn	0.059	0.013	0.092	2.75			0.29	0.010

## 111. Ores (powder form)

SRM	79a	113b	180	181	182	183	277	330	331	2430
Type	Fluorspar, Customs Grade	Zinc Concentrate	Fluorspar, High Grade	Lithium Ore (Spodumene)	Lithium Ore (Petalite)	Lithium Ore (Lepidolite)	Tungsten Concentrate	Copper Ore Mill Heads	Copper Ore Mill Tails	Scheelite Ore
Unit Size (in g)	120	100	120	45	45	45	100	100	100	100
Component (Concentrations are mass fractions, in %, unless noted by an asterisk for mg/kg)										
Ca		0.8196					(0.37)			As 0.002
CaF <sub>2</sub>	97.39		98.80							
Cd		0.7804								
Cu		0.2953						0.84	0.091	(0.01)
Fe		2.077					(7.4)			(1.0)
Au								(0.093*)	(0.034*)	
Hg		(0.55*)								
Li <sub>2</sub> O				6.39	4.34	4.12				
Mg		0.4460								
Mn							(10.0)			(0.12)
Mo							(0.06)	0.018	0.0022	0.22
Nb							(1.00)			
O <sub>2</sub>							(21.4)			Al (0.4)
P							(0.03)			0.017
Pb		2.731					(0.07)			Bi 0.078
Re								0.30*	0.04*	
Si							(0.85)			Mg (0.5)
Ag		0.04607						(1.51*)	(0.243*)	
S		30.032					(0.25)			0.26
Ta							(0.20)			(<0.01)
Sn							(0.54)			K (0.16)
Ti							(2.2)			Na (0.02)
WO <sub>3</sub>							67.4			70.26
Zn		56.49								

Values in parentheses are not certified and are given for information only.

## 111. Ores (powder form) – Continued

SRM	25d	27f	69b	120c	600	670	690	691	692	693
Type	Manganese Ore	Iron Ore, Sibley	Bauxite, Arkansas	Phosphate Rock, Florida	Bauxite, Australian	Rutile Ore	Iron Ore, Canada	Iron Oxide, Reduced	Iron Ore, Labrador	Iron Ore, Nimba
Unit Size (in g)	100	80	60	90	90	90	100	100	100	100
Component (Concentrations are mass fractions, in %, unless noted by an asterisk for mg/kg).										
Al <sub>2</sub> O <sub>3</sub>	5.32	0.82	48.8	1.30	40.0		0.18	1.22	1.41	1.02
BaO	(0.21)		(0.008)							
CdO				0.0010						
CaO	(0.052)	0.039	0.13	48.02	0.22		0.20	0.63	0.023	0.016
Co			(0.0001)					0.030		
Cu								0.032		
Cr <sub>2</sub> O <sub>3</sub>			0.011		0.024	0.23				
Total Fe		65.97					66.85	90.8	59.58	65.11
Fe <sub>2</sub> O <sub>3</sub>	3.92		7.14	1.08	17.0	0.86				
MgO		0.019	0.085	0.32	0.05		0.18	0.52	0.035	0.013
MnO	Mn 51.78	0.011	0.110	0.027	0.013		0.23	0.043	0.46	0.091
P		0.041					0.011	0.006	0.039	0.056
P <sub>2</sub> O <sub>5</sub>	0.25		0.118	33.34	0.039					
K <sub>2</sub> O	0.93	0.008	0.068	0.147	0.23		0.0030		0.039	0.0028
SiO <sub>2</sub>	2.52	4.17	13.43	5.5	20.3	0.51	3.71	3.7	10.14	3.87
Na <sub>2</sub> O		0.012	(0.025)	0.52	0.022		0.003	0.186	0.008	0.0028
S		0.005					0.003	0.008	0.005	0.005
SO <sub>3</sub>			0.551		0.155					
TiO <sub>2</sub>	0.13	0.019	1.90	0.103	1.31	96.16	0.022	0.27	0.045	0.035
V <sub>2</sub> O <sub>5</sub>			0.028	0.016	0.060	0.66				
ZnO			0.0035	CO <sub>2</sub> 3.27	0.003			C 0.12		
ZrO <sub>2</sub>			0.29	F 3.82	0.060	0.84				
Oxygen, Available	14.28									
Moisture	(0.96)									
Loss on Ignition			27.2		20.5					

Values in parentheses are not certified and are given for information only.



## 111. Ores (powder form) – Continued

SRM	694	696	697	698	699	886	1835
Type	Phosphate Rock, Western	Bauxite, Surinam	Bauxite, Dominican	Bauxite, Jamaican	Alumina (reduction grade)	Gold Ore, Refractory	Borate Ore
Unit Size (in g)	90	60	60	60	60	200	60
Component (Concentrations are mass fractions, in %, unless noted by an asterisk for mg/kg).							
Al <sub>2</sub> O <sub>3</sub>	1.8	54.5	45.8	48.2		Au 8.25*	3.474
BaO		(0.004)	(0.015)	(0.008)			0.0497
C <sub>Total</sub>						(5.7)	
CdO	0.015						
CaO	43.6	0.018	0.71	0.62	0.036		21.622
Co	F 3.2	(0.00009)	(0.0013)	(0.0045)			F 0.348
Cr <sub>2</sub> O <sub>3</sub>	(0.10)	0.047	0.100	0.080	0.0002		
Fe <sub>2</sub> O <sub>3</sub>	0.79	8.70	20.0	19.6	0.013		1.141
MgO	0.33	0.012	0.18	0.058	0.0006		3.411
MnO	0.0116	0.004	0.41	0.38	0.0005		0.0333
P <sub>2</sub> O <sub>5</sub>	30.2	0.050	0.97	0.37	0.0002		
K <sub>2</sub> O	0.51	0.009	0.062	0.010			1.261
SiO <sub>2</sub>	11.2	3.79	6.81	0.69	0.014		18.408
Na <sub>2</sub> O	0.86	(0.007)	(0.036)	(0.015)	0.59		3.484
S <sub>Total</sub>						1.466	
SO <sub>3</sub>		0.15	0.077	0.143			1.477
TiO <sub>2</sub>	(0.11)	2.64	2.52	2.38			0.1332
U	0.01414						
V <sub>2</sub> O <sub>5</sub>	0.31	0.072	0.063	0.064	0.0005		
ZnO	(0.19)	0.0014	0.037	0.029	0.013		
ZrO <sub>2</sub>		0.14	0.065	0.061			SrO 0.9418
Ga <sub>2</sub> O <sub>3</sub>					0.010		B <sub>2</sub> O <sub>3</sub> 18.739
Li <sub>2</sub> O					0.002		
Loss on Ignition – See certificate for conditions		29.9	22.1	27.3	0.69		25.72

Values in parentheses are not certified and are given for information only.

## 111. Ore Bioleaching Substrate (powder form)

This RM is for use as a bioleaching substrate and for testing bioleaching rates. The material consists of pyrite from New Mexico. Thiobacillus ferrooxidans was used in the determinations.

RM	Type	Unit Size (in g)	Bioleaching Rate (in mg Fe/L/hr)
8455	Pyrite Ore	100	12.4

## 111. Clays (powder form)

SRM	97b	98b	679
Type	Flint Clay	Plastic Clay	Brick Clay
Unit Size (in g)	60	60	75
Element (Concentrations are mass fractions, in %, unless noted by an asterisk for mg/kg).			
Aluminum	20.76	14.30	11.01
Antimony	(2.2)*	(1.6)*	
Barium	(0.018)	(0.07)	0.0432
Calcium	0.0249	0.0759	0.1628
Cerium			(105)*
Cesium	(3.4)*	(16.5)*	(9.6)*
Chromium	227*	119*	109.7*
Cobalt	(3.8)*	(16.3)*	(26)*
Europium	(0.84)*	(1.3)*	(1.9)*
Hafnium	(13)*	(7.2)*	(4.6)*
Iron	0.831	1.18	9.05
Lithium	550*	215*	71.7*
Magnesium	0.113	0.358	0.7552
Manganese	47*	116*	(1730)*
Phosphorus	(0.02)	(0.03)	(0.075)
Potassium	0.513	2.81	2.433
Rubidium	(33)*	(180)*	(190)*
Scandium	(22)*	(22)*	(22.5)*
Silicon	19.81	26.65	24.34
Sodium	0.0492	0.1496	0.1304
Strontium	84*	189*	73.4*
Thorium	(36)*	(21)*	(14)*
Titanium	1.43	0.809	0.577
Zinc	(87)*	(110)*	(150)*
Zirconium	(0.05)	(0.022)	
Loss on Ignition (At 1100 °C, 2 hours; sample previously dried.)	(13.3)	(7.5)	

Values in parentheses are not certified and are given for information only.

## 111. Rocks and Minerals (powder form)

SRM	1c	70a	81a	88b	99a	165a	278	688	1413
Type	Limestone, Argillaceous	Feldspar, Potash	Glass Sand	Limestone, Dolomite	Feldspar, Soda	Glass Sand (low iron)	Obsidian Rock	Basalt Rock	Glass Sand (high alumina)
Unit Size (in g)	50	40	75	75	40	75	35	60	75
Component (Concentrations are mass fractions, in %, unless noted by an asterisk for mg/kg).									
Al <sub>2</sub> O <sub>3</sub>	1.30	17.9	0.66	0.336	20.5	0.059	14.15	17.36	9.90
BaO		0.02		CO <sub>2</sub> 46.37	0.26		Ba (1140*)		0.12
CaO	50.3	0.11		29.95	2.14		0.983	(12.17)	0.74
Cr <sub>2</sub> O <sub>3</sub>			46*			(1*)	Cr (6.1*)	Cr 332*	
Fe <sub>2</sub> O <sub>3</sub> †	0.55	0.075	0.082	0.277	0.065	0.012	2.04	10.35	0.24
FeO†							1.36	7.64	
MgO	0.42			21.03	0.02		(0.23)	(8.4)	0.06
MnO	0.025			0.0160			0.052	0.167	
P <sub>2</sub> O <sub>5</sub>	0.04			0.0044	0.02		0.036	0.134	
K <sub>2</sub> O	0.28	11.8		0.1030	5.2		4.16	0.187	3.94
Rb <sub>2</sub> O		0.06					Rb 127.5*	Rb 1.91*	
SiO <sub>2</sub>	6.84	67.12		1.13	65.2		73.05	48.4	82.77
Na <sub>2</sub> O	0.02	2.55		0.0290	6.2		4.84	2.15	1.75
SrO	0.030			0.0076			Sr 63.5*	Sr 169.2*	
TiO <sub>2</sub>	0.07	0.01	0.12	(0.016)	0.007	0.011	0.245	1.17	0.11
ZrO <sub>2</sub>			0.034			0.006			
Loss on Ignition – See certificate for conditions	39.9	0.40		(46.98)	0.26				

Values in parentheses are not certified and are given for information only.

†Refer to certificate to ascertain if the value reported represents total iron or species-specific iron.

## 111. Refractories (powder form)

SRM	76a	77a	78a	154b	198	199
Type	Burnt Refractory (Al <sub>2</sub> O <sub>3</sub> –40%)	Burnt Refractory (Al <sub>2</sub> O <sub>3</sub> –60%)	Burnt Refractory (Al <sub>2</sub> O <sub>3</sub> –70%)	Titanium Dioxide	Silica Brick	Silica Brick
Unit Size (in g)	75	75	75	90	45	45
Component (mass fraction, in %)						
Al <sub>2</sub> O <sub>3</sub>	38.7	60.2	71.7		0.16	0.48
CaO	0.22	0.05	0.11	(~0.01)	2.71	2.41
FeO†						
Fe <sub>2</sub> O <sub>3</sub> †	1.60	1.00	1.2	(0.006)	0.66	0.74
Li <sub>2</sub> O	0.042	0.025	0.12		0.001	0.002
MgO	0.52	0.38	0.70	(~0.01)	0.07	0.13
MnO					0.008	0.007
P <sub>2</sub> O <sub>5</sub>	0.120	0.092	1.3	(0.04)	0.022	0.015
K <sub>2</sub> O	1.33	0.090	1.22		0.017	0.094
SiO <sub>2</sub>	54.9	35.0	19.4	(0.01)		
Na <sub>2</sub> O	0.07	0.037	0.078		0.012	0.015
SrO	0.037	0.009	0.25			
TiO <sub>2</sub>	2.03	2.66	3.22	99.74	0.02	0.06
ZrO <sub>2</sub>						
Loss on Ignition	(0.34)	(0.22)	(0.42)		0.21	0.17

Values in parentheses are not certified and are given for information only.

†Refer to certificate to ascertain if the value reported represents total iron or species-specific iron.



# 111. Soils, Sediments, and Sludges (powder form)

SRM	1646a	2704a	2709**	2710**	2711**	2781**	2782	RM 8407
Type	Estuarine Sediment	Buffalo River Sediment	San Joaquin Soil	Montana Soil Highly Elevated Traces	Montana Soil Moderately Elevated Traces	Domestic Sludge	Industrial Sludge	Tennessee River Sediment
Unit Size	75 g	50 g	50 g	50 g	50 g	40 g		25 g
Element	(Concentrations are in mg/kg, unless noted by an asterisk for mass fraction, in %).							
Aluminum	2.297*	In Prep	7.50*	6.44*	6.53*	(1.6)	In Prep	
Antimony	(0.3)		7.9	38.4	19.4			
Arsenic	6.23		17.7	626	105	7.82		
Barium	(210)		968	707	726			
Beryllium	(<1)							
Bromine				(6)	(5)			
Cadmium	0.148		0.38	21.8	41.7	12.78		
Calcium	0.519*		1.89*	1.25*	2.88*	(3.9)		
Carbon			(1.2*)	(3 *)	(2 *)			
Cerium	(34)		(42)	(57)	(69)			
Cesium			(5.3)	(107)	(6.1)			
Chlorine								
Chromium	40.9		130	(39)	(47)	(202)		
Cobalt	(5)		13.4	(10)	(10)			
Copper	10.01		34.6	2950	114	627.4		
Dysprosium			(3.5)	(5.4)	(5.6)			
Europium			(0.9)	(1)	(1.1)			
Gallium	(5)		(14)	(34)	(15)			
Germanium								
Gold			(0.3)	(0.6)	(0.03)			
Hafnium			(3.7)	(3.2)	(7.3)			
Holmium			(0.54)	(0.6)	(1)			
Indium				(5.1)	(1.1)			
Iodine			(5)		(3)			
Iron (Total)	2.008*		3.50*	3.38*	2.89*	(2.8*)		
Lanthanum	(17)		(23)	(34)	(40)			
Lead	11.7		18.9	5532	1162	202.1		
Lithium	(18)							
Magnesium	0.388*		1.51*	0.853*	1.05*	(0.59)		
Manganese	234.5		538	1.01*	638			
Mercury	(0.04)		1.40	32.6	6.25	3.64		(50)
Molybdenum	(1.8)		(2.0)	(19)	(1.6)	46.7		
Neodymium	(15)		(19)	(23)	(31)	N 4.78		
Nickel	22.5		88	14.3	20.6	80.2		
Phosphorus	0.027*		0.062*	0.106*	0.086*	(2.42)		
Potassium	0.864		2.03*	2.11*	2.45*	(0.49)		
Rubidium	(38)		(96)	(120)	(110)			
Samarium			(3.8)	(7.8)	(5.9)			
Scandium	(5)		(12)	(8.7)	(9)			
Selenium	0.193		1.57		1.52	16.0		
Silicon	40.00*		29.66*	28.97*	30.44*	(5.1)		
Silver			0.41	35.3	4.63	(98)		
Sodium	0.741*		1.16*	1.14*	1.14*	(0.21)		
Strontium	(68)		231	(330)	245.3			
Sulfur	0.352*		0.089*	0.240*	0.042*			
Thallium	(<0.5)		0.74	(1.3)	2.47			
Thorium	(5.8)		(11)	(13)	(14)			
Titanium	0.456*		0.342*	0.283*	0.306*	(0.32)		
Tungsten			(2)	(93)	(3)			
Uranium	(2.0)		(3)	(25)	(2.6)			
Vanadium	44.84		112	76.6	81.6			
Ytterbium			(1.6)	(1.3)	(2.7)			
Yttrium			(18)	(23)	(25)			
Zinc	48.9		106	6952	350.4	1273		
Zirconium			(160)		(230)			

Values in parentheses are not certified and are given for information only.

\*\*These SRMs also have noncertified leach data. The leach data for SRMs 2709, 2710, and 2711 are based on EPA Method 3050; the leach data for SRM 2781 is based on EPA Methods 3050 and 3051.

## 112. Ceramics and Glasses

### Carbides (powder form)

SRM	Type	Unit Size (in g)	Composition (mass fraction, in %)							
			SiC	Total C	Free C	Fe	O	N	Al	Ca
112b	Silicon Carbide	80	97.37	29.43	0.26	0.13			0.44	0.04
276b	Tungsten Carbide	75		6.10	(0.04)		(0.08)	(0.01)		

Values in parentheses are not certified and are given for information only.

### 112. Cemented Carbides (powder form)

SRMs 887–889 are prepared from sintered tungsten carbide base materials.

SRM	887	888	889
Type	Cemented Carbide (W83-Co10)	Cemented Carbide (W64-Co25-Ta5)	Cemented Carbide (W75-Co9-Ta5-Ti4)
Unit Size (in g)	100	100	100
Element	(mass fraction, in %)		
Cobalt	10.35	24.7	9.50
Tantalum		4.77	4.60
Titanium			4.03
Carbon	(5.5)	(4.6)	(6.0)

Values in parentheses are not certified and are given for information only.

## 112. Glasses (powder and solid forms)

SRM	81a	89	92	93a	165a	620	621	1411	1412	1413	1830	1831	1834
Type	Glass Sand	Lead-Barium	Low-Boron Soda-Lime Powder	High-Boron Borosilicate	Glass Sand (low Iron)	Soda-Lime, Flat	Soda-Lime, Container	Soft Borosilicate	Multi Component	Glass Sand (high alumina)	Soda-Lime, Float	Soda-Lime, Sheet	Fused Ore Glass
Unit Size	75 g	45 g	45 g	wafer 32 mm D×6 mm	75 g	3 platelets 35×35×3 mm	3 disks 38 mm D×5 mm	10 platelets 32×32×3 mm	8 platelets 32×32×3 mm	75 g	3 platelets 38×38×6 mm	3 platelets N37×37×3 mm	disk 30 mm D×3 mm
Component	(Concentrations are mass fractions, in %, unless noted by an asterisk for mg/kg).												
SiO <sub>2</sub>		65.35	(75.0)	80.8		72.08	71.13	58.04	42.38	82.77	73.07	73.08	Si 20.19
PbO		17.50							4.40				
Al <sub>2</sub> O <sub>3</sub>	0.66	0.18		2.28	0.059	1.80	2.76	5.68	7.52	9.90	0.12	1.21	Al 20.71
FeO				0.016							0.032	0.025	
Fe <sub>2</sub> O <sub>3</sub>	0.082	0.049		0.028	0.012	0.043	0.040	0.050	(0.031)	0.24	0.121	0.087	Fe 0.32
ZnO			(0.2)					3.85	4.48				
CdO									4.38				
MnO		0.088											
TiO <sub>2</sub>	0.12	0.01		0.014	0.011	0.018	0.014	0.02			0.011	0.019	Ti 1.11
ZrO <sub>2</sub>	0.034	0.005		0.042	0.006		0.007						Zr (0.047)
CaO		0.21	(8.3)	0.01		7.11	10.71	2.18	4.53	0.74	8.56	8.20	Ca 0.095
BaO		1.40					0.12	5.00	4.67	0.12			Ba 0.062
Li <sub>2</sub> O									(4.50)				Li (4.6)
MgO		0.03	(0.1)	0.005		3.69	0.27	0.33	(4.69)	0.06	3.90	3.51	Mg 0.088
K <sub>2</sub> O		8.40	(0.6)	0.014		0.41	2.01	2.97	4.14	3.94	0.04	0.33	K 0.42
Na <sub>2</sub> O		5.70	(13.1)	3.98		14.39	12.74	10.14	4.69	1.75	13.75	13.32	Na (0.14)
B <sub>2</sub> O <sub>3</sub>			0.70	12.56				10.94	4.53				B (1.1)
P <sub>2</sub> O <sub>5</sub>		0.23											P 0.152
As <sub>2</sub> O <sub>5</sub>		0.36											
As <sub>2</sub> O <sub>3</sub>		0.03				0.056	0.030						
SO <sub>3</sub>		0.03				0.28	0.13				0.26	0.25	
Cl		0.05		0.060									
Cr													(0.02)
SrO								0.09	4.55				Sr 0.153
F													
Cr <sub>2</sub> O <sub>3</sub>	46*				(1*)								
Loss on Ignition		0.32	(0.42)										

Values in parentheses are not certified and are given for information only.



## 112. Trace Elements (powder and wafer forms)

These SRMs are for calibrating instruments and evaluating analytical techniques used to determine trace elements in inorganic matrices. **NOTE:** The nominal glass composition of SRMs 610 through 617 is 72% SiO<sub>2</sub>, 12% CaO, 14% Na<sub>2</sub>O, and 2% Al<sub>2</sub>O<sub>3</sub>.

SRM	607	610 and 611	612 and 613	614 and 615	616 and 617
Type	Trace Elements in Potassium Feldspar	Trace Elements in Glass	Trace Elements in Glass	Trace Elements in Glass	Trace Elements in Glass
Wafer Thickness (in mm)		3 and 1	3 and 1	3 and 1	3 and 1
Unit Size	5 g	6 wafers	6 wafers	6 wafers	6 wafers
Element (in mg/kg)					
Antimony				(1.06)	(0.078)
Barium			(41)		
Boron		(351)	(32)	(1.30)	(0.20)
Cadmium				(0.55)	
Cerium			(39)		
Cobalt		(390)	(35.5)	(0.73)	
Copper		(444)	(37.7)	1.37	(0.80)
Dysprosium			(35)		
Erbium			(39)		
Europium			(36)	(0.99)	
Gadolinium			(39)		
Gallium				(1.3)	(0.23)
Gold		(25)	(5)	(0.5)	(0.18)
Iron		458	51	(13.3)	(11)
Lanthanum			(36)	(0.83)	(0.034)
Lead		426	38.57	2.32	1.85
Manganese		485	(39.6)		
Neodymium			(36)		
Nickel		458.7	38.8	(0.95)	
Potassium		(461)	(64)	30	29
Rubidium	523.90	425.7	31.4	0.855	(0.100)
Samarium			(39)		
Scandium				(0.59)	(0.026)
Silver		(254)	22.0	0.42	
Strontium	65.485*	515.5	78.4	45.8	41.72
Thallium		(61.8)	(15.7)	(0.269)	(0.0082)
Thorium		457.2	37.79	0.748	0.0252
Titanium		(437)	(50.1)	(3.1)	(2.5)
Uranium		461.5	37.38	0.823	0.0721
Ytterbium			(42)		
Zinc		(433)			

Values in parentheses are not certified and are given for information only.

In addition to the elements listed above, the glass SRMs contain the following 25 elements: As, Be, Bi, Cs, Cl, F, Ge, Hf, Hg, Li, Lu, Mg, Nb, P, Pr, Se, S, Te, Tb, Tm, Sn, W, V, Y, and Zr.

\*Also certified for isotopic ratio – <sup>87</sup>Sr/<sup>86</sup>Sr = 1.20039.

# 113. Cement

## Portland Cements (powder form)

These SRMs are for x-ray spectroscopic and chemical analysis of portland cements and related materials. Each unit consists of three sealed vials, each containing approximately 5 g of material. [Also see Category 301.]

SRM	1880	1881	1882	1883	1884
COLOR	BLACK	WHITE	ORANGE	SILVER	IVORY
Component (mass fraction, in %)					
CaO	63.14	58.67	37.6	27.8	64.01
SiO <sub>2</sub>	19.82	22.25	3.40	0.35	23.19
Al <sub>2</sub> O <sub>3</sub>	5.03	4.16	38.6	71.2	3.31
Fe <sub>2</sub> O <sub>3</sub>	2.91	4.68	15.8	0.08	3.30
SO <sub>3</sub>	3.37	3.65			1.67
MgO	2.69	2.63	1.25	0.29	2.32
K <sub>2</sub> O	0.91	1.17	0.12	(0.01)	0.51
TiO <sub>2</sub>	0.23	0.25	1.83	(0.01)	0.16
Na <sub>2</sub> O	0.28	0.04	(0.06)	0.32	0.13
SrO	0.06	0.11			0.048
P <sub>2</sub> O <sub>5</sub>	0.29	0.09			0.12
Mn <sub>2</sub> O <sub>3</sub>	0.08	0.26			0.11
F	0.10	0.09			(0.03)
ZnO	0.01	0.01			(0.02)
Cr <sub>2</sub> O <sub>3</sub>					(<0.01)
Cl	0.02	0.01			(0)
Loss on Ignition at 1000 °C	1.38	2.01	1.58	0.42	1.17
Total	100.28	100.04			(100.05)

SRM	1885	1886	1887	1888	1889
COLOR	TURQUOISE	CRANBERRY	BROWN	PURPLE	GRAY
Component (mass fraction, in %)					
CaO	62.14	67.43	62.88	63.78	65.08
SiO <sub>2</sub>	21.24	22.53	19.98	20.86	20.44
Al <sub>2</sub> O <sub>3</sub>	3.68	3.99	5.59	5.35	5.61
Fe <sub>2</sub> O <sub>3</sub>	4.40	0.31	2.16	3.18	2.67
SO <sub>3</sub>	2.22	2.04	4.61	3.16	2.68
MgO	4.02	1.60	1.26	0.71	1.38
K <sub>2</sub> O	0.83	0.16	1.27	0.56	0.32
TiO <sub>2</sub>	0.20	0.19	0.27	0.29	0.21
Na <sub>2</sub> O	0.38	0.02	0.10	0.14	0.11
SrO	0.037	0.11	0.07	0.07	0.20
P <sub>2</sub> O <sub>5</sub>	0.10	0.025	0.075	0.085	0.15
Mn <sub>2</sub> O <sub>3</sub>	0.12	0.013	0.072	0.025	0.24
F	(0.05)	(0.01)	(0.11)	(0.02)	(0.04)
ZnO	(0.03)	(<0.01)	(0.01)	(0.01)	(<0.01)
Cr <sub>2</sub> O <sub>3</sub>	(<0.01)	(<0.01)	(<0.01)	(0.01)	(0.01)
Cl	(0.02)	(0)	(0.007)	(0.015)	(0.002)
Loss on Ignition at 1000 °C	0.74	1.73	1.49	1.79	0.92
Total	(100.19)	(100.02)	(99.908)	(100.05)	(100.04)

Values in parentheses are not certified and are given for information only.

### 113. Portland Cement Clinkers (solid form)

These RMs are intended primarily for use in the determination of the abundance of major phases in cement clinkers, i.e., the percentages of alite ( $C_3S$ ), belite ( $C_2S$ ), aluminate ( $C_3A$ ), and ferrite ( $C_2(A,F)$ ). **NOTE:** In cement chemist notation, C = CaO, S =  $SiO_2$ , A =  $Al_2O_3$  and F =  $Fe_2O_3$ .

RM	8486	8487	8488
Type	Portland Cement Clinker	Portland Cement Clinker	Portland Cement Clinker
Unit Size (in g)	3×10	3×10	3×10
Component	(mass fraction, in %)		
CaO	(63.36)	(67.20)	(66.50)
$SiO_2$	(22.48)	(21.43)	(22.68)
$Al_2O_3$	(4.70)	(5.53)	(4.90)
$Fe_2O_3$	(3.60)	(1.98)	(4.07)
$SO_3$	(0.27)	(0.83)	(0.31)
MgO	(4.73)	(1.48)	(0.98)
$K_2O$	(0.42)	(0.72)	(0.35)
$TiO_2$	(0.25)	(0.27)	(0.24)
$Na_2O$	(0.10)	(0.14)	(0.11)
SrO	(0.05)	(0.11)	(0.13)
$P_2O_5$	(0.06)	(0.29)	(0.08)
$Mn_2O_3$	(0.10)	(0.04)	(0.03)
Loss on Ignition	(0.16)	(0.17)	(0.21)
Total	(100.28)	(100.20)	(100.60)
Alite ( $C_3S$ )	(58.47)	(73.39)	(64.97)
Belite ( $C_2S$ )	(23.18)	(7.75)	(18.51)
Aluminate ( $C_3A$ )	(1.15)	(12.09)	(4.34)
Ferrite ( $C_2(A,F)$ )	(13.68)	(3.27)	(12.12)
Free CaO	(0.18)	(2.45)	(0.00)
Periclase	(3.21)	(0.09)	(0.05)
Alkali Sulfate	(0.14)	(0.98)	(0.03)
Total	(100.01)	(100.02)	(100.02)

Values in parentheses are not certified and are given for information only.



## 114. Engine Wear Materials

### 114. Metallo-Organic Compounds (solid form)

These SRMs are for preparing solutions in oils of known and reproducible concentrations of metals. Each SRM unit consists of 5 g of material.

SRM	Type	Elemental Composition (mass fraction, in %)	
1051b	Barium cyclohexanebutyrate	Barium	28.7
1052b	Bis(1-phenyl-1,3-butanediono)oxovanadium (IV)	Vanadium	13.01
1053a	Cadmium cyclohexanebutyrate	Cadmium	24.8
1057b	Dibutyltin bis (2-ethylhexanoate)	Tin	22.95
1059c	Lead cyclohexanebutyrate	Lead	37.5
1060a	Lithium cyclohexanebutyrate	Lithium	4.1
1065b	Nickel cyclohexanebutyrate	Nickel	13.89
1066a	Octaphenylcyclotetrasiloxane	Silicon	14.14
1069b	Sodium cyclohexanebutyrate	Sodium	12.0
1070a	Strontium cyclohexanebutyrate	Strontium	20.7
1071b	Triphenyl phosphate	Phosphorus	9.48
1073b	Zinc cyclohexanebutyrate	Zinc	16.66
1075a	Aluminum 2-ethylhexanoate	Aluminum	8.07
1077a	Silver 2-ethylhexanoate	Silver	42.60
1078b	Tris (1-phenyl-1,3-butanediono)chromium (III)	Chromium	9.6
1079b	Tris (1-phenyl-1,3-butanediono)iron (III)	Iron	10.45
1080a	Bis(1-phenyl-1,3-butanediono)copper (II)	Copper	16.37

### 114. Lubricating Base Oils (liquid form)

These SRMs are for determining the concentrations of a single element in lubricating base oil. SRMs 1818a and 1819a consist of five bottles, approximately 20 g of liquid each; SRM 1836 consists of four sets of four ampules, each ampule containing approximately 4 g of liquid.

SRM	Type	Elemental Composition (in mg/kg)				
		I	II	III	IV	V
1818a	Total Chlorine	31.6	60.0	78.2	154.4	234.0
1819a	Total Sulfur	423.5	741.1	4022	4689	6135
1836	Total Nitrogen	9.0	50.9	113.3	166.2	

### 114. Catalyst Characterization Material (liquid form)

This RM is for determining the activity of FCC Catalysts by Microactivity Test. It is distributed by NIST in cooperation with the ASTM.

RM	Type	Unit Size
8590	High Sulfur Gas Oil Feed	946 mL

## 114. Catalyst Package for Lubricant Oxidation (liquid form)

These SRMs and RM are for evaluating the oxidation stability of lubricating oils, i.e., automotive crankcase lubricants. SRM 1817c consists of a set of five ampules of each of three materials. The fuel fraction and the metal mixture are sealed under inert atmosphere. SRM 2567 consists of a set of five ampules of each of five materials. RM 8501 consists of a set of five ampules of each of four materials. The fuel fraction, model compound, and metal mixture in SRM 2567 and RM 8501 are also sealed under inert atmosphere.

SRM	Type	Consisting of	Unit Size
1817c	Catalyst Package IIID	1) an Oxidized/Nitrated Fuel Fraction, 2) a Metal Naphthenate Mixture, and 3) Distilled Water	5×0.15 g 5×0.3 g 5×1.0 g
2567	Catalyst Package IIIE	1) an Oxidized/Nitrated Fuel Fraction, 2) a Nitro-Paraffin Model Compound, 3) a Nitro-Aromatic Model Compound, 4) a Metal Naphthenate Mixture, and 5) Distilled Water	5×0.15 g 5×0.008 g 5×0.0075 g 5×0.16 g 5×0.03 g
RM 8501	Catalyst Package IIIE	1) an Oxidized/Nitrated Fuel Fraction, 2) a Nitro-Paraffin Model Compound, 3) a Metal Naphthenate Mixture, and 4) Distilled Water	5×0.15 g 5×0.15 g 5×0.3 g 5×1.0 g

## 114. Wear-Metals in Oil (liquid form)

SRM	Type	Unit Size	Elemental Composition (in mg/kg)					
			Al	Cl	Cr	Cu	Fe	Pb
1083	Wear-Metals (base oil)	150 mL	(<0.5)	(<0.17)	(<0.02)	(<0.5)	(<1)	(<0.04)
1084a	Wear-Metals	Set of 5 ampules: 1.6 g each	(104)		98.3	100.0	98.9	101.1
1085a	Wear-Metals	Set of 5 ampules: 1.6 g each	(289)		296.3	295.1	296.8	297.4
SRM	Mg	Mn	Mo	Ni	Si	Ag		
1083	(<0.1)	(<0.005)	(<0.01)	(<0.4)	(<1)	(<0.05)		
1084a	99.5		100.3	99.7	(103)	101.4		
1085a	296.0		302.9	302.9	(322)	305.7		
SRM	Na	Sn	S	Ti	V	Zn		
1083	(<0.06)	(<0.4)	(980)	(<5)	(<0.3)	(<0.08)		
1084a		97.2	(1700)	100.4	95.9			
1085a		296.0	(4500)	305.1	292.4			

Values in parentheses are not certified and are given for information only.

# Physical Properties







# Standard Reference Materials

for

## Physical Properties

### 201. Ion Activity

#### pH Calibration (powder form)

These SRMs are used to prepare solutions of known hydrogen ion activity to calibrate commercial pH instruments. SRMs 186If and 186IIIf, 191b and 192b are each certified for use as an admixture only. SRMs 186If and 186IIIf may be used to prepare solutions with a pH of 6.860 at 25 °C, or physiological buffer solutions with a pH of 7.414 at 25 °C.

SRM	Type	pH(S) Values (at 25 °C)	Unit Size (in g)
185g	Potassium Hydrogen Phthalate	4.006	60
186If	Potassium Dihydrogen Phosphate	(see above)	30
186IIIf	Disodium Hydrogen Phosphate		30
187d	Sodium Tetraborate Decahydrate (Borax)		In Prep
188	Potassium Hydrogen Tartrate	3.557	60
189a	Potassium Tetroxalate	1.681	65
191b	Sodium Bicarbonate		In Prep
192a	Sodium Carbonate		In Prep
2193	Calcium Carbonate	12.46	30

### 201. Biological Buffer Systems (powder form)

These SRMs are used to calibrate clinical instruments (e.g., blood pH measurements), in the physiologically important range of pH 7 to 8. They are based on a biological buffer system for clinical pH measurements and are each certified for use as an admixture only. The pH(S) values for the buffer solutions are certified at 0.05 molal and 0.08 molal with respect to the free acid and the sodium salt admixture as a function of temperature. The certified temperature range is from 0 °C to 50 °C.

SRM	Type	pH(S) Values (at 37 °C)		Unit Size (in g)
		0.05 molal	0.08 molal	
2181	HEPES Free Acid	7.364	7.373	60
2182	NaHEPESate			60
2183	MOPSO Free Acid	6.699	6.676	60
2184	NaMOPSOate			60

### 201. pD Calibration (powder form)

These SRMs are for the preparation of solutions of known deuterium ion activity to calibrate pH instruments to indicate pD data. SRMs 2186I and 2186II, and 2191a and 2192a are certified for use as admixtures only.

SRM	Type	pD(S) Values (at 25 °C)	Unit Size (in g)
2185	Potassium Hydrogen Phthalate	4.518	60
2186I	Potassium Dihydrogen Phosphate	7.428	30
2186II	Disodium Hydrogen Phosphate		30
2191a	Sodium Bicarbonate	10.732	30
2192a	Sodium Carbonate		30

## 201. Ion-Selective Electrode Calibration (powder form)

These SRMs are certified for the calibration of ion-selective electrodes and have conventional ionic activities based on the Stokes-Robinson hydration theory for ionic strengths greater than 0.1 mol/L.

SRM	Type	Certified Component	Unit Size (in g)
2201	Sodium Chloride	pNa, pCl	125
2202	Potassium Chloride	pK, pCl	160
2203	Potassium Fluoride	pF	125

## 201. Electrolytic Conductivity (liquid form)

These SRMs are for calibrating and standardizing conductivity cells and meters used in water purity determinations and in clinical applications. SRM 3190 is an aqueous solution of hydrochloric acid; SRMs 3191 through 3195 are solutions of high purity potassium chloride in deionized water in equilibrium with atmospheric carbon dioxide. SRM 3196 is a solution of high purity sodium chloride in deionized water in equilibrium with atmospheric carbon dioxide. (NOTE—This SRM closely matches biological fluids for conductivity measurements in clinical materials. SRMs 3190–3195 are less suitable for such purposes.) SRMs 3198 and 3199 are solutions of potassium chloride in a mixture of n-propanol and deionized water.

SRM	Type	Nominal Conductivity ( $\mu\text{S/cm}$ )	Unit Size (in mL)
3190	HCl in deionized Water	25	500
3191	KCl in deionized Water	100	500
3192	KCl in deionized Water	500	500
3193	KCl in deionized Water	1000	500
3194	KCl in deionized Water	10000	500
3195	KCl in deionized Water	100000	500
3196	NaCl in deionized Water	20000	500
3198	KCl in n-propanol/deionized Water	5	500
3199	KCl in n-propanol/deionized Water	15	500



## 202. Polymeric Properties

### Molecular Weight and Melt Flow (liquid, pellet and powder forms)

These SRMs are for the calibration of instrumentation used in polymer technology science for the determination of molecular weight and molecular weight distribution and as characterized samples for other physical properties of polymers.

SRM	Type	Unit Size (in g)
705a	Polystyrene, narrow molecular weight distribution, $M_w \approx 179,300$ , $M_w/M_n \approx 1.07$	5
706	Polystyrene, broad molecular weight distribution, $M_w \approx 257,800$ , $M_w/M_n \approx 2.1$	18
1473a	Polyethylene Resin, low density, melt flow = 1.17 g/10 min	60
1474	Polyethylene Resin, melt flow = 5.03 g/10 min	60
1475a	Polyethylene, linear, $M_w \approx 52,000$ ( $M_z:M_w:M_n \approx 7.54:2.90:1$ ), melt flow = 2.02 g/10 min	50
1478	Polystyrene, narrow molecular weight distribution, $M_w \approx 37,400$ ( $M_w/M_n \approx 1.04$ )	2
1479	Polystyrene, narrow molecular weight distribution, $M_w \approx 1,050,000$	2
1480	Polyurethane ( $M_w \approx 47,300$ )	1
1482a	Polyethylene, linear, $M_w \approx 13,600$ ( $M_w/M_n \approx 1.19$ )	1
1483	Polyethylene, linear, $M_w \approx 32,100$ ( $M_w/M_n \approx 1.11$ )	1
1484a	Polyethylene, linear, $M_w \approx 119,600$ ( $M_w/M_n \approx 1.19$ )	0.3
1487	Poly(methylmethacrylate), $M_w \approx 6,000$	2
1488	Poly(methylmethacrylate), $M_n \approx 29,000$	2
1489	Poly(methylmethacrylate), $M_n \approx 115,000$	2
1496	Polyethylene Gas Pipe Resin, melt flow (Unpigmented)	908
1497	Polyethylene Gas Pipe Resin, melt flow (Pigmented)	9080
1923	Poly(ethylene oxide), $M_w \approx 26,900$ ( $M_w/M_n \approx 1.04$ )	0.2
1924	Poly(ethylene oxide), $M_w \approx 120,900$ ( $M_w/M_n \approx 1.06$ )	0.2

Property	Method	705a	706	1473a	1474	1475a	1478	1479	1480	1482a	1483	1484a	1487	1488	1489	1496	1497	1923	1924
Molecular Weight: Weight Average	(Light Scattering)	X	X			X		X	X	X	X	X						X	X
	(Sed. Equili.)	X	X				X						X	X					
	(Gel Permeation/Filtration Chromatography-GPC)																	X	X
Number Average	(Osmometry)	X					X			X	X	X			X				
	(Size Excl. Chromatography)					X			X										
Molecular Weight Distribution	(GPC)					X													
Limiting Viscosity No.	(Capillary Viscometry)																		
Benzene, 25 °C		X	X																
Benzene, 35 °C		X																	
Cyclohexane, 35 °C		X	X																
1-Chloronaphthalene, 130 °C						X				X	X	X							
1,2,4-Trichlorobenzene, 130 °C						X				X	X	X							
Decahydronaphthalene, 130 °C						X													
Tetrahydrofuran, 25 °C									X				X						
Toluene, 25 °C							X								X	X			
Melt Flow	(ASTM)			X	X	X										X	X		
Density	(ASTM)					X													
Heat Capacity	(Adiabatic)	X				X													

## 202. Polyethylene Pipe Products

These RMs are for the testing and characterization of polyethylene pipe products.

RM	Type	Tensile Properties* (in MPa)	Melt Flow (in g/10 min)	Density (in g/cm <sup>3</sup> )
8450	Polyethylene Piping, 1.3 cm	16.40/0.125	0.851	0.938
8451	Polyethylene Piping, 4.8 cm	17.35/0.127		0.937
8452	Polyethylene Piping, 10.2 cm			0.938
8453	Polyethylene Socket T Joint		0.508	
8454	Polyethylene Butt T Joint		0.996	

\*Expressed as Yield Stress/Strain at Yield (Strain Rate=81% per min).

## 203. Thermodynamic Properties

### Combustion Calorimetry (powder form)

These SRMs are for use as standards for calibration of combustion bomb calorimeters used in checking the performance of apparatus and analytical procedures and for the characterization of high purity compounds, fuels, and related fuel materials.

SRM	Type	Heat of Combustion (in MJ/kg)*	Unit Size (in g)
39j	Benzoic Acid	26.434	30
1656	Thianthrene	33.480	30
1657	Synthetic Refuse-Derived Fuel	13.87**	100
2151	Nicotinic Acid	22.184	25
2152	Urea	10.536	25
2683a	Coal, Bituminous: %S=1.89; %Ash=6.8	31.90**	50
2684a	Coal, Bituminous: %S=3.06; %Ash=11.0	28.50**	50
2692a	Coal, Bituminous: %S=1.184; %Ash=7.94	32.64**	50

\*The calorific values (MJ/kg) may decrease upon the aging or normal oxidation of the coals. NIST will continue to monitor these calorific values and report any substantive change to the purchaser.

\*\*Gross calorific value or HHV (Higher Heating Value).

### 203. Solution Calorimetry

SRM	Type	Heat of Solution (in MJ/kg)	Unit Size (in g)
1655	Potassium Chloride (Water Solution Calorimetry)	Absorbed (0.235)	30

### 203. Flash Point Reference Materials (liquid form)

These RMs are for verifying the performance of various flash point testing instruments. The reference flash points of RMs 8517, 8518, 8519, and 8520 for specific flash point methods were determined through a cooperative inter-laboratory program between NIST and ASTM S-15 Coordinating Committee on Flash Point. The participating laboratories used ASTM Standard Test Methods D 56, D 92, D 93, D 3278, and D 3828. Each RM unit contains 4×20 mL of liquid.

RM	Type	ASTM Test Method	Reference Value (in °C)	Unit Size
8517	n-Decane	D 56 D 93 D 3278/D 3828	50.9 52.8 49.7	Set of 4 ampules
8518	n-Undecane	D 56 D 92 D 93 D 3278/D 3828	67.1 73.2 68.7 65.9	Set of 4 ampules
8519	n-Tetradecane	D 92 D 93	115.5 109.3	Set of 4 ampules
8520	n-Hexadecane	D 92 D 93	138.8 133.9	Set of 4 ampules



### 203. Enthalpy and Heat Capacity (solid forms)

SRM	Type	Unit Size	Temperature Range (in K)	Molecular Weight (in g/mol)
RM 5	Copper	0.19 D×12 cm	25 to 300	170,900
705a	Polystyrene	5 g	10 to 350	
720	Synthetic Sapphire	15 g	10 to 2250	
781-D2	Molybdenum	0.64 D×10 cm	273.15 to 2800	

### 203. Differential Scanning Calorimetry (solid forms)

These SRMs are for calibrating differential scanning calorimeters, differential thermal analyzers, and similar instruments. SRM 1514 is for evaluating methods of determining purity by differential scanning calorimetry. It consists of pure phenacetin and phenacetin doped with p-aminobenzoic acid.

SRM	Type	Unit Size	Melting Temperature (in K)	Enthalpy of Fusion (in J/g)
1514	Thermal Analysis Purity Set	Set of 4 vials: 0.5 g each		*
2220	Tin (99.9995%)	2.5 cm×2.5 cm×0.0127 cm	505.10	60.22
2221b	Zinc (99.999%)		In Prep	
2222	Biphenyl (99.984%)	1 g	342.41	120.41
2225	Mercury	2.5 g	234.30	11.469

\*Certified for four levels of p-ABA (in mol %).

### 203. Differential Thermal Analysis (liquid and solid forms)

In cooperation with the International Confederation of Thermal Analysis and Calorimetry (ICTAC), NIST distributes transition point, melting point and magnetic transition measurement RMs 8754, 8759, and 8760 for use with differential thermal analyzers, differential scanning calorimeters, and thermogravimetry apparatus.

The ICTAC has recently undertaken a complete reevaluation of all the materials comprising these RMs and it is anticipated that the RMs will be redistributed in the future, as single material units rather than in sets. Therefore, only limited quantities of the current RMs are still available. Information about RM status can be obtained by contacting the SRM Program Sales Office.

### 203. Superconductive Thermometric Fixed Point Device

This SRM is composed of six small cylinders of high purity materials mounted in a threaded copper stud and enclosed in a measuring coil pair. It is intended to provide superconductive fixed points, i.e., temperature of transitions from the normal to the superconductive state.

SRM	Type	Material	Temperature (in K)
767a	Superconductive Thermometric Fixed Point Device	Niobium	9.2
		Lead	7.2
		Indium	3.4
		Aluminum	1.2
		Zinc	0.9
		Cadmium	0.5

### 203. Defining Fixed Point, International Temperature Scale of 1990, ITS-90 (solid forms)

These SRMs are for use in preparing defining fixed points of the International Temperature Scale of 1990, ITS-90.

SRM	Type	Temperature (in °C)	Unit Size (in g)
740a	Zinc (Freezing Point)	419.527	200, shot
741	Tin (Freezing Point)	231.928	350, ingot
743	Mercury (Triple Point)	-38.8344	680, ampule
1744	Aluminum (Freezing Point)	660.323	200, shot
1745	Indium (Freezing Point)	156.5985	20×10, ingot
1746	Silver (Freezing Point)	961.78	300, shot

### 203. Defining Fixed Point Cells, International Temperature Scale of 1990, ITS-90

These SRM fixed point devices are for use in the realization of the International Temperature Scale of 1990, ITS-90.

SRM	Type	Temperature (in °C)	Unit Size (in g)
1747	Tin (Freezing Point), 99.9999+%	231.928	1071, semi-open cell
1748	Zinc (Freezing Point), 99.9999+%	419.527	1031, semi-open cell

### 203. Reference Points (solid forms)

These moderate purity SRMs are for use in preparing reference point devices and for calibrating thermometers, thermocouples and other temperature measuring devices.

SRM	Type	Temperature (in °C)	Unit Size (in g ingot)
45d	Copper (Freezing Point)	1084.8	450
49e	Lead (Freezing Point)	327.45	600
742	Alumina, 99.9+%	2052	10 (powder)

### 203. Freezing Point, Melting Point, and Triple Point Cells (solid forms)

These SRM fixed point devices are for use in the realization of internationally accepted secondary reference points and/or triple points. They are **not** intended for calibration of differential scanning calorimeters.

SRM	Type	Temperature (in °C)	Unit Size (in g)
1968	Gallium (Melting Point), 99.9999+%	29.7646	25, sealed cell
1969	Rubidium (Triple Point), 99.9+%	39.3	154, sealed cell
1970	Succinonitrile (Triple Point), 99.999+%	58.0642	60, sealed cell
1971	Indium (Freezing Point), 99.9999+%	156.598	100, sealed cell
1972	1,3-Dioxolan-2-one (Ethylene Carbonate) (Triple Point), 99.999+%	36.3143	60, sealed cell
1973	n-Docosane (Triple Point), 99.999+%	43.879	60, sealed cell

### 203. Laboratory Thermometer (mercury in glass)

This thermometer is for use in clinical laboratories. Its main scale extends from 24.00 °C to 38.00 °C, in 0.05 °C divisions. It has an auxiliary scale from -0.20 °C to +0.20 °C.

SRM	Type	Calibrated Points (in °C)	Unit Size
934	Clinical Laboratory Thermometer	0, 25, 30, 37	1 each

### 203. Thermoelement Material, Platinum (wire form)

SRM	Type	Temperature Range (in °C)	Unit Size
1967	Platinum, High Purity (99.999+%)	197 to 1767	0.051D×100 cm

### 203. Vapor Pressure of Metals (rod and wire forms)

SRM	Type	Pressure Range (in Pa)	Temperature Range (in K, ITS-90)	Unit Size (in cm)
745	Gold	$10^{-4}$ to $10^2$	1300 to 2100	wire, 0.14×15.2
746	Cadmium	$10^{-6}$ to $10^1$	350 to 594	rod, 0.64×6.4



### 203. Thermal Conductivity of Graphite and Metals (rod form)

SRM	Type	Unit Size (in cm)	Temperature Range (in K)	Conductivity at 293 K (in $\text{W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$ )
1461	Stainless Steel	1.27D×5.0	2 to 1200	14.1
1462	Stainless Steel	3.18D×5.0	2 to 1200	14.1
RM 8420	Electrolytic Iron	0.64D×5.0	2 to 1000	77.9
RM 8421	Electrolytic Iron	3.18D×5.0	2 to 1000	77.9
RM 8424	Graphite	0.64D×5.0	5 to 2500	90.9
RM 8425	Graphite	1.27D×5.0	5 to 2500	90.9
RM 8426	Graphite	2.54D×5.0	5 to 2500	90.9

### 203. Thermal Expansion of Metal Glass and Silica (rod form)

SRM	Type	Temperature Range (in K)	Unit Size (in cm)
731	Borosilicate Glass	L1: 80 to 680 L2: 80 to 680 L3: 80 to 680	0.64×5.1 0.64×10.2 0.64×15.2
736	Copper	L1: 20 to 800	0.64×5.1
738	Stainless Steel (AISI 446)	293 to 780	0.64×5.1
739	Fused Silica	L1: 80 to 1000 L2: 80 to 1000 L3: 80 to 1000	0.64×5.1 0.64×10.2 0.64×15.2

### 203. Thermal Resistance of Glass, Silica, and Polystyrene (solid forms)

SRM	Type	Unit Size (in cm)	Temperature Range (in K)	Thermal Resistance at 293 K (in $\text{m}^2 \cdot \text{K} \cdot \text{W}^{-1}$ )
1449	Fumed Silica Board	60×60×2.54	297.1	1.2
1450c	Fibrous Glass Board	61×61×2.54	280 to 340	0.78
1452	Fibrous Glass Blanket	60×60×2.54	297.1	0.60
1453	Expanded Polystyrene Board	66×93×1.34	285 to 310	0.4
1459	Fumed Silica Board	30×30×2.54	297.1	1.2

## 204. Optical Properties

### Molecular Absorption (film, filter, solid, and solution forms)

The optical SRMs for spectrophotometry are certified transfer standards that fall into three general categories—transmittance, wavelength, and stray radiant energy—each of which addresses a specific instrumental parameter of an absorption spectrometer that must be in control for accurate optical transmittance measurements. To obtain optimum verification results, each SRM must be used within the specified range of conditions for which it is intended.

**SRM 930e:** This SRM is for the verification of the transmittance and absorbance scales of visible absorption spectrometers. It differs from the prior series, SRM 930d, only with respect to tightened optical polishing tolerances. SRM 930e has been polished to a parallelism of 20 arc seconds or better, to reduce the optical deviation (relative to SRM 930d) and improve performance in instruments where wavelength dispersion occurs *after* the light has passed through the filter. SRM 930e consists of three individual Schott NG-type glass filters in separate metal cuvette-style holders and an empty filter holder. The nominal percent transmittances of the three filters are 10 %, 20 %, and 30 %. The three filters are individually certified for transmittance at five wavelengths in the visible spectrum: 440.0 nm, 465.0 nm, 546.1 nm, 590.0 nm, and 635.0 nm. The optical transmittance neutrality of SRM 930e is sufficient for the filters to be used to verify accurately absorption spectrometers with maximum spectral bandpasses ranging from 2.2 nm to 6.5 nm for the five wavelengths at which the transmittances are certified. When SRM 930e is used in combination with SRM 1930, a 6-point stepwise verification of the transmittance scale is possible over the transmittance range from 1 % to 50 %. A detailed discussion of this SRM and SRM 1930 is given in Special Publication 260-116. (See NOTE.)

**SRM 931e:** This SRM is for the verification of the absorbance scales of ultraviolet and visible absorption spectrometers having narrow spectral bandpasses. SRM 931e consists of three sets of four solutions in sealed 10 mL ampules. The four solutions include a blank solution and three concentrations of an empirical inorganic solution prepared from high purity cobalt and nickel metals dissolved in a mixture of nitric and perchloric acids. The user must transfer the blank and standard solutions to cuvettes of known pathlength. The spectrum has absorption maxima at 302 nm, 395 nm, and 512 nm, and a plateau in the region of 678 nm at which the absorbances are certified. The nominal absorbances of the three empirical inorganic solution standards are 0.3, 0.6 and 0.9, respectively, at wavelengths 302 nm, 395 nm, and 512 nm. At wavelength 678 nm, the nominal absorbances of the three solutions are 0.1, 0.2, and 0.3, respectively. The liquid filters may be used to verify absorption spectrometers with maximum spectral bandpasses ranging from 1.5 nm to 8.5 nm for the four wavelengths at which the absorbances are certified.

**SRM 935a:** This SRM is for the verification of the absorbance scales of ultraviolet absorption spectrometers having spectral bandpasses not exceeding 2 nm. Issued in 15 g units, SRM 935a consists of crystalline potassium dichromate of established purity. Solutions of ten known concentrations of this SRM in 0.001 N perchloric acid (between 20 mg/kg and 200 mg/kg) are certified for their specific absorbances under well-defined conditions. The user must prepare the liquid solutions from SRM 935a and then transfer them to cuvettes of known pathlength. The certified specific absorbances for the solutions prepared may be converted to their corresponding reference absorbance values using Beer's Law. Acidic SRM 935a solutions may be prepared anywhere within the concentration range of 20 mg/kg to 200 mg/kg to provide a standard with the desired absorbance at a specified wavelength. The spectrum has absorption maxima at 257 nm and 350 nm, and absorption minima at 235 nm and 313 nm at which the specific absorbance values are certified. A detailed discussion of this SRM is given in Special Publication 260-54.

**SRM 1921:** This SRM is for use in the calibration of the wavelength scale of spectrometers in the infrared (IR) spectral region from 3.2  $\mu\text{m}$  to 18  $\mu\text{m}$  ( $555\text{ cm}^{-1}$  to  $3125\text{ cm}^{-1}$ ). SRM 1921 consists of three cards made of a matte finish polystyrene film, approximately 38  $\mu\text{m}$  thick with a 25-mm diameter clear aperture and centered 38 mm from the bottom of a cardboard holder 5 cm  $\times$  11 cm  $\times$  2 mm in size. The certified wavelength values, corresponding peak wavenumber values for thirteen absorption peak positions in the 3  $\mu\text{m}$  to 18  $\mu\text{m}$  range and a spectrum marked with arrows identifying the certified peaks, are provided with each unit. A detailed discussion of this SRM is given in Special Publication 260-122.



**SRM 1930:** This SRM complements SRM 930e for the verification of the transmittance and absorbance scales of visible absorption spectrometers. SRM 1930 consists of three individual Schott NG-type glass filters in separate metal cuvette-style holders and an empty filter holder. The nominal transmittances of the three filters are 1 %, 3 %, and 50 %. The three filters are individually certified for transmittance at five wavelengths in the visible spectrum: 440.0 nm, 465.0 nm, 546.1 nm, 590.0 nm, and 635.0 nm. The optical transmittance neutrality of SRM 1930 is sufficient for the filters to be used to verify accurately absorption spectrometers with maximum spectral bandpasses ranging from 2.2 nm to 6.5 nm for the five wavelengths at which the transmittances are certified. When SRM 1930 is used in combination with SRM 930e, a 6-point stepwise verification of the transmittance scale is possible over the transmittance range from 1 % to 50 %. A detailed discussion of this SRM and SRM 930 is given in Special Publication 260-116. (See NOTE.)

**SRM 2030a:** This SRM is for use in the one-point verification of the transmittance and absorbance scales of spectrophotometers at the given wavelength and at the nominal transmittance of 30 %. SRM 2030a consists of one glass filter in its holder and one empty holder. The exposed surface of the glass is approximately 29 mm×8 mm, measured from a point 1.5 mm above the base of the filter holder. The filter bears an identification number. The certified transmittance value at a wavelength of 465.0 nm and for a maximum spectral bandpass of 2.7 nm is provided for each unit. The uncertainty estimation is described in Special Publication 260-116. (See NOTE.)

**SRM 2031a:** This SRM is for the verification of the transmittance and absorbance scales of ultraviolet and visible absorption spectrometers. SRM 2031 consists of three individual non-fluorescent, fused silica filters in separate metal cuvette-style holders and an empty filter holder. The nominal transmittances of the three filters are 10 %, 30 %, and 90 %. The quartz base plates of the 10 % and 30 % filters carry different thicknesses of semi-transparent chromium metal that are optically contacted to quartz cover plates. The nominal 90 % filter is a single clear quartz plate. The three filters are individually certified for transmittances at ten wavelengths in the ultraviolet and visible spectral regions: 250.0 nm, 280.0 nm, 340 nm, 360.0 nm, 400.0 nm, 465.0 nm, 500.0 nm, 546.1 nm, 590.0 nm, and 635.0 nm. The optical transmittance neutrality of SRM 2031 is such that wider spectral bandpasses can be used. Consequently, SRM 2031 is the only transmittance SRM that is suitable for use with those absorption spectrometers with large spectral bandpasses, e.g., 8 nm to 20 nm. A detailed discussion of this SRM is given in Special Publication 260-68. CAUTION: Because the 10 % and 30 % chromium-coated filters attenuate incident radiation by reflection to a large extent, SRM 2031a may possibly generate interreflections between optical surfaces in the sample compartment of some absorption spectrometers. Such interreflections may affect the accuracy of the transmittance measurement. Consequently, when contemplating the purchase of SRM 2031a, the user should contact the instrument manufacturer to verify that metal-on-quartz filters are compatible with the spectrometer.

**SRM 2032:** This SRM is for use in the assessment of heterochromatic stray radiation energy (stray light) in ultraviolet absorption spectrometers in the spectral region below 260 nm. Issued in 25 g units, SRM 2032 consists of reagent grade crystalline potassium iodide (KI). Solutions of this SRM in distilled water are certified for their specific absorbances under well-defined conditions at 240 nm, 245 nm, 250 nm, 255 nm, 260 nm, 265 nm, 270 nm, and 275 nm. The KI solutions exhibit sharp cutoffs in transmittances below about 260 nm. The user must prepare a liquid KI solution from SRM 2032 and then transfer it to a cuvette of known pathlength. The certified specific absorbance for the solution prepared is then converted to its corresponding reference transmittance or absorbance value using Beer's Law. The amount of heterochromatic stray light in the absorption spectrometer at a wavelength below 260 nm may be determined from the equations given in the certificate.

**SRM 2034:** This SRM is for use in the verification of the wavelength scale of ultraviolet and visible absorption spectrometers having nominal spectral bandwidths not exceeding 3 nm. SRM 2034, a liquid consisting of 4% (m/v) holmium oxide in an aqueous solution of 10% (v/v) perchloric acid, is sealed in a nonfluorescent, fused silica cuvette of optical quality. SRM 2034 is batch certified for wavelength location of minimum transmittance of 14 bands in the spectral range from 240 nm to 650 nm for six spectral bandwidths from 0.1 nm to 3 nm. A detailed discussion of this SRM is given in Special Publication 260-102. (See NOTE.)

**NOTE:** A recertification service for units of this SRM whose certification has expired, is available directly from the NIST Analytical Chemistry Division. Contact the Division for details: Phone — (301) 975-4115; Fax — (301) 977-0587.



## 204. Molecular Absorption (film, filter, solid, and solution forms)—Continued

SRM	Type	Wavelength Range (in nm)	Unit Size
930e	Glass Filters, Transmittance	440 to 635	3 filters/4 holders
931e	Liquid Filters, Absorbance	302 to 678	Set of 12 ampules
935a	Potassium Dichromate, UV Absorbance	235 to 350	15 g
1921	Infrared Transmission Wavelength	3 $\mu\text{m}$ to 18 $\mu\text{m}$	3 polystyrene cards
1930	Glass Filters, Transmittance	440 to 635	3 filters/4 holders
2030a	Glass Filter, Transmittance	465.0	1 filter/1 holder
2031a	Metal-on-Quartz Filters, Transmittance	250 to 635	In Prep
2032	Potassium Iodide, Stray Light	240 to 280	25 g
2034	Holmium Oxide Solution, Wavelength	240 to 650	1 sealed cuvette

## 204. Molecular Luminescence (solid form)

This SRM is for use in the evaluation of methods and the calibration of fluorescence spectrometers. Issued in 1 g units, SRM 936 consists of solid quinine sulfate dihydrate. It is certified for the relative molecular emission spectrum,  $E(\lambda)$ , in radiometric units for a solution of  $1.28 \times 10^{-6}$  mol/L quinine sulfate dihydrate in 0.105 mol/L perchloric acid using an excitation wavelength of 347.5 nm. The values of the molecular emission spectrum are certified at 5 nm wavelength intervals from 375 nm to 675 nm. The user must prepare the solution and transfer it to a cuvette of known pathlength. A detailed discussion of this SRM is given in Special Publication 260-64.

SRM	Type	Wavelength Range (in nm)	Unit Size
936a	Quinine Sulfate Dihydrate, Fluorescence	375 to 675	1 g

## 204. Specular Spectral Reflectance (plate form)

These SRMs are for calibrating the reflectance scale of integrating sphere reflectometers used to evaluate materials for solar energy collectors and to calibrate reflectometers used in evaluating the appearance of polished metals and metal-plated objects.

SRM	Type	Wavelength Range (in nm)	Unit Size (in cm)
2003	First Surface, Aluminum on Glass	250 to 2500	5.1D $\times$ 0.65
2011	First Surface, Gold on Nickel-Plated Aluminum	600 to 2500	5.1D $\times$ 1.2
2023	Second Surface, Aluminum on Fused Quartz	250 to 2500	5.1D $\times$ 0.6
2026	First Surface, Black Glass	250 to 2500	5.1D $\times$ 0.6

## 204. Infrared Reflectance (solid form)

This SRM is for establishing the accuracy of the near infrared (IR) wavelength scale of reflectance spectrophotometers.

SRM	Type	Wavelength Range (in nm)	Unit Size (in cm)
1920a	Rare Earth Oxide Mixture	740 to 2000	holder: 5.1D×1.2

## 204. Diffuse Spectral Reflectance (wafer form)

This SRM is for calibrating the photometric scale of integrating sphere reflectometer-spectrophotometers used in the measurement of spectral 6°/hemispherical reflectance.

SRM	Type	Wavelength Range (in nm)	Unit Size (in cm)
2015	White Opal Glass (vitrolite)	400 to 750	5.1×3.8

## 204. Optical Rotation (powder form)

These SRMs are for calibrating or checking polarimetric apparatus. In aqueous solution, the optical rotation of SRM 17d is certified at three wavelengths, while that of SRM 41c is certified at two wavelengths. SRM 41c is also certified at one wavelength in a dimethyl sulfoxide solution.

SRM	Type	Optical Rotation (in mrad)—Aqueous Solution Wavelength			Unit Size (in g)
		546 nm	589 nm	633 nm	
17d	Sucrose	711.64	604.26	519.17	60
41c	Dextrose	1101.1	931.8	798.6	70

## 204. X-Ray and Photography (chart and step tablet forms)

SRM 1001 is a calibrated x-ray film step tablet of 17 steps that cover the optical density range from <0.200 to >4.000; it has a blue tint and emulsion on both sides. SRM 1008 is a calibrated photographic step tablet of 21 steps that cover the optical density range from <0.200 to >4.000; it has a black tint and emulsion on a single side. SRM 1010a is used to test the resolving power of cameras or of whole microcopying systems. It consists of five charts printed photographically on paper, that have 26 high-contrast, 5-line patterns ranging in spatial frequency of 1 mm<sup>-1</sup> to 18 mm<sup>-1</sup>.

SRM	Type	Unit Size
1001	X-ray Film Step Tablet	25.4 cm × 3.5 cm
1008	Photographic Step Tablet	25.4 cm × 3.5 cm
1010a	Microcopy Resolution Test Chart	Set of 5 charts



## 205. Radioactivity

### Radiation Dosimetry (wire form)

This SRM is a cobalt-in-aluminum alloy wire 0.5 mm in diameter and 1 m in length for use as a neutron density monitor standard.

SRM	Type	Cobalt Composition (mass fraction, in %)
953	Neutron density monitor wire (Co in Al)	0.116

### 205. Fission Track Glass (wafer form)

This SRM, which contains uranium, will aid laboratories performing fission track analyses in interlaboratory comparisons of data and in monitoring neutron fluences. The material was irradiated in the 20 MW reactor at the NIST Center for Neutron Research, at two different neutron energies. Each unit consists of four unirradiated glass wafers and two irradiated wafers.

SRM	Uranium Composition (in mg/kg)	Uranium-235 (in Atom %)	Reactor Position	Neutron Fluence Copper Foil	Gold Foil
963a	0.823	0.2792	RT-4: RT-3: ( $10^{14}$ n/cm <sup>2</sup> )	39.5 41.2	43.0 45.8

### 205. Special Nuclear Materials

The U.S. Department of Energy New Brunswick Laboratory issues special nuclear reference materials as NBL Certified Reference Materials (CRMs). These CRMs include the plutonium and uranium assay and isotopic materials previously issued by the National Institute of Standards and Technology. All orders or inquiries should be addressed to: U.S. Department of Energy, New Brunswick Laboratory, 9800 S. Cass Avenue, Bldg. 350, Argonne, IL 60439-4899. Attn: Reference Materials Sales; Phone – (630) 252-2767; Fax – (630) 252-6256; E-mail – [usdoe.nbl@ch.doe.gov](mailto:usdoe.nbl@ch.doe.gov).

The SRMs in the following 4 pages are certified and distributed for the SRM Program by the NIST Radioactivity Group. The radionuclide types represented by these SRMs are suitable for a variety of measurement and instrument calibration needs. Detailed information about the NIST Radioactivity SRMs and a form for license certification can be obtained by contacting the Radioactivity Group. Inquiries should be directed to the **National Institute of Standards and Technology, Radioactivity Group, Ionizing Radiation Division, Building 245, Room C114, Gaithersburg, MD 20899-0001; Phone — (301) 975-5531; Fax — (301) 926-7416; E-Mail — [rad.srms@nist.gov](mailto:rad.srms@nist.gov).**

Requests for new or renewal SRMs can be submitted to the Radioactivity Group. Upon receipt, these requests are evaluated and interested customers are notified whether or not the SRMs can be made available.

**NOTE:** Certain radionuclides are not economical to maintain as SRMs because of short half lives or low customer demand. NIST Special Publication 250, *Calibration Services Users Guide*, describes the procedure for requesting calibration of radionuclides not provided as SRMs. Requests for such tests should also be submitted, with full source information for approval of suitability, to the Radioactivity Group at the above address.



## 205. Radioactive Solutions

These SRMs are intended for the calibration of radioactivity measuring instruments and for the monitoring of chemical and geochemical processes. They are calibrated in terms of activity per gram of solution. Each SRM is contained in a flame-sealed glass ampule or bottle and, except as noted, consists of the radionuclide dissolved in an aqueous solution (usually acidic).

SRM	Radionuclide	Decay Modes	Activity per gram (in Bq • g <sup>-1</sup> )	Time of Calibration (month/year)	Volume of Solution (mL)
4322B*	Americium-241	α	40	09/91	5
4332D*	Americium-243	α	40	05/95	5
4251C*	Barium-133	EC, γ	500 000	09/93	5
4222C	Carbon-14 (as hexadene)	β <sup>-</sup>	50 000	09/90	5
4233D*	Cesium-137 Burn-up Standard	β <sup>-</sup> , γ	600 000	07/95	5
4943	Chlorine-36	β <sup>-</sup>	10 000	12/84	3
4915E*	Cobalt-60	β <sup>-</sup> , γ	75 000	01/95	5
4329*	Curium-243	α	70	06/84	5
4320A*	Curium-244	α	35	02/96	5
4370C*	Europium-152	β <sup>-</sup> , EC, γ	90 000	02/87	5
4361C	Hydrogen-3 (as water)	β <sup>-</sup>	1	In Prep	490
4926D	Hydrogen-3 (as water)	β <sup>-</sup>	3 000	07/89	18
4927E	Hydrogen-3 (as water)	β <sup>-</sup>	500 000	07/91	3
4947C	Hydrogen-3 (as toluene)	β <sup>-</sup>	300 000	03/87	4
4949C*	Iodine-129	β <sup>-</sup> , γ	3 000	03/93	5
4929E	Iron-55	EC	30 000	In Prep	5
4341*	Neptunium-237	α	100	03/94	5
4226C*	Nickel-63	β <sup>-</sup>	50 000	08/95	5
4323A*	Plutonium-238	α	30	02/94	5
4330A*	Plutonium-239	α	40	12/95	5
4338A*	Plutonium-240	α	40	05/96	5
4340A*	Plutonium-241	β <sup>-</sup>	250	12/95	5
4334F*	Plutonium-242	α	25	12/89	5
4326	Polonium-209	α, EC	90	03/94	5
4952C	Radium-226 Blank	—	0.000 2	08/91	5
4965	Radium-226	α, γ	30	09/91	5
4966	Radium-226	α, γ	270	09/91	5
4967	Radium-226	α, γ	2 700	09/91	5
4339A	Radium-228	β <sup>-</sup>	200	04/94	5
4919H*	Strontium-90	β <sup>-</sup>	4 000	07/95	5
4234A*	Strontium-90	β <sup>-</sup>	2 500 000	03/95	5
4288A	Technetium-99	β <sup>-</sup>	30 000	09/96	5
4328B	Thorium-229	α	30	07/96	5
4324A	Uranium-232	α	40	11/93	5
4321B	Uranium-238 "natural uranium"	α	250	01/92	5
4276C*	Long-Lived Mixed Radionuclide:			09/88	5
	Antimony-125	β <sup>-</sup> , γ	12 000		
	Europium-154	β <sup>-</sup> , γ	16 000		
	Europium-155	β <sup>-</sup> , γ	6 000		

\* License certification is required of purchaser by NIST before shipment.

## 205. Radiopharmaceuticals (solution and gaseous forms)

These SRMs are intended for the calibration of radioactivity-measuring instruments. They are calibrated in terms of activity per gram of solution (except SRM 4415, which is calibrated in terms of activity). Each SRM is contained in a 5 mL flame-sealed glass ampule and, except for SRM 4415, consists of the radionuclide dissolved in an aqueous solution (usually acidic).

These SRMs are produced in collaboration with the Nuclear Energy Institute and, because of the short half lives, are available only at specific times. For the current production schedule, contact the Radioactivity Group at the address given on page 112.

SRM	Radionuclide	Half Life (days)	Activity per gram (MBq · g <sup>-1</sup> )
4408F*	Cobalt-57	271.7	2
4416Q*	Gallium-67	3.3	4
4417Q*	Indium-111	2.8	5
4407U*	Iodine-125	59.6	1
4401W*	Iodine-131	8.0	5
4412V*	Molybdenum-99/Technetium-99m	2.7	10
4406O*	Phosphorus-32	14.3	2
4425B*	Samarium-153	1.9	4
4426A*	Strontium-89	50.0	1
4410V*	Technetium-99m	0.3	1 000
4404S*	Thallium-201	3.0	4
4415U*	Xenon-133	5.2	Total 500
4427B*	Yttrium-90	2.7	1

\* License certification is required of purchaser by NIST before shipment.

## 205. Alpha Particle Point Sources

These SRMs are intended for the calibration of alpha particle detectors. Each SRM consists of a practically weightless deposit of the radionuclide electroplated on a thin platinum foil cemented to a monel disk.

SRM	Radionuclide	Principal Alpha Energies (MeV)	Activity (Bq)	Time of Calibration (month/year)
4906C*	Plutonium-238	5.456, 5.499	10 to 300	09/87
4906HC*	Plutonium-238	5.456, 5.499	1 000 to 50 000	10/87

\* License certification is required of purchaser by NIST before shipment.

## 205. Carbon-14 Dating (solid form)

This SRM is an international standard for contemporary carbon-14 against which world-wide measurements can be compared. Each SRM consists of approximately 225 g of a 450 kg lot of oxalic acid prepared by fermentation of French beet molasses from the 1977 spring, summer, and autumn harvests.

SRM	Material	Description
4990C	Oxalic Acid	Set of 8: 28 g each

## 205. Accelerator Mass Spectrometry (solution form)

This SRM is intended for the calibration of accelerator mass spectrometers used to measure beryllium isotopic ratios. It is calibrated in terms of the isotopic ratio. The SRM is contained in a flame-sealed glass ampule and consists of the nuclides dissolved in an aqueous solution (acidic).

SRM	Nuclides	Isotopic Ratio	Total Nuclide Concentration (mg · g <sup>-1</sup> )	Time of Calibration (month/year)	Volume of Solution (mL)
4325	Beryllium-10/Beryllium-9	$3 \times 10^{-11}$	5	08/86	50

## 205. Gamma Ray Point Sources

These SRMs are intended for the calibration of gamma ray detectors. Each SRM consists of a small deposit of radioactive material sealed between two layers of polyester tape that are mounted on an aluminum annulus.

SRM	Radionuclide	Principal Photon Energies (keV)	Activity (Bq)	Time of Calibration (month/year)
4241C*	Barium-133	81 to 384	In Prep	
4200B	Cesium-137/Barium-137m	662	60 000	09/79
4207B	Cesium-137/Barium-137m	662	300 000	03/87
4203D*	Cobalt-60	1173, 1332	10 000 to 60 000	01/95
4201B*	Niobium-94	702, 871	4 000	04/70
4275C*	Long-Lived Mixed Radionuclide: Antimony-125 Europium-154 Europium-155	27 to 1596	120 000 160 000 55 000	09/88

\*License certification is required of purchaser by NIST before shipment.

## 205. Radon Emanation (encapsulated solution form)

This SRM is intended for the calibration of radon-222 measuring instruments. It consists of a small heat-sealed polyethylene cylinder containing approximately 0.35 g of radium-226 solution. The SRM is calibrated in terms of the radium-226 activity and in terms of the emanation fraction of the radon-222 under specified conditions.

SRM	Radionuclide	Activity (Bq)	Time of Calibration (month/year)
4968	Radium-226	3 to 500	09/91



## 205. Natural Matrix Materials (powder form)

### SRM 4350B—Columbia River Sediment

This material, provided in 85 g units, was collected from a river downstream from a nuclear reactor facility. Concentrations of fission and activation products are elevated over typical world-wide levels. Plutonium-239/plutonium-240 and americium-241 are very homogeneously distributed through the sample and are in acid-leachable forms. Inhomogeneity is 3% or better for other radionuclides.

### SRM 4351—Human Lung

This material, provided in 45 g units, contains radioactivity concentrations on the order of  $10^{-4}$  Bq · g<sup>-1</sup>. It has been freeze-dried, cryogenically ground, homogenized, and packed in a glass bottle under vacuum. There is significant inhomogeneity in plutonium-239/plutonium-240 which is unavoidable because plutonium was taken into the lungs in particulate form. Assessments of accuracy of measurement techniques can be improved by averaging over several samples.

### SRM 4352—Human Liver

This material, provided in 45 g units, contains radioactivity concentrations on the order of  $10^{-4}$  Bq · g<sup>-1</sup>. It has been freeze-dried, cryogenically ground, homogenized, and packed in a glass bottle under vacuum.

### SRM 4353A—Rocky Flats Soil Number II In Prep

This material was collected at Rocky Flats, CO, but in a different location from its predecessor, SRM 4353. Trans-actinide concentrations are about an order of magnitude higher than typical world-wide levels and there is a potential that ≈10% of these nuclides could be in refractory form. It is also possible that ≈15% of the uranium and thorium nuclides present are in non-acid leachable form. The SRM is intended for use in validation of radiochemical environmental studies methods.

### SRM 4354—Freshwater Lake Sediment

This material (gyttja) contains approximately 25 g of freeze-dried, pulverized freshwater lake sediment (approximately 50% organic by mass) in a polyethylene bottle. The SRM is intended for use in tests of measurements of environmental radioactivity contained in matrices similar to the sample, for evaluating analytical methods, or as a generally available calibrated “real” sample matrix in interlaboratory comparisons.

### SRM 4355—Peruvian Soil

This material, provided in 75 g units, has nonmeasurable radioactivity concentrations for many fallout radionuclides and can be used as a blank or for sensitive tests of radioanalytical procedures at low radioactivity concentrations for other radionuclides. The results of a trace element study are given for 57 elements.

### SRM 4356—Ashed Bone In Prep

This material, provided in 15 g units, is a partially ashed bone per sample aliquant of a 1:100 composite of human and bovine bones. The SRM is intended for use in validation of radiobiochemical methods for measurement of such radionuclides as strontium-90, radium-226, thorium-228, thorium-230, thorium-232, uranium-234, uranium-235, uranium-238, plutonium-238, plutonium-239/plutonium-240, and curium-243/curium-244. The thorium-232 and uranium-238 decay chains are **not** in equilibrium.

### SRM 4357—Ocean Sediment

This material, provided in 80 g units, consists of a blend of sediments collected in the Chesapeake Bay and in the sea off of the British Nuclear Fuels Sellafield facility in the United Kingdom. The SRM, which has been freeze-dried, pulverized, homogenized, and radiation-sterilized, is intended for use in tests of low level radiochemical methods for measurement of such fission products as strontium-90 and cesium-137 and actinides such as thorium-232, uranium-238, and plutonium-239/plutonium-240.

### SRM 4358—Ocean Shellfish In Prep

This material, provided in ≈300 g units, was prepared from oysters from the southeastern Pacific Ocean blended with mussels from the White and Irish Seas. The SRM is intended for use in the validation of radiochemical ocean studies methods on material which is both a food product and a bioaccumulator of radionuclides associated with ocean nuclear waste dumping programs. The radionuclides determined include strontium-90, radium-226, thorium-228, thorium-230, thorium-232, uranium-234, uranium-235, uranium-238, plutonium-238, and plutonium-239/plutonium-240.

## 206. Electrical Properties

### Electrical Resistivity and Conductivity of Metals (rod form)

These SRM and RM materials are for evaluating methods of measuring electrical resistivity over wide temperature ranges.

SRM/RM	Type	Temperature Range (in K)	Resistivity at 293 K (in $\mu\Omega \cdot \text{cm}$ )	Unit Size (in cm)
1461	Stainless Steel	5 to 1200	80.5	rod: 1.27D×5.0
1462	Stainless Steel	5 to 1200	80.5	rod: 3.18D×5.0
RM 8420	Electrolytic Iron	6 to 1000	10.1	rod: 0.64D×5.0
RM 8421	Electrolytic Iron	6 to 1000	10.1	rod: 3.18D×5.0

### 206. Electrical Resistivity and Conductivity of Silicon (block and wafer forms)

SRMs 2526, 2527, 2528, and 2529 are sets of 16 silicon chips, each mounted on beveling blocks, intended to provide a number of resistivity scale reference points for calibrating spreading resistance measurements of (111) p-type and n-type (SRMs 2526 and 2527) and (100) p-type and n-type (SRMs 2528 and 2529) silicon. SRMs 2541 through 2547 consist of single wafers intended for use as reference standards for sheet resistance and resistivity measurements utilizing the four-point probe method. SRMs 2541, 2542, and 2543 are made Czochralski-grown, boron-doped silicon with (100) crystallographic orientation; SRMs 2544, 2545, 2546, and 2547 are float zone (111) orientation and phosphorus-doped by the neutron transmutation doping process.

SRM	Type	Resistivity (in $\Omega \cdot \text{cm}$ )	Unit Size (in mm)
2526	Spreading Resistance	0.001 to 200	Set of 16: 5×10×0.625
2527	Spreading Resistance	0.001 to 200	Set of 16: 5×10×0.625
2528	Spreading Resistance	0.001 to 200	Set of 16: 5×10×0.625
2529	Spreading Resistance	0.001 to 200	Set of 16: 5×10×0.625
2541	Silicon Resistivity	0.01	100D×0.625
2542	Silicon Resistivity	0.1	100D×0.625
2543	Silicon Resistivity	1	100D×0.625
2544	Silicon Resistivity	10	100D×0.625
2545	Silicon Resistivity	25	100D×0.625
2546	Silicon Resistivity	100	100D×0.625
2547	Silicon Resistivity	200	100D×0.625

### 206. Residual Resistivity Ratio (rod form)

This SRM is a set of five aluminum rods for use in checking four-terminal dc and eddy current decay techniques. The residual resistivity ratio (RRR), the ratio of electrical resistivity at 273.15 K to resistivity at 4 K, is a sensitive indicator of purity and of the mechanical state of a material.

SRM	Type	RRR Values	Unit Size (in cm)
769	Aluminum	130, 683, 1205, 2650, and 11,000	0.64D×5.2

### 206. Superconducting Critical Current (wire form)

This SRM is for checking the performance of measurement systems used in superconductor technology. It consists of 2.2 m of a multifilamentary niobium titanium, copper-stabilized superconducting wire wound in a single layer onto a spool with a core diameter of 8.7 cm.

SRM	Type	Magnetic Field (in T)	Critical Current (in A)
1457	Niobium-Titanium Wire	2.000	293.30
		4.000	187.38
		6.000	124.72
		8.000	69.72



## 207. Metrology

### Scanning Electron Microscope (SEM)

These SRMs and RM are for calibrating the magnification scale and evaluating the performance of scanning electron microscopes. SRM 484g can be used to calibrate the magnification scale of an SEM from 1000 to 20,000 X.

SRM 2069b consists of graphitized rayon fibers with smooth and uniform edges on a 12.5 mm diameter SEM specimen mount with a 3 mm pcg. SRM 2090 consists of a silicon chip and was developed to meet the SEM needs of the semiconductor industry. RM 8090 is the noncertified prototype of SRM 2090.

SRM	Type	Spacings	Size in mm
484g	SEM Magnification Standard	0.5 to 5 $\mu\text{m}$	6.5D $\times$ 11
2069b	SEM Performance Standard	2 to 4 mm	12D
2090	SEM Magnification Standard	0.2 to 3000 $\mu\text{m}$	10 $\times$ 10
RM 8090	SEM Magnification Reference	0.2 to 3000 $\mu\text{m}$	10 $\times$ 10

### 207. Optical Microscope Linewidth Measurement (photomask)

These SRMs are for use in calibrating optical microscopes used to measure the widths of opaque lines and clear spaces on integrated circuit photomasks. They can also be used to calibrate line spacings and line-to-space ratios. They are not for use with partially transmitting materials, in reflected light with opaque materials, or in a scanning electron microscope. SRMs 473 and 475 are patterned with antireflecting chromium on quartz; SRM 476 is patterned with bright chromium on glass.

SRM	Type	Linewidth (in $\mu\text{m}$ )	Pitch (in $\mu\text{m}$ )	Unit Size (in cm)
473	Linewidth Measurement Standard	0.5 to 30	2 to 70	12.7 $\times$ 12.7 $\times$ 0.23
475	Linewidth Measurement Standard	0.9 to 10.8	2 to 38	6.35 $\times$ 6.35 $\times$ 0.15
476	Linewidth Measurement Standard	0.9 to 10.8	2 to 38	6.35 $\times$ 6.35 $\times$ 0.15

### 207. Depth Profiling (wafer form)

SRMs 2134 and 2137 are for calibrating the secondary ion response to minor and trace element levels in a silicon matrix. SRM 2134 is certified for arsenic; SRM 2137 is certified for boron. SRMs 2135c and 2136 are for calibrating equipment used to measure sputtered depth and erosion rates in surface analysis. SRM 2135c will be certified for total chromium and total nickel thickness, for individual layer uniformity, for nickel/chromium bilayer uniformity, and for individual layer thickness. SRM 2136 is certified for total chromium thickness of seven individual layer thicknesses.

SRM	Type	Value	Unit/Size (in cm)
2134	Arsenic Implant in Silicon Depth Profile Standard	$^{75}\text{As} - 7 \times 10^{14} \text{ atoms/cm}^2$	1 $\times$ 1
2135c	Nickel-Chromium Thin-Film Depth Profile Standard	In Prep	1 $\times$ 2.54 $\times$ 0.04
2136	Chromium/Chromium Oxide Thin-Film Depth Profile Standard	175.3 $\mu\text{m/cm}^2$	1 $\times$ 2.54 $\times$ 0.04
2137	Boron Implant in Silicon Depth Profile Standard	$^{10}\text{B} - 1.018 \times 10^{15} \text{ atoms/cm}^2$	1 $\times$ 1



## 207. Optoelectronics (solid forms)

These SRMs are intended for calibrating equipment (tunable diode lasers, video microscopes, optical retarders, etc.) and measurement systems used in the manufacture and testing of optical fiber. SRM 2518 is a device with a stable and known polarization mode dispersion which simulates optical fiber; SRMs 2517 and 2519 are fiber-connected molecular gas absorption cells with lines in the 1520 to 1570 nm region; SRM 2520 is an optical fiber specimen with a known cladding diameter value; SRM 2521 is a glass specimen with a known diameter and a refractive index approximating that of the polymer coating on fiber; SRM 2522 is a steel wire, with a known diameter, like that used to size bores in fiber connector ferrules; SRM 2523 is a ceramic connector ferrule with a specified outside diameter and roundness; SRM 2524 is an optical fiber with a known zero dispersion wavelength; SRM 2525 is a nominally 90° retarder with a known retardance.

SRM	Type	Certified Property
2517	Wavelength Reference Absorption Cell (Acetylene)	$\nu_1 + \nu_3$ band, in nm
2518	Polarization Mode Dispersion Standard	In Prep
2519	Wavelength Reference Absorption Cell (Hydrogen Cyanide)	In Prep
2520	Optical Fiber Diameter Standard	125 $\mu\text{m}$ D, nominal
2521	Optical Fiber Coating Standard	In Prep
2522	Pin Gauge Standard for Optical Fiber Ferrules	126 $\mu\text{m}$ D, nominal
2523	Optical Fiber Ferrule Geometry Standard	2.5 mm D, nominal
2524	Optical Fiber Chromatic Dispersion Standard	$\lambda_0 = 1550$ nm, nominal
2525	Optical Retardance Standard	$\delta = 90^\circ$ , nominal

## 207. Chromium Over Copper on Steel (plate form)

These SRMs are suitable for calibrating instruments used in the measurement of organics and nonmagnetic inorganic coatings over steel. They consist of fine grained copper of varying thicknesses electrodeposited onto low carbon steel substrates having the properties of AISI 1010 steel. These uniform coatings are then overplated with a thin protective layer of chromium and the total coating thickness is then certified. The thickness range covered is between 2.5  $\mu\text{m}$  and 2000  $\mu\text{m}$ . **NOTE:** A recertification service for units of this SRM, whose certification has expired, is available from the NIST Metallurgy Division. Contact the Division for details: Phone: (301) 975-6411; Fax: (301) 975-4553.

SRM	Unit Size 30×30 mm	Coating Thickness, nominal	
		(in mils)	(in $\mu\text{m}$ )
1357	Set of 3	0.2, 0.8, 2.0	base, 6, 20, 48
1358a	Set of 3	3.1, 9.8, 39	base, 80, 225, 1000
1359	Set of 4	2.0, 5.5, 20, 32	48, 140, 505, 800
1360	Set of 4	0.1, 0.2, 0.5, 0.8	2.5, 6, 12, 20
1361a	Set of 4	0.2, 0.5, 1.0, 2.0	6, 12, 25, 48
1362b	Set of 4	1.6, 3.1, 5.5, 7.9	40, 80, 140, 205
1363a	Set of 4	9.8, 16, 20, 26	255, 385, 505, 635
1364a	Set of 4	32, 39, 59, 79	800, 1000, 1525, 1935

## 207. Solder Thickness (plate form)

This SRM is for calibrating x-ray fluorescence equipment. Each unit, which consists of a 1.5 cm×1.5 cm plate of an electroplated tin-lead alloy coating on a copper substrate, is individually certified for composition and mass per unit area.

SRM	Type	Composition	Coating Mass/Area, nominal (in $\text{mg}/\text{cm}^2$ )	Coating Thickness, estimated	
				(in $\mu\text{in}$ )	(in $\mu\text{m}$ )
2321	Tin-Lead Alloy	Sn: 60 Pb: 40	6.8	295	7.5

## 207. Ellipsometry (wafer form)

These SRMs are issued primarily to evaluate the accuracy of ellipsometers and can also be used as an aid in the calibration of various other optical thickness monitoring instruments. Each unit is certified for the ellipsometric parameters delta ( $\Delta$ ) and psi ( $\Psi$ ) at the vacuum wavelength  $\lambda = 633.0$  nm, and for the derived values of the thicknesses and indexes of refraction of the silicon dioxide and silicon layers.

SRM	Type	Substrate Size (in mm)	Thickness (in nm)
2531	Thin Film Thickness	76 D	50
2532	Thin Film Thickness	76 D	100
2533	Thin Film Thickness	76 D	200
2534	Thin Film Thickness	76 D	25
2535	Thin Film Thickness	76 D	14
2536	Thin Film Thickness	76 D	10

## 207. Oxygen Concentration in Silicon (wafer form)

SRM 2551 is for the calibration of infrared spectrophotometers used to measure the  $1107\text{ cm}^{-1}$  interstitial oxygen peak in silicon. Each unit is individually certified and consists of a set of three silicon wafers; one each of a low, medium and high oxygen level Czochralski specimen. A float zone specimen of minimum oxygen concentration is also included in each set. Certified values are provided in ppma, mg/kg and atoms/cm.

SRM	Type	Unit Size (in cm)	Concentration (in mg/kg, nominal)
2551	Oxygen in Silicon	Set of 4: $2.5 \times 2.5 \times 0.2$	L - 10 M - 13 H - 15 FZ - ( $<0.1$ )



## 208. Ceramics and Glasses

### Chemical Resistance [Durability] of Glass (solid form)

These SRMs are for checking test methods and calibrating equipment used to determine the resistance of glass containers to chemical attack. The values given represent the volume of 0.02 N sulfuric acid used to titrate to the methyl red end point of the alkaline extract from a crushed sample of glass after exposure to high purity water at 121 °C.

SRM	Type	Unit Size	mL of N/50 H <sub>2</sub> SO <sub>4</sub>
622	Soda-Lime Silica	2.2 kg	7.67
623	Borosilicate	2.2 kg	0.34

### 208. Electrical Properties of Glass (bar form)

SRM 624 is for checking test methods and for calibrating equipment used to determine the dc volume resistivity of glass per ASTM C 657. SRM 774 is for checking methods used to determine dielectric constant and ac loss characteristics of insulating materials per ASTM D 150.

SRM	Type	Unit Size (in cm)	Value
624	Lead-Silica, for dc resistivity	5×5×0.5	log <sub>10</sub> ρ~9.9 Ω-cm at 300 °C
774	Lead-Silica, for dielectric constant	5×5×2.5	K~7.47 at 100 Hz

### 208. Viscosity of Glass (bar form)

SRMs 710a, 711a, and 717a are for checking the performance of high temperature viscosity equipment (rotating cylinders) and low temperature viscosity equipment (fiber elongation, beam bending, parallel plates, etc.).

SRM	Type	Temperature (°C) at Log 10 Viscosity (in Pa • s)										
		1	2	3	4	5	6	7	8	9	10	11
710a	Soda-Lime-Silica	1464	1205	1037	918							
711a	Lead-Silica	In Prep										
717a	Borosilicate	1555.4	1256.5	1065.1	932.1	(834)	(758)	(697)	(647)	(606)	(570)	(540)

Values in parentheses are not certified and are given for information only.

### 208. Glass Liquidus Temperature (solid form)

This SRM is for checking test methods and for calibrating equipment used to determine the liquidus temperature of glass by the gradient furnace methods per ASTM C 829.

SRM	Type	Unit Size	Method	Temperature, °C
773	Soda-Lime-Silica	2.5 cm×2.5 cm×0.6 cm	A (boat)	988
			B (perforated plate)	991



## 208. Viscosity Fixpoints (solid forms)

These SRMs are for the calibration of equipment for the determination of the softening, annealing, and strain points of glass. SRM 709 is also used to measure relative stress optical coefficient. [Also see next table.].

SRM	Type	Unit Size	Softening Point, °C	Annealing Point, °C	Strain Point, °C
709	Extra Dense Lead Silica	4 cm×4 cm×5 cm	384	328	311
710a	Soda-Lime-Silica	10 cm×10 cm×4 cm	730.6	(545)	(504)
713	Dense Barium Crown 620/603	225 g	738	631	599
714	Alkaline Earth Alumina Silicate	225 g	908	710	662
716	Neutral	250 g	794	574	530
717a	Borosilicate	4.2 cm×4.2 cm×12.5 cm	(719)	(513)	(470)

Values in parentheses are not certified and are given for information only.

## 208. Relative Stress Optical Coefficient (bar form)

This SRM is for calibrating instruments used to measure the relative stress optical coefficient of glass.

SRM	Type	Unit Size	Relative Stress Optical Coefficient (C) at $\lambda=546.1$ nm (Value $\times 10^{-12}$ m <sup>2</sup> /N)
709	Extra Dense Lead Silica	4 cm×4 cm×5 cm	C = -1.359

## 208. Density and Refractive Index (solid form)

These SRMs are for reference in the determination of the density of solids. The certified refractive indexes of SRM 1820 at 13 wavelengths were measured with a precision spectrometer. A value for the sodium D<sub>1</sub>, D<sub>2</sub> line is given. The certified densities of SRMs 1826a and 1827a were determined by means of hydrostatic weighing.

SRM	Type	Unit Size	Density (in g/cm <sup>3</sup> )	Refractive Index*
1820	Borosilicate Glass	slab – 3.8 cm×3.8 cm×0.6 cm	(2.292)	1.49669
1826a	Soda-Lime Glass	slab – 0.8 cm×2.0 cm×4.0 cm	2.548932	
1827a	Lead Silica Glass	slab – 0.5 cm×2.5 cm×1.2 cm	3.593014	

\*Value is at 20 °C and 435.83 nm (mercury spectral source).

Values in parentheses are not certified and are given for information only.

## 209. X-Ray Spectrometry

### X-Ray Diffraction (powder and solid forms)

SRMs 656, 676, 674a, and 1878a consist of high phase purity materials for use in the quantitative analysis of samples by the internal standard method. SRM 656, a silicon nitride, is certified for both  $\alpha$  and  $\beta$  polymorphs. SRMs 640c, 660, 675, and 1976 consist of materials with select crystallographic and microstructure properties used in the evaluation of diffraction equipment for the following variables; 1) d-spacing or line position, 2) line or instrument intensity, and 3) instrumental or sample contributions to the shape of reflection profiles. SRM 1976, a sintered alumina plate, is also certified with respect to lattice parameters as well as 12 relative intensity values from  $25^\circ$  to  $145^\circ$   $2\theta$  (Cu  $K_\alpha$ ). SRM 1990 will be certified for lattice parameter. SRM 2910 is a high purity synthetic calcium hydroxyapatite for which line profile, relative intensity, lattice parameter, and crystallographically disordered material fraction reference data have been provided.

SRM	Type	XRD Application	Lattice Parameters (in nm)	Unit Size (in g)
640c	Silicon Powder $2\theta$ /d-spacing	Line Position		In Prep
656	Silicon Nitride	Quantitative Analysis	$\alpha$ -(0.7752630/0.5619372) $\beta$ -(0.7602293/0.2906827)	10 10
660	LaB <sub>6</sub> - $2\theta$	Line Profile	0.415695	3
674a	Powder Diffraction Intensity	Quantitative Analysis		
	$\alpha$ -Al <sub>2</sub> O <sub>3</sub> (corundum)		(0.4759397/1.299237)	10
	CeO <sub>2</sub> (fluorite)		(0.5411102)	10
	Cr <sub>2</sub> O <sub>3</sub> (corundum)		(0.4959610/1.358747)	10
	TiO <sub>2</sub> (rutile)		(0.4593939/0.2958862)	10
	ZnO (wurtzite)		(0.3249074/0.5206535)	10
675	Mica Low $2\theta$	Line Position	0.998104	7.5
676	Alumina (corundum)	Quantitative Analysis	0.475919/1.299183	20
1878a	Respirable Quartz	Quantitative Analysis		In Prep
1976	Alumina Plate, Sintered	Instrument Sensitivity	0.4758846/1.299306	4.5 cm $\times$ 4.5 cm $\times$ 0.16 cm
1990	Ruby Sphere	Quantitative Analysis		In Prep
2910	Calcium Hydroxyapatite	Quantitative Analysis	(a-0.942253) (c-0.688501)	5

Values in parentheses are not certified but are provided as reference values or are given for information only.

### 209. X-Ray Stage Calibration (solid forms)

These SRMs are to be used to check the dimensional accuracy of x-ray inspection systems.

SRM	Type	Unit Size (in mm)
1842	Calibration Board (X and Y dimensions)	Board: 300 $\times$ 300 $\times$ 3
1843	Calibration Specimen (Z dimension)	Triangular Block: 37 $\times$ 20 $\times$ 12





# Engineering Materials





# Standard Reference Materials for

## Engineering Materials

### 301. Sizing

#### Particle Size (powder and solid forms)

These SRMs are for evaluating and calibrating specific types of particle size measuring instruments, including light scattering, electrical zone flow-through counters, optical and scanning electron microscopes, sedimentation systems, and wire cloth sieving devices. SRM 659 consists of equiaxed silicon nitride particles with a minimal amount of large agglomerates; SRM 1978 consists of granular, irregular shaped zirconium oxide particles with a minimal amount of large agglomerates; SRM 1982 consists of spheroidal particles measured using scanning electron microscopy, laser scattering, and sieving. SRMs 1003b, 1004a, 1017b, 1018b and 1019b each consist of soda-lime glass beads covering a particular size distribution range. SRMs 1690, 1691, 1692 and 1963 are commercially manufactured latex particles in a water suspension. SRMs 1960 and 1961 (also called "space beads") are latex particles in a water suspension produced by the National Aeronautics and Space Administration (NASA) during the Challenger STS-6 and STS-11 missions, respectively. SRM 1965 consists of two different groupings of the SRM 1960 particles.

SRM	Type	Particle Size Diameter, nominal (in $\mu\text{m}$ )	Unit Size
659	Silicon Nitride	0.2 to 10	5 vials: 2.5 g each
1003b	Glass Beads	10 to 60 (600 to 325 mesh)	25 g
1004a	Glass Beads	40 to 170 (325 to 100 mesh)	70 g
1017b	Glass Beads	100 to 400 (140 to 45 mesh)	70 g
1018b	Glass Beads	220 to 750 (60 to 25 mesh)	87 g
1019b	Glass Beads	750 to 2450 (20 to 10 mesh)	200 g
1690	Polystyrene (0.5 % in $\text{H}_2\text{O}$ )	0.895	5 mL vial
1691	Polystyrene (0.5 % in $\text{H}_2\text{O}$ )	0.269	5 mL vial
1692	Polystyrene (0.25 % in $\text{H}_2\text{O}$ )	2.982	5 mL vial
1960	Polystyrene (0.4 % in $\text{H}_2\text{O}$ )	9.89	5 mL vial
1961	Polystyrene (0.5 % in $\text{H}_2\text{O}$ )	29.64	5 mL vial
1963	Polystyrene (0.5 % in $\text{H}_2\text{O}$ )	0.1007	5 mL vial
1965	Polystyrene	9.84 (hexagonal array) 9.89 (unordered clusters)	1 slide
1978	Zirconium Oxide	0.33 to 2.19	5 g
1982	Zirconium Oxide	10 to 150	10 g

### 301. Cement Turbidimetry and Fineness

This SRM is for calibrating the Blaine fineness meter according to the latest issue of Federal Test Method Standard 158, Method 2101 or ASTM C 204 to calibrate the Wagner turbidimeter according to ASTM C 115 and to determine sieve residue according to ASTM C 430. Each set consists of twenty sealed laminated film pouches, each containing approximately 10 g of cement.

SRM	Type	Properties Certified	Value
114p	Portland Cement	Residue on 45 $\mu\text{m}$ (No. 325) sieve Specific Surface area (Wagner turbidimeter) Specific Surface area (Air permeability)	8.24 % 2086 $\text{cm}^2 \cdot \text{g}^{-1}$ 3774 $\text{cm}^2 \cdot \text{g}^{-1}$



### 301. Electrophoretic Mobility, $\mu_E$ (suspension form)

SRM 1980 is intended for use in the calibration and evaluation of equipment used to measure electrophoretic mobility. It consists of a goethite suspension saturated with phosphate in a sodium perchlorate electrolyte solution.

SRM	Type	Property Certified	Unit Size
1980	Goethite ( $\alpha$ -FeOOH)	$+\mu_E$ , $-2.53 \mu\text{m} \cdot \text{cm}/\text{V} \cdot \text{s}$	40 mL

### 301. Surface Area of Powders

These SRM and RM materials are for calibrating and checking instruments used to determine the specific surface area of powders by the Brunauer, Emmett and Teller (BET) method. The surface areas of SRMs 1899 and 1900 and RMs 8570, 8571, and 8572 (issued by NIST in cooperation with the ASTM) were determined by both the static (volumetric) and single point methods.

SRM	Type	Surface Area (in $\text{m}^2/\text{g}$ )		Unit Size (in g)
		Static	Single Point	
1899	Silicon Nitride	10.67	10.52	In Prep
1900	Silicon Nitride			In Prep
RM 8570	Calcined Kaolin	10.9	10.3	25
RM 8571	Alumina	158.7	153.2	25
RM 8572	Silica-Alumina	291.2	277.6	25

### 301. Particle Count Materials (powder and suspension forms)

These SRM and RM materials are intended for use in calibrating the response of particle sizing instrumentation, including optical counters, in accordance with National Fluid Power Association (NFPA) and ISO standard methods for determining particle contamination in oils. SRM 2806 is certified for particle concentration and projected area diameter. It consists of a polydisperse, irregularly-shaped mineral dust suspended in 5606 hydraulic fluid. RMs 8631 and 8632 are mineral test dusts of medium and ultrafine particle size and can be used to prepare suspensions in other types of oils. **NOTE:** The same lot of medium test dust was used to produce SRM 2806 and RM 8631.

SRM	Type	Particle Concentration	Unit Size
2806	Medium Test Dust (MTD) in Hydraulic Fluid	2.8 mg/L, nominal	$2 \times 400 \text{ mL}$
RM 8631	Medium Test Dust (MTD)	In Prep	
RM 8632	Ultrafine Test Dust (ULTD)	In Prep	

## 302. Surface Finish

### Microhardness (block form)

These SRMs are for use in calibrating and checking the performance of microhardness testers. SRMs 1893 through 1907 are 1.25 cm×1.25 cm (SRM 2798 is 1.35 cm×1.35 cm) and were made by electroforming the test metal on AISI 1010 steel substrate. SRMs 2830 and 2831 are intended to meet the needs of the structural, electronic and biomedical ceramics communities.

SRM	Type	Load (in Newtons)	Hardness, nominal (in kg/mm <sup>2</sup> )
1893	Bright Copper (Knoop)	0.245, 0.490, 0.981	125
1894	Bright Copper (Vickers)	0.245, 0.490, 0.981	125
1895	Bright Nickel (Knoop)	0.245, 0.490, 0.981	600
1896	Bright Nickel (Vickers)	0.245, 0.490, 0.981	600
1905	Bright Nickel (Knoop)	2.943	600
1906	Bright Nickel (Knoop)	4.905	600
1907	Bright Nickel (Knoop)	9.81	600
2798	Bright Nickel (Vickers)	4.905	600
2830	Ceramic, Silicon Nitride (Knoop)	19.6	1500
2831	Ceramic, Tungsten Carbide (Vickers)	9.81	In Prep

### 302. Abrasive Wear (block form)

This SRM is for use in the dry sand/rubber wheel abrasion test per ASTM G 65, Procedure A.

SRM	Type	Unit Size (in cm)
1857	D-2 Tool Steel	2 blocks: 0.78×2.5×7.6

### 302. Corrosion (plate form)

This SRM is for determining the reliability of step test measurements of electrochemical potential and thickness of multilayered nickel deposits. It consists of a 5.0 cm×5.0 cm plate of copper-plated steel over which a duplex nickel coating has been deposited.

SRM	Type	Step Test Potential (in mV)	Nickel Coating Thickness Bright Semibright (in μm)	
2350	Nickel Step Test	110 to 150	7	20

### 302. Surface Roughness (block form)

These SRMs are for calibrating stylus instruments that measure surface roughness. These electroless-nickel coated steel blocks have a sinusoidal roughness profile machined on the top surface.

SRM	Type	Roughness, R <sub>a</sub> (in μm)	Wavelength, D (in μm)	Unit Size (in cm)
2071b	Sinusoidal Roughness	0.3	100	In Prep
2073a	Sinusoidal Roughness	3.0	100	block: 2.4×3.3
2074	Sinusoidal Roughness	1.0	40	block: 2.4×3.3
2075	Sinusoidal Roughness	1.0	800	block: 2.4×3.3

## 303. Nondestructive Evaluation

### Dye Penetrant Test Blocks

These SRMs are for checking the performance of liquid dye penetrants and dye penetrant crack detection systems and devices for surface defect detection. These test blocks, composed of a laminate cross section of electrodeposited nickel and copper, have four synthetic cracks, approximately 0.2  $\mu\text{m}$ , 0.5  $\mu\text{m}$ , 1  $\mu\text{m}$ , and 2  $\mu\text{m}$  wide.

SRM	Type	Surface	Unit Size (in cm)
1850	Penetrant Test Block	Bright Finish	5D×1
1851	Penetrant Test Block	Matte Finish	5D×1

### 303. Artificial Flaw for Eddy Current NDE

RM 8458 provides a flaw of known size and geometry that closely resembles an actual fatigue crack. It is intended to produce a response suitable for calibrating eddy current nondestructive evaluation (NDE) systems. The flaw size is 3.0 mm×0.1 mm long by 1.0 mm deep in a 7 cm×7 cm×2 cm block of 7075-T651 aluminum alloy, heat treated to the T6 temper.

### 303. Magnetic Particle Inspection

SRM 1853 provides a means for obtaining a leakage field of known value. Such a field is useful for verifying the magnetic properties of particles used in Magnetic Particle Inspection (MPI). Each individually calibrated ring was machined from vacuum arc remelted 52100 steel and has a series of holes machined at various depths below the surface.

SRM	Type	Leakage Field Gradient (in Oe/cm)		Unit Size (in cm)
1853	Magnetic Particle Test Ring	min. A	50 to 2000	12.7D×2.2
		max. A	100 to 2500	

### 304. Automatic Data Processing — Discontinued



## 305. Fire Research

### Surface Flammability (sheet form)

This SRM is for checking the operation of radiant panel test equipment in accordance with the procedures outlined in ASTM E 162-78.

SRM	Type	Certification	Unit Size (in cm)
1002d	Hardboard Sheet	Flame Spread Index, I = 153 Heat Evolution Factor, Q = 36.5	Set of 4: 15.2×45.7×0.63

### 305. Smoke Density Chamber (sheet form)

This SRM is certified for maximum specific optical density and for performing operational checks of smoke density chambers.

SRM	Type	Maximum Specific Optical Density	Unit Size (in cm)
1007b	Flaming Exposure Condition (plastic)	Dm (corr.)=421 to 493	3 sheets: 25.4×25.4×0.076

### 305. Smoke Toxicity (granular and sheet forms)

SRM 1048 is for checking the operation of the Cup Furnace Smoke Toxicity Method under two observation periods. It consists of eight sheets, 16 cm×16 cm×0.76 cm each, of acrylonitrile-butadiene-styrene copolymer. SRM 1049 is for checking the operation of the University of Pittsburgh I Smoke Toxicity Method. It consists of 150 g of Nylon 6/6 granules which is enough to determine the LC<sub>50</sub> value four times.

SRM	Type	Combustion Mode	Observation Time	Values	
				LC <sub>50</sub>	N-Gas
1048	Smoke Toxicity (ABS sheets)	Flaming	WE*	27	1.4
			WE & PE**	25	1.5
		Nonflaming	WE*	58	1.2
			WE & PE**	53	1.4
1049	Smoke Toxicity (Nylon 6/6)	30-min. exposure		4.4	
		10-min. post-exposure			

\*WE = within 30 min.

\*\*WE & PE = 30 min+14 d.

### 305. Flooring Radiant Panel (sheet form)

This SRM consists of three sheets of kraft paperboard. It is for checking the operation of flooring radiant panel test apparatus used to measure critical radiant flux as per ASTM E 648.

SRM	Type	Critical Radiant Flux	Unit Size (in cm)
1012	Flooring Radiant Panel	0.36 W/cm <sup>2</sup>	104.1×25.4×0.305

## 309. Miscellaneous Performance Engineering Materials

### 309. Charpy V-Notch Test Blocks

These SRMs are test specimens intended for the certification of Charpy V-Notch testing machines in accordance with both ASTM Standard E 23 and ISO/DIS 12736 dimensional requirements. Each SRM unit consists of five 10 mm×10 mm×54 mm steel bars. SRMs 2092 and 2096 are made from 4340 alloy steel; SRM 2098 is made from a high strength maraging steel. SRMs 2092 and 2096 are to be tested at -40 °C; SRM 2098 is to be tested at room temperature (20 °C to 22 °C). All SRMs are to be tested in accordance with the testing procedures of the appropriate section of the current ASTM Standard E 23. All SRM bar specimens should be tested (broken) at the same time, then returned to NIST Boulder for evaluation. An acceptable machine will produce an average value within 1.4 J or 5 % of the certified energy value, whichever is greater, provided the specimens appear to have normal markings.

SRM	Type	Energy Range		
		(in J)	(in kgf • m)	(in ft • lbf)
2092	Low Energy	12.2 to 20.3	1.24 to 2.07	9.0 to 15.0
2096	High Energy	88.1 to 115.2	8.98 to 11.75	65.0 to 85.0
2098	Super High Energy	210.0 to 230.0	21.40 to 28.43	155.0 to 170.0

### 309. Socketed Ball Bar

This SRM is for measuring the performance of coordinate measuring machines (CMMs) as per ASME Standard B89.1.12. It consists of a set of three precision balls pinned and cemented onto threaded shafts, one table-mount magnetic socket, one ram-mount magnetic socket, and five partially insulated extension tubes—50 mm, 100 mm, 200 mm, 400 mm, and 800 mm long.

SRM	Type	Measuring Lengths (in 50 mm steps)	Unit Size
2083	Socketed Ball Bar	100 to 1650	Set

### 309. Coordinate Measuring Machine (CMM) Probe Performance

These SRMs are designed to aid in the performance evaluation of CMMs and their subsystems in accordance with American National Standard ASME B89.4.1 “Methods for Performance Evaluation of Coordinate Measuring Machines” and related international standards. SRM 2084 consists of a precision 10 mm tungsten carbide sphere and stem and a stand which allows the sphere to be mounted in either a horizontal, vertical, or 45° orientation. SRMs 2084R and 2085 are separate 10 mm tungsten carbide and 25 mm stainless steel spheres, respectively, that can be used with SRM 2084 to provide multiple or alternative artifact configurations. All spheres are calibrated for both form (roundness) and size (diameter).

SRM	Type	Unit Size
2084	CMM Probe Performance	one 10 mm sphere stem and stand
2084R	CMM Probe Performance	one 10 mm sphere (stem only)
2085	CMM Probe Performance	one 25 mm sphere (stem only)

### 309. Tape Adhesion Testing (sheet form)

This SRM is intended as a uniform source of linerboard for use with ASTM Standards D 2860 Standard Test Method for Adhesion of Pressure-Sensitive Tape to Fiberboard at 90° Angle and Constant Stress, D 3654 Standard Test Method for Holding Power of Pressure-Sensitive Tapes, and D 3889 Standard Method for Adherence to Linerboard of Pressure-Sensitive Tapes at Low Temperature.

SRM	Type	Unit Size
1810a	Linerboard for Tape Adhesion Testing	50 sheets: 21.6 cm×28 cm

### 309. Bleached Kraft Pulps (sheet form)

RM 8495 Northern Softwood Bleached Kraft Pulp and RM 8496 Eucalyptus Hardwood Bleached Kraft Pulp are intended primarily for use in fundamental studies on the physical properties of fibers and paper sheets. The materials selected for these two RMs are bleached dried lap pulp, each from a single lot of a standard commercial production run. The materials were selected because of their differing fiber size, differing papermaking properties, and similarity to commercially available materials.

RMs 8495 and 8496 were developed and prepared with input and support from the Pulp Material Research Committee (PMRC), a subcommittee of the Fundamental Research Committee. These materials were donated by industry and are being distributed by the SRM Program. At this time, no extensive property measurements have been made on these materials beyond ensuring they were within the control limits of the normal production run. A measurement error study is in progress with participation by international paper technical laboratories. As results become available, they will be published and added to the Report of Investigation that accompanies each of these materials.

RM	Type	Unit Size
8495	Northern Softwood	10 standard lap sheets ×0.5 kg
8496	Eucalyptus Hardwood	10 standard lap sheets ×0.5 kg





---

## *NIST Special Publications in the 260 Series*

This series of publications contains the results of research and development work conducted by the National Institute of Standards and Technology (NIST) in the field of forensic science. The publications are intended to provide information to the forensic community and to the general public. The publications are available in both print and electronic formats. The publications are available for purchase from the NIST Store or from the NIST website. The publications are also available for loan from the NIST Library.





# *NIST Special Publications in the 260 Series*

Trahey, N. M., editor, **NIST Standard Reference Materials Catalog (1997-98 edition)**, NIST Spec. Publ. 260 (October 1997).

Michaelis, R. E., and Wyman, L. L., **Standard Reference Materials: Preparation of White Cast Iron Spectrochemical Standards**, NBS Misc. Publ. 260-1 (June 1964). COM74-11061

Michaelis, R. E., Wyman, L. L., and Flitsch, R., **Standard Reference Materials: Preparation of NBS Copper-Base Spectrochemical Standards**, NBS Misc. Publ. 260-2 (October 1964). COM74-11063

Michaelis, R. E., Yakowitz, H., and Moore, G. A., **Standard Reference Materials: Metallographic Characterization of an NBS Spectrometric Low-Alloy Steel Standard**, NBS Misc. Publ. 260-3 (October 1964). COM74-11060

Hague, J. L., Mears, T. W., and Michaelis, R. E., **Standard Reference Materials: Sources of Information**, Publ. 260-4 (February 1965). COM74-11059

Alvarez, R., and Flitsch, R., **Standard Reference Materials: Accuracy of Solution X-Ray Spectrometric Analysis of Copper-Base Alloys**, NBS Misc. Publ. 260-5 (March 1965). PB168068

Shultz, J. I., **Standard Reference Materials: Methods for the Chemical Analysis of White Cast Iron Standards**, NBS Misc. Publ. 260-6 (July 1965). COM74-11068

Bell, R. K., **Standard Reference Materials: Methods for the Chemical Analysis of NBS Copper-Base Spectrochemical Standards**, NBS Misc. Publ. 260-7 (October 1965). COM74-11067

Richmond, M. S., **Standard Reference Materials: Analysis of Uranium Concentrates at the National Bureau of Standards**, NBS Misc. Publ. 260-8 (December 1965). COM74-11066

Anspach, S. C., Cavallo, L. M., Garfinkel, S. B., Hutchinson, J. M. R., and Smith, C. N., **Standard Reference Materials: Half Lives of Materials Used in the Preparation of Standard Reference Materials of Nineteen Radioactive Nuclides Issued by the National Bureau of Standards**, NBS Misc. Publ. 260-9 (November 1965). COM74-11065

Yakowitz, H., Vieth, D. L., Heinrich, K. F. J., and Michaelis, R. E., **Standard Reference Materials: Homogeneity Characterization of NBS Spectrometric Standards II: Cartridge Brass and Low-Alloy Steel**, NBS Misc. Publ. 260-10 (December 1965). COM74-11064

Napolitano, A., and Hawkins, E. G., **Standard Reference Materials: Viscosity of Standard Lead-Silica Glass**, NBS Misc. Publ. 260-11 (November 1966).

Yakowitz, H., Vieth, D. L., and Michaelis, R. E., **Standard Reference Materials: Homogeneity Characterization of NBS Spectrometric Standards III: White Cast Iron and Stainless Steel Powder Compact**, NBS Misc. Publ. 260-12 (September 1966).

Spijckerman, J. J., Snediker, D. K., Ruegg, F. C., et al., **Standard Reference Materials: Mossbauer Spectroscopy Standard for the Chemical Shift of Iron Compounds**, NBS Misc. Publ. 260-13 (July 1967).

Menis, O., and Sterling, J. T., **Standard Reference Materials: Determination of Oxygen in Ferrous Materials (SRMs 1090, 1091, 1092)**, NBS Misc. Publ. 260-14 (September 1966).

Passaglia, E. and Shouse, P. J., **Standard Reference Materials: Recommended Method of Use of Standard Light-Sensitive Paper for Calibrating Carbon Arcs Used in Testing Textiles for Colorfastness to Light**, NBS Spec. Publ. 260-15 (July 1967). Superseded by SP 260-41.

Yakowitz, H., Michaelis, R. E., and Vieth, D. L., **Standard Reference Materials: Homogeneity Characterization of NBS Spectrometric Standards IV: Preparation and Microprobe Characterization of W-20% Mo Alloy Fabricated by Powder Metallurgical Methods**, NBS Spec. Publ. 260-16 (January 1969). COM74-11062

Catanzaro, E. J., Champion, C. E., Garner, E. L., et al., **Standard Reference Materials: Boric Acid; Isotopic, and Assay Standard Reference Materials**, NBS Spec. Publ. 260-17 (February 1970). PB189457

Geller, S. B., Mantek, P. A., and Cleveland, N. G., **Calibration of NBS Secondary Standards Magnetic Tape Computer Amplitude Reference Amplitude Measurement "Process A"**, NBS Spec. Publ. 260-18 (November 1969). Superseded by SP 260-29.

Paule, R. C., and Mandel, J., **Standard Reference Materials: Analysis of Interlaboratory Measurements on the Vapor Pressure of Gold (Certification of Standard Reference Material 745)**, NBS Spec. Publ. 260-19 (January 1970). PB190071

260-20: Unassigned

Paule, R. C., and Mandel, J., **Standard Reference Materials: Analysis of Interlaboratory Measurements on the Vapor Pressures of Cadmium and Silver**, NBS Spec. Publ. 260-21 (January 1971). COM74-11359

Yakowitz, H., Fiori, C. E., and Michaelis, R. E., **Standard Reference Materials: Homogeneity Characterization of Fe-3 Si Alloy**, NBS Spec. Publ. 260-22 (February 1971). COM74-11357

Napolitano, A., and Hawkins, E. G., **Standard Reference Materials: Viscosity of a Standard Borosilicate Glass**, NBS Spec. Publ. 260-23 (December 1970). COM71-00157

Sappenfield, K. M., Marinenko, G., and Hague, J. L., **Standard Reference Materials: Comparison of Redox Standards**, NBS Spec. Publ. 260-24 (January 1972). COM72-50058

Copies of NIST 260 special publications can be purchased through the U.S. Department of Commerce National Technical Information Service (NTIS), Springfield VA 22161.

Telephone: (703) 487-4650  
Telephone: (800) 553-6847  
(credit cards only)

Fax: (703) 321-8547  
E-Mail: [orders@ntis.fedworld.gov](mailto:orders@ntis.fedworld.gov)

Provide the COM, PB, SN number, or the text title of the publication.



Hicho, G. E., Yakowitz, H., Rasberry, S. D., and Michaelis, R. E., **Standard Reference Materials: A Standard Reference Material Containing Nominally Four Percent Austenite**, NBS Spec. Publ. 260-25 (February 1971). COM74-11356

Martin, J. F., **Standard Reference Materials: National Bureau of Standards-U.S. Steel Corporation Joint Program for Determining Oxygen and Nitrogen in Steel**, NBS Spec. Publ. 260-26 (February 1971). PB81-176620

Garner, E. L., Machlan, L. A., and Shields, W. R., **Standard Reference Materials: Uranium Isotopic Standard Reference Materials**, NBS Spec. Publ. 260-27 (April 1971). COM74-11358

Heinrich, K. F. J., Myklebust, R. L., Rasberry, S. D., and Michaelis, R. E., **Standard Reference Materials: Preparation and Evaluation of SRMs 481 and 482 Gold-Silver and Gold-Copper Alloys for Microanalysis**, NBS Spec. Publ. 260-28 (August 1971). COM71-50365

Geller, S. B., **Standard Reference Materials: Calibration of NBS Secondary Standard Magnetic Tape (Computer Amplitude Reference) Using the Reference Tape Amplitude Measurement "Process A-Model 2,"** NBS Spec. Publ. 260-29 (June 1971). COM71-50282. Supersedes Measurement System in SP 260-18.

Gorozhanina, R. S., Freedman, A. Y., and Shaievitch, A. B. (translated by M. C. Selby), **Standard Reference Materials: Standard Samples Issued in the USSR (A Translation from the Russian)**, NBS Spec. Publ. 260-30 (June 1971). COM71-50283

Hust, J. G., and Sparks, L. L., **Standard Reference Materials: Thermal Conductivity of Electrolytic Iron SRM 734 from 4 to 300 K**, NBS Spec. Publ. 260-31 (November 1971). COM71-50563

Mavrodineanu, R., and Lazar, J. W., **Standard Reference Materials: Standard Quartz Cuvettes for High Accuracy Spectrophotometry**, NBS Spec. Publ. 260-32 (December 1973). COM74-50018

Wagner, H. L., **Standard Reference Materials: Comparison of Original and Supplemental SRM 705, Narrow Molecular Weight Distribution Polystyrene**, NBS Spec. Publ. 260-33 (May 1972). COM72-50526

Sparks, L. L., and Hust, J. G., **Standard Reference Material: Thermoelectric Voltage of Silver-28 Atomic Percent Gold Thermocouple Wire, SRM 733, Versus Common Thermocouple Materials (Between Liquid Helium and Ice Fixed Points)**, NBS Spec. Publ. 260-34 (April 1972). COM72-50371

Sparks, L. L., and Hust, J. G., **Standard Reference Materials: Thermal Conductivity of Austenitic Stainless Steel, SRM 735 from 5 to 280 K**, NBS Spec. Publ. 260-35 (April 1972). COM72-50368

Cali, J. P., Mandel, J., Moore, L. J., and Young, D. S., **Standard Reference Materials: A Referee Method for the Determination of Calcium in Serum**, NBS SRM 915, NBS Spec. Publ. 260-36 (May 1972). COM72-50527

Shultz, J. I., Bell, R. K., Rains, T. C., and Menis, O., **Standard Reference Materials: Methods of Analysis of NBS Clay Standards**, NBS Spec. Publ. 260-37 (June 1972). COM72-50692

Richmond, J. C., and Hsia, J. J., **Standard Reference Materials: Preparation and Calibration of Standards of Spectral Specular Reflectance**, NBS Spec. Publ. 260-38 (May 1972). COM72-50528

Clark, A. F., Denson, V. A., Hust, J. G., and Powell, R. L., **Standard Reference Materials: The Eddy Current Decay Method for Resistivity Characterization of High-Purity Metals**, NBS Spec. Publ. 260-39 (May 1972). COM72-50529

McAdie, H. G., Garn, P. D., and Menis, O., **Standard Reference Materials: Selection of Thermal Analysis Temperature Standards Through a Co-operative Study (SRM 758, 759, 760)**, NBS Spec. Publ. 260-40 (August 1972). COM72-50776

Wood, L. A., and Shouse, P. J., **Standard Reference Materials: Use of Standard Light-Sensitive Paper for Calibrating Carbon Arcs Used in Testing Textiles for Colorfastness to Light**, NBS Spec. Publ. 260-41 (August 1972). COM72-50775

Wagner, H. L., and Verdier, P. H., eds., **Standard Reference Materials: The Characterization of Linear Polyethylene, SRM 1475**, NBS Spec. Publ. 260-42 (September 1972). COM72-50944

Yakowitz, H., Ruff, A. W., and Michaelis, R. E., **Standard Reference Materials: Preparation and Homogeneity Characterization of an Austenitic Iron-Chromium-Nickel Alloy**, NBS Spec. Publ. 260-43 (November 1972). COM73-50760

Schooley, J. F., Soulen, R. J., Jr., and Evans, G. A., Jr., **Standard Reference Materials: Preparation and Use of Superconductive Fixed Point Devices, SRM 767**, NBS Spec. Publ. 260-44 (December 1972). COM73-50037

Greifer, B., Maienthal, E. J., Rains, T. C., and Rasberry, S. D., **Standard Reference Materials: Powdered Lead-Based Paint, SRM 1579**, NBS Spec. Publ. 260-45 (March 1973). COM73-50226

Hust, J. G., and Giarratano, P. J., **Standard Reference Materials: Thermal Conductivity and Electrical Resistivity Standard Reference Materials: Austenitic Stainless Steel, SRM's 735 and 798, from 4 to 1200 K**, NBS Spec. Publ. 260-46 (March 1975). COM75-10339

Hust, J. G., **Standard Reference Materials: Electrical Resistivity of Electrolytic Iron, SRM 797, and Austenitic Stainless Steel, SRM 798, from 5 to 280 K**, NBS Spec. Publ. 260-47 (February 1974). COM74-50176

Mangum, B. W., and Wise, J. A., **Standard Reference Materials: Description and Use of Precision Thermometers for the Clinical Laboratory, SRM 933 and SRM 934**, NBS Spec. Publ. 260-48 (May 1974). Superseded by NIST Spec. Publ. 260-113. COM74-50533

Carpenter, B. S., and Reimer, G. M., **Standard Reference Materials: Calibrated Glass Standards for Fission Track Use**, NBS Spec. Publ. 260-49 (November 1974). COM74-51185

Hust, J. G., and Giarratano, P. J., **Standard Reference Materials: Thermal Conductivity and Electrical Resistivity Standard Reference Materials: Electrolytic Iron, SRM's 734 and 797 from 4 to 1000 K**, NBS Spec. Publ. 260-50 (June 1975). COM75-10698

Mavrodineanu, R., and Baldwin, J. R., **Standard Reference Materials: Glass Filters as a Standard Reference Material for Spectrophotometry—Selection, Preparation, Certification, Use—SRM 930**, NBS Spec. Publ. 260-51 (November 1975). COM75-10339



- Hust, J. G., and Giarratano, P. J., **Standard Reference Materials: Thermal Conductivity and Electrical Resistivity Standard Reference Materials 730 and 799, from 4 to 3000 K**, NBS Spec. Publ. 260-52 (September 1975). COM75-11193
- Durst, R. A., **Standard Reference Materials: Standardization of pH Measurements**, NBS Spec. Publ. 260-53 (December 1978). Superseded by SP 260-53 Rev. 1988 Edition. PB88-217427
- Burke, R. W., and Mavrodineanu, R., **Standard Reference Materials: Certification and Use of Acidic Potassium Dichromate Solutions as an Ultraviolet Absorbance Standard—SRM 935**, NBS Spec. Publ. 260-54 (August 1977). PB272168
- Ditmars, D. A., Cezairliyan, A., Ishihara, S., and Douglas, T. B., **Standard Reference Materials: Enthalpy and Heat Capacity; Molybdenum SRM 781, from 273 to 2800 K**, NBS Spec. Publ. 260-55 (September 1977). PB272127
- Powell, R. L., Sparks, L. L., and Hust, J. G., **Standard Reference Materials: Standard Thermocouple Materials, Pt-67: SRM 1967**, NBS Spec. Publ. 260-56 (February 1978). PB277172
- Cali, J. P., and Plebanski, T., **Standard Reference Materials: Guide to United States Reference Materials**, NBS Spec. Publ. 260-57 (February 1978). PB277173
- Barnes, J. D., and Martin, G. M., **Standard Reference Materials: Polyester Film for Oxygen Gas Transmission Measurements SRM 1470**, NBS Spec. Publ. 260-58 (June 1979). PB297098
- Chang, T., and Kahn, A. H., **Standard Reference Materials: Electron Paramagnetic Resonance Intensity Standard: SRM 2601; Description and Use**, NBS Spec. Publ. 260-59 (August 1978). PB292097
- Velapoldi, R. A., Paule, R. C., Schaffer, R., Mandel, J., and Moody, J. R., **Standard Reference Materials: A Reference Method for the Determination of Sodium in Serum**, NBS Spec. Publ. 260-60 (August 1978). PB286944
- Verdier, P. H., and Wagner, H. L., **Standard Reference Materials: The Characterization of Linear Polyethylene (SRMs 1482, 1483, 1484)**, NBS Spec. Publ. 260-61 (December 1978). PB289899
- Soulen, R. J., and Dove, R. B., **Standard Reference Materials: Temperature Reference Standard for Use Below 0.5 K (SRM 768)**, NBS Spec. Publ. 260-62 (April 1979). PB294245
- Velapoldi, R. A., Paule, R. C., Schaffer, R., Mandel, J., Machlan, L. A., and Gramlich, J. W., **Standard Reference Materials: A Reference Method for the Determination of Potassium in Serum**, NBS Spec. Publ. 260-63 (May 1979). PB297207
- Velapoldi, R. A., and Mielenz, K. D., **Standard Reference Materials: A Fluorescence Standard Reference Material Quinine Sulfate Dihydrate (SRM 936)**, NBS Spec. Publ. 260-64 (January 1980). PB80-132046
- Marinenko, R. B., Heinrich, K. F. J., and Ruegg, F. C., **Standard Reference Materials: Micro-Homogeneity Studies of NBS Standard Reference Materials, NBS Research Materials, and Other Related Samples**, NBS Spec. Publ. 260-65 (September 1979). PB300461
- Venable, W. H., Jr., and Eckerle, K. L., **Standard Reference Materials: Didymium Glass Filters for Calibrating the Wavelength Scale of Spectrophotometers—SRM 2009, 2010, 2013 and 2014**, NBS Spec. Publ. 260-66 (October 1979). PB80-104961
- Velapoldi, R. A., Paule, R. C., Schaffer, R., Mandel, J., Murphy, T. J., and Gramlich, J. W., **Standard Reference Materials: A Reference Method for the Determination of Chloride in Serum**, NBS Spec. Publ. 260-67 (November 1979). PB80-110117
- Mavrodineanu, R., and Baldwin, J. R., **Standard Reference Materials: Metal-On-Quartz Filters as a Standard Reference Material for Spectrophotometry—SRM 2031**, NBS Spec. Publ. 260-68 (April 1980). PB80-197486
- Velapoldi, R. A., Paule, R. C., Schaffer, R., Mandel, J., Machlan, L. A., Garner, E. L., and Rains, T. C., **Standard Reference Materials: A Reference Method for the Determination of Lithium in Serum**, NBS Spec. Publ. 260-69 (July 1980). PB80-20917
- Marinenko, R. B., Biancianiello, F., Boyer, P. A., et al., **Standard Reference Materials: Preparation and Characterization of an Iron-Chromium-Nickel Alloy for Microanalysis: SRM 479a**, NBS Spec. Publ. 260-70 (May 1981). SN003-003-02328-1
- Seward, R. W., and Mavrodineanu, R., **Standard Reference Materials: Summary of the Clinical Laboratory Standards Issued by the National Bureau of Standards**, NBS Spec. Publ. 260-71 (November 1981). PB82-135161
- Reeder, D. J., Coxon, B., Enagonio, D., Christensen, R. G., Schaffer, R., Howell, B. F., Paule, R. C., and Mandel, J., **Standard Reference Materials: SRM 900, Antiepilepsy Drug Level Assay Standard**, NBS Spec. Publ. 260-72 (June 1981). PB81-220758
- Interrante, C. G., and Hicho, G. E., **Standard Reference Materials: A Standard Reference Material Containing Nominally Fifteen Percent Austenite (SRM 486)**, NBS Spec. Publ. 260-73 (January 1982). PB82-215559
- Marinenko, R. B., **Standard Reference Materials: Preparation and Characterization of K-411 and K-414 Mineral Glasses for Microanalysis: SRM 470**, NBS Spec. Publ. 260-74 (April 1982). PB82-221300
- Weidner, V. R., and Hsia, J. J., **Standard Reference Materials: Preparation and Calibration of First Surface Aluminum Mirror Specular Reflectance Standards (SRM 2003a)**, NBS Spec. Publ. 260-75 (May 1982). PB82-221367
- Hicho, G. E., and Eaton, E. E., **Standard Reference Materials: A Standard Reference Material Containing Nominally Five Percent Austenite (SRM 485a)**, NBS Spec. Publ. 260-76 (August 1982). PB83-115568
- Furukawa, G. T., Riddle, J. L., Bigge, W. G., and Pfeiffer, E. R., **Standard Reference Materials: Application of Some Metal SRMs as Thermometric Fixed Points**, NBS Spec. Publ. 260-77 (August 1982). PB83-117325
- Hicho, G. E., and Eaton, E. E., **Standard Reference Materials: Standard Reference Material Containing Nominally Thirty Percent Austenite (SRM 487)**, NBS Spec. Publ. 260-78 (September 1982). PB83-115576
- Richmond, J. C., Hsia, J. J., Weidner, V. R., and Wilmering, D. B., **Standard Reference Materials: Second Surface Mirror Standards of Specular Spectral Reflectance (SRM's 2023, 2024, 2025)**, NBS Spec. Publ. 260-79 (October 1982). PB84-203447



- Schaffer, R., Mandel, J., Sun, T., Cohen, A., and Hertz, H. S., **Standard Reference Materials: Evaluation by an ID/MS Method of the AACC Reference Method for Serum Glucose**, NBS Spec. Publ. 260-80 (October 1982). PB84-216894
- Burke, R. W., and Mavrodineanu, R., **Standard Reference Materials: Accuracy in Analytical Spectrophotometry**, NBS Spec. Publ. 260-81 (April 1983). PB83-214536
- Weidner, V. R., **Standard Reference Materials: White Opal Glass Diffuse Spectral Reflectance Standards for the Visible Spectrum (SRM's 2015 and 2016)**, NBS Spec. Publ. 260-82 (April 1983). PB83-220723
- Bowers, G. N., Jr., Alvarez, R., Cali, J. P., Eberhardt, K. R., Reeder, D. J., Schaffer, R., and Uriano, G. A., **Standard Reference Materials: The Measurement of the Catalytic (Activity) Concentration of Seven Enzymes in NBS Human Serum SRM 909**, NBS Spec. Publ. 260-83 (June 1983). PB83239509
- Gills, T. E., Seward, R. W., Collins, R. J., and Webster, W. C., **Standard Reference Materials: Sampling, Materials Handling, Processing, and Packaging of NBS Sulfur in Coal Standard Reference Materials 2682, 2683, 2684, and 2685**, NBS Spec. Publ. 260-84 (August 1983). PB84-109552
- Swyt, D. A., **Standard Reference Materials: A Look at Techniques for the Dimensional Calibration of Standard Microscopic Particles**, NBS Spec. Publ. 260-85 (September 1983). PB84-112648
- Hicho, G. E., and Eaton, E. E., **Standard Reference Materials: A Standard Reference Material Containing Two and One-Half Percent Austenite, SRM 488**, NBS Spec. Publ. 260-86 (December 1983). PB84-143296
- Mangum, B. W., **Standard Reference Materials: SRM 1969: Rubidium Triple-Point—A Temperature Reference Standard Near 39.30 °C**, NBS Spec. Publ. 260-87 (December 1983). PB84-149996
- Gladney, E. S., Burns, C. E., Perrin, D. R., et al., **Standard Reference Materials: 1982 Compilation of Elemental Concentration Data for NBS Biological, Geological, and Environmental Standard Reference Materials**, NBS Spec. Publ. 260-88 (March 1984). PB84-218338
- Hust, J. G., **Standard Reference Materials: A Fine-Grained, Isotropic Graphite for Use as NBS Thermophysical Property RMs from 5 to 2500 K**, NBS Spec. Publ. 260-89 (September 1984). PB85-112886
- Hust, J. G., and Lankford, A. B., **Standard Reference Materials: Update of Thermal Conductivity and Electrical Resistivity of Electrolytic Iron, Tungsten, and Stainless Steel**, NBS Spec. Publ. 260-90 (September 1984). PB85-115814
- Goodrich, L. F., Vecchia D. F., Pittman, E. S., Ekin, J. W. and Clark, A. F., **Standard Reference Materials: Critical Current Measurements on an NbTi Superconducting Wire Standard Reference Material**, NBS Spec. Publ. 260-91 (September 1984). PB85-118594
- Carpenter, B. S., **Standard Reference Materials: Calibrated Glass Standards for Fission Track Use (Supplement to NBS Spec. Publ. 260-49)**, NBS Spec. Publ. 260-92 (September 1984). PB85-113025
- Ehrstein, J., **Standard Reference Materials: Preparation and Certification of Standard Reference Materials for Calibration of Spreading Resistance Probes**, NBS Spec. Publ. 260-93 (January 1985). PB85-177921
- Gills, T. E., Koch, W. F., Stolz, J. W., Kelly, W. R., Paulsen, P. J., Colbert, J. C., Kirklin, D. R., Pei, P. T. S., Weeks, S., Lindstrom, R. M., Fleming, R. F., Greenberg, R. R., and Paule, R. C., **Standard Reference Materials: Methods and Procedures Used at the National Bureau of Standards to Certify Sulfur in Coal SRMs for Sulfur Content, Calorific Value, Ash Content**, NBS Spec. Publ. 260-94 (December 1984). PB85-165900
- Mulholland, G. W., Hartman, A. W., Hembree, G. G., Marx, E., and Lettieri, T. R., **Standard Reference Materials: Development of a 1  $\mu$ m Diameter Particle Size Standard, SRM 1690**, NBS Spec. Publ. 260-95 (May 1985). PB86-113693
- Carpenter, B. S., Gramlich, J. W., Greenberg, R. R., Machlan, L. A., DeBievre, P., Eschbach, H. L., Meyer, H., Van Andenhove, J., Connelly, V. E., Trahey, N. M., and Zook, A. C., **Standard Reference Materials: Uranium-235 Isotopic Abundance Standard Reference Materials for Gamma Spectrometry Measurements**, NBS Spec. Publ. 260-96 (September 1986). PB87-108544
- Mavrodineanu, R., and Gills, T. E., **Standard Reference Materials: Summary of the Coal, Ore, Mineral, Rock, and Refractory Standards Issued by the National Bureau of Standards**, NBS Spec. Publ. 260-97 (September 1985). PB86-110830
- Hust, J. G., **Standard Reference Materials: Glass Fiberboard SRM for Thermal Resistance**, NBS Spec. Publ. 260-98 (August 1985). SN003-003-02674-3\*
- Callanan, J. E., Sullivan, S. A., and Vecchia, D. F., **Standard Reference Materials: Feasibility Study for the Development of Standards Using Differential Scanning Calorimetry**, NBS Spec. Publ. 260-99 (August 1985). PB86-106747
- Taylor, J. K., (Trahey, N. M., ed.) **Standard Reference Materials: Handbook for SRM Users**, NBS Spec. Publ. 260-100 (February 1993). PB93-183796
- Mangum, B. W., **Standard Reference Materials: SRM 1970, Succinonitrile Triple-Point Standard: A Temperature Reference Standard Near 58.08 °C**, NBS Spec. Publ. 260-101 (March 1986). PB86-197100
- Weidner, V. R., Mavrodineanu, R., Mielenz, K. D., Velapoldi, R. A., Ecklerle, K. L., and Adams, B., **Standard Reference Materials: Holmium Oxide Solution Wavelength Standard from 240-650 nm, SRM 2034**, NBS Spec. Publ. 260-102 (July 1986). PB86245727
- Hust, J. G., **Standard Reference Materials: Glass Fiberblanket SRM for Thermal Resistance**, NBS Spec. Publ. 260-103 (September 1985). PB86-109949
- Mavrodineanu, R., and Alvarez, R., **Standard Reference Materials: Summary of the Biological and Botanical Standards Issued by the National Bureau of Standards**, NBS Spec. Publ. 260-104 (November 1985). PB86-155561
- Mavrodineanu, R., and Rasberry, S. D., **Standard Reference Materials: Summary of the Environmental Research Analysis, and Control Standards Issued by the National Bureau of Standards**, NBS Spec. Publ. 260-105 (March 1986). PB86-204005



- Koch, W. F., ed., **Standard Reference Materials: Methods and Procedures Used at the National Bureau of Standards to Prepare, Analyze, and Certify SRM 2694, Simulated Rainwater, and Recommendations for Use**, NBS Spec. Publ. 260-106 (July 1986). PB86247483
- Hartman, A. W., McKenzie, R. L., **Standard Reference Materials: SRM 1965, Microsphere Slide (10  $\mu$ m Polystyrene Spheres)**, NIST Spec. Publ. 260-107 (November 1988). PB89153704
- Mavrodineanu, R., and Gills, T. E., **Standard Reference Materials: Summary of Gas Cylinder and Permeation Tube Standard Reference Materials Issued by the National Bureau of Standards**, NBS Spec. Publ. 260-108 (May 1987). PB87209953
- Candela, G. A., Chandler-Horowitz, D., Novotny, D. B., Marchiando, J. F., and Belzer, B. J., **Standard Reference Materials: Preparation and Certification of an Ellipsometrically Derived Thickness and Refractive Index Standard of a Silicon Dioxide Film (SRM 2530)**, NIST Spec. Publ. 260-109 (October 1988). PB89133573
- Kirby, R. K., and Kanare, H. M., **Standard Reference Materials: Portland Cement Chemical Composition Standards (Blending, Packaging, and Testing)**, NBS Spec. Publ. 260-110 (February 1988). PB88193347
- Gladney, E. S., O'Malley, B. T., Roelandts, I., Gills, T. E., **Standard Reference Materials: Compilation of Elemental Concentration Data for NBS Clinical, Biological, Geological, and Environmental Standard Reference Materials**, NBS Spec. Publ. 260-111 (November 1987). PB88156708
- Marinenko, R. B., Blackburn, D. H., Bodkin, J. B., **Standard Reference Materials: Glasses for Microanalysis: SRMs 1871-1875**, NIST Spec. Publ. 260-112 (February 1990). PB90215807
- Mangum, B. W., Wise, J. A., **Standard Reference Materials: Description and Use of a Precision Thermometer for the Clinical Laboratory, SRM 934**, NIST Spec. Publ. 260-113 (June 1990). PB90257643\*
- Vezzetti, C. F., Varner, R. N., Potzick, J. E., **Standard Reference Materials: Bright-Chromium Standard Reference Material, SRM 476, for Calibration of Optical Microscope Linewidth Measuring Systems**, NIST Spec. Publ. 260-114 (January 1991). PB91167163
- Williamson, M. P., Willman, N. E., Grubb, D. S., **Standard Reference Materials: Calibration of NIST Standard Reference Material 3201 for 0.5 inch [10brkt]12.65 mm[1cbrkt] Serial Serpentine Magnetic Tape Cartridge**, NIST Spec. Publ. 260-115 (February 1991). PB91187542
- Mavrodineanu, R., Burke, R. W., Baldwin, J. R., et al., **Standard Reference Materials: Glass Filters as a Standard Reference Material for Spectrophotometry -Selection, Preparation, Certification and Use of SRM 930 and SRM 1930**, NIST Spec. Publ. 260-116 (March 1994). PB94-188844/AS
- Vezzetti, C. F., Varner, R. N., and Potzick, J. E., **Standard Reference Materials: Antireflecting-Chromium Linewidth Standard, SRM 475, for Calibration of Optical Microscope Linewidth Measuring Systems**, NIST Spec. Publ. 260-117 (January 1992). PB92-149798
- Williamson, M. P., **Standard Reference Material 3202 for 18-Track, Parallel, and 36-Track, Parallel Serpentine, 12.65 mm (0.5 in), 1491 cpmm (37871 cpi), Magnetic Tape Cartridge**, NIST Spec. Publ. 260-118 (July 1992). PB92-226281
- Vezzetti, C. F., Varner, R. N., and Potzick, J. E., **Standard Reference Materials: Antireflecting-Chromium Linewidth Standard, SRM 473, for Calibration of Optical Microscope Linewidth Measuring System**, NIST Spec. Publ. 260-119 (September 1992).
- Caskey, G. W., Philips, S. D., Borchardt, et al., **Standard Reference Materials: A Users' Guide to NIST SRM 2084: CMM Probe Performance Standard**, NIST Spec. Publ. 260-120 (June 1994).
- Rennex, B. G., **Standard Reference Materials: Certification of a Standard Reference Material for the Determination of Interstitial Oxygen Concentration in Semiconductor Silicon by Infrared Spectrophotometry**, NIST Spec. Publ. 260-121 (August 1994). PB95-125076/AS
- Gupta, D., Wang, L., Hanssen, L. M., Hsai, J. J., and Datla, R. U., **Standard Reference Materials: Polystyrene Films for Calibrating the Wavelength Scale of Infrared Spectrophotometer (SRM 1921)**, NIST Spec. Publ. 260-122 (April 1995). PB95-226866/AS
- Strouse, G. F., **Standard Reference Materials: SRM 1744: Aluminum-Freezing Point Standard**, NIST Spec. Publ. 260-124 (March 1995). SN003-003-03342-1.
- Schiller, S. B., **Standard Reference Materials: Statistical Aspects of the Certification of Chemical Batch SRMs**, NIST Spec. Publ. 260-125 (July 1996). PB96-210877/AS.
- Guenther, F. R., Dorko, W. D., Miller, W. R., et al., **Standard Reference Materials: The NIST Traceable Reference Material Program for Gas Standards**, NIST Spec. Publ. 260-126 (July 1996). PB96-210786/AS.
- Strouse, G. F., and Ahmet, A. T., **Standard Reference Material 1747: Tin Freezing-Point Cell and Standard Reference Material 1748: Zinc Freezing-Point Cell**, NIST Spec. Publ. 260-127 (August 1997). SN003-003-03488-6.
- Zhang, Z. M., Gentile, T. R., Migdall, A. L., and Datla, R. U., **Standard Reference Material 2036: Transmission Filters with Measured Optical Density at 1064 nm Wavelength**, NIST Spec. Publ. 260-128 (In Prep).
- Potzick, J. E., **Standard Reference Materials: Antireflecting-Chromium Linewidth Standard, SRM 473, for Calibration of Optical Microscope Linewidth Measuring Systems**, NIST Spec. Publ. 260-129 (February 1997). PB97-151922/AS.
- Zarr, R. R., **Standard Reference Materials: Glass Fiberboard, Standard Reference Material 1450c, for Thermal Resistance from 280K to 340K**, NIST Spec. Publ. 260-130 (April 1997). PB97-177166/AS.
- Ehrstein, J. R., and Croarkin, M. C., **The Certification of 100 mm Diameter Silicon Resistivity SRMs 2541 through 2547 Using Dual-Configuration Four-Point Probe Measurements**, NIST Spec. Publ. 260-131 (In Prep).
- Strouse, G. G., **Standard Reference Material 1745: Indium Freezing Point Standard and Standard Reference Material 2232: Indium DSC Melting Point Standard**, NIST Spec. Publ. 260-132 (In Prep).
- Gilbert, S. L., and Swann, W. C., **Acetylene<sup>12</sup>C<sub>2</sub>H<sub>2</sub> Absorption Reference for 1510-1540 nm Wavelength Calibration — SRM 2517**, NIST Spec. Publ. 260-133 (In Prep).





---

# *SRM/RM Indexes*

## *Subject Index*



## Subject Index

### A

#### ABSORBANCE

See MOLECULAR Absorption, 108–110

#### ACETANILIDE

use in MICROCHEMISTRY, 56

#### ACIDIMETRIC VALUE (STOICHIOMETRY), 56

of Benzoic Acid

of Boric Acid

of Potassium Carbonate

of Potassium Hydrogen Phthalate

#### ACID RAIN

See SIMULATED RAINWATERS, 68

#### ADHESION (TAPE ADHESION TESTING)

Linerboard for, 132

#### AGRICULTURAL MATERIALS, 82

Apple Leaves

Corn Kernel (Zea Mays)

Corn Stalk (Zea Mays)

Fluoride in Vegetation

Peach Leaves

Pine Needles

Spinach Leaves

Tomato Leaves

See USA/CANADA COLLABORATIVE MATERIALS, 80–81

#### AIR PARTICULATES (INORGANIC)

See TRACE ELEMENTS, 69

#### AIR POLLUTION

See PRIMARY GAS MIXTURES, 70–71

#### ALCOHOL

Ethanol Solutions, 64

#### ALCOHOLS (FOSSIL FUELS), 72

Alcohol Mixture

Ethanol

Methanol

Methanol and t-Butanol

#### ALLOYS (FERROUS)

See FERROUS METALS, 31–43

#### ALLOYS (NONFERROUS)

See NONFERROUS METALS, 44–52

#### ALUMINA

as Bauxite (ORES), 84–86

as Burnt REFRACTORIES, 88

Reduction Grade (ORES), 84–86

REFERENCE POINTS, 105

for SURFACE AREA OF POWDERS, 128

X-RAY SPECTROMETRY, 123

#### ALUMINUM

Freezing Point of (DEFINING

FIXED POINT, ITS-90), 105

as a METALLO-ORGANIC COMPOUND, 95

Residual Resistivity Ratio, 117

SPECTROMETRY Solution, 57–59

Specular Reflectance (Mirrors), 110

#### ALUMINUM BASE ALLOYS

See NONFERROUS METALS, 44–52

#### AMERICIUM (RADIOACTIVITY), 112–116

as Americium-241

as Americium-243

Columbia River Sediment

Human Liver

Human Lung

Peruvian Soil

Rocky Flats Soil Number II

#### AMMONIUM DIHYDROGEN PHOSPHATE

constituent in FERTILIZERS, 83

#### ANALYZED GASES

See PRIMARY GAS MIXTURES, 70–71

See PERMEATION DEVICES, 71

#### ANGIOTENSIN I

See CLINICAL LABORATORY MATERIALS, 62

#### ANISIC ACID

use in MICROCHEMISTRY, 56

#### ANION CHROMATOGRAPHY, 60

Bromide Solution

Chloride Solution

Fluoride Solution

Nitrate Solution

Phosphate Solution

Sulfate Solution

#### ANTICONVULSANT DRUG LEVEL ASSAY

See CLINICAL LABORATORY MATERIALS, 62

#### ANTIEPILEPSY DRUG LEVEL ASSAY

See CLINICAL LABORATORY MATERIALS, 62

#### ANTIMONY

as Antimony-125 Mixed Nuclide

(RADIOACTIVITY), 112–116

SPECTROMETRY Solution, 57–58

#### AQUATIC MATERIALS (FOOD AND AGRICULTURE)

Aquatic Plant (AGRICULTURAL MATERIALS), 82

Aquatic Mass (AGRICULTURAL MATERIALS), 82

#### ARGILLACEOUS LIMESTONE

See ROCKS AND MINERALS, 88

#### ARSENIC

in FREEZE-DRIED URINE, 64

in MATERIALS ON FILTER MEDIA, 66

Implant in Silicon (DEPTH PROFILING), 118

SPECTROMETRY Solution, 57–59



**ARSENIC TRIOXIDE (STOICHIOMETRY)**

Reductometric value of, 56

**ASBESTOS, 67**

Common Commercial

Uncommon Commercial

Mixture on Filter

**ASHED BONE (RADIOACTIVITY)**

NATURAL MATRIX MATERIALS, 116

**ATOMIC ABSORPTION SPECTROMETRY**

See SPECTROMETRY, MULTIELEMENT

STANDARD SOLUTIONS, 58-59

See SPECTROMETRY, SINGLE ELEMENT

STANDARD SOLUTIONS, 57-58

**AUTO CATALYSTS**

Platinum Group Metals, 69

**B****BALL BAR (MISCELLANEOUS PERFORMANCE  
....MATERIALS)**

Socketed Ball Bar, 132

**BARIUM**

as Barium-133 (RADIOACTIVITY), 112-116

as Cesium-137 Burn-up Standard

(RADIOACTIVITY), 112-116

as a METALLO-ORGANIC COMPOUND, 95

SPECTROMETRY Solution, 57-59

**BASALT ROCK**

See ROCKS AND MINERALS, 88

**BASIMETRIC VALUE (STOICHIOMETRY)**

of Tris(hydroxymethyl)aminomethane, 56

**BAUXITE (ORES), 84-86**

from Arkansas

from Australia

from the Dominican Republic

from Jamaica

from Surinam

**BEARING METAL (Pb-Sb-Sn)**

See LEAD BASE ALLOYS, 49

**BENZOIC ACID**

Acidimetric Value of (STOICHIOMETRY), 56

Calorimetric Value of (COMBUSTION CALORIMETRY), 103

**BERYLLIUM**

in COPPER BASE ALLOYS, 45-46

in MATERIALS ON FILTER MEDIA, 66

SPECTROMETRY Solution, 57-58

**BET**

abbr. for Brunauer, Emmett, and Teller (method)

**BET SURFACE AREA**

See SURFACE AREA OF POWDERS, 128

**BEVERAGE**

See FOODS AND BEVERAGES, 79

**BILIRUBIN**

See CLINICAL LABORATORY MATERIALS, 62

**BIOLOGICAL**

See FOOD AND AGRICULTURE, 79-83

See HEALTH AND INDUSTRIAL HYGIENE, 62-67

**BIOLOGICAL BUFFER SYSTEMS (ION ACTIVITY), 99**

HEPES Free Acid

MOPSO Free Acid

NaHEPESate

NaMOPSOate

**BIPHENYL**

for DIFFERENTIAL SCANNING CALORIMETRY, 104

**BISMUTH**

SPECTROMETRY Solution, 57

**BONE ASH**

See CLINICAL REFERENCE MATERIALS, 62

See NATURAL MATRIX MATERIALS  
(RADIOACTIVITY), 112-116

**BONE MEAL**

SEE CLINICAL REFERENCE MATERIALS, 62

**BORATE ORE**

See ORES, 84-86

**BORON**

Implant in Silicon (DEPTH PROFILING), 118

SPECTROMETRY Solution, 57

**BORIC ACID**

Acidimetric/Assay Values of (STOICHIOMETRY), 56

Enriched in Boron-10 (STABLE ISOTOPIC  
MATERIALS), 60

**BOTANICAL**

See AGRICULTURAL MATERIALS, 82

**BOVINE**

Liver (FOOD AND AGRICULTURE), 79-83

Muscle Powder (USA/CANADA COLLABORATIVE  
MATERIALS), 80-81

Serum Albumin (CLINICAL REFERENCE  
MATERIALS), 62

**BRASS**

See NONFERROUS METALS, 44-52

**BROMIDE**

ANION CHROMATOGRAPHY Solution, 60

Sodium Bromide (STABLE ISOTOPIC  
MATERIALS), 60

**BROMINE**

in FOOD AND AGRICULTURE, 79-83

**BROMO COMPOUNDS**

o-Bromobenzoic Acid (MICROCHEMISTRY), 56

**BRONZE**

See COPPER BASE ALLOYS, 45-46

**BUFFERS**

See ION ACTIVITY, 99-100

**BURNT REFRACTORIES (ALUMINUM OXIDE)**

See REFRACTORIES, 88

**C****CADMIUM**

Cadmium Cyclohexanecarboxylate

(METALLO-ORGANIC COMPOUND), 95

in MATERIALS ON FILTER MEDIA, 66

SPECTROMETRY Solution, 57-59

VAPOR PRESSURE OF METALS, 106

**CALCIUM**

Calcium Carbonate (CLINICAL LABORATORY  
MATERIALS), 62

Calcium Hydroxyapatite (BIOMATERIALS), 65  
SPECTROMETRY Solution, 57-59

**CALORIMETRY (THERMODYNAMIC PROPERTIES)**

COMBUSTION CALORIMETRY, 103

DIFFERENTIAL SCANNING CALORIMETRY, 104

DIFFERENTIAL THERMAL ANALYSIS, 104

ENTHALPY AND HEAT CAPACITY, 104

SOLUTION CALORIMETRY, 103

**CARBIDES (CERAMICS AND GLASSES) (SURFACE FINISH)**

Silicon CARBIDE, 90

Tungsten CARBIDE, 90

Tungsten Carbide (MICROHARDNESS), 129

See CEMENTED CARBIDES, 90

## **CARBON**

- Carbon Modified Silica (**INORGANICS**), 69
- Carbon-14 Dating  
(**RADIOACTIVITY**), 112–116
- in PLAIN CARBON STEELS  
(**FERROUS METALS**), 31–43

## **CARBON DIOXIDE (PRIMARY GAS MIXTURES), 70–71**

- Carbon Dioxide in Nitrogen
- Carbon Monoxide, Propane, and Carbon Dioxide

## **CARBON MONOXIDE (PRIMARY GAS MIXTURES), 70–71**

- Carbon Monoxide in Air
- Carbon Monoxide in Nitrogen
- Carbon Monoxide and Propane in Nitrogen
- Carbon Monoxide, Propane, and Carbon Dioxide  
in Nitrogen

## **β-CAROTENE (FAT SOLUBLE VITAMINS)**

- in Human Serum (**CLINICAL LABORATORY MATERIALS**), 62

## **CARTRIDGE BRASS**

- See **NONFERROUS METALS**, 44–52

## **CAST IRON**

- See **FERROUS METALS**, 31–43

## **CAST STEEL**

- See **FERROUS METALS**, 31–43

## **CATALYST MATERIALS**

- Catalyst Package (**FOR LUBRICANT OXIDATION**), 96
- High Sulfur Gas Oil Feed (**CATALYST CHARACTERIZATION MATERIAL**), 95
- Used Auto Catalysts (**INORGANICS**), 69

## **CELLULOSE**

- Microcrystalline (**USA/CANADA COLLABORATIVE MATERIALS**), 80–81

## **CEMENTS**

- CEMENT TURBIDIMETRY AND FINENESS  
(**SIZING**), 127
- PORTLAND CEMENT CLINKERS, 94
- PORTLAND CEMENTS, 93

## **CERAMIC MATERIALS (CERAMICS AND GLASSES)**

- CARBIDES, 90
- CEMENTED CARBIDES, 90
- GLASSES, 91
- See **REFRACTORIES**, 88
- See **ROCKS AND MINERALS**, 83
- See **SPECULAR SPECTRAL REFLECTANCE**, 110

## **CERIUM**

- SPECTROMETRY** Solution, 57

## **CESIUM (RADIOACTIVITY), 112–116**

- as Cesium-137 Burn-up Standard
- as Cesium-137-Barium-137
- SPECTROMETRY** Solution, 57

## **CHARPY**

- V-NOTCH TEST BLOCKS, 132

## **CHEMICAL**

- See **HIGH PURITY MATERIALS**, 54–61

## **CHLORIDE**

- ANION ION CHROMATOGRAPHY** Solution, 60
- CLINICAL LABORATORY MATERIALS**, 62
- in **SERUM MATERIALS**, 63
- in **SIMULATED RAINWATERS**, 68

## **CHLORINE**

- as Chlorine-36 (**RADIOACTIVITY**), 113
- in **LUBRICATING BASE OILS**, 95
- STABLE ISOTOPES** of, 60
- as a Trace Element in **FOSSIL FUELS**, 74

## **CHLORO COMPOUNDS (ORGANIC CONSTITUENTS), 75–78**

- in Biphenyls
- in Cod Liver Oil
- in Halocarbons
- m-Chlorobenzoic Acid (**MICROCHEMISTRY**), 56
- in Pesticides
- in Phenols
- in Pollutants

## **CHOLESTEROL (HEALTH CARE AND NUTRIENTS), 80**

- in Coconut Oil
- in freeze-dried Human Serum (**SERUM MATERIALS**), 63
- in frozen Human Serum (**SERUM MATERIALS**), 63
- in Whole Egg Powder (**USA/CANADA COLLABORATIVE MATERIALS**), 80–81

## **CHROMIUM**

- as Chromium Nitrate (**STABLE ISOTOPIC MATERIALS**), 60
- in **CLAYS**, 87
- Chromium/Chromium Oxide (**DEPTH PROFILING**), 118
- Tris (1-phenyl-1,3-butanediono)chromium (III)  
(**METALLO-ORGANIC COMPOUNDS**), 95
- SPECTROMETRY** Solution, 57–59
- in Steels (**FERROUS METALS**), 31–43

## **CHROMIUM COMPOUNDS**

- in **ROCKS AND MINERALS**, 88

## **CHROMIUM SPECIATION**

- See **HIGH PURITY MATERIALS**, 60

## **CHRYSOTILE**

- in **ASBESTOS (HEALTH AND INDUSTRIAL HYGIENE)**, 67

## **CLAYS, 87**

- Brick
- Flint
- Plastic

## **CLINICAL LABORATORY MATERIALS, 62**

- Amino Acids in HCl
- Angiotensin I (Human)
- Anticonvulsant Drug Level Assay
- Antiepilepsy Drug Level Assay
- Bilirubin
- Bone Ash
- Bone Meal
- Bovine Serum Albumin (**SERUM MATERIALS**)
- Bovine Serum—Inorganic Constituents



- Calcium Carbonate
- Cholesterol
- Cholesterol in Freeze-dried Human Serum
- Cortisol (Hydrocortisone)
- Creatinine
- Electrolytes in Frozen Human Serum (SERUM MATERIALS)
- D-Glucose (Dextrose)
- Glucose in Frozen Human Serum (SERUM MATERIALS)
- Iron Metal
- Human Serum (SERUM MATERIALS)
- Lead Nitrate
- Lead in Blood
- Lipids in Frozen Human Serum (SERUM MATERIALS)
- Lithium Carbonate
- Magnesium Gluconate Dihydrate
- D-Mannitol
- 4-Nitrophenol
- Potassium Chloride
- Sodium Chloride
- Sodium Pyruvate
- Tripalmitin
- Urea
- Uric Acid
- Vitamins (Fat-Soluble) and Cholesterol in Human Serum
- VMA (4-hydroxy-3-methoxymandelic acid)
- COAL**
  - for COMBUSTION CALORIMETRY, 103
  - Sulfur in (SULFUR IN FOSSIL FUELS), 73
  - TRACE ELEMENTS in, 74
- COAL FLY ASH**
  - TRACE ELEMENTS in, 74
- COATING THICKNESS**
  - Nonmagnetic—CHROMIUM OVER COPPER, 119
  - Tin-Lead Alloy (SOLDER THICKNESS), 119
- COBALT**
  - as Cobalt-60 (RADIOACTIVITY), 112–116
  - SPECTROMETRY Solution, 57–59
- COBALT BASE ALLOYS**
  - See NONFERROUS METALS, 44–52
- COCAINE METABOLITE**
  - See FREEZE-DRIED URINE, 64–65
- COCONUT OIL**
  - Cholesterol in (HEALTH CARE AND NUTRIENTS), 80
- COD LIVER OIL**
  - Organics in (ORGANIC CONSTITUENTS), 75–78
- COLUMBIA RIVER SEDIMENT**
  - See NATURAL MATRIX MATERIALS (RADIOACTIVITY), 112–116
- CONDUCTIVITY (RESIDUAL RESISTIVITY RATIO)**
  - of Aluminum, 117
- CONDUCTIVITY, ELECTRICAL (ELECTRICAL PROPERTIES), 117**
  - of Electrolytic Iron
  - of Lead-Silica (ELECTRICAL PROPERTIES OF GLASS), 121
  - of Stainless Steel
- CONDUCTIVITY, ELECTROLYTIC (ION ACTIVITY), 100**
  - Hydrochloric Acid in Water
  - Potassium Chloride in Water
  - Potassium Chloride in Water-Propanol Mixture
  - Sodium Chloride in Water
- CONDUCTIVITY, THERMAL (THERMODYNAMIC PROPERTIES), 107**
  - of Electrolytic Iron
  - of Graphite
  - of Stainless Steel
- COORDINATE MEASURING MACHINE PROBE PERFORMANCE, 132**
- COPPER**
  - Bis(1-phenyl-1,3-butanedione)copper (II) (METALLO-ORGANIC COMPOUNDS), 95
  - Brass (COPPER BASE ALLOYS), 46
  - Bronze (COPPER BASE ALLOYS), 45–46
  - CARTRIDGE BRASS, 48
  - Cupro-Nickel (COPPER BASE ALLOYS), 45–46
  - ENTHALPY AND HEAT CAPACITY of, 104
  - in FERROUS METALS, 31–43
  - FREE CUTTING BRASS, 48
  - Freezing Point of (REFERENCE POINTS), 105
  - Gilding Metal (COPPER BASE ALLOYS), 46
  - GILDING METAL, 49
  - High-Purity METALS (MICROANALYSIS), 53
  - NAVAL BRASS, 48
  - Nickel Silver (COPPER BASE ALLOYS), 45
  - in NONFERROUS METALS, 44–52
  - in ORES, 84–85
  - as Phosphorized Copper (COPPER “BENCHMARK”), 47
  - SPECTROMETRY Solution, 57–59
  - STABLE ISOTOPES of, 60
  - as Unalloyed Copper (COPPER “BENCHMARK”), 47
- COPPER BASE ALLOYS**
  - See NONFERROUS METALS, 44–52
- CORN**
  - Bran (USA/CANADA COLLABORATIVE MATERIALS), 81
  - Kernel (AGRICULTURAL MATERIALS), 80–81
  - Stalk (AGRICULTURAL MATERIALS), 80–81
  - Starch (USA/CANADA COLLABORATIVE MATERIALS), 81
- CORROSION**
  - Nickel Step Test, 129
  - Tool Steel (ABRASIVE WEAR), 129
- CORTISOL (HYDROCORTISONE)**
  - See CLINICAL LABORATORY MATERIALS, 62
- COTININE**
  - in FREEZE-DRIED URINE, 64
- CREATININE**
  - See CLINICAL LABORATORY MATERIALS, 62
- CRUDE OIL**
  - Vanadium in (METAL CONSTITUENTS), 72
- CUP FURNACE (FIRE RESEARCH)**
  - See SMOKE TOXICITY, 131
- CURIUM (RADIOACTIVITY), 112–116**
  - as Curium-243
  - as Curium-244
- CYSTINE**
  - See MICROCHEMISTRY, 56



**DENSITY**

- of Borosilicate Glass, 122
- of Lead Silica Glass, 122
- Neutron Density Monitor Wire (RADIATION DOSIMETRY), 112
- of Smoke (SMOKE DENSITY CHAMBER), 131
- of Soda-Lime Glass, 122

**DEPTH PROFILING, 118**

- Chromium/Chromium Oxide Thin Film
- Nickel/Chromium Thin Film
- Arsenic Implant in Silicon
- Boron Implant in Silicon

**DEXTROSE (D-GLUCOSE)**

- See CLINICAL LABORATORY MATERIALS, 62

**DIFFERENTIAL SCANNING CALORIMETRY, 104**

- Biphenyl
- Mercury
- Thermal Analysis Purity Set
- Tin
- Zinc

**DIFFERENTIAL THERMAL ANALYSIS, 104****DIFFRACTION (X-RAY), 123****DIFFUSE SPECTRAL REFLECTANCE, 111**

- White Opal Glass

**DIOXIN (IN ISO OCTANE)**

- See ORGANIC CONSTITUENTS, 75-78

**DISODIUM HYDROGEN PHOSPHATE**

- for pD CALIBRATION, 99
- for pH CALIBRATION, 99

**DNA**

- abbr. for Deoxyribonucleic Acid

**DNA PROFILING**

- (HEALTH AND INDUSTRIAL HYGIENE), 65
- DNA Profiling
- PCR-Based DNA Profiling

**DOLOMITIC LIMESTONE**

- See ROCKS AND MINERALS, 88

**DOSIMETRY (RADIOACTIVITY)**

- Neutron Density Monitor Wire (RADIATION DOSIMETRY), 112

**DRUG LEVEL ASSAY (Antiepilepsy)**

- See CLINICAL LABORATORY MATERIALS, 62

**DRUGS OF ABUSE**

- in FREEZE-DRIED URINE, 64-65
- in HAIR, 65

**DSC**

- abbr. for Differential Scanning Calorimetry

**DTA**

- abbr. for Differential Thermal Analysis

**DURUM WHEAT FLOUR**

- See USA/CANADA COLLABORATIVE MATERIALS, 80-81

**DUST**

- Urban (TRACE ELEMENTS), 69
- Urban (ORGANIC CONSTITUENTS), 75-78

**DYE PENETRANT TEST (CRACK) BLOCK (NONDESTRUCTIVE EVALUATION), 130**

- Bright Finish
- Matte Finish

**DYSPROSIUM**

- SPECTROMETRY Solution, 57

**EDDY CURRENT**

- Aluminum, 117
- ARTIFICIAL FLAW FOR NDE, 130
- DYE PENETRANT TEST BLOCKS, 130

**ELECTRICAL PROPERTIES**

- See ELECTRICAL RESISTIVITY AND CONDUCTIVITY OF METALS, 117
- See ELECTRICAL RESISTIVITY AND CONDUCTIVITY OF SILICON, 117
- See RESIDUAL RESISTIVITY RATIO, 117
- See SUPERCONDUCTING CRITICAL CURRENT, 117
- of GLASS (CERAMICS AND GLASSES), 121

**ELECTROLYTIC CONDUCTIVITY (ION ACTIVITY), 100**

- Hydrochloric Acid Solutions for
- Potassium Chloride Solutions for
- Sodium Chloride Solutions for

**ELECTRON MICROSCOPE**

- THIN FILM FOR TRANSMISSION ELECTRON MICROSCOPE, 53

**ELECTRONIC AND MAGNETIC ALLOY, 50**

- Nickel-Iron
- Nickel-Molybdenum

**ELECTROPHORETIC MOBILITY (SIZING), 128****ELLIPSOMETRY, THIN FILM**

- Silicon Dioxide on Silicon, 120

**ENGINEERING MATERIALS**

- See GUIDE TO SRM/RM TECHNICAL CATEGORIES, 25-27

**ENTHALPY (THERMODYNAMIC PROPERTIES), 104**

- of Copper
- of Molybdenum
- of Synthetic Sapphire
- of Polystyrene

**ENVIRONMENTAL MATRICES**

- See METAL CONSTITUENTS (INORGANICS), 68
- See NATURAL MATRIX MATERIALS (RADIOACTIVITY), 112-116
- See ORGANIC CONSTITUENTS (ORGANICS), 75-78
- See SIMULATED RAINWATERS, 68
- See TRACE ELEMENTS (FOSSIL FUELS), 74

**ERBIUM**

- SPECTROMETRY Solution, 57

**ESTUARINE SEDIMENT**

- See (SOILS, SEDIMENTS, AND SLUDGES), 89

**ETHANOL**

- Ethanol (ALCOHOLS AND ETHERS IN REFERENCE FUELS), 72
- Ethanol-Water (ETHANOL SOLUTIONS), 64

**ETHERS (ALCOHOLS AND ETHERS IN REFERENCE FUELS), 72**

- t-Amyl Methyl Ether,
- Ethyl t-Butyl Ether,
- Methyl t-Butyl Ether,

**EUCALYPTUS HARDWOOD**

- BLEACHED KRAFT PULPS, 133

**EUROPIUM**

- as Europium-152 (RADIOACTIVITY), 112-116
- as Europium-154/Europium-155 Mixed Nuclide (RADIOACTIVITY), 112-116
- SPECTROMETRY solution, 57

## F

### **FATTY ACIDS (HEALTH CARE AND NUTRIENTS), 80**

Diet Composite

### **FELDSPAR (ROCKS AND MINERALS), 88**

in Potash

in Soda

### **FERROUS ALLOYS**

See **FERROUS METALS**, 31–44

### **FERTILIZERS (FOOD AND AGRICULTURE), 83**

Ammonium Dihydrogen Phosphate

Phosphate Rock (Florida & Western)

Potassium Dihydrogen Phosphate

Potassium Nitrate

### **FIBROUS GLASS BLANKET**

See **THERMAL RESISTANCE OF GLASS,**

**SILICA, AND POLYSTYRENE**, 107

### **FIBROUS GLASS BOARD**

See **THERMAL RESISTANCE OF GLASS,**

**SILICA, AND POLYSTYRENE**, 107

### **FILTER MEDIA (MATERIALS ON FILTER MEDIA), 66**

Beryllium and Arsenic on

Metals on

Quartz on

### **FILTERS, OPTICAL**

See **MOLECULAR ABSORPTION**, 108–111

### **FINENESS (SIZING)**

of Portland Cement (**CEMENT TURBIDIMETRY AND FINENESS**), 127

### **FIRE RESEARCH, 131**

FLOORING RADIANT PANEL

SMOKE DENSITY CHAMBER

SMOKE TOXICITY

SURFACE FLAMMABILITY

### **FISSION TRACK GLASS, 112**

Irradiated

Unirradiated

### **FLAMMABILITY**

SURFACE FLAMMABILITY (**FIRE RESEARCH**), 131

### **FLASH POINT**

FLASH POINT REFERENCE MATERIALS, 103

### **FLOORING RADIANT PANEL**

See **FIRE RESEARCH**, 131

### **FLOUR**

Durum Wheat (USA/CANADA COLLABORATIVE MATERIALS), 81

Hard Red Spring Wheat (USA/CANADA COLLABORATIVE MATERIALS), 81

Rice (FOODS AND BEVERAGES), 79

Soft Winter Wheat (USA/CANADA COLLABORATIVE MATERIALS), 81

Wheat (FOODS AND BEVERAGES), 79

### **FLUORESCENCE**

Quinine Sulfate Dihydrate (**MOLECULAR ABSORPTION**), 108–111

### **FLUORIDE**

ANION CHROMATOGRAPHY solution, 60

in FREEZE-DRIED URINE, 64

in Vegetation (**AGRICULTURAL MATERIALS**), 82

### **FLUORO COMPOUNDS**

p-Fluorobenzoic Acid (**MICROCHEMISTRY**), 56

### **FLUORSPAR (ORES), 84**

Customs Grade

High Grade

### **FLY ASH COAL**

Coal Fly Ash (**FOSSIL FUELS**)

TRACE ELEMENTS, 74

### **FOODS AND BEVERAGES, 79**

Bovine Liver

Non-Fat Milk Powder

Oyster Tissue

Rice Flour

Wheat Flour

### **FOSSIL FUELS**

Alcohols (**ALCOHOLS AND ETHERS IN REFERENCE FUELS**), 72

Coal Heat of Combustion (**COMBUSTION CALORIMETRY**), 103

Ethanol (**ALCOHOLS AND ETHERS IN REFERENCE FUELS**), 72

Isooctane (**REFERENCE LIQUIDS FOR EVALUATING FUELS**), 73

n-Heptane (**REFERENCE LIQUIDS FOR EVALUATING FUELS**), 73

METAL CONSTITUENTS in Reference Fuel, 72

METAL CONSTITUENTS in Residual Fuel Oil, 72

Methanol (**ALCOHOLS AND ETHERS IN REFERENCE FUELS**), 72

Methanol and t-Butanol (**ALCOHOLS AND ETHERS IN REFERENCE FUELS**), 72

Sulfur in Coal (**SULFUR IN FOSSIL FUELS**), 73

Sulfur in Distillate Fuel oil (**SULFUR IN FOSSIL FUELS**), 73

Sulfur in Kerosine (**SULFUR IN FOSSIL FUELS**), 73

Sulfur in Residual Fuel Oil (**SULFUR IN FOSSIL FUELS**), 73

Synthetic Refuse Derived Oil (**COMBUSTION CALORIMETRY**), 103

TRACE ELEMENTS in Coal, 74

TRACE ELEMENTS in Coal Fly Ash, 74

TRACE ELEMENTS in Fuel Oil, 72

Vanadium in Crude Oil (**METAL CONSTITUENTS IN FOSSIL FUELS**), 72

### **FREE CUTTING BRASS**

See **NONFERROUS METALS**, 44–52

### **FRESHWATER LAKE SEDIMENT (RADIOACTIVITY)**

Freshwater Lake Sediment (**NATURAL MATRIX MATERIALS**), 116

### **FREEZING POINT (THERMODYNAMIC PROPERTIES)**

of Aluminum (**DEFINING FIXED POINT, ITS-90**), 105

of Copper (**REFERENCE POINTS**), 105

of Indium (**DEFINING FIXED POINT, ITS-90**), 105

of Lead (**REFERENCE POINTS**), 105

of Silver (**DEFINING FIXED POINT, ITS-90**), 105

of Tin (**DEFINING FIXED POINT, ITS-90**), 105

of Zinc (**DEFINING FIXED POINT, ITS-90**), 105

### **FSV**

abbr. for Fat Soluble Vitamins

### **FUELS**

See **FOSSIL FUELS**, 72–74

### **FUMED SILICA BOARD**

See **THERMAL RESISTANCE OF GLASS, SILICA, AND POLYSTYRENE**, 107



## G

### GADOLINIUM

SPECTROMETRY Solution, 57

### GALLIUM

in Buffalo River Sediment (SOILS, SEDIMENTS, AND SLUDGES), 89  
in Coal (TRACE ELEMENTS), 74  
in Coal Fly Ash (TRACE ELEMENTS), 74  
as Gallium-67 (RADIOPHARMACEUTICALS), 114  
in Glass (TRACE ELEMENTS), 92  
Melting Point  
(THERMODYNAMIC PROPERTIES), 105  
Metal (STABLE ISOTOPIC MATERIALS), 60  
SPECTROMETRY Solution, 57

### GAS CHROMATOGRAPHY (ORGANIC

CONSTITUENTS), 75

GC/MS System Performance  
LC Selectivity

### GASES (PRIMARY GAS MIXTURES)

See PRIMARY GAS MIXTURES, 70-71  
See PERMEATION DEVICES, 71

### GASES IN METALS

in Irons (FERROUS METALS), 34  
in Steels (FERROUS METALS), 34  
in Unalloyed Titanium (NONFERROUS METALS), 52

### GASOLINE

See FOSSIL FUELS, 72-74

### GEOLOGICAL

See GEOLOGICAL MATERIALS AND ORES, 84-89

### GERMANIUM

SPECTROMETRY Solution, 57

### GILDING METAL

See NONFERROUS METALS, 44-52

### GLASS BEADS

See SIZING, 127-128

### GLASSES

Borosilicate (CHEMICAL RESISTANCE) and (VISCOSITY OF GLASS), 121  
Chemical Composition, 91-92  
DENSITY AND REFRACTIVE INDEX of, 122  
Fused Ore Glass, 91  
GLASS LIQUIDUS TEMPERATURE, 121  
High-Boron Borosilicate, 91  
Lead-Barium, 91  
Lead-Silica (ELECTRICAL PROPERTIES OF GLASS) (VISCOSITY OF GLASS), 121  
Low-Boron Soda-Lime Powder, 91  
LABORATORY THERMOMETER (MERCURY IN GLASS), 106  
Multi Component, 91  
RELATIVE STRESS OPTICAL COEFFICIENT of, 122  
Sand (ROCKS AND MINERALS), 88  
Soda-Lime Container, 91  
Soda-Lime Flat, 91  
Soda-Lime Float, 91  
Soda-Lime Sheet, 91  
Soda-Lime-Silica (VISCOSITY OF GLASS), 121  
Soft Borosilicate, 91  
SYNTHETIC GLASS (MICROANALYSIS), 53  
SYNTHETIC GLASS (TRACE ELEMENTS), 92

THERMAL EXPANSION OF METAL GLASS AND SILICA, 107

THERMAL RESISTANCE OF GLASS, SILICA, AND POLYSTYRENE, 107

VISCOSITY FIXPOINTS of, 122

### GLASS SAND

See ROCKS AND MINERALS, 88

### GLASS SPHERES

PARTICLE SIZE (SIZING), 127

### D-GLUCOSE

aka. Dextrose (CLINICAL LABORATORY MATERIALS), 62  
Polarimetric Value of (STOICHIOMETRY), 56

### GOETHITE

aka.  $\alpha$ -FeOOH (ELECTROPHORETIC MOBILITY), 128

### GOLD

First Surface, Gold on Nickel-Plated Aluminum (SPECULAR SPECTRAL REFLECTANCE), 110  
METALS (HIGH PURITY METALS), 54  
METALS (MICROANALYSIS), 53  
Ore, Refractories, 86  
SPECTROMETRY Solution, 57  
VAPOR PRESSURE OF METALS, 106  
Royal Canadian Mint Reference Materials (HIGH PURITY MATERIALS), 54-55

### GRAPHITE

THERMAL CONDUCTIVITY OF GRAPHITE AND METALS, 107

### GRAVITY SEDIMENTATION

Zirconium Oxide (PARTICLE SIZE), 127

## H

### HAFNIUM

SPECTROMETRY Solution, 57  
in Zircaloy (ZIRCONIUM BASE ALLOYS), 52

### HARDNESS (FOOD AND AGRICULTURE)

WHEAT HARDNESS, 83

### HARDNESS (SURFACE FINISH)

of Bright Copper (MICROHARDNESS), 129  
of Bright Nickel (MICROHARDNESS), 129  
of Ceramic (MICROHARDNESS), 129

### HASTELLOY™

NICKEL BASE ALLOYS, 50

### HEALTH CARE AND NUTRIENTS, 80

Baby Food Composite  
BCR Spiked Skim Milk  
Cholesterol ..... in Coconut Oil  
Fatty Acids ..... Frozen Diet Composite  
Infant Formula (milk-based)  
Typical Diet  
Whole Egg Powder  
Whole Milk

### HEAT (THERMODYNAMIC PROPERTIES), 103-107

COMBUSTION CALORIMETRY  
DEFINING FIXED POINT, ITS-90  
DEFINING FIXED POINT CELLS, ITS-90  
DIFFERENTIAL SCANNING CALORIMETRY  
DIFFERENTIAL THERMAL ANALYSIS  
ENTHALPY AND HEAT CAPACITY  
FLASH POINT REFERENCE MATERIALS



FREEZING POINT, MELTING POINT, AND  
 TRIPLE POINT CELLS  
 LABORATORY THERMOMETER  
 REFERENCE POINTS  
 SOLUTION CALORIMETRY  
 SUPERCONDUCTIVE THERMOMETRIC  
 FIXED POINT DEVICE  
 THERMAL CONDUCTIVITY OF GRAPHITE  
 AND METALS  
 THERMAL EXPANSION OF METAL GLASS AND SILICA  
 THERMAL RESISTANCE OF GLASS, SILICA,  
 AND POLYSTYRENE  
 THERMOELEMENT MATERIAL, PLATINUM  
 VAPOR PRESSURE OF METALS  
**HEPES (ION ACTIVITY)**  
 abbr. for N-2-Hydroxyethyl-piperazine-N'-2-ethanesulfonic  
 Acid  
 HEPES Free Acid (BIOLOGICAL BUFFER  
 SYSTEMS), 99  
 NaHEPESate (BIOLOGICAL BUFFER  
 SYSTEMS), 99  
**n-HEPTANE (FOSSIL FUELS)**  
 REFERENCE LIQUIDS FOR EVALUATING FUELS, 73  
**HIGH ALLOY STEELS (FERROUS METALS), 34**  
 Chromium Nickel (Copper Precipitation Hardening)  
 Chromium Nickel (Molybdenum Precipitation Hardening)  
 High Nickel  
 High Temperature Alloy (A286) Nickel-Chromium  
 High Temperature Alloy L605  
 High Temperature Alloy Iron-Nickel-Cobalt  
 Valve Steel  
**HIGH PURITY METALS, 54**  
 Refined Copper  
 High Purity Gold  
 High Purity Platinum  
 Selenium Intermediate Purity  
 Zinc Metal  
 High Purity Zinc  
 Zinc Intermediate Purity  
**HIGH TEMPERATURE ALLOYS**  
 See **FERROUS METALS**, 31-43  
 See **COBALT BASE ALLOYS**, 44  
 See **NICKEL BASE ALLOYS**, 50  
**HOLMIUM**  
 Holmium Oxide Solution Wavelength (MOLECULAR  
 ABSORPTION), 108-110  
 SPECTROMETRY Solution, 57  
**HUMAN**  
 See **CLINICAL LABORATORY MATERIALS**, 62  
 LIVER (NATURAL MATRIX MATERIALS)  
 (RADIOACTIVITY), 112-116  
 LUNG (NATURAL MATRIX MATERIALS)  
 (RADIOACTIVITY), 112-116  
 Serum (SERUM MATERIALS), 63  
**HUMAN SERUM (HEALTH AND INDUSTRIAL HYGIENE)**  
 Cholesterol in Human Serum (CLINICAL  
 LABORATORY MATERIALS), 62  
 Electrolytes in (SERUM MATERIALS), 63  
 Fat Soluble Vitamins in (CLINICAL LABORATORY  
 MATERIALS), 62  
 Glucose in Frozen (SERUM MATERIALS), 63  
 Lipids in Frozen (SERUM MATERIALS), 63  
 SERUM MATERIALS, 63

**HUMAN SERUM (ORGANICS)**  
 Polychlorinated Biphenyls in (ORGANIC  
 CONSTITUENTS), 75-78  
**HYDROGEN**  
 as Hydrogen-3 (RADIOACTIVE SOLUTIONS), 113  
 Unalloyed Titanium for (GASES IN METALS), 52  
**HYDROXYAPATITE**  
 See Calcium Hydroxyapatite, 65, 123  
**4-HYDROXY-3-METHOXY-DL-MANDELIC ACID (VMA)**  
 See **CLINICAL LABORATORY MATERIALS**, 62

## I

**ICTAC**  
 abbr. for International Confederation of Thermal Analysis  
 and Calorimetry  
**IMAGE QUALITY INDICATOR (OPTICAL PROPERTIES)**  
 X-RAY AND PHOTOGRAPHY, 111  
**INCONEL™**  
 NICKEL BASE ALLOYS (NONFERROUS METALS), 50  
**INDIUM**  
 as Indium-111 (RADIOPHARMACEUTICALS), 114  
 DEFINING FIXED POINT, ITS-90, 105  
 FREEZING POINT, MELTING POINT, AND TRIPLE  
 POINT CELLS, 105  
 SPECTROMETRY Solution, 57  
**INDUSTRIAL HYGIENE**  
 See **HEALTH AND INDUSTRIAL HYGIENE**, 62-67  
**INFRARED, NEAR**  
 INFRARED REFLECTANCE, 111  
**INSTRUMENT PERFORMANCE**  
 See **GUIDE TO SRM/RM TECHNICAL  
 CATEGORIES**, 25-27  
**IODINE (RADIOACTIVITY), 112-116**  
 as Iodine-125 (RADIOPHARMACEUTICALS)  
 as Iodine-129 (RADIOACTIVE SOLUTIONS)  
 as Iodine-131 (RADIOPHARMACEUTICALS)  
**ION ACTIVITY, 99-100**  
 BIOLOGICAL BUFFER SYSTEMS  
 ELECTROLYTIC CONDUCTIVITY  
 ION-SELECTIVE ELECTRODE CALIBRATION  
 pD CALIBRATION  
 pH CALIBRATION  
**IRON**  
 Electrolytic Iron (THERMAL CONDUCTIVITY OF  
 GRAPHITE AND METALS), 107  
 Electrolytic Iron (ELECTRICAL RESISTIVITY AND  
 CONDUCTIVITY OF METALS), 117  
 See **FERROUS METALS**, 31-43  
 as Iron-55 (RADIOACTIVE SOLUTIONS), 113  
 Iron Metal (CLINICAL LABORATORY  
 MATERIALS), 62  
 SPECTROMETRY Solution, 57-59  
 Tris(1-phenyl-1,3-butanediono)iron (III)  
 (METALLO-ORGANIC COMPOUNDS), 95  
**ISOTOPE(S)**  
 See **LIGHT STABLE ISOTOPIC MATERIALS  
 (HIGH PURITY MATERIALS)**, 61  
 See **RADIOACTIVITY**, 112-116  
 See **STABLE ISOTOPIC MATERIALS (HIGH PURITY  
 MATERIALS)**, 60

## K

### KAOLIN

SURFACE AREA OF POWDERS (SIZING), 128

### KEROSINE

Sulfur in (SULFUR IN FOSSIL FUELS), 73

### KNOOP MICROHARDNESS (SURFACE FINISH), 129

Bright Copper

Bright Nickel

Silicon Nitride

## L

### LANTHANUM

SPECTROMETRY Solution, 57-59

### LAKE SEDIMENT (RADIOACTIVITY)

Freshwater Lake Sediment (NATURAL MATRIX MATERIALS), 116

### LEAD

Lead Cyclohexanebutyrate (METALLO-ORGANIC COMPOUNDS), 95

Lead in Blood (CLINICAL LABORATORY MATERIALS), 62

Lead Nitrate (CLINICAL LABORATORY MATERIALS), 62

Metal, Equal Atom (STABLE ISOTOPIC MATERIALS), 60

Metal, Natural (STABLE ISOTOPIC MATERIALS), 60

Metal, Radiogenic (STABLE ISOTOPIC MATERIALS), 60

Metals on filter Media (MATERIALS ON FILTER MEDIA), 66

See **NONFERROUS METALS**, 44-52

Powdered Lead Base Paint (LEAD IN PAINT, DUST, AND SOIL), 67

in Paint (LEAD IN PAINT, DUST, AND SOIL), 67

in Reference Fuel (METAL CONSTITUENTS IN FOSSIL FUELS), 72

REFERENCE POINTS, 105

SPECTROMETRY Solution, 57-59

### LEAD BASE ALLOYS/MATERIALS

See **NONFERROUS METALS**, 44-52

### LEAVES (AGRICULTURAL MATERIALS), 82

Apple

Peach

Pine Needles

Spinach

Tomato

### LIMESTONE (ROCKS AND MINERALS), 88

Argillaceous

Dolomitic

### LINERBOARD

for TAPE ADHESION TESTING, 132

### LINEWIDTH (METROLOGY)

OPTICAL MICROSCOPE LINEWIDTH

MEASUREMENT, 118

### LIPIDS

in Human Serum (SERUM MATERIALS), 63

### LIQUID CHROMATOGRAPHY

GC/MS AND LC SYSTEM PERFORMANCE, 75

### LIQUIDUS TEMPERATURE

(CERAMICS AND GLASSES), 121

## LITHIUM

Carbonate (LIGHT STABLE ISOTOPIC MATERIALS), 61

Carbonate (CLINICAL LABORATORY MATERIALS), 62

Lithium Cyclohexanebutyrate (METALLO-ORGANIC COMPOUNDS), 95

Ore, Lepidolite (ORES), 84-86

Ore, Petalite (ORES), 84-86

Ore, Spodumene (ORES), 84-86

SPECTROMETRY Solution, 57

## LIVER

Bovine (FOODS AND BEVERAGES), 79

Human (NATURAL MATRIX MATERIALS) (RADIOACTIVITY), 112-116

## LUBRICANT OXIDATION (ENGINE WEAR MATERIALS)

Catalyst Package (CATALYST PACKAGE FOR LUBRICANT OXIDATION), 96

## LUBRICATING OIL (ENGINE WEAR MATERIALS)

Chlorine in LUBRICATING BASE OILS, 95

Nitrogen in LUBRICATING BASE OILS, 95

Sulfur in LUBRICATING BASE OILS, 95

WEAR-METALS IN OIL, 91

## LUNG (RADIOACTIVITY)

Human (NATURAL MATRIX MATERIALS), 116

## LUTETIUM

SPECTROMETRY Solution, 57

## M

## MAGNESIUM

Magnesium Gluconate Dihydrate (CLINICAL LABORATORY MATERIALS), 62

Magnesium Metal (STABLE ISOTOPIC MATERIALS), 60

SPECTROMETRY Solution, 57-59

## MAGNETIC PARTICLE TEST RING (NONDESTRUCTIVE EVALUATION), 130

## MAGNIFICATION

SCANNING ELECTRON MICROSCOPE (SEM), 118

## MANGANESE

Metals on Filter Media (MATERIALS ON FILTER MEDIA), 66

SPECTROMETRY Solution, 57-59

## D-MANNITOL

CLINICAL LABORATORY MATERIALS, 62

## MARIJUANA METABOLITE

THC-9-COOH (DRUGS OF ABUSE IN URINE), 64

## MARINE MATERIALS

Buffalo River Sediment (METAL CONSTITUENTS IN NATURAL MATRICES), 68

(SOILS, SEDIMENTS, AND SLUDGES), 89

Estuarine Sediment (METAL CONSTITUENTS IN NATURAL MATRICES), 68

(SOILS, SEDIMENTS, AND SLUDGES), 89

Limestone, Argillaceous (ROCKS AND MINERALS), 88

Limestone, Dolomitic (ROCKS AND MINERALS), 88

Mercury in Tennessee River Sediment (METAL CONSTITUENTS IN NATURAL MATRICES), 68

(SOILS, SEDIMENTS, AND SLUDGES), 89

Organics in Marine Sediment (ORGANIC CONSTITUENTS), 75-78



- Organics in Mussel Tissue (ORGANIC CONSTITUENTS), 75–78
- Organics in Whale Blubber (ORGANIC CONSTITUENTS), 75–78
- Oyster Tissue (FOODS AND BEVERAGES), 79
- Polychlorinated Biphenyls in River Sediment A (ORGANIC CONSTITUENTS), 75–78
- MASS SPECTROMETRY**
  - GC/MS SYSTEM PERFORMANCE (ORGANICS), 75–78
  - See LIGHT STABLE ISOTOPIC MATERIALS, 61
  - See RADIOACTIVITY, 112–116
  - See STABLE ISOTOPIC MATERIALS, 60
- MATERIALS ON FILTER MEDIA**, 59
  - Arsenic
  - Barium
  - Beryllium
  - Cadmium
  - Chromium
  - Clay
  - Iron
  - Lead
  - Magnesium
  - Manganese
  - Nickel
  - Quartz
  - Selenium
  - Vanadium
  - Zinc
- MELTING POINT (THERMODYNAMIC PROPERTIES)**, 105
- MERCURY**
  - Mercury (TOXIC SUBSTANCES IN URINE), 64
  - Mercury (Triple Point) (DEFINING FIXED POINT, ITS-90), 105
  - ORGANIC CONSTITUENTS, 75–78
  - SPECTROMETRY Solution, 57
  - in Tennessee River Sediment (METAL CONSTITUENTS IN NATURAL MATRICES), 68
  - SOILS, SEDIMENTS, AND SLUDGES, 89
  - TRACE ELEMENTS (FOSSIL FUELS), 74
  - Trace Mercury in Coal (TRACE ELEMENTS), 74
  - in Water (METAL CONSTITUENTS IN NATURAL MATRICES), 68
- METALLO-ORGANICS (ENGINE WEAR MATERIALS)**
  - See METALLO-ORGANIC COMPOUNDS, 95
- METALS ON FILTER MEDIA**
  - See MATERIALS ON FILTER MEDIA, 66
- METHANE (PRIMARY GAS MIXTURES)**, 71
  - Methane in Air
- METHYLMERCURY**
  - ORGANIC CONSTITUENTS, 75–78
- METROLOGY**
  - See GUIDE TO SRM/RM TECHNICAL CATEGORIES, 25–27
- MICROANALYSIS**, 53
- MICROCHEMISTRY (HIGH PURITY MATERIALS)**, 56
  - Acetanilide
  - Anisic Acid
  - o-Bromobenzoic Acid
  - m-Chlorobenzoic Acid
  - Cystine
  - p-Fluorobenzoic Acid
  - Nicotinic Acid
  - Urea
- MICROCOPY**
  - Microcopy Resolution Test Chart (X-RAY AND PHOTOGRAPHY), 111
- MICROHARDNESS (SURFACE FINISH)**, 129
  - of Bright Copper
  - of Bright Nickel
  - of Ceramic
- MICROSCOPY (METROLOGY)**
  - DEPTH PROFILING, 118
  - ELLIPSOMETRY, 120
  - OPTICAL MICROSCOPE LINEWIDTH MEASUREMENT, 118
  - SCANNING ELECTRON MICROSCOPE (SEM), 118
- MICROSPHERE (SIZING)**
  - Glass Beads (PARTICLE SIZE), 127
  - Polystyrene Spheres (PARTICLE SIZE), 127
- MILK (FOOD AND AGRICULTURE)**
  - Infant Formula (HEALTH CARE AND NUTRIENTS), 80
  - Non-Fat Milk Powder (FOODS AND BEVERAGES), 79
  - Spiked Skim Milk Powder (HEALTH CARE AND NUTRIENTS), 80
  - Whole Milk (HEALTH CARE AND NUTRIENTS), 80
- MINERALS**
  - See ROCKS AND MINERALS, 88
- MIXTURES AND POLLUTANTS (PRIMARY GAS MIXTURES)**, 70–71
  - Ambient Non-Methane Organics in Nitrogen
  - Ambient Toxic Organics in Nitrogen
  - Carbon Dioxide in Nitrogen
  - Carbon Monoxide in Air
  - Carbon Monoxide in Nitrogen
  - Hydrogen Sulfide in Nitrogen
  - Methane in Air
  - Methane-Propane in Air
  - Methane in Nitrogen
  - Nitric Oxide in Nitrogen
  - Oxides of Nitrogen in Air
  - Oxygen in Nitrogen
  - Propane in Air
  - Carbon Dioxide in Air
  - Propane in Nitrogen
  - Sulfur Dioxide in Nitrogen
- MOLECULAR WEIGHT AND MELT FLOW (POLYMERIC PROPERTIES)**, 101
  - Polyethylene Gas Pipe Resin
  - Polyethylene, Linear
  - Poly(ethylene oxide)
  - Polyethylene Resin
  - Poly(methylmethacrylate)
  - Polystyrene
  - Polyurethane
  - See POLYETHYLENE PIPE PRODUCTS, 102
- MOLYBDENUM**
  - ENTHALPY AND HEAT CAPACITY, 104
  - as Molybdenum-99-Technetium-99m (RADIOPHARMACEUTICALS), 114
  - SPECTROMETRY Solution, 57–59

## N

- NAVAL BRASS**
  - See NONFERROUS METALS, 44–52
- NDE**
  - abbr. for Nondestructive Evaluation
- NEODYMIUM**
  - SPECTROMETRY Solution, 57



## **NEUTRON MONITOR (RADIOACTIVITY)**

Neutron Density Monitor Wire (RADIATION DOSIMETRY), 112

## **NICKEL**

as Nickel-63 (RADIOACTIVE SOLUTIONS), 113

Nickel Cyclohexanebutyrate (METALLO-ORGANIC COMPOUNDS), 95

Nickel (STABLE ISOTOPIC MATERIALS), 60

NICKEL BASE ALLOYS (NONFERROUS METALS), 44-52

Nickel-Chromium Thin Film (DEPTH PROFILING), 118

NICKEL OXIDES (NONFERROUS METALS), 44-52

SPECTROMETRY Solution, 57-59

## **NICOTINIC ACID**

MICROCHEMISTRY (HIGH PURITY MATERIALS), 56

## **NIOBIUM**

as Niobium-94 (GAMMA RAY POINT SOURCES), 115  
SPECTROMETRY Solution, 57

## **NITRATE**

ANION CHROMATOGRAPHY Solution, 60

## **NITRIC OXIDE (PRIMARY GAS MIXTURES),**

Nitric Oxide in Nitrogen, 71

## **NITRIDE**

Silicon Nitride (SURFACE AREA OF POWDERS), 128  
(MICROHARDNESS), 129

## **NITROGEN (PRIMARY GAS MIXTURES), 70-71**

Ambient Non-methane Organics in

Ambient Toxic Organics in

Carbon Dioxide in

Carbon Monoxide in

Hydrogen Sulfide in

Nitric Oxide in

Oxygen in

Oxides of

Propane in

Sulfur Dioxide in

Total Nitrogen (LUBRICATING BASE OILS), 95

## **4-NITROPHENOL**

CLINICAL LABORATORY MATERIALS, 62

## **NONDESTRUCTIVE EVALUATION, 130**

ARTIFICIAL FLAW FOR EDDY CURRENT NDE

DYE PENETRANT TEST BLOCKS

MAGNETIC PARTICLE INSPECTION

## **NONFERROUS ALLOYS**

See NONFERROUS METALS, 44-52

## **NORTHERN SOFTWOOD**

BLEACHED KRAFT PULPS, 133

## **NUCLEAR MATERIALS (RADIOACTIVITY), 112-116**

ACCELERATOR MASS SPECTROMETRY

ALPHA PARTICLE POINT SOURCES

Carbon-14 DATING

FISSION TRACK GLASS

GAMMA RAY POINT SOURCES

NATURAL MATRIX MATERIALS

RADIATION DOSIMETRY

RADIOACTIVE SOLUTIONS

RADIOPHARMACEUTICALS

RADON EMANATION

SPECIAL NUCLEAR MATERIALS

## **NUTRITION**

See FOODS AND BEVERAGES, 79

See HEALTH CARE AND NUTRIENTS, 80

## **O**

## **OBSIDIAN ROCK**

ROCKS AND MINERALS, 83

## **OCEAN MATERIALS (RADIOACTIVITY) (NATURAL MATRIX MATERIALS), 116**

Ocean Sediment

Ocean Shellfish

## **OIL**

Chlorine in (LUBRICATING BASE OILS), 95

Fuel Oil (FOSSIL FUELS), 72-74

High Sulfur Gas Oil Feed (CATALYST CHARACTERIZATION MATERIALS), 95

Moisture in Oils (FOSSIL FUELS), 73

Nitrogen (LUBRICATING BASE OILS), 95

Organics in Cod Liver Oil (ORGANIC CONSTITUENTS), 75-78

Petroleum Crude Oil (ORGANIC CONSTITUENTS), 75-78

Polychlorinated Biphenyls in (ORGANIC CONSTITUENTS), 75-78

Shale Oil (ORGANIC CONSTITUENTS), 75-78

Sulfur (LUBRICATING BASE OILS), 95

Sulfur in Distillate Fuel Oil (SULFUR IN FOSSIL FUELS), 73

Sulfur in Residual Fuel Oil (SULFUR IN FOSSIL FUELS), 73

Vanadium in Crude Oil (METAL CONSTITUENTS IN FOSSIL FUELS), 72

Vanadium and Nickel in Residual Fuel Oil (METAL CONSTITUENTS IN FOSSIL FUELS), 72

WEAR-METALS IN OIL (ENGINE WEAR MATERIALS), 96

## **OPAL**

White Opal Glass (DIFFUSE SPECTRAL REFLECTANCE), 111

## **OPTICAL**

See GUIDE TO SRM/RM TECHNICAL CATEGORIES, 25-27

## **OPTOELECTRONICS (METROLOGY), 119**

Optical Fiber Chromatic Dispersion

Optical Fiber Coating

Optical Fiber Diameter

Optical Fiber Ferrule Geometry

Optical Retardance

Pin Gauge for Optical Fiber Ferrules

Polarization Mode Dispersion

Wavelength Reference Absorption Cell

## **ORES (GEOLOGICAL MATERIALS AND ORES), 84-89**

Alumina (Reduction Grade)

Bauxite, Arkansas

Bauxite, Australian

Bauxite, Dominican

Bauxite, Jamaican

Bauxite, Surinam

Borate Ore

Chinese Ores

Copper Ore Mill Heads

Copper Ore Mill Tails

Fluorspar, Customs Grade

Fluorspar, High Grade

Gold Ore, Refractory

Iron Ore, Canada

Iron Ore, Labrador

Iron Ore, Nimba

Iron Ore, Sibley

- Iron Oxide, Reduced
- Lithium Ore (Lepidolite)
- Lithium Ore (Petalite)
- Lithium Ore (Spodumene)
- Manganese Ore
- Phosphate Rock, Florida
- Phosphate Rock, Western
- Pyrite Ore (ORE BIOLEACHING SUBSTRATE)
- Rutile Ore
- Scheelite Ore
- Tungsten Concentrate
- Zinc Concentrate

## ORGANICS

- ORGANIC CONSTITUENTS, 75–78
- GC/MS AND LC SYSTEM PERFORMANCE, 75

## OXALIC ACID (RADIOACTIVITY)

- CARBON-14 Dating, 114

## OXYGEN (PRIMARY GAS MIXTURES), 70–71

- Oxygen in Nitrogen

## OXYGEN CONCENTRATION IN SILICON

- Oxygen in Silicon, 120

## OXYGENATES

- ALCOHOLS . . . IN REFERENCE FUELS, 72

## OYSTER TISSUE

- FOODS AND BEVERAGES, 79

# P

## PACKAGE

- Catalyst Package (CATALYST PACKAGE FOR LUBRICANT OXIDATION), 96

## PAINT

- LEAD IN PAINT, DUST, AND SOIL, 67

## PALLADIUM

- SPECTROMETRY Solution, 57

## PARTICLE COUNT (SIZING)

- for suspensions, 128

## PARTICLE SIZE (SIZING), 127

- Glass Spheres
- Polystyrene Spheres
- Silicon Nitride
- Zirconium Oxide

## PARTICULATES

- Diesel Particulate Matter (ORGANIC CONSTITUENTS), 75–78
- MATERIALS ON FILTER MEDIA, 66
- Urban Dust/Organics (ORGANIC CONSTITUENTS), 75–78
- Urban Particulate Matter (INORGANICS), 68–69

## pD CALIBRATION (ION ACTIVITY), 99

- Disodium Hydrogen Phosphate
- Potassium Dihydrogen Phosphate
- Potassium Hydrogen Phthalate
- Sodium Bicarbonate
- Sodium Carbonate

## PERMEATION DEVICES (PRIMARY GAS MIXTURES), 71

- Sulfur Dioxide Permeation Tube

## PERUVIAN SOIL (RADIOACTIVITY)

- NATURAL MATRIX MATERIALS, 116

## PESTICIDES (ORGANIC CONSTITUENTS), 75–78

- Chlorinated Pesticides in Hexane
- Chlorinated Pesticides in *Iso*octane

## pH CALIBRATION (ION ACTIVITY), 99

- Calcium Carbonate
- Disodium Hydrogen Phosphate
- Potassium Dihydrogen Phosphate
- Potassium Hydrogen Phthalate
- Potassium Hydrogen Tartrate
- Potassium Tetroxalate
- Sodium Bicarbonate
- Sodium Carbonate
- Sodium Tetraborate Decahydrate
- See BIOLOGICAL BUFFER SYSTEMS, 99

## PHOSPHATE

- See pD CALIBRATION, 99
- See pH CALIBRATION, 99
- ANION CHROMATOGRAPHY Solution, 60
- Phosphate Rock (ORES), 84–86
- Triphenyl Phosphate (METALLO-ORGANIC COMPOUNDS), 95

## PHOSPHORUS

- as Phosphorus-32 (RADIOPHARMACEUTICALS), 114
- SPECTROMETRY Solution, 57–59

## PHOTOGRAPHY

- See X-RAY AND PHOTOGRAPHY, 111

## PINE NEEDLES

- AGRICULTURAL MATERIALS, 82

## PLASTIC

- See POLYMERIC PROPERTIES, 101–102

## PLATINUM

- High Purity Platinum (HIGH PURITY METALS), 54
- Platinum, High Purity (THERMOELEMENT MATERIAL), 106
- SPECTROMETRY Solution, 57

## PLUTONIUM (RADIOACTIVITY), 112–116

- Ashed Bone
- Columbia River Sediment
- Human Liver
- Human Lung
- Ocean Sediment
- Ocean Shellfish
- Peruvian Soil
- as Plutonium-238
- as Plutonium-240
- as Plutonium-241
- as Plutonium-242
- Rocky Flats Soil Number II

## POLLUTANTS

- METAL CONSTITUENTS IN NATURAL MATRICES, 68
- PRIMARY GAS MIXTURES, 70–71
- ORGANIC CONSTITUENTS (ORGANICS), 75–78
- SIMULATED RAINWATERS (INORGANICS), 68

## POLONIUM (RADIOACTIVITY)

- as Polonium-209 (RADIOACTIVE SOLUTIONS), 113

## POLYCHLORINATED BIPHENYLS—PCBs (ORGANICS), 75–78

- Chlorinated Biphenyls
- Chlorinated Biphenyl Congeners in *Iso*octane
- Polychlorinated Biphenyl Congeners in *Iso*octane
- Polychlorinated Biphenyls in Human Serum
- Polychlorinated Biphenyls in Oil
- Polychlorinated Biphenyls in River Sediment A



**POLYETHYLENE (MOLECULAR WEIGHT AND MELT FLOW)**, 101  
 Polyethylene Gas Pipe Resin  
 Polyethylene, Linear  
 Poly(ethylene Oxide)  
 Polyethylene Resin

**POLYETHYLENE (POLYETHYLENE PIPE PRODUCTS)**, 102  
 Polyethylene Butt T Joint  
 Polyethylene Piping  
 Polyethylene Socket T Joint

**POLYMER**  
 See **POLYMERIC PROPERTIES**, 101–102

**POLY(METHYLMETHACRYLATE) (POLYMERIC PROPERTIES)**  
 MOLECULAR WEIGHT AND MELT FLOW, 101

**POLYSTYRENE**  
 ENTHALPY AND HEAT CAPACITY  
 (THERMODYNAMIC PROPERTIES), 103–107  
 MOLECULAR WEIGHT AND MELT FLOW  
 (POLYMERIC PROPERTIES), 101–102

**POTASSIUM**  
 SPECTROMETRY Solution, 57–59

**POTASSIUM CHLORIDE**  
 CLINICAL LABORATORY MATERIALS, 62  
 ELECTROLYTIC CONDUCTIVITY, 100  
 ION-SELECTIVE ELECTRODE CALIBRATION, 100  
 STABLE ISOTOPIC MATERIALS, 60  
 SOLUTION CALORIMETRY, 103  
 STOICHIOMETRY, 56

**POTASSIUM DICHROMATE**  
 MOLECULAR ABSORPTION, 108–110  
 STOICHIOMETRY, 56

**POTASSIUM DIHYDROGEN PHOSPHATE**  
 FERTILIZERS, 83  
 pD CALIBRATION, 99  
 pH CALIBRATION, 99

**POTASSIUM FLUORIDE**  
 ION-SELECTIVE ELECTRODE CALIBRATION, 100

**POTASSIUM HYDROGEN PHTHALATE**  
 pD CALIBRATION, 99  
 pH CALIBRATION, 99  
 STOICHIOMETRY, 56

**POTASSIUM HYDROGEN TARTRATE**  
 pH CALIBRATION, 99

**POTASSIUM IODIDE**  
 MOLECULAR ABSORPTION, 108–110

**POTASSIUM NITRATE**  
 FERTILIZERS, 83  
 LIGHT STABLE ISOTOPIC MATERIALS, 61

**POTASSIUM TETROXALATE**  
 pH CALIBRATION, 99

**POWDERED LEAD BASE PAINT**  
 LEAD IN PAINT, DUST, AND SOIL, 67

**PRASEODYMIUM**  
 SPECTROMETRY Solution, 57

**PRIMARY CHEMICALS**  
 STOICHIOMETRY, 56

**PRIORITY POLLUTANT PAHS**  
 ORGANIC CONSTITUENTS, 75–78

**PYRITE ORE**  
 ORE BIOLEACHING SUBSTRATE, 86

## Q

**QUARTZ**  
 MATERIALS ON FILTER MEDIA, 66

Metal-on-Quartz Filters, Transmittance (MOLECULAR ABSORPTION), 108–110

**QUININE SULFATE DIHYDRATE**  
 MOLECULAR LUMINESCENCE, 110

## R

**RADIOACTIVITY**, 112–116  
 ACCELERATOR MASS SPECTROMETRY  
 ALPHA PARTICLE POINT SOURCES  
 FISSION TRACK GLASS  
 GAMMA RAY POINT SOURCES  
 NATURAL MATRIX MATERIALS  
 RADIATION DOSIMETRY  
 RADIOACTIVE SOLUTIONS  
 RADIOPHARMACEUTICALS  
 RADON EMANATION  
 CARBON-14 DATING  
 SPECIAL NUCLEAR MATERIALS

**RADIUM (RADIOACTIVITY)**  
 as Radium-226 (RADIOACTIVE SOLUTIONS), 113  
 as Radium-226 (RADON EMANATION), 115  
 as Radium-228 (RADIOACTIVE SOLUTIONS), 113

**RAINWATER**  
 SIMULATED RAINWATERS  
 (INORGANICS), 68

**RECYCLED ALUMINUM**  
 Cadmium and Lead Levels (ALUMINUM BASE ALLOYS), 44

**REFERENCE FUELS**  
 See **FOSSIL FUELS**, 72–74

**REFLECTANCE (OPTICAL PROPERTIES)**  
 DIFFUSE SPECTRAL REFLECTANCE, 111  
 INFRARED REFLECTANCE, 111  
 SPECULAR SPECTRAL REFLECTANCE, 110

**REFRACTIVE INDEX (CERAMICS AND GLASSES)**  
 See **DENSITY AND REFRACTIVE INDEX**, 122

**REFRACTORIES (GEOLOGICAL MATERIALS AND ORES)**  
 Burnt Refractory, 88

**REFORMULATED GASOLINES**  
 See **FOSSIL FUELS**, 72–74

**RESIDUAL RESISTIVITY RATIO (ELECTRICAL PROPERTIES)**  
 Aluminum, 117

**RESISTANCE (THERMODYNAMIC PROPERTIES)**  
 THERMAL RESISTANCE OF GLASS SILICA, AND POLYSTYRENE, 107

**RESISTIVITY (ELECTRICAL PROPERTIES)**  
 ELECTRICAL RESISTIVITY AND CONDUCTIVITY OF METALS, 117  
 ELECTRICAL RESISTIVITY AND CONDUCTIVITY OF SILICON, 117  
 RESIDUAL RESISTIVITY RATIO, 117

**RHENIUM**  
 SPECTROMETRY Solution, 57

**RHODIUM**  
 SPECTROMETRY Solution, 57

**RICE FLOUR (FOOD AND AGRICULTURE)**  
 FOODS AND BEVERAGES, 79

**RIVER SEDIMENT**  
 (INORGANICS, GEOLOGICAL MATERIALS AND ORES) (METAL CONSTITUENTS IN NATURAL MATRICES), 68  
 SOILS, SEDIMENTS, AND SLUDGES, 89



Buffalo River Sediment  
Estuarine Sediment  
Tennessee River Sediment

**RIVER SEDIMENT (ORGANICS)**

Polychlorinated Biphenyls in River Sediment A  
(ORGANIC CONSTITUENTS), 75–78

**RIVER SEDIMENT (RADIOACTIVITY)**

Columbia River Sediment (NATURAL MATRIX  
MATERIALS), 116

**ROCKS**

Basalt Rock (ROCKS AND MINERALS), 88  
Obsidian Rock (ROCKS AND MINERALS), 88  
Phosphate Rock (Florida) (FERTILIZERS), 83  
Phosphate Rock (Western) (FERTILIZERS), 83  
Phosphate Rock (Western) (ORES), 84–86

**ROCKY FLATS SOIL NUMBER II (RADIOACTIVITY)**

NATURAL MATRIX MATERIALS, 116

**ROYAL CANADIAN MINT REFERENCE MATERIALS**

(HIGH PURITY MATERIALS), 54–55

**RRR**

abbr. for Residual Resistivity Ratio

**RUBIDIUM**

Rubidium (FREEZING POINT, MELTING POINT, AND  
TRIPLE POINT CELLS), 105  
Rubidium Chloride (STABLE ISOTOPIC  
MATERIALS), 60  
SPECTROMETRY Solution, 57

**S**

**SAMARIUM**

SPECTROMETRY Solution, 58

**SAND (GLASS)**

See ROCKS AND MINERALS, 88

**SCANDIUM**

SPECTROMETRY Solution, 58

**SCANNING ELECTRON MICROSCOPE**

(METROLOGY), 118–120

SEM Magnification Standard  
SEM Performance Standard  
SEM Magnification Reference

**SCHEELITE ORE**

ORES, 84–86

**SEDIMENT**

METAL CONSTITUENTS IN NATURAL MATRICES, 68  
NATURAL MATRIX MATERIALS  
(RADIOACTIVITY), 116  
ORGANIC CONSTITUENTS (ORGANICS), 75–78  
SOILS, SEDIMENTS, AND SLUDGES, 89

**SELENIUM**

Selenium, Intermediate Purity (HIGH PURITY  
METALS), 54  
SPECTROMETRY Solution, 58

**SEM**

abbr. for Scanning Electron Microscope

**SERUM MATERIALS, 63**

Bovine Serum Albumin  
Electrolytes in Frozen Human Serum  
Glucose in Frozen Human Serum  
Human Serum  
Lipids in Frozen Human Serum

**SHELLFISH**

Mussel Tissue (ORGANIC CONSTITUENTS), 75–78  
Ocean Shellfish (NATURAL MATRIX MATERIALS), 116  
Oyster Tissue (FOODS AND BEVERAGES), 79

**SILICA**

Carbon Modified Silica (INORGANICS), 69  
Fumed Silica Board (THERMAL RESISTANCE OF  
GLASS, SILICA, AND POLYSTYRENE), 107  
Fused Silica (THERMAL EXPANSION OF METAL GLASS  
AND SILICA), 107  
Lead Silica Glass (DENSITY AND REFRACTIVE  
INDEX), 122  
Respirable Alpha Quartz (RESPIRABLE SILICA), 66  
Respirable Cristobalite (RESPIRABLE SILICA), 66  
Sand (LIGHT STABLE ISOTOPIC MATERIALS), 61  
Silica Brick (REFRACTORIES), 88

**SILICON**

ELECTRICAL RESISTIVITY AND CONDUCTIVITY  
OF SILICON, 117  
Octaphenylcyclotetrasiloxane (METALLO-ORGANIC  
COMPOUNDS), 95  
Silicon Carbide (CARBIDES), 90  
Silicon Metal (STABLE ISOTOPIC MATERIALS), 60  
Silicon Metal (STEELMAKING ALLOYS), 41  
Silicon Powder (X-RAY DIFFRACTION), 123  
SPECTROMETRY Solution, 58  
See STEELMAKING ALLOYS, 41

**SILICON DIOXIDE**

Thin Film Thickness (ELLIPSOMETRY), 120

**SILICON NITRIDE (SIZING) (SURFACE FINISH)**

PARTICLE SIZE, 127  
SURFACE AREA OF POWDERS, 128  
MICROHARDNESS, 129

**SILVER**

Alloy (MICROANALYSIS)/(METALS), 53  
Royal Canadian Mint Reference Materials, 54–55  
Silver 2-ethylhexanoate (METALLO-ORGANIC  
MATERIALS), 95  
Silver Nitrate (STABLE ISOTOPIC MATERIALS), 60  
SPECTROMETRY Solution, 58–59

**SINUSOIDAL ROUGHNESS**

SURFACE ROUGHNESS (SURFACE FINISH), 129

**SIZING**

CEMENT TURBIDIMETRY AND FINENESS, 127  
PARTICLE SIZE, 127  
SURFACE AREA OF POWDERS, 128

**SLUDGE**

Domestic Sludge (METAL CONSTITUENTS IN NATURAL  
MATRICES), 68  
Industrial Sludge (METAL CONSTITUENTS IN NATURAL  
MATRICES), 68  
SOILS, SEDIMENTS, AND SLUDGES (GEOLOGICAL  
MATERIALS AND ORES), 89

**SMOKE (FIRE RESEARCH), 131**

SMOKE DENSITY CHAMBER  
SMOKE TOXICITY

**SOCKETED BALL BAR (MISCELLANEOUS  
PERFORMANCE . . . MATERIALS)**

Socketed Ball Bar, 132

**SODA LIME GLASS (CERAMICS AND GLASSES)**

Soda-Lime, Container (GLASSES), 91  
Soda-Lime, Flat (GLASSES), 91  
Soda-Lime, Float (GLASSES), 91  
Soda-Lime, Sheet (GLASSES), 91

**SODIUM**

Disodium Hydrogen Phosphate  
(ION ACTIVITY), 99–100  
Sodium Bicarbonate (ION ACTIVITY), 99–100  
Sodium Carbonate (STOICHIOMETRY), 56  
Sodium Carbonate (ION ACTIVITY), 99–100

Sodium Chloride  
(CLINICAL LABORATORY MATERIALS), 62  
(ION ACTIVITY), 99–100  
Sodium Cyclohexanecarboxylate (METALLO-ORGANIC MATERIALS), 95  
Sodium Oxalate (STOICHIOMETRY), 59  
Sodium Pyruvate (CLINICAL LABORATORY MATERIALS), 62  
Sodium Tetraborate Decahydrate  
(pH CALIBRATION), 99  
SPECTROMETRY Solution, 58–59

**SOILS**  
METAL CONSTITUENTS IN NATURAL MATRICES, 89  
SOILS, SEDIMENTS, AND SLUDGES, 89

**SOLDER (METROLOGY)**  
Tin-Lead Alloy (SOLDER THICKNESS), 119

**SPECIAL NUCLEAR MATERIALS (RADIOACTIVITY)**  
See SPECIAL NUCLEAR MATERIALS, 112

**SPECIATION**  
CHROMIUM SPECIATION, 60

**SPECTRAL REFLECTANCE (OPTICAL PROPERTIES)**  
DIFFUSE SPECTRAL REFLECTANCE, 111  
SECULAR SPECTRAL REFLECTANCE, 110

**SPHERES (SIZING)**  
PARTICLE SIZE, 127

**SPECTROMETRY**  
SINGLE ELEMENT solutions  
(HIGH PURITY MATERIALS), 57–58  
MULTI-ELEMENT Solutions  
(HIGH PURITY MATERIALS), 58–59  
See MOLECULAR ABSORPTION  
(OPTICAL PROPERTIES), 108–111

**SPECULAR SPECTRAL REFLECTANCE, 110**  
First Surface, Aluminum on Glass  
First Surface, Black Glass  
First Surface, Gold on Nickel-Plated Aluminum  
Second Surface, Aluminum on Fused Quartz

**STAINLESS STEEL**  
See FERROUS METALS, 31–43

**STEEL COATINGS**  
CHROMIUM OVER COPPER ON STEEL, 119

**STEELS (FERROUS METALS)**  
See GUIDE TO SRM/RM TECHNICAL CATEGORIES, 25–27

**STRONTIUM**  
as Strontium-90 (RADIOACTIVITY), 112–116  
Strontium Carbonate (STOICHIOMETRY), 56  
Strontium Carbonate (STABLE ISOTOPIC MATERIALS), 60  
Strontium Cyclohexanecarboxylate (METALLO-ORGANIC MATERIALS), 95  
SPECTROMETRY Solution, 58–59

**SUCCINONITRILE (THERMODYNAMIC PROPERTIES)**  
FREEZING POINT, MELTING POINT, AND TRIPLE POINT CELLS, 108

**SUCROSE**  
OPTICAL ROTATION, 111  
STOICHIOMETRY, 56

**SULFATE**  
ANION CHROMATOGRAPHY Solution, 60

**SULFIDE (PRIMARY GAS MIXTURES), 70–71**  
Hydrogen Sulfide in Nitrogen

**SULFUR**  
CATALYST CHARACTERIZATION MATERIAL, 95  
SPECTROMETRY Solution, 58  
SULFUR IN FOSSIL FUELS, 73  
WEAR-METALS IN OIL, 96

**SULFUR DIOXIDE (PRIMARY GAS MIXTURES), 70–71**  
Sulfur Dioxide in Nitrogen  
Sulfur Dioxide Permeation Tube (PERMEATION DEVICES), 71

**SUPERCONDUCTIVE (THERMODYNAMIC PROPERTIES)**  
Superconductive Thermometric Fixed Point Device, 104

**SURFACE AREA (SIZING)**  
SURFACE AREA OF POWDERS, 128

**SURFACE FINISH, 129**  
ABRASIVE WEAR  
CORROSION  
MICROHARDNESS  
SURFACE ROUGHNESS

**SURFACE FLAMMABILITY (FIRE RESEARCH), 131**  
Hardboard Sheet

## T

**TANTALUM**  
SPECTROMETRY Solution, 58

**TAPE ADHESION TESTING**  
Linerboard for Tape Adhesion Testing, 132

**TECHNETIUM**  
as Technetium-99 (RADIOACTIVE SOLUTIONS), 113  
as Technetium-99m  
(RADIOPHARMACEUTICALS), 114

**TELLURIUM**  
SPECTROMETRY Solution, 58

**TEM**  
abbr. for Transmission Electron Microscope

**TERBIUM**  
SPECTROMETRY Solution, 58

**TETRAHYDROCANNABINOL (Marijuana Metabolite)**  
DRUGS OF ABUSE IN URINE, SINGLE ANALYTE, 64  
DRUGS OF ABUSE IN URINE, MULTIANALYTE, 65

**THALLIUM**  
SPECTROMETRY Solution, 58–59  
as Thallium-201 (RADIOPHARMACEUTICALS), 114

**THC**  
abbr. for Tetrahydrocannabinol

**THERMAL ANALYSIS (THERMODYNAMIC PROPERTIES)**  
COMBUSTION CALORIMETRY, 103  
DIFFERENTIAL SCANNING CALORIMETRY, 104  
DIFFERENTIAL THERMAL ANALYSIS, 104  
ENTHALPY AND HEAT CAPACITY, 104  
SOLUTION CALORIMETRY, 103

**THERMAL CONDUCTIVITY OF GRAPHITE AND METALS (THERMODYNAMIC PROPERTIES), 107**



- Electrolytic Iron
  - Graphite
  - Stainless Steel
  - THERMAL EXPANSION OF METAL GLASS AND SILICA (THERMODYNAMIC PROPERTIES), 107**
    - Borosilicate Glass
    - Copper
    - Fused Silica
    - Stainless Steel (AISI 446)
  - THERMAL RESISTANCE OF GLASS, SILICA, AND POLYSTYRENE (THERMODYNAMIC PROPERTIES), 107**
    - Expanded Polystyrene Board
    - Fibrous Glass Blanket
    - Fibrous Glass Board
    - Fumed Silica Board
  - THERMOGRAVIMETRY (THERMODYNAMIC PROPERTIES)**
    - See DIFFERENTIAL THERMAL ANALYSIS, 104
  - THERMOMETER (THERMODYNAMIC PROPERTIES)**
    - LABORATORY THERMOMETER, 106
  - THERMOMETRIC FIXED POINTS (THERMODYNAMIC PROPERTIES)**
    - DEFINING FIXED POINT, ITS-90, 105
    - DEFINING FIXED POINT CELLS, ITS-90, 105
    - FREEZING POINT, MELTING POINT, AND TRIPLE POINT, 105
    - SUPERCONDUCTIVE THERMOMETRIC FIXED POINT DEVICE, 104
  - THIANTHRENE**
    - COMBUSTION CALORIMETRY, 103
  - THICKNESS (METROLOGY)**
    - CHROMIUM OVER COPPER ON STEEL, 119
    - ELLIPSOMETRY, 120
    - SOLDER THICKNESS, 119
  - THORIUM**
    - SPECTROMETRY Solution, 58
  - THORIUM (RADIOACTIVITY), 112–116**
    - NATURAL MATRIX MATERIALS
    - RADIOACTIVE SOLUTIONS
  - THULIUM**
    - SPECTROMETRY Solution, 58
  - TIN**
    - DEFINING FIXED POINT, ITS-90, 105
    - DEFINING FIXED POINT CELLS, ITS-90, 105
    - Dibutyltin bis (2-ethylhexanoate) (METALLO-ORGANIC COMPOUNDS), 95
    - DIFFERENTIAL SCANNING CALORIMETRY, 104
    - SPECTROMETRY Solution, 58
  - TIN BASE ALLOYS**
    - See NONFERROUS METALS, 44-52
  - TITANIUM**
    - GASES IN METALS (NONFERROUS METALS), 52
    - SPECTROMETRY Solution, 58
    - TITANIUM BASE ALLOYS (NONFERROUS METALS), 51
  - TITANIUM DIOXIDE**
    - REFRACTORIES, 88
  - TOXIC METALS**
    - TOXIC SUBSTANCES IN URINE, 64
  - TRACE ELEMENTS**
    - See CERAMICS AND GLASSES, 90–92
    - See FOSSIL FUELS, 72–74
    - See TRACE ELEMENTS IN NICKEL BASE SUPERALLOYS, 50
  - TRANSMISSION ELECTRON MICROSCOPE**
    - See THIN FILM FOR TRANSMISSION ELECTRON MICROSCOPE (MICROANALYSIS), 53
    - See ASBESTOS, 67
  - TRANSMITTANCE**
    - See MOLECULAR ABSORPTION, 108–110
  - TRIPLE POINT (THERMODYNAMIC PROPERTIES), 103–107**
  - 2,2,4-TRIMETHYLPENTANE (ISO OCTANE)**
    - REFERENCE LIQUIDS FOR RATING FUELS, 73
  - TRIPALMITIN**
    - CLINICAL LABORATORY MATERIALS, 62
  - TRIS(HYDROXYMETHYL)AMINOMETHANE**
    - STOICHIOMETRY, 56
  - TUNGSTEN**
    - SPECTROMETRY Solution, 58
    - Tungsten Carbide (CARBIDES), 90
    - Tungsten Carbide (MICROHARDNESS), 129
    - Tungsten Concentrate (ORES), 84–86
  - TURBIDIMETRY (SIZING)**
    - Portland Cement (CEMENT TURBIDIMETRY AND FINENESS), 127
- U**
- UNIVERSITY OF PITTSBURGH I (FIRE RESEARCH)**
    - See SMOKE TOXICITY, 131
  - URANIUM**
    - SPECTROMETRY Solution, 58
  - URANIUM (RADIOACTIVITY), 112–116**
    - FISSION TRACK GLASS
    - RADIOACTIVE SOLUTIONS
    - NATURAL MATRIX MATERIALS
  - UREA**
    - CLINICAL LABORATORY MATERIALS, 62
    - COMBUSTION CALORIMETRY (THERMODYNAMIC PROPERTIES), 103
    - in Human Serum (SERUM MATERIALS), 63
    - MICROCHEMISTRY, 56
  - URIC ACID**
    - CLINICAL LABORATORY MATERIALS, 62
  - URINE, FREEZE-DRIED (HEALTH AND INDUSTRIAL HYGIENE), 62–67**
    - Cocaine Metabolite in
    - Cotinine in
    - Fluoride in
    - Mercury in
    - Morphine and Codeine in
    - Morphine Glucuronide in
    - Multi-drugs of Abuse in
    - THC (Marijuana Metabolite) in
    - Toxic Metals in
  - USA/CANADA COLLABORATIVE MATERIALS (FOOD AND AGRICULTURE), 80–81**
    - Bovine Muscle
    - Corn Bran
    - Corn Kernel
    - Corn Stalk
    - Corn Starch
    - Durum Wheat Flour
    - Hard Red Spring Wheat Flour



Microcrystalline Cellulose  
Soft Winter wheat Flour  
Wheat Gluten  
Whole Egg  
Whole Milk

## V

### VANADIUM

Bis(1-phenyl-1,3-butanediono)oxovanadium (IV)  
(METALLO-ORGANIC COMPOUNDS), 95  
SPECTROMETRY Solution, 58-59  
Vanadium in Crude Oil (METAL CONSTITUENTS IN  
FOSSIL FUELS), 72  
Vanadium and Nickel in Residual Fuel Oil (METAL  
CONSTITUENTS IN FOSSIL FUELS), 72

### VAPOR PRESSURE OF METALS (THERMODYNAMIC PROPERTIES), 106

Cadmium  
Gold

### VICKERS (MICROHARDNESS) (SURFACE FINISH), 129

Bright Copper  
Bright Nickel  
Tungsten Carbide

### VISCOSITY OF GLASS (CERAMICS AND GLASSES)

VISCOSITY FIXPOINTS, 122  
VISCOSITY OF GLASS, 121

### VITAMINS

Baby Food Composite (HEALTH CARE AND  
NUTRIENTS), 80  
Cholesterol and FSV in Coconut Oil (HEALTH CARE  
AND NUTRIENTS), 80  
Fat Soluble Vitamins in Human Serum (CLINICAL  
LABORATORY MATERIALS)/(SERUM  
MATERIALS), 62-63  
Infant Formula (HEALTH CARE AND NUTRIENTS), 80

### VMA

aka. 4-hydroxy-3-methoxymandelic acid

## W

### WASPALLOY™

NICKEL BASE ALLOYS (NONFERROUS  
METALS), 50

### WATER ANALYSIS (INORGANICS)

Mercury in Water (METAL CONSTITUENTS IN  
NATURAL MATRICES), 68  
Natural Water (METAL CONSTITUENTS IN NATURAL  
MATRICES), 68  
SIMULATED RAINWATERS, 68  
Trace Elements in Water (METAL CONSTITUENTS IN  
NATURAL MATRICES), 68

### WAVELENGTH (OPTICAL PROPERTIES)

Holmium Oxide Solution (MOLECULAR  
ABSORPTION), 108-110

### WEAR (SURFACE FINISH)

D-2 Tool Steel (ABRASIVE WEAR), 129

### WEAR-METALS (ENGINE WEAR MATERIALS)

WEAR METALS IN OIL, 96

### WHALE BLUBBER (ORGANICS)

ORGANIC CONSTITUENTS, 75-78

### WHEAT FLOUR (FOOD AND AGRICULTURE)

FOODS AND BEVERAGES, 79  
USA/CANADA COLLABORATIVE MATERIALS, 80-81

### WHEAT HARDNESS (FOOD AND AGRICULTURE), 83

## X

### XENON (RADIOACTIVITY)

as Xenon-133 (RADIOPHARMACEUTICALS), 114

### X-RAY

THIN FILMS FOR X-RAY FLUORESCENCE  
(INORGANICS), 68

X-RAY DIFFRACTION, 123

X-RAY STAGE CALIBRATION, 123

### X-RAY FILM

X-Ray Film Step Tablet (X-RAY AND PHOTOGRAPHY), 111

## Y

### YTTERBIUM

SPECTROMETRY Solution, 58

### YTTRIUM

SPECTROMETRY Solution, 58

## Z

### ZINC

DEFINING FIXED POINT, ITS-90, 105  
DEFINING FIXED POINT CELLS, ITS-90, 105  
DIFFERENTIAL SCANNING CALORIMETRY, 104  
METALS (HIGH PURITY METALS), 54  
Metals on Filter Media (MATERIALS ON FILTER  
MEDIA), 66  
SPECTROMETRY Solution, 58-59  
Spelter (ZINC BASE ALLOYS), 52  
ZINC BASE ALLOYS (NONFERROUS METALS), 52  
Zinc Cyclohexanecarboxylate (METALLO-ORGANIC  
COMPOUNDS), 95  
Zinc Concentrate (ORES), 84-86

### ZIRCONIUM

SPECTROMETRY Solution, 58  
Zircaloy-4 (ZIRCONIUM BASE ALLOYS), 52  
ZIRCONIUM BASE ALLOYS (NONFERROUS  
METALS), 52



---

## *SRM/RM Indexes—(Continued)*

### *Numerical and Certificate Index*





# Numerical and Certificate Index

SRM	Descriptor	Cert. Date	Section Code	Page	SRM	Descriptor	Cert. Date	Section Code	Page
1c	Limestone, Argillaceous	Mar 90	111	88	101g	Stainless Steel (AISI 304L)	Aug 86	101	35
4L	Cast Iron	Jun 90	101	42	106b	LA Steel, Cr-Mo-Al (Nitalloy G)	Mar 61	101	32
5m	Cast Iron	Jan 97	101	42	107c	Cast Iron (Ni-Cr-Mo)	May 83	101	42
RM 5	Cu Low Temp Heat Capacity	Mar 92	203	104	112b	Silicon Carbide	Nov 87	112	90
6g	Cast Iron	Nov 70	101	42	113b	Zinc Concentrate	Mar 95	111	84
7g	Cast Iron Hi-Phos.	Oct 59	101	42	114p	Portland Cement	May 94	301	127
8j	Carbon Steel, 0.1 C	Apr 72	101	31	115a	Cast Iron (Cu-Ni-Cr)	Apr 62	101	42
11h	Carbon Steel, 0.2 C	Feb 92	101	31	120c	Phosphate Rock (Florida)	Feb 88	110/111	83/85
12h	Carbon Steel, 0.4 C	Mar 66	101	31	121d	Stainless Steel, Cr-Ni-Ti (AISI 321)	Aug 81	101	35
13g	Carbon Steel, 0.6 C	Apr 74	101	31	122i	Cast Iron	Sep 92	101	42
14g	Carbon Steel, 0.8 C	Mar 90	101	31	123c	Stainless Steel, Cr-Ni-Nb (AISI 348)	Oct 81	101	35
15h	Carbon Steel, 0.1 C	Jun 93	101	31	125b	LA Steel, High Silicon	Oct 95	101	32
16f	Carbon Steel, 1.0 C	Jul 93	101	31	126c	HA Steel, High Nickel	Dec 77	101	34
17e	Sucrose (Polarimetric)	In Prep	104/204	56/111	127b	Solder, 40Sn-60Pb	Aug 90	102	49
19h	Carbon Steel, 0.2 C	Sep 87	101	31	129c	LA Steel, High Sulfur (SAE 112)	Aug 73	101	32
20g	Carbon Steel	Oct 70	101	31	131f	LA Steel, High Silicon	May 97	101	32
25d	Manganese Ore	Feb 84	111	85	132b	Tool Steel (AISI M2)	Aug 95	101	35
27f	Iron Ore, Sibley	Dec 91	111	85	133c	Stainless Steel, Cr-13, Mo-0.3, S-0.3	In Prep	101	35
30f	LA Steel, Cr-V (SAE 6150)	Mar 92	101	32	134a	Tool Steel, Mo-W-Cr-V	May 57	101	35
32e	LA Steel, Ni-Cr (SAE 3140)	Apr 57	101	32	136e	Potassium Dichromate (Oxidimetric)	Jun 89	104	56
33e	LA Steel, Ni-Mo (SAE 4820)	Mar 95	101	32	139b	LA Steel, Cr-Ni-Mo (AISI 8640)	Jun 93	101	32
36b	LA Steel, Cr-Mo	Jul 69	101	32	141d	Acetanilide	In Prep	104	56
39j	Benzoic Acid (Combustion Cal.)	May 95	203	103	142	Anisic Acid	Jul 69	104	56
40h	Sodium Oxalate (Reductometric)	May 92	104	56	143d	Cystine	In Prep	104	56
41c	Dextrose (D-Glucose) (Polarimetric)	May 93	104/204	56/111	148	Nicotine Acid	Dec 94	104	56
45d	Cu (Freezing Point)	Apr 90	203	105	152a	Carbon Steel, 0.5 C	Oct 65	101	31
49e	Lead (Freezing Point)	Apr 90	203	105	154b	Titanium Dioxide	Sep 91	111	88
50c	Tool Steel, W-Cr-V	Jun 57	101	35	155	LA Steel, Cr-W	Oct 46	101	32
53e	Bearing Metal (Pb-Sb-Sn)	Jan 70	102	49	158a	Bronze, Silicon	Aug 61	102	45
54d	Bearing Metal (Tin Base)	Sep 57	102	51	160b	Stainless Steel, Cr-Ni-Mo (AISI 316)	Jul 86	101	35
57a	Silicon Metal	May 93	101	41	163	LA Steel, 1.0 C	Jan 68	101	32
58a	Ferrosilicon (73% Si)	Apr 78	101	41	165a	Glass Sand (Low Iron)	Nov 92	111/112	88/91
59a	Ferrosilicon	Nov 69	101	41	166c	Stainless Steel, Carbon Only	Mar 70	101	35
64c	Ferrochromium, High Carbon	Feb 92	101	41	173b	Titanium Alloy Al-V	Dec 84	102	51
68c	Ferromanganese, High Carbon	Aug 79	101	41	176	Titanium Alloy Al-Sn	Discontinued		
69b	Bauxite (Arkansas)	Jan 91	111	85	178	Carbon Steel, 0.4 C	Jul 69	101	31
70a	Feldspar, Potash	Nov 90	111	88	179	LA Steel, High Silicon	May 94	101	32
72g	LA Steel (AISI 4130)	Jun 81	101	32	180	Fluorspar, High Grade	Aug 86	111	84
73c	Stainless Steel, Cr (SAE 420)	Feb 92	101	35	181	Lithium Ore (Spodumene)	Oct 81	111	84
76a	Burnt Refractory (Al2O3-40%)	Mar 92	111	88	182	Lithium Ore (Petalite)	Oct 81	111	84
77a	Burnt Refractory (Al2O3-60%)	Mar 92	111	88	183	Lithium Ore (Lepidolite)	Oct 81	111	84
78a	Burnt Refractory (Al2O3-70%)	Mar 92	111	88	185g	Potassium Hydrogen Phthalate, pH	Feb 91	201	99
79a	Fluorspar, Customs Grade	Jan 80	111	84	186lf	Potassium Dihydrogen Phosphate, pH	Dec 96	201	99
81a	Glass Sand	Jan 78	111/112	88/91	186llf	Sodium Hydrogen Phosphate, pH	Dec 96	201	99
82b	Cast Iron (Ni-Cr)	Apr 66	101	42	187d	Sodium Tetraborate (Borax), pH	In Prep	201	99
83d	Arsenic Trioxide (Reductometric)	Apr 95	104	56	188	Potassium Hydrogen Tartrate, pH	May 87	201	99
84j	Potassium Hydrogen Phthalate	Jan 93	104	56	189a	Potassium Tetroxalate, pH	Feb 91	201	99
87a	Aluminum-Silicon Alloy	Jan 91	102	44	191b	Sodium Bicarbonate, pH	In Prep	201	99
88b	Limestone, Dolomite	May 94	111	88	192b	Sodium Carbonate, pH	In Prep	201	99
89	Glass, Lead Barium	Dec 90	112	91	193	Potassium Nitrate	Nov 91	110	83
90	Ferrophosphorus	Oct 28	101	41	194	Ammonium Dihydrogen Phosphate	Sep 92	110	83
91	Glass, Opal Powder	Discontinued			195	Ferrosilicon (75% Si-HP Grade)	Apr 78	101	41
92	Low-Boron, Soda-Lime Powder	Mar 82	112	91	196	Ferrochromium, Low Carbon	Nov 70	101	41
93a	High-Boron Borosilicate	Sep 91	112	91	198	Silica Brick	Jan 60	111	88
94c	Zinc-Base Die Casting Alloy	Dec 94	102	52	199	Silica Brick	Jan 91	111	88
97b	Flint Clay	Apr 88	111	87	200a	Potassium Dihydrogen Phosphate	In Prep	110	83
98b	Plastic Clay	Apr 88	111	87	211d	Toluene	Discontinued		
99a	Feldspar, Soda	Nov 90	111	88	276b	Tungsten Carbide	Sep 94	112	90
100b	LA Steel, Manganese (SAE (T340))	Aug 59	101	32	277	Tungsten Concentrate	Oct 78	111	84

SRM	Descriptor	Cert. Date	Section Code	Page	SRM	Descriptor	Cert. Date	Section Code	Page
278	Obsidian Rock	Mar 92	111	88	621	Soda-Lime Container	Jan 82	112	91
291	LA Steel, Cr-Mo (ASTM A 213)	Oct 75	101	32	622	Soda-Lime Silica (Durability)	Mar 76	208	121
293	LA Steel, Cr-Ni-Mo (AISI 8620)	Mar 75	101	32	623	Borosilicate (Durability)	Mar 76	208	121
330	Copper Ore Mill Heads	Aug 91	111	84	624	Lead-Silica, for dc resistivity	Oct 77	207	121
331	Copper Ore Mill Tails	Sep 91	111	84	625	Zinc-Base A	Jun 96	102	52
334	Gray Cast Iron (Carbon & Sulfur)	Mar 82	101	42	626	Zinc-Base B	Jun 96	102	52
337a	Carbon Steel, 1.1 C (Carbon & Sulfur)	Apr 85	101	31	627	Zinc-Base C	Jun 96	102	52
338	White Cast Iron (Carbon & Sulfur)	May 93	101	42	628	Zinc-Base D	Jun 96	102	52
339	Stainless Steel, Cr-Ni-Se (SAE 303Se)	Jul 65	101	35	629	Zinc-Base E	Jun 96	102	52
341	Ductile Cast Iron	Mar 62	101	42	630	Zinc-Base F	Jun 96	102	52
342a	Nodular Cast Iron	Mar 92	101	42	631	Zinc Spelter (mod.)	Feb 95	102	52
343a	Stainless Steel (AISI 431)	Jun 94	101	35	640c	Line Position, Silicon (XRD)	In Prep	209	123
344	HA Steel, (Mo Precipitation Hardening)	Oct 63	101	34	641	Titanium Alloy, 8 Mn (A)	Oct 81	102	51
345a	HA Steel, (Cu Precipitation Hardening)	Jun 92	101	34	642	Titanium Alloy, 8 Mn (B)	Oct 81	102	51
346a	Valve Steel	Feb 92	101	34	643	Titanium Alloy, 8 Mn (C)	Oct 81	102	51
347	Magnesium Ferrosilicon	Aug 90	101	41	644	Titanium Alloy, Cr-Fe-Mo	Discontinued		
348a	Hi Temp. Alloy, (A286) Ni-Cr	Mar 87	101	34	647	Titanium Alloy, Al-Mo-Sn-Zr	Aug 86	102	51
349a	Waspalloy™	Jan 97	102	50	648	Titanium Alloy, Al-Sn-Zr-Cr-Mo	Jun 87	102	51
350a	Benzoic Acid	Mar 95	104	56	649	Titanium Alloy, V-Al-Cr-Sn	Jul 90	102	51
351	Sodium Carbonate (Assay)	Sept 96	104	56	650	Unalloyed Titanium A	Nov 85	102	51
352c	Unalloyed Titanium, Hydrogen	Jun 90	102	52	651	Unalloyed Titanium B	Nov 85	102	51
360b	Zircaloy 4, Zr-Base Alloy	Apr 86	102	52	652	Unalloyed Titanium C	Nov 85	102	51
361	LA Steel (AISI 4340)	Feb 81	101	33	654b	Titanium Alloy, Al-V	Sep 91	102	51
362	LA Steel (AISI 94B17) (mod.)	Jun 89	101	33	656	Silicon Nitride Quant. Anal. (XRD)	Mar 95	209	123
363	LA Steel, Cr-V (mod.)	Feb 81	101	33	659	Silicon Nitride, Particle Size	Mar 92	301	127
364	LA Steel, High C (mod.)	May 93	101	33	660	Line Profile, LaB6 (XRD)	Jun 89	209	123
367	Stainless Steel (AISI 446)	Mar 95	101	35	661	LA Steel (AISI 4340)	Dec 91	101	36
368	Carbon Steel (AISI 1211)	Jan 78	101	31	663	LA Steel, Cr-V (mod.)	Dec 91	101	36
371h	Sulfur (Rubber Compound)	Discontinued			664	LA Steel, High Carbon, (mod.)	Dec 91	101	36
372i	Stearic Acid (Rubber Compound)	Discontinued			665	Electrolytic Iron	Dec 91	101	36
383a	Mercaptobenzothiazole	Discontinued			670	Rutile Ore	Jan 93	111	85
386k	Styrene-Butadiene/500	Discontinued			671	Nickel Oxide 1	Sep 60	102	51
393	Unalloyed Copper-"O" (chips)	Sep 80	102	47	672	Nickel Oxide 2	Sep 60	102	51
395	Unalloyed Copper II (chips)	Jul 93	102	47	673	Nickel Oxide 3	Sep 60	102	51
396	Unalloyed Copper III (chips)	Apr 86	102	47	674a	Quant. Analysis, Set (XRD)	Jan 89	209	123
398	Unalloyed Copper V (chips)	Jul 93	102	47	675	Line Position, Mica (XRD)	Jun 82	209	123
399	Unalloyed Copper VI (chips)	Jul 93	102	47	676	Quantitative Analysis, Alumina (XRD)	May 92	209	123
400	Unalloyed Copper VII (chips)	Apr 86	102	47	679	Brick Clay	Jan 87	111	87
454	Unalloyed Copper XI (chips)	Apr 86	102	47	680L1a	High Purity Platinum	Jul 95	104	54
457	Unalloyed Copper IV (solid)	Apr 86	102	47	680L2a	High Purity Platinum	Jul 95	104	54
458	Beryllium-Copper (17510)	Sep 92	102	45	682	High Purity Zinc	Jan 88	104	54
459	Beryllium-Copper (17200)	Sep 92	102	45	683	Zinc, Metal	Jan 88	104	54
460	Beryllium-Copper (17300)	Sep 92	102	45	685R	High Purity Gold	Oct 81	104	54
473	Optical Linewidth	Jan 97	207	118	685W	High Purity Gold	Oct 81	104	54
475	Optical Linewidth	Jan 92	207	118	688	Basalt Rock	Aug 81	111	88
476	Optical Linewidth	Sep 90	207	118	689	Ferrochromium Silicon	Feb 82	101	41
480	Tungsten-Molybdenum EPMA	Nov 68	103	53	690	Iron Ore Canada	Jun 92	111	85
481	Gold-Silver EPMA	Feb 69	103	53	691	Iron Oxide, Reduced	Oct 91	111	85
482	Gold-Copper EPMA	Aug 88	103	53	692	Iron Ore, Labrador	Jan 92	111	85
484g	SEM Magnification	Sept 96	207	118	693	Iron Ore, Nimba	Jul 90	111	85
487	Austenite in Ferrite, 30%	Discontinued			694	Phosphate Rock, Western	Sep 93	110/111	83/86
488	Austenite in Ferrite, 2.5%	Discontinued			696	Bauxite, Surinam	Jan 91	111	86
494	Unalloyed Copper I (solid)	Apr 86	102	47	697	Bauxite, Dominican	Jan 91	111	86
495	Unalloyed Copper II (solid)	Oct 87	102	47	698	Bauxite, Jamaican	Jan 91	111	86
496	Unalloyed Copper III (solid)	Apr 86	102	47	699	Alumina (Reduction Grade)	Dec 93	111	86
498	Unalloyed Copper V (solid)	May 93	102	47	705a	Polystyrene	Jul 90	202/203	101/104
499	Unalloyed Copper VI (solid)	Mar 86	102	47	706	Polystyrene	Apr 95	202	101
500	Unalloyed Copper VII (solid)	Mar 86	102	47	709	Extra Dense Lead	Jun 74	208	122
600	Bauxite, Australian	Jan 91	111	85	710a	Soda-Lime Silica Glass	Mar 91	208	121/122
607	Potassium Feldspar	May 73	112	92	711a	Lead-Silica Glass	In Prep	208	121
610	Trace Elements in Glass	Jan 92	112	92	713	Dense Barium Crown Glass 620/603	Oct 65	208	122
611	Trace Elements in Glass	Jan 92	112	92	714	Alkaline Earth Glass	Oct 65	208	122
612	Trace Elements in Glass	Jan 92	112	92	716	Neutral Glass	Sep 66	208	122
613	Trace Elements in Glass	Jan 92	112	92	717a	Borosilicate	Sep 96	208	121/122
614	Trace Elements in Glass	Jan 92	112	92	720	Synthetic Sapphire (Heat Capacity)	Apr 82	203	104
615	Trace Elements in Glass	Jan 92	112	92	723c	Tris (Basimetric)	In Prep	104	56
616	Trace Elements in Glass	Jan 92	112	92	724a	Tris (Heat of Soln.)	Discontinued		
617	Trace Elements in Glass	Jan 92	112	92	726	Selenium, Intermediate Purity	Jan 67	104	54
620	Soda Lime, Flat	Jan 82	112	91					



SRM	Descriptor	Cert. Date	Section Code	Page	SRM	Descriptor	Cert. Date	Section Code	Page
728	Zinc, Intermediate Purity	Jul 96	104	54	931e	Liquid Filters, Absorbance	Apr 97	204	108/110
731L1	Borosilicate Glass (Therm. Expansion)	Jul 93	203	107	934	Clinical Thermometer	Oct 92	203	106
731L2	Borosilicate Glass (Therm. Expansion)	Jul 93	203	107	935a	Potassium Dichromate, UV Absorbance	Apr 88	204	108/110
731L3	Borosilicate Glass (Therm. Expansion)	Jul 93	203	107	936a	Quinine Sulfate, Fluorescence	Dec 94	204	110
736L1	Copper Therm. Exp.	Oct 90	203	107	937	Iron Metal (Clinical)	Sep 95	105	62
738	Stainless Steel (Therm. Expansion)	May 93	203	107	938	4-Nitrophenol	Aug 95	105	62
739L1	Fused Silica (Therm. Resist.)	Dec 91	203	107	951	Boric Acid, Assay and Isotopic	Feb 69	105	56/60
739L2	Fused Silica (Therm. Resist.)	Dec 91	203	107	952	Boric Acid 95% enr. 10B	Feb 69	104	60
739L3	Fused Silica (Therm. Resist.)	Dec 91	203	107	953	Neutron Density Monitor Wire	Mar 69	205	112
740a	Zinc (Freezing Point)	Nov 90	203	105	955b	Lead in Blood	Dec 94	105	62
741	Tin (Freezing Point)	Jun 90	203	105	956a	Electrolytes in Frozen Human Serum	Nov 96	105	62/63
742	Alumina (Reference Point)	Jul 90	203	105	963a	Fission Track Glass U-1 mg/g	Feb 84	205	112
743	Mercury (Triple Point)	Jul 90	203	105	965	Glucose in Frozen Human Serum	Dec 96	105	62/63
745	Gold-Vapor Pressure	Aug 90	203	106	966	Toxic Elements in Blood	In Prep	105	62
746	Cadmium-Vapor Pressure	Jan 91	203	106	968b	Fat-Sol. Vit. & Chol. in Serum	Aug 95	105	62/63
767a	Thermometric Fixed Point	Feb 92	203	104	975a	Chlorine (Isotopic)	In Prep	104	60
769	Aluminum (Residual Resist. Ratio)	Nov 82	206	117	976	Copper (Isotopic)	Jan 94	104	60
773	Soda-Lime-Silica (Glass Liquidus)	Nov 80	208	121	977	Bromine (Isotopic)	Mar 65	104	60
774	Lead-Silica (Dielectric Constant)	Jul 82	208	121	978a	Silver (Isotopic)	Sep 84	104	60
781D2	Molybdenum (Heat Capacity)	Apr 77	203	104	979	Chromium (Isotopic)	May 66	104	60
855a	Aluminum Casting Alloy 356	Jan 90	102	44	980	Magnesium (Isotopic)	Jan 67	104	60
856a	Aluminum Casting Alloy 380	Jan 90	102	44	981	Natural Lead (Isotopic)	Mar 91	104	60
858	Aluminum Alloy 6011	Mar 95	102	44	982	Equal Atom Lead (Isotopic)	Mar 91	104	60
859	Aluminum Alloy 7075	Jun 80	102	44	983	Radiogenic Lead (Isotopic)	Mar 91	104	60
862	High Temp. Alloy L605	Oct 91	101/102	34/44	984	Rubidium Assay (Isotopic)	Jul 70	104	60
864	Inconel™, 600	May 84	102	50	985	Potassium Assay (Isotopic)	Aug 79	104	60
865	Inconel™, 625	May 84	102	50	986	Nickel (Isotopic)	May 90	104	60
866	Incoloy™, 800	May 84	102	39	987	Strontium Assay and Isotopic	Oct 82	104	56/60
867	Incoloy™, 825	May 84	102	39	989	Rhenium Assay (Isotopic)	Feb 74	104	60
868	High Temp. Alloy Fe-Ni-Co	Apr 93	101	34	990	Silicon Assay (Isotopic)	Aug 74	104	60
869	LC Column Selectivity	Mar 90	109	75	991	Lead-206 Spike Assay and Isotopic	Mar 76	104	60
871	Bronze, Phosphor (CDA 521)	Aug 79	102	45	994	Gallium (Isotopic)	Feb 86	104	60
872	Bronze, Phosphor (CDA 544)	Aug 79	102	45	997	Thallium (Isotopic)	Jul 86	104	60
874	Cupro-Nickel, 10% (CDA 706) "H-P"	Jan 78	102	45	998	Angiotensin I (Human)	Jan 83	105	62
875	Cupro-Nickel, 10% (CDA 706) "Doped"	Jan 78	102	45	999a	Potassium Chloride (Assay)	Apr 95	104	56
879	Nickel Silver, (CDA 762)	Jun 79	102	45	1001	X-Ray Film Step Tablet	Oct 97	204	111
880	Nickel Silver, (CDA 770)	Jun 79	102	45	1002d	Hard Board (Surface Flammability)	Aug 89	305	131
882	Alloy Ni-Cu-Al	Aug 79	102	50	1003b	Glass (Particle Size)	Sep 93	301	127
885	Refined Copper	Mar 91	104	54	1004a	Glass (Particle Size)	Dec 93	301	127
886	Gold, Ore Refractory	Mar 95	111	86	1006c	Alpha-Cellulose (Smoke Density)	Discontinued		
887	Cemented Carbide (W83-Co10)	Sep 88	112	90	1007b	Plastic, (Smoke Density)	Apr 91	305	131
888	Cemented Carbide (W64-Co25-Ta5)	Sep 88	112	90	1008	Photographic Step Tablet	In Prep	204	111
889	Cemented Carbide (W75-Co9-Ta5-Ti4)	Sep 88	112	90	1010a	Microcopy Test Chart	Jun 90	204	111
890	Cast Iron, HC250+V	Apr 82	101	42	1012	Flooring Radiant Panel	Sep 84	305	131
891	Cast Iron, Ni-Hard, Type I	Apr 82	101	42	1017b	Glass (Particle Size)	Aug 95	301	127
892	Cast Iron, Ni-Hard, Type IV	Apr 82	101	42	1018b	Glass (Particle Size)	Apr. 97	301	127
893	Stainless Steel (SAE 405)	Mar 92	101	35	1019b	Glass (Particle Size)	Jul 97	301	127
895	Stainless Steel (SAE 201)	Dec 91	101	35	1034	Unalloyed Copper	Feb 82	102	45
897	"Tracealloy" A	Aug 83	102	50	1035	Leaded-Tin Bronze Alloy	Feb 82	102	45
898	"Tracealloy" B	Aug 83	102	50	1048	Smoke Toxicity (Cup Furnace)	Nov 91	305	131
899	"Tracealloy" C	Aug 83	102	50	1049	Smoke Toxicity (Univ. Pitts.)	Nov 92	305	131
900	Antiepilepsy Drug (4) Level	Apr 79	105	62	1051b	Barium (Metallo-Organic)	Jun 91	114	95
909b	Human Serum	Oct 97	105	62/63	1052b	Vanadium (Metallo-Organic)	Apr 93	114	95
910	Sodium Pyruvate	May 81	105	62	1053a	Cadmium (Metallo-Organic)	Jan 70	114	95
911b	Cholesterol	Apr 94	105	62	1057b	Tin (Metallo-Organic)	Aug 68	114	95
912a	Urea	Dec 90	105	62	1059c	Lead (Metallo-Organic)	Sep 87	114	95
913	Uric Acid	Sep 68	105	62	1060a	Lithium (Metallo-Organic)	Apr 64	114	95
914a	Creatinine	Feb 94	105	62	1065b	Nickel (Metallo-Organic)	Nov 93	114	95
915a	Calcium Carbonate (Clinical)	Jan 95	105	62	1066a	Silicon (Metallo-Organic)	Jun 91	114	95
916a	Bilirubin	Jun 89	105	62	1069b	Sodium (Metallo-Organic)	Jun 91	114	95
917a	D-Glucose (Dextrose-Clinical)	Aug 89	105	62	1070a	Strontium (Metallo-Organic)	Apr 64	114	95
918a	Potassium Chloride (Clinical)	Apr 95	105	62	1071b	Phosphorus (Metallo-Organic)	Sep 91	114	95
919a	Sodium Chloride (Clinical)	Feb 91	105	62	1073b	Zinc (Metallo-Organic)	Sep 86	114	95
920	D-Mannitol	Jan 72	105	62	1075a	Aluminum (Metallo-Organic)	Oct 67	114	95
921	Cortisol (Hydrocortisone)	Feb 93	105	62	1077a	Silver (Metallo-Organic)	Feb 68	114	95
924a	Lithium Carbonate (Clinical)	Jun 95	105	62	1078b	Chromium (Metallo-Organic)	Jul 72	114	95
925	VMA (Clinical)	May 73	105	62	1079b	Iron (Metallo-Organic)	Feb 69	114	95
927c	Bovine Serum Albumin	In Prep	105	62/63	1080a	Copper (Metallo-Organics)	Feb 69	114	95
928	Lead Nitrate (Clinical)	Apr 94	105	62	1083	Wear Metals (Base Oil)	Jul 91	114	96
929	Magnesium Gluconate	Mar 93	105	62	1084a	Wear Metals	Apr 91	114	96
930e	Glass Filters, Transmittance	Jun 96	204	108/110	1085a	Wear Metals	Apr 91	114	96
					1089	Steels, Set (SRMs 1095-99)	Apr 86	101	34

SRM	Descriptor	Cert. Date	Section Code	Page	SRM	Descriptor	Cert. Date	Section Code	Page
1090	Ingot Iron, Oxygen	Nov 85	101	34	1244	Inconel™ 600	May 84	101	50
1091a	Stainless Steel (AISI 431)	Nov 85	101	34	1245a	Inconel™ 625	May 84	101	50
1093	Valve Steel, Oxygen	Nov 84	101	34	1246	Incoloy™ 800	May 84	101	39
1094	Maraging Steel	Nov 84	101	34	1247	Incoloy™ 825	May 84	101	39
1095	Steel (AISI 4340) [see SRM 1089]	Apr 86	101	34	C1248	Nickel-Copper Alloy	Dec 86	102	50
1096	Steel (AISI 94B17) [see SRM 1089]	Apr 86	101	34	1249	Inconel™ 718	Mar 96	102	50
1097	Cr-V Steel (mod.) [see SRM 1089]	Apr 86	101	34	1250	High Temp. Alloy Fe-Ni-Co	Jul 93	101	39
1098	Steel (High Carbon) [see SRM 1089]	Apr 86	101	34	C1252	Phos. Copper IX	Apr 86	102	47
1099	Electrolytic Iron [see SRM 1089]	Apr 86	101	34	C1253	Phos Copper X	Discontinued		
1104	Free-Cutting Brass	Aug 65	102	46	1254	LA Steel (Ca only)	Apr 82	101	36
1107	Naval Brass B	Nov 81	102	46	1258	Aluminum Alloy 6011	May 78	102	44
1108	Naval Brass C	Nov 81	102	46	1259	Aluminum Alloy 7075	May 78	102	44
1110	Red Brass B	Oct 81	102	46	1261a	LA Steel (AISI 4340)	May 93	101	36
1111	Red Brass C	Oct 81	102	46	1262b	LA Steel (AISI 94B17)	Oct 92	101	36
1112	Gilding Metal A (disk)	Oct 81	102	46	1263a	LA Steel Cr-V (mod.)	Feb 81	101	36
C1112	Gilding Metal A (block)	Oct 81	102	46	1264a	LA Steel, High Carbon (mod.)	Jan 88	101	36
1113	Gilding Metal B (disk)	Oct 81	102	46	1265a	Electrolytic Iron	Jun 89	101	36
C1113	Gilding Metal B (block)	Oct 81	102	46	1269	Line Pipe (AISI 1521 mod.)	Jun 81	101	36
1114	Gilding Metal C (disk)	Oct 81	102	46	1270	LA Steel, Cr-Mo (A336) (F-22)	Jun 81	101	36
C1114	Gilding Metal C (block)	Oct 81	102	46	1271	LA Steel (HSLA-100)	Oct 91	101	36
1115	Commercial Bronze A (disk)	Nov 81	102	46	1276a	Cupro-Nickel (CDA 715)	Jun 89	102	46
C1115	Commercial Bronze A (block)	Nov 81	102	46	C1285	LA Steel (A242) (mod.)	Jun 82	101	36
1116	Commercial Bronze B (disk)	Nov 81	102	46	1286	LA Steel HY 80	Mar 92	101	36
C1116	Commercial Bronze B (block)	Nov 81	102	46	C1287	Stainless Steel (AISI 310 mod.)	Jun 81	101	40
1117	Commercial Bronze C (disk)	Nov 81	102	46	C1288	Stainless Steel (A-743)	Aug 81	101	40
C1117	Commercial Bronze C (block)	Nov 81	102	46	C1289	Stainless Steel (AISI 414 mod.)	Discontinued		
C1122	Beryllium-Copper (block)	Dec 81	102	46	C1290	High Alloy (HC-250 + V)	Jan 85	101	43
C1123	Beryllium-Copper (block)	Discontinued			C1291	High Alloy (Ni-Hard, Type I)	Jan 85	101	43
1128	Ti Alloy, V-Al-Cr-Sn	Jul 91	102	51	C1292	High Alloy (Ni-Hard, Type IV)	Jan 85	101	43
1129	Solder 63Sn-37Pb	May 89	102	49	1295	Stainless Steel (SAE 405)	Mar 92	101	40
1131	Solder 60Pb-40Sn	Oct 81	102	49	C1296	Stainless Steel 28Cr-3Mo (SAE 460)	Dec 91	101	40
1132	Bearing Metal (Pb-Sn)	Nov 94	102	49	1297	Stainless Steel Cr-Ni-Mn (SAE 201)	Dec 91	101	40
1134	LA Steel, High Silicon	Apr 70	101	36	1357	Cu & Cr Coating on Steel	Jul 91	207	119
1135	LA Steel, High Silicon	Jul 72	101	36	1358a	Cu & Cr Coating on Steel	In Prep	207	119
C1137a	White Cast Iron	Sep 96	101	43	1359	Cu & Cr Coating on Steel	Jul 91	207	119
1138a	Cast Steel (No. 1)	Jan 77	101	43	1360	Cu & Cr Coating on Steel	Jul 91	207	119
1139a	Cast Steel (No. 2)	Jan 77	101	43	1361a	Cu & Cr Coating on Steel	Jul 91	207	119
C1145a	White Cast Iron	Jan 88	101	43	1362b	Cu & Cr Coating on Steel	In Prep	207	119
C1146a	White Cast Iron	Discontinued			1363a	Cu & Cr Coating on Steel	Jul 91	207	119
C1151a	Stainless Steel 23Cr-7Ni	Dec 92	101	40	1364a	Cu & Cr Coating on Steel	Jul 91	207	119
C1152a	Stainless Steel 18Cr-11Ni	Feb 90	101	40	1371	Gold Coating on Fe-Ni-Co Alloy	Discontinued		
C1153a	Stainless Steel 17Cr-9Ni	Sep 90	101	40	1373	Gold Coating on Fe-Ni-Co Alloy	Discontinued		
C1154a	Stainless Steel 19Cr-13Ni	Jun 92	101	40	1374	Gold Coating on Fe-Ni-Co Alloy	Discontinued		
1155	Stainless Steel Cr-Ni-Mo (AISI 316)	Aug 69	101	40	1400	Bone Ash	Dec 92	105	62
1157	Specialty Steel, Tool (AISI M2)	Aug 73	101	40	1411	Soft Borosilicate Glass	Aug 85	112	91
1158	Specialty Steel, High Nickel (Ni36)	Dec 77	101	40	1412	Multicomponent Glass	Aug 85	112	91
1159	Elec/Mag Ni-Fe	Aug 81	102	50	1413	Glass Sand (High Alumina)	Aug 85	111/112	88/91
1160	Elec/Mag Ni-Mo-Fe	Aug 81	102	50	1414	Lead-Silica (Resistivity)	Discontinued		
1171	Stainless Steel Cr-Ni-Ti (AISI 321)	May 93	101	40	1416	Glass Al-Silicate (Glass Liquidus)	Discontinued		
1172	Stainless Steel Cr-Ni-Nb (AISI 348)	Jul 71	101	40	1449	Fumed Silica Board	Jan 89	203	107
1173	Ni-Cr-Mo-V Steel	Jun 89	101	43	1450c	Fibrous Glass Board	Mar 97	203	107
C1173	Cast Steel 3	Jan 89	101	43	1452	Fibrous Glass Blanket	Apr 86	203	107
1216	Carbon Modified Silicon	Nov 87	106	69	1453	Expanded Polystyrene Board	Dec 96	203	107
1218	LA Steel, High Silicon	Nov 84	101	36	1457	Superconducting Nb-Ti Wire	Jun 84	206	117
1219	Stainless Steel Cr-Ni (AISI 431)	Sep 85	101	40	1459	Fumed Silica Board	Jan 89	203	107
C1221	LA Carbon (AISI 1211)	Apr 93	101	36	1461	Stainless Steel (Therm./Elec. Resist.)	May 84	203/206	107/117
1222	LA Steel, Cr-Ni-Mo (AISI 8640)	Sep 90	101	36	1462	Stainless Steel (Therm./Elect. Resist.)	May 84	203/206	107/117
1223	Chromium Steel	May 93	101	40	1473a	Polyethylene Resin	Aug 95	202	101
1224	LA Steel, Carbon (AISI 1078)	Feb 81	101	36	1474	Polyethylene Resin	Apr 90	202	101
1225	LA Steel (AISI 4130)	Mar 83	101	36	1475a	Polyethylene, Linear	Jun 96	202	101
1226	LA Steel	Sep 96	101	36	1478	Polystyrene, Narrow Mol. Wt.	Jul 92	202	101
1227	LA Steel, Basic Open Hearth, 1% C	Mar 83	101	36	1479	Polystyrene, Narrow Mol. Wt.	Mar 92	202	101
1228	LA Steel, 0.1% C	Jun 93	101	36	1480	Polyurethane	Aug 92	202	101
1230	High Temp. Alloy, A286	Jun 87	101	39	1482a	Polyethylene, Linear	Dec 97	202	101
1233	Specialty Steel, Valve Steel	Mar 92	101	40	1483	Polyethylene, Linear	Mar 76	202	101
1235	Zirconium B for Hf	Discontinued			1484a	Polyethylene, Linear	Oct 92	202	101
1242	High Temp. Alloy L-605	Nov 91	102	44	1486	Bone Meal	Dec 92	105	62
1243	Waspaloy™	Jan 89	102	50	1487	Poly (methylmethacrylate)	Jun 89	202	101



SRM	Descriptor	Cert. Date	Section Code	Page	SRM	Descriptor	Cert. Date	Section Code	Page
1488	Poly (methylmethacrylate)	Feb 88	202	101	1658a	CH4/Air, 1 µmol/mol	Jun 93	107	71
1489	Poly (methylmethacrylate)	Mar 86	202	101	1659a	CH4/Air, 10 µmol/mol	Aug 97	107	71
1491	Arom. Hydro/Hexane Toluene	Aug 89	109	75	1660a	CH4-C3H8/Air, 1 µmol/mol	Nov 95	107	71
1492	Chlor. Pesticides/Hexane	Apr 92	109	75	1661a	SO2/N2, 500 µmol/mol	Feb 97	107	71
1493	PCB Congeners	Feb 95	109	75	1662a	SO2/N2, 1000 µmol/mol	Feb 97	107	71
1496	Polyethylene Gas Pipe Resin	Sep 88	202	101	1663a	SO2/N2, 1500 µmol/mol	Feb 97	107	71
1497	Polyethylene Gas Pipe Resin	Jul 87	202	101	1664a	SO2/N2, 2500 µmol/mol	Aug 96	107	71
1507b	THC-COOH in Urine	Nov 94	105	64	1665b	C3H8/Air, 3 µmol/mol	May 97	107	71
1508a	Cocaine Metab. in Urine	In Prep	105	64	1666b	C3H8/Air, 10 µmol/mol	May 97	107	71
1511	Multi-Drugs of Abuse in Urine	Sep 94	105	65	1667b	C3H8/Air, 50 µmol/mol	Feb 97	107	71
1514	Thermal Analysis Purity Set (DSC)	Jul 84	203	104	1668b	C3H8/Air, 100 µmol/mol	Jan 97	107	71
1515	Apple Leaves	Jan 93	110	82	1669b	C3H8/Air, 500 µmol/mol	Oct 96	107	71
1543	GC/MS and LS System Performance	Aug 84	109	75	1670a	CO2/Air, 300 µmol/mol	Discontinued		
1544	Diet Composite	Feb 96	110	80	1671a	CO2/Air, 340 µmol/mol	In Prep	107	71
1547	Peach Leaves	Jan 92	110	82	1672a	CO2/Air, 350 µmol/mol	In Prep	107	71
1548a	Typical Diet	In Prep	110	80	1674b	CO2/N2, mol 7%	In Prep	107	70
1549	Non-Fat Milk Powder	Jul 85	110	79	1675b	CO2/N2, mol 14%	In Prep	107	70
1563	Coconut Oil	Nov 96	110	80	1677c	CO/N2, 10 µmol/mol	Mar 94	107	70
1566b	Oyster Tissue	In Prep	110	79	1678c	CO/N2, 50 µmol/mol	Nov 95	107	70
1567a	Wheat Flour	Sep 88	110	79	1679c	CO/N2, 100 µmol/mol	Jun 97	107	70
1568a	Rice Flour	Jan 88	110	79	1680b	CO/N2, 500 µmol/mol	Nov 95	107	70
1570a	Trace Elements in Spinach Leaves	Jul 96	110	82	1681b	CO/N2, 1000 µmol/mol	Nov 95	107	70
1573a	Tomato Leaves	Nov 95	110	82	1683b	NO/N2, 50 µmol/mol	Dec 97	107	71
1575	Pine Needles	Feb 93	110	82	1684b	NO/N2, 100 µmol/mol	In Prep	107	71
1577b	Bovine Liver	Aug 91	110	79	1685b	NO/N2, 250 µmol/mol	Nov 96	107	71
1580	Shale Oil	Nov 80	109	75	1686b	NO/N2, 500 µmol/mol	Sep 96	107	71
1581	PCBs in Oil	Jun 90	109	75	1687b	NO/N2, 1000 µmol/mol	Nov 96	107	71
1582	Petroleum Crude Oil	Jan 84	109	75	1690	Polystyrene (Particle Size)	Dec 82	301	127
1584	Phenols in Methanol	Apr 84	109	75	1691	Polystyrene (Particle Size)	May 84	301	127
1586	Isotope Label Pollutants	Oct 84	109	75	1692	Polystyrene (Particle Size)	May 91	301	127
1587	Nitro PAH in Methanol	Jun 85	109	75	1693a	SO2/N2, 50 µmol/mol	Aug 96	107	71
1588a	Organics in Cod Liver Oil	In Prep	109	75	1694a	SO2/N2, 100 µmol/mol	Aug 96	107	71
1589a	PCBs (Aroclor 1260) in Human Serum	In Prep	109	75	1696a	SO2/N2, 3500 µmol/mol	Sep 96	107	71
1595	Tripalmitin	Jul 83	105	62	1700a	CO2/N2, 10 mol (Blood Gas) %	Discontinued		
1596	Nitropyrenes in Methylene Chloride	Jul 87	109	75	1701a	CO2-5%, O2-12 mol (Blood Gas) %/N2	Discontinued		
1597	Complex PAH Mix	May 92	109	75	1702a	CO2-5%, O2-20 mol (Blood Gas) %/N2	Discontinued		
1598	Inorg. Const. in Bovine Serum	Jan 90	105	62	1703a	CO2-10%, O2-7 mol (Blood Gas) %/N2	Discontinued		
1599	2 Anticonvulsant Drugs	Aug 82	105	62	1710	Aluminum Alloy 3004	Jun 93	102	44
1614	Dioxin in Isooctane	Jul 85	109	75	1711	Aluminum Alloy 3004	Jun 93	102	44
1616a	Sulfur in Kerosene	Sep 95	108	73	1712	Aluminum Alloy 3004	Jun 93	102	44
1617a	Sulfur in Kerosene	Jul 95	108	73	1713	Aluminum Alloy 5182	Jun 93	102	44
1618	Vanadium & Nickel in Fuel Oil	May 85	108	72	1714	Aluminum Alloy 5182	Jun 93	102	44
1619a	Sulfur in Residual Fuel Oil	Apr 91	108	73	1715	Aluminum Alloy 5182	Jun 93	102	44
1620b	Sulfur in Residual Fuel Oil	Jul 90	108	73	1744	Aluminum (Freezing Point)	Nov 94	203	105
1621e	Sulfur in Residual Fuel Oil	Jul 96	108	73	1745	Indium (Freezing Point)	In Prep	203	105
1622e	Sulfur in Residual Fuel Oil	Apr 97	108	73	1746	Silver (Freezing Point)	Jul 93	203	105
1623c	Sulfur in Residual Fuel Oil	Jul 96	108	73	1747	Tin (Freezing Point)	Mar 97	203	105
1624c	Sulfur in Distillate Fuel Oil	Jun 97	108	73	1748	Zinc (Freezing Point)	Mar 97	203	105
1625	SO2 Permeation Tube-10 cm	May 95	107	71	1754	Steel (AISI 4320)	Feb 89	101	34
1626	SO2 Permeation Tube-5 cm	May 95	107	71	1761	LA Steel	Apr 92	101	36
1627	SO2 Permeation Tube-2 cm	Discontinued			1762	LA Steel	Apr 92	101	36
1629a	NO2 Permeation Device 1 cm	Discontinued			1763	LA Steel	Apr 92	101	36
1632b	Trace Elements in Coal (Bituminous)	Jun 97	108	73/74	1764	LA Steel	Feb 93	101	36
1633b	Trace Elements in Coal Fly Ash	Jun 93	108	74	1765	LA Steel	Feb 93	101	36
1634c	Trace Elements in Fuel Oil	Aug 95	108	72	1766	LA Steel	Feb 93	101	36
1635	Trace Elements in Coal (Subbituminous)	Oct 95	108	73/74	1767	LA Steel	Jun 93	101	36
1639	Halocarbons (in methanol)	Apr 83	109	75	1768	High-Purity Iron	Dec 91	101	36
1640	Natural Water	Oct 97	106	68	1772	Tool Steel (S-7)	Oct 95	101	40
1641c	Mercury in Water	Jun 93	106	68	1776	Naval Brass WK1	Jul 95	102	48
1643d	Trace Elements in Water	Jul 95	106	68	1777	Naval Brass WK2	Jul 95	102	48
1646a	Estuarine Sediment	Jan 95	106/111	68/89	1778	Naval Brass WK3	Jul 95	102	48
1647d	Priority Pollutant PAHs	Oct 96	109	75	1779	Naval Brass WK4	Jul 95	102	48
1648	Urban Particulate Matter	Aug 91	106	68/69	1780	Naval Brass WK5	Jul 95	102	48
1649a	Urban Dust/Organics	In Prep	109	75	1781	Free-Cutting Brass WN1	In Prep	102	48
1650a	Diesel Particulate Matter	In Prep	109	75	1782	Free-Cutting Brass WN2	In Prep	102	48
1655	KCl Solution Calorimetry	Mar 81	203	103	1783	Free-Cutting Brass WN3	In Prep	102	48
1656	Thianthrene Combustion Calorimetry	Jan 85	203	103	1784	Free-Cutting Brass WN4	In Prep	102	48
1657	Synthetic Refuse-Derived Fuel	May 93	203	103	1785	Free-Cutting Brass WN5	In Prep	102	48



SRM	Descriptor	Cert. Date	Section Code	Page	SRM	Descriptor	Cert. Date	Section Code	Page
1786	Cartridge Brass MH1	In Prep	102	48	1907	Microhardness, Ni-Knoop	Mar 95	302	129
1787	Cartridge Brass MH2	In Prep	102	48	1920a	Near IR Reflectance	In Prep	204	111
1788	Cartridge Brass MH3	In Prep	102	48	1921	IR Transmission Wavelength	Jun 97	204	108/110
1789	Cartridge Brass MH4	In Prep	102	48	1923	Poly(ethylene oxide)	Jun 94	202	101
1790	Cartridge Brass MH5	In Prep	102	48	1924	Poly(ethylene oxide)	Jun 94	202	101
1791	Gilding Metal M11	In Prep	102	49	1930	Glass Filters, Transmittance	Aug 94	204	109/110
1792	Gilding Metal M12	In Prep	102	49	1931	Fluorescence Spectra	Discontinued		
1793	Gilding Metal M13	In Prep	102	49	1939a	PCBs in River Sediment A	Oct 90	109	75
1794	Gilding Metal M14	In Prep	102	49	1941a	Organics in Marine Sediment	Mar 94	109	75
1795	Gilding Metal M15	In Prep	102	49	1944	NY/NJ Waterway Sediment	In Prep	109	75
1800	Organic Compounds/N2 (large)	Dec 93	107	71	1945	Organics in Whale Blubber	Jun 94	109	75
1800a	Organic Compounds/N2 (small)	Aug 97	107	71	1951a	Cholesterol in Human Serum	Jun 97	105	62/63
1804a	Tox. Organic Compounds/N2	Nov 92	107	71	1952a	Cholesterol in Human Serum	Jan 90	105	62
1810a	Linerboard	May 97	309	132	1960	Polystyrene (Particle Size)	Apr 85	301	127
1811	Aromatic Organics/N2	Discontinued			1961	Polystyrene (Particle Size)	Jan 87	301	127
1812	Aromatic Organics/N2	Discontinued			1963	Polystyrene (Particle Size)	Nov 93	301	127
1815a	n-Heptane (Fuel Rating)	Mar 85	108	73	1965	Polystyrene (on Slide)(Particle Size)	Jan 87	301	127
1816a	Isooctane (Fuel Rating)	Mar 85	108	73	1967	Platinum Thermoelement Material	Jul 90	203	106
1817c	Catalyst Package IIID	Jun 92	114	96	1968	Gallium (Melting Point)	Mar 91	203	105
1818a	Chlorine in Lub. Base Oil	Apr 94	114	95	1969	Rubidium (Triple Point)	Mar 91	203	105
1819a	Sulfur in Lub. Base Oil	Apr 94	114	95	1970	Succinonitrile (Triple Point)	Apr 91	203	105
1820	Borosilicate Glass (Refractive Index)	Sep 74	209	122	1971	Indium (Freezing Point)	Aug 90	203	105
1822	Soda-Lime Glass (Refractive Index)	Discontinued			1972	1,3-Dioxolan-2-one (Triple Point)	May 94	203	105
1826a	Soda-Lime Glass (Density)	Feb 96	209	122	1973	n-Docosane (Triple Point)	May 93	203	105
1827a	Lead Silica Glass (Density)	Feb 96	209	122	1974a	Organics in Mussel Tissue	Jul 97	109	75
1828a	Ethanol-Water Soln.	Jun 96	105	64	1976	Instrument Intensity, Alumina (XRD)	Nov 91	209	123
1829	Alcohols in Ref. Fuels	Mar 86	108	72	1978	Zirconium Oxide (Particle Size)	Oct 93	301	127
1830	Soda Lime Float (Glass)	Apr 97	112	91	1980	Electrophoretic Mobility (Positive)	Mar 94	301	128
1831	Soda Lime Sheet (Glass)	Apr 97	112	91	1982	Thermal Spray Zirconia (Particle Size)	Nov 96	301	127
1832	Thin Glass Film (XRF)	Discontinued			1990	Ruby Sphere (XRD)	In Prep	209	123
1833	Thin Glass Film (XRF)	Out of Stock			2003	First Surface Aluminum on Glass	Mar 96	204	110
1834	Fused Ore (Glass)	Jul 90	112	91	2011	First Surface, Gold on Aluminum	May 92	204	110
1835	Borate Ore	Sep 87	111	86	2015	Opal Glass (Reflectance)	May 82	204	111
1836	Nitrogen in Lub. Base Oil	Dec 89	114	95	2023	Second Surface, Aluminum on Quartz	Sep 92	204	110
1837	Methanol, Butanol (Fossil Fuel)	Mar 86	108	72	2026	First Surface, Black Glass	Oct 92	204	110
1838	Ethanol (Fossil Fuel)	Mar 86	108	72	2030a	Glass Filters, Transmittance	Oct 93	204	109/110
1839	Methanol (Fossil Fuel)	Mar 86	108	72	2031a	Metal-on-Quartz Filters, Transmittance	Jul 97	204	109/110
1842	X-Ray Stage Calib., X and Y Dimen.	Nov 93	209	123	2032	Potassium Iodide, Stray Light	Oct 79	204	109/110
1843	X-Ray Stage Calib., Z Dimen.	Nov 93	209	123	2034	Holmium Oxide Wavelength	Jul 96	204	109/110
1845	Cholesterol in Egg Powder	Apr 94	110	80	2063a	Mineral Glass (Thin Film)	Feb 93	103	53
1846	Infant Formula (milk-based)	May 96	110	80	2069b	SEM Performance	May 91	207	118
1850	Penetrant Test Block	Aug 97	303	130	2071b	Sinusoidal Roughness	In Prep	302	129
1851	Penetrant Test Block	Apr 84	303	130	2073a	Sinusoidal Roughness	Oct 95	302	129
1853	Magnetic Particle Test Ring	Apr 92	303	130	2074	Sinusoidal Roughness	Jun 92	302	129
1857	Tool Steel (Abrasive Wear)	Mar 83	302	129	2075	Sinusoidal Roughness	Jan 94	302	129
1866a	Common Commercial Asbestos	Jun 91	105	67	2083	Socketed Ball Bar	Aug 85	309	132
1867	Uncommon Commercial Asbestos	Aug 93	105	67	2084	CMM Probe Performance	Oct 96	309	132
1868	Asbestos in Building Materialsk	In Prep	105	67	2084R	CMM Probe (10-mm sphere)	Jun 96	309	132
1872	Synthetic Glass	May 84	103	53	2085	CMM Probe (25-mm sphere)	Jun 96	309	132
1873	Synthetic Glass	May 84	103	53	2090	SEM Magnification	In Prep	207	118
1876b	Chrysotile Asbestos	Jan 92	105	67	2092	Low Energy Charpy	Feb 97	309	132
1878a	Respirable $\alpha$ -Quartz	In Prep	105/209	66/123	2096	High Energy Charpy	Feb 97	309	132
1879a	Respirable Cristobalite	In Prep	105	66	2098	Super High Energy Charpy	Feb 97	309	132
1880	Portland Cement, Black	Jan 93	113	93	2108	Chromium (III) Speciation	In Prep	104	60
1881	Portland Cement, White	Jan 89	113	93	2109	Chromium (VI) Speciation	Aug 95	104	60
1882	Portland Cement, Orange	Jul 90	113	93	2134	Arsenic Depth Profile	In Prep	207	118
1883	Portland Cement, Silver	Jul 90	113	93	2135c	Nickel-Chromium Depth Profile	In Prep	207	118
1884	Portland Cement, Ivory	Sep 89	113	93	2136	Chromium/Chromium Oxide Depth Profile	Mar 91	207	118
1885	Portland Cement, Turquoise	Sep 89	113	93	2137	Boron Implant in Silicon Depth Profile	Apr 93	207	118
1886	Portland Cement, Cranberry	Sep 89	113	93	2141	Urea	Aug 70	104	56
1887	Portland Cement, Brown	Sep 89	113	93	2142	O-Bromobenzoic Acid	Sep 70	104	56
1888	Portland Cement, Purple	Sep 89	113	93	2143	p-Fluorobenzoic Acid	Jan 82	104	56
1889	Portland Cement, Gray	Sep 89	113	93	2144	m-Chlorobenzoic Acid	Apr 73	104	56
1893	Microhardness, Cu-Knoop	Mar 95	302	129	2151	Nicotinic Acid (Comb. Calorimetry)	Jan 85	203	103
1894	Microhardness, Cu-Vickers	Nov 94	302	129	2152	Urea (Comb. Calorimetry)	Jan 85	203	103
1895	Microhardness, Ni-Knoop	Mar 95	302	129	2159	LA Steel, Carbon & Sulfur only	Mar 90	101	33
1896	Microhardness, Ni-Vickers	Mar 95	302	129	2160	LA Steel, Carbon & Sulfur only	Mar 90	101	33
1899	Specific Surface Area (BET)	Jun 97	301	128	2165	LA Steel, E	Jun 89	101	33
1900	Specific Surface Area (BET)	In Prep	301	128	2166	LA Steel, F	Jun 89	101	33
1905	Microhardness, Ni-Knoop	Mar 92	302	129	2167	LA Steel, G	Jun 89	101	33
1906	Microhardness, Ni-Knoop	Nov 94	302	129					

SRM	Descriptor	Cert. Date	Section Code	Page	SRM	Descriptor	Cert. Date	Section Code	Page
2168	High Purity Iron	Dec 91	101	33	2533	Si/SiO2 Thickness-200 nm	Jul 92	207	120
2171	LA Steel, (HSLA 100)	Oct 91	101	32	2534	Si/SiO2 Thickness-25 nm	Jul 92	207	120
2172	S-7 Tool Steel	Dec 96	101	35	2535	Si/SiO2 Thickness-14 nm	Sep 94	207	120
2181	HEPES Free Acid	Mar 92	201	99	2536	Si/SiO2 Thickness-10 nm	Sep 94	207	120
2182	HEPES ate	Mar 92	201	99	2541	Silicon Resistivity	In Prep	206	117
2183	MOPSO Free Acid	Mar 92	201	99	2542	Silicon Resistivity	In Prep	206	117
2184	MOPSO Bte	Mar 92	201	99	2543	Silicon Resistivity	In Prep	206	117
2185	Pot. Hydrogen Phthalate	Nov 84	201	99	2544	Silicon Resistivity	Aug 97	206	117
2186I	Pot. Dihydro. Phosphate	May 68	201	99	2545	Silicon Resistivity	Sep 96	206	117
2186II	Disod. Hydro. Phosphate	May 68	201	99	2546	Silicon Resistivity	In Prep	206	117
2191a	Sodium Bicarbonate	Feb 94	201	99	2547	Silicon Resistivity	In Prep	206	117
2192a	Sodium Carbonate	Feb 94	201	99	2551	Oxygen in Silicon	Mar 94	207	120
2193	Calcium Carbonate	Oct 91	201	99	2556	Recycled Pellet (Autocatalyst)	Aug 93	106	69
2201	Sodium Chloride (Ion-Selective)	May 93	201	100	2557	Recycled Monolith (Autocatalyst)	Aug 93	106	69
2202	Potassium Chloride (Ion-Selective)	Mar 84	201	100	2567	Catalyst Package III E	Jul 95	114	96
2203	Potassium Fluoride (Ion-Selective)	May 73	201	100	2570	Lead Paint Film, Blank	In Prep	105	67
2220	Tin (Dif. Scan. Calor.)	May 89	203	104	2571	Lead Paint Film, Nom. 3.5 mg/cm <sup>2</sup>	In Prep	105	67
2221b	Zinc (Dif. Scan. Calor.)	In Prep	203	104	2572	Lead Paint Film, Nom. 1.6 mg/cm <sup>2</sup>	In Prep	105	67
2222	Biphenyl (Dif. Scan. Calor.)	Jun 89	203	104	2573	Lead Paint Film, Nom. 1.0 mg/cm <sup>2</sup>	In Prep	105	67
2225	Mercury (Dif. Scan Calor.)	Mar 89	203	104	2574	Lead Paint Film, Nom. 0.7 mg/cm <sup>2</sup>	In Prep	105	67
2260	Aromatic Hydrocarbons in Toluene	Jun 91	109	75	2575	Lead Paint Film, Nom. 0.3 mg/cm <sup>2</sup>	In Prep	105	67
2261	Chlorinated Pesticides in Hexane	Jan 92	109	75	2576	Lead Paint Film, High Level	In Prep	105	67
2262	Chlorinated Biphenyls in Isooctane	Mar 95	109	75	2579a	Lead Paint Films	Mar 93	105	67
2286	Ethanol in Gasoline	Feb 95	108	72	2580	Powdered Paint, Nom. 4 % Pb	Dec 96	105	67
2287	Ethanol in Gasoline	Jan 95	108	72	2581	Powdered Paint, Nom. 0.5 % Pb	Jan 97	105	67
2288	t-Amyl Methyl Ether in Gas.	Jan 95	108	72	2582	Powdered Paint, (Low Lead)	Jun 97	105	67
2289	t-Amyl Methyl Ether in Gas.	Jan 95	108	72	2583	Trace El. in Indoor Dust	Dec 96	105/106	67/68
2290	Ethyl t-Butyl Ether in Gas.	Jan 95	108	72	2584	Trace El. in Indoor Dust	In Prep	105	67
2291	Ethyl t-Butyl Ether in Gas.	Jan 95	108	72	2586	Trace El. in Soil containing Lead	In Prep	105	67
2292	Methyl t-Butyl Ether in Gas.	Jan 95	108	72	2587	Trace El. in Soil containing Lead	In Prep	105	67
2293	Methyl t-Butyl Ether in Gas.	Feb 95	108	72	2589	Powdered Paint, Nom. 10 % Pb	Jun 97	105	67
2294	Reform. Gas. (nom. 11 % MTBE)	In Prep	108	72	2607	CO2/N2O/Air, 340/0.3 µmol/mol	Discontinued		
2295	Reform. Gas. (nom. 15 % MTBE)	In Prep	108	72	2609	CO2/N2O/Air, 380/0.33 µmol/mol	Discontinued		
2296	Reform. Gas. (nom. 13 % ETBE)	In Prep	108	72	2610	CO2/N2O/Air, 380/0.33 µmol/mol	Discontinued		
2297	Reform. Gas. (nom. 10 % Ethanol)	In Prep	108	72	2612a	CO/Air, 10 µmol/mol	Jun 97	107	70
2321	Sn-Pb Alloy Coating	Jun 91	207	119	2613a	CO/Air, 20 µmol/mol	Nov 95	107	70
2350	Nickel Step Test	Aug 85	302	129	2614a	CO/Air, 45 µmol/mol	Nov 95	107	70
2381	Morphine and Codeine in Urine	Jul 93	105	65	2619a	CO2/N2, 0.5 mol %	Jun 97	107	70
2382	Morphine Glucuronide in Urine	Jul 93	105	64	2620a	CO2/N2, 1.0 mol %	Jun 97	107	70
2383	Baby Food Composite	In Prep	110	80	2621a	CO2/N2, 1.5 mol %	Aug 97	107	70
2389	Amino Acids in Hydrochloric Acid	Dec 93	105	62	2622a	CO2/N2, 2.0 mol %	Nov 95	107	70
2390	DNA Profiling	Aug 92	105	65	2623a	CO2/N2, 2.5 mol %	Jun 92	107	70
2391	PCR-Based DNA Profiling	May 95	105	65	2624a	CO2/N2, 3.0 mol %	Jul 96	107	70
C2400	HA Steel ACI (17/4 PH)	Feb 86	101	39	2625a	CO2/N2, 3.5 mol %	Aug 94	107	70
C2401	HA Steel (ACI-C-4M-Cu)	Feb 86	101	39	2626a	CO2/N2, 4.0 mol %	Apr 95	107	70
C2402	Hastelloy™ C	Feb 86	101	50	2627a	NO/N2, 5 µmol/mol	Dec 95	107	71
C2415	Battery Lead	Mar 91	102	49	2628a	NO/N2, 10 µmol/mol	Jul 95	107	71
C2416	Bullet Lead	Feb 88	102	49	2629a	NO/N2, 20 µmol/mol	Aug 97	107	71
C2417	Lead-Base Alloy	Feb 87	102	49	2630	NO/N2, 1500 µmol/mol	Apr 97	107	71
C2418	High Purity Lead	Feb 87	102	49	2631a	NO/N2, 3,000 µmol/mol	In Prep	107	71
C2423	Ductile Iron A	Nov 85	101	43	2632a	CO2/N2, 300 µmol/mol	Discontinued		
C2423a	Ductile Iron B	Nov 85	101	43	2635a	CO/N2, 25 µmol/mol	Jun 97	107	70
C2424	Ductile Iron C	Jul 85	101	43	2636a	CO/N2, 250 µmol/mol	May 97	107	70
C2424a	Ductile Iron D	Jul 85	101	43	2637a	CO/N2, 2500 µmol/mol	May 97	107	70
2430	Scheelite Ore	Jan 87	111	84	2638a	CO/N2, 5000 µmol/mol	May 97	107	70
2431	Titanium Base Alloy	Aug 93	102	51	2639a	CO/N2, 1 mol %	Sep 97	107	70
2432	Titanium Base Alloy	Aug 93	102	51	2640a	CO/N2, 2 mol %	Sep 97	107	70
2433	Titanium Base Alloy	Apr 96	102	51	2641a	CO/N2, 4 mol %	Oct 97	107	70
2517	Wavelength Reference Absorption	Oct 97	207	119	2642a	CO/N2, 8 mol %	Sep 93	107	70
2518	Polarization Mode Dispersion	In Prep	207	119	2643a	C3H8/N2, 100 µmol/mol	In Prep	107	71
2519	Wavelength Reference Absorption	In Prep	207	119	2644a	C3H8/N2, 250 µmol/mol	In Prep	107	71
2520	Optical Fiber Diameter	Jan 96	207	119	2645a	C3H8/N2, 500 µmol/mol	In Prep	107	71
2521	Optical Fiber Coating	In Prep	207	119	2646a	C3H8/N2, 1000 µmol/mol	In Prep	107	71
2522	Pin Gauge for Opt. Fib. Ferrules	May 96	207	119	2647a	C3H8/N2, 2500 µmol/mol	In Prep	107	71
2523	Optical Fiber Ferrule Geometry	Aug 97	207	119	2648a	C3H8/N2 5000 µmol/mol	In Prep	107	71
2524	Optical Fiber Chromatic Dispersion	Feb 97	207	119	2649a	C3H8/N2, 1 mol %	In Prep	107	71
2525	Optical Retardance	Apr 97	207	119	2650	C3H8/N2, 2 mol %	In Prep	107	71
2526	111P-Type Si. Sprd. Resist.	Aug 83	206	117	2651	C3H8/N2 & O2, 0.01/5 mol %	Discontinued		
2527	111N-Type Si. Sprd. Resist.	Aug 83	206	117	2652	C3H8/N2 & O2, 0.01/10 mol %	Discontinued		
2528	100P-Type Si. Sprd. Resist.	Jan 84	206	117	2656	NOx/Air, 2500 µmol/mol	In Prep	107	71
2529	100N-Type Si. Sprd. Resist.	May 84	206	117	2657a	O2/N2, 2 mol %	Jun 93	107	71
2531	Si/SiO2 Thickness-50 nm	Jul 92	207	120	2658a	O2/N2, 10 mol %	In Prep	107	71
2532	Si/SiO2 Thickness-100 nm	Jul 92	207	120	2659a	O2/N2, 21 mol %	In Prep	107	71



SRM	Descriptor	Cert. Date	Section Code	Page	SRM/RM	Descriptor	Cert. Date	Section Code	Page
2660	NOx/Air, 100 µmol/mol	In Prep	107	71	3115a	Dysprosium Standard Soln.	Apr 96	104	57
2670	Toxic Metals in Urine	Aug 94	105	64	3116a	Erbium Standard Soln.	Sep 96	104	57
2671a	Fluorine in Urine	Aug 95	105	64	3117a	Europium Standard Soln.	Oct 96	104	57
2672a	Mercury in Urine	May 83	105	64	3118a	Gadolinium Standard Soln.	Jul 96	104	57
2676d	Metals on Filter Media	Aug 92	105	66	3119a	Gallium Standard Soln.	Jun 96	104	57
2677a	Be and As on Filter Media	Feb 94	105	66	3120	Germanium Standard Soln.	Mar 97	104	57
2678	Membrane Blank Filter	May 88	105	66	3121	Gold Standard Soln.	Mar 97	104	57
2679a	Quartz on Filter Media	May 84	105	66	3122	Hafnium Standard Soln.	Jan 96	104	57
2681	Ashless Blank Filter	May 88	105	66	3123a	Holmium Standard Soln.	Aug 95	104	57
2682a	Sulfur in Coal, 0.5%, (also Heat of Comb.)	May 94	108	73	3124a	Indium Standard Soln.	Jan 97	104	57
2683b	Sulfur in Coal, 2%, (also Heat of Comb.)	Oct 97	108/203	73/103	3126a	Iron Standard Soln.	Mar 96	104	57
2684a	Sulfur in Coal, 3%, (also Heat of Comb.)	Nov 92	108/203	73/103	3127a	Lanthanum Standard Soln.	Jul 96	104	57
2685a	Sulfur in Coal, 5%, (also Heat of Comb.)	May 94	108	73	3128	Lead Standard Soln.	May 97	104	57
2689	Coal Fly Ash	Dec 93	108	74	3129a	Lithium Standard Soln.	Feb 96	104	57
2690	Coal Fly Ash	Dec 93	108	74	3130a	Lutetium Standard Soln.	Jul 95	104	57
2691	Coal Fly Ash	Dec 93	108	74	3131a	Magnesium Standard Soln.	Jan 97	104	57
2692a	Sulfur in Coal, 1%	Sep 94	108/203	73/103	3132	Manganese Standard Soln.	Oct 95	104	57
2694b	Simulated Rainwater	In Prep	106	68	3133	Mercury Standard Soln.	Jan 97	104	57
2695	Fluoride in Vegetation	Aug 91	110	82	3134	Molybdenum Standard Soln.	May 96	104	57
2704a	Buffalo River Sediment	In Prep	106/111	68/89	3135a	Neodymium Standard Soln.	Feb 96	104	57
2709	San Joaquin Soil	Aug 93	106/111	68/89	3136	Nickel Standard Soln.	Jan 97	104	57
2710	Montana I Soil	Oct 97	106/111	68/89	3137	Niobium Standard Soln.	Mar 97	104	57
2711	Montana II Soil	Aug 93	106/111	68/89	3138	Palladium Standard Soln.	Dec 96	104	57
2712	Lead in Ref. Fuel	Sep 88	108	72	3139a	Phosphorus Standard Soln.	Aug 96	104	57
2713	Lead in Ref. Fuel	Sep 88	108	72	3140	Platinum Standard Soln.	Nov 97	104	57
2714	Lead in Ref. Fuel	Sep 88	108	72	3141a	Potassium Standard Soln.	Mar 97	104	57
2715	Lead in Ref. Fuel	Sep 88	108	72	3142a	Praseodymium Standard Soln.	Feb 96	104	57
2717	Sulfur in Residual Fuel Oil	Oct 90	108	73	3143	Rhenium Standard Soln.	Mar 97	104	57
2718	Trace El. in Green Petroleum Coke	In Prep	108	73/74	3144	Rhodium Standard Soln.	Aug 95	104	57
2719	Trace El. in Calcined Petroleum Coke	In Prep	108	73/74	3145a	Rubidium Standard Soln.	Aug 95	104	57
2723	Sulfur in Diesel Fuel Oil	In Prep	108	73	3147a	Samarium Standard Soln.	Aug 95	104	58
2724a	Sulfur in Diesel Fuel Oil, 0.04%	Aug 95	108	73	3148a	Scandium Standard Soln.	Jul 95	104	58
2727	IM Gases, 3 Components	Discontinued			3149	Selenium Standard Soln.	Apr 97	104	58
2728	IM Gases, 3 Components	Discontinued			3150	Silicon Standard Soln.	May 97	104	58
2730	H2S/N2, 5 µmol/mol	Apr 95	107	71	3151	Silver Standard Soln.	May 96	104	58
2731	H2S/N2, 20 µmol/mol	In Prep	107	71	3152a	Sodium Standard Soln.	May 97	104	58
2735	NO/N2, 800 µmol/mol	In Prep	107	71	3153a	Strontium Standard Soln.	Jan 97	104	58
2736	NO/N2, 2000 µmol/mol	Sep 90	107	71	3154	Sulfur Standard Soln.	Nov 95	104	58
2740	CO/N2, 10 mol %	Sep 90	107	70	3155	Tantalum Standard Soln.	Mar 96	104	58
2741	CO/N2, 13 mol %	Sep 90	107	70	3156	Tellurium Standard Soln.	May 95	104	58
2745	CO2/N2, 16 mol %	Jul 96	107	70	3157a	Terbium Standard Soln.	Aug 95	104	58
2750	CH4/Air, 50 µmol/mol	May 97	107	71	3158	Thallium Standard Soln.	May 97	104	58
2751	CH4/Air, 100 µmol/mol	May 97	107	71	3159	Thorium Standard Soln.	Oct 96	104	58
2764	C3H8/Air, 0.25 µmol/mol	Nov 95	107	71	3160a	Thulium Standard Soln.	Jul 95	104	58
2775	Foundry Coke	May 97	108	73	3161a	Tin Standard Soln.	Feb 97	104	58
2776	Furnace Coke	In Prep	108	73	3162a	Titanium Standard Soln.	Mar 97	104	58
2781	Domestic Sludge	Oct 96	106/111	68/89	3163	Tungsten Standard Soln.	May 97	104	58
2782	Industrial Sludge	In Prep	106/111	68/89	3164	Uranium Standard Soln.	Mar 97	104	58
2798	Microhardness, Ni Vickers	Aug 93	302	129	3165	Vanadium Standard Soln.	Apr 97	104	58
2806	Medium Test Dust in Hydraulic Fluid	Dec 97	301	128	3166a	Ytterbium Standard Soln.	Jul 95	104	58
2830	Microhardness, Ceramic-Knoop	Feb 96	302	129	3167a	Yttrium Standard Soln.	Aug 95	104	58
2831	Microhardness, Ceramic-Vickers	In Prep	302	129	3168a	Zinc Standard Soln.	Jun 96	104	58
2910	Calcium Hydroxyapatite	Nov 97	105/209	65/123	3169	Zirconium Standard Soln.	Jul 97	104	58
2974	Organics in Freeze-Dried Mussel Tissue	Jul 97	109	75	3171a	Multielement Mix A1 Standard Soln.	In Prep	104	58
2975	Diesel Particulate Matter	In Prep	109	75	3172a	Multielement Mix B1 Standard Soln.	Apr 96	104	59
3087a	Metals on Filter Media	Jan 97	105	66	3179	Multielement Mixes I, II, III Standard Solns.	Sep 97	104	59
3101a	Aluminum Standard Soln.	May 96	104	57	3181	Sulfate Anion Soln.	Sep 97	104	60
3102a	Antimony Standard Soln.	Apr 97	104	57	3182	Chloride Anion Soln.	Aug 97	104	60
3103a	Arsenic Standard Soln.	Mar 97	104	57	3183	Fluoride Anion Soln.	Aug 97	104	60
3104a	Barium Standard Soln.	Sep 97	104	57	3184	Bromide Anion Soln.	Dec 97	104	60
3105a	Beryllium Standard Soln.	Oct 96	104	57	3185	Nitrate Anion Soln.	Oct 96	104	60
3106	Bismuth Standard Soln.	Aug 96	104	57	3186	Phosphate Anion Soln.	Oct 97	104	60
3107	Boron Standard Soln.	Jan 97	104	57	3190	Electro. Conductivity (25 µS/cm)	Feb 97	201	100
3108	Cadmium Standard Soln.	Jan 97	104	57	3191	Electro. Conductivity (100 µS/cm)	Sep 97	201	100
3109a	Calcium Standard Soln.	Nov 96	104	57	3192	Electro. Conductivity (500 µS/cm)	Apr 97	201	100
3110	Cerium Standard Soln.	Feb 95	104	57	3193	Electro. Conductivity (1000 µS/cm)	Sep 97	201	100
3111a	Cesium Standard Soln.	Feb 95	104	57	3194	Electro. Conductivity (10,000 µS/cm)	In Prep	201	100
3112a	Chromium Standard Soln.	Oct 96	104	57	3195	Electro. Conductivity (100,000 µS/cm)	Apr 97	201	100
3113	Cobalt Standard Soln.	May 96	104	57	3196	Electro. Conductivity (20,000 µS/cm)	In Prep	201	100
3114	Copper Standard Soln.	Apr 97	104	57	3198	Electro. Conductivity (5 µS/cm)	Apr 97	201	100



SRM/RM	Descriptor	Cert. Date	Section Code	Page	RM	Descriptor	Cert. Date	Section Code	Page
3199	Electro. Conductivity (15 $\mu$ S/cm)	In Prep	201	100	4926D	Hydrogen-3 Water Soln.	Aug 89	205	113
4200B	Cesium/Barium-137m	Dec 79	205	115	4927E	Hydrogen-3 Soln.	Jan 89	205	113
4201B	Niobium-94	Jun 70	205	115	4929D	Iron-55 Soln.	Feb 86	205	113
4203D	Cobalt-60	Jun 95	205	115	4943	Chlorine-36 Soln.	Dec 84	205	113
4207B	Cesium-137/Barium-137m	Mar 87	205	115	4947C	Hydrogen-3 Toluene Soln.	May 87	205	113
4222C	Carbon-14 (as hexadene)	Jan 91	205	113	4949C	Iodine-129 Soln.	Feb 82	205	113
4226C	Nickel-63 Soln.	Dec 95	205	113	4952C	Radium-226 Blank Soln.	Jan 92	205	113
4233D	Cesium-137 Soln.	Jul 96	205	113	4965	Radium-226 Soln.	Jan 92	205	113
4234A	Strontium-90 Soln.	May 95	205	113	4966	Radium-226 Soln.	Jan 92	205	113
4241C	Barium-133	In Prep	205	115	4967	Radium-226 Soln.	Jan 92	205	113
4251C	Barium-133 Soln.	Oct 94	205	113	4968	Radium-226/Radon-222 Eman.	Aug 94	205	115
4275C	Mixed Radionuclide	Sep 88	205	115	4990C	Oxalic Acid (C-14 Dating)	Jul 83	205	114
4276C	Mixed Radionuclide Soln.	Sep 88	205	113	8030	BCR No 60 Aquatic Plant	Jun 82	110	82
4288A	Technetium-99 Soln.	Oct 96	205	113	8031	BCR No 61 Aquatic Mass	Jun 82	110	82
4320A	Curium-244 Soln.	Feb 96	205	113	8036	BCR No 150 Spiked Skim Milk	Dec 85	110	80
4321B	Natural Uranium Soln.	Feb 92	205	113	8050-8052	RCM Fine Gold	Aug 95	104	54/55
4322B	Americium-241 Soln.	Oct 91	205	113	8053-8055	RCM Fine Gold	Oct 95	104	54/55
4323A	Plutonium-238 Soln.	Feb 95	205	113	8056-8058	RCM Fine Gold	Oct 95	104	54/55
4324A	Uranium-232 Soln.	Jun 95	205	113	8059-8061	RCM Fine Gold	Oct 95	104	54/55
4325	Beryllium-10/Beryllium-9	May 90	205	115	8062-8064	RCM Fine Gold	Oct 95	104	54/55
4326	Polonium-209 Soln.	Jan 95	205	113	8065-8067	RCM Fine Gold	Sep 95	104	54/55
4328B	Thorium-229 Soln.	Jul 96	205	113	8068-8070	RCM Gold Bullion	Oct 95	104	54/55
4329	Curium-243 Soln.	Mar 85	205	113	8071-8073	RCM Gold Bullion	Oct 95	104	54/55
4330A	Plutonium-239 Soln.	Jan 96	205	113	8074-8076	RCM Gold Bullion	Oct 95	104	54/55
4332D	Americium-243 Soln.	Sep 95	205	113	8077-8079	RCM Gold Bullion	Oct 95	104	54/55
4334F	Plutonium-242 Soln.	Mar 96	205	113	8080-8082	RCM Gold Bullion	Oct 95	104	54/55
4338A	Plutonium-240 Soln.	Aug 96	205	113	8090	SEM Magnification Calibration	Aug 95	207	118
4339A	Radium-228 Soln.	Aug 95	205	113	8101a	Auto. Computer Time Service	Discontinued		
4340A	Plutonium-241 Soln.	May 96	205	113	8162	RCM Fine Silver	Oct 95	104	54/55
4341	Neptunium-237 Soln.	Jan 93	205	113	8165	RCM Fine Silver	Oct 95	104	54/55
4350B	River Sediment (Radioactivity)	Sep 81	205	116	8168	RCM Fine Silver	Sep 95	104	54/55
4351	Human Lung (Radioactivity)	Oct 82	205	116	8171	RCM Fine Silver	Oct 95	104	54/55
4352	Human Liver (Radioactivity)	Jun 82	205	116	8384	TBBS (powder)	Discontinued		
4353A	Rocky Flats Soil No. II (Radioactivity)	In Prep	205	116	8406	Tennessee River Sediment	Discontinued		
4354	Lake Sediment (Radioactivity)	Feb 86	205	116	8407	Tennessee River Sediment	Jun 90	106/111	68/89
4355	Peruvian Soil (Radioactivity)	Jun 82	205	116	8411	Mixed Asbestos Research Filter	Nov 88	105	67
4356	Ashed Bone (Radioactivity)	In Prep	205	116	8412	Corn Stalk (Zea Mays)	Sep 93	110	80/182
4357	Ocean Sediment (Radioactivity)	Mar 97	205	116	8413	Corn Kernel (Zea Mays)	Sep 93	110	80/182
4358	Ocean Shellfish (Radioactivity)	In Prep	205	116	8414	Bovine Muscle Powder (Beef)	Sep 93	110	80
4361C	Hydrogen-3 Soln.	In Prep	205	113	8415	Whole Egg Powder	Sep 93	110	80
4370C	Europium-152 Soln.	Mar 87	205	113	8416	Micro. Cellulose	Sep 93	110	80
4400N	Chromium-51 Soln.	Discontinued			8418	Wheat Gluten	Sep 93	110	80
4401W	Iodine-131 Soln.	FC	205	114	8420	Electrolytic Iron	May 84	203/206	107/117
4402C	Tin-113/Indium-113m Soln.	Discontinued			8421	Electrolytic Iron	May 84	203/206	107/117
4403B	Strontium-85 Soln.	Discontinued			8424	Graphite	May 84	203	107
4404S	Thallium-201 Soln.	FC	205	114	8425	Graphite	May 84	203	107
4405B	Gold-198 Soln.	Discontinued			8426	Graphite	May 84	203	107
4406O	Phosphorus-32 Soln.	FC	205	114	8432	Corn Starch	Sep 93	110	81
4407U	Iodine-125 Soln.	FC	205	114	8433	Corn Bran	Sep 93	110	81
4408F	Cobalt-57 Soln.	FC	205	114	8435	Whole Milk Powder	Sep 93	110	80/81
4409D	Selenium-75 Soln.	Discontinued			8436	Durum Wheat Flour	Sep 93	110	81
4410V	Technetium-99m Soln.	FC	205	114	8437	Hard Red Spring Wheat Flour	Sep 93	110	81
4411B	Iron-59 Soln.	Discontinued			8438	Soft Winter Wheat Flour	Sep 93	110	81
4412V	Molybdenum-99/Technetium-99 Soln.	FC	205	114	8441	Wheat Hardness	Dec 97	110	83
4414C	Iodine-123 Soln.	Discontinued			8442	LC Selectivity	Discontinued		
4415U	Xenon-133 Gas	FC	205	114	8443	GC/MS System Performance	Aug 84	109	75
4416Q	Gallium-67 Soln.	FC	205	114	8444	Cotinine in Freeze-dried Urine	Feb 89	105	64
4417Q	Indium-111 Soln.	FC	205	114	8448	Drugs of Abuse in Hair Segments	Mar 92	105	65
4418A	Mercury-203 Soln.	Discontinued			8449	Drugs of Abuse in Powdered Hair	Feb 92	105	65
4419C	Ytterbium-169 Soln.	Discontinued			8450	Polyethylene Piping, 1.3 cm	Jan 88	202	102
4420B	Lead-203 Soln.	Discontinued			8451	Polyethylene Piping, 4.8 cm	Jan 88	202	102
4421A	Gold-195 Soln.	Discontinued			8452	Polyethylene Piping, 10.2 cm	Jan 88	202	102
4424A	Sulfur-35 Soln.	Discontinued			8453	Poly Socket T Joint	Jan 88	202	102
4425B	Samarium-153 Soln.	FC	205	114	8454	Poly Butt T Joint	Jan 88	202	102
4426A	Strontium-89 Soln.	FC	205	114	8455	Pyrite Ore	Apr 91	111	86
4427B	Yttrium-90 Soln.	FC	205	114	8458	Artificial Flaw for Eddy Current NDF	Aug 91	303	130
4904NG	Americium-241	Discontinued			8466	Y-HCH (Lindane) (neat)	Apr 92	109	75
4904SG	Americium-241	Discontinued			8467	4,4'-DDE (neat)	Apr 92	109	75
4906C	Plutonium-238	Nov 87	205	114	8469	Pesticide, 4,4'-DDT (neat)	Apr 92	109	75
4906HC	Plutonium-238	Nov 87	205	114	8486	Portland Cement Clinker	May 89	113	94
4915E	Cobalt-60 Soln.	Feb 84	205	113	8487	Portland Cement Clinker	May 89	113	94
4919H	Strontium-90 Soln.	May 88	205	113	8488	Portland Cement Clinker	May 89	113	94

SRM/RM	Descriptor	Cert. Date	Section Code	Page	RM	Descriptor	Cert. Date	Section Code	Page
8495	Northern Softwood	N/A	209	133					
8496	Eucalyptus Hardwood	N/A	209	133					
8501	Catalyst Package III E	Jul 91	114	96					
8505	Vanadium in Crude Oil	Oct 83	108	72					
8506	Moisture in Transformer Oil	Jun 97	108	73					
8507	Moisture in Mineral Oil	Jun 97	108	73					
8509	Moisture in Methanol, 93 mg/kg	Jun 97	108	73					
8510	Moisture in Methanol, 325 mg/kg	Jun 97	108	73					
8517	N-Decane Flashpoint	Oct 95	203	103					
8518	N-Undecane Flashpoint	Oct 95	203	103					
8519	N-Tetradecane Flashpoint	Oct 95	203	103					
8520	N-Hexadecane Flashpoint	Oct 95	203	103					
8535	VSMOW-Water	Oct 92	104	61					
8536	GISP-Water	Oct 92	104	61					
8537	SLAP-Water	Oct 92	104	61					
8538	NBS30-Biotite	Jun 92	104	61					
8539	NBS22-Oil	Jun 92	104	61					
8540	PEFI-Polyethylene Foil	Jun 92	104	61					
8541	USGS24-Graphite	Jun 92	104	61					
8542	Sucrose ANU-Sucrose	Jun 92	104	61					
8543	NBS18-Carbonatite	Jun 92	104	61					
8544	NBS19-Limestone	Jun 92	104	61					
8545	LSVEC-Lithium Carbonate	Jun 92	104	61					
8546	NBS28-Silica Sand	Jun 92	104	61					
8547	IAEAN1-Ammonium Sulfate	Feb 93	104	61					
8548	IAEAN2-Ammonium Sulfate	Feb 93	104	61					
8549	IAEAN3-Potassium Nitrate	Feb 93	104	61					
8550	USGS 25-Ammonium Sulfate	Feb 93	104	61					
8551	USGS 26-Ammonium Sulfate	Feb 93	104	61					
8552	NSVEC-Gaseous Nitrogen	Feb 93	104	61					
8553	Soufre De Lacq-Element.-Sulf.	Jun 92	104	61					
8554	NZ1-Silver Sulfide	Jun 92	104	61					
8555	NZ2-Silver Sulfide	Jun 92	104	61					
8556	NBS123-Sphalerite	Jun 92	104	61					
8557	NBS127-Barium Sulfate	Jun 92	104	61					
8558	USGS32-Potassium Nitrate	Feb 93	104	61					
8570	Calcined Kaolin (Sur. Area)	Sep 94	301	128					
8571	Alumina (Sur. Area)	Sep 94	301	128					
8572	Silica-Alumina (Sur. Area)	Sep 94	301	128					
8590	High Sulfur Gas Oil Feed	N/A	114	95					
8600	Chinese Copper Ore	Jun 92	111	84					
8601	Chinese Copper Ore	Jun 92	111	84					
8603	Chinese Lead Ore	Jun 92	111	84					
8604	Chinese Zinc Ore	Jun 92	111	84					
8605	Chinese Molybdenum Ore	Jun 92	111	84					
8606	Chinese Molybdenum Ore	Jun 92	111	84					
8607	Chinese Tungsten Ore	Jun 92	111	84					
8608	Chinese Tungsten Ore	Jun 92	111	84					
8631	Medium Test Dust (MTD)	In Prep	301	128					
8632	Ultrafine Test Dust (ULTD)	In Prep	301	128					
8680	Paint on Fiberboard	Feb 97	105	67					
8754	ICTAC Polystyrene DTA	N/A	203	104					
8757	ICTAC Set DTA		Discontinued						
8758	ICTAC Set DTA		Discontinued						
8759	ICTAC Set DTA	N/A	203	104					
8760	ICTAC Set DTA	N/A	203	104					
8761	ICTAC Thermogravimetry		Discontinued						
N/A	- Certificate does not exist.								
FC	- New certificate is issued with each new subplot prepared.								
In Prep	- New or Renewal SRM being prepared.								

---

## *SRM/RM Indexes—(Continued)*

### *Numerical MSDS Index*





## Numerical MSDS Index

The following is a listing of Material Safety Data Sheets (MSDSs) for compounds that have been determined to be hazardous by the National Institute of Standards and Technology. Under current OSHA regulations, there is no expiration date associated with a MSDS. Materials **not** considered to require an MSDS, fall into one of the following categories:

1. The SRM is an article, as the word is defined in paragraph (c) of section 1910.1200 of the title 29 of the Code of Federal Regulations, which does not release or otherwise result in exposure to a hazardous chemical, under normal conditions and use.
2. The SRM has been determined to be non-hazardous by NIST under paragraph (d) of section 1910.1200 title 29 of the Code of Federal Regulations. The SRM will not release or otherwise result in exposure to a hazardous chemical under normal conditions of use.
3. The SRM is a pesticide or hazardous waste labeled according to regulations issued by the U.S. Environmental Protection Agency (EPA).
4. The SRM is a food, food additive, drug or clinical material labeled according to regulations issued by the Food and Drug Administration (FDA).
5. The SRM is a wine labeled according to regulations issued by the Bureau of Alcohol, Tobacco and Firearms (ATF).
6. The SRM is a tobacco product, wood or wood product which is exempted by paragraph (b)(5)(ii) and (iii) of section 1910.1200 of title 29 of the Code of Federal Regulations from the provisions of that section.
7. The SRM was obsoleted before MSDS regulations came into effect.

Additional information about MSDSs can be obtained by contacting the SRM MSDS Coordinator at:

Telephone: (301) 975-6439

Fax: (301) 926-4751

E-Mail: [srmmsds@nist.gov](mailto:srmmsds@nist.gov)

SRM	Descriptor	MSDS Date	Page	SRM	Descriptor	MSDS Date	Page
27f	Iron Ore, Sibley	Sep 94	85	351	Sodium Carbonate	Sep 96	56
39i	Benzoic Acid (Combustion Cal.)	Mar 92	103	607	Potassium Feldspar	Jul 94	92
40h	Sodium Oxalate (Reductometric)	May 90	56	640c	Line Position, Silicon (XRD)	In Prep	123
58a	Ferrosilicon (73% Si)	Nov 93	41	659	Silicon Nitride, Particle Size	Apr 92	127
59a	Ferrosilicon	Nov 93	41	660	Line Profile, Lab6 (XRD)	Nov 92	123
76a	Burnt Refractory (Al2O3-40%)	Sep 94	88	671	Nickel Oxide 1	Dec 91	51
77a	Burnt Refractory (Al2O3-60%)	Sep 94	88	672	Nickel Oxide 2	Dec 91	51
78a	Burnt Refractory (Al2O3-70%)	Sep 94	88	673	Nickel Oxide 3	Dec 91	51
81a	Glass Sand	Mar 95	88/91	674a	Quant. Analysis, Set (XRD)	Oct 93	123
83d	Arsenic Trioxide (Reductometric)	Dec 91	56	675	Line Position, Mica (XRD)	Jan 93	123
84j	Potassium Hydrogen Phthalate	Mar 92	56	676	Quantitative Analysis, Alumina (XRD)	Nov 92	123
114p	Portland Cement	Apr 94	127	699	Alumina (Reduction Grade)	Nov 93	86
127b	Solder, 40Sn-60Pb	Feb 94	49	742	Alumina (Reference Point)	Jul 92	105
136e	Potassium Dichromate (oxidimetric)	May 93	56	869	LC Column Selectivity	May 90	75
141d	Acetanilide	In Prep	56	887	Cemented Carbide	Aug 95	90
142	Anisic Acid	May 80	56	888	Cemented Carbide	Aug 95	90
148	Nicotine Acid	Jan 87	56	889	Cemented Carbide	Aug 95	90
154b	Titanium Dioxide	Jan 93	88	912a	Urea	Jun 96	62
165a	Glass Sand (Low Iron)	Sep 94	88/91	915a	Calcium Carbonate (Clinical)	Dec 91	62
181	Lithium Ore (Spodumene)	Feb 93	84	928	Lead Nitrate (Clinical)	Mar 89	62
182	Lithium Ore (Petalite)	Feb 93	84	931e	Liquid Absorbance	May 97	108/110
183	Lithium Ore (Lepidolite)	Feb 93	84	934	Clinical Thermometer	Mar 93	106
185g	Potassium Hydrogen Phthalate, pH	Mar 92	99	935a	Potassium Dichromate, UV Absorbance	Sep 94	108/110
187c	Sodium Tetraborate (Borax), pH	Oct 88	99	951	Boric Acid, Assay and Isotopic	Apr 92	56/60
189a	Potassium Tetroxalate	Jun 96	99	952	Boric Acid 95% enr. 10B	Apr 92	60
192b	Sodium Carbonate	In Prep	99	979	Chromium (Isotopic)	Dec 85	60
193	Potassium Nitrate	Sep 85	83	980	Magnesium (Isotopic)	Dec 85	60
194	Ammonium Dihydrogen Phosphate	Sep 86	83	981	Natural Lead (Isotopic)	Jan 92	60
198	Silica Brick	May 94	88	982	Equal Atom Lead (Isotopic)	Jan 92	60
199	Silica Brick	May 94	88	983	Radiogenic Lead (Isotopic)	Jan 92	60
276b	Tungsten Carbide	Oct 83	90	984	Rubidium Assay (Isotopic)	Dec 85	60
350a	Benzoic Acid	Mar 92	56				

SRM	Descriptor	MSDS Date	Page	SRM	Descriptor	MSDS Date	Page
986	Nickel (Isotopic)	Oct 94	60	1669b	C3H8/Air, 500 µmol/mol	Oct 96	71
987	Strontium Assay and Isotopic	Aug 94	56/60	1674b	CO2/N2, mol 7%	Sep 94	70
989	Rhenium Assay (Isotopic)	Apr 94	60	1675b	CO2/N2, mol 14%	Sep 94	70
991	Lead-206 Spike Assay and Isotopic	Oct 94	60	1677c	CO/N2, 10 µmol/mol	Jan 91	70
994	Gallium (Isotopic)	Sep 79	60	1678c	CO/N2, 50 µmol/mol	Jan 91	70
997	Thallium (Isotopic)	Oct 94	60	1679c	CO/N2, 100 µmol/mol	Jan 91	70
1007b	Plastic, (Smoke Density)	Sep 94	131	1680b	CO/N2, 500 µmol/mol	Jan 91	70
1051b	Barium (Metallo-Organic)	Feb 81	95	1681b	CO/N2, 1000 µmol/mol	Jan 91	70
1052b	Vanadium (Metallo-Organic)	Jul 80	95	1683b	NO/N2, 50 µmol/mol	Dec 90	71
1053a	Cadmium (Metallo-Organic)	May 81	95	1684b	NO/N2, 100 µmol/mol	Sep 94	71
1057b	Tin (Metallo-Organic)	May 81	95	1685b	NO/N2, 250 µmol/mol	Dec 90	71
1059c	Lead (Metallo-Organic)	Jun 84	95	1686b	NO/N2, 500 µmol/mol	Sep 96	71
1060a	Lithium (Metallo-Organic)	Sep 86	95	1687b	NO/N2, 1000 µmol/mol	Nov 96	71
1065b	Nickel (Metallo-Organic)	Feb 83	95	1693a	SO2/N2, 50 µmol/mol	Sep 94	71
1066a	Silicon (Metallo-Organic)	May 81	95	1694a	SO2/N2, 100 µmol/mol	Sep 94	71
1069b	Sodium (Metallo-Organic)	Aug 85	95	1696a	SO2/N2, 3500 µmol/mol	Sep 96	71
1073b	Zinc (Metallo-Organic)	Jun 84	95	1800	Organic Compounds/N2	Feb 94	71
1075a	Aluminum (Metallo-Organic)	Feb 81	95	1804a	Tox. Organic Compounds/N2	Oct 92	71
1077a	Silver (Metallo-Organic)	Feb 83	95	1815a	n-Heptane (Fuel Rating)	May 93	73
1079b	Iron (Metallo-Organic)	Apr 85	95	1816a	Isooctane (Fuel Rating)	Jan 93	73
1080a	Copper (Metallo-Organics)	Feb 83	95	1817c	Catalyst Package IIID	Mar 90	96
1083	Wear Metals (Base Oil)	Mar 92	96	1818a	Chlorine in Lub. Base Oil	Apr 94	95
1084a	Wear Metals	Mar 92	96	1819a	Sulfur in Lub. Base Oil	Apr 94	95
1085a	Wear Metals	Mar 92	96	1828a	Ethanol-Water Soln.	Jun 96	64
1129	Solder 63Sn-37Pb	Dec 93	49	1829	Alcohols in Ref. Fuels	Aug 93	72
1131	Solder 60Pb-40Sn	Feb 94	49	1836	Nitrogen in Lub. Base Oil	Oct 92	95
1400	Bone Ash	Jun 93	62	1837	Methanol, Butanol (Fossil Fuel)	Jun 93	72
1450b	Fibrous Glass Board	Apr 92	107	1838	Ethanol (Fossil Fuel)	May 93	72
1491	Arom. Hydro/Hexane Toluene	Aug 89	75	1839	Methanol (Fossil Fuel)	Jun 93	72
1492	Chlor. Pesticides/Hexane	Sep 89	75	1866a	Common Commercial Asbestos	Jan 94	67
1493	PCB Congeners	Dec 94	75	1867	Uncommon Commercial Asbestos	Aug 93	67
1514	Thermal Analysis Purity Set (DSC)	May 92	104	1879a	Respirable Cristobalite	In Prep	66
1543	GC/MS and LS System Performance	Mar 92	75	1880	Portland Cement, Black	Jan 92	93
1581	PCBs in Oil	Dec 91	75	1881	Portland Cement, White	Apr 91	93
1584	Phenols in Methanol	Mar 91	75	1882	Portland Cement, Orange	Jan 91	93
1586	Isotope Label Pollutants	Jun 93	75	1883	Portland Cement, Silver	Apr 91	93
1587	Nitro PAH in Methanol	Sep 93	75	1884	Portland Cement, Ivory	Apr 91	93
1597	Complex PAH Mix	Feb 94	75	1885	Portland Cement, Turquoise	Apr 91	93
1614	Dioxin in Isooctane	Aug 93	75	1886	Portland Cement, Cranberry	Apr 91	93
1616a	Sulfur in Kerosene	Aug 95	73	1887	Portland Cement, Brown	Apr 91	93
1617a	Sulfur in Kerosene	Aug 95	73	1888	Portland Cement, Purple	Apr 91	93
1618	Vanadium & Nickel in Fuel Oil	Apr 91	72	1889	Portland Cement, Gray	Apr 91	93
1619a	Sulfur in Residual Fuel Oil	Apr 91	73	1920a	IR Reflectance	In Prep	111
1620b	Sulfur in Residual Fuel Oil	Sep 90	73	1924	Poly(ethylene Oxide)	Aug 94	101
1621e	Sulfur in Residual Fuel Oil	Jul 96	73	1941a	Organics in Marine Sediment	Aug 92	75
1622d	Sulfur in Residual Fuel Oil	Nov 93	73	1945	Organics in Whale Blubber	July 94	75
1623c	Sulfur in Residual Fuel Oil	Jul 96	73	1970	Succinonitrile (Triple Point)	Nov 92	105
1624c	Sulfur in Distillate Fuel Oil	May 97	73	1972	1,3-Dioxolan-2-one (Triple Point)	Aug 94	105
1625	SO2 Permeation Tube-10 cm	May 95	71	1973	n-Docosane (Triple Point)	Aug 94	105
1626	SO2 Permeation Tube-5 cm	May 95	71	1978	Zirconium Oxide (Particle Size)	Oct 93	127
1632b	Trace Elements in Coal (Bituminous)	Feb 93	73/74	2034	Holmium Oxide Wavelength	Feb 92	109/110
1633b	Trace Elements in Coal Fly Ash	Sep 95	74	2108	Chromium (III) Speciation	Jun 93	60
1634c	Trace Elements in Fuel Oil	Jul 95	72	2109	Chromium (VI) Speciation	Aug 92	60
1635	Trace Elements in Coal (Subbituminous)	Sep 94	73/74	2141	Urea	Jul 96	56
1639	Halocarbons (in methanol)	May 93	75	2142	0-Bromobenzoic Acid	Aug 85	56
1641c	Mercury in Water	Dec 89	68	2143	p-Fluorobenzoic Acid	Mar 88	56
1643d	Trace Elements in Water	In Prep	68	2144	m-Chlorobenzoic Acid	May 91	56
1647c	Priority Pollutant PAHs	Apr 93	75	2152	Urea (Comb. Calorimetry)	Jul 96	103
1658a	CH4/Air, 1 µmol/mol	Jan 91	71	2185	Pot. Hydrogen Phthalate	Mar 92	99
1659a	CH4/Air, 10 µmol/mol	Jan 91	71	2193	Calcium Carbonate	Dec 91	99
1660a	CH4-C3H8/Air, 1 µmol/mol	Aug 95	71	2203	Potassium Fluoride (Ion-Selective)	May 82	100
1661a	SO2/N2, 500 µmol/mol	Jan 97	71	2222	Biphenyl (Dif. Scan. Calor.)	Mar 93	104
1662a	SO2/N2, 1000 µmol/mol	Jan 97	71	2225	Mercury (Dif. Scan. Calor.)	Mar 93	104
1663a	SO2/N2, 1500 µmol/mol	Jan 97	71	2260	Aromatic Hydrocarbons in Toluene	Feb 92	75
1664a	SO2/N2, 2500 µmol/mol	Jan 97	71	2261	Chlorinated Pesticides in Hexane	Feb 92	75
1665b	C3H8/Air, 3 µmol/mol	May 97	71	2262	Chlorinated Bephenyls in Isooctane	Mar 95	75
1666b	C3H8/Air, 10 µmol/mol	May 97	71	2286	Ethanol in Gasoline	Jan 95	72
1667b	C3H8/Air, 50 µmol/mol	Feb 97	71	2287	Ethanol in Gasoline	Jan 95	72
1668b	C3H8/Air, 100 µmol/mol	Jan 97	71	2288	t-Amyl Methyl Ether in Gasoline	Jan 95	72
				2289	t-Amyl Methyl Ether in Gasoline	Jan 95	72



SRM	Descriptor	MSDS Date	Page	SRM	Descriptor	MSDS Date	Page
2290	Ethyl t-Butyl Ether in Gasoline	Jan 95	72	3105a	Beryllium Standard Soln.	Jan 94	57
2291	Ethyl t-Butyl Ether in Gasoline	Jan 95	72	3106	Bismuth Standard Soln.	Feb 97	57
2292	Methyl t-Butyl Ether in Gasoline	Jan 95	72	3108	Cadmium Standard Soln.	May 90	57
2293	Methyl t-Butyl Ether in Gasoline	Jan 95	72	3109a	Calcium Standard Soln.	May 93	57
2389	Amino Acids in Hydrochloric Acid	Jan 94	62	3110	Cerium Standard Soln.	Apr 89	57
2579	Lead Paint Film	Oct 92	67	3111a	Cesium Standard Soln.	Jul 93	57
2580	Powdered Paint	Jan 97	67	3112a	Chromium Standard Soln.	May 93	57
2581	Powdered Paint	Jan 97	67	3113	Cobalt Standard Soln.	Mar 89	57
2582	Powdered Paint, (Low Lead)	Jan 97	67	3114	Copper Standard Soln.	May 90	57
2583	Trace Elements in Indoor Dust	Jan 97	67/68	3115a	Dysprosium Standard Soln.	Mar 94	57
2589	Powdered Paint	Apr 96	67	3116a	Erbium Standard Soln.	Jan 94	57
2612a	CO/Air, 10 µmol/mol	Jun 91	70	3117a	Europium Standard Soln.	Jan 93	57
2613a	CO/Air, 20 µmol/mol	Jun 91	70	3118a	Gadolinium Standard Soln.	Jan 93	57
2614a	CO/Air, 45 µmol/mol	Jun 91	70	3119a	Gallium Standard Soln.	Oct 93	57
2619a	CO <sub>2</sub> /N <sub>2</sub> , 0.5 mol %	Jun 92	70	3120	Germanium Standard Soln.	Apr 89	57
2620a	CO <sub>2</sub> /N <sub>2</sub> , 1.0 mol %	Jun 92	70	3121	Gold Standard Soln.	Apr 97	57
2621a	CO <sub>2</sub> /N <sub>2</sub> , 1.5 mol %	Jun 92	70	3122	Hafnium Standard Soln.	Jan 94	57
2622a	CO <sub>2</sub> /N <sub>2</sub> , 2.0 mol %	Jun 92	70	3123a	Holmium Standard Soln.	May 97	57
2623a	CO <sub>2</sub> /N <sub>2</sub> , 2.5 mol %	Jun 92	70	3124a	Indium Standard Soln.	May 93	57
2624a	CO <sub>2</sub> /N <sub>2</sub> , 3.0 mol %	Jul 96	70	3126a	Iron Standard Soln.	Feb 94	57
2625a	CO <sub>2</sub> /N <sub>2</sub> , 3.5 mol %	Sep 94	70	3127a	Lanthanum Standard Soln.	May 93	57
2626a	CO <sub>2</sub> /N <sub>2</sub> , 4.0 mol %	Jan 93	70	3128	Lead Standard Soln.	Sep 88	57
2627a	NO/N <sub>2</sub> , 5 µmol/mol	Jan 91	71	3129a	Lithium Standard Soln.	May 93	57
2628a	NO/N <sub>2</sub> , 10 µmol/mol	Jun 91	71	3130a	Lutetium Standard Soln.	Feb 94	57
2629a	NO/N <sub>2</sub> , 20 µmol/mol	Jun 91	71	3131a	Magnesium Standard Soln.	May 93	57
2630	NO/N <sub>2</sub> , 1500 µmol/mol	Jun 91	71	3132	Manganese Spectro Soln.	Apr 89	57
2631a	NO/N <sub>2</sub> , 3,000 µmol/mol	Jun 91	71	3133	Mercury Standard Soln.	May 97	57
2635a	CO/N <sub>2</sub> , 25 µmol/mol	Jan 89	70	3134	Molybdenum Standard Soln.	May 90	57
2636a	CO/N <sub>2</sub> , 250 µmol/mol	Jun 92	70	3135a	Neodymium Standard Soln.	May 93	57
2637a	CO/N <sub>2</sub> , 2500 µmol/mol	Jun 92	70	3136	Nickel Standard Soln.	May 97	57
2638a	CO/N <sub>2</sub> , 5000 µmol/mol	Jun 92	70	3138	Palladium Standard Soln.	Apr 89	57
2639a	CO/N <sub>2</sub> , 1 mol %	Jun 92	70	3139a	Phosphorus Standard Soln.	Jul 94	57
2640a	CO/N <sub>2</sub> , 2 mol %	Dec 88	70	3140	Platinum Standard Soln.	Apr 89	57
2641a	CO/N <sub>2</sub> , 4 mol %	Dec 88	70	3141a	Potassium Standard Soln.	May 97	57
2642a	CO/N <sub>2</sub> , 8 mol %	Sep 92	70	3142a	Praseodymium Standard Soln.	May 93	57
2643a	C <sub>3</sub> H <sub>8</sub> /N <sub>2</sub> , 100 µmol/mol	Dec 90	71	3143	Rhenium Standard Soln.	Jul 88	57
2644a	C <sub>3</sub> H <sub>8</sub> /N <sub>2</sub> , 250 µmol/mol	Dec 90	71	3144	Rhodium Standard Soln.	Jan 93	57
2645a	C <sub>3</sub> H <sub>8</sub> /N <sub>2</sub> , 500 µmol/mol	Dec 90	71	3145a	Rubidium Standard Soln.	Jan 94	57
2647a	C <sub>3</sub> H <sub>8</sub> /N <sub>2</sub> , 2500 µmol/mol	Dec 90	71	3147a	Samarium Standard Soln.	Jan 94	58
2648a	C <sub>3</sub> H <sub>8</sub> /N <sub>2</sub> 5000 µmol/mol	Nov 93	71	3148a	Scandium Standard Soln.	May 93	58
2649a	C <sub>3</sub> H <sub>8</sub> /N <sub>2</sub> , 1 mol %	Dec 90	71	3149	Selenium Standard Soln.	Apr 89	58
2650	C <sub>3</sub> H <sub>8</sub> /N <sub>2</sub> , 2 mol %	Feb 93	71	3151	Silver Standard Soln.	Apr 89	58
2656	NO <sub>x</sub> /Air, 2500 µmol/mol	Aug 93	71	3152a	Sodium Standard Soln.	Sep 94	58
2657a	O <sub>2</sub> /N <sub>2</sub> , 2 mol %	Jul 93	71	3153a	Strontium Standard Soln.	May 93	58
2658a	O <sub>2</sub> /N <sub>2</sub> , 10 mol %	Jul 93	71	3154	Sulfur Standard Soln.	Feb 93	58
2659a	O <sub>2</sub> /N <sub>2</sub> , 21 mol %	Jul 93	71	3155	Tantalum Standard Soln.	Mar 89	58
2660	NO <sub>x</sub> /Air, 100 µmol/mol	Jul 93	71	3156	Tellurium Standard Soln.	Mar 90	58
2682a	Sulfur in Coal, 0.5%, (also Heat of Comb.)	Apr 91	73	3157a	Terbium Standard Soln.	Feb 94	58
2683a	Sulfur in Coal, 2%, (also Heat of Comb.)	Apr 91	73/103	3158	Thallium Standard Soln.	Feb 89	58
2684a	Sulfur in Coal, 3%, (also Heat of Comb.)	Apr 91	73/103	3159	Thorium Standard Soln.	Jan 89	58
2685a	Sulfur in Coal, 5%, (also Heat of Comb.)	Apr 91	73	3160a	Thulium Standard Soln.	Mar 94	58
2689	Coal Fly Ash	Nov 85	74	3161a	Tin Standard Soln.	Feb 97	58
2690	Coal Fly Ash	Nov 85	74	3162a	Titanium Standard Soln.	Jan 93	58
2691	Coal Fly Ash	Nov 85	74	3163	Tungsten Standard Soln.	Nov 88	58
2692a	Sulfur in Coal, 1%	Jul 94	73/103	3164	Uranium Standard Soln.	Nov 96	58
2712	Lead in Ref. Fuel	Nov 88	72	3165	Vanadium Standard Soln.	Feb 90	58
2713	Lead in Ref. Fuel	Nov 88	72	3166a	Ytterbium Standard Soln.	Feb 94	58
2714	Lead in Ref. Fuel	Nov 88	72	3167a	Yttrium Standard Soln.	Jul 93	58
2715	Lead in Ref. Fuel	Nov 88	72	3168a	Zinc Standard Soln.	Oct 93	58
2717	Sulfur in Residual Fuel Oil	Feb 93	73	3169	Zirconium Standard Soln.	Oct 88	58
2724	Sulfur in Diesel Fuel Oil, 0.04%	Sep 94	73	3171a	Multielement Mix A1 Soln.	May 93	58
2735	NO/N <sub>2</sub> , 800 µmol/mol	Dec 90	71	3172a	Multielement Mix B1 Soln.	Jan 93	59
2736	NO/N <sub>2</sub> , 2000 µmol/mol	Dec 90	71	3179	Multielement Mixes I, II, III Solns.	Nov 93	59
2740	CO/N <sub>2</sub> , 10 mol %	Jan 91	70	3183	Fluoride Anion Soln.	Feb 93	60
2741	CO/N <sub>2</sub> , 13 mol %	Jan 91	70	8443	GC/MS System Performance	Mar 92	75
2745	CO <sub>2</sub> /N <sub>2</sub> , 16 mol%	Jul 96	70	8466	Y-HCH (Lindane) (neat)	May 92	75
2764	C <sub>3</sub> H <sub>8</sub> /Air, 0.25 µmol/mol	Aug 95	71	8467	4,4'-DDE (neat)	May 92	75
3101a	Aluminum Standard Soln.	May 93	57	8469	Pesticide, 4,4'-DDT (neat)	May 92	75
3102a	Antimony Standard Soln.	Jun 93	57	8505	Vanadium in Crude Oil	Jan 93	72
3103a	Arsenic Standard Soln.	Jul 93	57	8506	Transformer Oil	Mar 92	73
3104a	Barium Standard Soln.	May 97	57	8507	Mineral Oil	Mar 92	73

SRM	Descriptor	MSDS		SRM	Descriptor	MSDS	
		Date	Page			Date	Page
8509	Moisture in Methanol, 93 mg/kg	Sep 95	73				
8510	Moisture in Methanol, 325 mg/kg	Sep 95	73				
8517	N-Decane Flashpoint	Oct 95	103				
8518	N-Undecane Flashpoint	Oct 95	103				
8519	N-Tetradecane Flashpoint	Oct 95	103				
8520	N-Hexadecane Flashpoint	Oct 95	103				
8570	Calcined Kaolin (Sur. Area)	Apr 85	128				
8571	Alumina (Sur. Area)	May 92	128				
8572	Silica (Sur. Area)	May 85	128				
8590	High Sulfur Gas Oil Feed	Dec 91	95				
8759	ICTAC Set DTA	Aug 93	104				
8760	ICTAC Set DTA	Aug 93	104				







Clinical Standards



SRM®



**U.S. DEPARTMENT OF COMMERCE**

***Technology Administration***

**National Institute of Standards and Technology**

**Standard Reference Materials Program**

**Bldg. 202, Room 204, Gaithersburg, MD 20899**

**BULK RATE  
BOUND PRINTED MATTER  
POSTAGE AND FEES PAID  
NIST  
PERMIT NO. G195**

**Return and Forwarding Postage Guaranteed**

**Address Correction Requested**

**Official Business**

**Penalty for Private Use \$300**

# Cu



# K