on 260

*inistration*
e of Standards
and Technology


# NIST

# STANDARD REFERENCE MATERIALS CATALOG 1998-1999

To Order
Phone: 301-975-6776
Fax: 301-948-3730
E Mail: SRMINFO@nist.gov
HTTP://ts.nist.gov/srm

S

Zr



SRM®

Mg

# SRM®


Physical Property Standards

NIST

# 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
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

# *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

# 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 "SRM®", 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<br>renewal letter identifier<br>(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 µmol/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 coincidently 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

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
for MSDSs — 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
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
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
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
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
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
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*

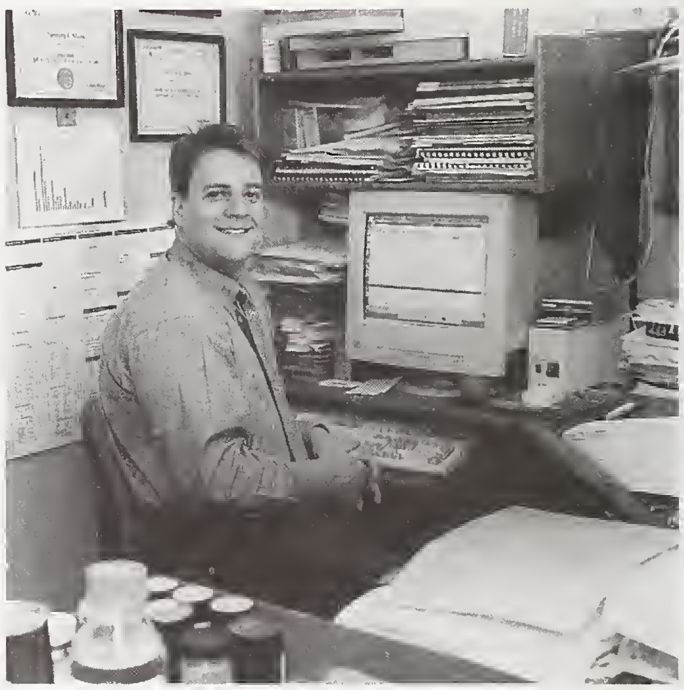
**Delores J. Covey,** *Secretary*

**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*

**Teressa 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*

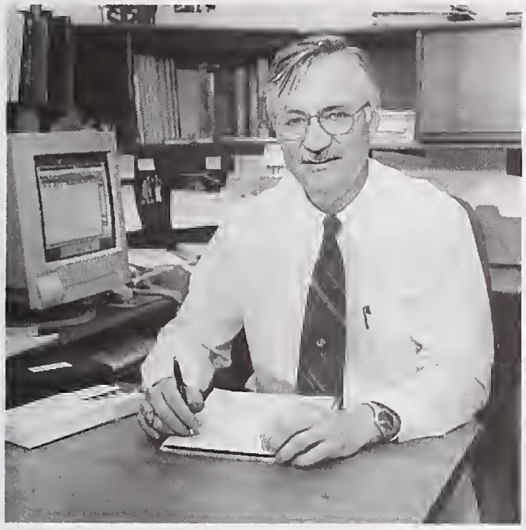
**Carmen S. Davis,** *SRM Assistant,*
*Hazardous Documentation Preparation*

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

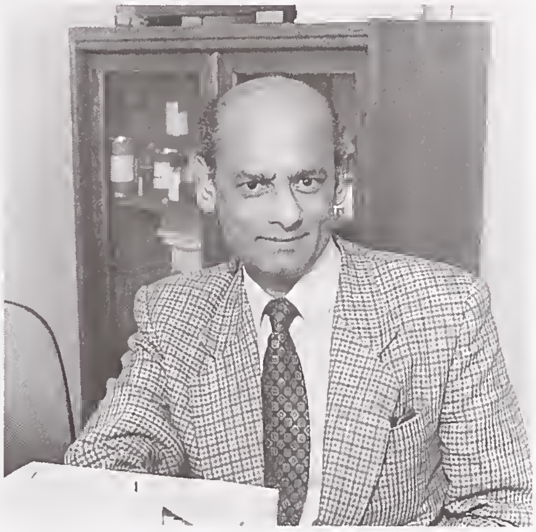
## Project Management

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

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

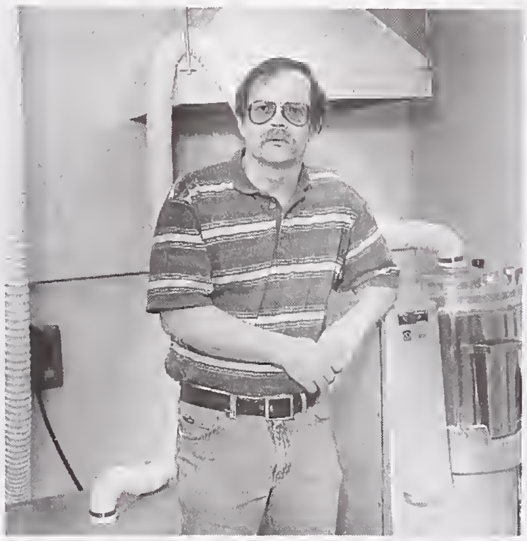


**Bruce S. MacDonald,** *Project Management, Chemical Composition, and Environmental Materials*



**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*

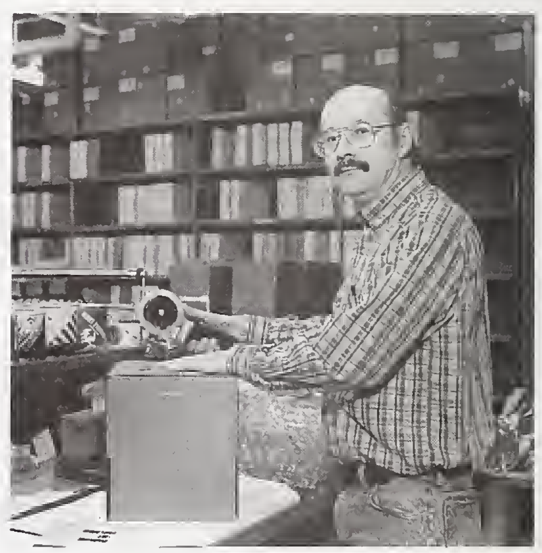
**Curtis N. Fales,** *Physical Science Technician, Materials Production & Packaging*

**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*

## *Standard Reference Materials for PHYSICAL PROPERTIES*

## *Standard Reference Materials for ENGINEERING MATERIALS*

# Chemical Composition

# *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 | C | Mn | P | S Grav | S Comb | Si | Cu |
|---|---|---|---|---|---|---|---|---|
| 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 (Nitralloy™ 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 |
| | | | | | Grav | Comb | | |
| 50c | W–Cr–V | 0.719 | 0.342 | 0.022 | 0.010 | 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) | (<0.005) | | **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 | Ta | 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) | (1.2) |

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 | Cn | 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 | 8162 | 8165 | 8168 | 8171 |
|---|---|---|---|---|
| Type | Fine Silver | Fine Silver | Fine Silver | Fine Silver |
| Block Form | B | B | B | B |
| Unit Size (in g) | 30 | 30 | 30 | 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 | 8068/8069/8070 | 8071/8072/8073 | 8074/8075/8076 | 8077/8078/8079 | 8080/8081/8082 |
|---|---|---|---|---|---|
| Type | Gold Bullion | Gold Bullion | Gold Bullion | Gold Bullion | Gold Bullion |
| Form (Disc, Wire, Foil) | D W F | D W F | D W F | D W F | D W F |
| Unit Size (in g) | 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 | 8050/8051/8052 | 8053/8054/8055 | 8056/8057/8058 | 8059/8060/8061 | 8062/8063/8064 | 8065/8066/8067 |
|---|---|---|---|---|---|---|
| Type | Fine Gold | Fine Gold | Fine Gold | Fine Gold | Fine Gold | Fine Gold |
| Form (Block, Wire, Turnings) | B W T | B W T | B W T | B W T | B W T | B W T |
| Unit Size (in g) | 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 ± 0.02 % (Purity 99.98+ %).
**Working Standard:**
a commercially available substance of purity 100 ± 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 | 99.9817 |
| | | | Potassium | 52.4354 |
| | | | Chloride | 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 | $CH_3O-$ |
| 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 | $HNO_3$ 10% |
| 3102a | Antimony | $HNO_3$ 10% + HF 2% |
| 3103a | Arsenic | $HNO_3$ 15% |
| 3104a | Barium | $HNO_3$ 1% |
| 3105a | Beryllium | $HNO_3$ 10% |
| 3106 | Bismuth | $HNO_3$ 10% |
| 3107 | Boron (5 mg/g) | $H_2O$ |
| 3108 | Cadmium | $HNO_3$ 10% |
| 3109a | Calcium | $HNO_3$ 10% |
| 3110 | Cerium | $HNO_3$ 10% |
| 3111a | Cesium | $HNO_3$ 1% |
| 3112a | Chromium | $HNO_3$ 10% |
| 3113 | Cobalt | $HNO_3$ 10% |
| 3114 | Copper | $HNO_3$ 10% |
| 3115a | Dysprosium | $HNO_3$ 10% |
| 3116a | Erbium | $HNO_3$ 10% |
| 3117a | Europium | $HNO_3$ 16% |
| 3118a | Gadolinium | $HNO_3$ 10% |
| 3119a | Gallium | $HNO_3$ 10% |
| 3120 | Germanium | Oxalic Acid 10% |
| 3121 | Gold | $HNO_3$ 5% + HF 2% |
| 3122 | Hafnium | $HNO_3$ 10% + HF 2% |
| 3123a | Holmium | $HNO_3$ 16% |
| 3124a | Indium | $HNO_3$ 10% |
| 3126a | Iron | $HNO_3$ 10% |
| 3127a | Lanthanum | $HNO_3$ 10% |
| 3128 | Lead | $HNO_3$ 10% |
| 3129a | Lithium | $HNO_3$ 1% |
| 3130a | Lutetium | $HNO_3$ 10% |
| 3131a | Magnesium | $HNO_3$ 10% |
| 3132 | Manganese | $HNO_3$ 10% |
| 3133 | Mercury | $HNO_3$ 10% |
| 3134 | Molybdenum | HCl 10% |
| 3135a | Neodymium | $HNO_3$ 10% |
| 3136 | Nickel | $HNO_3$ 10% |
| 3137 | Niobium | 5% $HNO_3$ + HF 2% |
| 3138 | Palladium | HCl 10% |
| 3139a | Phosphorus | $HNO_3$ 0.8% |
| 3140 | Platinum | HCl 10% |
| 3141a | Potassium | $HNO_3$ 1% |
| 3142a | Praseodymium | $HNO_3$ 10% |
| 3143 | Rhenium | $HNO_3$ 10% |
| 3144 | Rhodium (1 mg/g) | HCl 10% |
| 3145a | Rubidium | $HNO_3$ 1% |

# 104. Spectrometry, Single Element Standard Solutions – Continued

| SRM | Element | Acid Concentration |
|---|---|---|
| 3147a | Samarium | $HNO_3$ 10% |
| 3148a | Scandium | $HNO_3$ 10% |
| 3149 | Selenium | $HNO_3$ 10% |
| 3150 | Silicon | $H_2O$ |
| 3151 | Silver | $HNO_3$ 10% |
| 3152a | Sodium | $HNO_3$ 1% |
| 3153a | Strontium | $HNO_3$ 10% |
| 3154 | Sulfur | $H_2SO_4$ 0.1% |
| 3155 | Tantalum | $HNO_3$ 5% + HF 2% |
| 3156 | Tellurium | HCl 20% |
| 3157a | Terbium | $HNO_3$ 16% |
| 3158 | Thallium | $HNO_3$ 10% |
| 3159 | Thorium | $HNO_3$ 10% |
| 3160a | Thulium | $HNO_3$ 10% |
| 3161a | Tin | $HNO_3$ 5% + HF 2% |
| 3162a | Titanium | $HNO_3$ 10% + HF 2% |
| 3163 | Tungsten | $HNO_3$ 7% + HF 4% |
| 3164 | Uranium | $HNO_3$ 10% |
| 3165 | Vanadium (5 mg/g) | $HNO_3$ 10% |
| 3166a | Ytterbium | $HNO_3$ 16% |
| 3167a | Yttrium | $HNO_3$ 10% |
| 3168a | Zinc | $HNO_3$ 10% |
| 3169 | Zirconium | $HNO_3$ 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 $HNO_3$ 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 |

SRM 3172a Multielement Mix B1 Standard Solution (in $HNO_3$ 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 $HNO_3$ 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 $H_2O$ | <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 $^{10}B$, 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 ($^{208}Pb/^{206}Pb$) | Lead | 1.0 wire |
| *983 | Lead Metal, radiogenic (92% $^{206}Pb$) | 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 $N_2$ (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† | −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 μmol | | | | −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
†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 | **Mg 5.403** | 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 (triglyerides and total glyceride species).

| SRM | Type | Unit Size | Analyte Concentrations (in mmol/L) | | | |
|---|---|---|---|---|---|---|
| | | | | 909b-1 | 909b-2 | |
| 909b | Human Serum | 909b-1; 3 bottles | Calcium | 2.218 | 3.532 | |
| | | 909b-2; 3 bottles | 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 | | | |
| | | | | Level I | Level II | Level III |
| 956a | Electrolytes in Frozen Human Serum | Level I; 2 ampules | Calcium | 3.025 | 2.570 | 2.127 |
| | | Level II; 2 ampules | Lithium | 2.083 | 1.34 | 0.570 |
| | | Level III; 2 ampules | Magnesium | 1.441 | 0.947 | 0.448 |
| | | | Potassium | 6.008 | 3.985 | 2.025 |
| | | | Sodium | 121.4 | 141.0 | 160.9 |
| | | | | Level I | Level II | Level III |
| 965 | Glucose in Frozen Human Serum | Level I; 2 ampules | Glucose | 5.680 | 11.097 | 16.355 |
| | | Level II; 2 ampules | | | | |
| | | Level III; 2 ampules | | | | |
| | | | | Low* | Middle* | High* |
| 968b | Human Serum | Low; 1 vial | Retinol | 1.033 | 1.794 | 3.11 |
| | | Middle; 1 vial | Retinyl Palmitate | 0.189 | 0.339 | 0.469 |
| | | High; 1 vial | 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 |
| | | | | Level I | Level II | |
| 1951a | Lipids in Frozen Human Serum | Level I; 2 bottles | Cholesterol | 4.7109 | 7.1554 | |
| | | Level II; 2 bottles | Total Glycerides | 1.1357 | 1.9477 | |
| | | | Triglyerides Only | 1.0053 | 1.7462 | |

*Analyte Concentrations are expressed in μmol/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<br>Ethanol: 2.003<br>Ethanol: 0.0960<br>Ethanol: 0.02309 | Set: 1, 20 mL ampules<br>2, 20 mL ampules<br>1, 5 mL ampules<br>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 | $SO_4$ |
|---|---|---|---|---|---|---|---|---|
| 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<br>Blank | II<br>Low | III<br>Medium | IV<br>High |
| 1507b | THC–9–COOH | Set of 4 bottles | $x_D$:<1 | 11.7 | 24.1 | 49.6 |
| 1508a | Benzoylecgonine | Set of 4 bottles | In Prep | | | |
| 2382 | Morphine Glucuronide | Set of 4 bottles | $x_D$:<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 | Benzoylecgonine | 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 Mitochrondrial 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 µm pore size; SRM 2679a is 47 mm diameter and 0.45 µm pore size.

| SRM | Type | Unit Size | Element/Component (in µg/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<br>≤0.0005 Blank |
| | | | Arsenic | 0.269 | 2.69 | 26.92 | 0.101<br>≤0.0005 Blank |
| 2679a | Quartz on Filter Media | Set of 4 | Quartz | ≤2 | 30.8 | 80.2 | 202.7 |
| | | | Clay | (370) | (370) | (370) | (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 µg), 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 µm) | 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 $mg/cm^2$ | 1 sheet | In Prep |
| 2572 | Lead Paint Film, Nominal 1.6 $mg/cm^2$ | 1 sheet | In Prep |
| 2573 | Lead Paint Film, Nominal 1.0 $mg/cm^2$ | 1 sheet | In Prep |
| 2574 | Lead Paint Film, Nominal 0.7 $mg/cm^2$ | 1 sheet | In Prep |
| 2575 | Lead Paint Film, Nominal 0.3 $mg/cm^2$ | 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 $mg/cm^2$ |
| 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 $mg/cm^2$ | 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 $mm^2$) of chrysotile asbestos and a medium concentration (43 fibers/0.01 $mm^2$) 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 $cm^2$ |

# 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 $\mu g/cm^2$) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 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 |
| 1648 | Urban Particulate Matter | 2 g | 3.42 % | (45) | 115 | (737) |

| SRM | Br | Cd | Ce | Cs | Cl | Cr | Co | Cu |
|---|---|---|---|---|---|---|---|---|
| 1648 | (500) | 75 | (55) | (3) | (0.45 %) | 403 | (18) | 609 |

| SRM | Hf | In | I | Fe | La | Pb | Mg | Mn | Ni |
|---|---|---|---|---|---|---|---|---|---|
| 1648 | (4.4) | (1.0) | (20) | 3.91 % | (42) | 0.655 % | (0.8 %) | 786 | 82 |

| SRM | K | Rb | Sc | Se | Ag | S | Na | Th | Ti | U | V | W | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1648 | 1.05 % | (52) | (7) | 27 | (6) | (5.0) | 0.425 % | (7.4) | (0.40 %) | 5.5 | 127 | (4.8) | 0.476 % |

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 $m^3$ 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 µmol/mol) |
|---|---|---|---|
| 1674b† | Carbon Dioxide in Nitrogen | $CO_2$ | 7 mol % |
| 1675b† | Carbon Dioxide in Nitrogen | $CO_2$ | 14 mol % |
| 2619a | Carbon Dioxide in Nitrogen | $CO_2$ | 0.5 mol % |
| 2620a | Carbon Dioxide in Nitrogen | $CO_2$ | 1.0 mol % |
| 2621a | Carbon Dioxide in Nitrogen | $CO_2$ | 1.5 mol % |
| 2622a | Carbon Dioxide in Nitrogen | $CO_2$ | 2.0 mol % |
| 2623a | Carbon Dioxide in Nitrogen | $CO_2$ | 2.5 mol % |
| 2624a | Carbon Dioxide in Nitrogen | $CO_2$ | 3.0 mol % |
| 2625a† | Carbon Dioxide in Nitrogen | $CO_2$ | 3.5 mol % |
| 2626a | Carbon Dioxide in Nitrogen | $CO_2$ | 4.0 mol % |
| 2745† | Carbon Dioxide in Nitrogen | $CO_2$ | 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 µmol/mol) |
|---|---|---|---|
| 1658a | Methane in Air | $CH_4$ | 1 |
| 1659a | Methane in Air | $CH_4$ | 10 |
| 1660a | Methane-Propane in Air | $CH_4$ | 4 |
| | | $C_3H_8$ | 1 |
| 2750 | Methane in Air | $CH_4$ | 50 |
| 2751 | Methane in Air | $CH_4$ | 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 | $NO_x$ | 2500 |
| 2660† | Oxides of Nitrogen in Air | $NO_x$ | 100 |
| 2657a† | Oxygen in Nitrogen | $O_2$ | 2 mol % |
| 2658a† | Oxygen in Nitrogen | $O_2$ | 10 mol % |
| 2659a† | Oxygen in Nitrogen | $O_2$ | 21 mol % |
| 1665b | Propane in Air | $C_3H_8$ | 3 |
| 1666b | Propane in Air | $C_3H_8$ | 10 |
| 1667b | Propane in Air | $C_3H_8$ | 50 |
| 1668b† | Propane in Air | $C_3H_8$ | 100 |
| 1669b | Propane in Air | $C_3H_8$ | 500 |
| 2764 | Propane in Air | $C_3H_8$ | 0.25 |
| 1671a | Carbon Dioxide in Air | $CO_2$ | 340 |
| 1672a | Carbon Dioxide in Air | $CO_2$ | 350 |
| 2643a | Propane in Nitrogen | $C_3H_8$ | 100 |
| 2644a | Propane in Nitrogen | $C_3H_8$ | 250 |
| 2645a | Propane in Nitrogen | $C_3H_8$ | 500 |
| 2646a | Propane in Nitrogen | $C_3H_8$ | 1000 |
| 2647a | Propane in Nitrogen | $C_3H_8$ | 2500 |
| 2648a | Propane in Nitrogen | $C_3H_8$ | 5000 |
| 2649a | Propane in Nitrogen | $C_3H_8$ | 1 mol % |
| 2650 | Propane in Nitrogen | $C_3H_8$ | 2 mol % |
| 1661a† | Sulfur Dioxide in Nitrogen | $SO_2$ | 500 |
| 1662a† | Sulfur Dioxide in Nitrogen | $SO_2$ | 1000 |
| 1663a† | Sulfur Dioxide in Nitrogen | $SO_2$ | 1500 |
| 1664a† | Sulfur Dioxide in Nitrogen | $SO_2$ | 2500 |
| 1693a† | Sulfur Dioxide in Nitrogen | $SO_2$ | 50 |
| 1694a† | Sulfur Dioxide in Nitrogen | $SO_2$ | 100 |
| 1696a† | Sulfur Dioxide in Nitrogen | $SO_2$ | 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 | $H_2S$ | 5 |
| 2731 | Hydrogen Sulfide in Nitrogen | $H_2S$ | 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 µg/min) | Amount-of-Substance Fraction (in µmol/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 (Subbituminous) | 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, *iso*octane, 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 *Iso*octane | 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 *Iso*octane | 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 *Iso*octane | 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 1491 [23] | 2260 [23] | 1647d [16] | Natural Matrix 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 1492 [15] | 2261 [15] | Natural Matrix 1588a [12] | 1941a [6] | 1944 [10] | 1945 [15] | 1974a [7] | 2974 [7] |
|---|---|---|---|---|---|---|---|---|
| **Component (in µg/kg)** | | | | | | | | |
| Hexaclorobenzene | 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 | Calibration Solution | | Natural Matrix | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SRM | 1493 | 2262 | 1588a | 1589a | 1939a | 1941a | 1944 | 1945 | 1974a | 2974 |
| [No. of Components certified] | [18] | [25] | [15] | [tbd]* | [16] | [21] | [20] | [27] | [20] | [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 SRM | 1581 | 1584 | 1586-1 | 1586-2 | 1587 | 1596 | 1614 | 1639 | RM 8466 | RM 8467 | RM 8469 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| [No. of Components certified] | [4] | [10] | [10] | [10] | [6] | [4] | [2] | [7] | | | |

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 %.)

| Component | 1581 | 1584 | 1586-1 | 1586-2 | 1587 | 1596 | 1614 | 1639 | RM 8466 | RM 8467 | RM 8469 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 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-$^{13}$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 |
|---|---|---|---|---|
| Nutritional Constituent | (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-α-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 |
| Element | (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 | 1515 | 1547 | 1570a | 1573a | 1575 | 2695 | RM 8030 | RM 8031 | RM 8412 | RM8413 |
|---|---|---|---|---|---|---|---|---|---|---|
| Type | Apple Leaves | Peach Leaves | Spinach Leaves | Tomato Leaves | Pine Needles | Fluoride, in Vegetation | BCR No 60 Aquatic Plant | BCR No 61 Aquatic Moss | Corn Stalk (Zea Mays) | 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 |
| **Element** | **(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 | $P_2O_5$ | $K_2O$ | 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 | $SiO_2$ | F | $Fe_2O_3$ | $Al_2O_3$ | MgO | $Na_2O$ | MnO | $TiO_2$ | $Cr_2O_3$ | CdO | U | $V_2O_5$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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<br>5×5 pouches each (20 g/pouch)<br>Soft-1 through Soft-5<br>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** |
| $CaF_2$ | 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*) | | | | | | | | |
| $Li_2O$ | | | | 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) | | | |
| $O_2$ | | | | | | | (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)** |
| $WO_3$ | | | | | | | 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). | | | | | | | | | | |
| $Al_2O_3$ | 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 | | |
| $Cr_2O_3$ | | | 0.011 | | 0.024 | 0.23 | | | | |
| Total Fe | | 65.97 | | | | | 66.85 | 90.8 | 59.58 | 65.11 |
| $Fe_2O_3$ | 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 |
| $P_2O_5$ | 0.25 | | 0.118 | 33.34 | 0.039 | | | | | |
| $K_2O$ | 0.93 | 0.008 | 0.068 | 0.147 | 0.23 | | 0.0030 | | 0.039 | 0.0028 |
| $SiO_2$ | 2.52 | 4.17 | 13.43 | 5.5 | 20.3 | 0.51 | 3.71 | 3.7 | 10.14 | 3.87 |
| $Na_2O$ | | 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 |
| $SO_3$ | | | 0.551 | | 0.155 | | | | | |
| $TiO_2$ | 0.13 | 0.019 | 1.90 | 0.103 | 1.31 | 96.16 | 0.022 | 0.27 | 0.045 | 0.035 |
| $V_2O_5$ | | | 0.028 | 0.016 | 0.060 | 0.66 | | | | |
| ZnO | | | 0.0035 | **$CO_2$ 3.27** | 0.003 | | | **C 0.12** | | |
| $ZrO_2$ | | | 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). | | | | | | | |
| $Al_2O_3$ | 1.8 | 54.5 | 45.8 | 48.2 | | **Au 8.25*** | 3.474 |
| BaO | | (0.004) | (0.015) | (0.008) | | | 0.0497 |
| $C_{Total}$ | | | | | | (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** |
| $Cr_2O_3$ | (0.10) | 0.047 | 0.100 | 0.080 | 0.0002 | | |
| $Fe_2O_3$ | 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 |
| $P_2O_5$ | 30.2 | 0.050 | 0.97 | 0.37 | 0.0002 | | |
| $K_2O$ | 0.51 | 0.009 | 0.062 | 0.010 | | | 1.261 |
| $SiO_2$ | 11.2 | 3.79 | 6.81 | 0.69 | 0.014 | | 18.408 |
| $Na_2O$ | 0.86 | (0.007) | (0.036) | (0.015) | 0.59 | | 3.484 |
| $S_{Total}$ | | | | | | 1.466 | |
| $SO_3$ | | 0.15 | 0.077 | 0.143 | | | 1.477 |
| $TiO_2$ | (0.11) | 2.64 | 2.52 | 2.38 | | | 0.1332 |
| U | 0.01414 | | | | | | |
| $V_2O_5$ | 0.31 | 0.072 | 0.063 | 0.064 | 0.0005 | | |
| ZnO | (0.19) | 0.0014 | 0.037 | 0.029 | 0.013 | | |
| $ZrO_2$ | | 0.14 | 0.065 | 0.061 | | | **SrO 0.9418** |
| $Ga_2O_3$ | | | | | 0.010 | | **$B_2O_3$ 18.739** |
| $Li_2O$ | | | | | 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). | | | | | | | | | |
| $Al_2O_3$ | 1.30 | 17.9 | 0.66 | 0.336 | 20.5 | 0.059 | 14.15 | 17.36 | 9.90 |
| BaO | | 0.02 | | **$CO_2$ 46.37** | 0.26 | | **Ba (1140*)** | | 0.12 |
| CaO | 50.3 | 0.11 | | 29.95 | 2.14 | | 0.983 | (12.17) | 0.74 |
| $Cr_2O_3$ | | | 46* | | | (1*) | **Cr (6.1*)** | **Cr 332*** | |
| $Fe_2O_3$† | 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 | |
| $P_2O_5$ | 0.04 | | | 0.0044 | 0.02 | | 0.036 | 0.134 | |
| $K_2O$ | 0.28 | 11.8 | | 0.1030 | 5.2 | | 4.16 | 0.187 | 3.94 |
| $Rb_2O$ | | 0.06 | | | | | **Rb 127.5*** | **Rb 1.91*** | |
| $SiO_2$ | 6.84 | 67.12 | | 1.13 | 65.2 | | 73.05 | 48.4 | 82.77 |
| $Na_2O$ | 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*** | |
| $TiO_2$ | 0.07 | 0.01 | 0.12 | (0.016) | 0.007 | 0.011 | 0.245 | 1.17 | 0.11 |
| $ZrO_2$ | | | 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 ($Al_2O_3$–40%) | Burnt Refractory ($Al_2O_3$–60%) | Burnt Refractory ($Al_2O_3$–70%) | Titanium Dioxide | Silica Brick | Silica Brick |
| Unit Size (in g) | 75 | 75 | 75 | 90 | 45 | 45 |
| **Component** (mass fraction, in %) | | | | | | |
| $Al_2O_3$ | 38.7 | 60.2 | 71.7 | | 0.16 | 0.48 |
| CaO | 0.22 | 0.05 | 0.11 | (~0.01) | 2.71 | 2.41 |
| FeO† | | | | | | |
| $Fe_2O_3$† | 1.60 | 1.00 | 1.2 | (0.006) | 0.66 | 0.74 |
| $Li_2O$ | 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 |
| $P_2O_5$ | 0.120 | 0.092 | 1.3 | (0.04) | 0.022 | 0.015 |
| $K_2O$ | 1.33 | 0.090 | 1.22 | | 0.017 | 0.094 |
| $SiO_2$ | 54.9 | 35.0 | 19.4 | (0.01) | | |
| $Na_2O$ | 0.07 | 0.037 | 0.078 | | 0.012 | 0.015 |
| SrO | 0.037 | 0.009 | 0.25 | | | |
| $TiO_2$ | 2.03 | 2.66 | 3.22 | 99.74 | 0.02 | 0.06 |
| $ZrO_2$ | | | | | | |
| 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 Boro-silicate | Glass Sand (low Iron) | Soda-Lime, Flat | Soda-Lime, Con-tainer | Soft Boro-silicate | Multi Compo-nent | 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). | | | | | | | | | | | | |
| $SiO_2$ | | 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 | | | | |
| $Al_2O_3$ | 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 | |
| $Fe_2O_3$ | 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 | | | | | | | | | | | |
| $TiO_2$ | 0.12 | 0.01 | | 0.014 | 0.011 | 0.018 | 0.014 | 0.02 | | | 0.011 | 0.019 | Ti 1.11 |
| $ZrO_2$ | 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 |
| $Li_2O$ | | | | | | | | | (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 |
| $K_2O$ | | 8.40 | (0.6) | 0.014 | | 0.41 | 2.01 | 2.97 | 4.14 | 3.94 | 0.04 | 0.33 | K 0.42 |
| $Na_2O$ | | 5.70 | (13.1) | 3.98 | | 14.39 | 12.74 | 10.14 | 4.69 | 1.75 | 13.75 | 13.32 | Na (0.14) |
| $B_2O_3$ | | | 0.70 | 12.56 | | | | 10.94 | 4.53 | | | | B (1.1) |
| $P_2O_5$ | | 0.23 | | | | | | | | | | | P 0.152 |
| $As_2O_5$ | | 0.36 | | | | | | | | | | | |
| $As_2O_3$ | | 0.03 | | | | 0.056 | 0.030 | | | | | | |
| $SO_3$ | | 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 | | | | | | | | | | | | | |
| $Cr_2O_3$ | 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% $SiO_2$, 12% CaO, 14% $Na_2O$, and 2% $Al_2O_3$.

| 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 – $^{87}Sr/^{86}Sr = 1.20039$.

# 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 |
| $SiO_2$ | 19.82 | 22.25 | 3.40 | 0.35 | 23.19 |
| $Al_2O_3$ | 5.03 | 4.16 | 38.6 | 71.2 | 3.31 |
| $Fe_2O_3$ | 2.91 | 4.68 | 15.8 | 0.08 | 3.30 |
| $SO_3$ | 3.37 | 3.65 | | | 1.67 |
| MgO | 2.69 | 2.63 | 1.25 | 0.29 | 2.32 |
| $K_2O$ | 0.91 | 1.17 | 0.12 | (0.01) | 0.51 |
| $TiO_2$ | 0.23 | 0.25 | 1.83 | (0.01) | 0.16 |
| $Na_2O$ | 0.28 | 0.04 | (0.06) | 0.32 | 0.13 |
| SrO | 0.06 | 0.11 | | | 0.048 |
| $P_2O_5$ | 0.29 | 0.09 | | | 0.12 |
| $Mn_2O_3$ | 0.08 | 0.26 | | | 0.11 |
| F | 0.10 | 0.09 | | | (0.03) |
| ZnO | 0.01 | 0.01 | | | (0.02) |
| $Cr_2O_3$ | | | | | (<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 |
| $SiO_2$ | 21.24 | 22.53 | 19.98 | 20.86 | 20.44 |
| $Al_2O_3$ | 3.68 | 3.99 | 5.59 | 5.35 | 5.61 |
| $Fe_2O_3$ | 4.40 | 0.31 | 2.16 | 3.18 | 2.67 |
| $SO_3$ | 2.22 | 2.04 | 4.61 | 3.16 | 2.68 |
| MgO | 4.02 | 1.60 | 1.26 | 0.71 | 1.38 |
| $K_2O$ | 0.83 | 0.16 | 1.27 | 0.56 | 0.32 |
| $TiO_2$ | 0.20 | 0.19 | 0.27 | 0.29 | 0.21 |
| $Na_2O$ | 0.38 | 0.02 | 0.10 | 0.14 | 0.11 |
| SrO | 0.037 | 0.11 | 0.07 | 0.07 | 0.20 |
| $P_2O_5$ | 0.10 | 0.025 | 0.075 | 0.085 | 0.15 |
| $Mn_2O_3$ | 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) |
| $Cr_2O_3$ | (<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, | 5×0.15 g |
| | | 2) a Metal Naphthenate Mixture, and | 5×0.3 g |
| | | 3) Distilled Water | 5×1.0 g |
| 2567 | Catalyst Package IIIE | 1) an Oxidized/Nitrated Fuel Fraction, | 5×0.15 g |
| | | 2) a Nitro-Paraffin Model Compound, | 5×0.008 g |
| | | 3) a Nitro-Aromatic Model Compound, | 5×0.0075 g |
| | | 4) a Metal Naphthenate Mixture, and | 5×0.16 g |
| | | 5) Distilled Water | 5×0.03 g |
| **RM** 8501 | Catalyst Package IIIE | 1) an Oxidized/Nitrated Fuel Fraction, | 5×0.15 g |
| | | 2) a Nitro-Paraffin Model Compound, | 5×0.15 g |
| | | 3) a Metal Naphthenate Mixture, and | 5×0.3 g |
| | | 4) Distilled Water | 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 186IIf, 191b and 192b are each certified for use as an admixture only. SRMs 186If and 186IIf 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 |
| 186IIf | 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 | 60 |
| 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 (µS/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 | | | | | | | | | | |
| MolecularWeight 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$^3$) |
|---|---|---|---|---|
| 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 | 50.9 | Set of 4 ampules |
| | | D 93 | 52.8 | |
| | | D 3278/D 3828 | 49.7 | |
| 8518 | n-Undecane | D 56 | 67.1 | Set of 4 ampules |
| | | D 92 | 73.2 | |
| | | D 93 | 68.7 | |
| | | D 3278/D 3828 | 65.9 | |
| 8519 | n-Tetradecane | D 92 | 115.5 | Set of 4 ampules |
| | | D 93 | 109.3 | |
| 8520 | n-Hexadecane | D 92 | 138.8 | Set of 4 ampules |
| | | D 93 | 133.9 | |

## 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 | |
| 705a | Polystyrene | 5 g | 10 to 350 | 170,900 |
| 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 $W \cdot m^{-1} \cdot K^{-1}$) |
|---|---|---|---|---|
| 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 | 0.64×5.1 |
| | | L2: 80 to 680 | 0.64×10.2 |
| | | L3: 80 to 680 | 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 | 0.64×5.1 |
| | | L2: 80 to 1000 | 0.64×10.2 |
| | | L3: 80 to 1000 | 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 $m^2 \cdot K \cdot W^{-1}$) |
|---|---|---|---|---|
| 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 μm to 18 μm (555 $cm^{-1}$ to 3125 $cm^{-1}$). SRM 1921 consists of three cards made of a matte finish polystyrene film, approximately 38 μm thick with a 25-mm diameter clear aperture and centered 38 mm from the bottom of a cardboard holder 5 cm × 11 cm × 2 mm in size. The certified wavelength values, corresponding peak wavenumber values for thirteen absorption peak positions in the 3 μm to 18 μm 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 μm to 18 μm | 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(λ), in radiometric units for a solution of $1.28\times10^{-6}$ 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×0.65 |
| 2011 | First Surface, Gold on Nickel-Plated Aluminum | 600 to 2500 | 5.1D×1.2 |
| 2023 | Second Surface, Aluminum on Fused Quartz | 250 to 2500 | 5.1D×0.6 |
| 2026 | First Surface, Black Glass | 250 to 2500 | 5.1D×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 $mm^{-1}$ to 18 $mm^{-1}$.

| 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: ($10^{14}$ n/cm$^2$) | 39.5 | 43.0 |
| | | | RT-3: ($10^{14}$ n/cm$^2$) | 41.2 | 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.

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.**

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 $Bq \cdot g^{-1}$) | 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) | $\beta^-$ | 50 000 | 09/90 | 5 |
| 4233D* | Cesium-137 Burn-up Standard | $\beta^-$, γ | 600 000 | 07/95 | 5 |
| 4943 | Chlorine-36 | $\beta^-$ | 10 000 | 12/84 | 3 |
| 4915E* | Cobalt-60 | $\beta^-$, 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 | $\beta^-$, EC, γ | 90 000 | 02/87 | 5 |
| 4361C | Hydrogen-3 (as water) | $\beta^-$ | 1 | In Prep | 490 |
| 4926D | Hydrogen-3 (as water) | $\beta^-$ | 3 000 | 07/89 | 18 |
| 4927E | Hydrogen-3 (as water) | $\beta^-$ | 500 000 | 07/91 | 3 |
| 4947C | Hydrogen-3 (as toluene) | $\beta^-$ | 300 000 | 03/87 | 4 |
| 4949C* | Iodine-129 | $\beta^-$, 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 | $\beta^-$ | 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 | $\beta^-$ | 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 | $\beta^-$ | 200 | 04/94 | 5 |
| 4919H* | Strontium-90 | $\beta^-$ | 4 000 | 07/95 | 5 |
| 4234A* | Strontium-90 | $\beta^-$ | 2 500 000 | 03/95 | 5 |
| 4288A | Technetium-99 | $\beta^-$ | 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 | $\beta^-$, γ | 12 000 | | |
| | Europium-154 | $\beta^-$, γ | 16 000 | | |
| | Europium-155 | $\beta^-$, 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 ($MBq \cdot g^{-1}$) |
|---|---|---|---|
| 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 ($mg \cdot g^{-1}$) | Time of Calibration (month/year) | Volume of Solution (mL) |
|---|---|---|---|---|---|
| 4325 | Beryllium-10/Beryllium-9 | $3\times10^{-11}$ | 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: | 27 to 1596 | | 09/88 |
| | Antimony-125 | | 120 000 | |
| | Europium-154 | | 160 000 | |
| | Europium-155 | | 55 000 | |

*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 americum-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 · $g^{-1}$. 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 · $g^{-1}$. 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 μΩ • 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 Ω • 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 peg. 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 μm | 6.5D×11 |
| 2069b | SEM Performance Standard | 2 to 4 mm | 12D |
| 2090 | SEM Magnification Standard | 0.2 to 3000 μm | 10×10 |
| **RM** 8090 | SEM Magnification Reference | 0.2 to 3000 μm | 10×10 |

## 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 μm) | Pitch (in μm) | Unit Size (in cm) |
|---|---|---|---|---|
| 473 | Linewidth Measurement Standard | 0.5 to 30 | 2 to 70 | 12.7×12.7×0.23 |
| 475 | Linewidth Measurement Standard | 0.9 to 10.8 | 2 to 38 | 6.35×6.35×0.15 |
| 476 | Linewidth Measurement Standard | 0.9 to 10.8 | 2 to 38 | 6.35×6.35×0.15 |

## 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 | $^{75}As - 7\times10^{14}$ atoms/cm$^2$ | 1×1 |
| 2135c | Nickel-Chromium Thin-Film Depth Profile Standard | In Prep | 1×2.54×0.04 |
| 2136 | Chromium/Chromium Oxide Thin-Film Depth Profile Standard | 175.3 μm/cm$^2$ | 1×2.54×0.04 |
| 2137 | Boron Implant in Silicon Depth Profile Standard | $^{10}B - 1.018\times10^{15}$ atoms/cm$^2$ | 1×1 |

## 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) | $\upsilon_1 + \upsilon_3$ 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 μm D, nominal |
| 2521 | Optical Fiber Coating Standard | In Prep |
| 2522 | Pin Gauge Standard for Optical Fiber Ferrules | 126 μm 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 °, 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 μm and 2000 μm. **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 | Coating Thickness, nominal | |
|---|---|---|---|
| | 30×30 mm | (in mils) | (in μm) |
| 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 $mg/cm^2$) | Coating Thickness, estimated | |
|---|---|---|---|---|---|
| | | | | (in μin) | (in μm) |
| 2321 | Tin-Lead Alloy | Sn: 60<br>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 $cm^{-1}$ 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: 2.5×2.5×0.2 | L – 10<br>M – 13<br>H – 15<br>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 $H_2SO_4$ |
|---|---|---|---|
| 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 | $\log_{10}\rho \sim 9.9$ Ω-cm at 300 °C |
| 774 | Lead-Silica, for dielectric constant | 5×5×2.5 | $K \sim 7.47$ 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 λ=546.1 nm (Value × $10^{-12}$ $m^2/N$) |
|---|---|---|---|
| 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 $D_1$, $D_2$ line is given. The certified densities of SRMs 1826a and 1827a were determined by means of hydrostatic weighing.

| SRM | Type | Unit Size | Density (in $g/cm^3$) | 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 α and β 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° to 145° 2Θ (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 2Θ/d-Spacing | Line Position | | In Prep |
| 656 | Silicon Nitride | Quantitative Analysis | α-(0.7752630/0.5619372) | 10 |
| | | | β-(0.7602293/0.2906827) | 10 |
| 660 | $LaB_6$-2Θ | Line Profile | 0.415695 | 3 |
| 674a | Powder Diffraction Intensity | Quantitative Analysis | | |
| | α-$Al_2O_3$ (corundum) | | (0.4759397/1.299237)) | 10 |
| | $CeO_2$ (fluorite) | | (0.5411102) | 10 |
| | $Cr_2O_3$ (corundum) | | (0.4959610/1.358747) | 10 |
| | $TiO_2$ (rutile) | | (0.4593939/0.2958862) | 10 |
| | ZnO (wurtzite) | | (0.3249074/0.5206535) | 10 |
| 675 | Mica Low 2Θ | 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×4.5 cm×0.16 cm |
| 1990 | Ruby Sphere | Quantitative Analysis | | In Prep |
| 2910 | Calcium Hydroxyapatite | Quantitative Analysis | (a-0.942253)<br>(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<br>(X and Y dimensions) | Board: 300 × 300 × 3 |
| 1843 | Calibration Specimen<br>(Z dimension) | Triangular Block: 37 × 20 × 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 μm) | 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 $H_2O$) | 0.895 | 5 mL vial |
| 1691 | Polystyrene (0.5 % in $H_2O$) | 0.269 | 5 mL vial |
| 1692 | Polystyrene (0.25 % in $H_2O$) | 2.982 | 5 mL vial |
| 1960 | Polystyrene (0.4 % in $H_2O$) | 9.89 | 5 mL vial |
| 1961 | Polystyrene (0.5 % in $H_2O$) | 29.64 | 5 mL vial |
| 1963 | Polystyrene (0.5 % in $H_2O$) | 0.1007 | 5 mL vial |
| 1965 | Polystyrene | 9.84 (hexagonal array)<br>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 μm (No. 325) sieve | 8.24 % |
| | | Specific Surface area (Wagner turbidimeter) | 2086 $cm^2 \cdot g^{-1}$ |
| | | Specific Surface area (Air permeability) | 3774 $cm^2 \cdot g^{-1}$ |

## 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) | $+\mu_E$, $-2.53$ $\mu$m • cm/V • 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 $m^2$/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 × 400 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$^2$) |
|---|---|---|---|
| 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 (in µm) | |
|---|---|---|---|---|
| | | | Bright | Semibright |
| 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, $R_a$ (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 μm, 0.5 μm, 1 μm, and 2 μm 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<br>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 $LC_{50}$ value four times.

| SRM | Type | Combustion Mode | Observation Time | Values | |
|---|---|---|---|---|---|
| | | | | $LC_{50}$ | 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<br>10–min. post-exposure | 4.4 | |

*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 $W/cm^2$ | 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

# 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

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

Provide the COM, PB, SN number, or the text title of the publication.

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).

Spijkerman, J. J., Snediker, D. K., Ruegg, F. C., et al., **Standard Refereance 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

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 Cooperative 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., Biancaniello, 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 Pfieffer, 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 μm 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., Eckerle, 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 μm 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 |1obrkt|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 Linewdith 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 Cartrdige,** NIST Spec. Publ. 260–118 (July 1992). PB92-226281

Vezzetti, C. F., Varner, R. N., and Potzick, **Standard Reference Materialls: 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 $^{12}C_2H_2$ Absorption Referecne for 1510-1540 nm Wavelength Calibration — SRM 2517.** NIST Spec. Publ. 260-133 (In Prep).

# SRM/RM Indexes

## Subject Index

# Subject Index

## A

## F

## G



## H

## I

## N

## O

## P

## Q



## R

## S

## T

## U

# *SRM/RM Indexes*—(Continued)

## *Numerical and Certificate Index*

# Numerical and Certificate Index

| SRM | Descriptor | Cert. Date | Section Code | Page |
|---|---|---|---|---|
| 278 | Obsidian Rock | Mar 92 | 111 | 88 |
| 291 | LA Steel, Cr-Mo (ASTM A 213) | Oct 75 | 101 | 32 |
| 293 | LA Steel, Cr-Ni-Mo (AISI 8620) | Mar 75 | 101 | 32 |
| 330 | Copper Ore Mill Heads | Aug 91 | 111 | 84 |
| 331 | Copper Ore Mill Tails | Sep 91 | 111 | 84 |
| 334 | Gray Cast Iron (Carbon & Sulfur) | Mar 82 | 101 | 42 |
| 337a | Carbon Steel, 1.1 C (Carbon & Sulfur) | Apr 85 | 101 | 31 |
| 338 | White Cast Iron (Carbon & Sulfur) | May 93 | 101 | 42 |
| 339 | Stainless Steel, Cr-Ni-Se (SAE 303Se) | Jul 65 | 101 | 35 |
| 341 | Ductile Cast Iron | Mar 62 | 101 | 42 |
| 342a | Nodular Cast Iron | Mar 92 | 101 | 42 |
| 343a | Stainless Steel (AISI 431) | Jun 94 | 101 | 35 |
| 344 | HA Steel, (Mo Precipitation Hardening) | Oct 63 | 101 | 34 |
| 345a | HA Steel, (Cu Precipitation Hardening) | Jun 92 | 101 | 34 |
| 346a | Valve Steel | Feb 92 | 101 | 34 |
| 347 | Magnesium Ferrosilicon | Aug 90 | 101 | 41 |
| 348a | Hi Temp. Alloy, (A286) Ni-Cr | Mar 87 | 101 | 34 |
| 349a | Waspalloy™ | Jan 97 | 102 | 50 |
| 350a | Benzoic Acid | Mar 95 | 104 | 56 |
| 351 | Sodium Carbonate (Assay) | Sept 96 | 104 | 56 |
| 352c | Unalloyed Titanium, Hydrogen | Jun 90 | 102 | 52 |
| 360b | Zircaloy 4, Zr-Base Alloy | Apr 86 | 102 | 52 |
| 361 | LA Steel (AISI 4340) | Feb 81 | 101 | 33 |
| 362 | LA Steel (AISI 94B17) (mod.) | Jun 89 | 101 | 33 |
| 363 | LA Steel, Cr-V (mod.) | Feb 81 | 101 | 33 |
| 364 | LA Steel, High C (mod.) | May 93 | 101 | 33 |
| 367 | Stainless Steel (AISI 446) | Mar 95 | 101 | 35 |
| 368 | Carbon Steel (AISI 1211) | Jan 78 | 101 | 31 |
| 371h | Sulfur (Rubber Compound) | Discontinued | | |
| 372i | Stearic Acid (Rubber Compound) | Discontinued | | |
| 383a | Mercaptobenzothiazole | Discontinued | | |
| 386k | Styrene-Butadiene/500 | Discontinued | | |
| 393 | Unalloyed Copper-"O" (chips) | Sep 80 | 102 | 47 |
| 395 | Unalloyed Copper II (chips) | Jul 93 | 102 | 47 |
| 396 | Unalloyed Copper III (chips) | Apr 86 | 102 | 47 |
| 398 | Unalloyed Copper V (chips) | Jul 93 | 102 | 47 |
| 399 | Unalloyed Copper VI (chips) | Jul 93 | 102 | 47 |
| 400 | Unalloyed Copper VII (chips) | Apr 86 | 102 | 47 |
| 454 | Unalloyed Copper XI (chips) | Apr 86 | 102 | 47 |
| 457 | Unalloyed Copper IV (solid) | Apr 86 | 102 | 47 |
| 458 | Beryllium-Copper (17510) | Sep 92 | 102 | 45 |
| 459 | Beryllium-Copper (17200) | Sep 92 | 102 | 45 |
| 460 | Beryllium-Copper (17300) | Sep 92 | 102 | 45 |
| 473 | Optical Linewidth | Jan 97 | 207 | 118 |
| 475 | Optical Linewidth | Jan 92 | 207 | 118 |
| 476 | Optical Linewidth | Sep 90 | 207 | 118 |
| 480 | Tungsten-Molybdenum EPMA | Nov 68 | 103 | 53 |
| 481 | Gold-Silver EPMA | Feb 69 | 103 | 53 |
| 482 | Gold-Copper EPMA | Aug 88 | 103 | 53 |
| 484g | SEM Magnification | Sept 96 | 207 | 118 |
| 487 | Austenite in Ferrite, 30% | Discontinued | | |
| 488 | Austenite in Ferrite, 2.5% | Discontinued | | |
| 494 | Unalloyed Copper I (solid) | Apr 86 | 102 | 47 |
| 495 | Unalloyed Copper II (solid) | Oct 87 | 102 | 47 |
| 496 | Unalloyed Copper III (solid) | Apr 86 | 102 | 47 |
| 498 | Unalloyed Copper V (solid) | May 93 | 102 | 47 |
| 499 | Unalloyed Copper VI (solid) | Mar 86 | 102 | 47 |
| 500 | Unalloyed Copper VII (solid) | Mar 86 | 102 | 47 |
| 600 | Bauxite, Australian | Jan 91 | 111 | 85 |
| 607 | Potassium Feldspar | May 73 | 112 | 92 |
| 610 | Trace Elements in Glass | Jan 92 | 112 | 92 |
| 611 | Trace Elements in Glass | Jan 92 | 112 | 92 |
| 612 | Trace Elements in Glass | Jan 92 | 112 | 92 |
| 613 | Trace Elements in Glass | Jan 92 | 112 | 92 |
| 614 | Trace Elements in Glass | Jan 92 | 112 | 92 |
| 615 | Trace Elements in Glass | Jan 92 | 112 | 92 |
| 616 | Trace Elements in Glass | Jan 92 | 112 | 92 |
| 617 | Trace Elements in Glass | Jan 92 | 112 | 92 |
| 620 | Soda Lime, Flat | Jan 82 | 112 | 91 |
| 621 | Soda-Lime Container | Jan 82 | 112 | 91 |
| 622 | Soda-Lime Silica (Durability) | Mar 76 | 208 | 121 |
| 623 | Borosilicate (Durability) | Mar 76 | 208 | 121 |
| 624 | Lead-Silica, for dc resistivity | Oct 77 | 207 | 121 |
| 625 | Zinc-Base A | Jun 96 | 102 | 52 |
| 626 | Zinc-Base B | Jun 96 | 102 | 52 |
| 627 | Zinc-Base C | Jun 96 | 102 | 52 |
| 628 | Zinc-Base D | Jun 96 | 102 | 52 |
| 629 | Zinc-Base E | Jun 96 | 102 | 52 |
| 630 | Zinc-Base F | Jun 96 | 102 | 52 |
| 631 | Zinc Spelter (mod.) | Feb 95 | 102 | 52 |
| 640c | Line Position, Silicon (XRD) | In Prep | 209 | 123 |
| 641 | Titanium Alloy, 8 Mn (A) | Oct 81 | 102 | 51 |
| 642 | Titanium Alloy, 8 Mn (B) | Oct 81 | 102 | 51 |
| 643 | Titanium Alloy, 8 Mn (C) | Oct 81 | 102 | 51 |
| 644 | Titanium Alloy, Cr-Fe-Mo | Discontinued | | |
| 647 | Titanium Alloy, Al-Mo-Sn-Zr | Aug 86 | 102 | 51 |
| 648 | Titanium Alloy, Al-Sn-Zr-Cr-Mo | Jun 87 | 102 | 51 |
| 649 | Titanium Alloy, V-Al-Cr-Sn | Jul 90 | 102 | 51 |
| 650 | Unalloyed Titanium A | Nov 85 | 102 | 51 |
| 651 | Unalloyed Titanium B | Nov 85 | 102 | 51 |
| 652 | Unalloyed Titanium C | Nov 85 | 102 | 51 |
| 654b | Titanium Alloy, Al-V | Sep 91 | 102 | 51 |
| 656 | Silicon Nitride Quant. Anal. (XRD) | Mar 95 | 209 | 123 |
| 659 | Silicon Nitride, Particle Size | Mar 92 | 301 | 127 |
| 660 | Line Profile, LaB6 (XRD) | Jun 89 | 209 | 123 |
| 661 | LA Steel (AISI 4340) | Dec 91 | 101 | 36 |
| 663 | LA Steel, Cr-V (mod.) | Dec 91 | 101 | 36 |
| 664 | LA Steel, High Carbon, (mod.) | Dec 91 | 101 | 36 |
| 665 | Electrolytic Iron | Dec 91 | 101 | 36 |
| 670 | Rutile Ore | Jan 93 | 111 | 85 |
| 671 | Nickel Oxide 1 | Sep 60 | 102 | 51 |
| 672 | Nickel Oxide 2 | Sep 60 | 102 | 51 |
| 673 | Nickel Oxide 3 | Sep 60 | 102 | 51 |
| 674a | Quant. Analysis, Set (XRD) | Jan 89 | 209 | 123 |
| 675 | Line Position, Mica (XRD) | Jun 82 | 209 | 123 |
| 676 | Quantitative Analysis, Alumina (XRD) | May 92 | 209 | 123 |
| 679 | Brick Clay | Jan 87 | 111 | 87 |
| 680L1a | High Purity Platinum | Jul 95 | 104 | 54 |
| 680L2a | High Purity Platinum | Jul 95 | 104 | 54 |
| 682 | High Purity Zinc | Jan 88 | 104 | 54 |
| 683 | Zinc, Metal | Jan 88 | 104 | 54 |
| 685R | High Purity Gold | Oct 81 | 104 | 54 |
| 685W | High Purity Gold | Oct 81 | 104 | 54 |
| 688 | Basalt Rock | Aug 81 | 111 | 88 |
| 689 | Ferrochromium Silicon | Feb 82 | 101 | 41 |
| 690 | Iron Ore Canada | Jun 92 | 111 | 85 |
| 691 | Iron Oxide, Reduced | Oct 91 | 111 | 85 |
| 692 | Iron Ore, Labrador | Jan 92 | 111 | 85 |
| 693 | Iron Ore, Nimba | Jul 90 | 111 | 85 |
| 694 | Phosphate Rock, Western | Sep 93 | 110/111 | 83/86 |
| 696 | Bauxite, Surinam | Jan 91 | 111 | 86 |
| 697 | Bauxite, Dominican | Jan 91 | 111 | 86 |
| 698 | Bauxite, Jamaican | Jan 91 | 111 | 86 |
| 699 | Alumina (Reduction Grade) | Dec 93 | 111 | 86 |
| 705a | Polystyrene | Jul 90 | 202/203 | 101/104 |
| 706 | Polystyrene | Apr 95 | 202 | 101 |
| 709 | Extra Dense Lead | Jun 74 | 208 | 122 |
| 710a | Soda-Lime Silica Glass | Mar 91 | 208 | 121/122 |
| 711a | Lead-Silica Glass | In Prep | 208 | 121 |
| 713 | Dense Barium Crown Glass 620/603 | Oct 65 | 208 | 122 |
| 714 | Alkaline Earth Glass | Oct 65 | 208 | 122 |
| 716 | Neutral Glass | Sep 66 | 208 | 122 |
| 717a | Borosilicate | Sep 96 | 208 | 121/122 |
| 720 | Synthetic Sapphire (Heat Capacity) | Apr 82 | 203 | 104 |
| 723c | Tris (Basimetric) | In Prep | 104 | 56 |
| 724a | Tris (Heat of Soln.) | Discontinued | | |
| 726 | Selenium, Intermediate Purity | Jan 67 | 104 | 54 |

| SRM | Descriptor | Cert. Date | Section Code | Page |
|---|---|---|---|---|
| 728 | Zinc, Intermediate Purity | Jul 96 | 104 | 54 |
| 731L1 | Borosilicate Glass (Therm. Expansion) | Jul 93 | 203 | 107 |
| 731L2 | Borosilicate Glass (Therm. Expansion) | Jul 93 | 203 | 107 |
| 731L3 | Borosilicate Glass (Therm. Expansion) | Jul 93 | 203 | 107 |
| 736L1 | Copper Therm. Exp. | Oct 90 | 203 | 107 |
| 738 | Stainless Steel (Ther. Expansion) | May 93 | 203 | 107 |
| 739L1 | Fused Silica (Ther. Resist.) | Dec 91 | 203 | 107 |
| 739L2 | Fused Silica (Ther. Resist.) | Dec 91 | 203 | 107 |
| 739L3 | Fused Silica (Ther. Resis.) | Dec 91 | 203 | 107 |
| 740a | Zinc (Freezing Point) | Nov 90 | 203 | 105 |
| 741 | Tin (Freezing Point) | Jun 90 | 203 | 105 |
| 742 | Alumina (Reference Point) | Jul 90 | 203 | 105 |
| 743 | Mercury (Triple Point) | Jul 90 | 203 | 105 |
| 745 | Gold-Vapor Pressure | Aug 90 | 203 | 106 |
| 746 | Cadmium-Vapor Pressure | Jan 91 | 203 | 106 |
| 767a | Thermometric Fixed Point | Feb 92 | 203 | 104 |
| 769 | Aluminum (Residual Resist. Ratio) | Nov 82 | 206 | 117 |
| 773 | Soda-Lime-Silica (Glass Liquidus) | Nov 80 | 208 | 121 |
| 774 | Lead-Silica (Dielectric Constant) | Jul 82 | 208 | 121 |
| 781D2 | Molybdenum (Heat Capacity) | Apr 77 | 203 | 104 |
| 855a | Aluminum Casting Alloy 356 | Jan 90 | 102 | 44 |
| 856a | Aluminum Casting Alloy 380 | Jan 90 | 102 | 44 |
| 858 | Aluminum Alloy 6011 | Mar 95 | 102 | 44 |
| 859 | Aluminum Alloy 7075 | Jun 80 | 102 | 44 |
| 862 | High Temp. Alloy L605 | Oct 91 | 101/102 | 34/44 |
| 864 | Inconel™, 600 | May 84 | 102 | 50 |
| 865 | Inconel™, 625 | May 84 | 102 | 50 |
| 866 | Incoloy™, 800 | May 84 | 102 | 39 |
| 867 | Incoloy™, 825 | May 84 | 102 | 39 |
| 868 | High Temp. Alloy Fe-Ni-Co | Apr 93 | 101 | 34 |
| 869 | LC Column Selectivity | Mar 90 | 109 | 75 |
| 871 | Bronze, Phosphor (CDA 521) | Aug 79 | 102 | 45 |
| 872 | Bronze, Phosphor (CDA 544) | Aug 79 | 102 | 45 |
| 874 | Cupro-Nickel, 10% (CDA 706) "H-P" | Jan 78 | 102 | 45 |
| 875 | Cupro-Nickel, 10% (CDA 706) "Doped" | Jan 78 | 102 | 45 |
| 879 | Nickel Silver, (CDA 762) | Jun 79 | 102 | 45 |
| 880 | Nickel Silver, (CDA 770) | Jun 79 | 102 | 45 |
| 882 | Alloy Ni-Cu-Al | Aug 79 | 102 | 50 |
| 885 | Refined Copper | Mar 91 | 104 | 54 |
| 886 | Gold, Ore Refractory | Mar 95 | 111 | 86 |
| 887 | Cemented Carbide (W83-Co10) | Sep 88 | 112 | 90 |
| 888 | Cemented Carbide (W64-Co25-Ta5) | Sep 88 | 112 | 90 |
| 889 | Cemented Carbide (W75-Co9-Ta5-Ti4) | Sep 88 | 112 | 90 |
| 890 | Cast Iron, HC250+V | Apr 82 | 101 | 42 |
| 891 | Cast Iron, Ni-Hard, Type I | Apr 82 | 101 | 42 |
| 892 | Cast Iron, Ni-Hard, Type IV | Apr 82 | 101 | 42 |
| 893 | Stainless Steel (SAE 405) | Mar 92 | 101 | 35 |
| 895 | Stainless Steel (SAE 201) | Dec 91 | 101 | 35 |
| 897 | "Tracealloy" A | Aug 83 | 102 | 50 |
| 898 | "Tracealloy" B | Aug 83 | 102 | 50 |
| 899 | "Tracealloy" C | Aug 83 | 102 | 50 |
| 900 | Antiepilepsy Drug (4) Level | Apr 79 | 105 | 62 |
| 909b | Human Serum | Oct 97 | 105 | 62/63 |
| 910 | Sodium Pyruvate | May 81 | 105 | 62 |
| 911b | Cholesterol | Apr 94 | 105 | 62 |
| 912a | Urea | Dec 90 | 105 | 62 |
| 913 | Uric Acid | Sep 68 | 105 | 62 |
| 914a | Creatinine | Feb 94 | 105 | 62 |
| 915a | Calcium Carbonate (Clinical) | Jan 95 | 105 | 62 |
| 916a | Bilirubin | Jun 89 | 105 | 62 |
| 917a | D-Glucose (Dextrose-Clinical) | Aug 89 | 105 | 62 |
| 918a | Potassium Chloride (Clinical) | Apr 95 | 105 | 62 |
| 919a | Sodium Chloride (Clinical) | Feb 91 | 105 | 62 |
| 920 | D-Mannitol | Jan 72 | 105 | 62 |
| 921 | Cortisol (Hydrocortisone) | Feb 93 | 105 | 62 |
| 924a | Lithium Carbonate (Clinical) | Jun 95 | 105 | 62 |
| 925 | VMA (Clinical) | May 73 | 105 | 62 |
| 927c | Bovine Serum Albumin | In Prep | 105 | 62/63 |
| 928 | Lead Nitrate (Clinical) | Apr 94 | 105 | 62 |
| 929 | Magnesium Gluconate | Mar 93 | 105 | 62 |
| 930e | Glass Filters, Transmittance | Jun 96 | 204 | 108/110 |
| 931e | Liquid Filters, Absorbance | Apr 97 | 204 | 108/110 |
| 934 | Clinical Thermometer | Oct 92 | 203 | 106 |
| 935a | Potassium Dichromate, UV Absorbance | Apr 88 | 204 | 108/110 |
| 936a | Quinine Sulfate, Fluorescence | Dec 94 | 204 | 110 |
| 937 | Iron Metal (Clinical) | Sep 95 | 105 | 62 |
| 938 | 4-Nitrophenol | Aug 95 | 105 | 62 |
| 951 | Boric Acid, Assay and Isotopic | Feb 69 | 105 | 56/60 |
| 952 | Boric Acid 95% enr. 10B | Feb 69 | 104 | 60 |
| 953 | Neutron Density Monitor Wire | Mar 69 | 205 | 112 |
| 955b | Lead in Blood | Dec 94 | 105 | 62 |
| 956a | Electrolytes in Frozen Human Serum | Nov 96 | 105 | 62/63 |
| 963a | Fission Track Glass U-1 mg/g | Feb 84 | 205 | 112 |
| 965 | Glucose in Frozen Human Serum | Dec 96 | 105 | 62/63 |
| 966 | Toxic Elements in Blood | In Prep | 105 | 62 |
| 968b | Fat-Sol. Vit. & Chol. in Serum | Aug 95 | 105 | 62/63 |
| 975a | Chlorine (Isotopic) | In Prep | 104 | 60 |
| 976 | Copper (Isotopic) | Jan 94 | 104 | 60 |
| 977 | Bromine (Isotopic) | Mar 65 | 104 | 60 |
| 978a | Silver (Isotopic) | Sep 84 | 104 | 60 |
| 979 | Chromium (Isotopic) | May 66 | 104 | 60 |
| 980 | Magnesium (Isotopic) | Jan 67 | 104 | 60 |
| 981 | Natural Lead (Isotopic) | Mar 91 | 104 | 60 |
| 982 | Equal Atom Lead (Isotopic) | Mar 91 | 104 | 60 |
| 983 | Radiogenic Lead (Isotopic) | Mar 91 | 104 | 60 |
| 984 | Rubidium Assay (Isotopic) | Jul 70 | 104 | 60 |
| 985 | Potassium Assay (Isotopic) | Aug 79 | 104 | 60 |
| 986 | Nickel (Isotopic) | May 90 | 104 | 60 |
| 987 | Strontium Assay and Isotopic | Oct 82 | 104 | 56/60 |
| 989 | Rhenium Assay (Isotopic) | Feb 74 | 104 | 60 |
| 990 | Silicon Assay (Isotopic) | Aug 74 | 104 | 60 |
| 991 | Lead-206 Spike Assay and Isotopic | Mar 76 | 104 | 60 |
| 994 | Gallium (Isotopic) | Feb 86 | 104 | 60 |
| 997 | Thallium (Isotopic) | Jul 86 | 104 | 60 |
| 998 | Angiotensin I (Human) | Jan 83 | 105 | 62 |
| 999a | Potassium Chloride (Assay) | Apr 95 | 104 | 56 |
| 1001 | X-Ray Film Step Tablet | Oct 97 | 204 | 111 |
| 1002d | Hard Board (Surface Flammability) | Aug 89 | 305 | 131 |
| 1003b | Glass (Particle Size) | Sep 93 | 301 | 127 |
| 1004a | Glass (Particle Size) | Dec 93 | 301 | 127 |
| 1006c | Alpha-Cellulose (Smoke Density) | Discontinued | | |
| 1007b | Plastic, (Smoke Density) | Apr 91 | 305 | 131 |
| 1008 | Photographic Step Tablet | In Prep | 204 | 111 |
| 1010a | Microcopy Test Chart | Jun 90 | 204 | 111 |
| 1012 | Flooring Radiant Panel | Sep 84 | 305 | 131 |
| 1017b | Glass (Particle Size) | Aug 95 | 301 | 127 |
| 1018b | Glass (Particle Size) | Apr. 97 | 301 | 127 |
| 1019b | Glass (Particle Size) | Jul 97 | 301 | 127 |
| 1034 | Unalloyed Copper | Feb 82 | 102 | 45 |
| 1035 | Leaded-Tin Bronze Alloy | Feb 82 | 102 | 45 |
| 1048 | Smoke Toxicity (Cup Furnace) | Nov 91 | 305 | 131 |
| 1049 | Smoke Toxicity (Univ. Pitts.) | Nov 92 | 305 | 131 |
| 1051b | Barium (Metallo-Organic) | Jun 91 | 114 | 95 |
| 1052b | Vanadium (Metallo-Organic) | Apr 93 | 114 | 95 |
| 1053a | Cadmium (Metallo-Organic) | Jan 70 | 114 | 95 |
| 1057b | Tin (Metallo-Organic) | Aug 68 | 114 | 95 |
| 1059c | Lead (Metallo-Organic) | Sep 87 | 114 | 95 |
| 1060a | Lithium (Metallo-Organic) | Apr 64 | 114 | 95 |
| 1065b | Nickel (Metallo-Organic) | Nov 93 | 114 | 95 |
| 1066a | Silicon (Metallo-Organic) | Jun 91 | 114 | 95 |
| 1069b | Sodium (Metallo-Organic) | Jun 91 | 114 | 95 |
| 1070a | Strontium (Metallo-Organic) | Apr 64 | 114 | 95 |
| 1071b | Phosphorus (Metallo-Organic) | Sep 91 | 114 | 95 |
| 1073b | Zinc (Metallo-Organic) | Sep 86 | 114 | 95 |
| 1075a | Aluminum (Metallo-Organic) | Oct 67 | 114 | 95 |
| 1077a | Silver (Metallo-Organic) | Feb 68 | 114 | 95 |
| 1078b | Chromium (Metallo-Organic) | Jul 72 | 114 | 95 |
| 1079b | Iron (Metallo-Organic) | Feb 69 | 114 | 95 |
| 1080a | Copper (Metallo-Organics) | Feb 69 | 114 | 95 |
| 1083 | Wear Metals (Base Oil) | Jul 91 | 114 | 96 |
| 1084a | Wear Metals | Apr 91 | 114 | 96 |
| 1085a | Wear Metals | Apr 91 | 114 | 96 |
| 1089 | Steels, Set (SRMs 1095-99) | Apr 86 | 101 | 34 |

| SRM | Descriptor | Cert. Date | Section Code | Page |
|---|---|---|---|---|
| 1090 | Ingot Iron, Oxygen | Nov 85 | 101 | 34 |
| 1091a | Stainless Steel (AISI 431) | Nov 85 | 101 | 34 |
| 1093 | Valve Steel, Oxygen | Nov 84 | 101 | 34 |
| 1094 | Maraging Steel | Nov 84 | 101 | 34 |
| 1095 | Steel (AISI 4340) [see SRM 1089] | Apr 86 | 101 | 34 |
| 1096 | Steel (AISI 94B17) [see SRM 1089] | Apr 86 | 101 | 34 |
| 1097 | Cr-V Steel (mod.) [see SRM 1089] | Apr 86 | 101 | 34 |
| 1098 | Steel (High Carbon) [see SRM 1089] | Apr 86 | 101 | 34 |
| 1099 | Electrolytic Iron [see SRM 1089] | Apr 86 | 101 | 34 |
| 1104 | Free-Cutting Brass | Aug 65 | 102 | 46 |
| 1107 | Naval Brass B | Nov 81 | 102 | 46 |
| 1108 | Naval Brass C | Nov 81 | 102 | 46 |
| 1110 | Red Brass B | Oct 81 | 102 | 46 |
| 1111 | Red Brass C | Oct 81 | 102 | 46 |
| 1112 | Gilding Metal A (disk) | Oct 81 | 102 | 46 |
| C1112 | Gilding Metal A (block) | Oct 81 | 102 | 46 |
| 1113 | Gilding Metal B (disk) | Oct 81 | 102 | 46 |
| C1113 | Gilding Metal B (block) | Oct 81 | 102 | 46 |
| 1114 | Gilding Metal C (disk) | Oct 81 | 102 | 46 |
| C1114 | Gilding Metal C (block) | Oct 81 | 102 | 46 |
| 1115 | Commercial Bronze A (disk) | Nov 81 | 102 | 46 |
| C1115 | Commercial Bronze A (block) | Nov 81 | 102 | 46 |
| 1116 | Commercial Bronze B (disk) | Nov 81 | 102 | 46 |
| C1116 | Commercial Bronze B (block) | Nov 81 | 102 | 46 |
| 1117 | Commercial Bronze C (disk) | Nov 81 | 102 | 46 |
| C1117 | Commercial Bronze C (block) | Nov 81 | 102 | 46 |
| C1122 | Beryllium-Copper (block) | Dec 81 | 102 | 46 |
| C1123 | Beryllium-Copper (block) | Discontinued | | |
| 1128 | Ti Alloy, V-Al-Cr-Sn | Jul 91 | 102 | 51 |
| 1129 | Solder 63Sn-37Pb | May 89 | 102 | 49 |
| 1131 | Solder 60Pb-40Sn | Oct 81 | 102 | 49 |
| 1132 | Bearing Metal (Pb-Sn) | Nov 94 | 102 | 49 |
| 1134 | LA Steel, High Silicon | Apr 70 | 101 | 36 |
| 1135 | LA Steel, High Silicon | Jul 72 | 101 | 36 |
| C1137a | White Cast Iron | Sep 96 | 101 | 43 |
| 1138a | Cast Steel (No. 1) | Jan 77 | 101 | 43 |
| 1139a | Cast Steel (No. 2) | Jan 77 | 101 | 43 |
| C1145a | White Cast Iron | Jan 88 | 101 | 43 |
| C1146a | White Cast Iron | Discontinued | | |
| C1151a | Stainless Steel 23Cr-7Ni | Dec 92 | 101 | 40 |
| C1152a | Stainless Steel 18Cr-11Ni | Feb 90 | 101 | 40 |
| C1153a | Stainless Steel 17Cr-9Ni | Sep 90 | 101 | 40 |
| C1154a | Stainless Steel 19Cr-13Ni | Jun 92 | 101 | 40 |
| 1155 | Stainless Steel Cr-Ni-Mo (AISI 316) | Aug 69 | 101 | 40 |
| 1157 | Specialty Steel, Tool (AISI M2) | Aug 73 | 101 | 40 |
| 1158 | Specialty Steel, High Nickel (Ni36) | Dec 77 | 101 | 40 |
| 1159 | Elec/Mag Ni-Fe | Aug 81 | 102 | 50 |
| 1160 | Elec/Mag Ni-Mo-Fe | Aug 81 | 102 | 50 |
| 1171 | Stainless Steel Cr-Ni-Ti (AISI 321) | May 93 | 101 | 40 |
| 1172 | Stainless Steel Cr-Ni-Nb (AISI 348) | Jul 71 | 101 | 40 |
| 1173 | Ni-Cr-Mo-V Steel | Jun 89 | 101 | 43 |
| C1173 | Cast Steel 3 | Jan 89 | 101 | 43 |
| 1216 | Carbon Modified Silicon | Nov 87 | 106 | 69 |
| 1218 | LA Steel, High Silicon | Nov 84 | 101 | 36 |
| 1219 | Stainless Steel Cr-Ni (AISI 431) | Sep 85 | 101 | 40 |
| C1221 | LA Carbon (AISI 1211) | Apr 93 | 101 | 36 |
| 1222 | LA Steel, Cr-Ni-Mo (AISI 8640) | Sep 90 | 101 | 36 |
| 1223 | Chromium Steel | May 93 | 101 | 40 |
| 1224 | LA Steel, Carbon (AISI 1078) | Feb 81 | 101 | 36 |
| 1225 | LA Steel (AISI 4130) | Mar 83 | 101 | 36 |
| 1226 | LA Steel | Sep 96 | 101 | 36 |
| 1227 | LA Steel, Basic Open Hearth, 1% C | Mar 83 | 101 | 36 |
| 1228 | LA Steel, 0.1% C | Jun 93 | 101 | 36 |
| 1230 | High Temp. Alloy, A286 | Jun 87 | 101 | 39 |
| 1233 | Specialty Steel, Valve Steel | Mar 92 | 101 | 40 |
| 1235 | Zirconium B for Hf | Discontinued | | |
| 1242 | High Temp. Alloy L-605 | Nov 91 | 102 | 44 |
| 1243 | Waspaloy™ | Jan 89 | 102 | 50 |
| 1244 | Inconel™ 600 | May 84 | 101 | 50 |
| 1245a | Inconel™ 625 | May 84 | 101 | 50 |
| 1246 | Incoloy™ 800 | May 84 | 101 | 39 |
| 1247 | Incoloy™ 825 | May 84 | 101 | 39 |
| C1248 | Nickel-Copper Alloy | Dec 86 | 102 | 50 |
| 1249 | Inconel™ 718 | Mar 96 | 102 | 50 |
| 1250 | High Temp. Alloy Fe-Ni-Co | Jul 93 | 101 | 39 |
| C1252 | Phos. Copper IX | Apr 86 | 102 | 47 |
| C1253 | Phos Copper X | Discontinued | | |
| 1254 | LA Steel (Ca only) | Apr 82 | 101 | 36 |
| 1258 | Aluminum Alloy 6011 | May 78 | 102 | 44 |
| 1259 | Aluminum Alloy 7075 | May 78 | 102 | 44 |
| 1261a | LA Steel (AISI 4340) | May 93 | 101 | 36 |
| 1262b | LA Steel (AISI 94B17) | Oct 92 | 101 | 36 |
| 1263a | LA Steel Cr-V (mod.) | Feb 81 | 101 | 36 |
| 1264a | LA Steel, High Carbon (mod.) | Jan 88 | 101 | 36 |
| 1265a | Electrolytic Iron | Jun 89 | 101 | 36 |
| 1269 | Line Pipe (AISI 1521 mod.) | Jun 81 | 101 | 36 |
| 1270 | LA Steel, Cr-Mo (A336) (F-22) | Jun 81 | 101 | 36 |
| 1271 | LA Steel (HSLA-100) | Oct 91 | 101 | 36 |
| 1276a | Cupro-Nickel (CDA 715) | Jun 89 | 102 | 46 |
| C1285 | LA Steel (A242) (mod.) | Jun 82 | 101 | 36 |
| 1286 | LA Steel HY 80 | Mar 92 | 101 | 36 |
| C1287 | Stainless Steel (AISI 310 mod.) | Jun 81 | 101 | 40 |
| C1288 | Stainless Steel (A-743) | Aug 81 | 101 | 40 |
| C1289 | Stainless Steel (AISI 414 mod.) | Discontinued | | |
| C1290 | High Alloy (HC-250 + V) | Jan 85 | 101 | 43 |
| C1291 | High Alloy (Ni-Hard, Type I) | Jan 85 | 101 | 43 |
| C1292 | High Alloy (Ni-Hard, Type IV) | Jan 85 | 101 | 43 |
| 1295 | Stainless Steel (SAE 405) | Mar 92 | 101 | 40 |
| C1296 | Stainless Steel 28Cr-3Mo (SAE 460) | Dec 91 | 101 | 40 |
| 1297 | Stainless Steel Cr-Ni-Mn (SAE 201) | Dec 91 | 101 | 40 |
| 1357 | Cu & Cr Coating on Steel | Jul 91 | 207 | 119 |
| 1358a | Cu & Cr Coating on Steel | In Prep | 207 | 119 |
| 1359 | Cu & Cr Coating on Steel | Jul 91 | 207 | 119 |
| 1360 | Cu & Cr Coating on Steel | Jul 91 | 207 | 119 |
| 1361a | Cu & Cr Coating on Steel | Jul 91 | 207 | 119 |
| 1362b | Cu & Cr Coating on Steel | In Prep | 207 | 119 |
| 1363a | Cu & Cr Coating on Steel | Jul 91 | 207 | 119 |
| 1364a | Cu & Cr Coating on Steel | Jul 91 | 207 | 119 |
| 1371 | Gold Coating on Fe-Ni-Co Alloy | Discontinued | | |
| 1373 | Gold Coating on Fe-Ni-Co Alloy | Discontinued | | |
| 1374 | Gold Coating on Fe-Ni-Co Alloy | Discontinued | | |
| 1400 | Bone Ash | Dec 92 | 105 | 62 |
| 1411 | Soft Borosilicate Glass | Aug 85 | 112 | 91 |
| 1412 | Multicomponent Glass | Aug 85 | 112 | 91 |
| 1413 | Glass Sand (High Alumina) | Aug 85 | 111/112 | 88/91 |
| 1414 | Lead-Silica (Resistivity) | Discontinued | | |
| 1416 | Glass Al-Silicate (Glass Liquidus) | Discontinued | | |
| 1449 | Fumed Silica Board | Jan 89 | 203 | 107 |
| 1450c | Fibrous Glass Board | Mar 97 | 203 | 107 |
| 1452 | Fibrous Glass Blanket | Apr 86 | 203 | 107 |
| 1453 | Expanded Polystyrene Board | Dec 96 | 203 | 107 |
| 1457 | Superconducting Nb-Ti Wire | Jun 84 | 206 | 117 |
| 1459 | Fumed Silica Board | Jan 89 | 203 | 107 |
| 1461 | Stainless Steel (Therm./Elec. Resist.) | May 84 | 203/206 | 107/117 |
| 1462 | Stainless Steel (Therm./Elect. Resist.) | May 84 | 203/206 | 107/117 |
| 1473a | Polyethylene Resin | Aug 95 | 202 | 101 |
| 1474 | Polyethylene Resin | Apr 90 | 202 | 101 |
| 1475a | Polyethylene, Linear | Jun 96 | 202 | 101 |
| 1478 | Polystyrene, Narrow Mol. Wt. | Jul 92 | 202 | 101 |
| 1479 | Polystyrene, Narrow Mol. Wt. | Mar 92 | 202 | 101 |
| 1480 | Polyurethane | Aug 92 | 202 | 101 |
| 1482a | Polyethylene, Linear | Dec 97 | 202 | 101 |
| 1483 | Polyethylene, Linear | Mar 76 | 202 | 101 |
| 1484a | Polyethylene, Linear | Oct 92 | 202 | 101 |
| 1486 | Bone Meal | Dec 92 | 105 | 62 |
| 1487 | Poly (methylmethacrylate) | Jun 89 | 202 | 101 |

| SRM | Descriptor | Cert. Date | Section Code | Page |
|---|---|---|---|---|
| 1488 | Poly (methylmethacrylate) | Feb 88 | 202 | 101 |
| 1489 | Poly (methylmethacrylate) | Mar 86 | 202 | 101 |
| 1491 | Arom. Hydro/Hexane Toluene | Aug 89 | 109 | 75 |
| 1492 | Chlor. Pesticides/Hexane | Apr 92 | 109 | 75 |
| 1493 | PCB Congeners | Feb 95 | 109 | 75 |
| 1496 | Polyethylene Gas Pipe Resin | Sep 88 | 202 | 101 |
| 1497 | Polyethylene Gas Pipe Resin | Jul 87 | 202 | 101 |
| 1507b | THC-COOH in Urine | Nov 94 | 105 | 64 |
| 1508a | Cocaine Metab. in Urine | In Prep | 105 | 64 |
| 1511 | Multi-Drugs of Abuse in Urine | Sep 94 | 105 | 65 |
| 1514 | Thermal Analysis Purity Set (DSC) | Jul 84 | 203 | 104 |
| 1515 | Apple Leaves | Jan 93 | 110 | 82 |
| 1543 | GC/MS and LS System Performance | Aug 84 | 109 | 75 |
| 1544 | Diet Composite | Feb 96 | 110 | 80 |
| 1547 | Peach Leaves | Jan 92 | 110 | 82 |
| 1548a | Typical Diet | In Prep | 110 | 80 |
| 1549 | Non-Fat Milk Powder | Jul 85 | 110 | 79 |
| 1563 | Coconut Oil | Nov 96 | 110 | 80 |
| 1566b | Oyster Tissue | In Prep | 110 | 79 |
| 1567a | Wheat Flour | Sep 88 | 110 | 79 |
| 1568a | Rice Flour | Jan 88 | 110 | 79 |
| 1570a | Trace Elements in Spinach Leaves | Jul 96 | 110 | 82 |
| 1573a | Tomato Leaves | Nov 95 | 110 | 82 |
| 1575 | Pine Needles | Feb 93 | 110 | 82 |
| 1577b | Bovine Liver | Aug 91 | 110 | 79 |
| 1580 | Shale Oil | Nov 80 | 109 | 75 |
| 1581 | PCBs in Oil | Jun 90 | 109 | 75 |
| 1582 | Petroleum Crude Oil | Jan 84 | 109 | 75 |
| 1584 | Phenols in Methanol | Apr 84 | 109 | 75 |
| 1586 | Isotope Label Pollutants | Oct 84 | 109 | 75 |
| 1587 | Nitro PAH in Methanol | Jun 85 | 109 | 75 |
| 1588a | Organics in Cod Liver Oil | In Prep | 109 | 75 |
| 1589a | PCBs (Aroclor 1260) in Human Serum | In Prep | 109 | 75 |
| 1595 | Tripalmitin | Jul 83 | 105 | 62 |
| 1596 | Nitropyrenes in Methylene Chloride | Jul 87 | 109 | 75 |
| 1597 | Complex PAH Mix | May 92 | 109 | 75 |
| 1598 | Inorg. Const. in Bovine Serum | Jan 90 | 105 | 62 |
| 1599 | 2 Anticonvulsant Drugs | Aug 82 | 105 | 62 |
| 1614 | Dioxin in *Iso*octane | Jul 85 | 109 | 75 |
| 1616a | Sulfur in Kerosene | Sep 95 | 108 | 73 |
| 1617a | Sulfur in Kerosene | Jul 95 | 108 | 73 |
| 1618 | Vanadium & Nickel in Fuel Oil | May 85 | 108 | 72 |
| 1619a | Sulfur in Residual Fuel Oil | Apr 91 | 108 | 73 |
| 1620b | Sulfur in Residual Fuel Oil | Jul 90 | 108 | 73 |
| 1621e | Sulfur in Residual Fuel Oil | Jul 96 | 108 | 73 |
| 1622e | Sulfur in Residual Fuel Oil | Apr 97 | 108 | 73 |
| 1623c | Sulfur in Residual Fuel Oil | Jul 96 | 108 | 73 |
| 1624c | Sulfur in Distillate Fuel Oil | Jun 97 | 108 | 73 |
| 1625 | SO2 Permeation Tube-10 cm | May 95 | 107 | 71 |
| 1626 | SO2 Permeation Tube-5 cm | May 95 | 107 | 71 |
| 1627 | SO2 Permeation Tube-2 cm | Discontinued | | |
| 1629a | NO2 Permeation Device 1 cm | Discontinued | | |
| 1632b | Trace Elements in Coal (Bituminous) | Jun 97 | 108 | 73/74 |
| 1633b | Trace Elements in Coal Fly Ash | Jun 93 | 108 | 74 |
| 1634c | Trace Elements in Fuel Oil | Aug 95 | 108 | 72 |
| 1635 | Trace Elements in Coal (Subbituminous) | Oct 95 | 108 | 73/74 |
| 1639 | Halocarbons (in methanol) | Apr 83 | 109 | 75 |
| 1640 | Natural Water | Oct 97 | 106 | 68 |
| 1641c | Mercury in Water | Jun 93 | 106 | 68 |
| 1643d | Trace Elements in Water | Jul 95 | 106 | 68 |
| 1646a | Estuarine Sediment | Jan 95 | 106/111 | 68/89 |
| 1647d | Priority Pollutant PAHs | Oct 96 | 109 | 75 |
| 1648 | Urban Particulate Matter | Aug 91 | 106 | 68/69 |
| 1649a | Urban Dust/Organics | In Prep | 109 | 75 |
| 1650a | Diesel Particulate Matter | In Prep | 109 | 75 |
| 1655 | KCl Solution Calorimetry | Mar 81 | 203 | 103 |
| 1656 | Thianthrene Combustion Calorimetry | Jan 85 | 203 | 103 |
| 1657 | Synthetic Refuse-Derived Fuel | May 93 | 203 | 103 |
| 1658a | CH4/Air, 1 µmol/mol | Jun 93 | 107 | 71 |
| 1659a | CH4/Air, 10 µmol/mol | Aug 97 | 107 | 71 |
| 1660a | CH4-C3H8/Air, 1 µmol/mol | Nov 95 | 107 | 71 |
| 1661a | SO2/N2, 500 µmol/mol | Feb 97 | 107 | 71 |
| 1662a | SO2/N2, 1000 µmol/mol | Feb 97 | 107 | 71 |
| 1663a | SO2/N2, 1500 µmol/mol | Feb 97 | 107 | 71 |
| 1664a | SO2/N2, 2500 µmol/mol | Aug 96 | 107 | 71 |
| 1665b | C3H8/Air, 3 µmol/mol | May 97 | 107 | 71 |
| 1666b | C3H8/Air, 10 µmol/mol | May 97 | 107 | 71 |
| 1667b | C3H8/Air, 50 µmol/mol | Feb 97 | 107 | 71 |
| 1668b | C3H8/Air, 100 µmol/mol | Jan 97 | 107 | 71 |
| 1669b | C3H8/Air, 500 µmol/mol | Oct 96 | 107 | 71 |
| 1670a | CO2/Air, 300 µmol/mol | Discontinued | | |
| 1671a | CO2/Air, 340 µmol/mol | In Prep | 107 | 71 |
| 1672a | CO2/Air, 350 µmol/mol | In Prep | 107 | 71 |
| 1674b | CO2/N2, mol 7% | In Prep | 107 | 70 |
| 1675b | CO2/N2, mol 14% | In Prep | 107 | 70 |
| 1677c | CO/N2, 10 µmol/mol | Mar 94 | 107 | 70 |
| 1678c | CO/N2, 50 µmol/mol | Nov 95 | 107 | 70 |
| 1679c | CO/N2, 100 µmol/mol | Jun 97 | 107 | 70 |
| 1680b | CO/N2, 500 µmol/mol | Nov 95 | 107 | 70 |
| 1681b | CO/N2, 1000 µmol/mol | Nov 95 | 107 | 70 |
| 1683b | NO/N2, 50 µmol/mol | Dec 97 | 107 | 71 |
| 1684b | NO/N2, 100 µmol/mol | In Prep | 107 | 71 |
| 1685b | NO/N2, 250 µmol/mol | Nov 96 | 107 | 71 |
| 1686b | NO/N2, 500 µmol/mol | Sep 96 | 107 | 71 |
| 1687b | NO/N2, 1000 µmol/mol | Nov 96 | 107 | 71 |
| 1690 | Polystyrene (Particle Size) | Dec 82 | 301 | 127 |
| 1691 | Polystyrene (Particle Size) | May 84 | 301 | 127 |
| 1692 | Polystyrene (Particle Size) | May 91 | 301 | 127 |
| 1693a | SO2/N2, 50 µmol/mol | Aug 96 | 107 | 71 |
| 1694a | SO2/N2, 100 µmol/mol | Aug 96 | 107 | 71 |
| 1696a | SO2/N2, 3500 µmol/mol | Sep 96 | 107 | 71 |
| 1700a | CO2/N2, 10 mol (Blood Gas) % | Discontinued | | |
| 1701a | CO2-5%, O2-12 mol (Blood Gas) %/N2 | Discontinued | | |
| 1702a | CO2-5%, O2-20 mol (Blood Gas) %/N2 | Discontinued | | |
| 1703a | CO2-10%, O2-7 mol (Blood Gas) %/N2 | Discontinued | | |
| 1710 | Aluminum Alloy 3004 | Jun 93 | 102 | 44 |
| 1711 | Aluminum Alloy 3004 | Jun 93 | 102 | 44 |
| 1712 | Aluminum Alloy 3004 | Jun 93 | 102 | 44 |
| 1713 | Aluminum Alloy 5182 | Jun 93 | 102 | 44 |
| 1714 | Aluminum Alloy 5182 | Jun 93 | 102 | 44 |
| 1715 | Aluminum Alloy 5182 | Jun 93 | 102 | 44 |
| 1744 | Aluminum (Freezing Point) | Nov 94 | 203 | 105 |
| 1745 | Indium (Freezing Point) | In Prep | 203 | 105 |
| 1746 | Silver (Freezing Point) | Jul 93 | 203 | 105 |
| 1747 | Tin (Freezing Point) | Mar 97 | 203 | 105 |
| 1748 | Zinc (Freezing Point) | Mar 97 | 203 | 105 |
| 1754 | Steel (AISI 4320) | Feb 89 | 101 | 34 |
| 1761 | LA Steel | Apr 92 | 101 | 36 |
| 1762 | LA Steel | Apr 92 | 101 | 36 |
| 1763 | LA Steel | Apr 92 | 101 | 36 |
| 1764 | LA Steel | Feb 93 | 101 | 36 |
| 1765 | LA Steel | Feb 93 | 101 | 36 |
| 1766 | LA Steel | Feb 93 | 101 | 36 |
| 1767 | LA Steel | Jun 93 | 101 | 36 |
| 1768 | High-Purity Iron | Dec 91 | 101 | 36 |
| 1772 | Tool Steel (S-7) | Oct 95 | 101 | 40 |
| 1776 | Naval Brass WK1 | Jul 95 | 102 | 48 |
| 1777 | Naval Brass WK2 | Jul 95 | 102 | 48 |
| 1778 | Naval Brass WK3 | Jul 95 | 102 | 48 |
| 1779 | Naval Brass WK4 | Jul 95 | 102 | 48 |
| 1780 | Naval Brass WK5 | Jul 95 | 102 | 48 |
| 1781 | Free-Cutting Brass WN1 | In Prep | 102 | 48 |
| 1782 | Free-Cutting Brass WN2 | In Prep | 102 | 48 |
| 1783 | Free-Cutting Brass WN3 | In Prep | 102 | 48 |
| 1784 | Free-Cutting Brass WN4 | In Prep | 102 | 48 |
| 1785 | Free-Cutting Brass WN5 | In Prep | 102 | 48 |

| SRM | Descriptor | Cert. Date | Section Code | Page |
|---|---|---|---|---|
| 1786 | Cartridge Brass MH1 | In Prep | 102 | 48 |
| 1787 | Cartridge Brass MH2 | In Prep | 102 | 48 |
| 1788 | Cartridge Brass MH3 | In Prep | 102 | 48 |
| 1789 | Cartridge Brass MH4 | In Prep | 102 | 48 |
| 1790 | Cartridge Brass MH5 | In Prep | 102 | 48 |
| 1791 | Gilding Metal M11 | In Prep | 102 | 49 |
| 1792 | Gilding Metal M12 | In Prep | 102 | 49 |
| 1793 | Gilding Metal M13 | In Prep | 102 | 49 |
| 1794 | Gilding Metal M14 | In Prep | 102 | 49 |
| 1795 | Gilding Metal M15 | In Prep | 102 | 49 |
| 1800 | Organic Compounds/N2 (large) | Dec 93 | 107 | 71 |
| 1800a | Organic Compounds/N2 (small) | Aug 97 | 107 | 71 |
| 1804a | Tox. Organic Compounds/N2 | Nov 92 | 107 | 71 |
| 1810a | Linerboard | May 97 | 309 | 132 |
| 1811 | Aromatic Organics/N2 | Discontinued | | |
| 1812 | Aromatic Organics/N2 | Discontinued | | |
| 1815a | n-Heptane (Fuel Rating) | Mar 85 | 108 | 73 |
| 1816a | Isooctane (Fuel Rating) | Mar 85 | 108 | 73 |
| 1817c | Catalyst Package IIID | Jun 92 | 114 | 96 |
| 1818a | Chlorine in Lub. Base Oil | Apr 94 | 114 | 95 |
| 1819a | Sulfur in Lub. Base Oil | Apr 94 | 114 | 95 |
| 1820 | Borosilicate Glass (Refractive Index) | Sep 74 | 209 | 122 |
| 1822 | Soda-Lime Glass (Refractive Index) | Discontinued | | |
| 1826a | Soda-Lime Glass (Density) | Feb 96 | 209 | 122 |
| 1827a | Lead Silica Glass (Density) | Feb 96 | 209 | 122 |
| 1828a | Ethanol-Water Soln. | Jun 96 | 105 | 64 |
| 1829 | Alcohols in Ref. Fuels | Mar 86 | 108 | 72 |
| 1830 | Soda Lime Float (Glass) | Apr 97 | 112 | 91 |
| 1831 | Soda Lime Sheet (Glass) | Apr 97 | 112 | 91 |
| 1832 | Thin Glass Film (XRF) | Discontinued | | |
| 1833 | Thin Glass Film (XRF) | Out of Stock | | 68 |
| 1834 | Fused Ore (Glass) | Jul 90 | 112 | 91 |
| 1835 | Borate Ore | Sep 87 | 111 | 86 |
| 1836 | Nitrogen in Lub. Base Oil | Dec 89 | 114 | 95 |
| 1837 | Methanol, Butanol (Fossil Fuel) | Mar 86 | 108 | 72 |
| 1838 | Ethanol (Fossil Fuel) | Mar 86 | 108 | 72 |
| 1839 | Methanol (Fossil Fuel) | Mar 86 | 108 | 72 |
| 1842 | X-Ray Stage Calib., X and Y Dimen. | Nov 93 | 209 | 123 |
| 1843 | X-Ray Stage Calib., Z Dimen. | Nov 93 | 209 | 123 |
| 1845 | Cholesterol in Egg Powder | Apr 94 | 110 | 80 |
| 1846 | Infant Formula (milk-based) | May 96 | 110 | 80 |
| 1850 | Penetrant Test Block | Aug 97 | 303 | 130 |
| 1851 | Penetrant Test Block | Apr 84 | 303 | 130 |
| 1853 | Magnetic Particle Test Ring | Apr 92 | 303 | 130 |
| 1857 | Tool Steel (Abrasive Wear) | Mar 83 | 302 | 129 |
| 1866a | Common Commercial Asbestos | Jun 91 | 105 | 67 |
| 1867 | Uncommon Commercial Asbestos | Aug 93 | 105 | 67 |
| 1868 | Asbestos in Building Materialsk | In Prep | 105 | 67 |
| 1872 | Synthetic Glass | May 84 | 103 | 53 |
| 1873 | Synthetic Glass | May 84 | 103 | 53 |
| 1876b | Chrysotile Asbestos | Jan 92 | 105 | 67 |
| 1878a | Respirable α-Quartz | In Prep | 105/209 | 66/123 |
| 1879a | Respirable Cristobalite | In Prep | 105 | 66 |
| 1880 | Portland Cement, Black | Jan 93 | 113 | 93 |
| 1881 | Portland Cement, White | Jan 89 | 113 | 93 |
| 1882 | Portland Cement, Orange | Jul 90 | 113 | 93 |
| 1883 | Portland Cement, Silver | Jul 90 | 113 | 93 |
| 1884 | Portland Cement, Ivory | Sep 89 | 113 | 93 |
| 1885 | Portland Cement, Turquoise | Sep 89 | 113 | 93 |
| 1886 | Portland Cement, Cranberry | Sep 89 | 113 | 93 |
| 1887 | Portland Cement, Brown | Sep 89 | 113 | 93 |
| 1888 | Portland Cement, Purple | Sep 89 | 113 | 93 |
| 1889 | Portland Cement, Gray | Sep 89 | 113 | 93 |
| 1893 | Microhardness, Cu-Knoop | Mar 95 | 302 | 129 |
| 1894 | Microhardness, Cu-Vickers | Nov 94 | 302 | 129 |
| 1895 | Microhardness, Ni-Knoop | Mar 95 | 302 | 129 |
| 1896 | Microhardness, Ni-Vickers | Mar 95 | 302 | 129 |
| 1899 | Specific Surface Area (BET) | Jun 97 | 301 | 128 |
| 1900 | Specific Surface Area (BET) | In Prep | 301 | 128 |
| 1905 | Microhardness, Ni-Knoop | Mar 92 | 302 | 129 |
| 1906 | Microhardness, Ni-Knoop | Nov 94 | 302 | 129 |

| SRM | Descriptor | Cert. Date | Section Code | Page |
|---|---|---|---|---|
| 1907 | Microhardness, Ni-Knoop | Mar 95 | 302 | 129 |
| 1920a | Near IR Reflectance | In Prep | 204 | 111 |
| 1921 | IR Transmission Wavelength | Jun 97 | 204 | 108/110 |
| 1923 | Poly(ethylene oxide) | Jun 94 | 202 | 101 |
| 1924 | Poly(ethylene oxide) | Jun 94 | 202 | 101 |
| 1930 | Glass Filters, Transmittance | Aug 94 | 204 | 109/110 |
| 1931 | Fluorescence Spectra | Discontinued | | |
| 1939a | PCBs in River Sediment A | Oct 90 | 109 | 75 |
| 1941a | Organics in Marine Sediment | Mar 94 | 109 | 75 |
| 1944 | NY/NJ Waterway Sediment | In Prep | 109 | 75 |
| 1945 | Organics in Whale Blubber | Jun 94 | 109 | 75 |
| 1951a | Cholesterol in Human Serum | Jun 97 | 105 | 62/63 |
| 1952a | Cholesterol in Human Serum | Jan 90 | 105 | 62 |
| 1960 | Polystyrene (Particle Size) | Apr 85 | 301 | 127 |
| 1961 | Polystyrene (Particle Size) | Jan 87 | 301 | 127 |
| 1963 | Polystyrene (Particle Size) | Nov 93 | 301 | 127 |
| 1965 | Polystyrene (on Slide)(Particle Size) | Jan 87 | 301 | 127 |
| 1967 | Platinum Thermoelement Material | Jul 90 | 203 | 106 |
| 1968 | Gallium (Melting Point) | Mar 91 | 203 | 105 |
| 1969 | Rubidium (Triple Point) | Mar 91 | 203 | 105 |
| 1970 | Succinonitrile (Triple Point) | Apr 91 | 203 | 105 |
| 1971 | Indium (Freezing Point) | Aug 90 | 203 | 105 |
| 1972 | 1,3-Dioxolan-2-one (Triple Point) | May 94 | 203 | 105 |
| 1973 | n-Docosane (Triple Point) | May 93 | 203 | 105 |
| 1974a | Organics in Mussel Tissue | Jul 97 | 109 | 75 |
| 1976 | Instrument Intensity, Alumina (XRD) | Nov 91 | 209 | 123 |
| 1978 | Zirconium Oxide (Particle Size) | Oct 93 | 301 | 127 |
| 1980 | Electrophoretic Mobility (Positive) | Mar 94 | 301 | 128 |
| 1982 | Thermal Spray Zirconia (Particle Size) | Nov 96 | 301 | 127 |
| 1990 | Ruby Sphere (XRD) | In Prep | 209 | 123 |
| 2003 | First Surface Aluminum on Glass | Mar 96 | 204 | 110 |
| 2011 | First Surface, Gold on Aluminum | May 92 | 204 | 110 |
| 2015 | Opal Glass (Reflectance) | May 82 | 204 | 111 |
| 2023 | Second Surface, Aluminum on Quartz | Sep 92 | 204 | 110 |
| 2026 | First Surface, Black Glass | Oct 92 | 204 | 110 |
| 2030a | Glass Filters, Transmittance | Oct 93 | 204 | 109/110 |
| 2031a | Metal-on-Quartz Filters, Transmittance | Jul 97 | 204 | 109/110 |
| 2032 | Potassium Iodide,Stray Light | Oct 79 | 204 | 109/110 |
| 2034 | Holmium Oxide Wavelength | Jul 96 | 204 | 109/110 |
| 2063a | Mineral Glass (Thin Film) | Feb 93 | 103 | 53 |
| 2069b | SEM Performance | May 91 | 207 | 118 |
| 2071b | Sinusoidal Roughness | In Prep | 302 | 129 |
| 2073a | Sinusoidal Roughness | Oct 95 | 302 | 129 |
| 2074 | Sinusoidal Roughness | Jun 92 | 302 | 129 |
| 2075 | Sinusoidal Roughness | Jan 94 | 302 | 129 |
| 2083 | Socketed Ball Bar | Aug 85 | 309 | 132 |
| 2084 | CMM Probe Performance | Oct 96 | 309 | 132 |
| 2084R | CMM Probe (10-mm sphere) | Jun 96 | 309 | 132 |
| 2085 | CMM Probe (25-mm sphere) | Jun 96 | 309 | 132 |
| 2090 | SEM Magnification | In Prep | 207 | 118 |
| 2092 | Low Energy Charpy | Feb 97 | 309 | 132 |
| 2096 | High Energy Charpy | Feb 97 | 309 | 132 |
| 2098 | Super High Energy Charpy | Feb 97 | 309 | 132 |
| 2108 | Chromium (III) Speciation | In Prep | 104 | 60 |
| 2109 | Chromium (VI) Speciation | Aug 95 | 104 | 60 |
| 2134 | Arsenic Depth Profile | In Prep | 207 | 118 |
| 2135c | Nickel-Chromium Depth Profile | In Prep | 207 | 118 |
| 2136 | Chromium/Chromium Oxide Depth Profile | Mar 91 | 207 | 118 |
| 2137 | Boron Implant in Silicon Depth Profile | Apr 93 | 207 | 118 |
| 2141 | Urea | Aug 70 | 104 | 56 |
| 2142 | 0-Bromobenzoic Acid | Sep 70 | 104 | 56 |
| 2143 | p-Fluorobenzoic Acid | Jan 82 | 104 | 56 |
| 2144 | m-Chlorobenzoic Acid | Apr 73 | 104 | 56 |
| 2151 | Nicotinic Acid (Comb. Calorimetry) | Jan 85 | 203 | 103 |
| 2152 | Urea (Comb. Calorimetry) | Jan 85 | 203 | 103 |
| 2159 | LA Steel, Carbon & Sulfur only | Mar 90 | 101 | 33 |
| 2160 | LA Steel, Carbon & Sulfur only | Mar 90 | 101 | 33 |
| 2165 | LA Steel, E | Jun 89 | 101 | 33 |
| 2166 | LA Steel, F | Jun 89 | 101 | 33 |
| 2167 | LA Steel, G | Jun 89 | 101 | 33 |

| SRM | Descriptor | Cert. Date | Section Code | Page |
|---|---|---|---|---|
| 2168 | High Purity Iron | Dec 91 | 101 | 33 |
| 2171 | LA Steel, (HSLA 100) | Oct 91 | 101 | 32 |
| 2172 | S-7 Tool Steel | Dec 96 | 101 | 35 |
| 2181 | HEPES Free Acid | Mar 92 | 201 | 99 |
| 2182 | HEPES ate | Mar 92 | 201 | 99 |
| 2183 | MOPSO Free Acid | Mar 92 | 201 | 99 |
| 2184 | MOPSO Bte | Mar 92 | 201 | 99 |
| 2185 | Pot. Hydrogen Phthalate | Nov 84 | 201 | 99 |
| 2186I | Pot. Dihydro. Phosphate | May 68 | 201 | 99 |
| 2186II | Disod. Hydro. Phosphate | May 68 | 201 | 99 |
| 2191a | Sodium Bicarbonate | Feb 94 | 201 | 99 |
| 2192a | Sodium Carbonate | Feb 94 | 201 | 99 |
| 2193 | Calcium Carbonate | Oct 91 | 201 | 99 |
| 2201 | Sodium Chloride (Ion-Selective) | May 93 | 201 | 100 |
| 2202 | Potassium Chloride (Ion-Selective) | Mar 84 | 201 | 100 |
| 2203 | Potassium Fluoride (Ion-Selective) | May 73 | 201 | 100 |
| 2220 | Tin (Dif. Scan. Calor.) | May 89 | 203 | 104 |
| 2221b | Zinc (Dif. Scan. Calor.) | In Prep | 203 | 104 |
| 2222 | Biphenyl (Dif. Scan. Calor.) | Jun 89 | 203 | 104 |
| 2225 | Mercury (Dif. Scan Calor.) | Mar 89 | 203 | 104 |
| 2260 | Aromatic Hydrocarbons in Toluene | Jun 91 | 109 | 75 |
| 2261 | Chlorinated Pesticides in Hexane | Jan 92 | 109 | 75 |
| 2262 | Chlorinated Biphenyls in Isooctane | Mar 95 | 109 | 75 |
| 2286 | Ethanol in Gasoline | Feb 95 | 108 | 72 |
| 2287 | Ethanol in Gasoline | Jan 95 | 108 | 72 |
| 2288 | t-Amyl Methyl Ether in Gas. | Jan 95 | 108 | 72 |
| 2289 | t-Amyl Methyl Ether in Gas. | Jan 95 | 108 | 72 |
| 2290 | Ethyl t-Butyl Ether in Gas. | Jan 95 | 108 | 72 |
| 2291 | Ethyl t-Butyl Ether in Gas. | Jan 95 | 108 | 72 |
| 2292 | Methyl t-Butyl Ether in Gas. | Jan 95 | 108 | 72 |
| 2293 | Methyl t-Butyl Ether in Gas. | Feb 95 | 108 | 72 |
| 2294 | Reform. Gas. (nom. 11 % MTBE) | In Prep | 108 | 72 |
| 2295 | Reform. Gas. (nom. 15 % MTBE) | In Prep | 108 | 72 |
| 2296 | Reform. Gas. (nom. 13 % ETBE) | In Prep | 108 | 72 |
| 2297 | Reform. Gas. (nom. 10 % Ethanol) | In Prep | 108 | 72 |
| 2321 | Sn-Pb Alloy Coating | Jun 91 | 207 | 119 |
| 2350 | Nickel Step Test | Aug 85 | 302 | 129 |
| 2381 | Morphine and Codeine in Urine | Jul 93 | 105 | 65 |
| 2382 | Morphine Glucuronide in Urine | Jul 93 | 105 | 64 |
| 2383 | Baby Food Composite | In Prep | 110 | 80 |
| 2389 | Amino Acids in Hydrochloric Acid | Dec 93 | 105 | 62 |
| 2390 | DNA Profiling | Aug 92 | 105 | 65 |
| 2391 | PCR-Based DNA Profiling | May 95 | 105 | 65 |
| C2400 | HA Steel ACI (17/4 PH) | Feb 86 | 101 | 39 |
| C2401 | HA Steel (ACI-C-4M-Cu) | Feb 86 | 101 | 39 |
| C2402 | Hastelloy™ C | Feb 86 | 101 | 50 |
| C2415 | Battery Lead | Mar 91 | 102 | 49 |
| C2416 | Bullet Lead | Feb 88 | 102 | 49 |
| C2417 | Lead-Base Alloy | Feb 87 | 102 | 49 |
| C2418 | High Purity Lead | Feb 87 | 102 | 49 |
| C2423 | Ductile Iron A | Nov 85 | 101 | 43 |
| C2423a | Ductile Iron B | Nov 85 | 101 | 43 |
| C2424 | Ductile Iron C | Jul 85 | 101 | 43 |
| C2424a | Ductile Iron D | Jul 85 | 101 | 43 |
| 2430 | Scheelite Ore | Jan 87 | 111 | 84 |
| 2431 | Titanium Base Alloy | Aug 93 | 102 | 51 |
| 2432 | Titanium Base Alloy | Aug 93 | 102 | 51 |
| 2433 | Titanium Base Alloy | Apr 96 | 102 | 51 |
| 2517 | Wavelength Reference Absorption | Oct 97 | 207 | 119 |
| 2518 | Polarization Mode Dispersion | In Prep | 207 | 119 |
| 2519 | Wavelength Reference Absorption | In Prep | 207 | 119 |
| 2520 | Optical Fiber Diameter | Jan 96 | 207 | 119 |
| 2521 | Optical Fiber Coating | In Prep | 207 | 119 |
| 2522 | Pin Gauge for Opt. Fib. Ferrules | May 96 | 207 | 119 |
| 2523 | Optical Fiber Ferrule Geometry | Aug 97 | 207 | 119 |
| 2524 | Optical Fiber Chromatic Dispersion | Feb 97 | 207 | 119 |
| 2525 | Optical Retardance | Apr 97 | 207 | 119 |
| 2526 | 111P-Type Si. Sprd. Resist. | Aug 83 | 206 | 117 |
| 2527 | 111N-Type Si. Sprd. Resist. | Aug 83 | 206 | 117 |
| 2528 | 100P-Type Si. Sprd. Resist. | Jan 84 | 206 | 117 |
| 2529 | 100N-Type Si. Sprd. Resist. | May 84 | 206 | 117 |
| 2531 | Si/SiO2 Thickness-50 nm | Jul 92 | 207 | 120 |
| 2532 | Si/SiO2 Thickness-100 nm | Jul 92 | 207 | 120 |

| SRM | Descriptor | Cert. Date | Section Code | Page |
|---|---|---|---|---|
| 2533 | Si/SiO2 Thickness-200 nm | Jul 92 | 207 | 120 |
| 2534 | Si/SiO2 Thickness-25 nm | Jul 92 | 207 | 120 |
| 2535 | Si/SiO2 Thickness-14 nm | Sep 94 | 207 | 120 |
| 2536 | Si/SiO2 Thickness-10 nm | Sep 94 | 207 | 120 |
| 2541 | Silicon Resistivity | In Prep | 206 | 117 |
| 2542 | Silicon Resistivity | In Prep | 206 | 117 |
| 2543 | Silicon Resistivity | In Prep | 206 | 117 |
| 2544 | Silicon Resistivity | Aug 97 | 206 | 117 |
| 2545 | Silicon Resistivity | Sep 96 | 206 | 117 |
| 2546 | Silicon Resistivity | In Prep | 206 | 117 |
| 2547 | Silicon Resistivity | In Prep | 206 | 117 |
| 2551 | Oxygen in Silicon | Mar 94 | 207 | 120 |
| 2556 | Recycled Pellet (Autocatalyst) | Aug 93 | 106 | 69 |
| 2557 | Recycled Monolith (Autocatalyst) | Aug 93 | 106 | 69 |
| 2567 | Catalyst Package IIIE | Jul 95 | 114 | 96 |
| 2570 | Lead Paint Film, Blank | In Prep | 105 | 67 |
| 2571 | Lead Paint Film, Nom. 3.5 $mg/cm^2$ | In Prep | 105 | 67 |
| 2572 | Lead Paint Film, Nom. 1.6 $mg/cm^2$ | In Prep | 105 | 67 |
| 2573 | Lead Paint Film, Nom. 1.0 $mg/cm^2$ | In Prep | 105 | 67 |
| 2574 | Lead Paint Film, Nom. 0.7 $mg/cm^2$ | In Prep | 105 | 67 |
| 2575 | Lead Paint Film, Nom. 0.3 $mg/cm^2$ | In Prep | 105 | 67 |
| 2576 | Lead Paint Film, High Level | In Prep | 105 | 67 |
| 2579a | Lead Paint Films | Mar 93 | 105 | 67 |
| 2580 | Powdered Paint, Nom. 4 % Pb | Dec 96 | 105 | 67 |
| 2581 | Powdered Paint, Nom. 0.5 % Pb | Jan 97 | 105 | 67 |
| 2582 | Powdered Paint, (Low Lead) | Jun 97 | 105 | 67 |
| 2583 | Trace El. in Indoor Dust | Dec 96 | 105/106 | 67/68 |
| 2584 | Trace El. in Indoor Dust | In Prep | 105 | 67 |
| 2586 | Trace El. in Soil containing Lead | In Prep | 105 | 67 |
| 2587 | Trace El. in Soil containing Lead | In Prep | 105 | 67 |
| 2589 | Powdered Paint, Nom. 10 % Pb | Jun 97 | 105 | 67 |
| 2607 | CO2/N2O/Air, 340/0.3 µmol/mol | Discontinued | | |
| 2609 | CO2/N2O/Air, 380/0.33 µmol/mol | Discontinued | | |
| 2610 | CO2/N2O/Air, 380/0.33 µmol/mol | Discontinued | | |
| 2612a | CO/Air, 10 µmol/mol | Jun 97 | 107 | 70 |
| 2613a | CO/Air, 20 µmol/mol | Nov 95 | 107 | 70 |
| 2614a | CO/Air, 45 µmol/mol | Nov 95 | 107 | 70 |
| 2619a | CO2/N2, 0.5 mol % | Jun 97 | 107 | 70 |
| 2620a | CO2/N2, 1.0 mol % | Jun 97 | 107 | 70 |
| 2621a | CO2/N2, 1.5 mol % | Aug 97 | 107 | 70 |
| 2622a | CO2/N2, 2.0 mol % | Nov 95 | 107 | 70 |
| 2623a | CO2/N2, 2.5 mol % | Jun 92 | 107 | 70 |
| 2624a | CO2/N2, 3.0 mol % | Jul 96 | 107 | 70 |
| 2625a | CO2/N2, 3.5 mol % | Aug 94 | 107 | 70 |
| 2626a | CO2/N2, 4.0 mol % | Apr 95 | 107 | 70 |
| 2627a | NO/N2, 5 µmol/mol | Dec 95 | 107 | 71 |
| 2628a | NO/N2, 10 µmol/mol | Jul 95 | 107 | 71 |
| 2629a | NO/N2, 20 µmol/mol | Aug 97 | 107 | 71 |
| 2630 | NO/N2, 1500 µmol/mol | Apr 97 | 107 | 71 |
| 2631a | NO/N2, 3,000 µmol/mol | In Prep | 107 | 71 |
| 2632a | CO2/N2, 300 µmol/mol | Discontinued | | |
| 2635a | CO/N2, 25 µmol/mol | Jun 97 | 107 | 70 |
| 2636a | CO/N2, 250 µmol/mol | May 97 | 107 | 70 |
| 2637a | CO/N2, 2500 µmol/mol | May 97 | 107 | 70 |
| 2638a | CO/N2, 5000 µmol/mol | May 97 | 107 | 70 |
| 2639a | CO/N2, 1 mol % | Sep 97 | 107 | 70 |
| 2640a | CO/N2, 2 mol % | Sep 97 | 107 | 70 |
| 2641a | CO/N2, 4 mol % | Oct 97 | 107 | 70 |
| 2642a | CO/N2, 8 mol % | Sep 93 | 107 | 70 |
| 2643a | C3H8/N2, 100 µmol/mol | In Prep | 107 | 71 |
| 2644a | C3H8/N2, 250 µmol/mol | In Prep | 107 | 71 |
| 2645a | C3H8/N2, 500 µmol/mol | In Prep | 107 | 71 |
| 2646a | C3H8/N2, 1000 µmol/mol | In Prep | 107 | 71 |
| 2647a | C3H8/N2, 2500 µmol/mol | In Prep | 107 | 71 |
| 2648a | C3H8/N2 5000 µmol/mol | In Prep | 107 | 71 |
| 2649a | C3H8/N2, 1 mol % | In Prep | 107 | 71 |
| 2650 | C3H8/N2, 2 mol % | In Prep | 107 | 71 |
| 2651 | C3H8/N2 & O2, 0.01/5 mol % | Discontinued | | |
| 2652 | C3H8/N2 & O2, 0.01/10 mol % | Discontinued | | |
| 2656 | NOx/Air, 2500 µmol/mol | In Prep | 107 | 71 |
| 2657a | O2/N2, 2 mol % | Jun 93 | 107 | 71 |
| 2658a | O2/N2, 10 mol % | In Prep | 107 | 71 |
| 2659a | O2/N2, 21 mol % | In Prep | 107 | 71 |

| SRM | Descriptor | Cert. Date | Section Code | Page |
|---|---|---|---|---|
| 2660 | NOx/Air, 100 µmol/mol | In Prep | 107 | 71 |
| 2670 | Toxic Metals in Urine | Aug 94 | 105 | 64 |
| 2671a | Fluorine in Urine | Aug 95 | 105 | 64 |
| 2672a | Mercury in Urine | May 83 | 105 | 64 |
| 2676d | Metals on Filter Media | Aug 92 | 105 | 66 |
| 2677a | Be and As on Filter Media | Feb 94 | 105 | 66 |
| 2678 | Membrane Blank Filter | May 88 | 105 | 66 |
| 2679a | Quartz on Filter Media | May 84 | 105 | 66 |
| 2681 | Ashless Blank Filter | May 88 | 105 | 66 |
| 2682a | Sulfur in Coal, 0.5%, (also Heat of Comb.) | May 94 | 108 | 73 |
| 2683b | Sulfur in Coal, 2%, (also Heat of Comb.) | Oct 97 | 108/203 | 73/103 |
| 2684a | Sulfur in Coal, 3%, (also Heat of Comb.) | Nov 92 | 108/203 | 73/103 |
| 2685a | Sulfur in Coal, 5%, (also Heat of Comb.) | May 94 | 108 | 73 |
| 2689 | Coal Fly Ash | Dec 93 | 108 | 74 |
| 2690 | Coal Fly Ash | Dec 93 | 108 | 74 |
| 2691 | Coal Fly Ash | Dec 93 | 108 | 74 |
| 2692a | Sulfur in Coal, 1% | Sep 94 | 108/203 | 73/103 |
| 2694b | Simulated Rainwater | In Prep | 106 | 68 |
| 2695 | Fluoride in Vegetation | Aug 91 | 110 | 82 |
| 2704a | Buffalo River Sediment | In Prep | 106/111 | 68/89 |
| 2709 | San Joaquin Soil | Aug 93 | 106/111 | 68/89 |
| 2710 | Montana I Soil | Oct 97 | 106/111 | 68/89 |
| 2711 | Montana II Soil | Aug 93 | 106/111 | 68/89 |
| 2712 | Lead in Ref. Fuel | Sep 88 | 108 | 72 |
| 2713 | Lead in Ref. Fuel | Sep 88 | 108 | 72 |
| 2714 | Lead in Ref. Fuel | Sep 88 | 108 | 72 |
| 2715 | Lead in Ref. Fuel | Sep 88 | 108 | 72 |
| 2717 | Sulfur in Residual Fuel Oil | Oct 90 | 108 | 73 |
| 2718 | Trace El. in Green Petroleum Coke | In Prep | 108 | 73/74 |
| 2719 | Trace El. in Calcined Petroleum Coke | In Prep | 108 | 73/74 |
| 2723 | Sulfur in Diesel Fuel Oil | In Prep | 108 | 73 |
| 2724a | Sulfur in Diesel Fuel Oil, 0.04% | Aug 95 | 108 | 73 |
| 2727 | IM Gases, 3 Components | Discontinued | | |
| 2728 | IM Gases, 3 Components | Discontinued | | |
| 2730 | H2S/N2, 5 µmol/mol | Apr 95 | 107 | 71 |
| 2731 | H2S/N2, 20 µmol/mol | In Prep | 107 | 71 |
| 2735 | NO/N2, 800 µmol/mol | In Prep | 107 | 71 |
| 2736 | NO/N2, 2000 µmol/mol | Sep 90 | 107 | 71 |
| 2740 | CO/N2, 10 mol % | Sep 90 | 107 | 70 |
| 2741 | CO/N2, 13 mol % | Sep 90 | 107 | 70 |
| 2745 | CO2/N2, 16 mol % | Jul 96 | 107 | 70 |
| 2750 | CH4/Air, 50 µmol/mol | May 97 | 107 | 71 |
| 2751 | CH4/Air, 100 µmol/mol | May 97 | 107 | 71 |
| 2764 | C3H8/Air, 0.25 µmol/mol | Nov 95 | 107 | 71 |
| 2775 | Foundry Coke | May 97 | 108 | 73 |
| 2776 | Furnace Coke | In Prep | 108 | 73 |
| 2781 | Domestic Sludge | Oct 96 | 106/111 | 68/89 |
| 2782 | Industrial Sludge | In Prep | 106/111 | 68/89 |
| 2798 | Microhardness, Ni Vickers | Aug 93 | 302 | 129 |
| 2806 | Medium Test Dust in Hydraulic Fluid | Dec 97 | 301 | 128 |
| 2830 | Microhardness, Ceramic-Knoop | Feb 96 | 302 | 129 |
| 2831 | Microhardness, Ceramic-Vickers | In Prep | 302 | 129 |
| 2910 | Calcium Hydroxyapatite | Nov 97 | 105/209 | 65/123 |
| 2974 | Organics in Freeze-Dried Mussel Tissue | Jul 97 | 109 | 75 |
| 2975 | Diesel Particulate Matter | In Prep | 109 | 75 |
| 3087a | Metals on Filter Media | Jan 97 | 105 | 66 |
| 3101a | Aluminum Standard Soln. | May 96 | 104 | 57 |
| 3102a | Antimony Standard Soln. | Apr 97 | 104 | 57 |
| 3103a | Arsenic Standard Soln. | Mar 97 | 104 | 57 |
| 3104a | Barium Standard Soln. | Sep 97 | 104 | 57 |
| 3105a | Beryllium Standard Soln. | Oct 96 | 104 | 57 |
| 3106 | Bismuth Standard Soln. | Aug 96 | 104 | 57 |
| 3107 | Boron Standard Soln. | Jan 97 | 104 | 57 |
| 3108 | Cadmium Standard Soln. | Jan 97 | 104 | 57 |
| 3109a | Calcium Standard Soln. | Nov 96 | 104 | 57 |
| 3110 | Cerium Standard Soln. | Feb 95 | 104 | 57 |
| 3111a | Cesium Standard Soln. | Feb 95 | 104 | 57 |
| 3112a | Chromium Standard Soln. | Oct 96 | 104 | 57 |
| 3113 | Cobalt Standard Soln. | May 96 | 104 | 57 |
| 3114 | Copper Standard Soln. | Apr 97 | 104 | 57 |

| SRM/RM | Descriptor | Cert. Date | Section Code | Page |
|---|---|---|---|---|
| 3115a | Dysprosium Standard Soln. | Apr 96 | 104 | 57 |
| 3116a | Erbium Standard Soln. | Sep 96 | 104 | 57 |
| 3117a | Europium Standard Soln. | Oct 96 | 104 | 57 |
| 3118a | Gadolinium Standard Soln. | Jul 96 | 104 | 57 |
| 3119a | Gallium Standard Soln. | Jun 96 | 104 | 57 |
| 3120 | Germanium Standard Soln. | Mar 97 | 104 | 57 |
| 3121 | Gold Standard Soln. | Mar 97 | 104 | 57 |
| 3122 | Hafnium Standard Soln. | Jan 96 | 104 | 57 |
| 3123a | Holmium Standard Soln. | Aug 95 | 104 | 57 |
| 3124a | Indium Standard Soln. | Jan 97 | 104 | 57 |
| 3126a | Iron Standard Soln. | Mar 96 | 104 | 57 |
| 3127a | Lanthanum Standard Soln. | Jul 96 | 104 | 57 |
| 3128 | Lead Standard Soln. | May 97 | 104 | 57 |
| 3129a | Lithium Standard Soln. | Feb 96 | 104 | 57 |
| 3130a | Lutetium Standard Soln. | Jul 95 | 104 | 57 |
| 3131a | Magnesium Standard Soln. | Jan 97 | 104 | 57 |
| 3132 | Manganese Standard Soln. | Oct 95 | 104 | 57 |
| 3133 | Mercury Standard Soln. | Jan 97 | 104 | 57 |
| 3134 | Molybdenum Standard Soln. | May 96 | 104 | 57 |
| 3135a | Neodymium Standard Soln. | Feb 96 | 104 | 57 |
| 3136 | Nickel Standard Soln. | Jan 97 | 104 | 57 |
| 3137 | Niobium Standard Soln. | Mar 97 | 104 | 57 |
| 3138 | Palladium Standard Soln. | Dec 96 | 104 | 57 |
| 3139a | Phosphorus Standard Soln. | Aug 96 | 104 | 57 |
| 3140 | Platinum Standard Soln. | Nov 97 | 104 | 57 |
| 3141a | Potassium Standard Soln. | Mar 97 | 104 | 57 |
| 3142a | Praseodymium Standard Soln. | Feb 96 | 104 | 57 |
| 3143 | Rhenium Standard Soln. | Mar 97 | 104 | 57 |
| 3144 | Rhodium Standard Soln. | Aug 95 | 104 | 57 |
| 3145a | Rubidium Standard Soln. | Aug 95 | 104 | 57 |
| 3147a | Samarium Standard Soln. | Aug 95 | 104 | 58 |
| 3148a | Scandium Standard Soln. | Jul 95 | 104 | 58 |
| 3149 | Selenium Standard Soln. | Apr 97 | 104 | 58 |
| 3150 | Silicon Standard Soln. | May 97 | 104 | 58 |
| 3151 | Silver Standard Soln. | May 96 | 104 | 58 |
| 3152a | Sodium Standard Soln. | May 97 | 104 | 58 |
| 3153a | Strontium Standard Soln. | Jan 97 | 104 | 58 |
| 3154 | Sulfur Standard Soln. | Nov 95 | 104 | 58 |
| 3155 | Tantalum Standard Soln. | Mar 96 | 104 | 58 |
| 3156 | Tellurium Standard Soln. | May 95 | 104 | 58 |
| 3157a | Terbium Standard Soln. | Aug 95 | 104 | 58 |
| 3158 | Thallium Standard Soln. | May 97 | 104 | 58 |
| 3159 | Thorium Standard Soln. | Oct 96 | 104 | 58 |
| 3160a | Thulium Standard Soln. | Jul 95 | 104 | 58 |
| 3161a | Tin Standard Soln. | Feb 97 | 104 | 58 |
| 3162a | Titanium Standard Soln. | Mar 97 | 104 | 58 |
| 3163 | Tungsten Standard Soln. | May 97 | 104 | 58 |
| 3164 | Uranium Standard Soln. | Mar 97 | 104 | 58 |
| 3165 | Vanadium Standard Soln. | Apr 97 | 104 | 58 |
| 3166a | Ytterbium Standard Soln. | Jul 95 | 104 | 58 |
| 3167a | Yttrium Standard Soln. | Aug 95 | 104 | 58 |
| 3168a | Zinc Standard Soln. | Jun 96 | 104 | 58 |
| 3169 | Zirconium Standard Soln. | Jul 97 | 104 | 58 |
| 3171a | Multielement Mix A1 Standard Soln. | In Prep | 104 | 58 |
| 3172a | Multielement Mix B1 Standard Soln. | Apr 96 | 104 | 59 |
| 3179 | Multielement Mixes I, II, III Standard Solns. | Sep 97 | 104 | 59 |
| 3181 | Sulfate Anion Soln. | Sep 97 | 104 | 60 |
| 3182 | Chloride Anion Soln. | Aug 97 | 104 | 60 |
| 3183 | Fluoride Anion Soln. | Aug 97 | 104 | 60 |
| 3184 | Bromide Anion Soln. | Dec 97 | 104 | 60 |
| 3185 | Nitrate Anion Soln. | Oct 96 | 104 | 60 |
| 3186 | Phosphate Anion Soln. | Oct 97 | 104 | 60 |
| 3190 | Electro. Conductivity (25 µS/cm) | Feb 97 | 201 | 100 |
| 3191 | Electro. Conductivity (100 µS/cm) | Sep 97 | 201 | 100 |
| 3192 | Electro. Conductivity (500 µS/cm) | Apr 97 | 201 | 100 |
| 3193 | Electro. Conductivity (1000 µS/cm) | Sep 97 | 201 | 100 |
| 3194 | Electro. Conductivity (10,000 µS/cm) | In Prep | 201 | 100 |
| 3195 | Electro. Conductivity (100,000 µS/cm) | Apr 97 | 201 | 100 |
| 3196 | Electro. Conductivity (20,000 µS/cm) | In Prep | 201 | 100 |
| 3198 | Electro. Conductivity (5 µS/cm) | Apr 97 | 201 | 100 |

| SRM/RM | Descriptor | Cert. Date | Section Code | Page |
|---|---|---|---|---|
| 3199 | Electro. Conductivity (15 µS/cm) | In Prep | 201 | 100 |
| 4200B | Cesium/Barium-137m | Dec 79 | 205 | 115 |
| 4201B | Niobium-94 | Jun 70 | 205 | 115 |
| 4203D | Cobalt-60 | Jun 95 | 205 | 115 |
| 4207B | Cesium-137/Barium-137m | Mar 87 | 205 | 115 |
| 4222C | Carbon-14 (as hexadene) | Jan 91 | 205 | 113 |
| 4226C | Nickel-63 Soln. | Dec 95 | 205 | 113 |
| 4233D | Cesium-137 Soln. | Jul 96 | 205 | 113 |
| 4234A | Strontium-90 Soln. | May 95 | 205 | 113 |
| 4241C | Barium-133 | In Prep | 205 | 115 |
| 4251C | Barium-133 Soln. | Oct 94 | 205 | 113 |
| 4275C | Mixed Radionuclide | Sep 88 | 205 | 115 |
| 4276C | Mixed Radionuclide Soln. | Sep 88 | 205 | 113 |
| 4288A | Technetium-99 Soln. | Oct 96 | 205 | 113 |
| 4320A | Curium-244 Soln. | Feb 96 | 205 | 113 |
| 4321B | Natural Uranium Soln. | Feb 92 | 205 | 113 |
| 4322B | Americium-241 Soln. | Oct 91 | 205 | 113 |
| 4323A | Plutonium-238 Soln. | Feb 95 | 205 | 113 |
| 4324A | Uranium-232 Soln. | Jun 95 | 205 | 113 |
| 4325 | Beryllium-10/Beryllium-9 | May 90 | 205 | 115 |
| 4326 | Polonium-209 Soln. | Jan 95 | 205 | 113 |
| 4328B | Thorium-229 Soln. | Jul 96 | 205 | 113 |
| 4329 | Curium-243 Soln. | Mar 85 | 205 | 113 |
| 4330A | Plutonium-239 Soln. | Jan 96 | 205 | 113 |
| 4332D | Americium-243 Soln. | Sep 95 | 205 | 113 |
| 4334F | Plutonium-242 Soln. | Mar 96 | 205 | 113 |
| 4338A | Plutonium-240 Soln. | Aug 96 | 205 | 113 |
| 4339A | Radium-228 Soln | Aug 95 | 205 | 113 |
| 4340A | Plutonium-241 Soln. | May 96 | 205 | 113 |
| 4341 | Neptunium-237 Soln. | Jan 93 | 205 | 113 |
| 4350B | River Sediment (Radioactivity) | Sep 81 | 205 | 116 |
| 4351 | Human Lung (Radioactivity) | Oct 82 | 205 | 116 |
| 4352 | Human Liver (Radioactivity) | Jun 82 | 205 | 116 |
| 4353A | Rocky Flats Soil No. II (Radioactivity) | In Prep | 205 | 116 |
| 4354 | Lake Sediment (Radioactivity) | Feb 86 | 205 | 116 |
| 4355 | Peruvian Soil (Radioactivity) | Jun 82 | 205 | 116 |
| 4356 | Ashed Bone (Radioactivity) | In Prep | 205 | 116 |
| 4357 | Ocean Sediment (Radioactivity) | Mar 97 | 205 | 116 |
| 4358 | Ocean Shellfish (Radioactivity) | In Prep | 205 | 116 |
| 4361C | Hydrogen-3 Soln. | In Prep | 205 | 113 |
| 4370C | Europium-152 Soln. | Mar 87 | 205 | 113 |
| 4400N | Chromium-51 Soln. | | Discontinued | |
| 4401W | Iodine-131 Soln. | FC | 205 | 114 |
| 4402C | Tin-113/Indium-113m Soln. | | Discontinued | |
| 4403B | Strontium-85 Soln. | | Discontinued | |
| 4404S | Thallium-201 Soln. | FC | 205 | 114 |
| 4405B | Gold-198 Soln. | | Discontinued | |
| 4406O | Phosphorus-32 Soln. | FC | 205 | 114 |
| 4407U | Iodine-125 Soln. | FC | 205 | 114 |
| 4408F | Cobalt-57 Soln. | FC | 205 | 114 |
| 4409D | Selenium-75 Soln. | | Discontinued | |
| 4410V | Technetium-99m Soln. | FC | 205 | 114 |
| 4411B | Iron-59 Soln. | | Discontinued | |
| 4412V | Molybdenum-99/Technetium-99 Soln. | FC | 205 | 114 |
| 4414C | Iodine-123 Soln. | | Discontinued | |
| 4415U | Xenon-133 Gas | FC | 205 | 114 |
| 4416Q | Gallium-67 Soln. | FC | 205 | 114 |
| 4417Q | Indium-111 Soln. | FC | 205 | 114 |
| 4418A | Mercury-203 Soln. | | Discontinued | |
| 4419C | Ytterbium-169 Soln. | | Discontinued | |
| 4420B | Lead-203 Soln. | | Discontinued | |
| 4421A | Gold-195 Soln. | | Discontinued | |
| 4424A | Sulfur-35 Soln. | | Discontinued | |
| 4425B | Samarium-153 Soln. | FC | 205 | 114 |
| 4426A | Strontium-89 Soln. | FC | 205 | 114 |
| 4427B | Yttrium-90 Soln. | FC | 205 | 114 |
| 4904NG | Americium-241 | | Discontinued | |
| 4904SG | Americium-241 | | Discontinued | |
| 4906C | Plutonium-238 | Nov 87 | 205 | 114 |
| 4906HC | Plutonium-238 | Nov 87 | 205 | 114 |
| 4915E | Cobalt-60 Soln. | Feb 84 | 205 | 113 |
| 4919H | Strontium-90 Soln. | May 88 | 205 | 113 |

| RM | Descriptor | Cert. Date | Section Code | Page |
|---|---|---|---|---|
| 4926D | Hydrogen-3 Water Soln. | Aug 89 | 205 | 113 |
| 4927E | Hydrogen-3 Soln. | Jan 89 | 205 | 113 |
| 4929D | Iron-55 Soln. | Feb 86 | 205 | 113 |
| 4943 | Chlorine-36 Soln. | Dec 84 | 205 | 113 |
| 4947C | Hydrogen-3 Toluene Soln. | May 87 | 205 | 113 |
| 4949C | Iodine-129 Soln. | Feb 82 | 205 | 113 |
| 4952C | Radium-226 Blank Soln. | Jan 92 | 205 | 113 |
| 4965 | Radium-226 Soln. | Jan 92 | 205 | 113 |
| 4966 | Radium-226 Soln. | Jan 92 | 205 | 113 |
| 4967 | Radium-226 Soln. | Jan 92 | 205 | 113 |
| 4968 | Radium-226/Radon-222 Eman. | Aug 94 | 205 | 115 |
| 4990C | Oxalic Acid (C-14 Dating) | Jul 83 | 205 | 114 |
| 8030 | BCR No 60 Aquatic Plant | Jun 82 | 110 | 82 |
| 8031 | BCR No 61 Aquatic Mass | Jun 82 | 110 | 82 |
| 8036 | BCR No 150 Spiked Skim Milk | Dec 85 | 110 | 80 |
| 8050-8052 | RCM Fine Gold | Aug 95 | 104 | 54/55 |
| 8053-8055 | RCM Fine Gold | Oct 95 | 104 | 54/55 |
| 8056-8058 | RCM Fine Gold | Oct 95 | 104 | 54/55 |
| 8059-8061 | RCM Fine Gold | Oct 95 | 104 | 54/55 |
| 8062-8064 | RCM Fine Gold | Oct 95 | 104 | 54/55 |
| 8065-8067 | RCM Fine Gold | Sep 95 | 104 | 54/55 |
| 8068-8070 | RCM Gold Bullion | Oct 95 | 104 | 54/55 |
| 8071-8073 | RCM Gold Bullion | Oct 95 | 104 | 54/55 |
| 8074-8076 | RCM Gold Bullion | Oct 95 | 104 | 54/55 |
| 8077-8079 | RCM Gold Bullion | Oct 95 | 104 | 54/55 |
| 8080-8082 | RCM Gold Bullion | Oct 95 | 104 | 54/55 |
| 8090 | SEM Magnification Calibration | Aug 95 | 207 | 118 |
| 8101a | Auto. Computer Time Service | | Discontinued | |
| 8162 | RCM Fine Silver | Oct 95 | 104 | 54/55 |
| 8165 | RCM Fine Silver | Oct 95 | 104 | 54/55 |
| 8168 | RCM Fine Silver | Sep 95 | 104 | 54/55 |
| 8171 | RCM Fine Silver | Oct 95 | 104 | 54/55 |
| 8384 | TBBS (powder) | | Discontinued | |
| 8406 | Tennessee River Sediment | | Discontinued | |
| 8407 | Tennessee River Sediment | Jun 90 | 106/111 | 68/89 |
| 8411 | Mixed Asbestos Research Filter | Nov 88 | 105 | 67 |
| 8412 | Corn Stalk (Zea Mays) | Sep 93 | 110 | 80/182 |
| 8413 | Corn Kernel (Zea Mays) | Sep 93 | 110 | 80/182 |
| 8414 | Bovine Muscle Powder (Beef) | Sep 93 | 110 | 80 |
| 8415 | Whole Egg Powder | Sep 93 | 110 | 80 |
| 8416 | Micro. Cellulose | Sep 93 | 110 | 80 |
| 8418 | Wheat Gluten | Sep 93 | 110 | 80 |
| 8420 | Electrolytic Iron | May 84 | 203/206 | 107/117 |
| 8421 | Electrolytic Iron | May 84 | 203/206 | 107/117 |
| 8424 | Graphite | May 84 | 203 | 107 |
| 8425 | Graphite | May 84 | 203 | 107 |
| 8426 | Graphite | May 84 | 203 | 107 |
| 8432 | Corn Starch | Sep 93 | 110 | 81 |
| 8433 | Corn Bran | Sep 93 | 110 | 81 |
| 8435 | Whole Milk Powder | Sep 93 | 110 | 80/81 |
| 8436 | Durum Wheat Flour | Sep 93 | 110 | 81 |
| 8437 | Hard Red Spring Wheat Flour | Sep 93 | 110 | 81 |
| 8438 | Soft Winter Wheat Flour | Sep 93 | 110 | 81 |
| 8441 | Wheat Hardness | Dec 97 | 110 | 83 |
| 8442 | LC Selectivity | | Discontinued | |
| 8443 | GC/MS System Performance | Aug 84 | 109 | 75 |
| 8444 | Cotinine in Freeze-dried Urine | Feb 89 | 105 | 64 |
| 8448 | Drugs of Abuse in Hair Segments | Mar 92 | 105 | 65 |
| 8449 | Drugs of Abuse in Powdered Hair | Feb 92 | 105 | 65 |
| 8450 | Polyethylene Piping, 1.3 cm | Jan 88 | 202 | 102 |
| 8451 | Polyethylene Piping, 4.8 cm | Jan 88 | 202 | 102 |
| 8452 | Polyethylene Piping, 10.2 cm | Jan 88 | 202 | 102 |
| 8453 | Poly Socket T Joint | Jan 88 | 202 | 102 |
| 8454 | Poly Butt T Joint | Jan 88 | 202 | 102 |
| 8455 | Pyrite Ore | Apr 91 | 111 | 86 |
| 8458 | Artificial Flaw for Eddy Current NDF | Aug 91 | 303 | 130 |
| 8466 | Y-HCH (Lindane) (neat) | Apr 92 | 109 | 75 |
| 8467 | 4,4'-DDE (neat) | Apr 92 | 109 | 75 |
| 8469 | Pesticide, 4,4'-DDT (neat) | Apr 92 | 109 | 75 |
| 8486 | Portland Cement Clinker | May 89 | 113 | 94 |
| 8487 | Portland Cement Clinker | May 89 | 113 | 94 |
| 8488 | Portland Cement Clinker | May 89 | 113 | 94 |

| SRM/RM | Descriptor | Cert. Date | Section Code | Page |
|---|---|---|---|---|
| 8495 | Northern Softwood | N/A | 209 | 133 |
| 8496 | Eucalyptus Hardwood | N/A | 209 | 133 |
| 8501 | Catalyst Package IIIE | 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-Elemen.-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 sublot prepared.

In Prep - New or Renewal SRM being prepared.

| RM | Descriptor | Cert. Date | Section Code | Page |
|---|---|---|---|---|

# *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

| SRM | Descriptor | MSDS Date | Page |
|---|---|---|---|
| 986 | Nickel (Isotopic) | Oct 94 | 60 |
| 987 | Strontium Assay and Isotopic | Aug 94 | 56/60 |
| 989 | Rhenium Assay (Isotopic) | Apr 94 | 60 |
| 991 | Lead-206 Spike Assay and Isotopic | Oct 94 | 60 |
| 994 | Gallium (Isotopic) | Sep 79 | 60 |
| 997 | Thallium (Isotopic) | Oct 94 | 60 |
| 1007b | Plastic, (Smoke Density) | Sep 94 | 131 |
| 1051b | Barium (Metallo-Organic) | Feb 81 | 95 |
| 1052b | Vanadium (Metallo-Organic) | Jul 80 | 95 |
| 1053a | Cadmium (Metallo-Organic) | May 81 | 95 |
| 1057b | Tin (Metallo-Organic) | May 81 | 95 |
| 1059c | Lead (Metallo-Organic) | Jun 84 | 95 |
| 1060a | Lithium (Metallo-Organic) | Sep 86 | 95 |
| 1065b | Nickel (Metallo-Organic) | Feb 83 | 95 |
| 1066a | Silicon (Metallo-Organic) | May 81 | 95 |
| 1069b | Sodium (Metallo-Organic) | Aug 85 | 95 |
| 1073b | Zinc (Metallo-Organic) | Jun 84 | 95 |
| 1075a | Aluminum (Metallo-Organic) | Feb 81 | 95 |
| 1077a | Silver (Metallo-Organic) | Feb 83 | 95 |
| 1079b | Iron (Metallo-Organic) | Apr 85 | 95 |
| 1080a | Copper (Metallo-Organics) | Feb 83 | 95 |
| 1083 | Wear Metals (Base Oil) | Mar 92 | 96 |
| 1084a | Wear Metals | Mar 92 | 96 |
| 1085a | Wear Metals | Mar 92 | 96 |
| 1129 | Solder 63Sn-37Pb | Dec 93 | 49 |
| 1131 | Solder 60Pb-40Sn | Feb 94 | 49 |
| 1400 | Bone Ash | Jun 93 | 62 |
| 1450b | Fibrous Glass Board | Apr 92 | 107 |
| 1491 | Arom. Hydro/Hexane Toluene | Aug 89 | 75 |
| 1492 | Chlor. Pesticides/Hexane | Sep 89 | 75 |
| 1493 | PCB Congeners | Dec 94 | 75 |
| 1514 | Thermal Analysis Purity Set (DSC) | May 92 | 104 |
| 1543 | GC/MS and LS System Performance | Mar 92 | 75 |
| 1581 | PCBs in Oil | Dec 91 | 75 |
| 1584 | Phenols in Methanol | Mar 91 | 75 |
| 1586 | Isotope Label Pollutants | Jun 93 | 75 |
| 1587 | Nitro PAH in Methanol | Sep 93 | 75 |
| 1597 | Complex PAH Mix | Feb 94 | 75 |
| 1614 | Dioxin in Isooctane | Aug 93 | 75 |
| 1616a | Sulfur in Kerosene | Aug 95 | 73 |
| 1617a | Sulfur in Kerosene | Aug 95 | 73 |
| 1618 | Vanadium & Nickel in Fuel Oil | Apr 91 | 72 |
| 1619a | Sulfur in Residual Fuel Oil | Apr 91 | 73 |
| 1620b | Sulfur in Residual Fuel Oil | Sep 90 | 73 |
| 1621e | Sulfur in Residual Fuel Oil | Jul 96 | 73 |
| 1622d | Sulfur in Residual Fuel Oil | Nov 93 | 73 |
| 1623c | Sulfur in Residual Fuel Oil | Jul 96 | 73 |
| 1624c | Sulfur in Distillate Fuel Oil | May 97 | 73 |
| 1625 | SO2 Permeation Tube-10 cm | May 95 | 71 |
| 1626 | SO2 Permeation Tube-5 cm | May 95 | 71 |
| 1632b | Trace Elements in Coal (Bituminous) | Feb 93 | 73/74 |
| 1633b | Trace Elements in Coal Fly Ash | Sep 95 | 74 |
| 1634c | Trace Elements in Fuel Oil | Jul 95 | 72 |
| 1635 | Trace Elements in Coal (Subbituminous) | Sep 94 | 73/74 |
| 1639 | Halocarbons (in methanol) | May 93 | 75 |
| 1641c | Mercury in Water | Dec 89 | 68 |
| 1643d | Trace Elements in Water | In Prep | 68 |
| 1647c | Priority Pollutant PAHs | Apr 93 | 75 |
| 1658a | CH4/Air, 1 µmol/mol | Jan 91 | 71 |
| 1659a | CH4/Air, 10 µmol/mol | Jan 91 | 71 |
| 1660a | CH4-C3H8/Air, 1 µmol/mol | Aug 95 | 71 |
| 1661a | SO2/N2, 500 µmol/mol | Jan 97 | 71 |
| 1662a | SO2/N2, 1000 µmol/mol | Jan 97 | 71 |
| 1663a | SO2/N2, 1500 µmol/mol | Jan 97 | 71 |
| 1664a | SO2/N2, 2500 µmol/mol | Jan 97 | 71 |
| 1665b | C3H8/Air, 3 µmol/mol | May 97 | 71 |
| 1666b | C3H8/Air, 10 µmol/mol | May 97 | 71 |
| 1667b | C3H8/Air, 50 µmol/mol | Feb 97 | 71 |
| 1668b | C3H8/Air, 100 µmol/mol | Jan 97 | 71 |
| 1669b | C3H8/Air, 500 µmol/mol | Oct 96 | 71 |
| 1674b | CO2/N2, mol 7% | Sep 94 | 70 |
| 1675b | CO2/N2, mol 14% | Sep 94 | 70 |
| 1677c | CO/N2, 10 µmol/mol | Jan 91 | 70 |
| 1678c | CO/N2, 50 µmol/mol | Jan 91 | 70 |
| 1679c | CO/N2, 100 µmol/mol | Jan 91 | 70 |
| 1680b | CO/N2, 500 µmol/mol | Jan 91 | 70 |
| 1681b | CO/N2, 1000 µmol/mol | Jan 91 | 70 |
| 1683b | NO/N2, 50 µmol/mol | Dec 90 | 71 |
| 1684b | NO/N2, 100 µmol/mol | Sep 94 | 71 |
| 1685b | NO/N2, 250 µmol/mol | Dec 90 | 71 |
| 1686b | NO/N2, 500 µmol/mol | Sep 96 | 71 |
| 1687b | NO/N2, 1000 µmol/mol | Nov 96 | 71 |
| 1693a | SO2/N2, 50 µmol/mol | Sep 94 | 71 |
| 1694a | SO2/N2, 100 µmol/mol | Sep 94 | 71 |
| 1696a | SO2/N2, 3500 µmol/mol | Sep 96 | 71 |
| 1800 | Organic Compounds/N2 | Feb 94 | 71 |
| 1804a | Tox. Organic Compounds/N2 | Oct 92 | 71 |
| 1815a | n-Heptane (Fuel Rating) | May 93 | 73 |
| 1816a | Isooctane (Fuel Rating) | Jan 93 | 73 |
| 1817c | Catalyst Package IIID | Mar 90 | 96 |
| 1818a | Chlorine in Lub. Base Oil | Apr 94 | 95 |
| 1819a | Sulfur in Lub. Base Oil | Apr 94 | 95 |
| 1828a | Ethanol-Water Soln. | Jun 96 | 64 |
| 1829 | Alcohols in Ref. Fuels | Aug 93 | 72 |
| 1836 | Nitrogen in Lub. Base Oil | Oct 92 | 95 |
| 1837 | Methanol, Butanol (Fossil Fuel) | Jun 93 | 72 |
| 1838 | Ethanol (Fossil Fuel) | May 93 | 72 |
| 1839 | Methanol (Fossil Fuel) | Jun 93 | 72 |
| 1866a | Common Commercial Asbestos | Jan 94 | 67 |
| 1867 | Uncommon Commercial Asbestos | Aug 93 | 67 |
| 1879a | Respirable Cristobalite | In Prep | 66 |
| 1880 | Portland Cement, Black | Jan 92 | 93 |
| 1881 | Portland Cement, White | Apr 91 | 93 |
| 1882 | Portland Cement, Orange | Jan 91 | 93 |
| 1883 | Portland Cement, Silver | Apr 91 | 93 |
| 1884 | Portland Cement, Ivory | Apr 91 | 93 |
| 1885 | Portland Cement, Turquoise | Apr 91 | 93 |
| 1886 | Portland Cement, Cranberry | Apr 91 | 93 |
| 1887 | Portland Cement, Brown | Apr 91 | 93 |
| 1888 | Portland Cement, Purple | Apr 91 | 93 |
| 1889 | Portland Cement, Gray | Apr 91 | 93 |
| 1920a | IR Reflectance | In Prep | 111 |
| 1924 | Poly(ethylene Oxide) | Aug 94 | 101 |
| 1941a | Organics in Marine Sediment | Aug 92 | 75 |
| 1945 | Organics in Whale Blubber | July 94 | 75 |
| 1970 | Succinonitrile (Triple Point) | Nov 92 | 105 |
| 1972 | 1,3-Dioxolan-2-one (Triple Point) | Aug 94 | 105 |
| 1973 | n-Docosane (Triple Point) | Aug 94 | 105 |
| 1978 | Zirconium Oxide (Particle Size) | Oct 93 | 127 |
| 2034 | Holmium Oxide Wavelength | Feb 92 | 109/110 |
| 2108 | Chromium (III) Speciation | Jun 93 | 60 |
| 2109 | Chromium (VI) Speciation | Aug 92 | 60 |
| 2141 | Urea | Jul 96 | 56 |
| 2142 | 0-Bromobenzoic Acid | Aug 85 | 56 |
| 2143 | p-Fluorobenzoic Acid | Mar 88 | 56 |
| 2144 | m-Chlorobenzoic Acid | May 91 | 56 |
| 2152 | Urea (Comb. Calorimetry) | Jul 96 | 103 |
| 2185 | Pot. Hydrogen Phthalate | Mar 92 | 99 |
| 2193 | Calcium Carbonate | Dec 91 | 99 |
| 2203 | Potassium Fluoride (Ion-Selective) | May 82 | 100 |
| 2222 | Biphenyl (Dif. Scan. Calor.) | Mar 93 | 104 |
| 2225 | Mercury (Dif. Scan Calor.) | Mar 93 | 104 |
| 2260 | Aromatic Hydrocarbons in Toluene | Feb 92 | 75 |
| 2261 | Chlorinated Pesticides in Hexane | Feb 92 | 75 |
| 2262 | Chlorinated Bephenyls in Isooctane | Mar 95 | 75 |
| 2286 | Ethanol in Gasoline | Jan 95 | 72 |
| 2287 | Ethanol in Gasoline | Jan 95 | 72 |
| 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 |
|---|---|---|---|
| 2290 | Ethyl t-Butyl Ether in Gasoline | Jan 95 | 72 |
| 2291 | Ethyl t-Butyl Ether in Gasoline | Jan 95 | 72 |
| 2292 | Methyl t-Butyl Ether in Gasoline | Jan 95 | 72 |
| 2293 | Methyl t-Butyl Ether in Gasoline | Jan 95 | 72 |
| 2389 | Amino Acids in Hydrochloric Acid | Jan 94 | 62 |
| 2579 | Lead Paint Film | Oct 92 | 67 |
| 2580 | Powdered Paint | Jan 97 | 67 |
| 2581 | Powdered Paint | Jan 97 | 67 |
| 2582 | Powdered Paint, (Low Lead) | Jan 97 | 67 |
| 2583 | Trace Elements in Indoor Dust | Jan 97 | 67/68 |
| 2589 | Powdered Paint | Apr 96 | 67 |
| 2612a | CO/Air, 10 µmol/mol | Jun 91 | 70 |
| 2613a | CO/Air, 20 µmol/mol | Jun 91 | 70 |
| 2614a | CO/Air, 45 µmol/mol | Jun 91 | 70 |
| 2619a | CO2/N2, 0.5 mol % | Jun 92 | 70 |
| 2620a | CO2/N2, 1.0 mol % | Jun 92 | 70 |
| 2621a | CO2/N2, 1.5 mol % | Jun 92 | 70 |
| 2622a | CO2/N2, 2.0 mol % | Jun 92 | 70 |
| 2623a | CO2/N2, 2.5 mol % | Jun 92 | 70 |
| 2624a | CO2/N2, 3.0 mol % | Jul 96 | 70 |
| 2625a | CO2/N2, 3.5 mol % | Sep 94 | 70 |
| 2626a | CO2/N2, 4.0 mol % | Jan 93 | 70 |
| 2627a | NO/N2, 5 µmol/mol | Jan 91 | 71 |
| 2628a | NO/N2, 10 µmol/mol | Jun 91 | 71 |
| 2629a | NO/N2, 20 µmol/mol | Jun 91 | 71 |
| 2630 | NO/N2, 1500 µmol/mol | Jun 91 | 71 |
| 2631a | NO/N2, 3,000 µmol/mol | Jun 91 | 71 |
| 2635a | CO/N2, 25 µmol/mol | Jan 89 | 70 |
| 2636a | CO/N2, 250 µmol/mol | Jun 92 | 70 |
| 2637a | CO/N2, 2500 µmol/mol | Jun 92 | 70 |
| 2638a | CO/N2, 5000 µmol/mol | Jun 92 | 70 |
| 2639a | CO/N2, 1 mol % | Jun 92 | 70 |
| 2640a | CO/N2, 2 mol % | Dec 88 | 70 |
| 2641a | CO/N2, 4 mol % | Dec 88 | 70 |
| 2642a | CO/N2, 8 mol % | Sep 92 | 70 |
| 2643a | C3H8/N2, 100 µmol/mol | Dec 90 | 71 |
| 2644a | C3H8/N2, 250 µmol/mol | Dec 90 | 71 |
| 2645a | C3H8/N2, 500 µmol/mol | Dec 90 | 71 |
| 2647a | C3H8/N2, 2500 µmol/mol | Dec 90 | 71 |
| 2648a | C3H8/N2 5000 µmol/mol | Nov 93 | 71 |
| 2649a | C3H8/N2, 1 mol % | Dec 90 | 71 |
| 2650 | C3H8/N2, 2 mol % | Feb 93 | 71 |
| 2656 | NOx/Air, 2500 µmol/mol | Aug 93 | 71 |
| 2657a | O2/N2, 2 mol % | Jul 93 | 71 |
| 2658a | O2/N2, 10 mol % | Jul 93 | 71 |
| 2659a | O2/N2, 21 mol % | Jul 93 | 71 |
| 2660 | NOx/Air, 100 µmol/mol | Jul 93 | 71 |
| 2682a | Sulfur in Coal, 0.5%, (also Heat of Comb.) | Apr 91 | 73 |
| 2683a | Sulfur in Coal, 2%, (also Heat of Comb.) | Apr 91 | 73/103 |
| 2684a | Sulfur in Coal, 3%, (also Heat of Comb.) | Apr 91 | 73/103 |
| 2685a | Sulfur in Coal, 5%, (also Heat of Comb.) | Apr 91 | 73 |
| 2689 | Coal Fly Ash | Nov 85 | 74 |
| 2690 | Coal Fly Ash | Nov 85 | 74 |
| 2691 | Coal Fly Ash | Nov 85 | 74 |
| 2692a | Sulfur in Coal, 1% | Jul 94 | 73/103 |
| 2712 | Lead in Ref. Fuel | Nov 88 | 72 |
| 2713 | Lead in Ref. Fuel | Nov 88 | 72 |
| 2714 | Lead in Ref. Fuel | Nov 88 | 72 |
| 2715 | Lead in Ref. Fuel | Nov 88 | 72 |
| 2717 | Sulfur in Residual Fuel Oil | Feb 93 | 73 |
| 2724 | Sulfur in Diesel Fuel Oil, 0.04% | Sep 94 | 73 |
| 2735 | NO/N2, 800 µmol/mol | Dec 90 | 71 |
| 2736 | NO/N2, 2000 µmol/mol | Dec 90 | 71 |
| 2740 | CO/N2, 10 mol % | Jan 91 | 70 |
| 2741 | CO/N2, 13 mol % | Jan 91 | 70 |
| 2745 | CO2/N2, 16 mol% | Jul 96 | 70 |
| 2764 | C3H8/Air, 0.25 µmol/mol | Aug 95 | 71 |
| 3101a | Aluminum Standard Soln. | May 93 | 57 |
| 3102a | Antimony Standard Soln. | Jun 93 | 57 |
| 3103a | Arsenic Standard Soln. | Jul 93 | 57 |
| 3104a | Barium Standard Soln. | May 97 | 57 |
| 3105a | Beryllium Standard Soln. | Jan 94 | 57 |
| 3106 | Bismuth Standard Soln. | Feb 97 | 57 |
| 3108 | Cadmium Standard Soln. | May 90 | 57 |
| 3109a | Calcium Standard Soln. | May 93 | 57 |
| 3110 | Cerium Standard Soln. | Apr 89 | 57 |
| 3111a | Cesium Standard Soln. | Jul 93 | 57 |
| 3112a | Chromium Standard Soln. | May 93 | 57 |
| 3113 | Cobalt Standard Soln. | Mar 89 | 57 |
| 3114 | Copper Standard Soln. | May 90 | 57 |
| 3115a | Dysprosium Standard Soln. | Mar 94 | 57 |
| 3116a | Erbium Standard Soln. | Jan 94 | 57 |
| 3117a | Europium Standard Soln. | Jan 93 | 57 |
| 3118a | Gadolinium Standard Soln. | Jan 93 | 57 |
| 3119a | Gallium Standard Soln. | Oct 93 | 57 |
| 3120 | Germanium Standard Soln. | Apr 89 | 57 |
| 3121 | Gold Standard Soln. | Apr 97 | 57 |
| 3122 | Hafnium Standard Soln. | Jan 94 | 57 |
| 3123a | Holmium Standard Soln. | May 97 | 57 |
| 3124a | Indium Standard Soln. | May 93 | 57 |
| 3126a | Iron Standard Soln. | Feb 94 | 57 |
| 3127a | Lanthanum Standard Soln. | May 93 | 57 |
| 3128 | Lead Standard Soln. | Sep 88 | 57 |
| 3129a | Lithium Standard Soln. | May 93 | 57 |
| 3130a | Lutetium Standard Soln. | Feb 94 | 57 |
| 3131a | Magnesium Standard Soln. | May 93 | 57 |
| 3132 | Manganese Specto Soln. | Apr 89 | 57 |
| 3133 | Mercury Standard Soln. | May 97 | 57 |
| 3134 | Molybdenum Standard Soln. | May 90 | 57 |
| 3135a | Neodymium Standard Soln. | May 93 | 57 |
| 3136 | Nickel Standard Soln. | May 97 | 57 |
| 3138 | Palladium Standard Soln. | Apr 89 | 57 |
| 3139a | Phosphorus Standard Soln. | Jul 94 | 57 |
| 3140 | Platinum Standard Soln. | Apr 89 | 57 |
| 3141a | Potassium Standard Soln. | May 97 | 57 |
| 3142a | Praseodymium Standard Soln. | May 93 | 57 |
| 3143 | Rhenium Standard Soln. | Jul 88 | 57 |
| 3144 | Rhodium Standard Soln. | Jan 93 | 57 |
| 3145a | Rubidium Standard Soln. | Jan 94 | 57 |
| 3147a | Samarium Standard Soln. | Jan 94 | 58 |
| 3148a | Scandium Standard Soln. | May 93 | 58 |
| 3149 | Selenium Standard Soln. | Apr 89 | 58 |
| 3151 | Silver Standard Soln. | Apr 89 | 58 |
| 3152a | Sodium Standard Soln. | Sep 94 | 58 |
| 3153a | Strontium Standard Soln. | May 93 | 58 |
| 3154 | Sulfur Standard Soln. | Feb 93 | 58 |
| 3155 | Tantalum Standard Soln. | Mar 89 | 58 |
| 3156 | Tellurium Standard Soln. | Mar 90 | 58 |
| 3157a | Terbium Standard Soln. | Feb 94 | 58 |
| 3158 | Thallium Standard Soln. | Feb 89 | 58 |
| 3159 | Thorium Standard Soln. | Jan 89 | 58 |
| 3160a | Thulium Standard Soln. | Mar 94 | 58 |
| 3161a | Tin Standard Soln. | Feb 97 | 58 |
| 3162a | Titanium Standard Soln. | Jan 93 | 58 |
| 3163 | Tungsten Standard Soln. | Nov 88 | 58 |
| 3164 | Uranium Standard Soln. | Nov 96 | 58 |
| 3165 | Vanadium Standard Soln. | Feb 90 | 58 |
| 3166a | Ytterbium Standard Soln. | Feb 94 | 58 |
| 3167a | Yttrium Standard Soln. | Jul 93 | 58 |
| 3168a | Zinc Standard Soln. | Oct 93 | 58 |
| 3169 | Zirconium Standard Soln. | Oct 88 | 58 |
| 3171a | Multielement Mix A1 Soln. | May 93 | 58 |
| 3172a | Multielement Mix B1 Soln. | Jan 93 | 59 |
| 3179 | Multielement Mixes I, II, III Solns. | Nov 93 | 59 |
| 3183 | Fluoride Anion Soln. | Feb 93 | 60 |
| 8443 | GC/MS System Performance | Mar 92 | 75 |
| 8466 | Y-HCH (Lindane) (neat) | May 92 | 75 |
| 8467 | 4,4'-DDE (neat) | May 92 | 75 |
| 8469 | Pesticide, 4,4'-DDT (neat) | May 92 | 75 |
| 8505 | Vanadium in Crude Oil | Jan 93 | 72 |
| 8506 | Transformer Oil | Mar 92 | 73 |
| 8507 | Mineral Oil | Mar 92 | 73 |

| SRM | Descriptor | MSDS 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 |

| SRM | Descriptor | MSDS Date | Page |
|---|---|---|---|

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





Cu

K