NIST

Standard Reference Materials Catalog 1990-91

NIST Special Publication 260
U.S. DEPARTMENT OF COMMERCE
National Institute of Standards and Technology

TO ORDER
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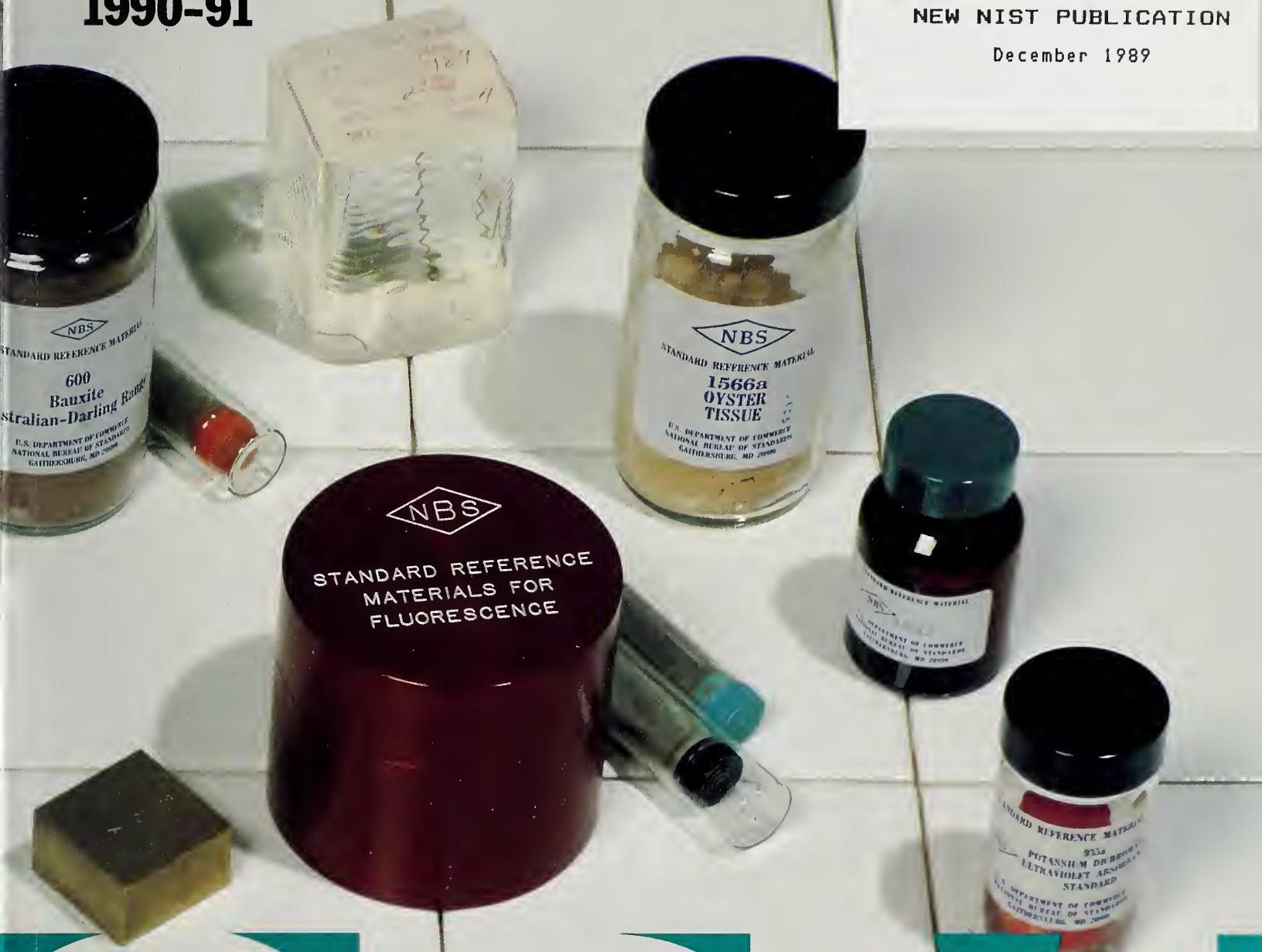
NEW NIST PUBLICATION

December 1989



SRM

UNITED STATES DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
(formerly National Bureau of Standards)
Gaithersburg, Maryland 20899

Dear Colleague:

Welcome to the very first catalog of Standard Reference Materials (SRM's) to be issued by the National Institute of Standards and Technology. Of course, the materials listed herein are an extension of 84 years of service to the U.S. technical community provided by the National Bureau of Standards since 1906. Our new name is indicative of the effort we are making to extend the tradition of SRM service into new fields and into a new era of service to technology.

You will find over two hundred changes in SRM availability listed in this catalog — new additions, renewals, and revised certificates. Please carefully review the sections which relate to your work to see the new (and previously issued) SRM's that are available. If we can help you with regard to any listing please give us a call.

Many of you have told us, at SRM exhibits, or by letter, that you are happy that SRM's continue to be available through the new NIST organization. In fact, we are seeing some modest growth in our ability to supply the materials that you need. If you have a requirement that we do not currently meet please let us know about it. In the front pages of this catalog you will find a section entitled *Guide for Requesting Development of Standard Reference Materials.* You can register your need with us with just a few minutes of effort. Then, as funding permits, we can try to be responsive to your needs.

Thank you for your continued interest in Standard Reference Materials from NIST. It is our privilege to provide them to you and thereby enhance the quality of measurements and analyses made throughout the technical community.

Sincerely,

William P. Reed

William P. Reed
Acting Chief
Office of Standard Reference Materials

NIST Special Publication 260

NIST Standard Reference Materials Catalog 1990 – 1991

R.L. McKenzie, *Editor*

Office of Standard Reference Materials
National Institute of Standards and Technology
Gaithersburg, MD 20899

CAUTION: The values shown in the catalog are nominal values only. Users should consult the certificate issued with an SRM for the certified values.

U.S. Department of Commerce
Robert A. Mosbacher, *Secretary*

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

Issued January 1990

TO ORDER
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See page 6 for ORDERING INSTRUCTIONS

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Contents

Abstract and Key Words

National Institute of Standards and Technology Standard Reference Materials 1990–91 Catalog

This catalog describes the Standard Reference Materials (SRM's) currently available from the National Institute of Standards and Technology (NIST), lists those in preparation, and provides ordering information. The descriptions provide *nominal* values for these SRM's. Certified values are provided in the certificates that accompany each SRM. Price Lists for SRM's are issued as separate supplements to this catalog and include new SRM's as they are issued.

Key Words: analysis, calibration, characterization, composition, concentration, materials, measurement, property, quality assurance, quality control, reference materials, Standard Reference Materials, standardization.

Look for us at the next meeting you attend! Our new exhibit booth, attended by representatives of our sales and technical staff, is scheduled to be at about a dozen professional meetings and expositions each year.

The Engineering Mechanics Building is now the home of the Standard Reference Materials Program. We look forward to continued and improved service to the technical community in our new offices and materials preparation and packaging facilities.

Program Information

The National Institute of Standards and Technology (NIST) offers for sale over 1,000 different materials through its Office of Standard Reference Materials. These materials are primarily Standard Reference Materials (SRM's) certified for their chemical composition, chemical property, or physical property, but include other reference materials. All materials bear distinguishing names and numbers by which they are permanently identified. Thus, each material bearing a given description is identical (within the specified limits) to every other sample bearing the same designation—with the exception of individually certified items, which are further identified by serial number.

Definitions

From "Terms and definitions used in connection with reference materials," ISO Guide 30–1981 (E):

1. "Reference Material (RM): A material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials."

2. "Certified Reference Material (CRM): A reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body."

NIST Standard Reference Materials (SRM's): Certified reference materials issued by NIST. These are well-characterized materials produced in quantity to improve measurement science. SRM's are certified for specific chemical or physical properties, and are issued by NIST with certificates that report the results of the characterization and indicate the intended use of the material. They are prepared and used for three main purposes:

(1) To help develop accurate methods of analysis (reference methods);
(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 certified values are obtained by one of three routes of measurement:

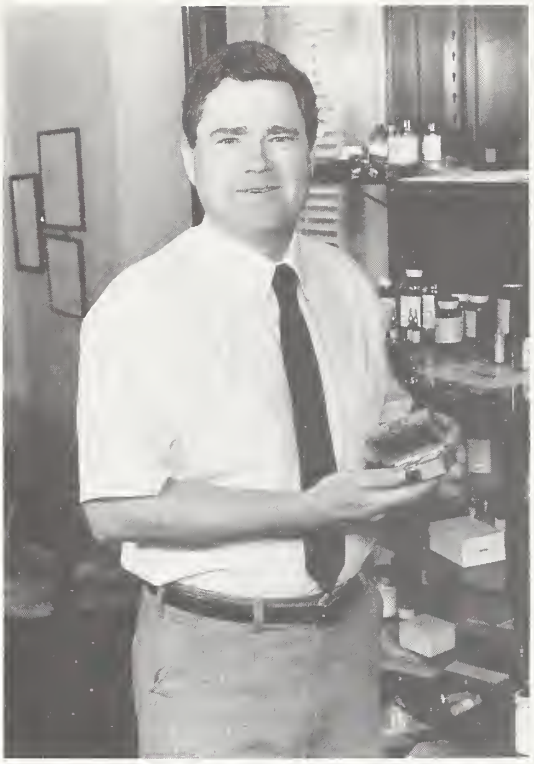
(1) A previously validated reference method,
(2) Two or more independent, reliable measurement methods, or
(3) A network of cooperating laboratories, technically competent and thoroughly knowledgeable with the material being tested.

These measurement routes are described in "The Role of Standard Reference Materials in Measurement Systems," NBS Monograph 148, 54 pages (Jan 1975).

Reference Materials (RM's) listed in this catalog are sold by, but not certified by, NIST. They meet the ISO definition for RM's, and many meet the definition for CRM's. The documentation issued with these materials is either a:

(1) "Report of Investigation," the sole authority of which is the author of the report. RM's are intended to further scientific or technical research on that particular material. The principal consideration in issuing an RM is to provide a homogeneous material so that investigators in different laboratories are assured that they are investigating the same material.

(2) "Certificate," issued by the certifying agency (other than NIST), e.g., other national laboratories, other government agencies, other standardizing bodies, or other non-profit organizations. When deemed to be in the public interest and when alternate means of national distribution do not exist, NIST acts as the distributor for such materials. This service is available to organizations that qualify and have the reference materials that would help meet national measurement needs.



Stan Rasberry, the new Acting Director of Measurement Services, displays one of the many SRM's developed in the program of the Office of Standard Reference Materials (OSRM). The enthusiasm and decisiveness Stan exercised while Chief of OSRM will continue to be an asset to the SRM program as well as to the additional programs to which he will now provide leadership — Standard Reference Data, Physical Measurement Services and the National Voluntary Laboratory Accreditation Programs.

SRM Catalog

New catalogs of NIST Standard Reference Materials are published approximately every 2 years, listing materials available and materials in preparation, and deleting discontinued materials. Catalog supplements (Price Lists) are issued simultaneously with new catalogs and approximately every 6 months to keep the catalog current between editions. These supplements list current prices, and reflect any changes in material availability—listing new and renewed materials and dropping discontinued ones.

The numerical values given in this catalog to describe the materials' properties are NOMINAL values only and are to be used only as guides in selecting SRM's. They are NOT TO BE USED in place of the values given on the certificate issued with the materials.

Two indices are provided for user convenience. The first is a numerical index that lists the numbers, names, and certificate dates of the materials in the catalog. The second is an alphabetical index that lists categories of materials, elements, and names of materials.

Preparation and Availability of Standard Reference Materials

New and renewal SRM's are being prepared continually. These SRM's are included in the next edition of the catalog and its supplements. Prospective users that have requested that their names be added to the SRM mail list are notified as these new items become available. To have your name placed on this mail list, please write to the address given below.

Renewal SRM's are intended to be completed before the supply of an existing SRM is exhausted. This is not always possible and an SRM may be out-of-stock for a time. When this occurs, those ordering the material are so notified and possible substitutes (if any) 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 an SRM may be discontinued permanently.

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

Guide for Requesting Development of Standard Reference Materials

The National Institute of Standards and Technology has the function to develop, produce, and distribute Standard Reference Materials (SRM's) that provide a basis for comparison of measurements on materials, and that aid in the control of production processes. To perform this function, the Office of Standard Reference Materials evaluates the requirements of science, industry, and government for carefully characterized reference materials, and directs their production and distribution.

NIST currently has over 1,000 SRM's available, about 100 new ones in preparation, and requests for the production of many others.

To be an SRM, a candidate material must meet one or more of these 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.
4. Its production by NIST would provide continued availability of a well-characterized material important to science, industry, or government.

NIST has recognized and responded 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 SRM's greatly exceed the Institute's capacity to produce and certify such materials. Consequently, requests for new SRM's of limited use, or for which the need is not very great, are deferred in favor of requests that clearly show a critical need. To determine which requests receive top priority, NIST needs and uses information supplied by industry and such interested organizations as the American National Standards Institute, American Nuclear Society, American Petroleum Institute, American Society for Testing and Materials, etc.

Accordingly, while NIST welcomes all requests for developing new SRM's, both NIST and industry would be helped if such requests provide information that permit objective assessment of the urgency and importance of the proposed new reference materials.

Requests for the development of new Standard Reference Materials should provide information such as listed below.

1. Short title of the proposed SRM.
2. Purpose for which the SRM would be used.
3. Reasons why the SRM is needed.
4. Special characteristics and requirements for the material. Include additional requirements and reasons if more than one SRM is necessary for standardization in this area.
5. An estimate of the probable present and future (6–10 year) demand for such an SRM in your operations and elsewhere. (National and international estimates are useful.)
6. Whether such an SRM, or a similar one, could be produced or obtained from a source other than NIST; and if so, justify its preparation by NIST.
7. Miscellaneous pertinent information to aid justification for the SRM, such as: (a) an estimate of the potential range of application, monetary significance of the measurement 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 committees, and others.

All such requests should be addressed to:

Office of Standard Reference Materials
ATTN: SRM Development
Room 205, Building 202
National Institute of Standards and Technology
Gaithersburg, MD 20899

Ordering Standard Reference Materials

General

Purchase orders for all SRM's should be addressed to:

Office of Standard Reference Materials
Room 205, Building 202
National Institute of Standards and Technology
Gaithersburg, MD 20899
Telephone: (301) 975–OSRM [6776]
FTS: 879-OSRM [6776]
Fax number: (301) 948–3730
Telex: TRT197674NIST UT

All orders should give the number of units, catalog number, and name of the material requested. For example: "1 each, SRM 79a, Fluorspar (Customs Grade)." The materials described in this catalog are sold only in the units listed or multiples thereof.

Acceptance of an order does not imply acceptance of any provisions set forth in the order contrary to the policy, practice, or regulations of the National Institute of Standards and Technology or the U.S. Government.

In general, orders received for "out-of-stock" material will be filled with the renewal material, if available; otherwise they will be canceled. Customers are notified when an order is canceled; and their names are placed on a notification list. This list is used when a renewal material is issued to notify customers of the price and availability of the item. Customers so notified are requested to submit a new order if they still want the item.

For some individually certified SRM's, production lots are small and may entail frequent stock outages. In these cases, the notification list is used to fill orders on a "first come, first served" basis. NOTE: For such SRM's, customers are notified that the SRM is again available and are requested to confirm their original purchase orders.

Lee Best, Manager of Sales and Marketing, has developed an excellent sales and marketing staff through the thoroughness and initiative of her leadership. We look forward to meeting many of you at one of the many exhibits Lee has scheduled for the Office of Standard Reference Materials.

Rosemary Blasingame, who displays enthusiasm and endurance in every responsibility she receives, serves as SRM assistant, performing many tasks in sales and marketing, including foreign sales.

Terms

Prices quoted are in U.S. dollars ($), and are published in the catalog supplements (price lists). When price lists are issued, they are sent to persons or organizations on the SRM mail list. These prices are subject to change without notice and orders will be billed for the prices in effect at the time of shipment. No discounts are given on purchases of SRM's or RM's.

Remittances of the purchase price need not accompany the purchase order. Payment of invoices is expected within 30 days of the receipt of the invoice. Payment on foreign orders may be made by any of the following:

a. Banker's draft against U.S.A. bank,
b. Bank to bank transfer to U.S.A. bank,
c. Cash against documents,
d. Sight draft,
e. International money order, or
f. UNESCO coupons.

Letters of credit: If a letter of credit or any method of payment other than those listed above is to be used, the services of an agent in the United States must be secured to act in your behalf. Your agent would purchase the material and our invoice would indicate that the agent is the purchaser. The material would be shipped to your agent, who would tranship in accordance with your instructions.

NOTE: A customer identification number; i.e., social security number (EIN) for consumer customers; tax identification number (TIN) for commercial customers; or agency location code (ALC) for government customers, is required with each order.

Phyllis Wagner, an SRM assistant, provides consistency and dependability to the delivery of many SRM's through her expertise in regulations and procedures for the shipment of hazardous materials.

Cindy Leonard provides customer sales and services with a joyfulness and friendliness that is appreciated by our customers.

Late Charges

Unless otherwise notified, payment is due within 30 days of shipment of the order to the customer. U.S. Treasury regulations require that late charges be assessed for each 30-day period, or portion thereof, that the payment is overdue.

Proforma Invoice (Price Quotation)

Proforma service will be provided only to those requiring such service.

Domestic Shipments

Shipments of material (except for certain restricted categories and refrigerated items) intended for the United States and Canada are normally shipped prepaid, providing the parcel does not exceed the weight limitations prescribed by postal laws and regulations. Refrigerated items are shipped prepaid air express with shipping costs added to the invoice.

Donna Clark, systems analyst, displays persistence and attention to details in the development and maintenance of the OSRM computer programs for sales and inventory control.

Jody Hines (left) and Sandy Barber combine their characteristic qualities of diligence, determination, flexibility and cooperativeness to the task of updating information for the preparation and publication of the new 1990-91 SRM Catalog.

Foreign Shipments

The regulations of various nations covering the importation of SRM's differ widely; any attempt to list all possible variations would be impractical. Therefore, where shipping practices outlined below do not apply, purchasers will be informed of the best method of shipment for their countries.

Most foreign orders will be shipped by prepaid International Air Parcel Post. Exceptions are those items in restricted categories, those items requiring refrigeration, and shipments exceeding parcel post weight limits. These exceptions will be shipped FOB Gaithersburg, MD, unless an agent (shipping or brokerage firm) located in the United States is used. When an agent is required, the purchaser will be notified and will be requested to obtain the services of one and inform us of the agent's name and address. In such cases, the material will be packed for overseas shipment and will be forwarded to the agent FOB Gaithersburg, MD.

Documentation

The documents we furnish are:

a. Two commercial invoices,
b. Two sight drafts,
c. Two packing slips, and
d. An air waybill for air shipments.

(All documents are printed in English.)

If documents other than those listed above are required, the services of an agent in the United States will be needed to purchase and ship the material.

NOTE: Orders and inquiries submitted in English will be processed more rapidly than those requiring translation.

Certified Reference Materials From Other Sources

Special Nuclear Materials

On October 1, 1987, the New Brunswick Laboratory began issuing special nuclear reference materials as NBL Certified Reference Materials (CRM's). These CRM's 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
Attn: Reference Materials Sales
9800 S. Cass Avenue, Bldg. 350
Argonne, IL 60439
(312) 972-2767

International CRM's

Certified reference materials (CRM's) are available from many sources. The International Organization for Standardization (ISO), through its Council Committee on Reference Materials (REMCO), has prepared an international Directory of Certified Reference Materials. Inquiries may be directed to:

Dr. M. Parkany
Secretary for REMCO
International Organization for Standardization
1, Rue de Varembe
Case Postale 56
1211 Geneva 20
Switzerland

The International Union of Pure and Applied Chemistry (IUPAC), through its Commission on Physicochemical Measurements and Standards, issues a catalog of CRM's that are useful for the realization of physicochemical properties. It also has prepared a number of related documents. The current IUPAC edition is: "Physicochemical Measurements: Catalogue of Reference Materials from National Laboratories," Revised 1976, Pure & Appl. Chem., **48,** 503–515 (1976).

Julie Frum makes the Division Office a pleasant and productive place by her dependability and warm spirit of hospitality.

Other Services of the National Institute of Standards and Technology

Calibration and Related Measurement Services

The measurement services of NIST include the calibration of standards, test of instruments, and certain interlaboratory testing programs. These services are described in NIST Special Publication 250, National Institute of Standards and Technology Calibration Services Users Guide, 1989 ed. [Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.]

An abbreviated list of the services offered through this program appears under Additional Information. These services are performed at either the NIST Washington laboratories (Gaithersburg, MD) or those in Boulder, CO. For additional information on available measurement services, consult Special Publication 250 or write to:

Office of Physical Measurement Services
Room B362 Physics Building
National Institute of Standards and Technology
Gaithersburg, MD 20899

Telephone: (301) 975-2002

Requests for measurement services available in Boulder should be addressed to:

Measurement Services Clerk
National Institute of Standards and Technology
Boulder, CO 80303

Telephone: (303) 497-3753

Office of Weights and Measures

The NIST Office of Weights and Measures 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:

Office of Weights and Measures
Room A617 Administration Building
National Institute of Standards and Technology
Gaithersburg, MD 20899

Telephone: (301) 975-4004

Proficiency Sample Programs

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

Materials Reference Laboratories
National Institute of Standards and Technology
Gaithersburg, MD 20899

Telephone: (301) 975–6704

Information is available on the following programs:

Proficiency Sample Programs for Hydraulic Cements 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

Accreditation of Testing Laboratories

General information about the National Voluntary Laboratory Accreditation Program (NVLAP) or application packages may be obtained from:

Manager, Laboratory Accreditation
Room A531 Administration Building
National Institute of Standards and Technology
Gaithersburg, MD 20899

Telephone: (301) 975–4016

National Center for Standards and Certification Information

The National Center for Standards and Certification Information (NCSCI) contains title information or full texts for more than 240,000 engineering or related standards issued by U.S. technical societies, professional organizations, and trade associations; State purchasing offices; U.S. Federal Government agencies; and major foreign national and international standardizing bodies. NCSCI publishes general and specific indices of standards. Information services which are free consist of searching Key-Word-In-Context (KWIC) Indices to determine whether any published standards, specifications, codes, test methods, or recommended practices exist for a given item or product. Inquiries should be directed to:

National Center for Standards and Certification Information
Room A629 Administration Building
National Institute of Standards and Technology
Gaithersburg, MD 20899

Telephone: (301) 975–4040

National Standard Reference Data System

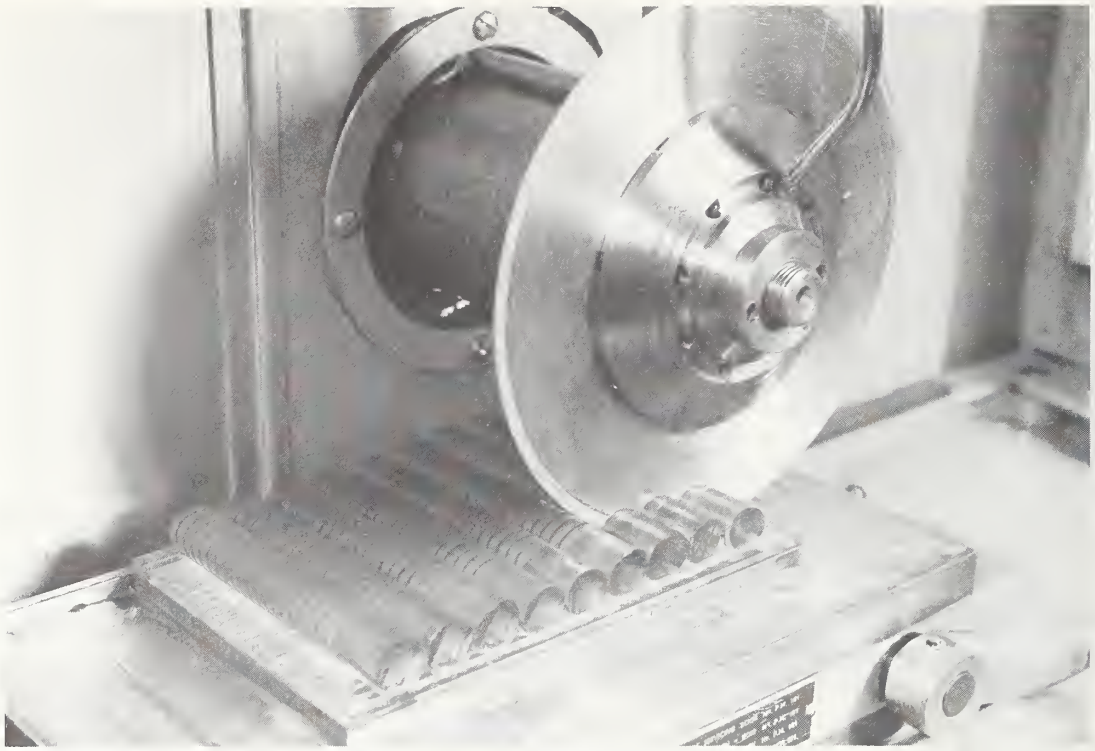
The National Standard Reference Data System (NSRDS) is a nationwide program established to compile and critically evaluate quantitative physical science data and assure its availability to the technical community. The program publishes compilations of critically evaluated data, critical reviews of experimental techniques, and bibliographies. A complete list of NSRDS publications is available from the Office of Standard Reference Data (OSRD). OSRD responds to queries within the scope of the program by providing references, referrals, documentation, or data, as available. Inquiries or requests for information should be directed to:

Office of Standard Reference Data
Room A323 Physics Building
National Institute of Standards and Technology
Gaithersburg, MD 20899

Telephone: (301) 975–2208

A sampling of Environmental SRM's which illustrate the diversity of SRM matrices and the creativity that must be exercised in the packaging of SRM's to maintain the integrity of the sample and its certified properties.

Roger Brown (left) contributes generous, industrious leadership to the shipping activities. Carlton Fisher (right front), whose qualities of orderliness and neatness combine with the responsibility and availability provided by Gary Proulx (center back) and Jim Fort (right back) to create a productive, efficient shipping department that sent out about 45,000 units this past year.



A diamond saw wafering machine, one of a wide variety of equipment used in the preparation of SRM materials, is being used to cut glass discs from glass rods.

Dan Swearingen, shown here using an automated band saw to prepare samples for one of the metal SRM's, is appreciated for the dependability and diligence he applies to the activities of sample preparation.

Chemical Composition

Ferrous Alloys

Steels (Chip Form)

These SRM's 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-gram units (unless otherwise noted) as chips usually sized between 0.4 to 1.2 mm, prepared from selected portions of commercial ingots.

Plain Carbon Steels

SRM	Type	Chemical Composition (Nominal Weight Percent)					
		C	Mn	P	S		Si
					Grav	Comb	
8j	Bessemer (simulated),0.1C	0.081	0.505	0.095		0.077	0.058
11h	BOH, 0.2C	0.200	0.510	0.010		0.026	0.21_1
12h	BOH, 0.4C	0.407	0.842	0.018		0.027	0.235
13g	Carbon, 0.6C	0.613	0.853	0.006		0.031	0.35_5
14f	BOH, 0.8C	0.753	0.410	0.009		0.039	0.172
15h	BOH, 0.1C	0.076	0.373	0.005		0.019	0.008
16f	BOH, 1.1C	0.97	0.404	0.014		0.026	0.214
19h	BES, 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
105	High-Sulfur (Carbon Only)	0.193					
152a	BOH, 0.5C (Tin bearing)	0.486	0.717	0.012		0.030	0.202
178	Basic Oxygen Furnace 0.4C	0.395	0.824	0.012		0.014	0.163
335	BOH, 0.1C (Carbon only) 300 g	0.092					
337a	BOH, 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					0.04_8	
14f	0.072	0.053	0.070	0.002	0.013				0.060	
15g	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, but are given for information only.

Low Alloy Steels

SRM	Type	(Other Forms)	Chemical Composition (Nominal Weight Percent)						
			C	Mn	P	S		Si	Cu
						Grav	Comb		
30f	Cr-V (SAE 6150)		0.490	0.79	0.011		0.009	0.283	0.074
32e	Ni-Cr (SAE 3140)		0.409	0.798	0.008	0.022	0.021	0.278	0.127
33e	Ni-Mo (SAE 4820)		0.186	0.525	0.005		0.009	0.262	0.070
36b	Cr-Mo		0.114	0.404	0.007		0.019	0.258	0.179
72g	AISI 4130		0.278	0.492	0.009		0.014	0.223	0.011
100b	Manganese (SAE T1340)		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	1134	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
131d	Low Carbon-Silicon (100g)	1218	0.0035				0.0011		
139b	Cr-Ni-Mo (AISI 8640)	1222	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 (100g)		0.933	0.897	0.007		0.027	0.488	0.087
291	Cr-Mo (ASTM A213)		0.177	0.55_0	0.008		0.020	0.23_0	0.047
293	Cr-Ni-Mo (AISI 8620)		0.222	0.96_0	0.018		0.022	0.30_0	0.032

SRM	Ni	Cr	V	Mo	Sn	Al (total)	N	Other
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	
291	0.065	1.33		0.53_8		0.002		
293	0.48_0	0.51_0	0.004	0.20_4		0.039		

Values in parentheses are not certified, but are given for information only.

Special Low Alloy Steels

SRM	Type	(Other forms)	Chemical Composition (Nominal Weight Percent)							
			C	Mn	P	S	Si	Cu	Ni	Cr
361	AISI 4340	661,1095,1261a	0.383	0.66	0.014	0.0143	0.222	0.042	2.00	0.69_4
362	AISI 94B17 (Mod)	662,1096	0.160	1.04	0.041	0.0360	0.39	0.50	0.59	0.30
363	Cr–V (Mod)	663,1097,1263a	0.62	1.50	0.02_9	0.0068	0.74	0.10	0.30	1.31
364	High Carbon (Mod)	664,1098,1264a	0.87	0.25_5	0.01	0.0250	0.06_5	0.24_9	0.14_4	0.06_3
365	Iron, Electrolytic	665,1099,1265a	(Supplies exhausted, see other forms.)							
2161	A IN PREP	1761	(1.03)	(0.68)	(0.043)	(0.033)	(0.19)	(0.30)	(1.99)	(0.21)
2162	B IN PREP	1762	(0.34)	(2.03)	(0.036)	(0.03)	(0.36)	(0.12)	(1.15)	(0.92)
2163	C IN PREP	1763	(0.20)	(1.59)	(0.012)	(0.022)	(0.65)	(0.045)	(0.49)	(0.51)
2164	D IN PREP	1764	(0.59)	(1.22)	(0.023)	(0.012)	(0.06)	(0.51)	(0.20)	(1.50)
2165	E	1765	(0.006)	(0.14)	(0.007)	(0.004)	(0.005)	(0.002)	(0.15)	(0.05)
2166	F	1766	(0.015)	(0.06)	(0.004)	(0.002)	(0.01)	(0.014)	(0.02)	(0.02)
2167	G	1767	(0.051)	(0.02)	(0.005)	(0.009)	(0.02)	(0.002)	(0.001)	(0.001)

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	0.02_1	0.022	0.020	0.009	(0.0037)	0.0001_0
362	0.040	0.068	0.20	0.30	0.084	0.09_2	0.016	0.09_5	0.29	0.20	0.19	(0.00404)	0.0002_1
363	0.31	0.028	0.046	0.048	0.050	0.010	0.10_4	0.24	0.049	(0.053)	0.049	(0.0041)	0.0002_2
364	0.10_5	0.49	0.10	0.15	0.24	0.05_2	0.008	(0.008)	0.15_7	0.11	0.068	(0.0032)	0.00003
365	0.0006	0.0050		0.007_0	0.0006	(0.0002)	(0.0002)	(0.0007)				0.0013	
2161	(0.05)	(0.10)		(0.03)	(0.17)	(0.01)	(0.04)	(0.05)	(0.02)	(0.05)	(0.01)		
2162	(0.20)	(0.36)		(0.06)	(0.1)	(0.02)	(0.04)	(0.07)	(0.07)	(0.02)	(0.03)		
2163	(0.31)	(0.49)		(0.09)	(0.31)	(0.05)	(0.008)	(0.05)	(0.10)	(0.01)	(0.04)		
2164	(0.11)	(0.20)		(0.01)	(0.03)	(0.009)	(0.015)	(0.01)	(0.04)	(0.03)	(<0.001)		
2165	(0.004)	(0.005)		(0.002)	(0.005)	(0.006)	(0.002)	(0.006)	(<0.002)	(0.005)	(0.001)		
2166	(0.009)	(0.004)		(0.003)	(0.001)	(<0.002)	(0.001)	(0.01)	(0.003)	(0.01)	(0.001)		
2167	(0.03)	(0.02)		(0.006)	(0.01)	(<0.002)	(0.007)	(0.004)	(0.007)	(<0.005)	(0.004)		

SRM	B	Pb	Sb	Bi	Ag	Se	Te	Ce	La	Nd	Fe
361	0.0003_7	0.00002_5	0.0042	(0.0004)	0.0004	(0.004)	(0.0006)	0.0040	(0.001)	0.0007_5	(95.6)
362	0.0025	0.0004_8	0.013	(0.002)	0.0011	(0.0012)	(0.0011)	0.0019	(0.001)	0.0007_5	(95.3)
363	0.0007_8	0.0018_6	0.002	(0.0008)	0.0037	(0.00016)	(0.0009)	0.0030	(0.002)	0.0012	(94.4)
364	0.0106	0.023_0	0.034	(0.0009)	(0.00002)	(0.00021)	(0.0002)	0.0005_7	(0.0002)	0.0001_8	(96.7)
365	0.00012	0.00001_9									99.90

SRM	Mg	Zn	Pr	Ge	O	H	Au	Hf	Sr
361	0.0002_6	(0.0001)	(0.0003)	[0.006]	(0.0009)	(<0.0005)	(<0.00005)	(0.0002)	
362	0.0006_8	(0.0005)	(0.0003)	[0.002]	(0.00107)	(<0.0005)	(<0.00005)	(0.0003)	
363	0.0006_2	(0.0004)	(0.0004)	[0.010]	(0.00066)	(<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)

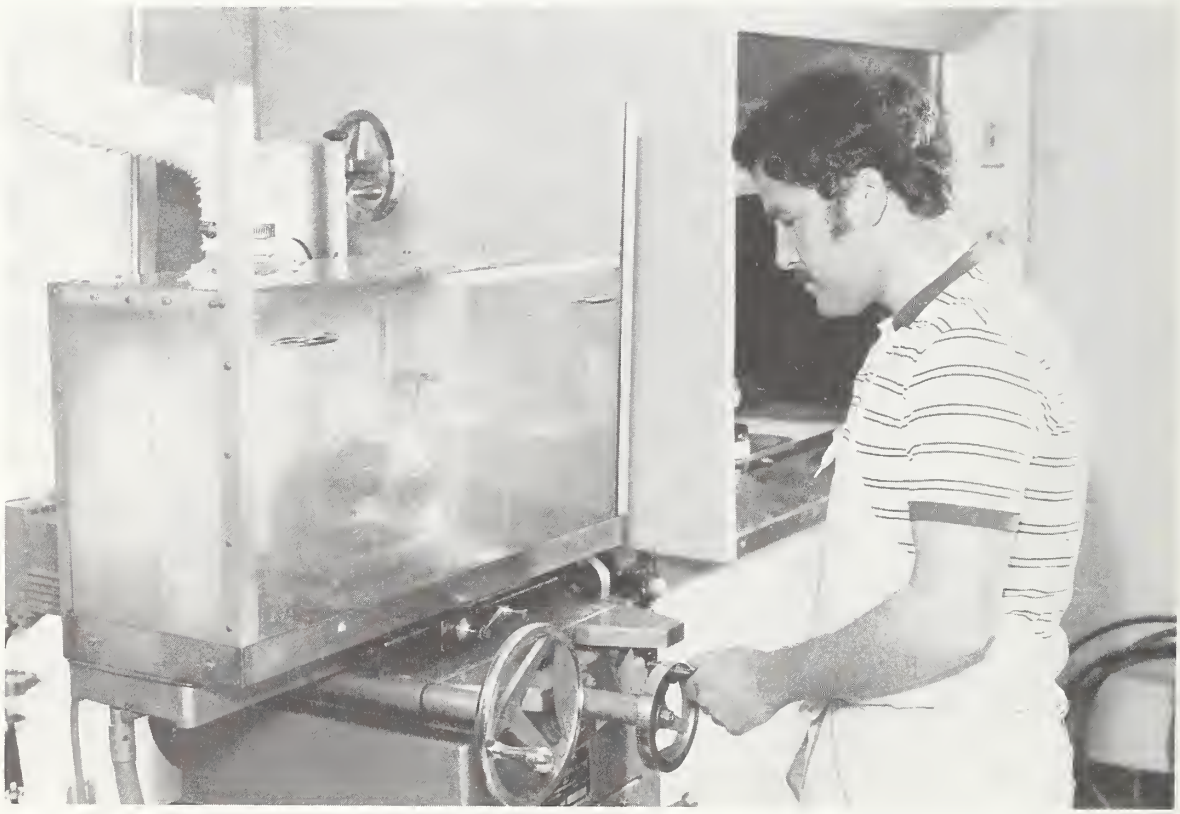
Values in parentheses are not certified, but are given for information only.
Values in brackets are approximate values from heat analysis and are given for information only.

High Alloy Steels

SRM	Type	(Other Forms)	Chemical Composition (Nominal Weight Percent)						
			C	Mn	P	S		Si	Cu
						Grav	Comb		
126c	High-Nickel (36% Ni)	1158	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
345	Cr-Ni (Cu Precipitation Hardening)		0.048	0.224	0.018	0.012	0.012	0.610	3.44
346a	Valve Steel	1233	0.502	9.16	0.031		0.002	0.219	0.375
348a	High Temperature Alloy (A286) Ni-Cr	1230	0.044	0.64	0.023		0.0007	0.43	0.14
868	High Temperature Alloy Fe-Ni-Co	1250	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				
345	4.24	16.04	0.041	0.122	0.089			0.231	0.002		
346a	3.43	21.08	0.096	0.237	(0.05)	(<0.001)	(0.001)	(0.01)	Sn (0.008)	(<0.001)	N 0.415
348a	24.2	14.8	0.23	1.18	0.15	2.12	0.24	(0.07)	W (0.07)	0.0055	(55.2)
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, but are given for information only.



Curt Fales, a valuable member of the materials preparation staff because of his resourcefulness and attention to detail, is shown here using the diamond saw wafering machine.

Stainless Steels

SRM	Type	(Other Forms)	Chemical Composition (Nominal Weight Percent) C	Mn	P	S	Si	Cu
73c	Cr (SAE 420)		0.310	0.330	0.018	0.036	0.181	0.080
101g	Stainless (AISI 304 L) (100g)		0.0136	0.085	0.007	0.0078	1.08	0.029
121d	Cr-Ni-Ti (AISI 321)	1171	0.067	1.80	0.019	0.013	0.54	0.121
123c	Cr-Ni-Nb (AISI 348)	1172	0.056	1.7_5	0.024	0.014	0.59	0.103
133b	Cr-Mo		0.128	1.07	0.018	0.328	0.327	0.080
160b	Cr-Ni-Mo (AISI 316)	1155	0.044	1.64	0.020	0.016	0.509	0.172
166c	Low Carbon (AISI 3162) Carbon Only (100g)		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)	1219	0.149	0.42	0.026	0.001	0.545	0.162
367	Cr-Ni (AISI 446)	1267	0.093	0.315	0.018	0.016	0.58	

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	17.4_3		0.165	0.10	0.342					
123c	11.3_4	17.4_0		0.22	0.12		0.65	<0.001			
133b	0.230	12.63	0.071	0.052							
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)		(<0.0001)		0.078
367	0.29	24.19	0.08								0.168

Values in parentheses are not certified, but are given for information only.

Tool Steels

SRM	Type	Chemical Composition (Nominal Weight Percent) C	Mn	P	S Grav	S Comb	Si	Cu
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
153a	Co-Mo-W-Cr-V	0.902	0.192	0.023	0.007	0.007	0.270	0.094

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				
153a	0.168	3.72	2.06	8.85	1.76	8.47			0.024

Steels (Solid Form)

These SRM's are furnished in various forms. The 600 series is for microchemical methods of analysis such as electron probe microanalysis, spark source mass spectrometric analysis, and laser probe analysis. The 1100, 1200, and 1700 series are for optical emission and x-ray spectroscopic methods of analysis. These materials have been prepared to ensure high homogeneity.

NOTE: Values in parentheses are not certified, but are given for additional information on the chemical composition.

Nominal Sizes for Solid Steel SRM's:

600 Series: 3.2 mm (⅛ in) diameter, 51 mm (2 in) long.
1100, 1200, and 1700 Series: 31 mm (1¼ in) diameter, 19 mm (¾ in) thick.
C indicates a chill cast sample: 31 mm (1¼ in) diameter, 19 mm (¾ in) thick.

Low-Alloy Steels

SRM	Type	(Other Forms)	Chemical Composition (Nominal Weight Percent)				
			C	Mn	P	S	Si
1134	High-Silicon	125b	0.026	0.277	0.028	0.009	2.89
1135	High-Silicon	179	0.027	0.094	0.006	0.026	3.19
1217	Nickel	33e	0.186	0.525	0.005	0.009	0.262
1218	Low Carbon and Sulfur Silicon	131d	0.0029	0.014	(0.002)	0.0011	(3.2)
C1221	Resulfurized/Rephosphorized, (AISI 1211)		0.020	0.102	0.090	0.112	0.876
1222	Cr–Ni–Mo (AISI 8640)	139b	0.43	0.78	0.013	0.022	0.24
1224	Carbon (AISI 4130)		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	Basic Open Hearth, 0.1% C		0.072	0.365	0.004	0.018	0.007
1254	Ca in Low Alloy (Si)		(0.03)	(0.28)	(0.03)	(0.008)	(2.9)
*661	AISI 4340		0.39_2	0.66	0.015	0.015	0.223
*662	AISI 94B17 (Modified)		0.163	1.05	0.044	0.037	0.40
*663	Cr–V (Modified)		0.57	1.50	0.02_9	0.0055	0.74
*664	High Carbon (Modified)		0.87_1	0.25_8	0.010	0.025	0.066
*665	Electrolytic Iron		0.008	0.0057	0.002_5	0.0059	0.008_0
1269	Line Pipe Steel (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
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	2161	1.03	0.678	0.042	0.035	0.18
1762	Low Alloy Steel	2162	0.337	2.00	0.034	0.030	0.35
1763	Low Alloy Steel	2163	0.203	1.58	0.012	0.023	0.63
1764	Low Alloy Steel	2164	0.592	1.21	0.021	0.012	0.057
1765	Low Alloy Steel	2165	0.006	0.144	0.006	0.0038	0.004
1766	Low Alloy Steel	2166	0.015	0.067	0.002	0.0024	0.010
1767	Low Alloy Steel	2167	0.052	0.021	0.004	0.0090	0.026

Values in parentheses are not certified, but are given for information only.
*SRM's 661, 662, 663, 664, and 665 are sold in a set only as SRM 668.

Low-Alloy Steels (Continued)

SRM	Cu	Ni	Cr	V	Mo	W	Co	Ti
1134	0.070	0.038	0.019		0.008			
1135	0.056	0.050	0.022	<0.01	0.014			
1217	0.070	3.36	0.068	(0.001)	0.224		(0.06)	(0.001)
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			
1254	(0.07)	(0.04)	(0.02)		(0.008)			
*661	0.042	1.99	0.69	0.011	0.19	0.01_7	0.032	0.020
*662	0.51	0.60	0.30	0.04_1	0.07_0	0.21	0.30	0.084
*663	0.09_8	0.32	1.31	0.31	0.030	0.04_6	0.048	0.050
*664	0.25_0	0.14_2	0.06_6	0.10_6	0.49	0.10_2	0.15	0.23
*665	0.0058	0.041	0.007_2	0.0006	0.0050	<1	0.007_0	0.0006
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)
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	0.43	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	(0.0015)	0.154	0.051	0.0040	0.005	(0.001)	(0.001)	0.0055
1766	0.015	0.021	0.024	0.009	0.0035	(0.001)	0.0020	0.0005
1767	0.0014	0.002	0.002	0.033	0.021	(0.003)	0.005	0.011

Values in parentheses are not certified, but are given for information only.
*SRM's 661, 662, 663, 664, and 665 are sold in a set only as SRM 668.

Helen Tyler, shown here applying heat-shrink packaging, ensures the integrity of packaging activities through her dependability and alertness to the details of packaging many different materials.

Low-Alloy Steels (Continued)

SRM	As	Sn	Al (total)	B	Pb	Ag	Ge
1134		0.003	0.329				
1135		0.004	0.0028				
1217			0.030				
1218			0.005				Zr (0.002)
C1221			0.111				
1222			0.038				
1224			0.060				
1226		(0.003)	0.054		(0.0001)	Nb (0.005)	Zr (0.010)
1227			(0.028)				Zr (0.0006)
1228			0.061				
1254		(0.003)	(0.33)				Ca 0.0053
*661	0.017	0.010_1	0.02_1	0.0005	0.00002_5	0.0004	[0.006]
*662	0.09_2	0.016	0.09_5	0.0025+	0.0004_3	(0.0010)	[0.002]
*663	0.010	(0.095)	0.24	0.0009_1	0.0022	(0.0038)	[0.010]
*664	0.05_2	(0.005)	(0.008)	0.011	0.024	(0.00002)	[0.003]
*665	[0.0002]	<5	(0.0007)	0.00013	0.00001_5	<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)	
C1285	(0.022)	0.35	(0.12)			Sb (0.04)	Zr (0.02)
1286	0.019	0.012	0.109	(0.006)	(0.0002)	Nb (0.012)	Zr (0.021)
1761	0.011	(0.05)	0.06	(0.002)			
1762	0.018	0.046	0.069	(0.004)			
1763	0.055	0.011	0.043	(0.005)			
1764	0.010	(0.02)	0.009	(0.001)			
1765	0.0010	0.002	(0.006)	(0.0009)	0.0003	0.0002	
1766	0.0035	0.0010	0.012	(0.0004)	0.003	0.0005	
1767	0.0005	0.006	0.004	(0.0010)	(<0.0005)		

SRM	O	N	H	Nb	Se	Ta	Sr	Zr
*661	(0.0009)	(0.0037)	(<0.0005)	0.022	0.004	0.020		0.009
*662	(0.0011)	(0.0041)	(<0.0005)	0.30	[0.001]	0.21		0.20
*663	(0.0007)	(0.0041)	(<0.0005)	0.049	[0.0001]	(0.053)		0.050
*664	[0.0017]	[0.003]	(<0.0005)	0.15_7	[0.0003]	0.11		0.69
*665	<70	<20	<5	<0.5	<0.1	<0.5		<0.1
1761				(0.02)		(0.05)		(0.01)
1762				(0.07)		(0.02)		(0.03)
1763				(0.10)		(0.01)		(0.04)
1764				(0.04)		(0.03)		(<0.001)
1765				(<0.002)		(0.005)		(0.001)
1766				(0.003)		(0.01)		(0.001)
1767				(0.007)		(<0.005)		(0.004)

*SRM's 661, 662, 663, 664, and 665 are sold in a set only as SRM 668.
Values in parentheses are not certified, but are given for information only.
Values in brackets are approximate values from heat analysis and are given for information only.

Low-Alloy Steels (Continued)

SRM	Sb	Bi	Ca	Mg	Te	Zn
*661	0.004_2		(<0.0001)	(0.0001)	0.0006	(0.0001)
*662	0.012	(0.002)	(0.0002)	(0.0006)	(0.0005)	(0.0005)
*663	(0.0007)	(0.0008)	(<0.0001)	(0.0005)	(0.0022)	(0.0004)
*664	(0.035)	(0.0009)	(<0.0001)	(0.0001)	(0.0002)	[0.001]
*665	<0.5	<0.5	<0.1	<0.2	<0.1	<3

SRM	Au	Ce	Hf	La	Nd	Pr	Fe
*661	(<0.0005)	0.001_3	[0.0002]	0.0004	0.0003	(0.00014)	(95.6)
*662	(<0.00005)	(0.0011)	[0.006]	0.0004	(0.0005)	(0.00012)	(95.3)
*663	0.0005	(0.0016)	[0.0015]	0.0006	(0.0007)	(0.00018)	(94.4)
*664	0.0001		[0.005]	0.00007	(0.00012)	(0.00003)	(96.7)
*665	<0.02	<0.05	<0.2	<0.05	<0.05	<0.05	<99.9

*SRM's 661, 662, 663, 664, and 665 are sold in a set only as SRM 668.
Values in parentheses are not certified, but are given for information only.
Values in brackets are approximate values from heat analysis and are given for information only.

John Norris applies the knowledge and skill of many years experience to the inspection of steel samples that have been analyzed by spark discharge.

Stainless Steels

SRM	Type	Other Forms	Chemical Composition (Nominal Weight Percent)							
			C	Mn	P	S	Si	Cu	Ni	Cr
C1151	Cr–Ni		0.039	2.50	0.017	0.038	0.38	0.418	7.29	22.70
C1152	Cr–Ni		0.148	0.96	0.021	0.0064	0.80	0.102	10.88	17.81
C1153	Cr–Ni		0.264	0.50	0.030	0.018	1.07	0.23	8.77	16.69
C1153a	Cr–Ni		0.225	0.544	0.030	0.019	1.00	0.226	8.76	16.70
C1154	Cr–Ni		0.086	1.42	0.06	0.053	0.50	0.40	12.92	19.06
1155	Cr–Ni–Mo (AISI 316)	160b	0.046	1.63	0.020	0.018	0.50_2	0.169	12.1_8	18.4_5
1171	Cr–Ni–Ti	121d	0.067	1.8_0	0.018	0.01_3	0.54	0.121	11.2	17.4
1172	Cr–Ni–Nb	123c	0.056	1.7_6	0.025	0.01_4	0.59	0.10_5	11.3_5	17.4_0
1219	Cr–Ni (AISI 431)	343a	0.149	0.42	0.026	0.001	0.545	0.162	2.16	15.64
1223	Chromium Steel	133b	0.127	1.08	0.018	0.329	0.327	0.081	0.232	12.64
1267	AISI 446	367	0.093	0.315	0.018	0.015	0.58		0.29	24.14
C1287	High-Alloy, ACI HK (AISI 310, Mod.)		0.36	1.66	0.029	0.024	1.66	0.58	21.16	23.98
C1288	High-Alloy, ACI CN–7M (A–743)		0.056	0.83	0.023	0.010	0.41	3.72	29.3	19.55
C1289	High-Alloy, ACI CA–6NM (AISI 414 Mod.)		0.014	0.35	0.017	0.021	0.156	0.205	4.13	12.12

SRM	V	Mo	Co	Ti	N	Al	Nb	Ta	W	Pb	Zr
C1151	0.037	0.80	0.032	(0.006)	(0.23)	(0.004)	(0.014)	(0.006)		0.0039	(0.005)
C1152	0.030	0.43	0.22	(0.011)	(0.055)	(0.004)	(0.16)	(0.001)		0.0047	(0.004)
C1153	0.18	0.24	0.127	(0.014)	(0.134)	(0.003)	(0.050)	(0.032)		0.0054	(0.003)
C1153a	0.176	0.24	0.127	(0.013)	(0.11)	(0.004)	(0.48)	(0.03)		0.006	(0.0001)
C1154	0.135	0.07	0.38	(0.004)	(0.084)	(0.004)	(0.23)	(0.075)		0.0178	(0.004)
1155	0.047	2.38	0.10_1							0.001	
1171		0.16_5	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			(0.05)	(<0.005)		Sn (0.004)		(0.0001)	
1267	0.08				0.17						
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)
C1289	0.007	0.82	0.035	0.005	(0.017)	(0.0016)	(0.10)	O (0.027)		0.0005	(0.001)

Values in parentheses are not certified, but are given for information only.

Specialty Steels

SRM	Type	Chemical Composition (Nominal Weight Percent)											
		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	2108	0.096	0.237	(0.01)	N 0.415

High-Temperature Alloys

SRM	Type	Other Forms	Chemical Composition (Nominal Weight Percent)					
			C	Mn	P	S	Si	Cu
1199*	L 605		(0.14)	1.42	(0.005)		0.83	
1200*	S 816		(0.40)	1.34	(0.015)		0.86	
1230	A 286	348a	0.044	0.64	0.023	0.0007	0.43	0.14
1244	Inconel 600		0.062	0.29	0.010	0.003	0.12	0.26
1245	Inconel 625		0.036	0.18	0.011	0.001	0.40	0.37
1246	Incoloy 800		0.082	0.91	0.018	0.001	0.18	0.49
1247	Incoloy 825		0.021	0.38	0.018	0.002	0.32	1.75
1250	Fe–Ni–Co	868	0.022	0.052	<0.003	0.0025	0.097	0.022
C2400	High-Alloy Steel, ACI (17/4 PH)		0.036	0.71	0.013	0.003	0.61	2.63
C2401	High-Alloy Steel, (ACI–CD–4M–Cu)		0.062	1.03	0.025	0.027	0.74	3.17
C2402	Hasteloy C		0.010	0.64	0.007	0.018	0.85	0.19

SRM	Ni	Cr	Mo	Co	Ti	Al	Nb	Ta	Fe	W	B
1199	10.2	19.9	(<0.02)	51.6	(<0.01)		(<0.02)		0.6_5	15.4	
1200	20.0	19.9	4.0_0	42.0	(0.03)		3.1_8	1.08	3.19	3.8_6	
1230	24.2	14.8	1.18	0.15	2.12	0.24	(0.07)	V 0.23	(55)	(0.07)	0.0055
1244	73.2	15.7	0.20	0.058	0.25	0.26	(0.14)		9.6		<0.05
1245	59.5	21.9	8.6	0.074	0.28	0.26	3.5	<0.01	4.5		<0.001
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)
C2402	51.5	16.15	17.1	1.50	Sn (0.001)		(<0.01)	V 0.22	7.3	4.29	(0.0004)

Values in parentheses are not certified, but are given for information only.
*SRM's 1199 and 1200 sold only in a set as S1199.

Bill Reed brings the qualitites of friendliness, resourcefulness and thoroughness to his new responsibility as the Acting Chief of the Office of Standard Reference Materials.

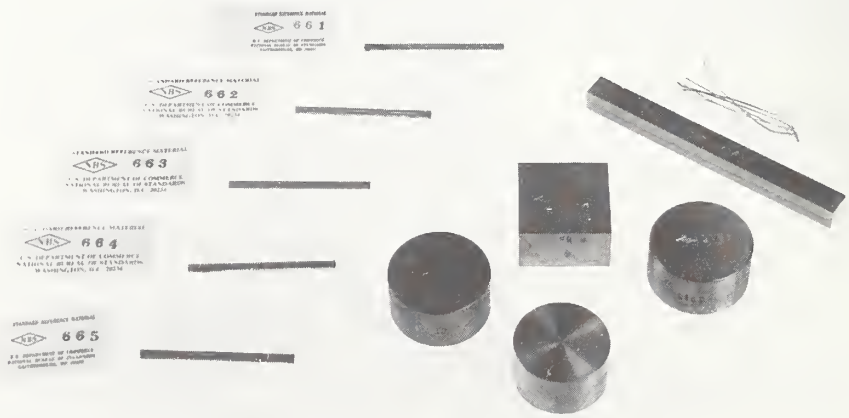
Steelmaking Alloys

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

SRM	Type	Wt/ Unit (grams)	Chemical Composition (Nominal Weight Percent)							
			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	
195	Ferrosilicon (75% Si-High-Purity Grade)	75	0.034	0.17	0.017	0.001	75.3	0.047	0.032	(0.42)
64c	Ferrochromium, High-Carbon	100	4.68	0.16	0.020	0.067	1.22	0.005	0.43	
196	Ferrochromium, Low-Carbon	100	0.035	(0.282)	0.020	0.003	0.373			
71	Calcium Molybdate	60								
90	Ferrophosphorus	75			26.2					
340	Ferroniobium	100	0.061	1.70	0.036		4.39		Sn 0.063	
68c	Ferromanganese, High-Carbon	100	6.72	80.04	0.19	0.008	0.225			
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	
195	<0.01	(0.001)	(0.01)	0.037	0.046	Co<0.01	0.011	0.053	23.6	0.0010	(0.0024)
64c	68.00	0.15		0.02		Co 0.051		N 0.045	24.98		
196	70.83	(0.12)									
71			35.3	0.06					1.92		
90											
340				0.89		57.51	Ta3.73				
68c	0.074								12.3		0.021
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, but are given for information only.



This group of steel SRM's illustrates the variety of forms of materials required to meet the SRM needs of the technical community.

Cast Irons (Chip Form)

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

SRM	Type	Chemical Composition (Nominal Weight Percent)							
		C		Mn	P	S		Si	Cu
		Total	Graphitic			Grav	Comb		
3d	White (110g)	2.54		0.40	0.02_5		0.05_2	1.31	0.043
4k	Cast	3.2_2	2.6_5	0.82_5	0.149		0.043	1.33	0.24_3
5L	Cast	2.60	1.98	0.68	0.284		0.124	1.82	1.01
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
122h	Cast (Car Wheel)	3.52	2.82	0.543	0.311		0.072	0.513	0.028
334	Gray Cast	2.83					0.043		
338	White Cast	3.33		(0.76)	(0.054)		0.015	(1.82)	(0.27)
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
3d	0.025	0.03	(0.002)	(0.007)		(0.003)
4k	0.042	0.116	0.024	0.040	Zn (<0.001)	(0.03)
5L	0.086	0.148	0.034	0.020		0.050
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
122h	0.078	0.052	0.041	(0.003)		0.034
338	(5.5)	(10.2)	(0.04)		(0.32)	
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)

Values in parentheses are not certified, but are given for information only.

Cast Irons (Chip Form) (Continued)

SRM	As	Sn	Al (total)	Mg	N	Fe
4k	(0.03)	(0.004)	(0.004)	Sb(<0.001)	(0.0016)	Pb(0.001)
5L					0.005	
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, but are for information only.

Cast Steels, White Cast Irons, Ductile Irons, and Blast Furnace Irons (Solid Form)

These SRM's are for analysis of cast steels and cast irons by rapid instrumental methods.

SRM	Type	Chemical Composition (Nominal Weight Percent)							
		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)	0.11_8	0.35	0.035	0.056	0.25	0.09	0.10	0.13
1139a	Cast Steel (No. 2)	0.79_0	0.92	0.012	0.013	0.80	0.47	0.98	2.1_8
1144a	Blast Furnace Iron (2)	4.32	1.23	0.08_4	0.083	0.18_2	0.09_1	0.06_3	0.029
C1145a	White Cast Iron	2.92	0.187	0.215	0.191	0.271	0.46	0.62	0.63
C1146a	White Cast Iron	1.97	1.60	0.55	0.016	3.93	1.48	3.07	2.56
C1150a	White Cast Iron	3.32	0.77	0.078	0.065	1.35	0.112	0.097	0.155
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	3.76	0.98	0.27	(0.0006)	1.67	1.55	0.146	0.322
C2423a	Ductile Iron	3.66	0.91	0.246	(<0.001)	1.59	1.61	0.147	0.322
C2424	Ductile Iron	2.68	0.268	0.041	0.024	3.37	0.125	0.061	0.13
C2424a	Ductile Iron	2.76	0.207	0.034	0.016	3.30	0.099	0.045	0.15
C2425	Ductile Iron	3.26	0.76	0.191	0.012	2.50	0.47	0.55	0.092
C2425a	Ductile Iron	3.30	0.72	0.188	0.010	2.38	0.47	0.57	0.085

Cast Steels, White Cast Irons, Ductile Irons, and Blast Furnace Irons (Solid Form) (Continued)

SRM	V	Mo	Ti	As	Al	Te	Co
C1137a	0.019	0.86	(0.04)		(0.007)	Mg 0.032	Ce 0.016
1138a	0.02$_0$	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)	
1144a	0.02$_5$	(0.007)	0.32	(0.004)	(<0.005)	0.02$_2$	
C1145a	0.112	0.48	0.012	(0.02)	(0.04)		0.058
C1146a	0.20	1.52	0.20	(0.16)	(0.028)	Pb 0.0018	0.13
C1150a	0.040	0.086	0.040	(0.017)	(0.005)	Pb 0.001	0.014
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)	0.076
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)
C2425	0.013	0.30	0.19		(0.02)		(0.02)
C2425a	0.013	0.29	0.20		(0.02)		(0.03)

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)
C2425	0.040	0.0062	0.0015	(0.10)
C2425a	0.047	0.023	0.0037	(0.1)

Values in parentheses are not certified, but are given for information only.

Aluminum-Base Alloys

SRM	Type	Wt/ Unit (grams)	Chemical Composition (Nominal Weight Percent)					
			Mn	Si	Cu	Ni	Cr	V
87a	Al–Si (Chip)	75	0.26	6.24	0.30	0.57	0.11	<0.01
853	Alloy 3004 (Chip)	30	1.26	0.18	0.15	0.004	<0.001	0.017
1240	Alloy 3004	Disk	1.26	0.18	0.15	0.004	<0.001	0.017
1240a	Alloy 3004	Disk	1.27	0.18	0.15	0.004	<0.001	0.017
1240b	Alloy 3004	Disk	1.27	0.18	0.15	0.004	<0.001	0.017
854	Alloy 5182 (Chip)	30	0.38	0.16	0.050	0.020	0.032	0.016
1241a	Alloy 5182	Disk	0.38	0.16	0.050	0.020	0.032	0.016
1241b	Alloy 5182	Disk	0.38	0.16	0.050	0.020	0.032	0.016
855	Casting Alloy 356 (fine millings)	30	0.057	7.17	0.13	0.015	0.013	
1255a	Casting Alloy 356	Disk	0.053	7.22	0.12	0.017	0.012	0.024
856	Casting Alloy 380 (fine millings)	30	0.35	9.21	3.51	0.37	0.055	
1256a	Casting Alloy 380	Disk	0.38	9.18	3.51	0.41	0.055	0.018
C1257	High Purity	Disk	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1
858	Alloy 6011 (modified) (fine millings)	35	0.48	0.79	0.84	0.0006	0.0011	0.0030
1258	Alloy 6011 (35mm D×19mm thick)	Disk	0.48	0.78	0.84	0.0006	0.0011	
859	Alloy 7075 (fine millings)	35	0.078	0.17	1.59	0.063	0.176	0.0082
1259	Alloy 7075 (35mm D×19mm thick)	Disk	0.079	0.18	1.60	0.063	0.173	

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		
853	0.018		0.018	0.50		1.11	0.052	0.002	
1240	0.022		0.018	0.50		1.11	0.052	0.002	
1240a	0.022		0.018	0.50		1.12	0.051	0.002	
1240b	0.021		0.018	0.50		1.11	0.051	0.002	
854	0.030		0.018	0.20		4.54	0.051	0.002	
1241a	0.032		0.018	0.20		4.54	0.052	0.002	
1241b	0.034		0.018	0.20		4.54	0.051	0.002	
855	0.15	0.010		0.16	0.015	0.37	0.083		
1255a	0.156	0.013		0.14	0.017	0.36	0.083	Sr 0.02	
856	0.068	0.10		0.92	0.10	0.061	0.96		
1256a	0.084	0.10		0.90	0.10	0.062	1.02	Sr 0.020	
C1257	(<0.1)	(<0.1)	(<0.1)	1.0	(<0.1)	<1.0	(<0.1)	(<0.1)	(<0.1)
858	0.042			0.078		1.01	1.04		<0.0001
1258	(0.04)		(0.010)	0.079		0.98	1.03		<0.0001
859	0.041			0.202		2.45	5.46		0.0026
1259	(0.04)		(0.022)	0.205		2.48	5.44		0.0025

Values in parentheses are not certified, but are given for information only.

Copper-Base Alloys (Chip Form)

SRM	Type	Wt/ Unit (grams)	Chemical Composition (Nominal Weight Percent)				
			Cu	Ni	Fe	Zn	Pb
158a	Bronze, Silicon	150	90.93	0.001	1.23	2.08	0.097
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			
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)								

SRM	Bi	O	Co	C	Au	H	S	As	Mg	Ti
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 ppm	(0.2)	(<1)	
1035		(0.64)					22.3 ppm		P (0.004)	

Values in parentheses are not certified, but are given for information only.
*Values for SRM 1034 are ppm by weight.
**Sulfur value for SRM 1035 is ppm by weight.

Copper-Base Alloys (Solid Form)

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

SRM		Type	Chemical Composition (Nominal Weight Percent)							
			Cu	Zn	Pb	Fe	Sn	Ni	Al	Sb
1103		Free-Cutting Brass	59.27	35.72	3.73	0.26	0.88	0.15		
1104		Free-Cutting Brass	61.33	35.31	2.77	0.088	0.43	0.070		
1107	C1107	Naval Brass B	61.2_1	37.3_4	0.18	0.037	1.04	0.098		
1108	C1108	Naval Brass C	64.9_5	34.4_2	0.063	0.050	0.39	0.033		
	C1110	Red Brass B	84.5_9	15.2_0	0.033	0.033	0.051	0.053		
1111	C1111	Red Brass C	87.1_4	12.8_1	0.013	0.010	0.019	0.022		
1112	C1112	Gilding Metal A	93.3_8	6.3_0	0.057	0.07_0	0.12	0.10_0		
1113	C1113	Gilding Metal B	95.0_3	4.8_0	0.026	0.04_3	0.06_4	0.057		
1114	C1114	Gilding Metal C	96.4_5	3.4_7	0.012	0.01_7	0.02_7	0.021		
1115	C1115	Commercial Bronze A	87.9_6	11.7_3	0.013	0.13	0.10	0.074		
1116	C1116	Commercial Bronze B	90.3_7	9.4_4	0.042	0.046	0.04_4	0.048		
1117	C1117	Commercial Bronze C	93.0_1	6.8_7	0.069	0.014	0.02_1	0.020		
	C1119	Aluminum Brass B	77.1_2	20.5_3	0.051	0.03_2			2.14	0.050
1275		Cupro-Nickel (CDA 706)	88.2	0.085	0.006	1.46	0.008	9.76		0.0005
1276		Cupro-Nickel (CDA 715)	67.8	0.038	0.004	0.56	0.023	30.5		0.0004

SRM		As	Be	Cd	Mn	P	Si	Ag
1103						0.003		
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		
	C1119					0.070		
1275		(0.001)		0.0003	0.42	0.005	(0.001)	(0.004)
1276				0.0002	1.01	0.006		

SRM	Te	Co	Cr	Se	Mg	B	S	Ti
1275	(0.0002)	0.024	(0.0002)	0.0004	0.003	(0.0009)	(0.008)	(0.0002)
1276		0.045		0.0005	0.12			

Values in parentheses are not certified, but are given for information only.

Copper "Benchmark"

SRM (Chip)	SRM (Solid)	Type	Cu(Wt%)	Sb	As	Bi	Cr	Co	Fe	Pb	Mn
				Chemical Composition (Nominal Parts Per Million by Weight)							
393		Unalloyed Copper "O"	99.998	0.25	0.41	<0.1	<0.5	0.02	<1	0.039	<0.01
394	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	498	Unalloyed Copper V	99.98	7.5	25	2.0	(0.3)	2.8	11.4	9.9	(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)
	C1251	Phosphorized Copper VIII	99.96	14	14.4	(3)	2.8	8.8	(264)	7.5	(5)
	C1252	Phosphorized Copper IX	99.89	42	115	21	7.4	90	(35)	60	(17)
	C1253	Phosphorized Copper X	99.42	(140)	432	70	216	495	(330)	244	(380)
454		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
394	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	498	7.0	17.5	20.1	(11)	10.1	4.8	24	(<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)
	C1251	22	11.4	85	(31)	15	(15)	8	(2)	2	15.0	(10)
	C1252	128	53.6	166.6	(29)	51	(110)	60	(7)	14	34.9	(20)
	C1253	(500)	164	495	55	199	(470)	350	(180)	74	74.4	(80)
454		(150)	479	286		27	2.2	7			7.5	

SRM		Si	Be	B	Ca	Li	Pd	P	Ti	Zr
393		<0.5	<0.01	<0.01	<0.05	<0.01	<0.05	<0.05	<0.5	<0.5
394	494	(<2)								
395	495	(<2)								
396	496	(<2)								
398	498	(<2)								
399	499	(<2)								
400	500	(<2)								
	C1251	(15)	(<0.5)		(4)	(0.04)		(0.4%)		
	C1252	(13)	(<5)		(6)	(0.03)				
	C1253	(350)	(12)		(1)	(9)		518		
454							(0.1)			

Values in parentheses are not certified, but are given for information only.

Lead-Base Alloys

SRM Chip	SRM Disk	Type	Cu	Ni	As	Sn	Sb	Bi	Ag	Fe
			Chemical Composition (Nominal Weight Percent)							
1129		Solder 63Sn–37Pb	0.16	0.010	0.055	62.7	0.13	0.13	0.075	
127b	1131	Solder 60Pb–40Sn	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

Lead-Base Material

SRM	C2416	C2417	C2418
Type	Bullet Lead	Lead-Base Alloy	High-Purity Lead
Size	50 mm	50 mm	50 mm
	Chemical Composition (Nominal Weight Percent)		
Sb	0.79	0.010	(<0.0001)
As	0.056	0.011	(<0.0001)
Bi	0.10	0.010	(<0.0005)
Cu	0.065	0.010	(<0.0001)
S	0.0015	(<0.0005)	—
Ag	0.0044	0.010	0.0001
Sn	0.09	(<0.010)	(<0.0005)
Al	(<0.0001)	(<0.0001)	(<0.0001)
Cd	(0.0002)	(<0.0002)	0.0003
Ca	(<0.001)	(<0.001)	(<0.0005)
Co	(<0.0002)	(<0.0002)	(<0.0005)
Fe	(<0.0005)	(<0.0003)	(<0.0005)
Mn	(<0.0005)	(<0.0003)	(<0.0005)
Ni	(<0.0005)	(<0.0005)	(<0.0005)
Te	(<0.0005)	(<0.0005)	(<0.0005)
Zn	(<0.0005)	(<0.0005)	(<0.0005)

These lead-base materials 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.

Nickel-Base Alloys

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent)							
			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
882	Ni-Cu-A	100	0.006	0.0007		0.0014	0.006	31.02	65.25	
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
866	Incoloy, 800	100	0.082	0.92	0.017	0.001	0.17	0.49	30.8	20.1
867	Incoloy, 825	100	0.021	0.39	0.018	0.002	0.32	1.74	43.5	23.4
1159	Electronic and Magneic Alloy Ni-Fe	Disk	0.007	0.30_5	0.003	0.003	0.32	0.038	48.2	0.06
1160	Electronic and Magnetic Alloy Ni-Mo	Disk	0.019	0.55_0	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
C1248	Ni-Cu	Disk	0.266	0.31	0.002	0.0008	1.61	29.80	65.75	0.095

SRM	Mo	Co	Ti	Al	B	Fe	Nb
349a	4.25	12.46	3.06	1.23	0.005	1.15	V 0.012
882			0.57	2.85		0.009	
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
866	0.36	0.075	0.31	0.29	<0.001	46.1	(0.09)
867	2.73	0.089	0.75	0.062	0.002	26.6	(0.45)
1159	0.01_0	0.022				51.0	
1160	4.3_5	0.054				14.3	
1243	4.25	12.46	3.06	1.23	0.005	0.79	V 0.12
C1248	0.006	Pb 3.8 μg/g	Sn 1.1 μg/g	0.009		2.10	Zn 3 μg/g

Values in parentheses are not certified, but are given for information only.

Carbon Modified Silicon

SRM 1216—This SRM is intended for the calibration of instruments used to measure total elemental carbon. The SRM consists of three, one gram bottles of chemically modified microparticulate silica certified at the carbon levels of 0.70, 9.06, and 17.04% carbon, respectively.

SRM	Type	Bottle	Percent Carbon
1216	Carbon Modified Silicon	I	0.070
		II	9.06
		III	17.04

Trace Elements in Nickel-Base Superalloys (Chip Form)

SRM	Type	Wt/Unit (grams)	Nominal Trace Composition (Parts Per Million by Weight)				
			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	Approximate Base Composition (Weight Percent)											
	C	Cr	Co	Ni	W	Nb	Al	Ti	B	Zr	Ta	Hf
897	(0.12)	(12.0)	(8.5)	(Bal)	(1.75)	(0.9)	(2.0)	(2.0)	(0.010)	(0.10)	(1.75)	(1.2)
898	(0.12)	(12.0)	(8.5)	(Bal)	(1.75)	(0.9)	(2.0)	(2.0)	(0.010)	(0.10)	(1.75)	(1.2)
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, but are given for information only.

Nickel Oxides (Powder Form)

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent)								
			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	Nominal Trace Composition (Parts Per Million by Weight)											
	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, but are given for information only.

Titanium-Base Alloys

SRM	Type	Wt/ Unit (grams)	Chemical Composition (Nominal Weight Percent)				
			C	Mn	Cr	Cu	Mo
173b	Al-V	50	0.025			0.008	0.013
176	Al-Sn	100	0.015	0.0008		0.003	0.0003
641	Mn (A)	Disk		6.6_8			
642	Mn (B)	Disk		9.0_8			
643	Mn (C)	Disk		11.6_8			
644	Cr-Fe-Mo (A)	Disk			1.03		3.61
646	Cr-Fe-Mo (C)	Disk			3.43		1.11
647	Al-Mo-Sn-Zr	50	0.006				1.96
648	Al-Sn-Zr-Cr-Mo	50	0.011		3.84		3.75
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
654a	Al-V (B)	Disk		(<0.1)	(0.20)		(<0.05)
1133	Al-Sn-Zr-Cr-Mo	Disk	0.011				3.75

SRM	Fe	Al	V	Sn	Si	N	W	Zr
173b	0.23	6.36	4.31	(0.03)	0.046	0.015		
176	0.07_0	5.16		2.47		0.01_0		
644	1.36							
646	2.14							
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
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	
654a	(0.20)	6.3_4	3.9_5					
1133	0.15	5.13		1.98	0.027	(0.01)		1.84

Values in parentheses are not certified, but are given for information only.

Zinc-Base Alloys

SRM	Type	Wt/ Unit (grams)	Chemical Composition (Nominal Weight Percent)								
			Mn	Cu	Ni	Sn	Al	Cd	Fe	Pb	Mg
94c	Die Casting Alloy	150	0.014	1.01	0.006	0.006	4.13	0.002	0.018	0.006	0.042

SRM	Type	Chemical Composition (Nominal Weight Percent)							
		Cu	Al	Mg	Fe	Pb	Cd	Sn	Cr
625	Zinc-base A–ASTM AG 40A	0.034	3.06	0.070	0.036	0.0014	0.0007	0.0006	0.0128
626	Zinc-base B–ASTM AG 40A	0.056	3.56	0.020	0.103	0.0022	0.0016	0.0012	0.039_5
627	Zinc-base C–ASTM AG 40A	0.132	3.88	0.030	0.023	0.0082	0.0051	0.0042	0.0038
628	Zinc-base D–ASTM AC 41A	0.611	4.59	0.0094	0.066	0.0045	0.0040	0.0017	0.0087
629	Zinc-base E–ASTM AC 41A	1.50	5.15	0.094	0.017	0.0135	0.0155	0.012	0.0008
630	Zinc-base F–ASTM AC 41A	0.976	4.30	0.030	0.023	0.0083	0.0048	0.0040	0.0031
631	Zinc spelter (modified)	0.001_3	0.50	(<0.001)	0.005	(0.001)	0.0002	0.0001	0.0001

SRM	Mn	Ni	Si	In	Ga	Ca	Ag	Ge
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	0.0001_5	(<0.0005)	(0.002)	0.002_3	(0.00_2)	<0.001	(<0.0005)	(0.000_2)

Values in parentheses are not certified, but are given for information only.

Zirconium-Base Alloys

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent)										
			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

SRM 31 mm D× 9.5 mm thick	Type	Chemical Composition (Nominal Parts Per Million)											
		Hf	C	Cr	Cu	Fe	Mn	Mo	Ni	N	Si	Ti	W
1234	Zirconium A	46	(80)	(55)	(<10)	(240)	(10)	(2)	(20)	(14)	(40)	(20)	(25)
1237	Zircaloy D	31	(100)	(1510)	(<10)	(1650)	(10)	(<10)	(40)	(19)	(35)	(30)	(25)

Values in parentheses are not certified, but are given for information only.

Gases in Metals

These SRM's are for determining hydrogen, oxygen, and nitrogen by vacuum fusion, inert gas fusion, and neutron activation methods. SRM's 1095 to 1099 are sold only in a set as SRM 1089.

SRM	Type	Form	Oxygen (ppm)	Hydrogen (ppm)	Nitrogen (ppm)
352c	Unalloyed titanium for hydrogen	Platelets		(IN PREP)	
1090	Ingot iron	Rod	(491)		(60)
1091a	Stainless steel (AISI 431)	Rod	132.2		
1093	Valve steel	Rod	60		
1094	Maraging steel	Rod	4.5		(71)
1089	Set of 5: 1095, 1096, 1097, 1098, and 1099	Rods			
1754	Low-Alloy Steel, AISI 4320	Rod	24		81

Values in parentheses are not certified, but are given for information only.

Dale Friend removes some material from the large cone blender for homogeneity analysis. Dale's dedication and availability as supervisor of the preparation and packaging activities is a valued asset of the program.

High-Purity Metals

These SRM's are for determining impurity elements in high-purity metals. (See also specific metals.)

SRM	Type	Unit Size	Chemical Composition (Nominal Parts Per Million by Weight)				
			Cu	Ni	Sn	Pb	Zr
685W*	High-Purity Gold (Wire)	1.4 mm D×102 mm long	0.1	(<0.05)	(<0.07)		
685R*	High-Purity Gold (Rod)	5.9 mm D×25 mm long	0.1	(<0.05)	(<0.07)		
680a	High-Purity Platinum (Wire)	0.51 mm D: L1 (10 cm); L2 (1 m)	0.1	<1		<1	<0.1
681	Doped-Platinum (Wire)	0.51 mm D: L1 (10 cm); L2 (1 m)	$5._0$	0.5		12	11
682*	High-Purity Zinc	Semicirc 57 mm D	0.042	(<0.1)	(0.02)		
683*	Zinc Metal	Semicirc 57 mm D	5.9		(0.02)	11.1	
728	Zinc, Intermediate Purity	Shot, 450 g	5.7		(0.02)	11.1	
726	Selenium, Intermediate Purity	Shot, 450 g	<1	<0.5	<1	<1	Mn<0.3
C1257	Aluminum, High Purity	Disk	(<0.1)	(<0.1)	(<0.1)	(<0.1)	(<0.1)

SRM	Ag	Mg	In	Fe	O	Pd	Au	Rh	Ir	Cd	Tl
685W*	[0.1]	(<0.2)	0.00_7	0.3	[2]						
685R*	[0.1]	(<0.2)	0.00_7	0.2	[<2]						
680a	<0.1	<1		1.3	4	0.2	<1	<0.2	<0.01		
681	$2._0$	12		5	7	6	9	9	11		
682*	(0.02)	(<0.1)		(0.1)	(<0.5)					(0.1)	
683*	1.3			2.2						1.1	(0.2)
728	1.1			2.7						1.1_5	(0.2)
726	<1	<1	S 12	1	Cr<1	Mo<0.3	Te 0.3	As<2	Al<1	B<1	Ca<1
C1257	Si 2.0	5.0		1.0	Cr (<0.1)					(<0.1)	Ca (<0.1)

*Certificate gives upper limits for other elements found to be present.
Values in parentheses are not certified, but are given for information only.
Values in brackets are subject to greater error since only one method of analysis was employed.

RM 1R—Ultra-Purity Aluminum Polycrystalline Rods

These rods are intended for use in research on the mechanical and physical properties of extremely pure aluminum; e.g., in the determination of resistivity as a function of strain at cryogenic temperatures to facilitate the design of cryogenic magnets, or superconductor stabilizing elements. Unit of issue: 4.2 mm in diameter and 25.4 mm long.

Microanalytical

These SRM's provide a highly homogeneous material at microscopic spatial resolution. They are intended primarily for use in calibration of quantitative electron probe, secondary ion mass spectrometry, spark source mass spectrometry, and laser probe microanalytical techniques.

SRM	Type	Unit Size
470	Mineral Glasses (K-411 & K-412)	2 Rods: 1×1×15 mm
480	Tungsten-20% Mo Alloy	Rod: 1 mm D, 1 mm long
481	Au-Ag Set	6 Wire: 0.5 mm D, 50 mm long
482	Au-Cu Set	6 Wire: 0.5 mm D, 50 mm long
1871	Glasses (K-456, K-493, & K-523)	3 Rods: 2×2×20 mm
1872	Glasses (K-453, K-491, & K-968)	3 Rods: 2×2×20 mm
1873	Glasses (K-458, K-489 & K-963)	3 Rods: 2×2×20 mm
1874	Glasses (K-495, K-490, & K-546)	3 Rods: 2×2×20 mm
1875	Glasses (K-496, K-497, & K-1013)	3 Rods: 2×2×20 mm
2063	Thin Film Mg-Si-Ca-Fe	3 mm diameter film
2064	Thin Film Al-Si-Ca-Ti-Mn-Zn	3 mm diameter film

Metals for Microanalysis

SRM	Type	Chemical Composition (Nominal Weight Percent)				
		Au	Cu	Ag	W	Mo
480	Tungsten-20% Mo Alloy				78.5	21.5
481	Au 100 A	100.0_0				
	Au-20% Ag B	80.0_5		19.9_6		
	Au-40% Ag C	60.0_5		39.9_2		
	Au-60% Ag D	40.0_3		59.9_3		
	Au-80% Ag E	22.4_3		77.5_8		
	Ag 100 F			100.0_0		
482	Au 100 A	100.0_0				
	Au-20% Cu B	80.1_5	19.8_3			
	Au-40% Cu C	60.3_6	39.6_4			
	Au-60% Cu D	40.1_0	59.9_2			
	Au-80% Cu E	20.1_2	79.8_5			
	Cu 100 F		100.0_0			

Mineral Glasses for Microanalysis

SRM 470	Composition (Nominal Weight Percent)				
Glass	SiO_2	FeO	MgO	CaO	Al_2O_3
K–411	54.30	14.42	14.67	15.47	—
K–412	45.35	9.96	19.33	15.25	9.27

Glasses for Microchemical Analysis

	SRM 1871			SRM 1872			SRM 1873			SRM 1874			SRM 1875		
	Glass			Glass			Glass			Glass			Glass		
	K–456	K–493	K–523	K–453	K–491	K–968	K–458	K–489	K–963	K–495	K–490	K–546	K–496	K–497	K–1013
	Composition (Nominal Weight Percent)														
Pb	65.67	63.28	63.10	54.21	54.69	54.74	—	(1.32)	—	—	(1.47)	—	—	(0.86)	—
Si	13.37	(13.09)	(12.94)	—	(0.11)	—	23.05	(22.23)	(21.96)	—	(0.19)	—	—	(0.13)	—
Ge	—	—	(0.20)	28.43	26.10	25.93	—	—	(0.47)	—	—	(0.50)	—	—	(0.34)
Ba	—	—	(0.61)	—	—	(0.46)	41.79	39.53	39.21	—	—	(0.99)	—	—	(0.52)
Zn	—	—	—	—	—	—	3.01	2.93	2.95	—	—	—	—	—	—
P	—	—	(0.24)	—	—	(0.21)	—	—	(0.33)	—	—	(0.42)	32.98	31.59	32.26
Mg	—	—	(0.12)	—	—	(0.22)	—	—	(0.34)	—	—	(0.17)	6.65	6.49	5.86
Al	—	(0.13)	—	—	(0.10)	—	—	(0.11)	—	10.89	(10.2)	(10.1)	6.47	5.97	6.08
B	—	—	—	—	—	—	—	—	—	(23.0)	(21.5)	(21.6)	—	[0.05]	—
Zr	—	(0.38)	(0.33)	—	(0.26)	(0.48)	—	(0.40)	(0.61)	—	(0.53)	(0.52)	—	(0.32)	(0.45)
Ti	—	(0.20)	(0.21)	—	(0.14)	(0.16)	—	(0.27)	(0.32)	—	(0.31)	(0.39)	—	(0.22)	(0.21)
Ce	—	(0.53)	—	—	(0.59)	—	—	[0.80]	—	—	(1.46)	—	—	(0.94)	—
Ta	—	(0.64)	—	—	(0.52)	—	—	(0.95)	—	—	(1.02)	—	—	(0.71)	—
Fe	—	(0.25)	—	—	(0.17)	—	—	(0.35)	—	—	(0.38)	—	—	(0.26)	—
Li	—	—	—	—	—	—	—	—	—	(2.3)	(2.2)	(2.2)	—	[0.0005]	—
Ni	—	—	(0.25)	—	—	(0.20)	—	—	(0.33)	—	—	(0.39)	—	—	(0.31)
Eu	—	—	(0.73)	—	—	(0.64)	—	—	(0.95)	—	—	(1.21)	—	—	(0.53)
U	—	—	(0.23)	—	—	(0.05)	—	—	(0.16)	—	—	(0.24)	—	—	(0.15)
Th	—	—	(0.08)	—	—	(0.12)	—	—	(0.06)	—	—	(0.16)	—	—	(0.10)
Cr	—	—	(0.20)	—	—	(0.19)	—	—	(0.31)	—	—	(0.14)	—	—	(0.14)
O	(20.35)	(20.58)	(20.80)	(16.73)	(16.45)	(16.67)	(31.86)	(31.70)	(32.00)	(63.49)	(60.74)	(61.36)	(53.90)*	(52.46)*	(53.05)*
Total	(99.39)	(99.08)	(100.19)	(99.37)	(99.13)	(100.07)	(99.71)	(100.59)	(100.00)	(99.68)	(100.01)	(100.39)	(100.00)	(100.00)	(100.00)

Values in parentheses are for information only, they are *not certified.*

Values in brackets were calculated from the weight of material added to the melt, they are *not certified.*

*Oxygen values in SRM 1875 were calculated by difference, not by the stoichiometry of the oxides as was done for the other glasses.

Thin Film for X-Ray Spectrometry

This SRM is for standardizing chemical analysis by x-ray spectrometry and energy loss spectrometry on the analytical electron microscope

SRM	Type	Chemical Composition (Nominal Weight Percent)					
		Mg	Si	Ca	Fe	Ar	O
2063	Thin Film Mg-Si-Ca-Fe	8.04	23.89	12.89	12.43	(0.8)	(41.95)
2064	Thin Film Al-Si-Ca-Ti-Mn-Zn	(IN PREP)					

Values in parentheses are not certified, but are given for information only.

Glass Fibers for Microanalysis—RM 8531

	K-456	K-493	K-453	K-491	K-458	K-489	K-495	K-490	K-496	K-497
	Chemical Composition (Nominal Weight Percent)									
SiO_2	28.77	27.89	—	0.19	49.38	46.76	—	0.42	—	0.27
PbO	71.23	69.08	58.72	59.35	—	1.28	—	1.55	—	0.99
GeO_2	—	—	41.28	37.98	—	—	—	—	—	—
BaO	—	—	—	—	46.80	43.88	—	—	—	—
ZnO	—	—	—	—	3.82	3.72	—	—	—	—
P_2O_5	—	—	—	—	—	—	—	—	79.54	76.03
MgO	—	—	—	—	—	—	—	—	9.03	8.64
Al_2O_3	—	0.20	—	0.16	—	0.29	20.00	18.68	11.43	10.92
B_2O_3	—	0.14	—	0.11	—	0.20	75.00	70.00	—	0.15
ZrO_2	—	0.49	—	0.40	—	0.70	—	0.85	—	0.54
TiO_2	—	0.32	—	0.26	—	0.46	—	0.55	—	0.35
CeO_2	—	0.68	—	0.56	—	0.98	—	1.19	—	0.76
Ta_2O_5	—	0.88	—	0.72	—	1.26	—	1.53	—	0.98
Fe_2O_3	—	0.32	—	0.26	—	0.046	—	0.55	—	0.35
Li_2O	—	0.001	—	0.001	—	0.002	5.00	4.67	—	0.001

Primary, Working, and Secondary Chemicals

These SRM's are high-purity chemicals 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 percent (Purity 99.98 + percent).

Working Standard:
a commercially available substance of purity 100±0.05 percent (Purity 99.95 + percent).

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

SRM	Type	Wt/Unit (grams)	Certified Use	Purity Stoichiometric
17d	Sucrose	60	Polarimetric Value	(99.9)[a]
40h	Sodium Oxalate	60	Reductometric Value	99.972
41c	Dextrose (D-Glucose)	70	Reductometric 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
723a	Tris(hydroxymethyl)aminomethane	50	Basimetric Value	99.9703
951	Boric Acid	100	Acidimetric and Boron Isotopic Value	100.00
987	Strontium Carbonate	1	Assay and Isotopic	99.98
999	Potassium Chloride	60	Assay Standard for:	
			Potassium	99.98_1
			Chloride	99.99

[a]Sucrose = Moisture <0.02 percent, Ash <0.005 percent.

Microchemical

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent)							
			C	H	N	Br	Cl	F	S	CH_3O–
141c	Acetanilide	2	71.09	6.71	10.36					
142	Anisic Acid	2								20.40
143c	Cystine	2	29.99	5.03	11.66				26.69	
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			

Spectrometric Solutions

These SRM's are intended as standard stock solutions for use in atomic absorption spectrometry, optical emission (plasma) spectrometry, or any other analytical technique that requires aqueous solutions for calibrating instruments. Each SRM is a single element solution of 50 mL with a concentration of 10 mg/mL, except where noted.

SRM	Element	Acid Concentration
3101	Aluminum	HCl 10%
3102	Antimony	HCl 50%
3103	Arsenic	HCl 15%
3104	Barium	HCl 10%
3105	Beryllium	HCl 10%
3106	Bismuth	HNO_3 10%
3107	Boron (5.00)	Water
3108	Cadmium	HNO_3 10%
3109	Calcuim	HCl 10%
3110	Cerium	HNO_3 10%
3111	Cesium	HCl 1%
3112	Chromium	HCl 10%
3113	Cobalt	HNO_3 10%
3114	Copper	HNO_3 10%
3115	Dysprosium	HCl 10%
3116	Erbium	HCl 10%
3117	Europium	HCl 10%
3118	Gadolinium	HCl 10%
3119	Gallium	HCl 10%
3120	Germanium	Oxalic Acid 10%
3121	Gold	HCl 10%
3122	Hafnium	HNO_3 10% + HF 2%
3123	Holmium	HCl 10%
3124	Indium	HCl 10%
3125	Iridium	IN PREP
3126	Iron	HCl 10%
3127	Lanthanum	HCl 10%
3128	Lead	HNO_3 10%
3129	Lithium	HCl 1%
3130	Lutetium	HCl 10%
3131	Magnesium	HCl 10%
3132	Manganese	HNO_3 10%
3133	Mercury	HNO_3 10%
3134	Molybdenum	HCl 10%
3135	Neodymium	HCl 10%
3136	Nickel	HNO_3 10%
3137	Niobium	5% HNO_3 + 2% HF
3138	Palladium	HCl 10%
3139	Phosphorus	HCl 0.05%
3140	Platinum	HCl 10%
3141	Potassium	HCl 1%
3142	Praseodymium	HCl 10%
3143	Rhenium	HNO_3 10%
3144	Rhodium	IN PREP
3145	Rubidium	HCl 1%

Spectrometric Solutions (Continued)

SRM	Element	Acid Concentration
3146	Ruthenium	IN PREP
3147	Samarium	HC1 10%
3148	Scandium	HC1 10%
3149	Selenium	HNO_3 10%
3150	Silicon	Water
3151	Silver	HNO_3 10%
3152	Sodium	HC1 1%
3153	Strontium	HC1 10%
3154	Sulfur	H_2SO_4 0.1%
3155	Tantalum	5% HNO_3 + 2% HF
3156	Tellurium	HC1 10%
3157	Terbium	HC1 10%
3158	Thallium	HNO_3 10%
3159	Thorium	HNO_3 10%
3160	Thulium	HC1 10%
3161	Tin	HC1 60%
3162	Titanium	HC1 40%
3163	Tungsten	7% HNO_3 + 4% HF
3164	Uranium	HNO_3 10%
3165	Vanadium (5.00)	HNO_3 10%
3166	Ytterbium	HC1 10%
3167	Yttrium	HC1 10%
3168	Zinc	HC1 10%
3169	Zirconium	10% HNO_3 + 2% HF

Dolly Downs helps implement the technical and editorial review process for all certificates in addition to performing many other reporting and documentation activities that help keep track of the many certification projects. Her sincerity and neatness are instrumental in keeping all these activities functioning smoothly.

SRM's now cover a wide range of materials, including organics in shale oil and elemental composition of glasses for microanalysis.

Multielement Spectrometric Solutions

Element	Source, Purity	Concentration, μg/mL
SRM 3171 Multielement Mix A Standard Solution		
Aluminum	Metal, (99.99+)	100.0 ± 0.5
Beryllium	Metal, (99.9)	10.0 ± 0.1
Cadmium	Metal, (99.99+)	100.0 ± 0.5
Chromium	Metal, (99.99+)	100.0 ± 0.5
Iron	Metal, (99.99+)	100.0 ± 0.5
Magnesium	Metal, (99.999)	100.0 ± 0.5
Manganese	Metal, (99.99)	100.0 ± 0.5
Nickel	Metal, (99.999)	100.0 ± 0.5
Potassium	KCl, (99.98)	500.0 ± 2.5
Sodium	NaCl, (99.98)	100.0 ± 0.5
SRM 3172 Multielement Mix B Standard Solution		
Arsenic	$A_{s2}O_3$, (99.9926)	200.0 ± 1.0
Barium	$BaCO_3$, (99.99)	10.0 ± 0.1
Calcium	$CaCO_3$, (99.99)	10.0 ± 0.1
Cobalt	Metal, (99.99)	100.0 ± 0.5
Copper	Metal, (99.998)	100.0 ± 0.5
Lead	Metal, (99.99)	100.0 ± 0.5
Selenium	Metal, (99.99)	500.0 ± 2.5
Silver	Metal, (99.999+)	100.0 ± 0.5
Strontium	$SrCO_3$, (99.99)	10.0 ± 0.1
Zinc	Metal, (99.99+)	100.0 ± 0.5
SRM 3173 Multielement Mix C Standard Solution		IN PREP
SRM 3174 Multielement Mix D Standard Solution		
Aluminum	Metal, (99.99+)	100.0 ± 0.5
Beryllium	Metal, (99.9)	100.0 ± 0.5
Boron	H_3BO_3, (99.99)	100.0 ± 0.5
Cadmium	Metal, (99.999)	100.0 ± 0.5
Gold	Metal, (99.999)	100.0 ± 0.5
Hafnium	Metal, (99.95)	100.0 ± 0.5
Iron	Metal, (99.99)	100.0 ± 0.5
Lead	Metal, (99.995)	100.0 ± 0.5
Titanium	Metal, (99.99)	50.0 ± 0.25
Zirconium	Metal, (99.84)	100.0 ± 1.0

Anion Ion Chromatographic Solutions

These SRM's are single-component solutions prepared gravimetrically for use in anion ion chromatography, or any other technique that requires aqueous standard solutions for calibration on control materials.

SRM	Anion		Wt/Unit (mL)	Concentration (μg/g)
3181	Sulfate		50	1000
3182	Chloride		50	1000
3183	Fluoride		50	1000
3184	Bromide	IN PREP	50	
3185	Nitrate	IN PREP	50	
3186	Phosphate	IN PREP	50	

John Savoy, shown here placing labels on bottles of a new SRM, performs his responsibilities in packaging materials with the consistency and orderliness necessary to accurately package and label a large number of different materials.

Clinical Laboratory

These SRM's are for calibrating apparatus and validating analytical methods used in clinical and pathology laboratories. See also: Spectrophotometric SRM's and Temperature SRM's.

SRM	Type	Associated Publications	Purity %	Wt/Unit
900	Antiepilepsy Drug Level Assay (phenytoin, ethosuximide, phenobarbital, and primidone)		4 drugs 3 levels	Set of 4 vials
909	Human Serum		#	Set of 6 vials
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
915	Calcium Carbonate	SP 260–36	99.9	20 g
916a	Bilirubin		98.3	100 mg
917a	D-Glucose (Dextrose)		99.9	25 g
918	Potassium Chloride	SP 260–63	99.9	30 g
919a	Sodium Chloride	SP 260–60	IN PREP	30 g
920	D-Mannitol		99.8	50 g
921	Cortisol (Hydrocortisone)		98.9	1 g
922	Tris(hydroxymethyl) aminomethane		99.99	25 g
923	Tris(hydroxymethyl) aminomethane HCl		99.69	35 g
924	Lithium Carbonate	SP 260–69	100.0	30 g
925	VMA (4–hydroxy–3–methoxymandelic acid)		99.4	1 g
926	Bovine Serum Albumin (Powder)		*	5 g
927a	Bovine Serum Albumin (7% Solution)		*	10 vials, 2.15 mL ea.
928	Lead Nitrate		100.00	30 g
929	Magnesium Gluconate Dihydrate		(100.1)	5 g
937	Iron Metal		99.90	50 g
938	4–Nitrophenol		(99.75)	15 g
956	Electrolytes in Serum for ISE		IN PREP	
968	Fat Soluble Vitamins in Human Serum		3 levels	Set of 6 vials
998	Angiotensin I (Human)		94.1	0.5 mg
1589	Polychlorinated Biphenyls (PCB's) in Human Serum (as Aroclor 1260)		—	Set of 3 bottles
1595	Tripalmitin		99.5	2 g
1598	Inorganic Constituents in Bovine Serum			Set of 2 vials
1599	Anticonvulsant Drug Level Assay (valproic acid and carbamazepine)		2 drugs/ 3 levels	Set of 4 vials
1700a	Blood Gas: CO_2–10%, Bal N_2		—	Cylinder, 20 cubic feet
1701a	Blood Gas: CO_2–5%, O_2–12%, Bal N_2		—	Cylinder, 20 cubic feet
1702a	Blood Gas: CO_2–5%, O_2–20%, Bal N_2		—	Cylinder, 20 cubic feet
1703a	Blood Gas: CO_2–10%, O_2–7%, Bal N_2		—	Cylinder, 20 cubic feet
1951a	Cholesterol in Human Serum (Frozen)		IN PREP	Set of 6 bottles
1952a	Cholesterol in Human Serum (Freeze-dried)		IN PREP	Set of 3 bottles
RM 8430	Aspartate Aminotransferase (AST) Human Erythrocyte Source		—	Set of 3 bottles

*Conforms to NCCLS specification ACC–1.

Electrolytes, selected organics.

The SRM program has continually expanded in response to needs for certified reference materials. The SRM's shown here have primary relevance to clinical and health related areas of analysis.

Serum Reference Materials

These materials are for calibrating instrumentation and evaluating the reliability of analytical methods for the determination of major, minor, and trace constituents in blood serum, plasma, and similar biological fluids.

Constituent	Concentrations			
	SRM 909 (Procedure A)		SRM 909 (Procedure B)	
Cadmium	1.46	ng/mL/g	1.24	ng/mL
Calcium	3.560	mmol/L/g	3.013	mmol/L
Chloride	128.0	mmol/L/g	108.4	mmol/L
Chromium	108	ng/mL/g	91.3	ng/mL
Cholesterol	4.326	mmol/L/g	3.66	mmol/L
Copper	1.29	μg/mL/g	1.10	μg/mL
Creatinine	0.179	mmol/L/g	0.152	mmol/L
Glucose	7.38	mmol/L/g	6.25	mmol/L
Iron	2.34	μg/mL/g	1.98	μg/mL
Lead	23.7	ng/mL/g	20.0	ng/mL
Lithium	1.945	mmol/L/g	1.65	mmol/L
Magnesium	1.425	mmol/L/g	1.21	mmol/L
Potassium	4.155	mmol/L/g	3.52	mmol/L
Sodium	158.4	mmol/L/g	134.1	mmol/L
Urea	11.39	mmol/L/g	9.64	mmol/L
Uric Acid	0.567	mmol/L/g	0.480	mmol/L
Vanadium	3.19	ng/mL/g	2.70	ng/mL

Biological Materials

These SRM's are intended for use in the calibration of apparatus and methods used in the analysis of biological materials for major, minor, and trace constituents.

Food and Beverage

SRM	1548	1549	1566a*	1567a	1568a	1569	1577a	RM 50
Type	Total Diet	Non-fat Milk Powder	Oyster Tissue	Wheat Flour	Rice Flour	Brewers Yeast	Bovine* Liver	Albacore* Tuna
Unit Size		100 g			80 g	50 g	50 g	70 g
ELEMENTS	**Nominal Composition in μg/g, unless otherwise noted.**							
Aluminum	202.5	(2)		5.7	4.4		(2)	(4.39)
Antimony	(0.01)	(0.00027)			(0.0005)		(0.003)	
Arsenic	14.0	(0.0019)		(0.006)	0.29		0.047	(3.3)
Bromine		(12)		(6)	(8)		(9)	
Cadmium	4.15	0.0005		0.026	0.022		0.44	
Calcium	0.196 wt. %	1.30 wt. %	0.17 wt. %	0.0191 wt. %	0.011		120	
Chlorine	0.829 wt. %	1.09 wt. %	0.87 wt. %	(565)	(300)		0.28 wt. %	
Chromium	1.43	0.0026		—	—	2.12		
Cobalt	0.57	(0.0041)		(0.006)	(0.018)		0.21	
Copper	66.3	0.7	2.6	2.1	2.4		158	
Fluorine	(240)	(0.20)		—	—			
Iodine	4.46	3.38		(0.0009)	(0.009)			
Iron	539	1.78	32.2	14.1	7.4		194	
Lead	0.371	0.019		(<0.020)	(<0.010)		0.135	
Magnesium	0.118 wt. %	0.120 wt. %	0.055 wt. %	0.040 wt. %	0.056 wt. %		600	
Manganese	12.3	0.26	5.1	9.4	20.0		9.9	
Mercury	0.0642	0.0003		(0.0005)	0.0058		0.004	(0.95)
Molybdenum		(0.34)		0.48	1.46		3.5	
Nickel	2.25		0.41	—	(0.16)			
Nitrogen	6.81 wt. %		3.5 wt. %	—	—		(10.7%)	
Phosphorus	0.623 wt. %	1.06 wt. %	0.32 wt. %	0.134 wt. %	0.153 wt. %		1.11 wt. %	
Potassium	0.790 wt. %	1.69 wt. %	0.60 wt. %	0.133 wt. %	0.1280 wt. %		0.996 wt. %	
Rubidium	(3)	(11)		0.68	6.14		12.5	
Selenium	2.21	0.11	0.25	1.1	0.38		0.71	(3.6)
Silver	1.68	(<0.0003)		—	—		0.04	
Sodium	0.417 wt. %	0.497 wt. %	0.63 wt. %	6.1	6.6		0.243%	
Strontium	11.1			—	—		0.138	
Sulfur	0.862 wt. %	0.351 wt. %	0.28 wt. %	0.165 wt. %	0.120 wt. %		0.78%	
Tellurium				—	(<0.002)			
Thallium				—			(0.003)	
Thorium	(0.04)			—				
Tin	(3)	(<0.02)		(0.0033)	(0.0047)			
Uranium	0.132			(.0003)	(0.0003)		0.00071	
Vanadium	4.68			(0.011)	(0.007)		0.099	
Zinc	830	46.1	30.8	11.6	19.4		123	(13.6)

Values in parentheses are not certified, but are given for information only.
*Indicates freeze-dried.

Food and Beverage (Continued)

SRM	1845	1563
Type	Cholesterol in Whole Egg Powder	Cholesterol and Fat Soluble Vitamins in Coconut Oil
Unit Size	3 bottles, 8 g each	Set of 10
Cholesterol	19.0 mg/g	IN PREP

Bob Alvarez, a project manager for OSRM, friendly and outgoing, provides a rich background of experience and knowledge in the SRM program. Bob provides leadership for many of the organic, clinical, chemical and environmental SRM's.

Ethanol Solutions See also: Alcohol in Reference Fuels

SRM	Type	Certified Constituent	Wt/Unit
1590	Stabilized Wine	Ethanol: 18.57% by volume	Set of 10, 10-mL vials
1828	Ethanol-Water Solutions	Ethanol: 95.629 wt%	Set: 1, 15-mL vial
		Ethanol: 0.2992 wt%	2, 3-mL vials
		Ethanol: 0.1487 wt%	2, 3-mL vials

Agricultural

SRM	1515	1547	1572	1573a	1575	2695	RM 8412	RM 8413
Type	Apple Leaves	Peach Leaves	Citrus Leaves	Tomato Leaves	Pine Needles	Fluoride in Vegetation	Corn Stalk	Corn Kernel
Unit Size	IN PREP	IN PREP	70 g	IN PREP	70 g	IN PREP	34 g	47 g
ELEMENT	**Nominal Composition in $\mu g/g$, unless otherwise noted.**							
Aluminum			92		545			(4)
Antimony			(0.04)		(0.2)			
Arsenic			3.1		0.21			
Barium			21					
Boron								
Bromine			(8.2)		(9)			
Cadmium			0.03		(<0.5)			
Calcium			3.15%		0.41%		(2160)	(42)
Cerium			(0.28)		(0.4)			
Cesium			(0.098)					
Chlorine			(414)				(2440)	(450)
Chromium			0.8		2.6			
Cobalt			(0.02)		(0.1)			
Copper			16.5		3.0		(8)	(3.0)
Europium			(0.01)		(0.006)			
Fluorine								(0.24)
							(0.65)	
Iodine			1.84					
Iron			90		200		(139)	(23)
Lanthanum			(0.19)		(0.2)			
Lead			13.3		10.8			
Magnesium			0.58%				(1600)	(990)
Manganese			23		675		(15)	(4.0)
Mercury			0.08		0.15			
Molybdenum			0.17					
Nickel			0.6		(3.5)			
Nitrogen			(2.86%)		(1.2%)		(6970)	(13750)
Phosphorous			0.13%		0.12%			
Potassium			1.82%		0.37%		(17350)	(3570)
Rubidium			4.84		11.7			
Samarium			(0.052)					
Scandium			(0.01)		(0.03)			
Selenium			(0.025)					
							(0.016)	(0.004)
Sodium			160				(28)	
Strontium			100		4.8		(12)	
Sulfur			0.407%					
Tellurium			(0.02)					
Thallium			(<0.01)		(0.05)			
Thorium					0.037			
Tin			(0.24)					
Uranium			(<0.15)		0.020			
Zinc			29				(32)	(15.7)

Values in parentheses are not certified, but are given for information only.

Environmental Materials

Analyzed Gases

These SRM's are for calibrating apparatus used to measure various components of gas mixtures and atmospheric pollutants. All cylinders conform to the appropriate DOT specifications.

SRM	Type	Certified Component	Nominal Concentration
1811	Aromatic Organic Gases in Nitrogen		
	Benzene	C_6H_6	0.25 μmole/mole
	Toluene	$C_6H_5CH_3$	0.25 μmole/mole
	Chlorobenzene	C_6H_5Cl	0.25 μmole/mole
	Bromobenzene	C_6H_5Br	0.25 μmole/mole
1812	Aromatic Organic Gases in Nitrogen		
	Benzene	C_6H_6	10 μmole/mole
	Toluene	$C_6H_5CH_3$	10 μmole/mole
	Chlorobenzene	C_6H_5Cl	10 μmole/mole
	Bromobenzene	C_6H_5Br	10 μmole/mole
1813	Aliphatic Organic Gases in Nitrogen		
	Carbon Tetrachloride	CCl_4	0.25 μmole/mole
	Chloroform	$CHCl_3$	0.25 μmole/mole
	Tetrachloroethylene	CCl_2CCL_2	0.2 μmole/mole
	Vinyl Chloride	CH_2CHCl	0.25 μmole/mole
1814	Aliphatic Organic Gases in Nitrogen		
	Carbon Tetrachloride	CCl_4	10 μmole/mole
	Chloroform	$CHCl_3$	10 μmole/mole
	Tetrachloroethylene	CCl_2CCL_2	10 μmole/mole
	Vinyl Chloride	CH_2CHCl	10 μmole/mole
1805	Benzene in Nitrogen	C_6H_6	0.25 μmole/mole
1806	Benzene in Nitrogen	C_6H_6	10 μmole/mole
1700a	Blood Gas: CO_2–10%, Bal N_2	CO_2 in N_2	10%
1701a	Blood Gas: CO_2–5%, O_2–12%, Bal N_2	CO_2 & O_2 in N_2	5% Carbon Dioxide, 12% Oxygen
1702a	Blood Gas: CO_2–5%, O_2–20%, Bal N_2	CO_2 & O_2 in N_2	5% Dioxide, 20% Oxygen
1703a	Blood Gas: CO_2–10%, O_2–7%, Bal N_2	CO_2 & O_2 in N_2	10% Carbon Dioxide, 7% Oxygen
1670	Carbon Dioxide in Air	CO_2	330 μmole/mole
1671	Carbon Dioxide in Air	CO_2	340 μmole/mole
1672	Carbon Dioxide in Air	CO_2	350 μmole/mole
2607	Carbon Dioxide and Nitrous Oxide in Air		
	Carbon Dioxide	CO_2	340 μmole/mole
	Nitrous Oxide	N_2O	300 μmole/mole
2608	Carbon Dioxide and Nitrous Oxide in Air		
	Carbon Dioxide	CO_2	340 μmole/mole
	Nitrous Oxide	N_2O	300 μmole/mole
2609	Carbon Dioxide and Nitrous Oxide in Air		
	Carbon Dioxide	CO_2	380 μmole/mole
	Nitrous Oxide	N_2O	330 μmole/mole
2610	Carbon Dioxide and Nitrous Oxide in Air		
	Carbon Dioxide	CO_2	380 μmole/mole
	Nitrous Oxide	N_2O	330 μmole/mole

Analyzed Gases (Continued)

SRM	Type	Certified Component	Nominal Concentration	
1674b	Carbon Dioxide in Nitrogen	CO_2	7.0	mole percent
1675b	Carbon Dioxide in Nitrogen	CO_2	14.0	mole percent
2619a	Carbon Dioxide in Nitrogen	CO_2	0.5	mole percent
2620a	Carbon Dioxide in Nitrogen	CO_2	1.0	mole percent
2621a	Carbon Dioxide in Nitrogen	CO_2	1.5	mole percent
2622a	Carbon Dioxide in Nitrogen	CO_2	2.0	mole percent
2623a	Carbon Dioxide in Nitrogen	CO_2	2.5	mole percent
2624a	Carbon Dioxide in Nitrogen	CO_2	3.0	mole percent
2625a	Carbon Dioxide in Nitrogen	CO_2	3.5	mole percent
2626a	Carbon Dioxide in Nitrogen	CO_2	4.0	mole percent
2612a	Carbon Monoxide in Air	CO	10	μmole/mole
2613a	Carbon Monoxide in Air	CO	20	μmole/mole
2614a	Carbon Monoxide in Air	CO	45	μmole/mole
1677c	Carbon Monoxide in Nitrogen	CO	10	μmole/mole
1678c	Carbon Monoxide in Nitrogen	CO	50	μmole/mole
1679c	Carbon Monoxide in Nitrogen	CO	100	μmole/mole
1680b	Carbon Monoxide in Nitrogen	CO	500	μmole/mole
1681b	Carbon Monoxide in Nitrogen	CO	1000	μmole/mole
2635a	Carbon Monoxide in Nitrogen	CO	25	μmole/mole
2636a	Carbon Monoxide in Nitrogen	CO	250	μmole/mole
2637a	Carbon Monoxide in Nitrogen	CO	2500	μmole/mole
2638a	Carbon Monoxide in Nitrogen	CO	5000	μmole/mole
2639a	Carbon Monoxide in Nitrogen	CO	1	mole percent
2640	Carbon Monoxide in Nitrogen	CO	2	mole percent
2641	Carbon Monoxide in Nitrogen	CO	4	mole percent
2642a	Carbon Monoxide in Nitrogen	CO	8	mole percent
2725	Carbon Monoxide and Propane in Nitrogen	CO	1.6	mole percent
		C_3H_8	600	μmole/mole
2726	Carbon Monoxide and Propane in Nitrogen	CO	8	mole percent
		C_3H_8	3000	μmole/mole
2727	Carbon Monoxide, Propane and Carbon Dioxide in Nitrogen	CO	1.6	mole percent
		C_3H_8	600	μmole/mole
		CO_2	11	mole percent
2728	Carbon Monoxide, Propane and Carbon Dioxide in Nitrogen	CO	8	mole percent
		C_3H_8	3000	μmole/mole
		CO_2	14	mole percent
1658a	Methane in Air	CH_4	1	μmole/mole
1659a	Methane in Air	CH_4	10	μmole/mole
1660a	Methane-Propane in Air	CH_4	4	μmole/mole
		C_3H_8	1	μmole/mole
1683b	Nitric Oxide in Nitrogen	NO	50	μmole/mole
1684b	Nitric Oxide in Nitrogen	NO	100	μmole/mole
1685b	Nitric Oxide in Nitrogen	NO	250	μmole/mole
1686b	Nitric Oxide in Nitrogen	NO	500	μmole/mole
1687b	Nitric Oxide in Nitrogen	NO	1000	μmole/mole
2627a	Nitric Oxide in Nitrogen	NO	5	μmole/mole
2628a	Nitric Oxide in Nitrogen	NO	10	μmole/mole
2629a	Nitric Oxide in Nitrogen	NO	20	μmole/mole

Analyzed Gases (Continued)

SRM	Type	Certified Component	Nominal Concentration	
2630	Nitric Oxide in Nitrogen	NO	1500	μmole/mole
2631	Nitric Oxide in Nitrogen	NO	3000	μmole/mole
2654	Nitrogen Dioxide in Air	NO_2	500	μmole/mole
2655	Nitrogen Dioxide in Air	NO_2	1000	μmole/mole
2656	Nitrogen Dioxide in Air	NO_2	2500	μmole/mole
2657a	Oxygen in Nitrogen	O_2	2	mole percent
2658a	Oxygen in Nitrogen	O_2	10	mole percent
2659a	Oxygen in Nitrogen	O_2	21	mole percent
1665b	Propane in Air	C_3H_8	3	μmole/mole
1666b	Propane in Air	C_3H_8	10	μmole/mole
1667b	Propane in Air	C_3H_8	50	μmole/mole
1668b	Propane in Air	C_3H_8	100	μmole/mole
1669b	Propane in Air	C_3H_8	500	μmole/mole
2645a	Propane in Nitrogen	C_3H_8	500	μmole/mole
2646a	Propane in Nitrogen	C_3H_8	1000	μmole/mole
2647a	Propane in Nitrogen	C_3H_8	2500	μmole/mole
2648a	Propane in Nitrogen	C_3H_8	5000	μmole/mole
2649	Propane in Nitrogen	C_3H_8	1	mole percent
2650	Propane in Nitrogen	C_3H_8	2	mole percent
2651	Propane in Nitrogen and Oxygen	C_3H_8	0.01	mole percent
		O_2	5.0	mole percent
2652	Propane in Nitrogen and Oxygen	C_3H_8	0.01	mole percent
		O_2	10.0	mole percent
1661a	Sulfur Dioxide in Nitrogen	SO_2	500	μmole/mole
1662a	Sulfur Dioxide in Nitrogen	SO_2	1000	μmole/mole
1663a	Sulfur Dioxide in Nitrogen	SO_2	1500	μmole/mole
1664a	Sulfur Dioxide in Nitrogen	SO_2	2500	μmole/mole
1693a	Sulfur Dioxide in Nitrogen	SO_2	50	μmole/mole
1694a	Sulfur Dioxide in Nitrogen	SO_2	100	μmole/mole
1696	Sulfur Dioxide in Nitrogen	SO_2	3500	μmole/mole
1804	Ambient Toxic Organics in Nitrogen	(Fifteen components, call for details.)		
1808	Tetrachloroethylene in Nitrogen	C_2Cl_4	0.25	μmole/mole
1809	Tetrachloroethylene in Nitrogen	C_2Cl_4	10	μmole/mole
2730	Hydrogen Sulfide in Nitrogen	H_2S	5	μmole/mole
2731	Hydrogen Sulfide in Nitrogen	H_2S	20	μmole/mole

Permeation Devices

These SRM's are for calibrating air pollution monitoring apparatus, and may be used to verify air pollution analytical methods and procedures. Each tube is individually certified.

SRM's 1625, 1626, and 1627 are certified over the temperature range of 20 to 30 °C. SRM 1629a is calibrated at 25.0 °C only; cannot be shipped by air.

SRM	Type	Tube Length (cm)	Permeation Rate (μg/min) at 25 °C	Typical Concentrations (ppm) Flow Rates (liters per minute)		
				1	5	10
1625	Sulfur Dioxide Permeation Tube	10	2.8	1.07	0.214	0.107
1626	Sulfur Dioxide Permeation Tube	5	1.4	0.535	0.107	0.0535
1627	Sulfur Dioxide Permeation Tube	2	0.56	0.214	0.0428	0.0214

Gerald Roderick (left) and Bill Dorko, of the Gas and Particulate Science Division, connect some gas cylinders to a sampling manifold in preparation for certification measurements.

Mark Cronise checks the certificate and supplemental documentation for a gas composition SRM against the SRM and serial numbers in preparation for shipment to a customer. Mark's initiative in implementing inventory control and processing procedures have benefited the SRM program.

Wayne Wolf, a Research Associate with OSRM, is providing initiative and resourcefulness in the development and management of food and nutritional SRM's. Here he examines some materials that are to be distributed to the technical divisions for certification analyses.

Analyzed Liquids and Solids

These SRM's are for analysis of materials for constituents of interest in health or environmental problems. See also: Clinical SRM's and Industrial Hygiene SRM's.

SRM	Type	Unit Size	Certified Element				
			Lead	Nickel	Sulfur	Mercury	Vanadium
1579	Powdered Lead Base Paint	35 g	11.87%				
1618	Vanadium and Nickel in Residual Fuel Oil	100 mL		75μg/g	(4.3%)		423μg/g
1630	Trace Mercury in Coal	50 g				0.13 μg/g	
1638b	Lead in Reference Fuel	12 vials	767 μg/g				
1641b	Mercury in Water (μg/mL)	6×20 mL				1.52 μg/mL	
2712	Lead in Reference Fuel	6×20 mL	11.4 μg/g				
2713	Lead in Reference Fuel	6×20 mL	19.4 μg/g				
2714	Lead in Reference Fuel	6×20 mL	28.1 μg/g				
2715	Lead in Reference Fuel	6×20 mL	784 μg/g				
8505	Vanadium in Crude Oil	250 mL					(390μg/g)

Simulated Rainwaters

These materials were developed to aid in the analysis of acidic rainwater by providing stable, homogeneous material as control standards at two levels of acidity.

NOTE: Values in parentheses are not certified.

SRM	Type		Unit of Issue
2694	Simulated Rainwater	IN PREP	Set 4: 2–50mL each of 2 levels

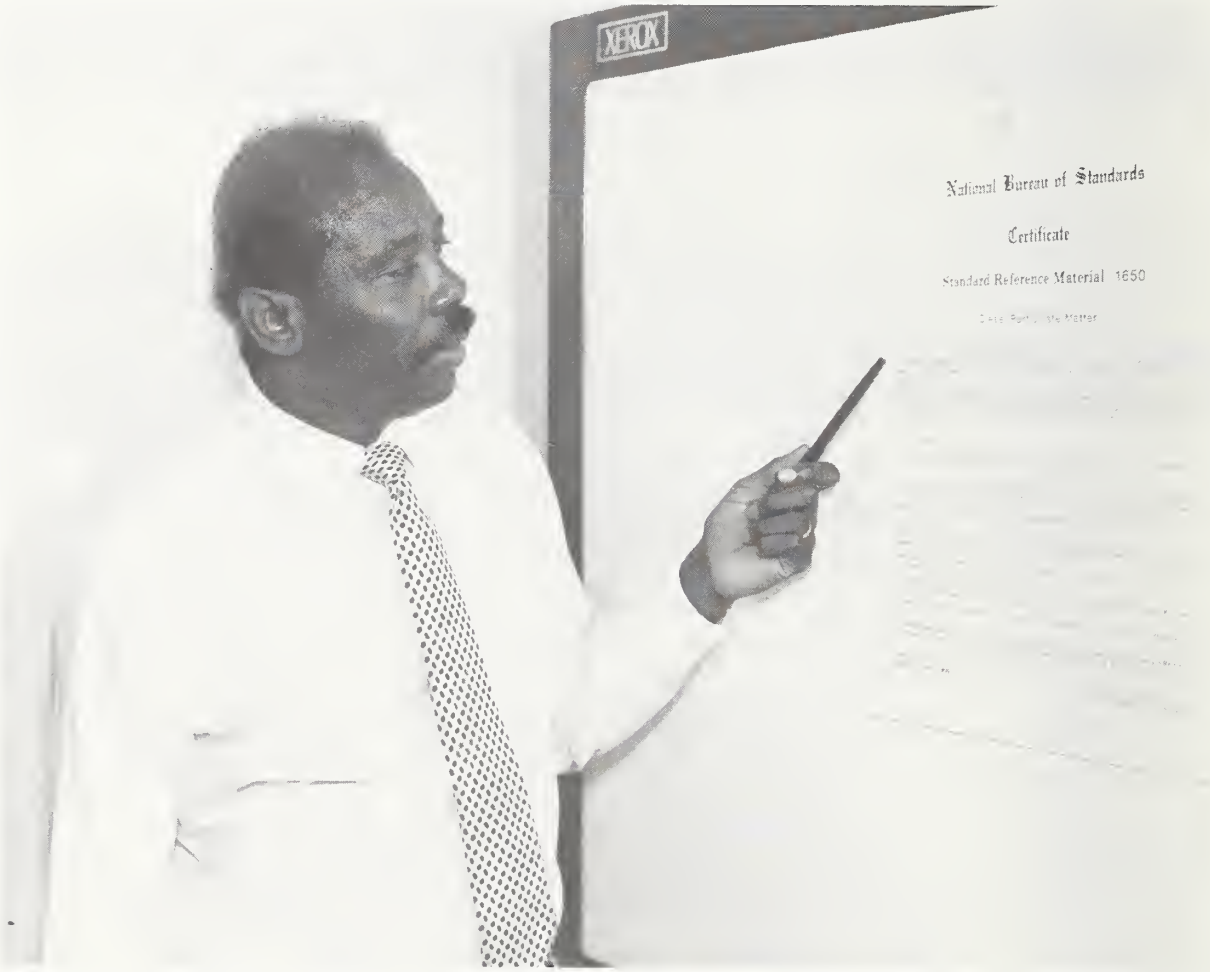
Constituent Element/Parameter	2694–I	2694–II
	(Target Values)	
pH, 25 °C	4.3	3.6
Specific Conductance (μS/cm, 25 °C)	26	130
Acidity, meq/L	0.05	0.3
Fluoride, mg/L	0.05	0.1
Chloride, mg/L	(0.2)	(1.0)
Nitrate, mg/L	0.5	7.0
Sulfate, mg/L	2	11
Sodium, mg/L	0.2	0.4
Potassium, mg/L	0.05	0.1
Ammonium, mg/L	—	(1.0)
Calcium, mg/L	0.01	0.05
Magnesium, mg/L	0.02	0.05

Values in parentheses are not certified, but are given for information only.

Alcohols in Reference Fuels

These SRM's are for calibrating instruments and validating methods used to determine various alcohols in gasoline. Each SRM is issued as a set of sealed 20-mL ampoules.

SRM	Type	Nominal Concentration in Weight Percent			
		Wt/Unit	Methanol	Ethanol	Methanol and t-Butanol
1829	Alcohols in Reference Fuel	Set (6)	0.335	11.39	10.33+6.63
1837	Methanol and t-Butanol	Set (5)			10.33+6.63
1838	Ethanol	Set (5)		11.39	
1839	Methanol	Set (5)	0.335		



Tom Gills, Program Manager for Production and Certification, has implemented many improvements in the production and certification procedures and documentation through his initiative and determination to achieve these objectives.

These SRM's represent the large number of environmental SRM's that are now available.

Sulfur in Fossil Fuels

SRM	Type	Unit Size	Sulfur Wt.%	Furnace Ash Wt.%	HHV2 MJ•Kg^{-1}	HHV2 (Btu•lb^{-1})
1616	Sulfur in Kerosine	100 mL	0.0152			
1617	Sulfur in Kerosine	100 mL	0.169			
1619	Sulfur in Residual Fuel Oil	100 mL	0.719			
1620b	Sulfur in Residual Fuel Oil	IN PREP	4.3 (Target Value)			
1621c	Sulfur in Residual Fuel Oil	100 mL	1.040			
1622c	Sulfur in Residual Fuel Oil	100 mL	2.012			
1623b	Sulfur in Residual Fuel Oil	IN PREP	0.30 (Target Value)			
1624b	Sulfur in Distillate Fuel Oil	IN PREP	0.20 (Target Value)			
2717	Sulfur in Residual Fuel Oil	IN PREP	3.5 (Target Value)			
2682	Coal (Sub-bituminous)	50 g	0.47	6.37		
2683a	Coal (Bituminous)	50 g	1.89	6.85	32.40	(13930)
2684a	Coal (Bituminous)	50 g	3.05	11.09	29.03	(12480)
2685	Coal (Bituminous)	50 g	4.62	16.53	27.38	(11770)
2692	Sulfur in Coal, 1%	50 g	1.115	7.9	30.61	(13160)
2720	Synthetic Sulfur in Oil	IN PREP				
8590	High Sulfur Gas Oil Feed	IN PREP				

NOTE: The calorific values (MJ·Kg^{-1}) 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.

Trace Elements

SRM	1632b	1633a	1634b	1635	1643b	1646	1648	2689	2690	2691	2704
Type	Coal (Bituminous)	Coal Fly Ash	Fuel Oil	Coal (Subbituminous)	Water	Estuarine Sediment	Urban Particulate	Coal Fly Ash	Coal Fly Ash	Coal Fly Ash	Buffalo River Sediment
Unit Size	55 g	75 g	100 mL	75 g	950 mL	75 g	2 g	30 g	30 g	30 g	50 g
ELEMENT	Nominal Concentrations in μg/g, unless otherwise noted.										
Aluminum	0.855%	14.3%	(16)	(0.32%)		6.25%	3.42%	12.94%	12.35%	9.81%	6.11
Antimony	(0.24)	6.8		(0.14)		(0.4)	(45)				3.79
Arsenic	3.72	145	0.12	0.42	(49) ng/g	11.6	115				23.4
Barium	67.5	(0.15%)	(1.3)		44 ng/g		(737)	(0.08%)	(0.65%)	(0.66%)	414
Beryllium		(12)			19 ng/g	(1.5)					
Bismuth					(11) ng/g						
Bromine	(17)				B (94) ng/g		(500)				(7)
Cadmium	0.0573	1.00		0.03	20 ng/g	0.36	75				3.45
Calcium	0.204%	1.11%	(15)			0.83%		2.18%	5.71%	18.45%	2.60
Carbon	78.11%										3.348
Cerium	(9)	(180)		(3.6)		(80)	(55)				(72)
Cesium	(0.44)	(11)				(3.7)	(3)				(6)
Chlorine	(1260)						(0.45%)				(<0.01)
Chromium	(11)	196	(0.7)	2.5	18.6 ng/g	76	403				135
Cobalt	2.29	(46)	0.32	(0.65)	26 ng/g	10.5	(18)				14.0
Copper	6.28	118		3.6	21.9 ng/g	18	609				98.6
Europium	(0.17)	(4)		(0.06)		(1.5)	(0.8)				(1.3)
Gallium		(58)		(1.05)							(15)
Germanium						(1.4)					
Hafnium	(0.43)	(8)		(0.29)			(4.4)				(8)
Hydrogen	5.07%										
Indium							(1.0)				
Iodine							(20)				(2)
Iron (Total)	0.759%	9.4%	31.6	0.239%	99 ng/g	3.35%	3.91%	9.32%	3.57%	4.42%	4.11
Lanthanum	(5.1)						(42)				(29)
Lead	3.67	72.4	(2.8)	1.9	23.7 ng/g	28.2	0.655%				161
Lithium	(10)					(49)					(50)
Magnesium	0.0383%	0.455%				1.09%	(0.8%)	0.61%	1.53%	3.12%	1.20
Manganese	12.4	179	0.23	21.4	28 ng/g	375	(860)	(0.03%)	(0.03%)	(0.02%)	555
Mercury		0.16	(<0.001)			0.063					1.44
Molybdenum	(0.9)	(29)			85 ng/g	(2.0)					
Nickel	6.10	127	28	1.74	49 ng/g	32	82				44.1
Nitrogen	1.56%										
Phosphorus						0.054%		0.10%	0.52%	0.51%	0.0998
Potassium	0.0748%	1.88%				(1.4%)	1.05%	2.20%	1.04%	0.34%	2.00
Rubidium	5.05	131				(87)	(52)				(100)
Samarium	(0.87)						(4.4)				(6.7)
Scandium	(1.9)	(40)		(0.63)		(10.8)	(7)				(12)
Selenium	1.29	10.3	0.18	0.9	9.7 ng/g	(0.6)	27				(1.1)
Silicon	(1.4%)	22.8%				(31%)		24.06%	25.85%	16.83%	29.08
Silver					9.8 ng/g		(6)				
Sodium	0.0515%	0.17%	(90)	(0.24%)		(2.0%)	0.425%	0.25%	0.24%	1.09%	0.547
Strontium	(102)	830			227 ng/g			(0.07%)	(0.20%)	(0.27%)	(130)
Sulfur	1.89%	(0.18%)	2.80%	0.33%		(0.96%)	(5%)		0.15%	0.83%	(0.4)
Tellurium						(0.5)					
Thallium		5.7			8.0 ng/g	(0.5)					1.2
Thorium	1.342	24.7		0.62		(10)	(7.4)				(9.2)
Titanium	0.0454%	(0.8%)		(0.02%)		(0.51%)	(0.40%)	0.75%	0.52%	0.90%	0.457
Tungsten	(0.48)						(4.8)				
Uranium	0.436	10.2		0.24			5.5				3.13
Vanadium	(14)	297	55.4	5.2	45.2 ng/g	94	140				95
Zinc	11.89	220	3.0	4.7	66 ng/g	138	0.476%				438

Values in parentheses are not certified, but are given for information only.

Organic Constituents

SRM	Type	Unit of Issue
1491	Aromatic Hydrocarbons in Hexane	5 ampoules
1492	Chlorinated Pesticides in Hexane	5 ampoules
1493	Polychlorinated Biphenyls in 2,2,4 Trimethylpentane	5 ampoules
1580	Shale Oil	Set of 5, 2mL/ampoules
1581	Polychlorinated Biphenyls in Oil	Set of 8, 5mL/ampoules
1582	Petroleum Crude Oil	Set of 5, 2mL/ampoules
1583	Chlorinated Pesticides in *Iso*octane	Set of 6, 2mL/ampoules
1584	Phenols in Methanol	Set of 5, 2mL/ampoules
1585	Chlorinated Biphenyls	Set of 5, 1.2mL/ampoules
1586	Isotopically Labelled Priority Pollutants	Set of 6, 2mL/ampoules
1587	Nitro PAH in Methanol	Set of 4, 1mL/ampoules
1588	Organics in Cod Liver Oil	Set of 5, 1.2mL/ampoules
1589	Polychlorinated Biphenyls in Human Serum (as Aroclor 1260)	Set of 3
1596	Dinitropyrene Isomers and 1-Nitropyrene in Methylene Chloride	Set of 5, 1.3mL/ampoules
1597	Complex Mixture of Polycyclic Aromatic Hydrocarbons	Set of 4, 1.2mL/ampoules
1614	Dioxin (2,3,7,8 TCDD) in *Iso*octane	Set of 6, 1.2mL/ampoules
1639	Halocarbons (in Methanol)	Set of 5, 1.5mL/ampoules
1647a	Priority Pollutant PAH (in Acetonitrile)	Set of 5, 1.2mL/ampoules
1649	Urban Dust/Organics	10 grams
1650	Diesel Particulate Matter	Set of 5, 100mg/ampoules
1939	Polychlorinated Biphenyls in Sediments	IN PREP
1940	Polychlorinated Biphenyls in Sediments	IN PREP
1941	Organics in Marine Sediment	IN PREP
1974	Organics in Mussel Tissue	IN PREP
1975	Diesel Particulate Bioassay	IN PREP

Anna Carroll, punctual and accurate, receives and processes customers orders by phone and mail.

Organic Constituents (Continued)

SRM	1491	1580	1582	1597		1647	1649	1650
Constituents	(μg/g)	(μg/g)	(μg/g)	(μg)	(μg/mL)	(μg/mL)	(μg/g)	(μg/g)
Anthracene	11.69			101	87.4	3.29		
Benz[a]anthracene	5.37		3.0	98.6	85.3	5.03	2.6	6.5
Benzo[a]pyrene	10.14	21	1.1	95.8	82.9	5.30	2.9	1.2
Benzo[e]pyrene	8.40	18						(10)
Fluoranthene	8.84	54	2.5			10.1	7.1	51
o-Cresol		385						
Phenol		407						
Perylene	10.65	3.4	31	26.1	22.6			(0.13)
Pyrene	8.81	104		235	204	9.84		48
2,6-Dimethylphenol		175						
Benzo[f]quinoline (5,6-Benzoquinoline)		16						
Naphthalene	10.30			1160	1000	22.5		
Acenaphthylene	10.40					19.1		
Acenaphthene	10.89					21.0		
1-Nitropyrene								19
Fluorene	10.87					4.92		
Phenanthrene	10.48		101	462	400	5.06		(71)
Chrysene	10.50			71.7	62.0	4.68		(22)
Benzo[b]fluoranthene	7.85					5.11		
Benzo[k]fluoranthene	8.33					5.02		(2.1)
Benzo[ghi]perylene	7.90			53.7	46.5	4.01	4.5	2.4
Dibenz[a,h]anthracene	7.74					3.68		
Indeno[1,2,3-cd]pyrene	9.40			602	52.1	4.06	3.3	(0.23)
Dibenzothiophene			33					
Fluoranthrene				322	278			
Tryphenylene				12.1	10.5			
1-Methylnaphthalene	12.4							
Biphenyl	10.46							
2,6-Dimethylnaphthalene	10.8							
2,3,5-Trimethylnaphthalene	9.9							
1-Methylphenanthrene	10.4							

Values in parentheses are not certified, but are given for information only.

SRM 1639—Certified Concentration of Halocarbons at 23±3 °C.

Compound	Concentration, ng/μL
Chloroform	6235
Chlorodibromomethane	124.6
Bromodichloromethane	389.9
Bromoform	86.5
Carbon Tetrachloride	157.0
Trichloroethylene	85.8
Tetrachloroethylene	40.6

SRM 1492 Chlorinated Pesticides in Hexane

Pesticide	Concentration (ng/g)
Hexachlorobenzene	308
gamma-HCH	310
Heptachlor	299
Aldrin	304
Heptachlor epoxide	307
cis-Chlordane	305
trans-Nonachlor	297
Dieldrin	307
Mirex	306
2,4′-DDE	303
4,4′-DDE	306
2,4′-DDD	299
4,4′-DDD	296
2,4′-DDT	307
4,4′-DDT	302

SRM 1581 Polychlorinated Biphenyls in Oils

Matrix	Aroclor Type	Concentration (μg/g)
Motor Oil	1242	100
Motor Oil	1260	100
Transformer Oil	1242	100
Transformer Oil	1260	100

SRM 1583 Chlorinated Pesticides in 2,2,4–Trimethylpentane

Pesticide	Concentrations	
	(μg/g)	(μg/mL, 23 °C)
Y-BHC (Lindane)	1.11	0.77
d-BHC	0.76	0.53
Aldrin	0.86	0.59
Heptachlor Epoxide	(0.997)	
4,4′–DDE (p,p′–DDE)	1.23	0.85
4,4′–DDT (p,p′–DDT)	1.90	1.31

SRM 1584 Priority Pollutant Phenols in Methanol

Compound	Concentration (μg/mL, 23 °C)
2–Chlorophenol	64.4
Phenol	29.7
2–Nitrophenol	25.2
2,4–Dimethylphenol	51.6
2,4–Dichlorophenol	35.6
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)

SRM 1585 Chlorinated Biphenyls in 2,2,4-Trimethylpentane (Iso octane)

Chlorinated Biphenyl	Concentration	
	μg/g	μg/mL at 23.0°C
4-Chlorobiphenyl	43.3	29.9
4,4′-Dichlorobiphenyl	9.53	6.57
2,4,4′-Trichlorobiphenyl	3.70	2.55
2,2′,5,5′-Tetrachlorobiphenyl	7.72	5.32
3,3′,4,4′-Tetrachlorobiphenyl	6.62	4.56
2,2′,4,5,5′-Pentachlorobiphenyl	5.24	3.61
2,2′,3,4,4′,5′-Hexachlorobiphenyl	2.37	1.63
2,2′,4,4′,5,5′-Hexachlorobiphenyl	3.06	2.11

SRM 1586 Isotopically Labeled and Unlabeled Priority Pollutants in Methanol

Compound	Concentrations (μg/g)	
	1586-1 (unlabeled)	1586-2 (labeled)
Carbon tetrachloride	128.5	124.4
Benzene	101.1	99.0
Chlorobenzene	133.0	144.0
Phenol	117.0	116.0
Nitrobenzene	126.0	134.5
2-Nitrophenol	103.6	101.9
2,4-Dichlorophenol	102.5	82.2
Naphthalene	126.5	126.6
Bis(2-ethylhexyl)phthalate	63.9	60.4
Benzo[a]pyrene	49.2	44.1

SRM 1587 Nitrated Polycyclic Aromatic Hydrocarbons in Methanol

Compound	Concentrations	
	(μg/g)	(μg/mL, 23 °C)
2-Nitrofluorene	9.67	7.64
9-Nitroanthracene	5.01	3.96
3-Nitrofluoranthene	9.24	7.30
1-Nitropyrene	8.95	7.07
7-Nitrobenz[a]anthracene	9.27	7.32
6-Nitrochrysene	8.13	6.42
6-Nitrobenzo[a]pyrene	(6.1)	(4.8)

SRM 1588 Organics in Cod Liver Oil

Compound	Concentration (ng/g)
Hexachlorobenzene	148
alpha-HCH	86
trans-Chlordane	50
cis-Chlordane	158
trans-Nonachlor	209
Dieldrin	150
4,4′-DDD	277
4,4′-DDE	641
2,4′-DDT	156
4,4′-DDT	529
PCB 101	261
PCB 138	276
PCB 170	45
PCB 180	107

SRM 1589 PCB's in Human Serum

Compound	Concentrations	
	(ng/g)	(ng/mL)
Aroclor 1260	106.0	107.9

SRM 1596 Dinitropyrene Isomers and 1-Nitropyrene in Methylene Chloride

Compound	Concentration	
	μg/g	μg/mL
1-Nitropyrene	4.38	5.81
1,3-Dinitropyrene	2.10	2.79
1,6-Dinitropyrene	4.82	6.39
1,8-Dinitropyrene	7.90	10.48

SRM 1614 Dioxin (2,3,7,8-TCDD in *Iso*octane)

Compound	Concentrations	
	(ng/g)	(ng/mL, 23 °C)
2,3,7,8-TCDD	98.3	67.8
2,3,7,8–TCDD–^{13}C	95.6	65.9

GC/MS System Performance

These SRM's are for evaluating the sensitivity of gas chromatographic/mass spectrometry (GC/MS) instrumentation. They consist of two concentrations each of methyl stearate and benzophenone.

SRM	Type	Concentrations (ng/μL)		Unit Size
		Methyl Stearate	Benzophenone	
1543	GC/MS System Performance	0.99; 4.98	1.01; 5.01	1 Set, 4 vials
8443	GC/MS System Performance	0.99; 4.98	1.01; 5.01	5 Sets, 20 vials

Industrial Hygiene

These SRM's were developed for industrial hygiene analyses to provide reference materials for toxicology research and for monitoring human exposure to selected toxic elements.

Freeze-Dried Urine

SRM's 2670, 2671a, and 2672a consist of freeze-dried urine in 30 mL serum bottles. The freeze-dried urine SRM's are to be reconstituted by the addition of 20 mL of pure water to each bottle. Each unit contains a set of four bottles, two bottles each at normal and elevated levels.

SRM	2670		2671a		2672a	
Type	Toxic Metals		Fluoride		Mercury	
	Low Level	Elevated Level	Low Level	Elevated Level	Low Level	Elevated Level
Aluminum	(0.18) μg/mL	(0.18) μg/mL				
Arsenic	(0.06) μg/mL	0.48 μg/mL				
Beryllium	(≤0.0005) μg/mL	(0.033) μg/mL				
Cadmium	(0.00040) μg/mL	0.088 μg/mL				
Calcium	0.105 mg/mL	0.105 mg/mL				
Chloride	(4.4) mg/mL	(4.4) mg/mL				
Chromium	(0.013) μg/mL	0.085 μg/mL				
Copper	0.13 μg/mL	0.37 μg/mL				
Gold	(0.008) ng/mL	(0.24) μg/mL	0.55 mg/L	5.7 mg/L		
Lead	(0.01) μg/mL	0.109 μg/mL				
Magnesium	0.063 mg/mL	0.063 mg/mL				
Manganese	(0.03) μg/mL	(0.33) μg/mL				
Mercury	(0.002) μg/mL	0.105 μg/mL			(0.002) mg/L	0.105 mg/L
Nickel	(0.07) μg/mL	(0.30) μg/mL				
Platinum	(0.008) ng/mL	(0.12) μg/mL				
Potassium	(1.5) mg/mL	(1.5) mg/mL				
Selenium	0.030 μg/mL	0.46 μg/mL				
Sodium	2.62 mg/mL	2.62 mg/mL				
Sulfate	(1.3) mg/mL	(1.3) mg/mL				
Vanadium		(0.12) μg/mL				

Values in parentheses are not certified, but are given for information only.

Freeze-Dried Urine (Continued)

SRM	1507	1508	RM 8444
Type	THC in Urine	Cocaine in Urine	Cotinine in Urine
Unit Size	3 bottles	IN PREP	4 vials
Certified Concentration	20 ng/mL		Blank level 0.8 ng/g Low level 54 ng/g High level 488 ng/g

Thin Films for X-ray Fluorescence

These SRM's are for standardizing x-ray spectrometers. They 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 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	Chemical Composition (Nominal μg/cm²)											
		Al	Ca	Co	Cu	Fe	Pb	K	Mn	Si	Ti	V	Zn
1832	Thin-Glass Film	15	20	1	2				5	36		5	
1833	Thin-Glass Film					15	17	18		35	14		4

Materials on Filter Media

These SRM's consist of potentially hazardous materials deposited on filters to be used to determine the levels of these materials in industrial atmospheres.

SRM	Type	Unit Size	Material Certified	Quantity Certified (μg/filter)			
				I	II	III	IV
2676c	Metals on Filter Media	Set of 8	Cadmium	0.954	2.83	10.09	(<0.01)
			Lead	7.47	14.92	29.81	(<0.01)
			Manganese	2.11	9.92	19.85	(<0.01)
			Zinc	9.99	49.68	99.28	(<0.01)
2677	Beryllium and Arsenic on Filter Media	2 sets of 4	Beryllium	0.052	0.256	1.03	<0.001
			Arsenic	0.103	1.07	10.5	<0.002
2679a	Quartz on Filter Media	Set of 4	Quartz	<2	30.8	80.2	202.7
			Clay	(370)	(370)	(370)	(370)

Values in parentheses are not certified, but are given for information only.

Blank Filters

"These SRM's, except for SRM's 2678–81, consist of potentially hazardous materials deposited on filter media to be used to determine the levels of these materials in industrial atmospheres. SRM's 2678–81 are blank filters that have been analyzed at NIST and are to be used in the assessment of system blank and in the evaluation of detection limits."

SRM	Type	Diameter	Pore Size	Nominal Filter wt g
2678	Cellulose Acetate Membrane	47 mm	0.45 micron	0.09
2680	Cellulose Acetate Membrane	37 mm	0.80 micron	0.05
2681	Ashless	42.5 mm	—	0.14

Ray McKenzie, a project manager for OSRM, provides responsive, creative leadership for a variety of physical properties and engineering SRM's.

Respirable Quartz

These SRM's consists of quartz powders that are in the respirable size range. They are intended for use in determining the level of quartz in an industrial atmosphere by x-ray diffraction.

SRM	Type	Constituent Certified	Amount
1878	Alpha Quartz	95.5% Crystalline α-quartz	5 g
1879	Cristobalite	98.0% Crystalline Cristobalite	5 g

Asbestos

These SRM's consist of four 3×3 mm sections of a 0.4 mm pore size polycarbonate filter containing chrysotile fibers mixed with an urban dust or with grunerite fibers. They are intended for use in evaluating the techniques used to count and identify chrysotile and grunerite asbestos fibers in filter samples by transmission electron microscopy.

SRM	Type	Fiber Loading
1876a	Chrysotile Asbestos	37 fibers/0.01 mm^2
8410	Chrysotile Asbestos Research Filter	7.9 fibers/0.01 mm^2
8411	Mixed asbestos Research Filter	138 fibers/0.01 mm Chrysotile 43 fibers/0.01 mm Grunerite

SRM 1866, Bulk Asbestos-Common, is a set of the three common bulk mine-grade asbestos materials and one synthetic glass fiber sample. There are 4-5 grams of each sample in the set of materials. The three asbestos types are Chrysotile, Grunerite (Amosite), and Riebeckite (Crocidolite). The optical properties of each of these materials observed by polarized light microscopy have been characterized so that these samples may serve as primary calibration standards for the identification of asbestos types in building material. SRM 1867, Bulk Asbestos-Uncommon, will contain three materials: Anthophylite, Actinolite, and Tremolite and will be used in the same manner and for the same purpose as SRM 1866.

SRM	Type	Asbestos Type
1866	Bulk Asbestos-Common	Chrysotile, Grunerite, Riebeckite
1867	Bulk Asbestos-Uncommon (IN PREP)	Anthophylite, Actinolite, Tremolite

SRM 1866, Bulk Asbestos (a set of four materials), our newest asbestos SRM, joins our other available asbestos SRM's — Chrysotile Filter (SRM 1876a) and Research Filters (8410 and 8411).

Lubricating Materials

Metallo-Organic Compounds

These SRM's are for preparing solutions in oils of known and reproducible concentrations of metals. Certificates give directions for preparing a solution of known concentration in lubricating oil.

SRM	Type	Constituent Certified		
		Element	(Wt. percent)	Wt/Unit (grams)
1075a	Aluminum 2–ethylhexanoate	Aluminum	8.07	5
1051b	Barium cyclohexanebutyrate	Barium	28.7	5
1053a	Cadmium cyclohexanebutyrate	Cadmium	24.8	5
1078b	Tris (1–phenyl–1,3–butanediono)chromium (III)	Chromium	9.6	5
1080a	Bis(1–phenyl–1,3–butanediono)copper (II)	Copper	16.37	5
1079b	Tris (1-phenyl-1,3-butanediono)iron (III)	Iron	10.45	5
1059c	Lead cyclohexanebutyrate	Lead	37.5	5
1060a	Lithium cyclohexanebutyrate	Lithium	4.1	5
1061c	Magnesium cyclohexanebutyrate	Magnesium	6.45	5
1065b	Nickel cyclohexanebutyrate	Nickel	13.89	5
1071b	Triphenyl phosphate	Phosphorus	9.48	5
1066a	Octaphenylcyclotetrasiloxane	Silicon	14.14	5
1077a	Silver 2–ethylhexanoate	Silver	42.60	5
1069b	Sodium cyclohexanebutyrate	Sodium	12.0	5
1070a	Strontium cyclohexanebutyrate	Strontium	20.7	5
1057b	Dibutyltin bis (2–ethylhexanoate)	Tin	22.95	5
1052b	Bis(1–phenyl–1,3-butanediono)oxovanadium (IV)	Vanadium	13.01	5
1073b	Zinc cyclohexanebutyrate	Zinc	16.66	5

Lubricating Base Oils

Each of these SRM's consists of a series of five concentrations (5 bottles, 20 g each) of a single element in a base oil.

SRM	Type	Element	Concentration (μg/g)				
			I	II	III	IV	V
1818	Chlorine in Lubricating Base Oil	Cl	29	63	78	231	558
1819	Sulfur in Lubricating Base Oil	S	299	1070	2865	6030	10550
1836	Nitrogen in Lubricating Base Oil	N			(IN PREP)		

Catalyst Package for Lubricant Oxidation

SRM 1817b is intended primarily for use in evaluating the oxidation stability of lubricating oils, i.e., automative crankcase lubricants. The SRM contains: (1) an oxidized/nitrated fuel fraction, (2) a metal naphthenate mixture, and (3) distilled water. The metal naphthenate mixture has the following weight percentages of metal naphthenates: lead–82, iron–7, copper–4, manganese–3.5, and tin–3.5. SRM 1817b is available as a kit of 5 ampoules of each of the three components. The fuel and metal catalysts are sealed under inert atmosphere to ensure their stabilities.

Wear-Metals in Oil

SRM	1083	1085
Type	Base Oil (ppm)	Wear-Metals in Oil 300 ppm
Unit Size	150 mL	85 mL
ELEMENT (Values in μg/g)		
Aluminum	(<0.5)	296
Chromium	(<0.02)	298
Copper	(<0.5)	295
Iron	(<1)	300
Lead	(<0.04)	(305)
Magnesium	(<0.1)	297
Molybdenum	(<0.01)	292
Nickel	(<0.4)	303
Silicon	(<1)	(308)
Silver	(<0.05)	(291)
Sulfur	(980)	(4806)
Tin	(<0.4)	296
Titanium	(<5)	300

Values in parentheses are not certified, but are given for information only.

Catalyst Characterization Materials

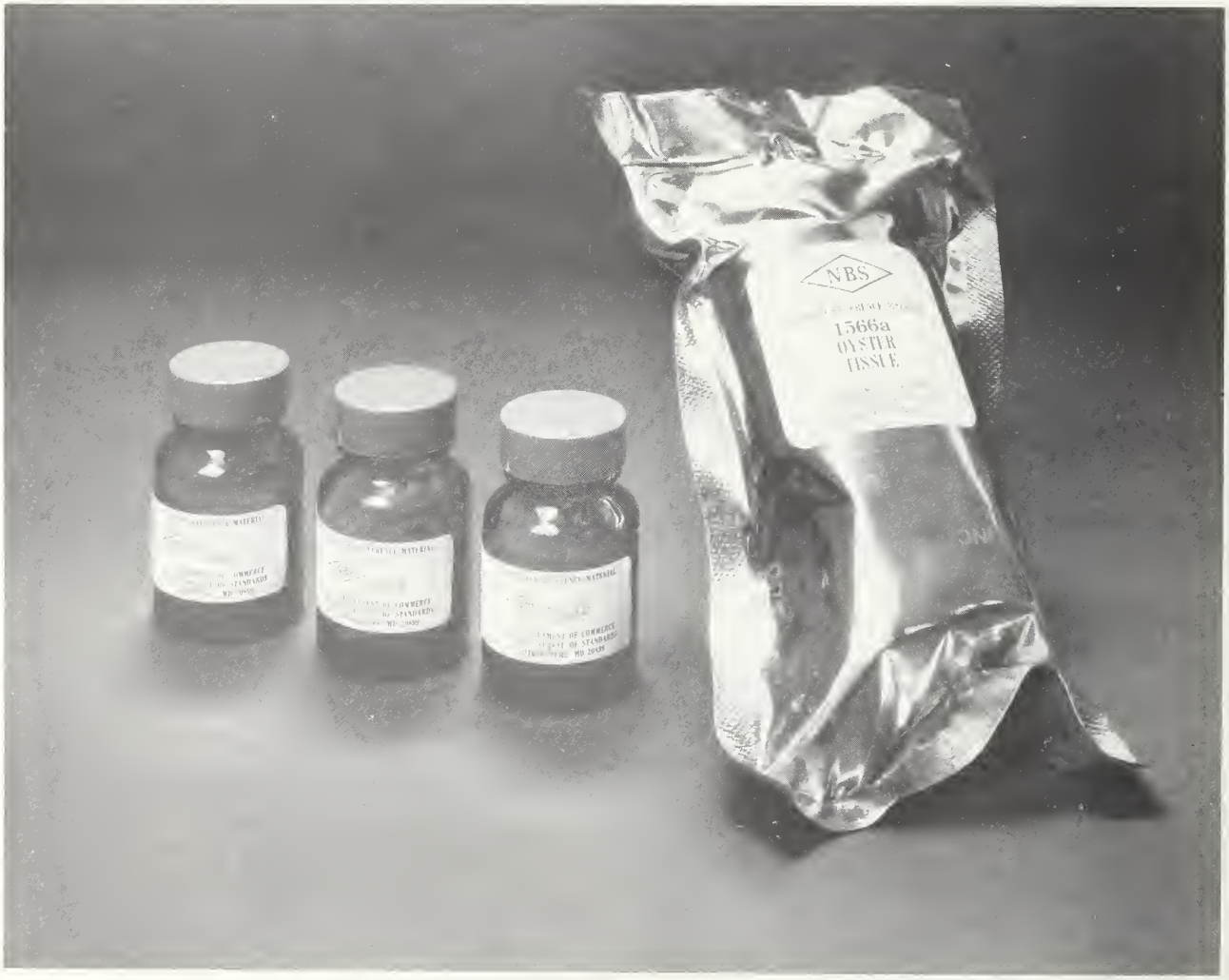
SRM	Type	Wt/Unit (grams)
RM8580	Nickel on Fresh Alumina (NiO 2.92 Wt %)	25 gm
RM8581	Nickel on Fresh Alumina (NiO 14.35 Wt %)	25 gm
RM8582	Nickel on Fresh Alumina (NiO 54.97 Wt %)	25 gm
RM8583	Platinum on Fresh Alumina (Pt 0.5760 Wt %)	50 gm
RM8584	Platinum on Fresh Alumina (Pt 0.540 Wt %)	50 gm
RM8586	FCC Catalyst	25 gm
RM8587	FCC Catalyst	10 gm
RM8588	Faujasite Y	25 gm
RM8589	FCC Catalysts	Set of 6, 50 gm each

Fertilizers

These SRM's are intended for use in the fertilizer industry as working standards for the determination of the certified constituents.

SRM	Type	Wt/Unit (grams)	Composition (Nominal Weight Percent)					
			N	P	K	P_2O_5	K_2O	CaO
193	Potassium Nitrate	90	13.85		38.66			
194	Ammonium Dihydrogen Phosphate	90	12.15	26.92				
200	Potassium Dihydrogen Phosphate	90		22.74	28.76			
120c	Phosphate Rock (Florida)	90				33.34	0.110	48.02
694	Phosphate Rock (Western)	90				30.2	0.51	43.6

SRM	Composition (Nominal Weight Percent)											
	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



SRM's 1845, Cholesterol in Egg Powder and 1566a, Oyster Tissue are two of the important and popular food related SRM's now available.

Ores

SRM	79a	180	181	182	183
Type	Fluorspar, Customs Grade	Fluorspar, High Grade	Lithium Ore (Spodumene)	Lithium Ore (Petalite)	Lithium Ore (Lepidolite)
Unit Weight	120g	120 g	45 g	45 g	45 g
Constituents					
CaF_2	97.39%	98.80%			
Li_2O			6.3$_9$%	4.3$_4$%	4.1$_2$%

SRM	330	331
Type	Copper, Ore Mill Heads	Copper, Ore Mill Tails
Unit Weight	100 g	100 g
Constituents		
Cu	0.84%	0.091%
Re	0.30 ppm	0.04 ppm
Mo	0.018%	0.0022%
Au	(0.093 ppm)	(0.034 ppm)
Ag	(1.51 ppm)	(0.243 ppm)

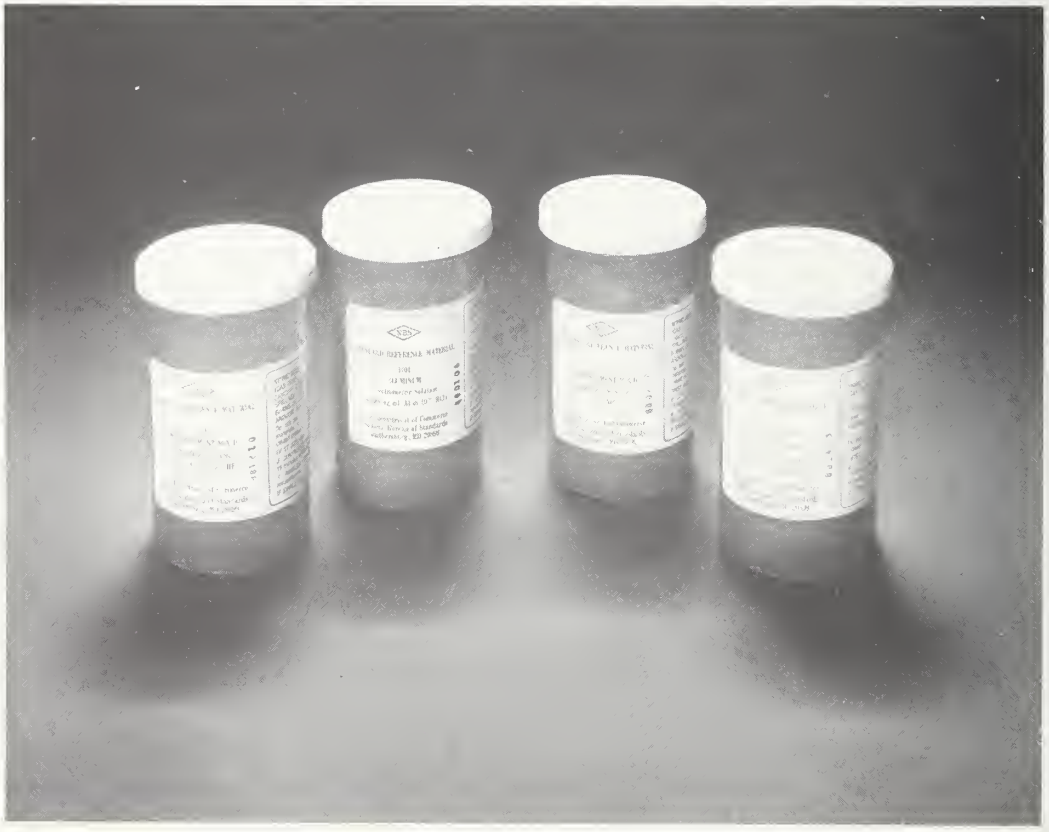
SRM	Type	Wt/ Units (grams)	Constituent (Nominal Weight Percent)				
			WO_3	Ca	Fe	Pb	Mn
277	Tungsten Concentrate	100	67.4	(0.37)	(7.4)	(0.07)	(10.0)
2430	Scheelite Ore	100	70.26	As 0.002	(1.0)	Bi 0.078	(0.12)

SRM	Mo	Nb	O_2	P	Si	S	Ta	Sn	Ti
277	(0.06)	(1.00)	(21.4)	(0.03)	(0.85)	(0.25)	(0.20)	(0.54)	(2.2)
2430	0.22	Cu (0.01)	Al (0.4)	0.017	Mg (0.5)	0.26	(<0.01)	K (0.16)	Na (0.02)

Values in parentheses are not certified, but are given for information only.

Ores (Continued)

SRM	27f	690	691	692	693
Type	Iron Ore, Sibley	Iron Ore, Canada	Iron Oxide, Reduced	Iron Ore, Labrador	Iron Ore, Nimba
Unit Weight	100 g	150 g	100 g	150 g	150 g
Constituents (Nominal Weight Percent)					
Al_2O_3	0.82	0.18	1.22	1.41	1.02
CaO	0.039	0.20	0.63	0.023	0.016
Co			0.030		
Cu			0.032		
Total Fe	65.97	66.85	90.8	59.58	65.11
MgO	0.019	0.18	0.52	0.035	0.013
MnO	0.011	0.23	0.043	0.46	0.091
P	0.041	0.011	0.006	0.039	0.056
K_2O	0.008	0.0030		0.039	0.0028
SiO_2	4.17	3.71	3.7	10.14	3.87
Na_2O	0.012	0.003	0.186	0.008	0.0028
S	0.005	0.003	0.008	0.005	0.005
TiO_2	0.019	0.022	0.27	0.045	0.035



Pictured here are four of the more than 70 spectrometric standard solutions now available either as single element or multielement solutions.

Ores (Continued)

SRM	69b	696	697	698	699	120c	694	25d	670	600	1835
Type	Bauxite, Arkansas	Bauxite, Surinam	Bauxite, Dominican	Bauxite, Jamaican	Alumina (Reduction Grade)	Phosphate Rock, Florida	Phosphate Rock, Western	Manganese Ore	Rutile Ore	Bauxite, Australian	Borate Ore
Unit Weight	60 g	60 g	60 g	60 g	60 g	90 g	90 g	100 g	90 g	90 g	60 g
Constituents (Nominal Weight Percent)											
Al_2O_3	48.8	54.5	45.8	48.2		1.30	1.8	5.32		40.0	3.474
BaO	(0.008)	(0.004)	(0.015)	(0.008)				(0.21)			0.0497
CdO						0.0010	0.015				
CaO	0.13	0.018	0.71	0.62	0.036	48.02	43.6	(0.052)		0.22	21.622
Co	(0.0001)	(0.00009)	(0.0013)	(0.0045)			F 3.2				
Cr_2O_3	0.011	0.047	0.100	0.080	0.0002		(0.10)		0.23	0.024	
Fe_2O_3	7.14	8.70	20.0	19.6	0.013	1.02	0.79	3.92	0.86	17.0	1.141
MgO	0.085	0.012	0.18	0.058	0.0006	0.32	0.33			0.05	3.411
MnO	0.110	0.004	0.41	0.38	0.0005	0.027	0.0116	Mn 51.78		0.013	0.0333
P_2O_5	0.118	0.050	0.97	0.37	0.0002	33.34	30.2	0.25		0.039	
K_2O	0.068	0.009	0.062	0.010		0.110	0.51	0.93		0.23	1.261
SiO_2	13.43	3.79	6.81	0.69	0.014	5.5	11.2	2.52	0.51	20.3	18.408
Na_2O	(0.025)	(0.007)	(0.036)	(0.015)	0.59	0.52	0.86			0.022	3.484
SO_3	0.63	0.21	0.13	0.22						0.19	1.477
TiO_2	1.90	2.64	2.52	2.38		0.103	(0.11)	0.13	96.16	1.31	0.1332
U							0.01414				
V_2O_5	0.028	0.072	0.063	0.064	0.0005		0.31		0.66	0.060	
ZnO	0.0035	0.0014	0.037	0.029	0.013		(0.19)			0.003	
ZrO_2	0.29	0.14	0.065	0.061					0.84	0.060	
Ga_2O_3					0.010						
Li_2O					0.002						
Available Oxygen								14.28			
Moisture								(0.96)			
Loss on Ignition	27.2	29.9	22.1	27.3							

Values in parentheses are not certified, but are given for information only.

Clays

SRM	97b	98b	679
Type	Flint Clay	Plastic Clay	Brick Clay
Unit Weight	60 g	60 g	75 g
Element	Nominal Concentrations (μg/g, unless noted otherwise)		
Al	20.76 wt. %	14.30 wt. %	11.01 wt. %
Ba	(0.018) wt. %	(0.07) wt. %	
Ca	0.0249 wt. %	0.0759 wt .%	0.1628 wt. %
Ce			(105)
Cs	(3.4)	(16.5)	(9.6)
Cr	227	119	109.7
Co	(3.8)	(16.3)	(26)
Eu	(0.84)	(1.3)	(1.9)
Hf	(13)	(7.2)	(4.6)
Fe	0.831 wt. %	1.18 wt. %	9.05 wt. %
Li	550	215	71.7
Mg	0.113 wt. %	0.358 wt. %	0.7552 wt. %
Mn	47	116	(1730)
P	(200)	(300)	(750)
K	0.513 wt. %	2.81 wt. %	2.433 wt. %
Rb	(33)	(180)	(190)
Sc	(22)	(22)	(22.5)
Si	19.81 wt. %	26.65 wt. %	24.34wt. %
Na	0.0492 wt. %	0.1496 wt. %	0.1304 wt. %
Sr	84	189	73.4
Th	(36)	(21)	(14)
Ti	1.43 wt. %	0.809 wt. %	0.577 wt. %
Zn	(87)	(110)	(150)
Zr	(0.05) wt. %	(0.022) wt. %	
Sb	(2.2)	(1.6)	
Loss on Ignition	(13.3 wt. %)	(7.5 wt. %)	

Values in parentheses are not certified, but are given for information only.

Karen Applestein provides the alertness and attention to detail that ensures that each customers order or service request is handled punctually and accurately.

Rocks, Minerals, and Refractories

SRM	1c	88b	70a	99a	81a	165a	1413	2709	2710
Type	Lime-stone, argilla-ceous	Limestone, dolomitic	Feld-spar, potash	Feld-spar, soda	Glass sand	Glass sand (low iron)	Glass sand (high alumina)	Agricultur-al Soil (Baseline Levels)	Agricultur-al Soil (Elevated Levels)
Unit Weight	50 g	75 g	40 g	40 g	75 g	75 g	75 g	IN PREP	IN PREP
Constituents (Nominal Weight Percent)									
Al_2O_3	1.30	0.336	17.9	20.5	0.66	0.059	9.90		
BaO		CO_2 46.37	0.02	0.26			0.12		
CaO	50.3	30.12	0.11	2.14			0.74		
Cr_2O_3					46 μg/g	(1) μg/g			
Fe_2O_3	0.55	0.277	0.07_5	0.06_5	0.082	0.012	0.24		
MgO	0.42	21.03		0.02			0.06		
MnO	0.025	0.0160							
P_2O_5	0.04	0.0044		0.02					
K_2O	0.28	0.1030	11.8	5.2			3.94		
Rb_2O			0.06						
SiO_2	6.84	1.13	67.1	65.2			82.77		
Na_2O	0.02	0.0290	2.5_5	6.2			1.75		
SrO	0.030	0.0076							
TiO_2	0.07	(0.016)	0.01	0.007	0.12	0.011	0.11		
ZrO_2					0.034	0.006			
Loss on Ignition	39.9	(46.98)	0.40	0.26					

Values in parentheses are not certified, but are given for information only.

Mercury in Soil

SRM	RM 8406	RM 8407	RM 8408
Type	Mercury in Soil	Mercury in Soil	Mercury in Soil
Unit Weight	110 μg/g	50 μg/g	0.07 μg/g

Rocks, Minerals, and Refractories (Continued)

SRM	154b	278	688	76a	77a	78a
Type	Titanium Dioxide	Obsidian Rock	Basalt Rock	Burnt Refractory (Al_2O_3–40%)	Burnt Refractory (Al_2O_3–60%)	Burnt Refractory (Al_2O_3–70%)
Unit Weight	90 g	35 g	60 g	75 g	75 g	75 g
Constituents (Nominal Weight Percent)						
Al_2O_3		14.15	17.36	38.7	60.2	71.7
CaO	(~0.01)	0.983	(12.17)	0.22	0.05	0.11
Cr			332 μg/g			
Cu		5.9 μg/g				
FeO		1.36	7.64			
Fe_2O_3	(0.006)	2.04	10.35	1.6_0	1.0_0	1.2
Pb		16.4 μg/g	3.3 μg/g			
Li_2O				0.042	0.02_5	0.12
MgO	(~0.01)	(0.23)	(8.4)	0.52	0.38	0.70
MnO		0.052	0.167			
Ni		3.6 μg/g				
P_2O_5	(0.04)	0.036	0.134	0.12_0	0.092	1.3
K_2O		4.16	0.187	1.33	0.09_0	1.22
Rb		127.5 μg/g	1.91 μg/g			
SiO_2	(0.01)	73.05	48.4	54.9	35.0	19.4
Na_2O		4.84	2.15	0.07	0.037	0.078
Sr		63.5 μg/g	169.2 μg/g			
SrO				0.037	0.009	0.25
Th		12.4 μg/g	0.33 μg/g			
TiO_2	99.74	0.245	1.17	2.0_3	2.6_6	3.2_2
Tl		0.54 μg/g				
U		4.58 μg/g				
Loss on Ignition				(0.34)	(0.22)	(0.42)

Values in parentheses are not certified, but are given for information only.

Rocks, Minerals, and Refractories (Continued)

SRM	103a	198	199
Type	Chrome Refractory	Silica Brick	Silica Brick
Unit Weight	60 g	45 g	45 g
Constituents (Nominal Weight Percent)			
Al_2O_3	29.96	0.16	0.48
CaO	0.69	2.71	2.41
Cr_2O_3	32.06		
FeO	12.43		
Fe_2O_3		0.66	0.74
Li_2O		0.001	0.002
MgO	18.54	0.07	0.13
MnO	0.11	0.008	0.007
P_2O_5	0.01	0.022	0.015
K_2O		0.017	0.094
SiO_2	4.63		
Na_2O		0.012	0.015
TiO_2	0.22	0.02	0.06
ZrO_2	0.01		
Loss on Ignition		0.21	0.17

Values in parentheses are not certified, but are given for information only.

Carbides

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent)					
			SiC	Total C	Free C	Fe	O_2	N_2
112b	Silicon Carbide	80	97.37	29.43	0.26	0.13		
276a	Tungsten Carbide	75		6.11	(0.02)		(0.03)	(0.003)

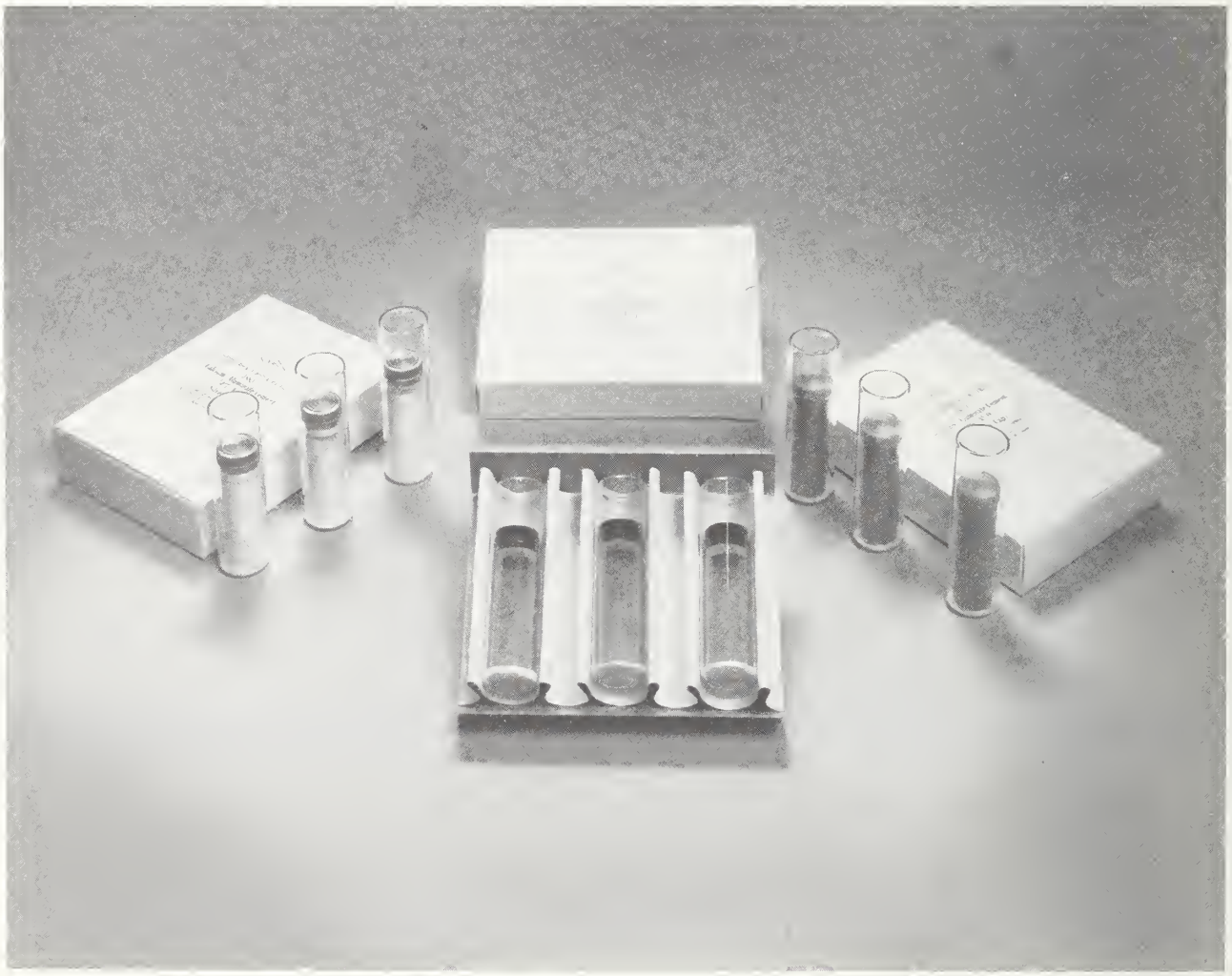
Values in parentheses are not certified, but are given for information only.

Cemented Carbides

SRM's 887–9 are fine powders prepared from sintered Tungsten Carbide bare materials.

SRM	887	888	889
Type	Cemented Carbide (W83-Co10)	Cemented Carbide (W64- Co25-Ta5)	Cemented Carbide (W75- Co9-Ta5-Ti4)
Unit Weight	100 g	100 g	100 g
Chemical Composition			
Cobalt	10.35	24.7	9.50
Tantalum		4.77	4.60
Titanium			4.03
Carbon	(5.5)	(4.6)	(6.0)
Tungsten	Bal	Bal	Bal

Values in parentheses are not certified, but are given for information only.



The portland and calcium aluminate SRM's pictured here are recent additions to very popular "630" portland cement composition SRM's. A new series—SRM's 1884-1889—are now available to replace the "630" series as those supplies are exhausted.

Glasses

SRM	89	91	92	93a	620	621	1411	1412	1830	1831	1834
Type	Lead-Barium	Opal Powder	Low-Boron Soda-Lime Powder	High-Boron Boro-silicate	Soda-Lime, Flat	Soda-Lime, Con-tainer	Soft Boro-silicate	Multi Compo-nent	Soda-Lime, Float	Soda-Lime, Sheet	Fused Ore Glass
Unit Size	45 g	45 g	45 g	Wafer 32 mm D×6 mm	3 platelets 35×35×3 mm	3 disks 38 mm D×5 mm	10 plate-lets	8 platelets	3 platelets 38×38×6 mm	3 platelets 37×37×3 mm	IN PREP
Constituent (Nominal Weight Percent)											
SiO_2	65.35	67.5	(75.0)	80.8	72.08	71.13	58.04	42.38	73.07	73.08	
PbO	17.50	0.10						4.40			
Al_2O_3	0.18	6.01		2.2_8	1.80	2.76	5.68	7.52	0.12	1.21	
Fe_2O_3	0.049	0.079		0.028	0.043	0.040	0.050	(0.031)	0.121	0.087	
ZnO		0.08	(0.2)				3.85	4.48			
CdO								4.38			
MnO	0.088	(0.008)									
TiO_2	0.01	0.019		0.01_4	0.018	0.014	0.02		0.011	0.019	
ZrO_2	0.005	0.009		0.04_2		0.007					
CaO	0.21	10.49	(8.3)	0.01	7.11	10.71	2.18	4.53	8.56	8.20	
BaO	1.40					0.12	5.00	4.67			
Li_2O								(4.50)			
MgO	0.03	(0.008)	(0.1)	0.00_5	3.69	0.27	0.33	(4.69)	3.90	3.51	
K_2O	8.40	3.24	(0.6)	0.01_4	0.41	2.01	2.97	4.14	0.04	0.33	
Na_2O	5.70	8.47	(13.1)	3.9_8	14.39	12.74	10.14	4.69	13.75	13.32	
B_2O_3			0.70	12.5_6			10.94	4.53			
P_2O_5	0.23	0.023									
As_2O_5	0.36	0.10									
As_2O_3	0.03	0.09			0.056	0.030					
SO_3	0.03				0.28	0.13			0.26	0.25	
Cl	0.05	0.015		0.06_0							
SrO							0.09	4.55			
F		5.73									
Loss on Ignition	0.32		(0.42)								

Values in parentheses are not certified, but are given for information only.

Cements

These SRM's 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.

SRM	1880	1881	1882	1883	1884	1885	1886
Type	BLACK	WHITE	ORANGE	SILVER	IVORY	TURQUOISE	CRANBERRY
Unit Weight	15 g	15 g	15 g	15 g	15 g	15 g	15 g
Constituent (Nominal Weight Percent)							
CaO	63.1_4	58.6_8	37.6	27.8	64.01	62.14	67.43
SiO_2	19.8_2	22.2_5	3.40	0.35	23.19	21.24	22.53
Al_2O_3	5.0_3	4.1_9	38.6	71.2	3.31	3.68	3.99
Fe_2O_3	2.91	4.68	15.8	0.08	3.30	4.40	0.31
SO_3	3.37	3.6_5			1.67	2.22	2.04
MgO	2.6_9	2.62	1.25	0.29	2.32	4.02	1.60
K_2O	0.91	1.17	0.12	(0.01)	0.51	0.83	0.16
TiO_2	0.23	0.2_3	1.83	(0.01)	0.16	0.20	0.19
Na_2O	0.28	0.04	(0.06)	0.32	0.13	0.38	0.02
SrO	0.06	0.11			0.048	0.037	0.11
P_2O_5	0.29	0.09			0.12	0.10	0.025
Mn_2O_3	0.08	0.26			0.11	0.12	0.013
F	0.10	0.09			(0.03)	(0.05)	(0.01)
ZnO	0.01	0.01			(0.02)	(0.03)	(<0.01)
Cr_2O_3	Cl 0.02				(<0.01)	(<0.04)	(<0.01)
Cl					(0)	(0.02)	(0)
L.O.I. (Loss-on-Ignition)					1.17	0.74	1.73
Total					(100.05)	(100.19)	(100.02)

Values in parentheses are not certified, but are given for information only.

Cements (continued)

SRM	1887	1888	1889	8486	8487	8488
Type	BROWN	PURPLE	GRAY	Portland Cement Clinker	Portland Cement Clinker	Portland Cement Clinker
Unit Weight	15 g	15 g	15 g	3×10g	3×10g	3×10g
Constituent (Nominal Weight Percent)						
CaO	62.88	63.78	65.08	(63.36)	(67.20)	(66.50)
SiO_2	19.98	20.86	20.44	(22.48)	(21.43)	(22.68)
Al_2O_3	5.59	5.35	5.61	(4.70)	(5.53)	(4.90)
Fe_2O_3	2.16	3.18	2.67	(3.60)	(1.98)	(4.07)
SO_3	4.61	3.16	2.68	(0.27)	(0.88)	(0.31)
MgO	1.26	0.71	1.38	(4.73)	(1.48)	(0.98)
K_2O	1.27	0.56	0.32	(0.42)	(0.72)	(0.35)
TiO_2	0.27	0.29	0.21	(0.25)	(0.27)	(0.24)
Na_2O	0.10	0.14	0.11	(0.10)	(0.14)	(0.11)
SrO	0.07	0.07	0.20	(0.05)	(0.11)	(0.13)
P_2O_5	0.075	0.085	0.15	(0.06)	(0.29)	(0.08)
Mn_2O_3	0.072	0.025	0.24	(0.10)	(0.04)	(0.03)
F	(0.11)	(0.02)	(0.04)			
ZnO	(0.01)	(0.01)	(<0.01)			
Cr_2O_3	(<0.01)	(0.01)	(0.01)			
Cl	(0.007)	(0.015)	(0.002)			
L.O.I. (Loss on-Ignition)	1.49	1.79	0.92	(0.16)	(0.17)	(0.21)
Total	(99.908)	(100.05)	(100.04)	(100.28)	(100.20)	(100.60)

Values in parentheses are not certified, but are given for information only.

Portland Cement Clinkers

These RM's 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_3S)*, aluminate (C_3A)*, and ferrite (($C_2(A,F)$)*.

[*Note: Cement chemist's notation: C=CaO, S=SiO_2, A=Al_2O_3, F=Fe_2O_3.]

RM	Concentration (wt. %)		
Phase	8486	8487	8488
Alite	(58.47)	(73.39)	(64.97)
Belite	(23.18)	(7.75)	(18.51)
Aluminate	(1.15)	(12.09)	(4.34)
Ferrite	(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, but are given for information only.

Trace Elements

The SRM's are for trace chemical analysis, specifically for calibrating instruments and evaluating analytical techniques used to determine trace elements in inorganic matrices.

SRM	607	610–611	612–613	614–615	616–617
Type	Trace Elements in Potassium Feldspar	Trace Elements in Glass	Trace Elements in Glass	Trace Elements in Glass	Trace Elements in Glass
Concentration	(μg/g)	(500 ppm)	(50 ppm)	(1 ppm)	(0.02 ppm)
Wafer Thickness		610 3 mm 611 1 mm	612 3 mm 613 1 mm	614 3 mm 615 1 mm	616 3 mm 617 1 mm
Unit of Issue	5 g	6 Wafers	6 Wafers	6 Wafers	6 Wafers
Element		Nominal Concentrations (ppm)			
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)			

In addition to the elements listed above, the glass SRM's 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.

NOTE: Glass—Nominal Composition: 72% SiO_2, 12% CaO, 14% Na_2O, and 2% Al_2O_3.

Values in parentheses are not certified, but are given for information only.

Nuclear Radiation Monitoring

Radiation Dosimetry

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

SRM	Identification (Batch Name)	Cobalt Content (Weight Percent)
953	Neutron density monitor wire (Co in Al)	0.116

Fission Track Glass

This SRM contains uranium at three concentration levels, and will aid laboratories performing fission track analyses in interlaboratory comparisons of data and in monitoring neutron fluences. The material was irradiated in the NIST 10 Megawatt Research Reactor, at two different neutron energies.

The SRM unit contains four unirradiated glass wafers and two irradiated wafers.

SRM	Uranium Content (ng/g)	U (Atom Percent)	Reactor Position	Cu Foil	Au Foil
				Neutron Fluence ($\times 10^{14}$n·cm^{-2})	
963a	0.823	0.2792	RT–3:	41.2	45.8
			RT–4:	39.5	43.0

Stable Isotopic Materials

The isotopic composition of these SRM's has been determined by mass spectrometry.

SRM	Isotopic Reference Standards	Element Certified	Wt/Unit (grams)
951	Boric Acid	Boron	100
952	Boric Acid, 95% Enriched ^{10}B	Boron	0.25
975	Sodium Chloride	Chlorine	0.25
976	Copper Metal	Copper	0.25
977	Sodium Bromide	Bromine	0.25
978a	Silver Nitrate	Silver	0.25
979	Chromium Nitrate	Chromium	0.25
980	Magnesium Metal	Magnesium	0.25
*981	Lead Metal, Natural	Lead	1.0
*982	Lead Metal, Equal Atom (206/208)	Lead	1.0
*983	Lead Metal, Radiogenic (92%-206)	Lead	1.0
984	Rubidium Chloride, assay and isotopic	Rubidium	0.25
985	Potassium Chloride, assay and isotopic	Potassium	1.0
986	Nickel	Nickel	1.0
987	Strontium Carbonate, assay and isotopic	Strontium	1.0
989	Rhenium, assay and isotopic	Rhenium	pkg. (50)
990	Silicon, assay and isotopic	Silicon	wafer, 3 cm×0.2 cm
991	Lead-206 Spike, assay and isotopic	Lead	15
994	Gallium Metal, isotopic	Gallium	0.25
997	Thallium Metal, isotopic	Thallium	0.25

*Sold as a set containing SRM 981, 982, and 983.

John Moody, a research chemist in the Inorganic Analytical Research Division, prepares some botanical materials in the clean room for trace analysis.

Physical Properties

ION ACTIVITY

pH

These SRM's are used to prepare solutions of known hydrogen ion concentration to calibrate commercial pH instruments. SRM's 186Id and 186IId, 191a and 192a, and 922 and 923 are certified for use as admixtures only. SRM's 186Id and 186IId may be used to prepare a solution with a pH of 6.863 at 25 °C, or a physiological buffer solution with a pH of 7.41 at 25 °C.

SRM	Type	pH(S) Values (at 25 °C)	Wt/Unit (grams)
185f	Potassium hydrogen phthalate	4.006	60
186Id	Potassium dihydrogen phosphate	(see above)	30
186IId	Disodium hydrogen phosphate		30
187c	Sodium tetraborate decahydrate (Borax)	9.180	30
188	Potassium hydrogen tartrate	3.557	60
189a	Potassium tetroxalate	1.681	65
191a	Sodium bicarbonate	10.011	25
192a	Sodium carbonate		30
922	Tris(hydroxymethyl)aminomethane	7.699	25
923	Tris(hydroxymethyl)aminomethane hydrochloride		35

pD

These SRM's are for the preparation of solutions of known deuterium-ion concentration to calibrate pH indicating equipment to indicate pD data. SRM's 2186I and 2186II, and 2191a and 2192a are certified for use as admixtures only.

SRM	Type	pD(S) Values (at 25 °C)	Wt/Unit (grams)
2181	Hepes/pH Buffer	7.503	60
2182	Hepes/pH Buffer	7.516	60
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

Ion-Selective Electrodes

These SRM's 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 mole per liter.

SRM	Type	Certified Property	Wt/Unit (grams)
2201	Sodium Chloride	pNa, pCl	125
2202	Potassium Chloride	pK, pCl	160
2203	Potassium Fluoride	pF	125

METROLOGY

Scanning Electron Microscope (SEM)

These SRM's are for calibrating the magnification scale and evaluating the performance of Scanning Electron Microscopes. SRM 484f has spacings of 0.5, 1, 2, 5, 10, 30, and 50 μm and can be used to calibrate the magnification scale of an SEM from 1000 to 20,000 X to an accuracy of 5 percent or better. SRM 2069a consists of graphitized natural fibers with smooth and uniform edges on an SEM specimen mount.

SRM	Type	Size
484f	SEM Magnification Standard	11 mm D, 0.65 mm high
2069a	SEM Performance Standard	12 mm D, 3 mm peg

Robbin Frazer creates a warm, friendly atmosphere in the certification and production office where she helps perform the documentation and records keeping for SRM certification projects.

Optical Microscope Linewidth-Measurement

These SRM's 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. The accuracy of a measured linewidth or line spacing is ±0.05 μm or better. They are not for use with partially transmitting materials, in reflected light with opaque materials, or in a scanning electron microscope. SRM 475 is made with anti-reflective chromium on a borosilicate glass substrate. SRM 476 is made with bright chromium.

SRM	Type	Spacings	Size
473	Optical Linewidth Standard IN PREP		
475	Linewidth Measurement Standard	0.5 to 12 μm	6.35×6.35×0.15 cm
476	Linewidth Measurement Standard IN PREP	0.5 to 12 μm	6.35×6.35×0.15 cm

Depth Profiling

This SRM is for calibrating equipment used to measure sputtered depth and erosion rates in surface analysis. SRM 2135c consists of nine alternating metal thin-film layers—five layers of pure chromium and four of pure nickel—on a polished silicon (100) substrate. It is certified for total chromium and total nickel thickness, for individual layer uniformity, for Ni/Cr bi-layer uniformity, and for individual layer thickness. The nominal thicknesses for Cr and Ni are 53 and 66 nm, respectively.

SRM	Type	Unit/Size
2135c	Ni-Cr Thin-Film Depth Profile Standard IN PREP	1×2.54×0.04 cm
2136	Cr/CrO Thin-Film Depth Profile Standard	1×2.54×0.04 cm
2137	Boron Implant in Silicon Depth Profile IN PREP	

Lorna Sniegoski, research chemist in the Organic Analytical Research Division, uses a microbalance to weigh an analyte to prepare a solution for analysis of an SRM.

COATING THICKNESS

These magnetic type thickness SRM's are 30×30 mm for calibrating coating thickness gages used to measure the thickness of nonmagnetic coatings on steel, or nickel on steel. The steel substrates have the properties of AISI 1010 steel and the nickel coatings have the properties of an annealed Watts nickel electrodeposited free of cobalt and iron.

These SRM's may be used to measure the thickness of paint and other organic coatings on steel, as well as zinc (galvanized) and other nonmagnetic metallic coatings.

Nonmagnetic Coating on Magnetic Substrate (Cu and Cr on Steel)

SRM	Unit Size	Nominal Coating Thickness	
		micrometer	milliinch (mil)
1321	Set of 4	34, 37, 42, 47	7.4, 1.5, 1.7, 1.9
1322	Set of 4	53, 60, 69, 80	2.1, 2.4, 2.8, 3.2
1323	Set of 4	4, 112, 135, 167	3.8, 4.5, 5.4, 6.7
1357	Set of 3	6, 20, 48	0.24, 0.8, 1.9
1358	Set of 3	80, 225, 1000	3.1, 10, 39
1359	Set of 4	48, 140, 505, 800	2.0, 5.5, 20, 32
1360	Set of 4	2.5, 6, 12, 20	0.1, 0.2, 0.5, 0.8
1361a	Set of 4	6, 12, 25, 48	0.2, 0.5, 1.0, 2.0
1362a	Set of 4	40, 80, 140, 205	1.6, 3.1, 5.5, 7.9
1363a	Set of 4	255, 385, 505, 635	9.8, 16, 20, 26
1364a	Set of 4	800, 1000, 1525, 1935	32, 39, 59, 79

Magnetic Coating on Magnetic Substrate (Nickel on Steel)

SRM	Unit Size	Nominal Coating Thickness	
		micrometer	milliinch (mil)
1365a*	Set of 4	3, 9, 15, 20	0.1, 0.4, 0.6, 0.8
1366a*	Set of 4	25, 34.5, 40, 50	1.0, 1.4, 1.6, 2.0

*SRM's 1365a and 1366a will be reissued as SRM's 1331–1334 and 1335–1338, respectively.

Solder Thickness Standards

SRM	Type	Unit Size
2321	Solder Thickness	IN PREP
2322	Solder Thickness	IN PREP

COATING WEIGHT

The gold coating SRM's are 15×15 mm and were measured by beta-ray backscatter and x-ray fluorescence techniques relative to NIST gold coating materials for which the average weights per unit area were determined by weight and area measurements. These SRM's are for calibrating equipment used to measure weight per unit area of gold coating of equivalent purity.

Gold Coating on Nickel

SRM	Unit Size	Nominal Coating Weight (mg/cm²)	Nominal Coating Thickness	
			micrometer	microinch
1379	1 each	0.35	0.175	7
1380	1 each	0.55	0.275	11
1387	1 each	2.2	1.4	45
1399b	Set of 4	1.5, 3.0, 6.0, 14.0	0.8, 1.5, 3, 7	30, 60, 120, 280

ELLIPSOMETRY

Each of these SRM's is certified for the ellipsometric parameters of delta (Δ) and psi (Ψ) and the derived thickness and refractive index of the silicon dioxide layer on the silicon wafer.

SRM	Type	Unit Size	Nominal Thickness
2531	Thin Film Thickness	IN PREP	50 nm
2532	Thin Film Thickness	76 mm Dia wafer	100 nm
2533	Thin Film Thickness	IN PREP	200 nm
2534	Thin Film Thickness	IN PREP	25 nm

Carmelita Davis exhibits a warm, expressive personality and dependability as she handles the Materials Safety Date Sheets along with other responsibilities.

Glass

Chemical Resistance (Durability) of Glass

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

SRM	Type	Unit of Issue	mL of N/50 H_2SO_4
622	Soda-lime-silica	2.2 kg	7.67
623	Borosilicate	2.2 kg	0.34

Electrical Properties of Glass

SRM 624 is for checking test methods and for calibrating equipment used to determine the dc volume resistivity of glass per ASTM C657. SRM 774 is for checking methods used to determine dielectric constant and ac loss characteristics of insulating materials per ASTM D150.

SRM	Type	Unit of Issue	Approximate Value
624	Lead-silica, for dc resistivity	200 g	$\log_{10}\rho \sim 9.9$ Ω-cm
774	Lead-silica, for dielectric constant	5×5×2.5 cm	K~7.47

Viscosity

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

SRM	Temperature (°C) at Viscosity (poises)										
	10^2	10^3	10^4	10^5	10^6	10^7	10^8	10^9	10^{10}	10^{11}	10^{12}
710a	(IN PREP)										
711	1327.1	1072.8	909.0	794.7	710.4	645.6	594.3	552.7	518.2	489.2	464.5
717	1545.1	1248.8	1059.4	927.9	831.2	757.1	698.6	651.1	611.9	579.0	550.9

Viscosity Fixpoints

SRM	Type of Glass	Unit of Issue	Softening Point °C	Annealing Point °C	Strain Point °C
709	Extra Dense Lead	500 g	384	328	311
710a	Soda Lime-Silica, type 523/586 IN PREP				
711	Lead-Silica, type 617/366	1.3 kg	602	432	392
712	Mixed Alkali Lead Silicate ¼ in patties (6 pcs.)	225 g	528	386	352
713	Dense Barium Crown 620/603 1⅜ in diam × ⅝ in thick gobs (4 pcs.)	225 g	738	631	599
714	Alkaline Earth Alumina Silicate ¼ in diam cane (16 pcs.—6 in long)	225 g	908	710	662
715	Alkali-Free Aluminosilicate ¼ in diam cane (13 pcs.—6 in long)	200 g	961	764	714
716	Neutral, ½ in diam cane (6 pcs.—6 in long)	250 g	794	574	530
717	Borosilicate, 4.2 cm × 4.2 cm × 12.5 cm bar	450 g	720	516	471

Relative Stress Optical Coefficient

These glasses are for calibrating instruments used to measure relative stress optical coefficient per ASTM C770. They are rectangular bars.

SRM	Type of Glass	Unit of Issue	Relative Stress Optical Coefficient at $\lambda = 546.1$ nm	
708	Lead-Silica, A	625 g	Glass A	$C = 2.857$ Brewsters, $10^{-12} m^2/N$
	Borosilicate, B	275 g	Glass B	$C = 3.652$ Brewsters, $10^{-12} m^2/N$
709	Extra dense Lead	500 g		$C = -1.359$ Brewsters, $10^{-12} m^2/N$

Glass Liquidus Temperature

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 C829.

SRM	Type	Unit of Issue	Temperature, °C
773	Soda-lime-silica, for liquidus temperature 2.5 × 2.5 × 0.6 cm	60 g	990

Density

SRM's 211c, 2211, and 2213 are certified for density (air saturated at 1 atm) at 20, 25, and 30 °C, and may be used to calibrate pycnometers and density balances.

SRM's 1840 and 1841a are certified for density at 20 °C and may be used to determine the density of solids and liquids by means of hydrostatic weighing.

SRM	Type	Density 20 °C (g/cm³)	Amount
211c	Toluene	0.86686	5 mL
2211	Toluene	0.86686	8 mL
2213	2,2,4 Trimethylpentane (*Iso*octane)	0.691929	25 mL
1841a	Silicon	2.329	200 g
1825	Glass Density	2.20185	22 g
1826	Glass Density	2.54938	21 g
1827	Glass Density	3.0495	20 g

Microhardness

These SRM's are for use in calibrating and checking the performance of microhardness testers. These test blocks were made by electroforming the test metal on a steel substrate. The hardness numbers for 1893 through 1896 are each certified at loads of 25, 50, and 100-gram force, while 1905, 1906, and 1907 are certified for 300, 500, and 1000 gram-force, respectively.

SRM	Type	Load	Hardness	Size
1893	Bright Copper (Knoop)	25, 50, 100 g–f	125 kg/mm²	12.5 mm square
1894	Bright Copper (Vickers)	25, 50, 100 g–f	125 kg/mm²	12.5 mm square
1895	Bright Nickel (Knoop)	25, 50, 100 g–f	600 kg/mm²	12.5 mm square
1896	Bright Nickel (Vickers)	25, 50, 100 g–f	600 kg/mm²	12.5 mm square
1905	Bright Nickel (Knoop)	300 g–f	600 kg/mm²	12.5 mm square
1906	Bright Nickel (Knoop)	500 g–f	600 kg/mm²	12.5 mm square
1907	Bright Nickel (Knoop)	1000 g–f	600 kg/mm²	12.5 mm square

Gina Montgomery, a friendly, outgoing member of the customer sales and service staff, maintains and updates the SRM customer mail lists with valued dependability.

Ultrasonics

SRM 1855 is for point-by-point calibration of apparatus used to measure ultrasonic power. SRM 1856 is a displacement-measuring transducer to be used to determine the size and character of surf[illegible]ibrations.

SRM	Type	Frequency Range	Unit
1855	Ultrasonic Power Transducer	1.6 to 21.6 MHz	Each
1856	Acoustic Emission Transducer	0.1 to 1 MHz	Each

Polymers

Molecular Weight (Melt Flow)

SRM	Type	Wt/Unit (grams)
705	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
1474	Polyethylene Melt Flow	IN PREP
1475	Polyethylene, linear, $M_w \approx 52,000$, $M_w/M_n \approx 2.9$	50
1476	Polyethylene, branched	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	Polyurethanes Low MW	IN PREP
1481	Polyurethanes HI MW	IN PREP
1482	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
1484	Polyethylene, linear, $M_w \approx 119,600$ ($M_w/M_n \approx 1.19$)	1
1487	Poly(methylmethacrylate), $M_n \approx 6,000$	2
1488	Poly(methylmethacrylate), $M_n \approx 29,000$	2
1489	Poly(methylmethacrylate), $M_n \approx 115,000$	2
1496	Polyethylene Gas Pipe Resin (Unpigmented)	2 lbs.
1497	Polyethylene Gas Pipe Resin (Pigmented)	20 lbs.
1923	Polystyrene Sulfonates	IN PREP
1924	Polystyrene Sulfonates	IN PREP
1925	Polystyrene Sulfonates	IN PREP
8450	Polyethylene Piping ½ in	2 Pieces
8451	Polyethylene Piping 2 in	2 Pieces
8452	Polyethylene Piping 4 in	2 Pieces
8453	Polyethylene Piping Socket T	3 Pieces
8454	Polyethylene Piping Butt T	3 Pieces

These materials are certified for the properties indicated in the table.

Property	Method	705	706	1475	1476	1478	1479	1482	1483	1484	1487	1488	1489
Molecular Weight:													
Weight Average	(Light Scattering)	X	X	X			X	X	X	X			
	(Sed. Equili.)	X	X			X					X	X	
	(Gel Permeation Chromatography-GPC)			X									
Number Average	(Osmometry)	X				X		X	X	X			X
	(GPC)			X									
Molecular Weight Distribution	(GPC)			X									
Limiting Viscosity No.	(Capillary Viscometer)					X							X
Benzene 25 °C		X	X										
Benzene 35 °C		X											
Cyclohexane 35 °C		X	X										
1-Chloronaphthalene 130 °C				X	X			X	X	X			
1,2,4-trichlorobenzene 130 °C				X	X			X	X	X			
Decahydronaphthalene 130 °C				X	X								
Tetrahydrofuran 25 °C											X		
Toluene 25 °C												X	
Melt Flow	(ASTM)			X	X								
Density	(ASTM)			X	X								
Heat Capacity	(Adiabatic)	X		X									

Rheology

This SRM is for calibrating instruments used in polymer technology and science to determine rheological properties of polymer melts or solutions. It is certified for Rate of Shear, Viscosity, and First Normal Stress Difference at 25 °C.

SRM	Type	Unit size
1490	Polyisobutylene Solution in Cetane	250 mL

Heat

Calorimetric

These SRM's are intended to relate the gain or loss of energy and work experienced during a chemical reaction or by change of temperature to the units of energy and work as defined by the International System of Units (SI). The unit for energy and work under this system is the joule, which is related to the calorie by the equation: 4.184 joule=1 calorie.

Combustion Calorimetric

SRM	Type	Approximate Heat of Combustion (MJ/kg)	Unit Amount
39i	Benzoic Acid	26.434	30 g
2213	2,2,4–Trimethylpentane (*Iso*octane)	47.712	25 mL
1656	Thianthrene	33.480	30 g
1657	Synthetic Refuse Derived Fuel	13.87	100 g
2151	Nicotinic Acid	22.184	25 g
2152	Urea	10.536	25 g
2683a	Coal, Bituminous: %S=1.85; %Ash=6.85	32.30 (13887 Btu/lb)	50 g
2684a	Coal, Bituminous: %S=3.00; %Ash=11.09	28.92 (12433 Btu/lb)	50 g
2685	Coal, Bituminous: %S=4.62; %Ash=16.53	27.38 (11770 Btu/lb)	50 g

NOTE: 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.

Solution Calorimetric

SRM	Type	Heat of Solution (MJ/kg)	Wt/Unit (grams)
724a	Tris(hydroxymethyl)aminomethane (Hydrochloric Acid and Sodium Hydroxide Solution Calorimetry)	Evolved 0.24576 Absorbed 0.1418	50
1655	Potassium Chloride (Water Solution Calorimetry)	Absorbed (0.235)	30

Heat Source Calorimetric

SRM	Type	Heat of Evolution (MJ/kg)	Wt/Unit (grams)
1651	Zirconium-barium chromate heat source powder	1.46	50
1652	Zirconium-barium chromate heat source powder	1.632	50
1653	Zirconium-barium chromate heat source powder	1.762	50

Enthalpy and Heat Capacity

SRM	Type	Temperature Range (K)	Unit Size
705	Polystyrene, powder	10–350	5 g
1475	Polyethylene, powder	5–360	50 g

Differential Scanning Calorimetry

These SRM's are for calibrating differential scanning calorimeters, differential thermal analyzers, and similar instruments.

SRM	Type	Melting Temperature	Enthalpy of Fusion	Unit of Issue (mm)
2220	Tin (99.9995%)	505.10 K	7147 J/mol (107.46 J/g)	25×25×0.127
2221a	Zinc (99.999%)	692.74 K	7026 J/mol (60.22 J/g)	25×25×0.0508
2222	Biphenyl (99.984%)	342.41 K	120.41 J/g	1 g
2223	Potassium Nitrate	IN PREP		
2225	Mercury	234.30	11.469 J/g	2.5g

This SRM is for evaluating methods of determining purity by differential scanning calorimetry. It consists of phenacatin and phenacetin doped with p-aminobenzoic acid.

SRM	Type	Dopant Level (p-ABA, mol%)	Unit
1514	Thermal Analysis Purity	0, 0.7, 2, 5	Set of 4, 0.5 g/vial

Differential Thermal Analysis

GM's 754, 757, 758, 759, 760, and 761 have been issued by NIST in cooperation with the International Confederation of Thermal Analysis as standards for calibrating differential thermal analysis, differential scanning calorimetry, and thermogravimetry equipment under operating conditions.

GM	Material		Peak Temp.	Unit
754	Polystyrene	(glass transition)	105 °C	10 g
757	1,2–Dichloroethane	(melting point)	−32 °C	4 mL
	Clycohexane	(transition point)	−83 °C	4 mL
		(melting point)	7 °C	
	Phenyl Ether	(melting point)	30 °C	4 mL
	o-Terphenyl	(melting point)	58 °C	5 g
758	Potassium Nitrate	(transition point)	128 °C	10 g
	Indium	(melting point)	157 °C	3 g
	Tin	(melting point)	232 °C	3 g
	Potassium Perchlorate	(transition point)	300 °C	10 g
	Silver Sulfate	(transition point)	430 °C	3 g
759	Potassium Perchlorate	(transition point)	300 °C	10 g
	Silver Sulfate	(transition point)	430 °C	3 g
	Quartz	(transition point)	573 °C	3 g
	Potassium Sulfate	(transition point)	583 °C	10 g
	Potassium Chromate	(transition point)	665 °C	10 g
760	Quartz	(transition point)	573 °C	3 g
	Potassium Sulfate	(transition point)	583 °C	10 g
	Potassium Chromate	(transition point)	665 °C	10 g
	Barium Carbonate	(transition point)	810 °C	10 g
	Strontium Carbonate	(transition point)	925 °C	10 g
761	Permanorm 3	(magnetic transition)	259 °C	1 g
	Nickel	(magnetic transition)	353 °C	1 g
	Mumetal	(magnetic transition)	381 °C	1 g
	Permanorm 5	(magnetic transition)	454 °C	1 g
	Trafoperm	(magnetic transition)	750 °C	1 g

Superconductive Thermometric Fixed Point Device

Each device is composed of small cylinders of high purity material mounted in a threaded copper stud and enclosed by a mutual inductance coil set. SRM 767a is intended to provide fixed points on the 1976 Provisional 0.5 to 30 K Temperature Scale (EPT–76). This SRM should prove particularly valuable to users of ^{3}He–^{4}He dilution refrigerators, in which direct calibrations on the liquid helium vapor pressure-temperature scales are difficult, and to those who wish to determine the temperature reproducibility of physical phenomena or of cryogenic equipment.

SRM	Type	Material	Nominal Temperature (K)
767a	Superconductive Thermometric Fixed Point Device	Niobium	9.3
		Lead	7.2
		Indium	3.4
		Aluminum	1.2
		Zinc	0.9
		Cadmium	0.5

Freezing Point

SRM's 740a and 741 are defining fixed points for the International Practical Temperature Scale of 1968 (IPTS-68). The secondary reference points are for calibrating thermometers, thermocouples, and other temperature measuring devices. These SRM's are certified per IPTS-68.

Defining Fixed Points

SRM	Type	Temperature °C	Wt/Unit (grams)
740	Zinc	419.58	350
741	Tin	231.9681	350

Secondary Reference Points

SRM	Type	Temperature °C	Wt/Unit (grams)
43h	Zinc	419.5	350
44f	Aluminum	660.3	200
45d	Copper	1084.8	450
49e	Lead	327.493	600
743	Mercury	−38.841	680

Melting Point

SRM	Type	Form	Temperature °C	Wt/Unit (grams)
742	Alumina, 99.9+%	Powder	2053	10
1968	Gallium, 99.9999+%	Sealed Cell	29.7723	25
1969	Rubidium, 99.9+%	Sealed Cell	39.3	154
1970	Succinonitrile, 99.999+%	Sealed Cell	58.079	60
1971	Indium, 99.9999+%	Sealed Cell	156.635	100

GM 8000 is issued by NIST in cooperation with the Office of Reference Materials at the National Physical Laboratory (NPL) in Teddington, England. This set of 10 highly purified substances is intended for use in the calibration of thermometry used in determining the melting points of samples in glass capillary tubes. Both the meniscus point and the liquefaction point for each substance are certified by NPL.

GM	Type	Melting Point	Amount
8000	4-Nitrotoluene	52 °C	1 g
	Naphthalene (NPL# M14-11)	80	1 g
	Benzil	95	1 g
	Acetanilide	114	1 g
	Benzoic Acid	122	1 g
	Diphenylacetic Acid	147	1 g
	Anisic Acid	183	1 g
	2-Chloroanthraquinone	210	1 g
	Carbazole	246	1 g
	Anthraquinone	285	1 g

Laboratory Thermometer

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

SRM	Type	Calibrated Points (°C)	Unit
934	Clinical Laboratory Thermometer	0, 25, 30, 37	Each

Thermocouple Material

SRM	Type	Temperature Range (°C)	Form
1967	Platinum, High-Purity (99.999+%)	197 to 1767	Wire: 0.51 mm D, 1 meter long

Vapor Pressure

SRM	Type	Pressure Range (atmosphere)	Temperature Range (K)	Unit Size
745	Gold	10^{-9} to 10^{-3}	1300–2100	Wire 1.44 mm×152 mm
746	Cadmium	10^{-11} to 10^{-4}	350–594	Rod 6.4 mm×64 mm
748	Silver	10^{-12} to 10^{-3}	800–1600	Rod 6.4 mm×64 mm

Thermal Conductivity

SRM	Type	Dimension (mm)	Temperature Range (K)	Conductivity at 293 K (W/M·K)
1461	Stainless Steel	12.7 D, 50 length	2–1200	14.1
1462	Stainless Steel	34 D, 50 length	2–1200	14.1
8420	Electrolytic Iron	6.4 D, 50 length	2–1000	77.9
8421	Electrolytic Iron	31.7 D, 50 length	2–1000	77.9
8422	Sintered Tungsten	3.2 D, 50 length	2–3000	173
8423	Sintered Tungsten	6.4 D, 50 length	2–3000	173
8424	Graphite	6.4 D, 50 length	5–2500	90.9
8425	Graphite	12.7 D, 50 length	5–2500	90.9
8426	Graphite	25.4 D, 50 length	5–2500	90.9

Thermal Expansion

SRM	Type	Temperature Range (K)	Diameter (mm)	Length (mm)
731–L1	Borosilicate Glass	80–680	6.4	51
731–L2	Borosilicate Glass	80–680	6.4	102
731–L3	Borosilicate Glass	80–680	6.4	152
738	Stainless Steel (AISI 446)	293–780	6.4	51
739–L1	Fused Silica	80–1000	6.4	51
739–L2	Fused Silica	80–1000	6.4	102
739–L3	Fused Silica	80–1000	6.4	152

Thermal Resistance

SRM	Type	Dimension (mm)	Temperature Range (K)	Thermal Resistance at 293 K ($m^2 \cdot K/W$)
1449	Fumed Silica Board	600×600×25.4	297.1	1.2
1450b	Fibrous Glass Board	600×600×25.4	100–330	0.75
1451	Fibrous Glass Blanket	600×600×25.4	100–330	0.60
1452	Fibrous Glass Blanket	600×600×25.4	297.1	0.60
1459	Fumed Silica Board	300×300×25.4	297.1	1.2

Magnetic

Magnetic Susceptibility

SRM	Type	Gram Susceptibility @297 K ($10^6\chi g$, $cm^3 \cdot g^{-1}$)	Form/Unit
763	Aluminum	0.604	Cylinder 3 mm diameter × 3 mm
766	Manganese Fluoride	123.3	Cube 3 × 3 × 3 mm

Magnetic Moment

SRM	Type	Magnetic, H (Oe)	Moment, σ ($Oe \cdot cm^3 \cdot g^{-1}$)	Size
772	Nickel Sphere	3500–10,000	54.75–54.90	2.4 mm D

Ken Eckerle of the Radiometric Physics Division is shown here making an adjustment to a component of the high accuracy spectrophotometer in preparation for measurements of one of the optical properties SRM's.

OPTICAL

Spectrophotometric

SRM 930D: This SRM consists of three neutral density glass filters. The filters have transmittances of approximately 10, 20, and 30 percent. Each filter is individually certified for transmittance at wavelengths of 440, 465, 546.1, 590, and 635 nm.

SRM 931d: This SRM consists of three sets of four solutions—a blank solution and three concentrations of absorbing liquid. The net absorbances are certified for each concentration at wavelengths of 302, 395, 512, and 678 nm.

SRM 935a: Solutions made with this SRM are certified for apparent specific absorbances at wavelengths of 235, 257, 313, 345, and 350 nm.

SRM 936: A solution made with this SRM is certified for its molecular emission spectrum over the wavelength range of 375 to 675 nm.

SRM 1930: This SRM consists of three neutral density glass filters. The filters have transmittances of approximately 1, 3, and 50 percent. Each filter is individually certified for transmittance at wavelengths of 440, 465, 546.1, 590, and 635 nm.

SRM 1931: This SRM is a set of four luminescent samples and a blank certified for corrected luminescence emission spectra over the wavelength range from 400 to 760 nm. Each sample consists of an inorganic dye in a sintered polytetrafluoroethylene matrix mounted in a cuvette-sized holder.

SRM 2009a: This SRM is for checking the wavelength scale between 400 and 760 nm for bandpasses between 1.5 and 10.5 nm. SRM 2009a is mounted in a standard cuvette-sized holder.

SRM 2031: This SRM consists of three filters mounted in holders and an empty holder; all holders are equipped with shutters. Two of the filters have an evaporated layer of semi-transparent metal sandwiched between two quartz plates assembled by optical contact. The third filter is a single quartz plate. Each filter is individually calibrated at 250, 280, 340, 360, 400, 465, 500, 546.1, 590, and 635 nm.

SRM 2032: Aqueous solutions made with this SRM are certified for specific absorbances from 240 to 280 nm for use as a stray light standard in the ultraviolet region.

SRM 2033: This SRM consists of the same material as SRM 2032 plus a reference beam attenuator for extending the dynamic range of the stray light test.

SRM 2034: This SRM is a solution sealed in a non-fluorescent, fused-silica cuvette for checking the wavelength scale between 240 and 650 nm.

SRM	Type	Wavelength Range (nm)	Unit
930D	Glass Filters, Transmittance	440–635	3 filters/4 holders
931d	Liquid Filters, Absorbance	302–678	Set: 12 vials
935a	Potassium Dichromate, UV Absorbance	235–350	15 grams
936	Quinine Sulfate Dihydrate, Fluorescence	375–675	1 gram
1930	Glass Filters, Transmittance	440–635	3 filters/4 holders
1931	Fluorescence Corrected Emission Spectra	400–760	Set: 4 pieces
2009a	Didymium-oxide Glass, Wavelength	400–760	1 filter/1 holder
2031	Metal-on-Quartz Filters, Transmittance	250–635	3 filters/4 holders
2032	Potassium Iodide, Stray Light	240–280	25 grams
2033	Potassium Iodide with Attenuator	240–280	25 grams w/attenuator
2034	Holmium-oxide Solution, Wavelength	240–650	1 sealed cuvette

Reflectance

These SRM's 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.

Specular Spectral Reflectance

SRM	Type	Wavelength Range (nm)	Size
2003	First Surface, Aluminum on Glass	250–2500	5.1 cm D
2011	First Surface, Gold on Glass	IN PREP	5.1 cm D
2023a	Second Surface, Aluminum on Fused Quartz	IN PREP	5.1 cm D
2025	Second Surface, Aluminum on Fused Quartz with Wedge	250–2500	2.5 × 10.2 cm

Infrared Reflectance

This SRM is for use in establishing the accuracy of the wavelength scale of reflectance spectrophotometers.

SRM	Type	Wavelength Range (nm)	Size
1920	Near IR Wavelength	740–2000	51 mm D × 12 mm

Yvonne Barnes prepares to mount a sample on the reference spectral reflectometer to make certification measurements on a reflectance SRM.

Directional-Hemispherical Reflectance

SRM	Type	Wavelength Range (nm)	Size
2015	Opal Glass	400–750	2.5×5.0×0.64 cm
2016	Opal Glass	400–750	10×10×0.64 cm
2021	Black Porcelain Enamel	280–2500	5.1×5.1×0.20 cm

Refractive Index

SRM's 211c, 2211, and 2213 are certified for refractive index at 20, 25, and 30 °C, from 435.8 to 667.8 nm for seven wavelengths.

SRM 1822 is certified for refractive index at thirteen wavelengths from 404.7 nm to 706.5 nm. This SRM is designed for calibrating refractometers and certifying refractive index immersion liquids. It consists of two rectangular glass slabs: one slab has polished faces and is to be used to check the performance of a refractometer; the second slab is unpolished and can be broken into fragments to certify the refractive index of immersion liquids by microscope methods.

SRM 1823 consists of two silicone liquids that are miscible and span the refractive index range of a variety of glasses and glass fibers. The liquids are suitable for calibrating refractometers and are certified for refractive index at ten wavelengths from 435.8 to 667.8 nm, at temperatures of 20, 40, 60, and 80 °C.

SRM	Type	n^{20}, λ546.1	Unit Size
211c	Toluene	1.5008	5 mL
2211	Toluene	1.5008	8 mL
2213	2,2,4-Trimethylpentane (*Iso*octane)	1.3934	25 mL
1822	Glass (Soda-Lime)	1.5200	Set: 2 slabs
1823-I	Silicone Liquid (I)	1.5214	60 mL
1823-II	Silicone Liquid (II)	1.5638	60 mL

Optical Rotation

These SRM's are intended for use in 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 Aqueous Solution (mrad)			Unit Size
	Wavelengths	546	589	633	
17d	Sucrose	711.64	604.26	519.17	60 g
41c	Dextrose	1101.1	931.8	798.6	70 g

RADIOACTIVITY

These SRM's are shipped express or air freight (shipping charges collect). The amount of a radionuclide in an SRM, at a specified time, is stated as (1) the number of atoms (or the mass, for radium SRM's), (2) the activity, or "decays per second," or (3) the emission rate of a particular radiation, depending on the method of calibration or the intended use. For solution SRM's, the quantity is usually specified per gram of liquid. The active portion of gamma-ray "point-source" standards is usually restricted to the central few millimeters of a low-mass, low-Z support to minimize scattering. Alpha-particle-emitting radionuclides are deposited or plated on metal backings.

The unit for activity has traditionally been the curie (Ci), but simpler relations between activity, emission rate, and counting rate result if the current SI (International System of Units) unit "1 per second" is used. This is symbolized as "s^{-1}" and has been given the special name becquerel (Bq). The relationship between the curie and the becquerel is:

$1\ \text{Ci} = 3.7 \times 10^{10}\ \text{Bq}$.

Many SRM's are measured and certified in terms of emission rate. In this catalog, αs^{-1}, $\beta^{-}s^{-1}$, $\beta^{+}s^{-1}$, Kxs^{-1}, and γs^{-1} are used for the emission rates of alpha particles, negatrons, positrons, K x rays, and gamma rays, respectively.

The SRM's without an asterisk (*) may be ordered singly, without a license, under the general licensing provisions of the Atomic Energy Act of 1954. Those marked by an asterisk are available only under the special licensing provisions of the Atomic Energy Act of 1954.

NOTE: Certain radionuclides are not economical to maintain in stock because of short half lives or low demand. When sufficient demand exists, based on letters of inquiry, these materials are prepared and those who have expressed interest are notified of their availability. If you need any radionuclide not listed, write the Radioactivity Group, Room C114 Radiation Physics Building, National Institute of Standards and Technology, Gaithersburg, MD 20899; or telephone (301) 975-5531.

In addition, chemically stable solutions of most radionuclides may be submitted to NIST for calibration as described in Calibration Services Users Guide, NIST Special Publication 250 (1986-88/ Revised ed.). Requests for such tests should be submitted, with full source information, for approval of suitability to the Radioactivity Group.

Bert Coursey and Bill McLaughlin of the Ionizing Radiation Division discuss the preparation and measurement of a radioactivity sample.

Alpha-Particle, Beta-Particle, Gamma-Ray, and Electron-Capture Solutions

SRM	Radionuclide	Approximate activity, per gram, at time of calibration (month/year) (Bq g^{-1})		Approx. Mass of Solution (g)	Overall Uncertainty (%)
4322*	Americium-241	38.7	11/86	5	1.0
4332C*	Americium-243	89	9/89	5	1.4
4251B*	Barium-133	5×10^5	1/82	5	1.4
4233C*	Cesium-137-Barium-137m	7×10^5	8/89	5	1.4
4943*	Chlorine-36	1×10^4	12/84	3	0.8
4915D*	Cobalt-60	3×10^5	3/84	5	0.8
4320	Curium-244	57	4/89	5	1.0
4329*	Curium-243	70	6/84	5	1.4
4370*	Europium-152	9×10^4	2/87	5	1.1
4926D	Hydrogen-3	3×10^3	5/89	18	0.6
4927D	Hydrogen-3	7×10^5	4/89	3	0.8
4947C	Hydrogen-3	3×10^5	3/87	4	1.2
4361B	Hydrogen-3	1.1	8/87	490	1.0
4949B	Iodine-129	7×10^3	1/82	1	1.9
4929D	Iron-55	4×10^4	8/85	5	2.6
4226B*	Nickel-63	1×10^6	12/84	4	1.1
4327*	Polonium-208	77	6/84	1.1	1.4
4326	Polonium-209	370	9/89	5	2.0
4323*	Plutonium-238	33	11/86	5	0.5
4338*	Plutonium-240	18	4/80	5	1.0
4940C	Promethium-147	1×10^5	8/85	5	0.4
4423	Strontium-90	4×10^6	11/85	5	1.1
4919F*	Strontium-90	4×10^3	5/88	5	1.2
4288*	Technetium-99	4×10^4	11/82	5	1.6
4328*	Thorium-229	884	5/84	2	1.5
4324*	Uranium-232	83	2/84	5	1.5
4321	Uranium-238 (Natural)	263	11/86	5	0.4
4276C*	Long-Lived Mixed Radionuclide:		9/88	5	
	Antimony-125	2×10^4			
	Europium-154	1×10^4			
	Europium-155	7×10^3			

*License certification is required by NIST for these radionuclides.

Alpha-Particle Point-Sources

These SRM's consist of a practically weightless deposit of the nuclide on a thin platinum foil cemented to a monel disk.

SRM	Radionuclide	Approx. α-particle-emission rate into 2π geometry and/or approx. activity at time of calibration (month/year)		Overall uncertainty (%)
4904NG*	Americium-241	2300 Bq g^{-1}	5/86	1.3
4904SG*	Americium-241	2300 Bq g^{-1}	5/86	1.0 to 1.3
4906HC*	Plutonium-238	1×10^3–5×10^4	10/87	1.3
4906C*	Plutonium-238	1×10–3×10^2	10/87	1.3

*License certification is required by NIST for these radionuclides.

Radiocarbon Dating and Ground Water Studies

Contemporary Standard for Carbon-14 Dating Laboratories

SRM	Material	Description
4990C	Oxalic Acid	One-half pound of oxalic acid taken from specially prepared material for use as a common contemporary standard against which world-wide measurements can be compared.

Low-Level Tritiated-Water Standard

SRM	Material	Description
4361B	Hydrogen-3	Contains 490 grams of ^3H-H_2O in a flame-sealed bottle. The radioactivity concentration was 1.123 Bq g^{-1}, as of the date of the most recent gas-counting measurement—August 1, 1987. The total uncertainty in this value is 1.0.

Gaseous Materials

SRM	Radionuclide	Approximate activity or radioactivity concentration at time of calibration (month/year)		Approx. Vol. (cm^3)	Approx. Pressure (atm)	Overall Uncertainty (%)
4935C*	Krypton-85	5×10^7 Bq mol^{-1}	3/74	10	1	0.9
4235B*	Krypton-85	1×10^7 Bq	10/86	3	1	1.1
4308C	Krypton-85	2×10^6 Bq	11/82	30	0.3	3.2
4415LN*	Xenon-133	5×10^8 Bq	3/90	5	0.1	1.5

*License certification is required by NIST for these radionuclides.

Gamma-Ray and X-Ray Point-Sources

These SRM's are usually prepared by depositing the radioactive material and sealing it between two layers of polyester tape, mounted on an aluminum ring. SRM 4206c, Thorium-228, is prepared by depositing and sealing the radionuclide between two layers of gold foil and this sandwich is then sealed between two double layers of polyurethane-film tape.

SRM	Radionuclide	Principal Photon Energy (MeV)	Approximate activity, Bq, at time of calibration (except MRN)	(month/year)	Overall Uncertainty (%)
4202D	Cadmium-109-Silver-109m	0.088	4×10^5	10/86	2
4241B*	Barium-133	0.081–384	2×10^5	6/81	1.4
4200B	Cesium-137-Barium-137m	0.662	4×10^4	9/79	1.6
4207B	Cesium-137-Barium-137m	0.662	3×10^5	3/87	0.8
4203D*	Cobalt-60	1.173–1.332	2×10^4 to 2×10^5	3/84	0.9
4218E*	Europium-152	0.122 to 1.408	5×10^4 to 5×10^5	11/82	1.5
4201B	Niobium-94	0.702	5×10^3	4/70	1.5
Long-Lived Mixed Radionuclide					
4275C	Antimony-125-Tellurium-125m	0.027 to 1.596	5×10^4	9/88	
	Europium-154		6×10^4		
	Europium-155		3×10^4		

*License certification is required by NIST for these radionuclides.

Low-Energy-Photon Point-Sources

SRM's 4260C and 4264B consist of a thin-layer deposit of the radionuclide on a thin stainless steel or platinum foil cemented to a monel disk. SRM 4267 has the same construction as the above gamma-ray point sources.

SRM	Radionuclide	Principal Photon Energy (MeV)	Approx. emission rate at time of calibration (month/year)		Overall Uncertainty (%)
4264B	Tin-121m-Antimony-121	0.0372	$5\times10^2 s^{-1}$	11/82	3.0
4267	Niobium-93m	0.016	8×10^2 Kxs^{-1}	11/85	3.0

Radium-226 Solutions

Radon Analysis

These samples are contained in flame-sealed glass ampoules.

SRM	Nominal Radium Content (g)	(month/year)	Approx. Mass of Solution (g)	Overall Uncertainty (%)
4952B	8×10^{-15}	8/76	2	68
4953D	4×10^{-9}	6/84	5	1.2
4950E	4×10^{-10}	6/84	5	1.3

Gamma-Ray Solutions

These samples are contained in flame-sealed glass ampoules.

SRM	Nominal Radium Content (g)	(month/year)	Approx. Mass of Solution (g)	Overall Uncertainty (%)
4956	2×10^{-7}	9/67	5	4.4
4957	5×10^{-7}	9/67	5	1.8
4958	1×10^{-6}	9/67	5	1.8
4959	2×10^{-6}	9/67	5	1.3

Environmental Natural Matrix Materials for Quality Assurance Testing

SRM 4350B—Columbia River Sediment
This material was collected from a river downstream from a nuclear reactor facility. Concentrations of fission and activation products are elevated over typical world-wide levels. $^{239/240}$Pu and ^{241}Am are very homogeneously distributed through the sample and are in acid-leachable forms. Inhomogeneity is 3 percent or better for other radionuclides.

SRM 4351—Human Lung
This material 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 $^{239/240}$Pu which is unavoidable because plutonium was taken into the lungs in particulate form. Assessments of accuracy of measurement technique can be improved by averaging over several samples.

SRM 4352—Human Liver
This material 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 4353—Rocky Flats Soil Number 1
This material was collected within 13 centimeters of the soil surface at Rocky Flats, CO. $^{239/240}$Pu and ^{240}Am concentrations are about an order of magnitude higher than typical world-wide levels. Approximately 10 percent of the plutonium is in a acid-resistant form. The material also contains "hot" particles and a statistical method is provided for dealing with these. Inhomogeneities, excluding hot particles, are on the order of 3 percent or better.

SRM 4354—Freshwater Lake Sediment
This material (gyttja) contains approximately 25 grams of freeze-dried, pulverized freshwater lake sediment (approximately 50 percent organic by weight) 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 has non-measurable 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.

Radiopharmaceuticals

SRM	Radionuclide (5 mL solution)	Half Life		Approximate Radioactivity at Time of Dispatch ($Bq\ g^{-1}$)	Overall Uncertainty
4400LK*	Chromium-51	27.702	d	3×10^{6}	0.7
4416LK*	Gallium-67	3.261	d	3×10^{6}	0.8
4421L*	Gold-195	183	d	5×10^{5}	2.3
4405LB*	Gold-198	2.696	d	4×10^{6}	1.7
4417LI*	Indium-111	2.805	d	5×10^{6}	0.7
4414LC*	Iodine-123	13.221	h	6×10^{7}	1.5
4407LN*	Iodine-125	59.6	d	1×10^{6}	1.0
4401LP*	Iodine-131	8.021	d	5×10^{6}	0.9
4411LB*	Iron-59	44.51	d	8×10^{5}	1.5
4420LB*	Lead-203	51.88	h	3×10^{6}	1.0
4418L*	Mercury-203	46.60	d	1×10^{6}	1.0
4412LO*	Molybdenum-99-Technetium-99m	65.92	h	2×10^{6}	1.0
4406LJ*	Phosphorus-32	14.29	d	2×10^{6}	1.7
4409LD*	Selenium-75	119.8	d	1×10^{6}	2.8
4403LB*	Strontium-85	64.854	d	1×10^{6}	1.4
4410HO*	Technetium-99m	6.007	h	1×10^{9}	0.9
4404LL*	Thallium-201	72.91	h	4×10^{6}	1.6
4402LC*	Tin-113-Indium-113m	115.08	d	1×10^{6}	3.1
4415LN*	Xenon-133 (5 mL gas)	5.243	d	$5\times10^{8}\ s^{-1}$ total	1.0
4419LC*	Ytterbium-169	32.03	d	2×10^{6}	1.3

*License certification is required by NIST for these radionuclides.

This series of SRM's, ranging from glass composition to spectral wavelength to microhardness, represent some of the diversity of the SRM's now available.

Metallurgical

SRM's 485a, 486, 487, and 488 are for calibrating x-ray diffraction equipment used in determining the amount of retained austenite in ferrous materials. SRM 493 is for calibrating x-ray diffraction and Mössbauer equipment to determine the relative amounts of iron carbide in steel.

SRM	Type	Form
485a	Austenite in Ferrite 5%	Disk: 21 mm dia.×2.4 mm thick
486	Austenite in Ferrite 15%	Disk: 21 mm dia.×2.4 mm thick
487	Austenite in Ferrite 30%	Disk: 21 mm dia.×2.4 mm thick
488	Austenite in Ferrite 2.5%	Disk: 21 mm dia.×2.4 mm thick
489	Ferrite in Austenite 10%	IN PREP
493	Spheroidized Iron Carbide (Fe_3C) in Ferrite	Wafer: 29×29×2.4 mm

Abrasive Wear

SRM 1857 is for use in the dry sand/rubber wheel abrasion test per ASTM G65, Procedure A.

SRM	Type	Form
1857	D-2 Tool Steel	2 blocks: 7.8×25×76 mm

Corrosion

Electrochemical Potential and Thickness

This SRM is for determining the reliability of step test measurements of electrochemical and thickness of multilayered nickel deposits. It consists of a 50×50 mm plate of copper-plated steel over which a duplex nickel coating has been deposited.

SRM	Type	Step Test Potential (mV)	Nickel Thicknesses (micrometers) Total	Bright	Semibright
2350	Nickel Step Test Standard	110–150	27	(7)	(20)

Pitting or Crevice Corrosion

These SRM's are for use in evaluating the pitting or crevice corrosion of surgical implant materials per ASTM F746.

SRM	Type	Form
1890	316L Stainless Steel Rod and Teflon Collar	4 sets: 6.4 mm D, 25.4 mm long
1891	Co-Cr-Mo Alloy Rod and Teflon Collar	2 sets: 6.4 mm D, 25.4 mm long

X-ray Fluorescent Emission Target

This SRM is intended for use in determining the detector window absorption in semiconductor x-ray spectrometers according to ANSI-IEEE Standard STO 759. When excited by a ^{55}Fe source this glass target will emit fluorescent x rays in the range 1.0 to 5.2 keV.

SRM	Type	Form	Unit Size
477	Glass Fluorescence Source	Disk	2×25 mm D

X-ray Diffraction

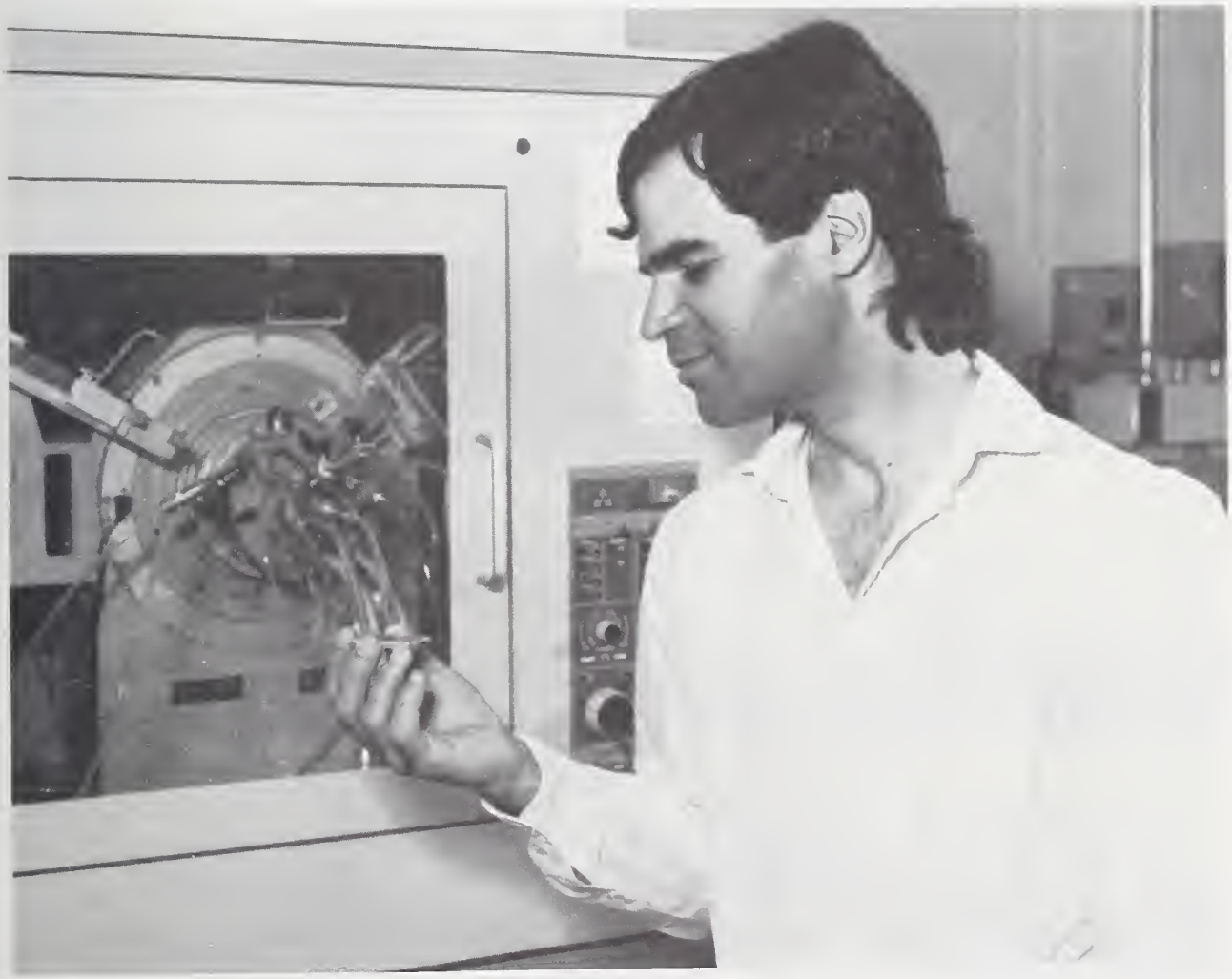
These SRM's are powdered materials to be used as internal standards for powder diffraction measurements. SRM 674a is a set of five oxides for use in the quantitative analysis (intensity measurement) of materials. See also: SRM's 485a–488, 493 (p. 104), and SRM 1878 (p. 62).

SRM	Type	Lattice Parameter (25.0 °C)	Unit Size
640b	Silicon Powder	5.430940 Å	7.5 g
656	Alpha/Beta Standard	IN PREP	
658	Tridymite	IN PREP	5 g
659	Ceramic Particle Size	IN PREP	
660	LaB_6-2Theta X-Ray Profile	4.15695 Å	3 g
674a	Powder Diffraction Intensity		
	Al_2O_3 (α-alumina)	4.75893 Å	10 g
	CeO_2	5.41129 Å	10 g
	Cr_2O_3	4.95916 Å	10 g
	TiO_2 (Rutile)	4.59365 Å	10 g
	ZnO	3.24981 Å	10 g
675	Powder Diffraction (Mica)	9.98104 Å	5 g
676	Crystalline Alpha Alumina	IN PREP	
677	Crystalline X-Ray Line Processing	IN PREP	
RM8585	Kaolin Based Relative XRD	IN PREP	25 g

Gas Transmission

SRM 1470 is for use in the measurement of gas transmission rates using a volumetric method (ASTM D1434), manometric method (ASTM D1434), or coulometric method (ASTM D3985) of measurement. The permeances of nitrogen, oxygen, carbon dioxide, and helium through this polyester film at 296.15 K are 0.0421, 0.352, 1.722, and 13.79 pmol-s^{-1}·Pa^{-1}, respectively.

SRM	Type	Unit Size
1470	Polyester Plastic Film for Gas Transmission	15 sheets, 23 cm square



Jim Cline prepares to insert a X-ray diffraction candidate SRM material into a diffractometer.

Reference Fuel

SRM's 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	Purity, %	Unit Size
1815a	n-Heptane	99.987	100 mL
1816a	*Iso*octane (2,2,4-Trimethylpentane)	99.987	100 mL

Electrical Resistivity and Conductivity

Metals

These materials are for evaluating methods of measuring electrical resistance over wide temperature ranges.

SRM	Type	Temperature Range	Resistivity at 293 K	Form
1461	Stainless Steel	5 to 1200 K	80.5 μΩ·cm	Rod: 12.7 mm D, 50 mm long
1462	Stainless Steel	5 to 1200 K	80.5 μΩ·cm	Rod: 34.0 mm D, 50 mm long
8420	Iron	6 to 1000 K	10.1 μΩ·cm	Rod: 6.4 mm D, 50 mm long
8421	Iron	6 to 1000 K	10.1 μΩ·cm	Rod: 31.7 mm D, 50 mm long
8422	Tungsten	4 to 3000 K	5.4 μΩ·cm	Rod: 3.2 mm D, 50 mm long
8423	Tungsten	4 to 3000 K	5.4 μΩ·cm	Rod: 6.4 mm D, 50 mm long

Silicon

SRM's 1521, 1522, and 1523 sets of Resistivity Standards will be replaced with SRM 2541–50 series of Resistivity Standards as they become available. This series will be 100 mm in diameter and will have improved accuracy and precision. SRM's 2526, 2527, 2528, and 2529 are mounted on beveling blocks for two-probe test equipment.

SRM	Type	Resistivity	Form
2526	111 p-Type Silicon, Spreading Resistance	0.001 to 200 Ω·cm	16 levels, 5×10×0.625 mm
2527	111 n-Type Silicon, Spreading Resistance	0.001 to 200 Ω·cm	16 levels, 5×10×0.625 mm
2528	100 p-Type Silicon, Spreading Resistance	0.001 to 200 Ω·cm	16 levels, 5×10×0.625 mm
2529	100 n-Type Silicon, Spreading Resistance	0.001 to 200 Ω·cm	16 levels, 5×10×0.625 mm
2541	Silicon Resistivity		4″ wafers
2542	Silicon Resistivity		4″ wafers
2543	Silicon Resistivity		4″ wafers
2544	Silicon Resistivity		4″ wafers
2546	Silicon Resistivity		4″ wafers
2547	Silicon Resistivity		4″ wafers
2548	Silicon Resistivity		4″ wafers
2549	Silicon Resistivity		4″ wafers
2550	Silicon Resistivity		4″ wafers

Residual Resistivity Ratio

This SRM is a set of five aluminum rods that are intended for use in checking four-terminal dc and eddy current decay techniques. The residual resistivity ratio, $\rho(273\ K)/\rho(4\ K)$, is a sensitive indicator of purity and of the mechanical state of a material.

SRM	Type	RRR Values	Form
769	Aluminum	130, 683, 1205, 2650, and 11,000	6.4 mm D, 52 mm long

Eddy Current

These SRM's are intended for use in the calibration of eddy current conductivity meters and of secondary electrical conductivity standards. Eddy current measurements are used in nondestructive inspection of conducting materials and in the sorting of alloys for composition and heat treatment.

SRM	Type	Conductivity	Form
1860	Aluminum	60% IACS	44×44×9.5 mm
1862	Aluminum-Magnesium Alloy	41% IACS	44×44×9.5 mm

Electrolytic Conductance

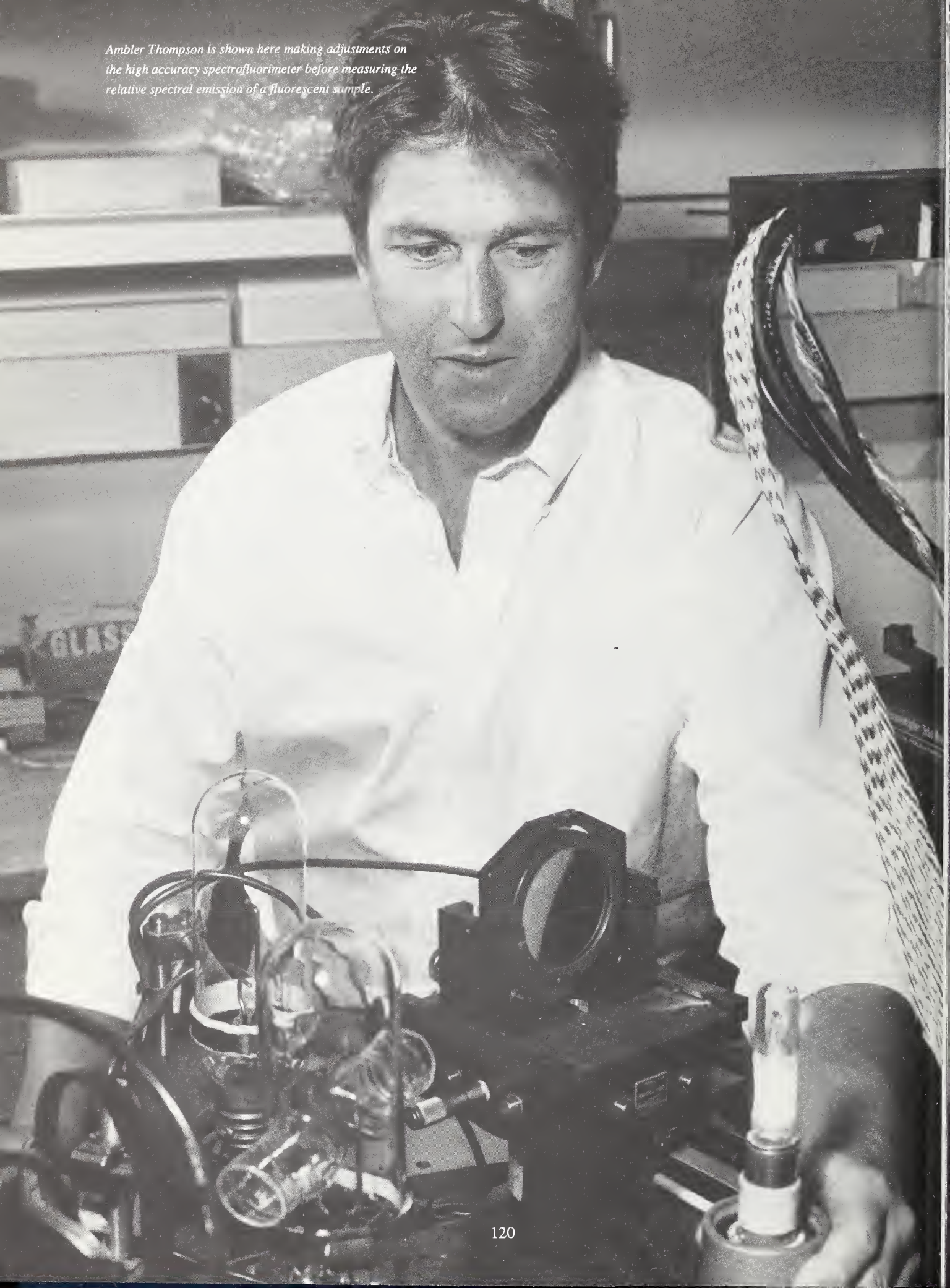
These SRM's are for calibrating and standardizing conductivity cells and meters used in water purity determinations. They are solutions of high-purity potassium chloride in de-ionized water in equilibrium with atmospheric carbon dioxide.

SRM	Type	Nominal Conductance (microsiemens per cm, μS/cm)	Unit Size
3191	Electrolytic Conductance	100	500 mL
3192	Electrolytic Conductance	500	500 mL
3193	Electrolytic Conductance	1000	500 mL
3194	Electrolytic Conductance	10000	500 mL
3195	Electrolytic Conductance	100000	500 mL

Superconducting Critical Current

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 (T)	Critical Current (A)
1457	Nb–Ti Wire	2.000	293.30
		4.000	187.38
		6.000	124.72
		8.000	69.72



Ambler Thompson is shown here making adjustments on the high accuracy spectrofluorimeter before measuring the relative spectral emission of a fluorescent sample.

Engineering Materials

Standard Rubbers and Rubber-Compounding Materials

These SRM's have been prepared to provide the rubber industry with standard materials for rubber compounding. They are useful for the testing of rubber and rubber-compounding materials in connection with quality control of raw materials and for the standardization of rubber testing.

Each material has been statistically evaluated for uniformity by mixing rubber and rubber compounds, and vulcanizing them in accordance with ASTM Designation D–15 and determining the stress-strain properties of the resulting vulcanizates. Certificates are issued for the rubbers because the properties of different lots are not the same. Replacement lots of rubber-compounding SRM's impart essentially the same characteristics to rubber vulcanizates so that Certificates are not issued for these SRM's.

Rubbers

SRM	Type	Wt/Unit	Pounds
386k	Styrene-butadiene 1500	34 kg	75
388p	Butyl	34 kg	75
1495	Butyl (Low Viscosity)	34 kg	75

Rubber Compounding Materials

SRM	Type	Wt/Unit	Pounds
370e	Zinc Oxide	8 kg	17.6
371h	Sulfur	6 kg	13.2
372i	Stearic Acid	3.2 kg	7.1
375g	Channel Black	28 kg	61.6
378b	Oil Furnace Black	28 kg	61.6
382a	Gas Furnace Black	32 kg	70.6
383a	Mercaptobenzothiazole	3.2 kg	7.1
384f	N-tertiary-Butyl-2-benzothiazolesulfenamide	3.2 kg	7.1

Sizing

Particle Size

SRM's 1003a, 1690, 1691, and 1960 can be used to calibrate various types of particle size measuring instruments including both light and electrical zone flow-through counters. SRM's 1004a, 1017a, 1018a, and 1019a are for calibrating test sieves.

SRM	Type	Size (μm)	Sieve No.	Wt/Unit
1003a	Glass Spheres	8–58	—	25 g
1004a	Glass Spheres	IN PREP		
1017a	Glass Spheres	100–310	140–50	84 g
1018a	Glass Spheres	225–780	60–25	74 g
1019a	Glass Spheres	760–2160	20–10	200 g
1690	Polystyrene Spheres (0.5% wt. concentration in water)	0.895	—	5 mL vial
1691	Polystyrene Spheres (0.5% wt. concentration in water)	0.269	—	5 mL vial
1960	Polystyrene Spheres (0.4% wt. concentration in water)	9.89	—	5 mL vial
1961	Polystyrene Spheres (0.5% wt. concentration in water)	29.64	—	5 mL vial
1962	Polystyrene Spheres (0.5% wt. concentration in water)	2.978	—	5 mL vial
1965	Polystyrene Spheres (0.5% wt. concentration in water)	9.94	—	1 slide

Cement Turbidimetric and Fineness

This SRM is available to calibrate the Blaine fineness meter according to the latest issue of Federal Test Method Standard 158, Method 2101 or ASTM Designation C204; to calibrate the Wagner turbidimeter according to ASTM Designation C115; and to determine sieve residue according to ASTM Designation C430. Each set consists of twenty sealed vials, each containing approximately 10 grams of cement.

SRM	Type	Properties Certified	Value	Unit
114n	Portland Cement	Residue on 45 μm, electroformed sieve wet method	8.3%	Set of 20 vials
		Surface area (Wagner turbidimeter)	2020 $cm^2 \cdot g^{-1}$	
		Surface area (Air-permeability)	3460 $cm^2 \cdot g^{-1}$	

Surface Area of Powders

These materials are for calibrating and checking instruments used to determine the specific surface area of powders by BET. RM's 8005 through 8008 have been certified by the National Physical Laboratory, Teddington, U.K. (and meet the ISO definition for CRM's); RM's 8570, 8571, and 8572 are issued by NBS in cooperation with ASTM, but are not certified.

RM	Type	Surface Area	Unit Size
8005	Alpha Alumina (NPL# M11-05/09)	2.1 m^2/g	50 g
8006	Alpha Alumina (NPL# M11-06/10)	0.3 m^2/g	50 g
8007	Alpha Alumina (NPL# M11-07/11)	0.1 m^2/g	50 g
8008	Alpha Alumina (NPL# M11-08/12)	0.8 m^2/g	50 g
8570	Calcined Kaolin	10.89 m^2/g	10 g
8571	Alumina	158.7 m^2/g	10 g
8572	Silica-Alumina	291.2 m^2/g	10 g

PERFORMANCE STANDARDS

Socketed Ball Bar

This SRM is for measuring the performance of coordinate measuring machines (CMM's) 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 5 partially insulated extension tubes—50, 100, 200, 400, and 800 mm long.

SRM	Type	Measuring Lengths (50 mm steps)	Unit
2083	Socketed Ball Bar	100 to 1650 mm	Set

Dye Penetrant Test Blocks

These SRM's are for checking the performance of liquid dye penetrants and dye penetrant crack detection techniques. These test blocks have four synthetic cracks, approximately 0.2, 0.5, 1, and 2 μm wide.

SRM	Type	Surface	Unit Size
1850	Penetrant Test Block	Bright Finish	5 cm dia., 1 cm thick
1851	NDE Penetrant Test Block	Matte Finish	5 cm dia., 1 cm thick

Surface Roughness

These SRM's 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	Wavelength	Unit of Issue
2071	Sinusoidal Roughness	0.3 μm	10 μm	Block, 24×33 mm
2072	Sinusoidal Roughness	1.0 μm	100 μm	Block, 24×33 mm
2073	Sinusoidal Roughness	3.0 μm	100 μm	Block, 24×33 mm
2074	Sinusoidal Roughness	1.0 μm	40 μm	IN PREP
2075	Sinusoidal Roughness	1.0 μm	800 μm	IN PREP

Charpy V-Notch Test Blocks

These SRM's are test specimens for standardizing the Charpy impact test and for certifying Charpy impact test machines. After the bars are broken in the user's laboratory, they are to be returned to NIST for examination and certification of the test machine.

SRM	Type	Range	Unit of Issue
2092	Charpy V-Notch Low Energy	11–18 ft-lb	5 bars
2096	Charpy V-Notch High Energy	65–80 ft-lb	5 bars

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±0.1 mm long by 1.0 mm deep in a 7×7×2 cm block of 7075–T651 aluminum alloy, heat treated to the T6 temper.

Color

These SRM's are available to illustrate a characteristic color for each of the ISCC-NBS color-name blocks in NBS Special Publication 440, COLOR: Universal Language and Dictionary of Names. SRM 2106 consists of 251 color chips on 18 constant-hue centroid color charts, and constitutes a supplement to SP 440. The centroid colors represent a systematic sampling of the whole color solid. Note: The color chips were remeasured in 1984 and are issued with the new data as an addendum. This addendum is available upon request.

SRM	Type	Unit of Issue
2106	Centroid Color Charts	Set: 18 Charts

X-ray and Photographic

SRM 1001 is a calibrated x-ray film step tablet of 17 steps that cover the optical density range from 0 to 4; 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 to 4; it has a black tint and emulsion on a single side.

SRM 1010a, Microcopy Resolution Test Charts, is used to test the resolving power of cameras or of whole microcopying systems. SRM 1010a consists of five charts printed photographically on paper, which have 26 high-contrast five-line patterns ranging in spatial frequency from one cycle per millimeter to 18 cycles per millimeter. Instructions for the use of the charts are supplied with each order.

SRM	Type	Unit
1001	X-ray Film Step Tablet (0–4)	1 tablet, 17 steps
1008	Photographic Step Tablet (0–4)	1 tablet, 21 steps
1010a	Microcopy Resolution Test Chart	Set of 5 charts

Magnetic Computer Storage Media

These SRM's are for evaluating the performance of magnetic computer storage media and systems, and for maintaining control over their production. Each SRM is individually calibrated and certified.

SRM	Description	Unit of Issue
3200	Secondary Standard Magnetic Tape—12.7 mm (½ in) wide tape, certified for signal amplitude outputs relative to the NIST Standard Reference Amplitudes at 8, 32, and 126 flux transitions per millimeter (200, 800, 3200 flux transitions per inch).	Open Reel
6250	Secondary Standard High Density Magnetic Tape—12.7 mm (½ in) wide tape, certified for signal amplitude output relative to the NIST Standard Reference Amplitude at 356 flux transitions per millimeter (9042 flux transitions per inch).	Open Reel

Magnetic Computer Storage Media (Continued)

SRM	Description	Unit of Issue
1600	Secondary Standard Magnetic Tape Cassette—3.8 mm (0.15 in) wide tape, certified for signal amplitude output relative to the NIST Standard Reference Amplitude at 63 flux transitions per millimeter (1600 flux transitions per inch).	Cassette
3216	Secondary Standard Magnetic Tape Cartridge—6.3 mm (¼ in) wide tape, certified for signal amplitude output relative to the NIST Standard Reference Amplitude at 126 flux transitions per millimeter (3200 flux transitions per inch).	Cartridge
3217	Secondary Standard High Density Magnetic Tape Cartridge—6.3 mm (¼ in) wide tape, certified for signal amplitude outputs relative to the NIST Standard Reference Amplitudes at 252 and 394 flux transitions per millimeter (6400 and 10,000 flux transitions per inch).	Cartridge

These RM's are certified by the Physikalisch-Technische Bundesantalt (PTB), Federal Republic of Germany, for signal amplitude, overwrite, and resolution. The RM numbers correspond to the ISO standard number, and the materials conform to relevant ANSI, ISO, and ECMA standards for flexible disk cartridges.

RM	Description	Unformatted Capacity	Unit/Size
6596	Flexible Disk Cartridge	125 K bytes	130 mm (5.25 in)
9529	Flexible Disk Cartridge	2000 K bytes	90 mm (3.5 in)

Centerline Drawings for Optical Character Recognition Style—B Characters

This SRM is an exact copy of the centerline drawings that uniquely define each printed character shape and size used in constant strokewidth Style B Size I Optical Character Recognition (OCR-B) applications in accordance with one or more of the following standards: American National Standard X3.49–1975 (R 1982), Character Set for Optical Character Recognition (OCR-B); Federal Information Processing Standards Publication (OCR), European Computer Manufacturers Association Standard ECMA–11 for the Alphanumeric Character Set OCR-B for Optical Recognition, 3rd Edition, 1976 and International Standard ISO 1073/II-1976, Alphanumeric Character Sets for Optical Recognition Part II: Character Set OCR-B.

This Standard Reference Material contains information on the shape, size, strokewidth, and position relative to the base line of the OCR-B characters.

SRM	Characters	Sheets	Size	Sheet Size
1901	118	118	OCR-B I	32×44×0.01 cm

NIST Time Software

The NIST automated time service is a telephone time service designed to provide computer with telephone access to NIST time at occurrences approaching one millisecond (0.001 second). Features of the service include automated compensation for telephone-line delay, advanced alert for changes to and from daylight savings time and advanced notice of insertion of leap seconds. The ASC11-character time code should operate with standard modems and most computer systems. While the system can be used to set up computer time-of-day, simple hardware can be developed to set non-computer clock system.

SRM	Description	Unit of Issue
8101	Automated Computer Time Service (Acts)	Diskette

Cassandra Beck responds to one of the many inquiries or orders she handles for radioactivity SRM's.

FIRE RESEARCH

Surface Flammability

SRM 1002d, Hardboard Sheet, is issued for checking the operation of radiant panel test equipment in accordance with the procedures outlined in ASTM Standard E162–78.

SRM	Type	Certification	Unit of Issue
1002d	Hardboard Sheet	Flame Spread Index, I=153 Heat Evolution Factor, Q=36.5	Set of 4: 6×18×¼ inch

Smoke Density Chamber

These SRM's are certified for maximum specific optical density and are issued for performing operational checks of smoke density chambers.

SRM	Type	Maximum Specific Optical Density	Unit of Issue
1006c	Non-flaming Exposure Condition (α-cellulose)	Dm (corr.)=178	6 sheets
1007a	Flaming Exposure Condition (plastic)	Dm (corr.)=421 to 493	3 sheets
1048	Smoke Toxicity-Comp. ABS		7 sheets

Flooring Radiant Panel

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 E648.

SRM	Type	Critical Radiant Flux	Unit Size (cm)
1012	Flooring Radiant Panel	0.36 W/cm^2	104.1×25.4×0.305

Tape Adhesion Testing

This material is intended as a uniform source of linerboard for use under ASTM Designation D2860, Procedure A: Adhesion of Pressure Sensitive Tape to Fiberboard at 90 Degree Angle and Constant Stress.

SRM	Type	Unit
1810a	Linerboard for Tape Adhesion Testing	IN PREP

Additional Information

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* Send order with remittance to Superintendent of Documents, US Government Printing Office, Washington, DC 20402. Remittance from foreign countries should include an additional one-fourth of the purchase price for postage.

** May be ordered from: National Technical Information Services (NTIS), Springfield, Virginia 22161.

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H. M. (Skip) Kingston of the Inorganic Analytical Research Division demonstrates the IR-100 award winning microwave dissolution system he led development of at NIST.

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629	Zn-Base Alloy E	Apr 64	38
630	Zn-Base Alloy F	Apr 64	38
631	Zinc Spelter (mod)	Nov 81	38
640b	Silicon X-ray Diffraction	Jan 87	116
641	Ti-Base Alloy, 8Mn (A)	Oct 81	37
642	Ti-Base Alloy, 8Mn (B)	Oct 81	37
643	Ti-Base Alloy, 8Mn (C)	Oct 81	37
644	Ti-Base 2Cr–2Fe–2Mo (A)	Jan 60	37
646	Ti-Base 2Cr–2Fe–2Mo (C)	Jan 60	37
647	Ti-Base 6Al–2Mo–2Sn–4Zr	Aug 86	37
648	Ti-Base Alloy 5Al–2Sn–2Zr–4Cr–4Mo	Jun 87	37
650	Titanium	Nov 85	37
651	Titanium	Nov 85	37
652	Titanium	Nov 85	37
654a	Titanium Alloy 6A1–4V	Oct 81	37
656	Silicon Nitride Alpha/Beta	*	117
658	Tridymite Quantitative XRD	*	117
659	Ceramic Particle Size	*	117
660	LaB_6—2 Theta X-Ray Line Profile	*	117
668	Steels, Set 661–665	Sep 81	20
670	Ore, Rutile	Jun 85	77
671	Nickel Oxide 1	Dec 60	36
672	Nickel Oxide 2	Dec 60	36
673	Nickel Oxide 3	Dec 60	36
674a	Intensity X-ray Diffraction Set	Jun 83	117
675	Mica X-ray Diffraction	Jun 82	117
676	Crystalline Alpha Alumina	*	117
677	Crystalline X-Ray Line Processing	*	117
679	Brick Clay	Jan 87	78
680a	Platinum, High Purity	Mar 77	40
681	Platinum, Doped	Mar 77	40
682	Zinc, High Purity	Jul 68	40
683	Zinc, Pure	Oct 81	40
685	Gold, High Purity	Oct 81	40
688	Basalt Rock	Aug 81	80
689	Ferrochromium Silicon	Feb 82	26
690	Ore, Iron (Canada)	Oct 78	76
691	Reduced Iron Oxide	Apr 82	76
692	Ore, Iron (Labrador)	Oct 82	76
693	Ore, Iron (Nimba)	Oct 78	76
694	Phosphate Rock (Western)	Jun 84	74, 77
696	Bauxite (Surinam)	Aug 79	77
697	Bauxite (Dominican)	Aug 79	77
698	Bauxite (Jamaican)	Aug 79	77
699	Alumina, Reduction Grade	Aug 81	77

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705	Polystyrene 179k mol wt	Nov 78	97, 98, 100
706	Polystyrene 258k mol wt	Feb 79	97, 98
708	Glasses, Stress Optical Coefficient	Sep 73	95
709	Glass, Extra Dense Lead	Jun 74	95
710a	Glass, Soda Lime-Silica	*	94, 95
711	Glass, Lead-Silica	Jul 64	94, 95
712	Glass, Alkali Lead-Silica	Oct 66	95
713	Glass, Dense Barium Crown	Oct 66	95
714	Glass, Alkali Alumina Silica	Oct 66	95
715	Glass, Alkali-free Alumina	Sep 66	95
716	Glass, Neutral	Sep 66	95
717	Glass, Borosilicate	Nov 69	94–95
723a	Tris(hydroxymethyl) aminomethane, Basimetric	Apr 81	44
724a	Tris(hydroxymethyl) aminomethane, Calorimetric	Sep 73	99
726	Selenium, Inter-Purity	Jan 67	40
728	Zinc-Intermediate Purity	Oct 81	40
731	Glass, Borosilicate	Jul 72	104
738	Stainless Steel	Nov 86	104
739	Fused Silica	May 71	104
740a	Zinc Freezing Point	Feb 70	102
741	Tin Freezing Point	Jul 72	102
742	Alumina Melting Point	Jul 70	102
743	Mercury, Triple Point	Apr 76	102
745	Gold, Vapor Pressure	May 69	102
746	Cadmium, Vapor Pressure	Aug 70	102
748	Silver, Vapor Pressure	Aug 70	102
763	Aluminun, Magnetic Susceptibility	Apr 73	105
766	Manganese Fluoride, Mag Suscept	Apr 73	105
767a	Thermometric Fix Point Device	Jun 83	101
769	Electrical "RRR" Set	Nov 82	119
772	Nickel, Magnetic Moment	Oct 78	105
773	Glass, Liquidus Temperature	Nov 80	95
774	Glass, Dielectric Constant	Jul 82	94
853	Aluminum Alloy 3004	May 85	30
854	Aluminum Alloy 5182	May 85	30
855	Aluminum Casting Alloy 356	Jan 80	30
856	Aluminum Casting Alloy 380	Jan 80	30
858	Aluminum Alloy 6011 (mod)	Jun 80	30
859	Aluminum Alloy 7075	Jun 80	30
864	Inconel 600	May 84	35
865	Inconel 625	May 84	35
866	Incoloy 800	May 84	35
867	Incoloy 825	May 84	35
868	High-Temperature Alloy (Fe–Ni–Co)	May 87	18
871	Phosphor Bronze, CDA 521	Aug 79	31
872	Phosphor Bronze, CDA 544	Aug 79	31
874	Cupro-Nickel, 10 (CDA 706) (pure)	Jan 78	31
875	Cupro-Nickel, 10 (CDA 706) (doped)	Jan 78	31
879	Nickel Silver, CDA 762	Jun 79	31
880	Nickel Silver, CDA 770	Jun 79	31
882	Ni-Cu Alloy (65Ni–31Cu–3Al)	Aug 79	35
887	Cemented Carbide	Sep 88	82
888	Cemented Carbide	Sep 88	82
889	Cemented Carbide	Sep 88	82
890	Iron, HA White Cast (HC–250+V)	Apr 82	27
891	Iron, HA White Cast (Ni-Hard I)	Apr 82	27
892	Iron, HA White Cast (Ni-Hard IV)	Apr 82	27
897	Tracealloy A	Aug 83	36
898	Tracealloy B	Aug 83	36
899	Tracealloy C	Aug 83	36

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900	Antiepilepsy Drug Level Assay	Apr 79	49
909	Human Serum	Mar 85	49, 50
910	Sodium Pyruvate	May 81	49
911b	Cholesterol	May 88	49
912a	Urea	Nov 79	49
913	Uric Acid	Nov 73	49
914a	Creatinine	Oct 87	49
915	Calcium Carbonate	Nov 73	49
916a	Bilirubin	*	49
917a	D-Glucose (Dextrose)	Sep 73	49
918	Potassium Chloride	Nov 73	49
919a	Sodium Chloride	Nov 73	49
920	D-Mannitol	Nov 73	49
921	Cortisol (Hydrocortisone)	Dec 73	49
922	Tris(hydroxymethyl) aminomethane, pH	Aug 76	89
923	Tris(hydroxymethyl) aminomethane hydrochloride, pH	Aug 76	49, 89
924	Lithium Carbonate	Nov 73	49
925	4-Hydroxy-3-methoxy-dl-mandelic Acid (VMA)	Dec 73	49
926	Bovine Serum Albumin (Total Protein)	Jul 77	49
927a	Bovine Serum Albumin (7% Solution, Total Protein)	Aug 86	49
928	Lead Nitrate	May 76	49
929	Magnesium Gluconate Dihydrate	Apr 79	49
930D	Glass Filters for Spectrophotometry (Visible)	Aug 84	106
931d	Liquid Absorbance Filters for UV and Visible Spectrophotometry	Oct 86	106
934	Clinical Laboratory Thermometer	*	103
935a	Crystalline Potassium Dichromate for UV Absorbance	Jun 77	106
936	Quinine Sulfate Dihydrate	Apr 79	106
937	Iron Metal	Jun 78	49
938	4-Nitrophenol	May 81	49
951	Boric Acid	Oct 71	44, 88
952	Enriched Boric Acid	Oct 71	88
953	Neutron Density Monitor Wire	Mar 69	87
956	Electrolytes in Serum for ISE	*	49
963a	Fission Track Glass (U–1 ppm)	Feb 84	87
968	Fat Soluble Vitamins in Human Serum	Apr 88	49
975	Chlorine, Isotopic	Mar 65	88
976	Copper, Isotopic	Mar 65	88
977	Bromine, Isotopic	Mar 65	88
978a	Silver, Isotopic	Sep 84	88
979	Chromium, Isotopic	May 66	88
980	Magnesium, Isotopic	Jan 67	88
981	Lead, Common Isotopic	Apr 73	88
982	Lead, Equal-Atom Isotopic	Jun 68	88
983	Lead, Radiogenic Isotopic	Jun 68	88
984	Rubidium Chloride, Assay & Isotopic	Jul 70	88
985	Potassium, Assay & Isotopic	Aug 79	88
986	Nickel, Isotopic	*	88
987	Strontium, Assay & Isotopic	Oct 82	44, 88
989	Rhenium, Assay & Isotopic	Feb 74	88
990	Silicon, Assay & Isotopic	Aug 75	88
991	Lead-206 Spike, Assay & Isotopic	Mar 76	88
994	Gallium, Isotopic	Dec 85	88
997	Thallium, Isotopic	Jan 86	88
998	Angiotensin I (Human)	Jan 83	49
999	Potassium Chloride (Primary)	Sep 72	44
1001	X-Ray Film Step Tablet (0–4)	Jun 86	125
1002c	Surface Flammability	Dec 78	128
1003a	Glass Spheres (8–58 μm)	Sep 84	122
1004a	Glass Beads (34–120 μm)	*	122
1006c	Smoke Density, Nonflame (cellulose)	Apr 83	128
1007a	Smoke Density, Flame (ABS plastic)	Feb 76	128
1008	Photographic Step Tablet (0–4)	Jun 86	125

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1010a	Microcopy Resolution Test Charts	Jun 82	125
1012	Flooring Radiant Panel	Sep 84	128
1017a	Glass Beads (100–310 μm)	Sep 71	122
1018a	Glass Beads (225–780 μm)	May 73	122
1019a	Glass Spheres (0.76–2.16 mm)	Oct 84	122
1034	Unalloyed Copper	Feb 82	31
1035	Leaded-Tin Bronze Alloy	Feb 82	31
1048	Smoke Toxicity	*	128
1051b	Barium Metallo-organic	Jul 15	72
1052b	Vanadium Metallo-organic	Mar 68	72
1053a	Cadmium Metallo-organic	Jan 70	72
1057b	Tin Metallo-organic	Aug 68	72
1059c	Lead Metallo-organic	Sep 87	6372
1060a	Lithium Metallo-organic	Apr 64	72
1061c	Magnesium Metallo-organic	Oct 81	72
1065b	Nickel Metallo-organic	Nov 67	72
1066a	Silicon Metallo-organic	Apr 69	72
1069b	Sodium Metallo-organic	Feb 69	72
1070a	Strontium Metallo-organic	Apr 64	72
1071b	Phosphorus Metallo-organic	Feb 76	72
1073b	Zinc Metallo-organic	Jul 67	72
1075a	Aluminum Metallo-organic	Oct 67	72
1077a	Silver Metallo-organic	Feb 68	72
1078b	Chromium Metallo-organic	Jul 72	72
1079b	Iron Metallo-organic	Feb 69	72
1080a	Copper Metallo-organic	Feb 69	72
1083	Wear-Metals in Lube Oil (Base Oil)	Jul 85	73
1085	Wear-Metals in Lube Oil (300 ppm)	Jul 85	73
1089	Gasometric Set (1095—1099)	Set	39
1090	Oxygen in Ingot Iron	Oct 85	39
1091a	Oxygen in Stainless Steel (AISI 431)	Oct 85	39
1093	Oxygen in Valve Steel	Nov 84	39
1094	Oxygen in Maraging Steel	Nov 84	39
1103	Brass, Free Cutting, A	Aug 65	32
1104	Brass, Free Cutting, B	Aug 65	32
1107	Brass, Naval, B	Nov 81	32
C1107	Brass, Naval, B	Nov 81	32
1108	Brass, Naval, C	Nov 81	32
C1108	Brass, Naval, C	Nov 81	32
C1110	Brass, Red, B	Oct 81	32
1111	Brass, Red, C	Oct 81	32
C1111	Brass, Red, C	Oct 81	32
1112	Gilding Metal, A	Oct 81	32
C1112	Gilding Metal, A	Oct 81	32
1113	Gilding Metal, B	Oct 81	32
C1113	Gilding Metal, B	Oct 81	32
1114	Gilding Metal, C	Oct 81	32
C1114	Gilding Metal, C	Oct 81	32
1115	Bronze, Commercial, A	Nov 81	32
C1115	Bronze, Commercial, A	Nov 81	32
1116	Bronze, Commercial, B	Nov 81	32
C1116	Bronze, Commercial, B	Nov 81	32
1117	Bronze, Commercial, C	Nov 81	32
C1117	Bronze, Commercial, C	Nov 81	32
C1119	Brass, Aluminum, B	Jul 82	32
1129	Solder (63Sn–37Pb)	May 89	34
1131	Solder (40Sn–60Pb)	Oct 81	34
1132	Bearing Metal, Pb–Base	Jan 70	34
1133	Titanium Base Alloy 5Al–2Sn–2Zr–4Cr–4Mo	Jul 87	37
1134	Steel, High-Silicon	Apr 70	20
1135	Steel, High-Silicon	Jul 72	20
C1137a	Iron, White Cast	Jan 84	28
1138a	Steel, Cast, 1	Jan 77	28
1139a	Steel, Cast, 2	Jan 77	28
1144a	Iron, Blast Furnace, 2a	Dec 76	28
C1145a	Iron, White Cast	Jun 87	28
C1146a	Iron, White Cast	Oct 83	28
C1150a	Iron, White Cast	Dec 85	28
C1151	Stainless Steel (23Cr–7Ni)	Jan 80	24
C1152	Stainless Steel (18Cr–11Ni)	Jan 80	24
C1153	Stainless Steel (17Cr–9Ni)	Jan 80	24
C1153a	Stainless Steel (17Cr–9Ni)	Jan 80	24
C1154	Stainless Steel (19Cr–13Ni)	Jan 80	24
1155	Stainless Steel (AISI 316)	Aug 69	24

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1157	Steel, Tool (AISI M2)	Aug 73	24
1158	Steel, High-Nickel (36Ni)	Dec 77	24
1159	Electronic and Magnetic Alloy	Aug 81	35
1160	Electronic and Magnetic Alloy	Aug 81	35
1171	Stainless Steel (AISI 321)	Jul 71	24
1172	Stainless Steel (AISI 348)	Jul 71	24
1173	Steel, Ni–Cr–Mo–V	May 83	28
C1173	Steel, Cast 3	Feb 81	28
1199	High Temperature Alloy—L605	Aug 74	25
1200	High Temperature Alloy—S816	Aug 74	25
1216	Carbon Modified Silicon	Nov 87	35
1217	Steel, Nickel (SAE 4820)	Nov 84	20
1218	Steel, Silicon, Low C & S	Nov 84	20
1219	Stainless Steel (AISI 413)	Sep 85	24
C1221	Steel, Resulfurized/Rephosphorized	Jan 82	20
1222	Cr, Ni, Mo (AISI 8640)	Oct 78	20
1223	Stainless Steel, High S (AISI 416)	Sep 85	24
1224	Steel, Carbon (AISI 1078)	Feb 81	20
1225	Steel, Low-Alloy (AISI 4130)	Mar 83	20
1226	Steel, Low-Alloy (HY 130)	Dec 82	20
1227	Steel, BOH 1.0 C	Mar 83	20
1228	Steel, BOH 0.1 C	Sep 82	20
1230	High Temperature Alloy	Jun 87	25
1233	Steel, Valve	Feb 86	24
1234	Zirconium A	Nov 80	38
1237	Zircaloy–4 D	Nov 80	38
1240	Aluminum Alloy 3004	Jul 85	30
1240a	Aluminum Alloy 3004	Jul 85	30
1240b	Aluminum Alloy 3004	Jul 85	30
1241a	Aluminum Alloy 5182	Aug 85	30
1241b	Aluminum Alloy 5182	Aug 85	30
1243	Waspaloy	Jan 89	35
1244	Inconel 600	May 84	25
1245	Inconel 625	May 84	25
1246	Inconel 800	May 84	25
1247	Inconel 825	May 84	25
C1248	Nickel Copper Alloy	Dec 86	35
1250	Pyromet	Jun 87	25
C1251	Phosphorized Copper (Cu VIII)	Sep 80	33
C1252	Phosphorized Copper (Cu IX)	Sep 80	33
C1253	Phosphorized Copper (Cu X)	Sep 80	33
1254	Steel, Silicon (Ca only)	Apr 82	20
1255a	Aluminum Casting Alloy 356	Nov 86	30
1256a	Aluminum Casting Alloy 380	Nov 86	30
C1257	High Purity Aluminum	Jan 87	30, 40
1258	Aluminum Alloy 6011 (mod)	May 78	30
1259	Aluminum Alloy 7075	May 78	30
1267	Stainless Steel (AISI 446)	Jan 78	24
1269	Steel (AISI 1526) Line Pipe (mod)	Jun 81	20
1270	Steel, A336 (F–22) 2.3Cr–1Mo	Jun 81	20
1275	Cupro-Nickel (CDA 706)	Mar 80	32
1276	Cupro-Nickel (CDA 715)	Mar 80	32
C1285	Steel, A242 (mod)	Jun 82	20
1286	Steel, Low Alloy (HY 80)	Jun 82	20
C1287	Steel, ACI HK (AISI 310 mod)	Jun 81	24
C1288	Steel, ACI CN–7M (A–743)	Aug 81	24
C1289	Steel, ACI CA–6NM (AISI 414 mod)	Jun 81	24
C1290	Iron, White Cast (HC–250+V)	Jan 85	28
C1291	Iron, White Cast (Ni–Hard, Type I)	Jan 85	28
C1292	Iron, White Cast (Ni–Hard, Type IV)	Jan 85	28
1321	Cu–Cr Coating (nonmagnetic) on Steel	Jul 88	92
1322	Cu–Cr Coating (nonmagnetic) on Steel	Jul 88	92
1323	Cu–Cr Coating (nonmagnetic) on Steel	Jul 88	92
1357	Cu–Cr Coating (nonmagnetic) on Steel	Aug 84	92
1358	Cu–Cr Coating (nonmagnetic) on Steel	Aug 84	92

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1359	Cu–Cr Coating (nonmagnetic) on Steel	May 84	92
1360	Cu–Cr Coating (nonmagnetic) on Steel	May 84	92
1361a	Cu–Cr Coating (nonmagnetic) on Steel	May 84	92
1362a	Cu–Cr Coating (nonmagnetic) on Steel	May 84	92
1363a	Cu–Cr Coating (nonmagnetic) on Steel	May 84	92
1364a	Cu–Cr Coating (nonmagnetic) on Steel	May 84	92
1365a	Nickel (magnetic) on Steel	May 84	92
1366a	Nickel (magnetic) on Steel	May 84	92
1379	Ultra-thin Gold on Nickel 0.35 mg	May 84	93
1380	Ultra-thin Gold on Nickel 0.55 mg	May 84	93
1387	Gold Coating on Nickel 2.2 mg	Sep 85	93
1399b	Gold Coating on Nickel (set)	May 84	93
1411	Soft Borosilicate Glass	Aug 85	83
1412	Multicomponent Glass	Aug 85	83
1413	Glass Sand, High Alumina	Aug 85	79
1449	Fumed Silica Board	Jan 89	104
1450b	Thermal Resistance, Fibrous Glass Board	May 85	104
1451	Thermal Resistance, Fibrous Glass Blanket	May 85	104
1452	Thermal Resistance, Fibrous Glass Batt	Apr 86	104
1457	Superconducting Critical Current Nb–Ti Wire	Jun 84	119
1459	Fumed Silica Board	Jan 89	104
1461	Thermal Conductivity and Electrical Resistivity, Stainless Steel	May 84	104, 118
1462	Thermal Conductivity and Electrical Resistivity, Stainless Steel	May 84	104, 118
1470	Gas Transmission, Polyester Film	Feb 82	117
1474	Polyethylene Melt Flow	*	97
1475	Linear Polyethylene (52k mol wt)	Dec 78	97, 98, 100
1476	Branched Polyethylene (viscosity)	Nov 69	97, 98
1478	Polystyrene (37k mol wt)	Jan 79	97, 98
1479	Polystyrene (1M mol wt)	Mar 81	97, 98
1480	Polyurethanes Low MW	*	97
1481	Polyurethanes High MW	*	97
1482	Linear Polyethylene (13k mol wt)	Oct 76	97, 98
1483	Linear Polyethylene (32k mol wt)	Mar 76	97, 98
1484	Linear Polyethylene (119k mol wt)	Oct 76	97, 98
1487	Poly (methylmethacrylate), $M_n \approx 6{,}000$	Jun 89	97, 98
1488	Poly (methylmethacrylate)	Feb 88	97, 98
1489	Poly (methylmethacrylate)	Mar 86	97, 98
1490	Polyisobutylene Solution in Cetane, Rheology	Dec 77	98
1491	Aromatic Hydrocarbons in Hexane	Aug 89	63, 64
1492	Chlorinated Pesticides in Hexane	Apr 89	63, 65
1493	Polychlorinated Biphenyls in 2,2,4-Trimethylpentane	undated	63
1495	Rubber, Isobutylene-Isoprene (Butyl) (Low Mooney Viscosity)	Mar 81	121
1496	Polythylene Resin (Natural)	Sep 88	97
1497	Polythylene Resin (Pigmented))	Jul 87	97
1507	THC in Freeze-Dried Urine	*	68
1508	Cocaine in Urine	*	68
1514	Thermal Analysis Purity (DSC)	Jul 84	100
1515	Apple Leaves	*	53
1543	GC/MS System Performance	Aug 84	67
1547	Peach Leaves	*	53
1548	Total Diet	undated	51
1549	Non-Fat Milk Powder	Jul 85	51
1563	Cholesterol and Fat–Soluble Vitamins in Coconut Oil	Jul 87	52
1566a	Oyster Tissue	Oct 89	51
1567a	Wheat Flour	Sep 88	51
1568a	Rice Flour	Jan 78	51
1569	Brewers Yeast (Cr only)	Sep 76	51
1572	Citrus Leaves	Dec 82	53
1573a	Tomato Leaves	**	53
1575	Pine Needles	Oct 76	53
1577a	Bovine Liver	Feb 85	51
1579	Powdered Lead-Based Paint (Pb only)	Jan 73	59
1580	Organics in Shale Oil	Nov 80	63, 64
1581	Polychlorinated Biphenyls in Oil	Jan 82	63, 65
1582	Petroleum Crude Oil	Jan 84	63, 64
1583	Chlorinated Pesticides in 2,2,4–Trimethylpentane	Feb 85	63, 65
1584	Priority Pollutant Phenols in Methanol	Apr 84	63, 65
1585	Chlorinated Biphenyls	Jan 86	63, 66
1586	Isotopically Labeled and Unlabeled Priority Pollutants in Methanol	Oct 84	63, 66
1587	Nitrated Polycyclic Aromatic Hydrocarbons in Methanol	Jun 85	63, 66
1588	Organics in Cod Liver Oil	Jan 89	63, 67
1589	PCB's in Human Serum	Nov 85	49, 67
1590	Stabilized Wine	Dec 80	52
1595	Tripalmitin	Jul 83	49
1596	Dinitropyrene Isomers and I-Nitropyrene in Methylene Chloride	Jul 87	63, 67
1597	Complex Mixture of Polycyclic Aromatic Hydrocarbons	Sep 87	63, 64
1598	Inorganic Constituents in Bovine Serum	Jan 89	49
1599	Anticonvulsant Drug Level Assay	Aug 82	49
1600	Secondary Standard Magnetic Tape Cassette (Computer Amplitude)	Mar 74	126
1614	Dioxin in *Iso*octane	Jul 85	63, 67
1616	Sulfur in Kerosene	Feb 88	61
1617	Sulfur in Kerosene	Feb 88	61
1618	V and Ni in Residual Fuel Oil	May 85	59
1619	Sulfur in Residual Fuel Oil (0.7%)	Dec 81	61
1620b	Sulfur in Residual Fuel Oil (4.5%)	*	61
1621c	Sulfur in Residual Fuel Oil (0.9%)	Sep 86	61
1622c	Sulfur in Residual Fuel Oil (1.9%)	Sep 86	61
1623b	Sulfur in Residual Fuel Oil (0.2%)	*	61
1624b	Sulfur in Distillate (Diesel) Fuel Oil (0.1%)	*	61
1625	Sulfur Dioxide Permeation Tube, 10 cm	Jan 73	57
1626	Sulfur Dioxide Permeation Tube, 5 cm	Aug 71	57
1627	Sulfur Dioxide Permeation Tube, 2 cm	Aug 71	57
1630	Trace Mercury in Coal	Aug 79	59

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1632b	Trace Elements in Coal (Bituminous)	Jun 85	62
1633a	Trace Elements in Coal Fly Ash	Jan 85	62
1634b	Trace Elements in Fuel Oil	Feb 86	62
1635	Trace Elements in Coal (Subbituminous)	Aug 79	62
1638b	Lead in Reference Fuel	Aug 86	59
1639	Halocarbons (in methanol) for Water Analysis	Apr 83	63, 64
1641b	Mercury in Water (μg/mL)	Apr 83	59
1643b	Trace Elements in Water	May 84	62
1646	Estuarine Sediment	Jun 82	62
1647a	Priority Pollutant Polynuclear Aromatic Hydrocarbons	Dec 81	63, 64
1648	Urban Particulate Matter	May 82	62
1649	Urban Dust/Organics	Apr 82	63, 64
1650	Diesel Particulate Matter	Feb 85	63, 64
1651	Heat-Source Powder for Calorimetry Zirconium-Barium Chromate, 1460	Nov 68	99
1652	Heat-Source Powder for Calorimetry Zirconium-Barium Chromate, 1632	Nov 68	99
1653	Heat Source for Calorimetry Zirconium-Barium Chromate, 1762	Nov 68	99
1655	Potassium Chloride for Solution Calorimetry	Mar 81	99
1656	Thianthrene, Combustion Calorimetry	Jan 85	99
1657	Synthetic Refuse-Derived Fuel, Combustion Calorimetry	Mar 85	99
1658a	Methane in Air, 1ppm	Mar 81	55
1659a	Methane in Air, 10 ppm	Mar 81	55
1660a	Methane (4) and Propane (1) in Air	Mar 81	55
1661a	Sulfur Dioxide in Nitrogen, 500 ppm	Oct 88	56
1662a	Sulfur Dioxide in Nitrogen, 1000 ppm	Oct 88	56
1663a	Sulfur Dioxide in Nitrogen, 1500 ppm	Mar 81	56
1664a	Sulfur Dioxide in Nitrogen, 2500 ppm	Mar 81	56
1665b	Propane in Air, 3 ppm	Dec 87	56
1666b	Propane in Air, 10 ppm	Dec 87	56
1667b	Propane in Air, 50 ppm	Dec 87	56
1668b	Propane in Air, 100 ppm	Jan 80	56
1669b	Propane in Air, 500 ppm	Jan 80	56
1670	Carbon Dioxide in Air, 330 ppm	Dec 82	54
1671	Carbon Dioxide in Air, 340 ppm	Dec 82	54
1672	Carbon Dioxide in Air, 350 ppm	Dec 82	54
1674b	Carbon Dioxide in Nitrogen, 7%	Jan 80	54
1675b	Carbon Dioxide in Nitrogen, 14%	Jan 80	54
1677c	Carbon Monoxide in Nitrogen, 10 ppm	Jan 80	55
1678c	Carbon Monoxide in Nitrogen, 50 ppm	Jan 80	55
1679c	Carbon Monoxide in Nitrogen, 100 ppm	Jan 80	55
1680b	Carbon Monoxide in Nitrogen, 500 ppm	Jan 80	55
1681b	Carbon Monoxide in Nitrogen, 1000 ppm	Jan 80	55
1683b	Nitric Oxide in Nitrogen, 50 ppm	Nov 88	55
1684b	Nitric Oxide in Nitrogen, 100 ppm	Nov 88	55
1685b	Nitric Oxide in Nitrogen, 250 ppm	Jan 80	55
1686b	Nitric Oxide in Nitrogen, 500 ppm	Jan 80	55
1687b	Nitric Oxide in Nitrogen, 1000 ppm	Jan 80	55

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1691	Polystyrene Spheres, 0.3 μm	May 84	122
1693a	Sulfur Dioxide in Nitrogen, 50 ppm	Jun 89	56
1694a	Sulfur Dioxide in Nitrogen, 100 ppm	Jun 89	56
1696	Sulfur Dioxide in Nitrogen, 3500 ppm	Jul 84	56
1700a	Carbon Dioxide in Nitrogen, 10% Blood Gas	Aug 88	49, 54
1701a	Carbon Dioxide and Oxygen in Nitrogen, 5% and 12%, Blood Gas	Aug 88	49, 54
1702a	Carbon Dioxide and Oxygen in Nitrogen, 5% and 20%, Blood Gas	Aug 88	49, 54
1703a	Carbon Dioxide and Oxygen in Nitrogen, 10% and 7%, Blood Gas	Aug 88	49, 54
1754	Steel, Low Alloy (AISI 4320)	Feb 89	39
1761	Steel, Low Alloy	Feb 88	20
1762	Steel, Low Alloy	Feb 88	20
1763	Steel, Low Alloy	Feb 88	20
1764	Steel, Low Alloy	Feb 88	20
1765	Steel, Low Alloy	Feb 88	20
1766	Steel, Low Alloy	Feb 88	20
1767	Steel, Low Alloy	Feb 88	20
1804	Ambient Toxic Organics in Nitrogen	*	56
1805	Benzene in Nitrogen, 0.25 ppm	Dec 82	54
1806	Benzene in Nitrogen, 10 ppm	Dec 82	54
1808	Tetrachloroethylene in Nitrogen, 0.25 ppm	Jun 83	57
1809	Tetrachloroethylene in Nitrogen, 10 ppm	Jun 83	57
1810a	Linerboard	Dec 83	128
1811	Aromatic Gases in Nitrogen 0.25 ppm	Nov 85	54
1812	Aromatic Gases in Nitrogen 10 ppm	Nov 85	54
1813	Aliphatic Organic Gases in Nitrogen 0.25 ppm	Mar 87	54
1814	Aliphatic Organic Gases in Nitrogen 10 ppm	Mar 87	54
1815a	n–Heptane, Reference Fuel	Mar 85	118
1816a	*Iso*octane, Reference Fuel	Mar 85	118
1817b	Catalyst Package for Lubricant Oxidation	Oct 86	73
1818	Chlorine in Lube Base Oil	Apr 86	72
1819	Sulfur in Lubricating Base Oil	Jul 85	72
1822	Refractive Index Glass, Soda-Lime	Nov 84	108
1823	Refractive Index Silicone Liquids	Dec 76	108
1825	Glass Density	*	96
1826	Glass Density	*	96
1827	Glass Density	*	96
1828	Ethanol-Water Solutions	Jun 85	52
1829	Alcohols in Reference Fuel	Mar 86	60
1830	Soda-Lime Float Glass	Jul 82	83
1831	Soda-Lime Sheet Glass	Jul 82	83
1832	Thin Glass Film on Polycarbonate for X-ray Fluorescence	May 84	69
1833	Thin Glass Film on Polycarbonate for X-ray Fluorescence	May 84	69
1834	Fused Ore Glass for XRF	*	83
1835	Borate Ore	Sep 87	77
1836	Nitrogen in Lube Base Oil	*	72
1837	Methanol and t-Butanol in Reference Fuels	Mar 86	60
1838	Ethanol in Reference Fuels	Mar 86	60
1839	Methanol in Reference Fuels	Mar 86	60
1841a	Silicon Density, 200 g	May 82	96
1845	Cholesterol In Whole Egg Powder	Jan 89	52
1850	Penetrant Test Block	Dec 80	123

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1856	Acoustic Emission Transducer	Jul 85	97
1857	Tool Steel Abrasive Wear	Mar 83	115
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1862	Al, Eddy Current 41% IACS	Aug 82	119
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1871	Pb–Si Glasses for Microanalysis	May 84	41, 42
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1878	Respirable Alpha Quartz	Nov 83	70
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1881	Portland Cement, white	Feb 84	84
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1883	Ca–Al Cement	Jul 86	84
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1885	Cement Composition	Sep 89	84
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1888	Cement Composition	Sep 89	85
1889	Cement Composition	Sep 89	85
1890	Stainless Steel for Pitting of Crevice Corrosion	May 83	116
1891	Co–Cr–Mo Alloy for Pitting of Crevice Corrosion	Sep 85	116
1893	Cu Microhardness Knoop	Feb 84	96
1894	Cu Microhardness Vickers	Feb 84	96
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1896	Ni Microhardness Vickers	Feb 84	96
1901	Centerline Drawings for Optical Character Recognition-Type B	Mar 76	126
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1924	Polystyrene Sulfonates	*	97
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1969	Rubidium Triple Point	Jan 84	102
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2025	Aluminum Mirror with Wedge, Second Surface, Reflectance	Feb 82	107
2031	Metal-on-Quartz Filters for Spectrophotometry	Oct 84	106
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2063	Microanalysis Thin Film Mg–Si–Ca–Fe	Aug 87	41, 43
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2151	Nicotinic Acid (Calorimetry)	Jan 85	99
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2164	Low Alloy Steel	*	17
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2166	Low Alloy Steel	*	17
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2181	Hepes	Mar 89	89
2182	Hepes Sodium Salt	Mar 89	89
2185	Potassium Hydrogen Phthalate, pD	Nov 84	89
2186I	Potassium Dihydrogen Phosphate, pD	May 68	89
2186II	Disodium Hydrogen Phosphate, pD	May 68	89
2191a	Sodium Bicarbonate, pD	Nov 84	89
2192a	Sodium Carbonate, pD	Nov 84	89
2201	Sodium Chloride, pNa & pCl	Mar 84	90
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2211	Toluene 8 mL	Mar 85	96, 108
2213	2,2,4–Trimethylpentane 25 mL	Mar 85	96, 99, 108
2220	Tin, Temp and Enthalpy of Fusion	Oct 85	100
2221a	Zinc, Temp and Enthalpy of Fusion	Oct 85	100
2222	Biphenyl, Temp and Enthalpy of Fusion	Sept 87	100
2223	Potassium Nitrate, Temp and Enthalpy of Fusion	*	100
2225	Temperature and Enthalphy of Fusion-Mercury	Mar 89	100
2321	Solder Thickness	*	92
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C2401	High Alloy Steel (ACI-CD-4M-Cu)	Feb 86	25
C2402	Hasteloy C	Feb 86	25
C2416	Bullet Lead	Feb 88	34
C2417	Lead-Base Alloy	Feb 87	34
C2418	High-Purity Lead	Feb 87	34
C2423	Ductile Iron	Nov 85	28
C2423a	Ductile Iron	Nov 85	28
C2424	Ductile Iron	Jul 85	28
C2424a	Ductile Iron	Jul 85	28
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C2425a	Ductile Iron	Jul 85	28
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2526	111 p-Type Si, Spreading Resistance	Aug 83	118
2527	111 n-Type Si, Spreading Resistance	Aug 83	118
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2532	Thin Film Thickness	*	93
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2534	Thin Film Thickness	*	93
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2542	Silicon Resistivity	*	118
2543	Silicon Resistivity	*	118
2544	Silicon Resistivity	*	118
2546	Silicon Resistivity	*	118
2547	Silicon Resistivity	*	118
2548	Silicon Resistivity	*	118
2549	Silicon Resistivity	*	118
2550	Silicon Resistivity	*	118
2607	Carbon Dioxide/Nitrous Oxide in Air	Sep 85	54
2608	Carbon Dioxide/Nitrous Oxide in Air	Sep 85	54
2609	Carbon Dioxide/Nitrous Oxide in Air	Sep 85	54
2610	Carbon Dioxide/Nitrous Oxide in Air	Sep 85	54
2612a	Carbon Monoxide in Air (10 ppm)	Jan 80	55
2613a	Carbon Monoxide in Air (20 ppm)	Jan 80	55
2614a	Carbon Monoxide in Air (45 ppm)	Jan 80	55
2619a	Carbon Dioxide in Nitrogen (0.5%)	Jan 80	54
2620a	Carbon Dioxide in Nitrogen (1.0%)	Jan 80	54
2621a	Carbon Dioxide in Nitrogen (1.5%)	Jan 80	54
2622a	Carbon Dioxide in Nitrogen (2.0%)	Jan 80	54
2623a	Carbon Dioxide in Nitrogen (2.5%)	Jan 80	55
2624a	Carbon Dioxide in Nitrogen (3.0%)	Jan 80	55
2625a	Carbon Dioxide in Nitrogen (3.5%)	Jan 80	55
2626a	Carbon Dioxide in Nitrogen (4.0%)	Jan 80	55
2627a	Nitric Oxide in Nitrogen (5 ppm)	Jun 82	55
2628a	Nitric Oxide in Nitrogen (10 ppm)	Jun 82	55
2629a	Nitric Oxide in Nitrogen (20 ppm)	Jun 82	55
2630	Nitric Oxide in Nitrogen (1500 ppm)	May 79	55
2631	Nitric Oxide in Nitrogen (3000 ppm)	May 79	55
2635a	Carbon Monoxide in Nitrogen (25 ppm)	Dec 88	55
2636a	Carbon Monoxide in Nitrogen (250 ppm)	Nov 87	55
2637a	Carbon Monoxide in Nitrogen (2500 ppm)	Mar 87	55
2638a	Carbon Monoxide in Nitrogen (5000 ppm)	Mar 87	55
2639a	Carbon Monoxide in Nitrogen (1%)	Mar 87	55
2640a	Carbon Monoxide in Nitrogen (2%)	Jul 79	55
2641a	Carbon Monoxide in Nitrogen (4%)	Jul 79	55
2642a	Carbon Monoxide in Nitrogen (8%)	Mar 87	55
2645a	Propane in Nitrogen (500ppm)	May 80	56
2646a	Propane in Nitrogen (1000 ppm)	May 80	56
2647a	Propane in Nitrogen (2500 ppm)	May 80	56
2648a	Propane in Nitrogen (5000 ppm)	May 80	56
2649	Propane in Nitrogen (10,000 ppm)	May 80	56
2650	Propane in Nitrogen (20,000 ppm)	May 80	56
2651	Propane and Oxygen in Nitrogen	Jul 80	56
2652	Propane and Oxygen in Nitrogen	Jul 80	56
2654	Nitrogen Dioxide in Air (500 ppm)	Jun 82	55
2655	Nitrogen Dioxide in Air (1000 ppm)	Jun 82	55
2656	Nitrogen Dioxide in Air (2500 ppm)	Jun 82	55
2657a	Oxygen in Nitrogen (2%)	Nov 87	55
2658a	Oxygen in Nitrogen (10%)	Nov 87	55
2659a	Oxygen in Nitrogen (20%)	Nov 87	55
2670	Toxic Metals in Freeze-Dried Urine	Mar 85	68
2671a	Freeze-Dried Urine for Fluorine	Dec 82	68
2672a	Freeze-Dried Urine for Mercury	May 83	68
2676c	Metals on Filter Media (Cd-Mn-Pb-Zn)	Feb 87	69
2677	Be & As on Filter Media	Oct 85	69
2678	Membrane Blank Filter	May 88	69
2679a	Quartz on Filter Media	May 84	69
2680	Membrane Blank Filter	May 88	69
2681	Ashless Blank Filter	May 88	69
2682	Sulfur in Coal (0.5)	Feb 85	69, 99
2683a	Sulfur in Coal (1.9)	Feb 85	61, 99
2684a	Sulfur in Coal (3.0)	Feb 85	61, 99
2685	Sulfur in Coal (4.6)	Feb 85	61, 99
2689	Coal Fly Ash	Oct 86	62
2690	Coal Fly Ash	Oct 86	62
2691	Coal Fly Ash	Oct 86	62
2692	Sulfur in Coal (0.1)	Nov 88	61
2694	Simulated Rainwater	*	59
2695	FL Vegetation	*	53
2696	FL Vegetation	*	53
2704	Buffalo River Sediment	Jun 88	62
2709	Agricultural Soil (Baseline Levels)	*	79
2710	Agricultural Soil (Elevated Levels)	*	79
2712	Lead in Reference Fuel	Sep 88	59
2713	Lead in Reference Fuel	Sep 88	59
2714	Lead in Reference Fuel	Sep 88	59
2715	Lead in Reference Fuel	Sep 88	59
2717	Sulfur in Residual Fuel Oil	*	61
2720	Synthetic Sulfur in Oil	*	61
2725	Auto Emission Inspection Maintenance Gas 1.6 mol%	Jan 89	55
2726	Auto Emission Inspection Maintenance Gas	Jan 89	55

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2728	Auto Emission Inspection Maintenance Gas	Jan 89	55
2730	Hydrogen Sulfide in Nitrogen	May 89	56
2731	Hydrogen Sulfide in Nitrogen	May 89	56
3101	Aluminum Spectrometric Solution	Nov 86	45
3102	Antimony Spectrometric Solution	Nov 86	45
3103	Arsenic Spectrometric Solution	Nov 86	45
3104	Barium Spectrometric Solution	Nov 86	45
3105	Beryllium Spectrometric Solution	Nov 86	45
3106	Bismuth Spectrometric Solution	Dec 86	45
3107	Boron Spectrometric Solution	Dec 86	45
3108	Cadmium Spectrometric Solution	Dec 86	45
3109	Calcium Spectrometric Solution	Nov 86	45
3110	Cerium Spectrometric Solution	Mar 87	45
3111	Cesium Spectrometric Solution	Feb 87	45
3112	Chromium Spectrometric Solution	Nov 86	45
3113	Cobalt Spectrometric Solution	Dec 86	45
3114	Copper Spectrometric Solution	Dec 86	45
3115	Dysprosium Spectrometric Solution	Mar 87	45
3116	Erbium Spectrometric Solution	Mar 87	45
3117	Europium Spectrometric Solution	Mar 87	45
3118	Gadolinium Spectrometric Solution	Mar 87	45
3119	Gallium Spectrometric Solution	Mar 87	45
3120	Germanium Spectrometric Solution	Mar 88	45
3121	Gold Spectrometric Solution	Nov 86	45
3122	Hafnium Spectrometric Solution	Apr 88	45
3123	Holmium Spectrometric Solution	Mar 87	45
3124	Indium Spectrometric Solution	Dec 86	45
3125	Iridium Spectrometric Solution	*	45
3126	Iron Spectrometric Solution	Nov 86	45
3127	Lanthanum Spectrometric Solution	Mar 87	45
3128	Lead Spectrometric Solution	Dec 86	45
3129	Lithium Spectrometric Solution	Nov 86	45
3130	Lutetium Spectrometric Solution	Mar 87	45
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3135	Neodymium Spectrometric Solution	Mar 87	45
3136	Nickel Spectrometric Solution	Dec 86	45
3137	Niobium Spectrometric Solution	Jan 88	45
3138	Palladium Spectrometric Solution	Nov 86	45
3139	Phosphorus Spectrometric Solution	Nov 86	45
3140	Platinum Spectrometric Solution	Nov 86	45
3141	Potassium Spectrometric Solution	Nov 86	45
3142	Praseodymium Spectrometric Solution	Mar 87	45
3143	Rhenium Spectrometric Solution	Jul 88	45
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3145	Rubidium Spectrometric Solution	Nov 86	45
3146	Ruthenium Spectrometric Solution	*	46
3147	Samarium Spectrometric Solution	Mar 87	46
3148	Scandium Spectrometric Solution	Mar 87	46
3149	Selenium Spectrometric Solution	Dec 86	46
3150	Silicon Spectrometric Solution	Dec 86	46
3151	Silver Spectrometric Solution	Dec 86	46
3152	Sodium Spectrometric Solution	Nov 86	46
3153	Strontium Spectrometric Solution	Nov 86	46
3154	Sulfur Spectrometric Solution	Aug 87	46
3155	Tantalum Spectrometric Solution	Jan 88	46
3156	Tellurium Spectrometric Solution	Aug 87	46
3157	Terbium Spectrometric Solution	Mar 87	46
3158	Thallium Spectrometric Solution	Dec 86	46
3159	Thorium Spectrometric Solution	Jan 88	46
3160	Thulium Spectrometric Solution	Mar 87	46
3161	Tin Spectrometric Solution	Nov 86	46
3162	Titanium Spectrometric Solution	Nov 86	46
3163	Tungsten Spectrometric Solution	Dec 86	46
3164	Uranium Spectrometric Solution	Dec 86	46
3165	Vanadium Spectrometric Solution	Dec 86	46
3166	Ytterbium Spectrometric Solution	Mar 87	46
3167	Yttrium Spectrometric Solution	Mar 87	46
3168	Zinc Spectrometric Solution	Nov 86	46
3169	Zirconium Spectrometric Solution	Dec 86	46
3171	Multielement Mix A Solution	Jul 88	47
3172	Multielement Mix B Solution	Jul 88	47
3173	Multielement Mix C Solution	*	47
3174	Multielement Mix D Solution	Mar 89	47
3181	Sulfate Anion Solution	Jan 87	48
3182	Chloride Anion Solution	Apr 87	48
3183	Fluoride Anion Solution	Apr 87	48
3184	Bromide Anion Solution	*	48
3185	Nitrate Anion Solution	*	48
3186	Phosphate Anion Solution	*	48
3191	Electrolytic Conductance	May 87	119
3192	Electrolytic Conductance	May 87	119
3193	Electrolytic Conductance	May 87	119
3194	Aqueous Electrolytic Conductance	Mar 89	119
3195	Aqueous Electrolytic Conductance	Mar 89	119
3200	Secondary Standard Magnetic Tape (Computer Amplitude Ref)	May 81	125
3216	Secondary Standard Magnetic Tape Cartridge (Computer Amplitude Ref)	Aug 82	126
3217	Secondary Standard Magnetic Tape Cartridge-High Density (C A Ref)	Jul 87	126
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4201B	Niobium-94 Gamma-ray	Jun 70	112
4202D	Cadmium-109-Silver-109m	Oct 86	112
4203D	Cobalt-60 Point Source	Feb 84	112
4207B	Cesium-137/Barium-137m Point Source	Mar 87	112
4218E	Europium-152 Point Source	Nov 82	112
4226B	Nickel-63 Solution	Dec 84	110
4233C	Cesium-137 Burn-up Standard	Nov 79	110

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4241B	Barium–133 Point Source	Apr 82	112
4251B	Barium–133 Solution	Dec 81	110
4264B	Tin–121m Point-Source Gamma-ray	Sep 82	112
4267	Niobium–93m Point Source	Oct 85	112
4275C	Mixed Radionuclide Point Source	Jul 83	112
4276C	Mixed Radionuclide Solution	Jul 83	110
4288	Technetium–99 Solution	Nov 82	110
4308C	Krypton–85 Gaseous	Jan 83	111
4320	Curium-244	Mar 89	110
4321	Uranium–238 Solution	Nov 86	110
4322	Americium–241 Solution	Nov 86	110
4323	Plutonium–238 Solution	Nov 86	110
4324	Uranium–232 Alpha-particle Solution	May 84	110
4326	Polonium-209	no date	110
4327	Polonium–208 Alpha-particle Solution	Jan 85	110
4328	Thorium–229 Alpha-particle Solution	May 85	110
4329	Curium–243 Alpha-particle Solution	Mar 85	110
4332C	Americium–243 Alpha-particle Solution	Feb 84	110
4338	Plutonium–240 Alpha-particle Solution	Aug 80	110
4350B	Environmental Radioactivity, River Sediment	Sep 81	113
4351	Environmental Radioactivity, Human Lung	Oct 82	113
4352	Environmental Radioactivity, Human Liver	Jun 82	113
4353	Environmental Radioactivity, Rocky Flats Soil Number 1	Dec 80	113
4354	Freshwater Lake Sediment (Gyttja)	Nov 86	113
4355	Environmental Radioactivity, Peruvian Soil	Jun 82	113
4361B	Hydrogen–3 Solution	Jan 81	110, 111
4370C	Europium–152 Solution	Mar 87	110
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4416L	Gallium–67 Solution	**	114
4417L	Indium–111 Solution	**	114
4420LB	Lead-203	**	114
4421L	Gold-195	**	114
4423	Strontium-90	**	110
4904G	Americium–241 Alpha-particle	Apr 82	111
4906C	Plutonium–238 Point Source	*	111
4915D	Cobalt–60 Solution	Feb 84	110
4919F	Strontium–99 Solution	May 83	110
4926D	Hydrogen–3 Tritiated Water	Jan 79	110
4927D	Hydrogen–3 Tritiated Water	Mar 85	110
4929D	Iron–55 X-ray Solution	Jul 85	110
4935C	Krypton–85 Beta-particle Gaseous	Jul 74	111
4940C	Promethium–147 Beta-particle Solution	Aug 85	110
4943	Chlorine–36 Beta-particle Solution	Dec 84	110
4947C	Hydrogen–3 Tritiated Toluene	Apr 79	110
4949B	Iodine–129 Solution	Feb 82	110
4950E	Radium–226 Solution	May 84	112

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4953D	Radium–226 Solution	May 84	112
4956	Radium–226 Gamma-ray Solution 0.2μg	Mar 68	113
4957	Radium–226 Gamma-ray Solution 0.5μg	Mar 68	113
4958	Radium–226 Gamma-ray Solution 1.0μg	Mar 68	113
4959	Radium–226 Gamma-ray Solution 2.0μg	Mar 68	113
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