NBS Standard Reference Materials Catalog 1988–89

NBS Special Publication 260

U.S. Department of Commerce
National Bureau of Standards

TO ORDER
PHONE 301/975-6776

UNITED STATES DEPARTMENT OF COMMERCE
National Bureau of Standards
Gaithersburg, Maryland 20899

Dear Colleague:

As our nation closed her bicentennial year of the Constitution, a few of George Washington's words, spoken at the Convention in 1787, seem to reecho through the years. "Let us raise a standard to which the wise and honest can repair." For 82 of those years, the National Bureau of Standards has issued Standard Reference Materials to help assure honest and accurate measurement. We thank you for joining with us to be part of that tradition.

We recognize that your work in material analysis and measurement becomes more challenging every day. And, to help you meet these challenges, we strive to issue the best standards possible. If we are not meeting your needs—tell us and we will try harder.

This catalog has more than 200 changes from the last one—new SRM's, renewal SRM's, and revised certificates. It contains an improved ***alphabetical index*** and a ***complete numerical index*** listing the ***latest renewal SRM's*** and ***latest certificate dates.*** Please compare the dates for your SRM's and certificates with this index to insure that your company or institution has the benefit of the latest advances in measurement technology. Renewal SRM's are indicated by a letter. For example, 1634b is the second renewal of the original Trace Elements in Fuel Oil SRM.

I urge you to inventory your SRM's carefully, and to keep up with the latest technology. If you have the latest renewal, but not the latest revision of the certificate for that material, you can contact the sales office, (301) 975-OSRM, for a free copy. Please note that the letters "OSRM" stand for "Office of Standard Reference Materials" to help you remember our telephone number.

Sincerely,

Stanley D. Rasberry

COVER: The stone gates are part of the NBS tradition. They stood on the Bureau's former site in Washington, D.C., for more than 60 years. They now grace the Gaithersburg, Md., laboratories. The quotation from George Washington appears over the 15th Street entrance of Department of Commerce's Herbert C. Hoover Building in Washington. The same quotation is inscribed on the base of the NBS flagpole.

NBS Special Publication 260

NBS Standard Reference Materials Catalog 1988–89

R.W. Seward, *Editor*

Office of Standard Reference Materials
National Bureau of Standards
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
C. William Verity, *Secretary*

National Bureau of Standards
Ernest Ambler, *Director*

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National Bureau of Standards
Standard Reference Materials 1988–89 Catalog

This catalog describes the Standard Reference Materials (SRM's) currently available from the National Bureau of Standards (NBS), 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.

The 40,000 SRM's shipped annually from NBS are packaged (from left) by Carlton Fisher, Roger Brown, and Gary Proulx.

Standard Reference Materials' new home. After 21 years in the Chemistry Building at the Gaithersburg, Md. site, OSRM is moving to the Engineering Mechanics Building.

Program Information

The National Bureau of Standards (NBS) offers for sale over 900 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."

NBS Standard Reference Materials (SRM's): Certified reference materials issued by NBS. 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 NBS 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.

NBS 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, NBS. 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 principle 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 NBS), 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, NBS 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, OSRM chief, and Julie Frum, secretary, check OSRM spending against budget documents.

SRM Catalog

New catalogs of NBS Standard Reference Materials are published approximately every two 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 six 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 Bureau of Standards 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.

NBS currently has over 900 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 NBS would provide continued availability of a well-characterized material important to science, industry, or government.

NBS 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 Bureau'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, NBS 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 NBS welcomes all requests for developing new SRM's, both NBS 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 NBS; and if so, justify its preparation by NBS.
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 B311 Chemistry Building
National Bureau of Standards
Gaithersburg, MD 20899

Ordering Standard Reference Materials

General

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

Office of Standard Reference Materials
Room B311 Chemistry Building
National Bureau of Standards
Gaithersburg, MD 20899
Telephone: (301) 975–OSRM [6776]
FTS: 879-OSRM [6776]
Telex: TRT197674NBS 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 Bureau of Standards 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.

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.

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.

The customer service staff is the primary contact most customers have with OSRM—for both orders and technical inquiries. From left: Ruth Meyer (foreign orders), Jodi Hines, and Robin Bradley.

From left: Gina Montgomery, Karen Applestein, and Aluanda Drain.

Donna Clarke (left), systems analyst, and Lee Klein, marketing and sales manager, review SRM computer files.

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.

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 Bureau of Standards. 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,** 503–414 (1976).

Phyllis Wagner (left) and Rosemary Blasingame, hazardous material specialists, check shipping regulations pertaining to new SRM's.

Other Services of the National Bureau of Standards

Calibration and Related Measurement Services

The measurement services of NBS include the calibration of standards, test of instruments, and certain interlaboratory testing programs. These services are described in NBS Special Publication 250, National Bureau of Standards Calibration Services Users Guide, 1986–88 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 NBS Washington laboratories (Gaithersburg, Md.) or those in Boulder, Colo. For additional information on available measurement services, consult Special Publication 250 or write to:

Office of Physical Measurement Services
Room B362 Physics Building
National Bureau of Standards
Gaithersburg, MD 20899

Telephone: (301) 975–2002

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

Measurement Services Clerk
National Bureau of Standards
Boulder, CO 80303

Telephone: (303) 497–3753

Office of Weights and Measures

The NBS 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 NBS and the States, write or telephone:

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

Telephone: (301) 975–4016

Information is available for the following specific testing areas:

Program for Thermal Insulation Materials
Program for Freshly Mixed Concrete
Program for Carpet
Program for Solid Fuel Room Heaters
Program for Personnel Dosimeters Processors
Program for Commercial Products (Paint, Paper, Mattresses)
Program for Seals and Sealants
Program for Photographic Film
Program for Electromagnetic Compatibility and Telecommunication Equipment
Acoustical Testing Services

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 B166 Technology Building
National Bureau of Standards
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 Bureau of Standards
Gaithersburg, MD 20899

Telephone: (301) 975–2208

After the surface grinding operation, the metal disks go to the lab for spectrometric analysis visible at the right. The water-based coolant will be deburred and stamped for issue as SRM's.

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	BOH, 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
15g	BOH, 0.1C	0.094	0.485	0.005	0.026	0.095
16f	BOH, 1.1C	0.97	0.404	0.014	0.026	0.214
19h	AOH, 0.2C (IN PREP)					
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 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	0.036	0.017	0.028	0.001						
16f	0.006	0.008	0.020	0.002	0.003	0.003				
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	Cr2–Mol		0.114	0.404	0.007		0.019	0.258	0.179
72g	Cr–Mo (SAE X4130)		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	Cr0.5–W0.5		0.905	1.24	0.015	0.010	0.011	0.322	0.083
163	Low Alloy, 1.0 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		Ca0.0051
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				W0.517
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)	662,1096,1262a	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	0.0068	0.0056	0.002_5	0.0055	0.008_0	0.0058	0.041	0.007_2
2161	A (Preliminary)	1761	(1.03)	(0.68)	(0.043)	(0.033)	(0.19)	(0.30)	(1.99)	(0.21)
2162	B (Preliminary)	1762	(0.34)	(2.03)	(0.036)	(0.03)	(0.36)	(0.12)	(1.15)	(0.92)
2163	C (Preliminary)	1763	(0.20)	(1.59)	(0.012)	(0.022)	(0.65)	(0.045)	(0.49)	(0.51)
2164	D (Preliminary)	1764	(0.59)	(1.22)	(0.023)	(0.012)	(0.06)	(0.51)	(0.20)	(1.50)
2165	E (Preliminary)	1765	(0.006)	(0.14)	(0.007)	(0.004)	(0.005)	(0.002)	(0.15)	(0.05)
2166	F (Preliminary)	1766	(0.015)	(0.06)	(0.004)	(0.002)	(0.01)	(0.014)	(0.02)	(0.02)
2167	G (Preliminary)	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.
Brackets indicate approximate value from heat analysis.

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	Cr15–Ni7–Mo2–Al1		0.069	0.57	0.018		0.019	0.395	0.106
345	Cr16–Ni4–Cu3		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	Ni26–Cr15 (A286)	1230	0.044	0.64	0.023		0.0007	0.43	0.14
868	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.

Dale Friend prepares to grind freeze-dried oyster tissue in an air grinder to produce a more uniform material.

Stainless Steels

SRM	Type	(Other Forms)	Chemical Composition (Nominal Weight Percent)					
			C	Mn	P	S	Si	Cu
73c	Cr13 (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	Cr17–Ni11–Ti0.3 (AISI 321)	1171	0.067	1.80	0.019	0.013	0.54	0.121
123c	Cr17–Ni11–Nb0.6 (AISI 348)	1172	0.056	1.7$_5$	0.024	0.014	0.59	0.103
133b	Cr13–Mo0.3–S0.3		0.128	1.07	0.018	0.328	0.327	0.080
160b	Cr19–Ni12–Mo3	1155	0.044	1.64	0.020	0.016	0.509	0.172
166c	Low Carbon (AISI 3162) Carbon Only (100g)		0.0078					
339	Cr17–Ni9–Se0.2 (SAE 303Se)		0.052	0.738	0.129	0.013	0.654	0.199
343a	Cr16–Ni2 (AISI 431)	1219	0.149	0.42	0.026	0.001	0.545	0.162
367	Cr24–Ni0.3 (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		Si	Cu
					Grav	Comb		
50c	W18–Cr4–V1	0.719	0.342	0.022	0.010	0.009	0.311	0.079
132b	Mo–W–Cr–V	0.864	0.341	0.012		0.004	0.185	0.088
134a	Mo8–W2–Cr4–V1	0.808	0.218	0.018	0.007	0.007	0.323	0.101
153a	Co8–Mo9–W2–Cr4–V2	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

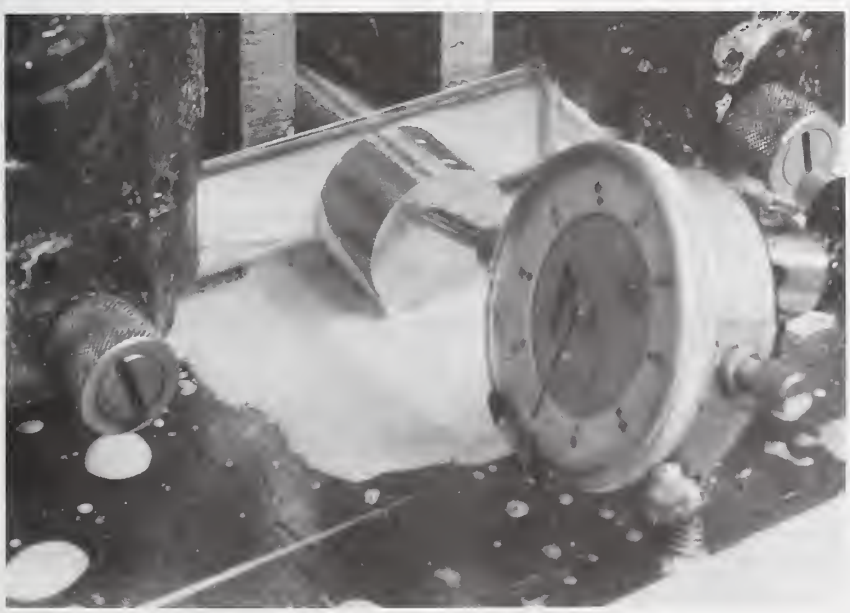
SRM		Type	(Other Forms)	Chemical Composition (Nominal Weight Percent)				
				C	Mn	P	S	Si
	1134	High-Silicon	125b	0.026	0.277	0.028	0.009	2.89
	1135	High-Silicon	179	0.027	0.094	0.006	0.026	3.19
	1217	Nickel	33e	0.186	0.525	0.005	0.009	0.262
	1218	Low Carbon and Sulfur Silicon	131c	0.0029	0.014	(0.002)	0.0011	(3.2)
	C1221	Resulfurized/Rephosphorized		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		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	1261a	AISI 4340	361,1095	0.39_1	0.67	0.016	0.015	0.228
*662	1262a	AISI 94B17 (Mod)	362,1096	0.16_3	1.05	0.044	0.037	0.40
*663	1263a	Cr-V (Mod)	363,1097	0.62_6	1.50	0.02_9	0.005_7	0.74
*664	1264a	High Carbon (Mod)	364,1098	0.87	0.25_8	0.010	0.025	0.067
*665	1265a	Electrolytic Iron	365,1099	0.0067	0.0057	0.002_5	0.0055	0.008_0
	1269	Low Alloy (AISI 1526, Mod)		0.298	1.35	0.012	0.0061	0.189
	1270	Cr-Mo Low Alloy		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 A (Preliminary)	2161	(1.03)	(0.68)	(0.043)	(0.033)	(0.19)
	1762	Low Alloy B (Preliminary)	2162	(0.034)	(2.03)	(0.036)	(0.03)	(0.36)
	1763	Low Alloy C (Preliminary)	2163	(0.20)	(1.59)	(0.012)	(0.022)	(0.65)
	1764	Low Alloy D (Preliminary)	2164	(0.59)	(1.22)	(0.023)	(0.012)	(0.06)
	1765	Low Alloy E (Preliminary)	2165	(0.006)	(0.14)	(0.007)	(0.004)	(0.005)
	1766	Low Alloy F (Preliminary)	2166	(0.015)	(0.06)	(0.004)	(0.002)	(0.01)
	1767	Low Alloy G (Preliminary)	2167	(0.051)	(0.02)	(0.005)	(0.009)	(0.02)

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

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	1261a	0.042	2.00	0.69_3	0.011	0.19	0.017	0.032	0.020
*662	1262a	0.51	0.60	0.30	0.04_1	0.07_0	0.20	0.30	0.085
*663	1263a	0.09_8	0.32	1.31	0.31	0.030	0.046	0.048	0.050
*664	1264a	0.25_0	0.14_2	0.06_6	0.10_6	0.49	0.10_2	0.15	0.24
*665	1265a	0.0058	0.041	0.007_2	0.0006	0.005		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)	(0.21)	(0.05)	(0.10)		(0.03)	(0.17)
	1762	(0.12)	(1.15)	(0.92)	(0.20)	(0.36)		(0.06)	(0.1)
	1763	(0.045)	(0.49)	(0.51)	(0.31)	(0.49)		(0.09)	(0.31)
	1764	(0.51)	(0.20)	(1.50)	(0.11)	(0.20)		(0.01)	(0.03)
	1765	(0.002)	(0.15)	(0.05)	(0.004)	(0.005)		(0.002)	(0.005)
	1766	(0.014)	(0.02)	(0.02)	(0.009)	(0.004)		(0.003)	(0.001)
	1767	(0.002)	(0.001)	(0.001)	(0.03)	(0.02)		(0.006)	(0.01)

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



A 1¼ inch diameter steel rod certified for chemical composition is cut on an automatic saw into ¾ inch thick disks for x-ray and optical emission spectroscopy.

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	1261a	0.017	0.010	0.02_1	0.0005	0.00002_5	0.0004	[0.006]
*662	1262a	0.09_5	0.016	0.09_5	0.0025	0.0004_3	(0.0011)	[0.002]
*663	1263a	0.010	0.10_4	0.24	0.0009_1	0.0022	(0.0037)	[0.010]
*664	1264a	0.05_2	0.008	(0.0080)	0.011	0.024	(0.00002)	[0.003]
*665	1265a	(0.0002)		(0.0007)	0.00013	0.00001_5		Fe (99.9)
	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	(0.01)	(0.04)	(0.05)				
	1762	(0.02)	(0.04)	(0.07)				
	1763	(0.05)	(0.008)	(0.05)				
	1764	(0.009)	(0.015)	(0.01)				
	1765	(0.006)	(0.002)	(0.006)				
	1766	(<0.002)	(0.001)	(0.01)				
	1767	(<0.002)	(0.007)	(0.004)				

	SRM	O	N	H	Nb	Se	Ta	Sr	Zr
*661	1261a	(0.0009)	(0.0037)	(<0.0005)	0.022	0.004	0.021	(<0.0005)	0.009
*662	1262a	(0.00107)	(0.00404)	(<0.0005)	0.30	(0.0012)	0.21	(<0.0005)	0.20
*663	1263a	(0.00066)	(0.0041)	(<0.0005)	0.049	(0.00016)	(0.053)	(<0.0005)	0.050
*664	1264a	(0.0010)	(0.0032)	(<0.0005)	0.15_7	(0.00021)	0.11	(<0.0005)	0.69
*665	1265a								
	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)

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

Low-Alloy Steels (Continued)

SRM		Sb	Bi	Ca	Mg	Te	Zn
*661	1261a	0.0042	0.0004	0.00002_8	0.00018	0.0006	(0.0001)
*662	1262a	0.012_0	(0.002)	0.00014	0.00062	0.0011	(0.0005)
*663	1263a	0.002	(0.0008)	0.00013	0.00049	0.0009	(0.0004)
*664	1264a	0.034	(0.0009)	0.0004	0.00015	0.00018	[0.001]

SRM		Au	Ce	Hf	La	Nd	Pr	Fe
*661	1261a	(<0.00005)	0.0014	(0.0002)	0.0004	0.0002_9	(0.00014)	(95.6)
*662	1262a	(<0.00005)	0.0015	(0.0003)	0.0004	0.0006_4	(0.00012)	(95.3)
*663	1263a	0.0005	0.0014	(0.0005)	0.0006	0.0006_0	(0.00018)	(94.4)
*664	1264a	0.0001	0.0002_2	(0.0013)	0.00007	0.00007	(0.00003)	(96.7)

*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.
Brackets indicate approximate value from heat analysis.

OSRM deputy Bill Reed (left), and research chemist John Norris examine chill-cast ferrous samples for homogeneity testing.

Stainless Steels

SRM	Type	Other Forms	Chemical Composition (Nominal Weight Percent)							
			C	Mn	P	S	Si	Cu	Ni	Cr
C1151	Cr22-Ni7		0.039	2.50	0.017	0.038	0.38	0.418	7.29	22.70
C1152	Cr18-Ni10		0.148	0.96	0.021	0.0064	0.80	0.102	10.88	17.81
C1153	Cr16-Ni8		0.264	0.50	0.030	0.018	1.07	0.23	8.77	16.69
C1153a	Cr16-Ni8		0.225	0.544	0.030	0.019	1.00	0.226	8.76	16.70
C1154	Cr19-Ni12		0.086	1.42	0.06	0.053	0.50	0.40	12.92	19.06
1155	Cr18-Ni12-Mo2 (AISI 316)	160b	0.046	1.63	0.020	0.018	0.50_2	0.169	12.1_8	18.4_5
1171	Cr17-Ni11-Ti0.3	121d	0.067	1.8_0	0.018	0.01_3	0.54	0.121	11.2	17.4
1172	Cr17-Ni11-Nb0.6	123c	0.056	1.7_6	0.025	0.01_4	0.59	0.10_5	11.3_5	17.4_0
1219	Cr16-Ni2 (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	AISI 310 Mod.		0.36	1.66	0.029	0.024	1.66	0.58	21.16	23.98
C1288	A-743		0.056	0.83	0.023	0.010	0.41	3.72	29.3	19.55
C1289	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	21.08	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.

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	Refined Silicon	60	0.024	0.015	0.003	0.003	98.55	0.004	0.008	(~0.3)
58a	Ferrosilicon (73Si)	75	0.014	0.16	0.009	<0.002	73.20	0.024	0.012	(0.20)
59a	Ferrosilicon (50Si)	50	0.046	0.75	0.016	0.002	48.10	0.052	0.033	
195	Ferrosilicon (75Si)	75	0.034	0.17	0.017	0.001	75.3	0.047	0.032	(0.42)
64c	Ferrochromium HC	100	4.68	0.16	0.020	0.067	1.22	0.005	0.43	
196	Ferrochromium LC	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 HC	100	6.72	80.04	0.19	0.008	0.225			
689	Fe–Cr–Si	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)
59	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		Co0.051		N0.045	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	Co0.034	Bi(<0.003)	N(0.002)	23.2	0.0017	(0.009)

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

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
365	Electrolytic Iron	0.0068		0.0056	0.002_5		0.0055	0.008_0	0.0058
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
365	0.041	0.007_2	0.0006	0.0050	0.007_0	0.0006
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		
365	(0.0002)	(~0.0002)	(0.0007)	$Pb0.00001_9$	0.001	99.90
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)	Mg0.032	Ce0.016
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)	Pb0.0018	0.13
C1150a	0.040	0.086	0.040	(0.017)	(0.005)	Pb0.001	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	(<0.1)	2.0	(<0.1)	(<0.1)	(<0.1)	(<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	Sr0.02	
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	Sr0.020	
C1257	(<0.1)	(<0.1)	(<0.1)	1.0	(<0.1)	5.0	(<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
37e	Brass, Sheet	150	69.61	0.53	0.004	27.85	1.00
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
37e			1.00								
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		
	C1106	Naval Brass A	59.0_8	40.0_8	0.032	0.004	0.74	0.025		
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		
	C1109	Red Brass A	82.2_2	17.4_3	0.075	0.053	0.10	0.10		
	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%)	Chemical Composition (Nominal Parts Per Million by Weight)							
				Sb	As	Bi	Cr	Co	Fe	Pb	Mn
393		Copper "O"	99.998	0.25	0.41	<0.1	<0.5	0.02	<1	0.039	<0.01
394	494	Copper I	99.908	4.5	2.6	0.35	2.0	0.5	147	26.5	3.7
395		Copper II	99.944	8.0	1.6	0.50	6.0		96	3.25	5.3
396		Copper III	99.955	<1	<0.2	0.07	4.3	0.4	143	0.41	7.5
	457	Copper IV	99.96	0.2	0.2	0.2	(0.3)	(0.2)	2.0	0.5	<0.1
398	498	Copper V	99.98	7.5	25	2.0	(0.3)	2.8	11.4	9.9	(0.3)
399		Copper VI	99.79	30	47	10.5	(0.5)	0.5	20.0	114	(0.3)
400	500	Copper VII	99.70	102	140	24.5	(0.5)	0.6	41	128	(0.2)
	C1251	Copper VIII	99.96	14	14.4	(3)	2.8	8.8	(264)	7.5	(5)
	C1252	Copper IX	99.89	42	115	21	7.4	90	(35)	60	(17)
	C1253	Copper X	99.42	(140)	432	70	216	495	(330)	244	(380)
454		Copper XI	99.84	24	46	19		(4)	(50)	66	

SRM (Chip)	SRM (Solid)	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		5.4	0.63	12.2	13	0.32	1.5	12.2	(<2)	(0.4)	(0.13)	(<1)
396		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		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 (Chip)	SRM (Solid)	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		(<2)								
396		(<2)								
398	498	(<2)								
399		(<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		Type	Chemical Composition (Nominal Weight Percent)							
Chip	Disk		Cu	Ni	As	Sn	Sb	Bi	Ag	Fe
127b	1131	Solder Pb60–Sn40	0.011	0.012	0.01	39.3	0.43	0.06	0.01	
53e	1132	Bearing Metal(84Pb–10Sb–6Sn)	0.054	0.003	0.057	5.84	10.26	0.052		<0.001

Nickel-Base Alloys

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent)							
			C	Mn	P	S	Si	Cu	Ni	Cr
349a	Ni57–Co14–Cr20	150	0.035	0.019	0.003	0.0024	0.018	0.007	58.1	19.3
882	Ni65–Cu31–A13	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	Ni48–Fe51	Disk	0.007	0.30_5	0.003	0.003	0.32	0.038	48.2	0.06
1160	Ni80, Mo4, balance Fe	Disk	0.019	0.55_0	0.003	0.001	0.37	0.021	80.3	0.05
1243	Waspaloy (IN PREP)	Disk	(0.035)	(0.019)	(0.003)	(0.0024)	(0.018)	(0.007)	(58.1)	(19.3)
C1248	Ni66–Cu30	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)	(1.15)	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.

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	6Al–4V	50	0.025			0.008	0.013
176	5Al–2.5Sn	100	0.015	0.0008		0.003	0.0003
641	8Mn (A)	Disk		6.6_8			
642	8Mn (B)	Disk		9.0_8			
643	8Mn (C)	Disk		11.6_8			
644	2Cr–2Fe–2Mo (A)	Disk			1.03		3.61
646	2Cr–2Fe–2Mo (C)	Disk			3.43		1.11
647	6Al–2Mo–2Sn–4Zr	50	0.006				1.96
648	5Al–2Sn–2Zr–4Cr–4Mo	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	6Al–4V (B)	Disk		(<0.1)	(0.20)		(<0.05)
1133	5Al–2Sn–2Zr–4Cr–4Mo	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.

The surface grinding Frank Mills is doing removes saw marks and finishes the sizing of metal disks for x-ray and spectrometric analysis.

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-2	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)
1235	Zirconium B	95	(170)	(60)	(80)	(850)	(25)	(40)	(65)	(32)	(95)	(90)	(50)
1237	Zircaloy D	31	(100)	(1510)	(<10)	(1650)	(10)	(<10)	(40)	(19)	(35)	(30)	(25)
1238	Zircaloy E	178	(310)	(580)	(60)	(2500)	(60)	(120)	(100)	(72)	(170)	(100)	(95)
1239	Zircaloy F	77	(170)	(1055)	(30)	(2300)	(50)	(45)	(45)	(42)	(95)	(40)	(45)

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

In this age of automation, many SRM's issued by NBS are still packaged by hand. John Savoy of the packaging and preparation group carefully weighs each unit (left) and then transfers the weighed unit to a sterilized bottle (right).

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)
352b	Unalloyed titanium for hydrogen	Platelets		46.9	
1087	Unalloyed titanium	Chips	(840)	57.5	
1088	Unalloyed titanium	Chips	(1450)	88.5	
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			
1095	AISI 4340 steel	Rod	9	(<5)	(37)
1096	AISI 94B17 (mod) steel	Rod	10.7	(<5)	40.4
1097	Cr–V (mod) steel	Rod	6.6	(<5)	(41)
1098	High carbon (mod) steel	Rod	10	(<5)	32
1099	Electrolytic iron	Rod	61	(<5)	(13)

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

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	(<10.05)	(<10.07)		
685R*	High-Purity Gold (Rod)	5.9 mm D×25 mm long	0.1	(<10.05)	(<10.07)		
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	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)	0.007	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-22% 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
483	Iron-3.22% Silicon	Plate: 3×3×0.28 mm thick
1871	Glasses (K-456, K-493, & K-523)	3 Rods: 1×1×15 mm
1872	Glasses (K-453, K-491, & K-968)	3 Rods: 1×1×15 mm
1873	Glasses (K-458, K-489 & K-963)	3 Rods: 1×1×15 mm
1874	Glasses (K-495, K-490, & K-546)	3 Rods: 1×1×15 mm
1875	Glasses (K-496, K-497, & K-1013)	3 Rods: 1×1×15 mm
2063	Thin Film Mg-Si-Ca-Fe	3 mm diameter film
8531	Glass Fibers (K-456, K-493, K-453, K-491, K-458, K-489, K-495, K-490, K-496, K-497)	Fibers: 10-100 μm D×50-60 mm long

Metals for Microanalysis

SRM	Type	Chemical Composition (Nominal Weight Percent)						
		Au	Cu	Ag	W	Mo	Si	Fe (by difference)
480	Tungsten-22% 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					
483	Iron-3.22% Silicon						3.22	96.7-96.8

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)

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	—	.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	—	.14	—	.11	—	.20	75.00	70.00	—	0.15
ZrO_2	—	.49	—	.40	—	.70	—	0.85	—	.54
TiO_2	—	.32	—	.26	—	.46	—	.55	—	.35
CeO_2	—	.68	—	.56	—	.98	—	1.19	—	.76
Ta_2O_5	—	.88	—	.72	—	1.26	—	1.53	—	.98
Fe_2O_3	—	.32	—	.26	—	0.046	—	0.55	—	.35
Li_2O	—	.001	—	.001	—	.002	5.00	4.67	—	.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	IN PREP
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	IN PREP
3121	Gold	HCl 10%
*3122	Hafnium	IN PREP
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	HCl 10%
3148	Scandium	HCl 10%
3149	Selenium	HNO_3 10%
3150	Silicon	Water
3151	Silver	HNO_3 10%
3152	Sodium	HCl 1%
3153	Strontium	HCl 10%
3154	Sulfur	H_2SO_4 0.1%
3155	Tantalum	5% HNO_3 + 2% HF
3156	Tellurium	HCl 10%
3157	Terbium	HCl 10%
3158	Thallium	HNO_3 10%
3159	Thorium	HNO_3 10%
3160	Thulium	HCl 10%
3161	Tin	HCl 60%
3162	Titanium	HCl 20%
3163	Tungsten	7% HNO_3 + 4% HF
3164	Uranium	HNO_3 10%
3165	Vanadium (5.00)	HNO_3 10%
3166	Ytterbium	HCl 10%
3167	Yttrium	HCl 10%
3168	Zinc	HCl 10%
3169	Zirconium	10% HNO_3 + 2% HF

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	

Ted Rains (left) and Terri Butler, research chemists, verify the certified value of a spectrometric solution in the 3100 series.

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	IN PREP		
912a	Urea		99.9	25 g
913	Uric Acid		99.7	10 g
914a	Creatinine	IN PREP		
915	Calcium Carbonate	SP 260–36	99.9+	20 g
916a	Bilirubin	IN PREP		
917	D-Glucose		99.9	25 g
918	Potassium Chloride	SP 260–63	99.9	30 g
919	Sodium Chloride	SP 260–60	99.9	30 g
920	D-Mannitol		99.8	50 g
921	Cortisol		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)	IN PREP	*	10 vials, 2.15 mL ea.
928	Lead Nitrate		100.00	30 g
929	Magnesium Gluconate		(100.1)	5 g
937	Iron Metal		99.90	50 g
938	4–Nitrophenol		(99.75)	15 g
955	Lead in Blood		4 levels	Set of 4 vials
998	Angiotensin I (Human)		94.1	500 μg
1589	Polychlorinated Biphenyls (PCB's) in Human Serum		—	Set of 3 bottles
1595	Tripalmitin		99.5	2 g
1598	Inorganic Constituents in Bovine Serum	IN PREP		
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	IN PREP	—	
1701a	Blood Gas: CO_2–5%, O_2–12%, Bal N_2	IN PREP	—	
1702a	Blood Gas: CO_2–5%, O_2–20%, Bal N_2	IN PREP	—	
1703a	Blood Gas: CO_2–10%, O_2–7%, Bal N_2	IN PREP	—	
1951	Cholesterol in Human Serum (Frozen)	IN PREP	—	Set of 3 bottles
1952	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.

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)	
	(per gram)			
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	4.359	mmol/L g	3.69	mmol/L
Copper	1.29	μg/mL g	1.10	μg/mL
Creatinine	0.179	mmol/L g	0.152	mmol/L
Glucose	7.56	mmol/L g	6.41	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	11.387	mmol/L g	9.64	mmol/L
Uric Acid	0.570	mmol/L g	0.483	mmol/L
Vanadium	3.19	ng/mL g	2.70	ng/mL

Research chemist Dennis Reeder (seated) shows Ray McKenzie, OSRM project manager, the analytical results of a clinical SRM.

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	1549	1566a*	1567a	1568	1569	1577a	RM 50	RM 8431*
Type	Non-fat Milk Powder	Oyster Tissue	Wheat Flour	Rice Flour	Brewers Yeast	Bovine* Liver	Albacore* Tuna	Mixed Diet
Unit Size	100 g	IN PREP	IN PREP	80 g	50 g	50 g	70 g	30 g
ELEMENTS	**Nominal Composition in μg/g, unless otherwise noted.**							
Aluminum	(2)					(2)	(4.39)	
Antimony	(0.00027)					(0.003)		
Arsenic	(0.0019)			0.41		0.047	(3.3)	(0.924)
Bromine	(12)			(1)		(9)		
Cadmium	0.0005			0.029		0.44		(0.042)
Calcium	1.30%			0.014%		120		(0.194%)
Chlorine	1.09%					0.28%		
Chromium	0.0026				2.12			(0.102)
Cobalt	(0.0041)			0.02		0.21		(0.038)
Copper	0.7			2.2		158		(3.36)
Fluorine	(0.20)							
Iodine	3.38							
Iron	1.78			8.7		194		(37.0)
Lead	0.019			0.045		0.135		(0.46)
Magnesium	0.120%					600		(0.065%)
Manganese	0.26			20.1		9.9		(8.12)
Mercury	0.0003			0.0060		0.004	(0.95)	
Molybdenum	(0.34)			(1.6)		3.5		(0.288)
Nickel				(0.16)				(0.644)
Nitrogen						(10.7%)		
Phosphorus	1.06%					1.11%		(0.332%)
Potassium	1.69%			0.112%		0.996%		(0.790%)
Rubidium	(11)			(7)		12.5		
Selenium	0.11			0.4		0.71	(3.6)	(0.242)
Silver	(<0.0003)					0.04		
Sodium	0.497%			6.0		0.243%		(0.312%)
Strontium						0.138		
Sulfur	0.351%					0.78%		
Tellurium				(<0.002)				
Thallium						(0.003)		
Thorium								
Tin	(<0.02)							
Uranium						0.00071		
Vanadium						0.099		
Zinc	46.1			19.4		123	(13.6)	(17.0)

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

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	1572	1573	1575	RM 8412	RM 8413
Type	Citrus Leaves	Tomato Leaves	Pine Needles	Corn Stalk	Corn Kernel
Unit Size	70 g	70 g	70 g	34 g	47 g
ELEMENT	Nominal Composition in μg/g, unless otherwise noted.				
Aluminum	92	(0.12%)	545		(4)
Antimony	(0.04)		(0.2)		
Arsenic	3.1	0.27	0.21		
Barium	21				
Boron		(30)			
Bromine	(8.2)	(26)	(9)		
Cadmium	0.03	(3)	(<0.5)		
Calcium	3.15%	3.00%	0.41%	(2160)	(42)
Cerium	(0.28)	(1.6)	(0.4)		
Cesium	(0.098)				
Chlorine	(414)			(2440)	(450)
Chromium	0.8	4.5	2.6		
Cobalt	(0.02)	(0.6)	(0.1)		
Copper	16.5	11	3.0	(8)	(3.0)
Europium	(0.01)	(0.04)	(0.006)		
Fluorine				(0.65)	(0.24)
Iodine	1.84				
Iron	90	690	200	(139)	(23)
Lanthanum	(0.19)	(0.9)	(0.2)		
Lead	13.3	6.3	10.8		
Magnesium	0.58%	(0.7%)		(1600)	(990)
Manganese	23	238	675	(15)	(4.0)
Mercury	0.08	(0.1)	0.15		

Agricultural (Continued)

SRM	1572	1573	1575	RM 8412	RM 8413
Type	Citrus Leaves	Tomato Leaves	Pine Needles	Corn Stalk	Corn Kernel
Unit Size	70 g	70 g	70 g	34 g	47 g
Molybdenum	0.17				
Nickel	0.6		(3.5)		
Nitrogen	(2.86%)	(5.0%)	(1.2%)	(6970)	(13750)
Phosphorous	0.13%	0.34%	0.12%		
Potassium	1.82%	4.46%	0.37%	(17350)	(3570)
Rubidium	4.84	16.5	11.7		
Samarium	(0.052)				
Scandium	(0.01)	(0.13)	(0.03)		
Selenium	(0.025)			(0.016)	(0.004)
Sodium	160			(28)	
Strontium	100	44.9	4.8	(12)	
Sulfur	0.407%				
Tellurium	(0.02)				
Thallium	(<0.01)	(0.05)	(0.05)		
Thorium		0.17	0.037		
Tin	(0.24)				
Uranium	(<0.15)	0.061	0.020		
Zinc	29	62		(32)	(15.7)

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

Safety precautions are essential in the packaging and preparation of SRM's. Lisa Gaines (left) and Helen Tyler wear dust masks and keep powdered material under a hooded bench during bottling operations.

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

Analyzed Gases (Continued)

SRM	Type		Certified Component	Nominal Concentration	
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
2633	Carbon Dioxide in Nitrogen		CO_2	400	μmole/mole (ppm)
2634	Carbon Dioxide in Nitrogen		CO_2	800	μmole/mole (ppm)
2612a	Carbon Monoxide in Air		CO	10	μmole/mole (ppm)
2613a	Carbon Monoxide in Air		CO	20	μmole/mole (ppm)
2614a	Carbon Monoxide in Air		CO	45	μmole/mole (ppm)
1677c	Carbon Monoxide in Nitrogen		CO	10	μmole/mole (ppm)
1678c	Carbon Monoxide in Nitrogen		CO	50	μmole/mole (ppm)
1679c	Carbon Monoxide in Nitrogen		CO	100	μmole/mole (ppm)
1680b	Carbon Monoxide in Nitrogen		CO	500	μmole/mole (ppm)
1681b	Carbon Monoxide in Nitrogen		CO	1000	μmole/mole (ppm)
2635a	Carbon Monoxide in Nitrogen		CO	25	μmole/mole (ppm)
2636a	Carbon Monoxide in Nitrogen		CO	250	μmole/mole (ppm)
2637a	Carbon Monoxide in Nitrogen		CO	2500	μmole/mole (ppm)
2638a	Carbon Monoxide in Nitrogen		CO	5000	μmole/mole (ppm)
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
1658a	Methane in Air		CH_4	1	μmole/mole (ppm)
1659a	Methane in Air		CH_4	10	μmole/mole (ppm)
1660a	Methane-Propane in Air		CH_4	4	μmole/mole (ppm)
			C_3H_8	1	μmole/mole (ppm)
1683b	Nitric Oxide in Nitrogen		NO	50	μmole/mole (ppm)
1684b	Nitric Oxide in Nitrogen		NO	100	μmole/mole (ppm)
1685b	Nitric Oxide in Nitrogen		NO	250	μmole/mole (ppm)
1686b	Nitric Oxide in Nitrogen		NO	500	μmole/mole (ppm)
1687b	Nitric Oxide in Nitrogen		NO	1000	μmole/mole (ppm)
2627a	Nitric Oxide in Nitrogen		NO	5	μmole/mole (ppm)
2628a	Nitric Oxide in Nitrogen		NO	10	μmole/mole (ppm)
2629a	Nitric Oxide in Nitrogen		NO	20	μmole/mole (ppm)
2630	Nitric Oxide in Nitrogen		NO	1500	μmole/mole (ppm)
2631	Nitric Oxide in Nitrogen		NO	3000	μmole/mole (ppm)
2654	Nitrogen Dioxide in Air		NO_2	500	μmole/mole (ppm)
2655	Nitrogen Dioxide in Air		NO_2	1000	μmole/mole (ppm)
2656	Nitrogen Dioxide in Air		NO_2	2500	μmole/mole (ppm)
2657	Oxygen in Nitrogen	IN PREP	O_2	2	mole percent
2658	Oxygen in Nitrogen	IN PREP	O_2	10	mole percent
2659	Oxygen in Nitrogen	IN PREP	O_2	21	mole percent

Analyzed Gases (Continued)

SRM	Type		Certified Component	Nominal Concentration	
1665b	Propane in Air		C_3H_8	3	μmole/mole (ppm)
1666b	Propane in Air		C_3H_8	10	μmole/mole (ppm)
1667b	Propane in Air		C_3H_8	50	μmole/mole (ppm)
1668b	Propane in Air		C_3H_8	100	μmole/mole (ppm)
1669b	Propane in Air		C_3H_8	500	μmole/mole (ppm)
2645a	Propane in Nitrogen		C_3H_8	500	μmole/mole (ppm)
2646a	Propane in Nitrogen		C_3H_8	1000	μmole/mole (ppm)
2647a	Propane in Nitrogen		C_3H_8	2500	μmole/mole (ppm)
2648a	Propane in Nitrogen		C_3H_8	5000	μmole/mole (ppm)
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/O_2	0.01/5.0	mole percent
2652	Propane in Nitrogen and Oxygen		C_3H_8/O_2	0.01/10.0	mole percent
1661a	Sulfur Dioxide in Nitrogen	IN PREP	SO_2	500	μmole/mole (ppm)
1662a	Sulfur Dioxide in Nitrogen	IN PREP	SO_2	1000	μmole/mole (ppm)
1663a	Sulfur Dioxide in Nitrogen		SO_2	1500	μmole/mole (ppm)
1664a	Sulfur Dioxide in Nitrogen		SO_2	2500	μmole/mole (ppm)
1693a	Sulfur Dioxide in Nitrogen		SO_2	50	μmole/mole (ppm)
1694a	Sulfur Dioxide in Nitrogen		SO_2	100	μmole/mole (ppm)
1696	Sulfur Dioxide in Nitrogen		SO_2	3500	μmole/mole (ppm)
1808	Tetrachloroethylene in Nitrogen		C_2Cl_4	0.25	μmole/mole (ppm)
1809	Tetrachloroethylene in Nitrogen		C_2Cl_4	10	μmole/mole (ppm)

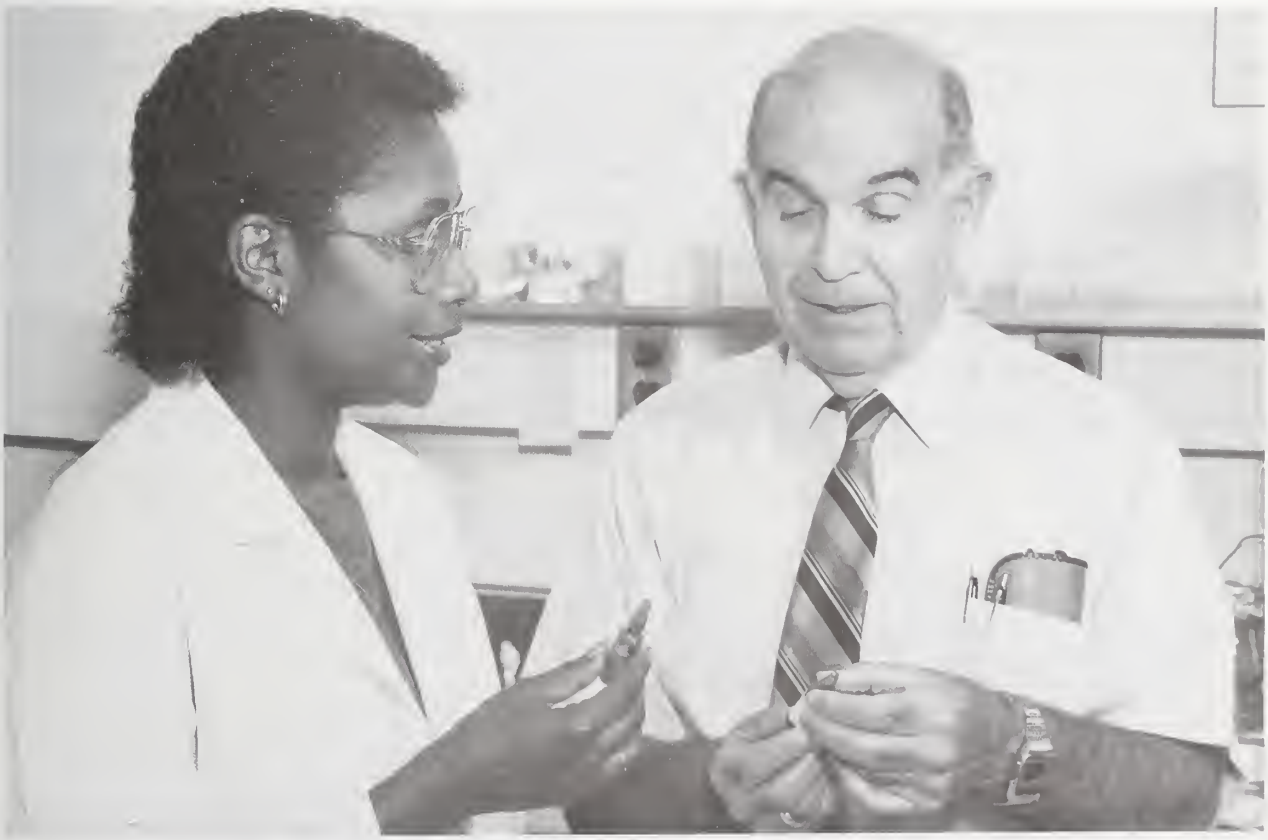
Permeation Devices

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's 1629a, 1911, and 1912 are calibrated at 25.0 °C only; and they 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
1629a	Nitrogen Dioxide Permeation Device	10	1.0	0.5	0.1	0.05
1911	Benzene Permeation Device	10	0.4	0.2	0.04	0.02
1912	Tetrachloroethylene Perm. Device	10	1.0	0.5	0.1	0.05

Research chemist Bill Dorko (foreground) and Tom Gills, OSRM project manager, check the setup for calibrating a new lot of gas SRM's.



Jeanice Brown-Thomas, research scientist, and Bob Alvarez, project manager, hold vials of coconut oil as they discuss certifying the oil for cholesterol and vitamins.

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	
1636a	Lead in Reference Fuel	3 vials each	11.2, 18.8, 25.1, 764 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	
1642b	Mercury in Water (ng/mL)	950 mL				1.49 ng/mL	
2712	Lead in Reference Fuel	IN PREP					
2713	Lead in Reference Fuel	IN PREP					
2714	Lead in Reference Fuel	IN PREP					
2715	Lead in Reference Fuel	IN PREP					
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	Set 4: 2–50mL each of 2 levels	
Constituent Element/Parameter		**2694–I**	**2694–II**
pH, 25 °C		4.30	3.59
Specific Conductance (μS/cm, 25 °C)		26	130
Acidity, meq/L		0.050	0.248
Fluoride, mg/L		0.054	0.098
Chloride, mg/L		(0.24)	(1.0)
Nitrate, mg/L		0.501	7.06
Sulfate, mg/L		2.69	10.8
Sodium, mg/L		0.205	0.419
Potassium, mg/L		0.052	0.106
Ammonium, mg/L		—	(1.0)
Calcium, mg/L		0.014	0.049
Magnesium, mg/L		0.024	0.051

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		

Sulfur in Fossil Fuels

SRM	Type	Unit Size	Sulfur Wt.%	Furnace Ash Wt.%	HHV2	
					$MJ \cdot Kg^{-1}$	$(BTU \cdot lb^{-1})$
1616	Sulfur in Kerosene	(IN PREP)				
1617	Sulfur in Kerosene	(IN PREP)				
1619	Sulfur in Residual Fuel Oil	100 mL	0.719			
1620a	Sulfur in Residual Fuel Oil	100 mL	4.504			
1621c	Sulfur in Residual Fuel Oil	100 mL	1.040			
1622c	Sulfur in Residual Fuel Oil	100 mL	2.012			
1623a	Sulfur in Residual Fuel Oil	100 mL	0.240			
1624a	Sulfur in Distillate Fuel Oil	100 mL	0.141			
2682	Coal (Sub-bituminous)	50 g	0.47	6.37		
2683	Coal (Bituminous)	50 g	1.85	6.85	32.45	(13950)
2684	Coal (Bituminous)	50 g	3.00	11.09	29.19	(12550)
2685	Coal (Bituminous)	50 g	4.62	16.53	27.45	(11800)
2692	Sulfur in Coal, 1%	(IN PREP)				

NOTE: The calorific values ($MJ \cdot Kg^{-1}$) may decrease upon the aging or normal oxidation of the coals. NBS 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	IN PREP
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%	
Antimony	(0.24)	6.8		(0.14)		(0.4)	(45)				
Arsenic	3.72	145	0.12	0.42	(49) ng/g	11.6	115				
Barium	67.5	(0.15%)	(1.3)		44 ng/g		(737)	(0.08%)	(0.65%)	(0.66%)	
Beryllium		(12)			19 ng/g	(1.5)					
Bismuth					(11) ng/g						
Bromine	(17)				B(94) ng/g		(500)				
Cadmium	0.0573	1.00		0.03	20 ng/g	0.36	75				
Calcium	0.204%	1.11%	(15)			0.83%		2.18%	5.71%	18.45%	
Carbon	78.11%										
Cerium	(9)	(180)		(3.6)		(80)	(55)				
Cesium	(0.44)	(11)				(3.7)	(3)				
Chlorine	(1260)						(0.45%)				
Chromium	(11)	196	(0.7)	2.5	18.6 ng/g	76	403				
Cobalt	2.29	(46)	0.32	(0.65)	26 ng/g	10.5	(18)				
Copper	6.28	118		3.6	21.9 ng/g	18	609				
Europium	(0.17)	(4)		(0.06)		(1.5)	(0.8)				
Gallium		(58)		(1.05)							
Germanium						(1.4)					
Hafnium	(0.43)	(8)		(0.29)			(4.4)				
Hydrogen	5.07%										
Indium							(1.0)				
Iodine							(20)				
Iron (Total)	0.759%	9.4%	31.6	0.239%	99 ng/g	3.35%	3.91%	9.32%	3.57%	4.42%	
Lanthanum	(5.1)						(42)				
Lead	3.67	72.4	(2.8)	1.9	23.7 ng/g	28.2	0.655%				
Lithium	(10)					(49)					
Magnesium	0.0383%	0.455%				1.09%	(0.8%)	0.61%	1.53%	3.12%	
Manganese	12.4	179	0.23	21.4	28 ng/g	375	(860)	(0.03%)	(0.03%)	(0.02%)	
Mercury		0.16	(<0.001)			0.063					
Molybdenum	(0.9)	(29)			85 ng/g	(2.0)					
Nickel	6.10	127	28	1.74	49 ng/g	32	82				
Nitrogen	1.56%										
Phosphorus						0.054%		0.10%	0.52%	0.51%	
Potassium	0.0748%	1.88%				(1.4%)	1.05%	2.20%	1.04%	0.34%	
Rubidium	5.05	131				(87)	(52)				
Samarium	(0.87)						(4.4)				
Scandium	(1.9)	(40)		(0.63)		(10.8)	(7)				
Selenium	1.29	10.3	0.18	0.9	9.7 ng/g	(0.6)	27				
Silicon	(1.4%)	22.8%				(31%)		24.06%	25.85%	16.83%	
Silver					9.8 ng/g		(6)				
Sodium	0.0515%	0.17%	(90)	(0.24%)		(2.0%)	0.425%	0.25%	0.24%	1.09%	
Strontium	(102)	830			227 ng/g			(0.07%)	(0.20%)	(0.27%)	
Sulfur	1.89%	(0.18%)	2.80%	0.33%		(0.96%)	(5%)		0.15%	0.83%	
Tellurium						(0.5)					

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

Trace Elements (Continued)

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	IN PREP
ELEMENT	Nominal Concentrations in μg/g, unless otherwise noted.										
Thallium		5.7			8.0 ng/g	(0.5)					
Thorium	1.342	24.7		0.62		(10)	(7.4)				
Titanium	0.0454%	(0.8%)		(0.02%)		(0.51%)	(0.40%)	0.75%	0.52%	0.90%	
Tungsten	(0.48)						(4.8)				
Uranium	0.436	10.2		0.24			5.5				
Vanadium	(14)	297	55.4	5.2	45.2 ng/g	94	140				
Zinc	11.89	220	3.0	4.7	66 ng/g	138	0.476%				

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

Organic Constituents

SRM	Type	Unit of Issue
1507	Tetrahydrocannabinol Freeze-Dried Urine	IN PREP
1547	Organics in Cod Liver Oil	IN PREP
1563	Cholesterol and Fat Soluable Vitamins in Coconut Oil	IN PREP
1580	Shale Oil	Set of 5, 2mL/ampoules
1581	Polychlorinated Biphenyls in Oil	Set of 4, 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 Solution	Set of 4, 1mL/ampoules
1589	Polychlorinated Biphenyls in Human Serum	Set of 3
1596	Dinitropyrene Isomers and 1-Nitropyrene in Methylene Chloride	IN PREP
1597	Complex Mixture of Polycyclic Aromatic Hydrocarbons	IN PREP
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
1644	Polynuclear Aromatic Hydrocarbon Generator Columns	Set of 3 columns
1647	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

Organic Constituents (Continued)

SRM	1580	1582	1644	1647	1649	1650
Constituents	(μg/g)	(μg/g)	(μg/kg)	(μg/mL)	(μg/g)	(μg/g)
Anthracene			16.6 to 60.1	3.29		
Benz[a]anthracene		3.0	3.38 to 12.8	5.03	2.6	6.5
Benzo[a]pyrene	21	1.1	0.59 to 2.26	5.30	2.9	1.2
Benzo[e]pyrene	18					(10)
Fluoranthene	54	2.5		10.1	7.1	51
o-Cresol	385					
Phenol	407					
Perylene	3.4	31				(0.13)
Pyrene	104			9.84		48
2,6-Dimethylphenol	175					
Benzo[f]quinoline (5,6-Benzoquinoline)	16					
Naphthalene				22.5		
Acenaphthylene				19.1		
Acenaphthene				21.0		
1-Nitropyrene						19
Fluorene				4.92		
Phenanthrene		101		5.06		(71)
Chrysene				4.68		(22)
Benzo[b]fluoranthene				5.11		
Benzo[k]fluoranthene				5.02		(2.1)
Benzo[ghi]perylene				4.01	4.5	2.4
Dibenz[a,h]anthracene				3.68		
Indeno[1,2,3-cd]pyrene				4.06	3.3	(0.23)
Dibenzothiophene		33				

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

Organic Constituents (Continued)

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 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

Organic Constituents (Continued)

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 1589 PCB's in Human Serum

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

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	
	Toxic Metals		Fluoride		Mercury	
Type	Low Level	Elevated Level	Low Level	Elevated Level	Low Level	Elevated Level
Aluminum	(0.18) μg/mL	(0.18) μg/mL				
Arsenic	(0.015) 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				
Fluoride			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	(<0.01) μg/mL	(0.11) 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				

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

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 12	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.

Respirable Quartz

This SRM consists of quartz powder that is in the respirable size range. It is 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

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. It is intended for use in evaluating the techniques used to count and identify chrysotile 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

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
1074a	Calcium 2-ethylhexanoate	Calcium	12.5	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	IN PREP	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 1817a 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 1817a 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.

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)	IN PREP						
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	CO_2	CdO	U	V_2O_5
694	11.2	3.2	0.79	1.8	0.33	0.86	0.0116	(0.11)		0.015	0.01414	0.31

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			6.3₉%	4.3₄%	4.1₂%

SRM	330	331	333
Type	Copper, Ore Mill Heads	Copper, Ore Mill Tails	Molybdenum, Concentrate
Unit Weight	100 g	100 g	35 g
Constituents			
Cu	0.84%	0.091%	1.038%
Re	0.30 ppm	0.04 ppm	0.087%
Mo	0.018%	0.0022%	55.3%
Au	(0.093 ppm)	(0.034 ppm)	(8.9 ppm)
Ag	(1.51 ppm)	(0.243 ppm)	(25.0 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

Ores (Continued)

SRM	69b	696	697	698	699	120c	694	25d	670
Type	Bauxite, Arkansas	Bauxite, Surinam	Bauxite, Dominican	Bauxite, Jamaican	Alumina (Reduction Grade)	Phosphate Rock, Florida	Phosphate Rock, Western	Manganese Ore	Rutile Ore
Unit Weight	60 g	60 g	60 g	60 g	60 g	IN PREP	90 g	100 g	90 g
Constituents (Nominal Weight Percent)									
Al_2O_3	48.8	54.5	45.8	48.2			1.8	5.32	
BaO	(0.008)	(0.004)	(0.015)	(0.008)				(0.21)	
CdO							0.015		
CaO	0.13	0.018	0.71	0.62	0.036		43.6	(0.052)	
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
Fe_2O_3	7.14	8.70	20.0	19.6	0.013		0.79	3.92	0.86
MgO	0.085	0.012	0.18	0.058	0.0006		0.33		
MnO	0.110	0.004	0.41	0.38	0.0005		0.0116	Mn51.78	
P_2O_5	0.118	0.050	0.97	0.37	0.0002		30.2	0.25	
K_2O	0.068	0.009	0.062	0.010			0.51	0.93	
SiO_2	13.43	3.79	6.81	0.69	0.014		11.2	2.52	0.51
Na_2O	(0.025)	(0.007)	(0.036)	(0.015)	0.59		0.86		
SO_3	0.63	0.21	0.13	0.22					
TiO_2	1.90	2.64	2.52	2.38			(0.11)	0.13	96.16
U							0.01414		
V_2O_5	0.028	0.072	0.063	0.064	0.0005		0.31		0.66
ZnO	0.0035	0.0014	0.037	0.029	0.013		(0.19)		
ZrO_2	0.29	0.14	0.065	0.061					0.84
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.

Rocks, Minerals, and Refractories

SRM	1c	88b	70a	99a	97b	98b	81a	165a	1413
Type	Lime-stone, argilla-ceous	Limestone, dolomitic	Feld-spar, potash	Feld-spar, soda	Clay, flint	Clay, plastic	Glass sand	Glass sand (low iron)	Glass sand (high alumina)
Unit Weight	50 g	75 g	40 g	40 g	IN PREP	IN PREP	75 g	75 g	75g
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.

SRM	Type	Wt/ Unit	Composition (Nominal Parts Per Million, except where noted)					
			Al	Ba	Ca	Ce	Cs	Cr
679	Brick Clay	75 g	11.01%	432.2	0.1628%	(105)	(9.6)	109.7

SRM	Co	Eu	Hf	Fe	Li	Mg	Mn	P	K
679	(26)	(1.9)	(4.6)	9.05%	71.7	0.7552%	(1730)	(750)	2.433%

SRM	Rb	Sc	Si	Na	Sr	Th	Ti	Zn
679	(190)	(22.5)	24.34%	0.1304%	73.4	(14)	0.577%	(150)

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	1.6₀	1.0₀	1.2
Pb		16.4 μg/g	3.3 μg/g			
Li_2O				0.042	0.02₅	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	0.12₀	0.092	1.3
K_2O		4.16	0.187	1.33	0.09₀	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	2.0₃	2.6₆	3.2₂
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 Refractory	Silica Refractory
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.

Glasses

SRM	89	91	92	93a	620	621	1411	1412	1830	1831
Type	Lead-Barium	Opal	Low-Boron	High-Boron	Soda-Lime, Flat	Soda-Lime, Container	Soft Borosilicate	Multi Component	Soda-Lime, Float	Soda-Lime, Sheet
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 platelets	8 platelets	3 platelets 38×38×6 mm	3 platelets 37×37×3 mm
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	633	634	635	636	637	638	639	1880	1881	1882	1883
Type	RED	GOLD	BLUE	YELLOW	PINK	GREEN	CLEAR	BLACK	WHITE	ORANGE	SILVER
Unit Weight	15 g	15 g	15 g	15 g	15 g	15 g	15 g	15 g	15 g	15 g	15 g
Constituent (Nominal Weight Pecent)											
CaO	64.5$_0$	62.5$_8$	59.8$_3$	63.5$_4$	66.0$_4$	62.0$_9$	65.7$_6$	63.1$_4$	58.6$_8$	37.6	27.8
SiO_2	21.8$_8$	20.7$_3$	18.4$_1$	23.2$_2$	23.0$_7$	21.4$_8$	21.6$_1$	19.8$_2$	22.2$_5$	3.40	0.35
Al_2O_3	3.7$_8$	5.2$_1$	6.2$_9$	3.0$_2$	3.2$_8$	4.4$_5$	4.2$_8$	5.0$_3$	4.1$_9$	38.6	71.2
Fe_2O_3	4.20	2.84	2.61	1.61	1.80	3.55	2.40	2.91	4.68	15.8	0.08
SO_3	2.2$_0$	2.2$_1$	7.0$_7$	2.3$_1$	2.3$_8$	2.3$_4$	2.4$_8$	3.37	3.6$_5$		
MgO	1.0$_4$	3.3$_0$	1.2$_3$	3.9$_5$	0.6$_7$	3.8$_3$	1.2$_6$	2.6$_9$	2.62	1.25	0.29
K_2O	0.17	0.42	0.45	0.59	0.25	0.59	0.06	0.91	1.17	0.12	(0.01)
TiO_2	0.24	0.29	0.32	0.18	0.21	0.25	0.32	0.23	0.2$_3$	1.83	(0.01)
Na_2O	0.64	0.15	0.07	0.11	0.15	0.13	0.65	0.28	0.04	(0.06)	0.32
SrO	0.31	0.12	0.21	0.04	0.09	0.07	0.15	0.06	0.11		
P_2O_5	0.24	0.10	0.17	0.08	0.24	0.06	0.08	0.29	0.09		
Mn_2O_3	0.04	0.28	0.09	0.12	0.06	0.05	0.08	0.08	0.26		
F	0.08	0.08	0.04	0.06	0.04	0.04	0.02	0.10	0.09		
ZnO	0.01	0.02	0.01	0.03	0.01	0.10	0.01	0.01	0.01		
Cr_2O_3	0.01	0.08	0.01	0.01	0.01	0.01	0.01	Cl 0.02			
Ignition Loss	0.7$_5$	1.6$_2$	3.2$_4$	1.1$_6$	1.6$_9$	0.9$_5$	1.0$_0$	1.38	2.01	1.58	0.42
Total	(100.06)	(100.00)	(100.03)	(100.00)	(99.97)	(99.97)	(100.16)	(100.28)	(100.04)		

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.

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 A1)	0.116

Fission Track Glass

These SRM's containing uranium at three concentration levels, will aid laboratories, performing fission track analyses, in interlaboratory comparisons of data and in monitoring neutron fluences. The materials were irradiated in the NBS 10 Megawatt Research Reactor, at two different neutron energies.

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

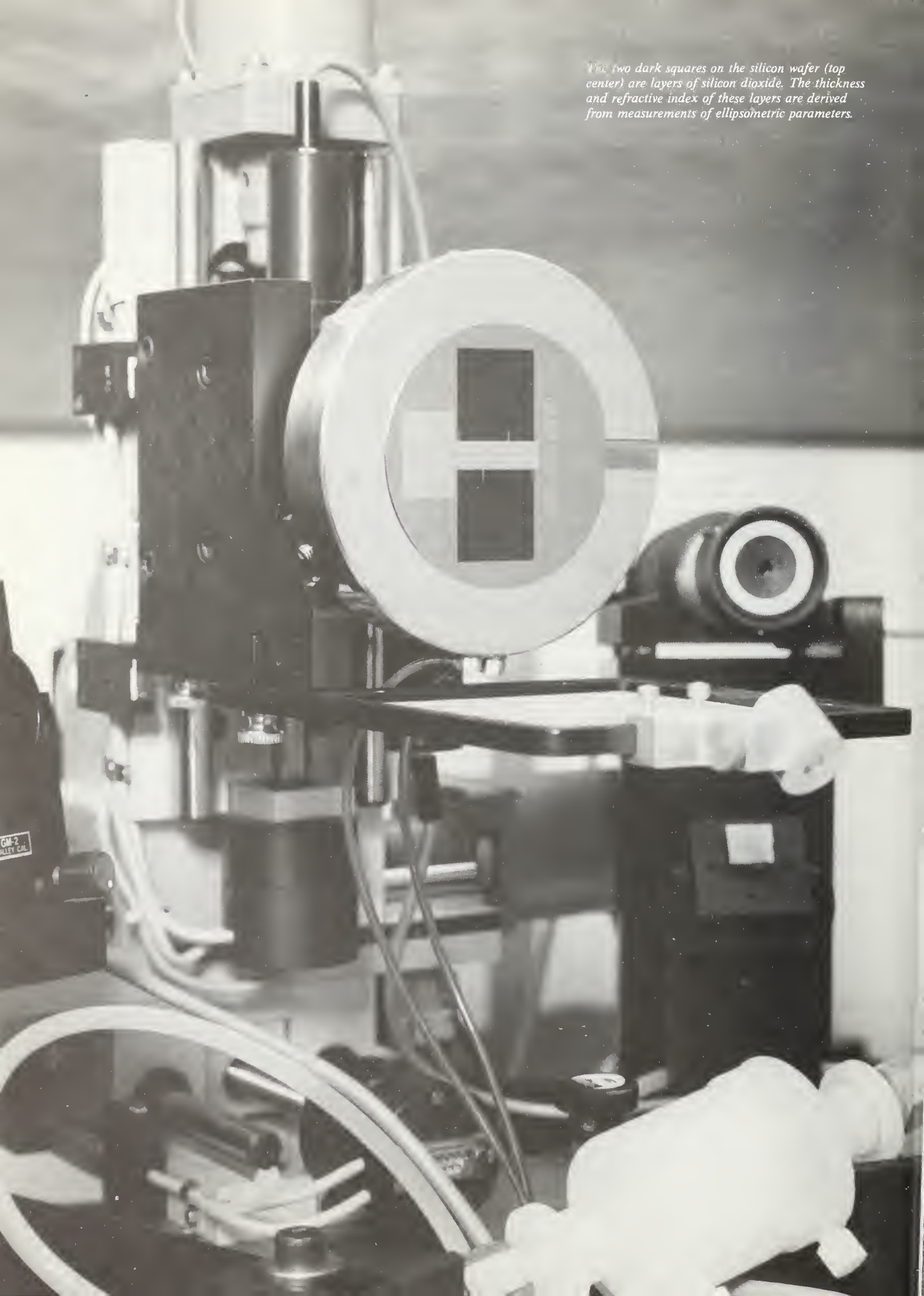
SRM	Uranium Content (ng/g)	U (Atom Percent)	Reactor Position	Cu Foil	Au Foil
				Neutron Flux ($\times 10^{12}$n·cm^{-2}·s^{-1})	
961	461.5	0.2376	RT-3:	4.56	5.43
			RT-4:	1.31	1.46
				Neutron Fluence ($\times 10^{14}$n·cm^{-2})	
962a	37.38	0.2392	RT-3:	4.37	4.75
			RT-4:	3.87	4.17
963a	0.823	0.2792	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	IN PREP	
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.



The two dark squares on the silicon wafer (top center) are layers of silicon dioxide. The thickness and refractive index of these layers are derived from measurements of ellipsometric parameters.

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 186Ic and 186IIc, 191a and 192a, and 922 and 923 are certified for use as admixtures only. SRM's 186Ic and 186IIc 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 7.415 at 25 °C.

SRM	Type	pH(S) Values (at 25 °C)	Wt/Unit (grams)
185f	Potassium hydrogen phthalate	4.006	60
186Ic	Potassium dihydrogen phosphate	6.863	30
186IIc	Disodium hydrogen phosphate	7.415	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)
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.

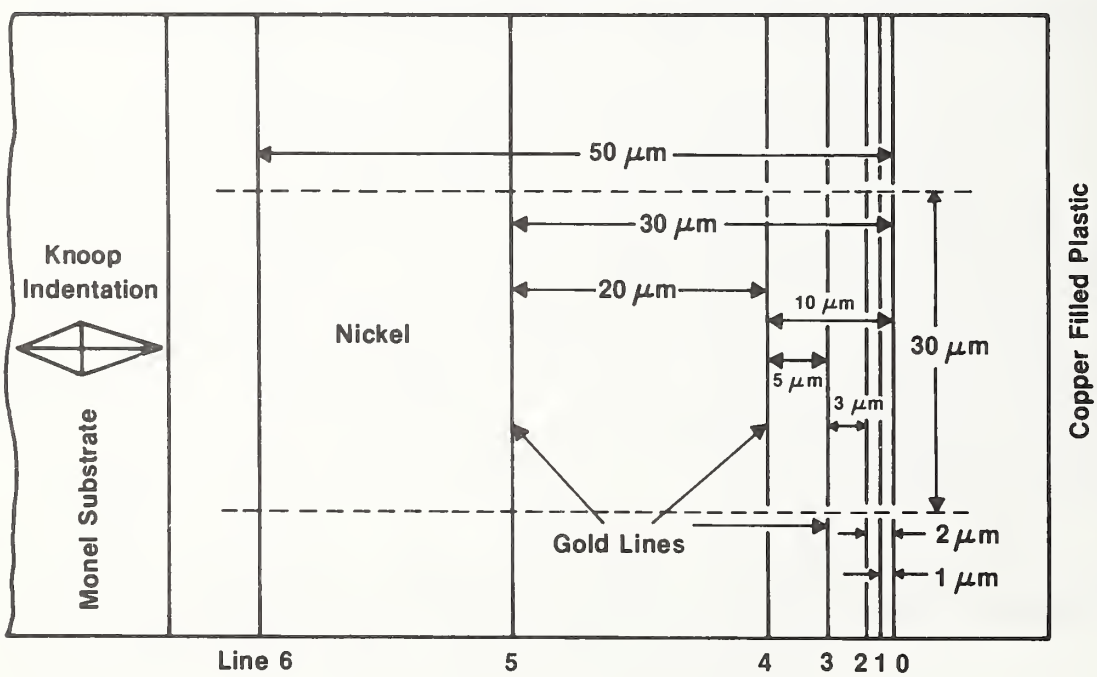
SRM	Type	Certified Property	Wt/Unit (grams)
2201	Sodium Chloride	pNa, pCl	125
2202	Potassium Chloride	pK, pCl	160
2203	Potassium Fluoride	pF	125

METROLOGY

Scanning Electron Microscope (SEM)

These SRM's are for calibrating the magnification scale and evaluating the performance of Scanning Electron Microscopes. SRM 484e has spacings of 1, 2, 3, 5, 10, 20, 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
484e	SEM Magnification Standard	IN PREP	11 mm D, 6.5 mm high
2069a	SEM Performance Standard		12 mm D, 3 mm peg



Alternating layers of gold and nickel are used to fabricate SRM 484d. The diagram shows the spacings between gold lines used to calibrate the magnification scale of scanning electron microscopes.

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
475	Linewidth Measurement Standard		0.5 to 12 μm	$6.35 \times 6.35 \times 0.15$ cm
476	Linewidth Measurement Standard	IN PREP	0.5 to 12 μm	$6.35 \times 6.35 \times 0.15$ cm

Depth Profiling

This SRM is for calibrating equipment used to measure sputtered depth and erosion rates in surface analysis. SRM 2135b 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
2135b	Ni-Cr Thin-Film Depth Profile Standard	$1 \times 2.54 \times 0.04$ cm
2136	Cr/CrO Thin-Film Depth Profile Standard	IN PREP
2137	Boron Implant in Silicon Depth Profile	IN PREP

Sam Jones and Carol Vezzetti of the Precision Engineering Division set up the computer-interfaced microscope to calibrate a photorepeater mask as a linewidth 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.

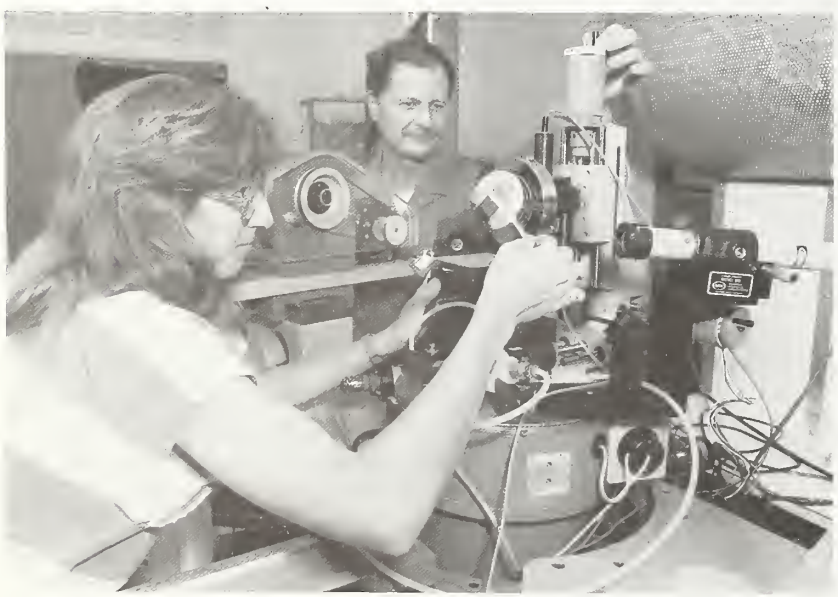
These SRM's may be used to measure the thickness of paint and other organic coatings on steel, as well as zinc (galvanized) and other nonmagnetic metallic coatings.

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

SRM	Unit Size	Nominal Coating Thickness	
		micrometer	milliinch (mil)
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	50, 140, 500, 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, 50	0.2, 0.5, 1.0, 2.0
1362a	Set of 4	40, 80, 140, 200	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, 8.5, 14, 19	0.1, 0.4, 0.6, 0.8
1366a	Set of 4	25, 34.5, 42, 50	1.0, 1.4, 1.6, 2.0



The thickness and refractive index of a silicon dioxide layer on the silicon wafer held by Barbara Belzer are derived from ellipsometric measurements. Deane Chandler Horowitz will adjust the sample stage once the wafer is mounted.

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 NBS 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 Glass Sealing Alloy (Fe53–Ni29–Co17)

SRM	Unit Size	Nominal Coating Weight (mg/cm²)	Nominal Coating Thickness	
			micrometer	microinch
1398a	Set of 4	1.5, 3.0, 6.0, 14.0	0.8, 1.5, 3, 7	30, 60, 120, 280

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	Nominal Thickness (nm)	Unit Size
2530-1	Si02 on Si Wafer	50	76-mm Dia Wafer
2530-2	Si02 on Si Wafer	100	76-mm Dia Wafer
2530-3	Si02 on Si Wafer	200	76-mm Dia Wafer

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 kg	$\log_{10}\rho \sim 9.9$ 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} m²/N
	Borosilicate, B	275 g	Glass B	C = 3.652 Brewsters, 10^{-12} m²/N
709	Extra dense Lead	500 g		C = −1.359 Brewsters, 10^{-12} m²/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, 2212, 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/cm^3)	Amount
211c	Toluene	0.86686	5 mL
2211	Toluene	0.86686	8 mL
2212	Toluene	0.86686	25 mL
2213	2,2,4 Trimethylpentane (*Iso*octane)	0.691929	25 mL
1840	Silicon	2.329	100 g
1841a	Silicon	2.329	200 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	Hardness	Size
1893	Bright Copper (Knoop)	125 kg/mm^2	12.5 mm square
1894	Bright Copper (Vickers)	125 kg/mm^2	12.5 mm square
1895	Bright Nickel (Knoop)	600 kg/mm^2	12.5 mm square
1896	Bright Nickel (Vickers)	600 kg/mm^2	12.5 mm square
1905	Bright Nickel (Knoop)	600 kg/mm^2	12.5 mm square
1906	Bright Nickel (Knoop)	600 kg/mm^2	12.5 mm square
1907	Bright Nickel (Knoop)	600 kg/mm^2	12.5 mm square

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 surface vibrations.

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

Retta Brown (left) and Dave Kelley, David Lashmore, and Geoff Stewart watch Perry Sharpless adjust a microhardness tester used to certify microhardness SRM's produced by the electrodeposition group.

Molecular Weight

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
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
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
1489	Poly(methylmethacrylate), $M_n \approx 115{,}000$	2
1496	Polyethylene Resin (Natural)	IN PREP
1497	Polyethylene Resin (Pigmented)	IN PREP
8450	Polyethylene Piping ½ in	IN PREP
8451	Polyethylene Piping 2 in	IN PREP
8452	Polyethylene Piping 4 in	IN PREP
8453	Polyethylene Piping Socket T	IN PREP
8454	Polyethylene Piping Butt T	IN PREP

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

Property	Method	705	706	1475	1476	1478	1479	1482	1483	1484	1489
Molecular Weight: Weight Average	(Light Scattering)	X	X	X			X	X	X	X	
	(Sedimentation Equilibrium)	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 Number	(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						
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
2683	Coal, Bituminous: %S = 1.85; %Ash = 6.85	32.45 (13950 BTU/lb)	50 g
2684	Coal, Bituminous: %S = 3.00; %Ash = 11.09	24.19 (12550 BTU/lb)	50 g
2685	Coal, Bituminous: %S = 4.62; %Ash = 16.53	27.45 (11800 BTU/lb)	50 g

NOTE: The calorific values (MJ/kg) may decrease upon the aging or normal oxidation of the coals. NBS 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
RM 5	Copper	~25	19 mm D×12 cm
705	Polystyrene, powder	10–350	5 g
781-D1	Molybdenum, sintered rod	273.15–2800	10 cm×0.32 cm D
781-D2	Molybdenum, sintered rod	273.15–2800	10 cm×0.64 cm D
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%)	505.08 K	56.057 J/g	25×25×0.127
2221	Zinc (99.999%)	692.59 K	111.18 J/g	25×25×0.0508
2222	Biphenyl (99.984%)	342.41 K	120.41 J/g	1 g
2223	Potassium Nitrate	IN PREP		

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 NBS 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

George Evans (left) and Jim Schooley with a cryogenic cold plate loaded with several units of SRM 767a, Thermometric Fixed Point Device, prior to calibrating the units.

Superconductive Thermometric Fixed Point Devices

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). Both SRM's 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
768	Superconductive Thermometric Fixed Point Device (Low)	Gold-Indium	0.205
		Gold-Aluminum	0.157
		Iridium	0.098
		Beryllium	0.024
		Tungsten	0.015

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)
740a	Zinc	(419.58)	IN PREP
741	Tin	231.9681	350

Secondary Reference Points

SRM	Type	Temperature °C	Wt/Unit (grams)
42g	Tin	231.967	350
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 NBS in cooperation with the Office of Reference Materials at the National Physical Laboratory (NPL) in Teddington, England. This set of ten 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	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	IN PREP

Thermocouple Material

SRM	Type	Temperature Range (°C)	Form
1967	Platinum, High-Purity (99.999+%)	−196 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)
1450b	Fibrous Glass Board	600×600×25.4	100–330	0.03
1451	Fibrous Glass Batt	600×600×25.4	100–330	0.039
1452	Fibrous Glass Blanket	600×600×25.4	297.1	
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
737	Tungsten	80–1800	6.4	51
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

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
765	Palladium	5.26	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

Kenneth Eckerle makes final adjustments on the high precision spectrophotometer used to develop and calibrate a variety of spectrophotometric 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 935: 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
935	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	IN PREP
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

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
2019d	White Ceramic Tile	350–2500	5.1 × 5.1 × 0.81 cm
2020c	White Ceramic Tile	350–2500	3.8 × 7.6 × 0.81 cm
2021	Black Porcelain Enamel	280–2500	5.1 × 5.1 × 0.20 cm

Refractive Index

SRM's 211c, 2211, 2212, 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
2212	Toluene	1.5008	25 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 bequerel is:

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

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 Bureau of Standards, Gaithersburg, MD 20899; or telephone (301) 975-5531.

In addition, chemically stable solutions of most radionuclides may be submitted to NBS for calibration as described in National Bureau of Standards Calibration Services Users Guide, NBS 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.

Jackie Calhoun of the radioactivity group prepares a series of solution SRM's for low-level tritium measurements.

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 (%)
4322B*	Americium-241	38.9	11/86	5	1.0
4332B*	Americium-243	89	11/83	5	1.4
4251B*	Barium-133	5×10^{5}	1/82	5	1.4
4222B	Carbon-14	5×10^{4}	7/83	5	1.3
4250B*	Cesium-134	2×10^{6}	4/82	5	1.2
4233B*	Cesium-137-Barium-137m	7×10^{5}	8/79	5	1.4
4943*	Chlorine-36	1×10^{4}	12/84	3	0.8
4408LD*	Cobalt-57	5×10^{6}	7/84	5	1.0
4915D*	Cobalt-60	3×10^{5}	3/84	5	0.8
4329*	Curium-243	70	6/84	5	1.4
4370C*	Europium-152	9×10^{4}	2/87	5	1.1
4926C	Hydrogen-3	3×10^{3}	9/78	18	0.6
4927C	Hydrogen-3	7×10^{5}	3/85	3	0.6
4947C	Hydrogen-3	3×10^{5}	4/87	4	1.0
4361	Hydrogen-3	1.3	9/78	490	0.9
4949B	Iodine-129	7×10^{3}	1/82	1	1.9
4929D	Iron-55	4×10^{4}	8/85	5	2.6
4932F*	Mercury-203	4×10^{5}	12/85	5	1.0
4226B*	Nickel-63	1×10^{6}	12/84	4	1.1
4327*	Polonium-208	77	6/84	1.1	1.4
4323*	Plutonium-238	33	11/86	5	0.5
4338*	Plutonium-240	18	4/80	5	1.0
4334C*	Plutonium-242	5	2/87	5	1.0
4940C	Promethium-147	1×10^{5}	8/85	5	0.4
4945F*	Strontium-89	2×10^{5}	5/87	5	0.9
4919E*	Strontium-90	3×10^{3}	5/83	5	1.4
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
4276B*	Long-Lived Mixed Radionuclide:		5/83	5	
	Antimony-125	1×10^{4}			
	Europium-154	1×10^{4}			
	Europium-155	7×10^{3}			

*License certification is required by NBS 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}	2/82	1.0 to 1.3
4906C*	Plutonium-238	IN PREP		

*License certification is required by NBS 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
4361	Hydrogen-3	Contains 490 grams of ^3H-H_2O in a flame-sealed bottle. The radioactivity concentration was 1.312 Bq g^{-1}, as of the date of the most recent gas-counting measurement—September 3, 1978. The total uncertainty in this value is 0.85%.

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
4235C*	Krypton-85	1×10^7 Bq	10/86	3	1	1.1
4308C	Krypton-85	2×10^6 Bq	11/82	30	0.3	3.1
4415LL*	Xenon-133	5×10^8 Bq	time of dispatch	5	0.1	1.0

*License certification is required by NBS 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 (%)
4241B*	Barium-133	0.081	8×10^4	1/82	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
4214B	Cobalt-57	0.122	4×10^5	2/85	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
4206C*	Thorium-228	2.615	2×10^5	11/80	2.0
Long-Lived Mixed Radionuclide					
4275B	Antimony-125-Tellurium-125m	0.027 to 1.596	5×10^4	5/83	
	Europium-154		6×10^4		
	Europium-155		3×10^4		

*License certification is required by NBS 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 (%)	
4260C	Iron-55	0.0059	2×10^4 Kxs^{-1} steradian^{-1}	11/82	1.8
4264B	Tin-121m-Antimony-121	0.0372	5×10^2s^{-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	Blank Solution	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 soluble chemical forms. Heterogeneity does not exceed 3 percent 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, blended, 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}Pu and ^{241} Am concentrations are about an order of magnitude higher than typical world-wide levels. Approximately 10 percent of the plutonium is in a refractory chemical state. The material also contains "hot" particles and a statistical method is provided for dealing with these. Inhomogeneities, excluding hot particles, do not exceed 3 percent.

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.

RM 45B—River Sediment
This material contains radioactivity concentrations of roughly an order of magnitude greater than SRM 4350B. The values, however, are uncertified although the inhomogeneity does not exceed 3 percent for all radionuclides. This material can be used for routine checking for reproducibility of results after tests have been performed with SRM 4350B.

Pam Hodge of the radioactivity group revises a certificate for a new issue of a radioactivity SRM in the 4400 series, which is devoted to radiopharmaceuticals.

Radiopharmaceuticals

SRM	Radionuclide (5 mL solution)	Half Life		Approximate Radioactivity at Time of Dispatch (Bq g^{-1})	Overall Uncertainty
4400LI*	Chromium-51	27.702	d	3×10^{6}	0.7
4408LD*	Cobalt-57	271.7	d	6×10^{6}	1.0
4416LI*	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
4417LG*	Indium-111	2.805	d	8×10^{6}	0.7
4414LC*	Iodine-123	13.221	h	6×10^{7}	1.5
4407LL*	Iodine-125	59.6	d	1×10^{6}	1.0
4401LM*	Iodine-131	8.021	d	6×10^{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
4412LM*	Molybdenum-99-Technetium-99m	65.92	h	4×10^{6}	1.0
4406LI*	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
4410HM*	Technetium-99m	6.007	h	1×10^{9}	0.9
4404LJ*	Thallium-201	72.91	h	4×10^{6}	1.3
4402LC*	Tin-113-Indium-113m	115.08	d	1×10^{6}	3.1
4415LL*	Xenon-133 (5 mL gas)	5.243	d	5×10^{8} s^{-1} total	1.0
4419LB*	Ytterbium-169	32.03	d	2×10^{6}	1.3

*License certification is required by NBS for these radionuclides.

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
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	10 g
658	Tridymite	IN PREP	5 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

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

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
1460	Stainless Steel	5 to 1200 K	80.5 μΩ·cm	Rod: 6.4 mm D, 50 mm long
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 are for calibrating four-probe and eddy-current test equipment; SRM's 2526, 2527, 2528, and 2529 are mounted on beveling blocks for two-probe test equipment.

SRM	Type	Resistivity	Form
1521	111 p-Type Silicon	0.1 and 10 Ω·cm	2 wafers, 51 mm D, 0.625 mm thick
1522	111 n-Type Silicon	25, 75, and 180 Ω·cm	3 wafers, 51 mm D, 0.625 mm thick
1523	100 and 111 p-Type Silicon	0.01 and 1 Ω·cm	2 wafers, 51 mm D, 0.625 mm thick
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

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 resisitivity 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

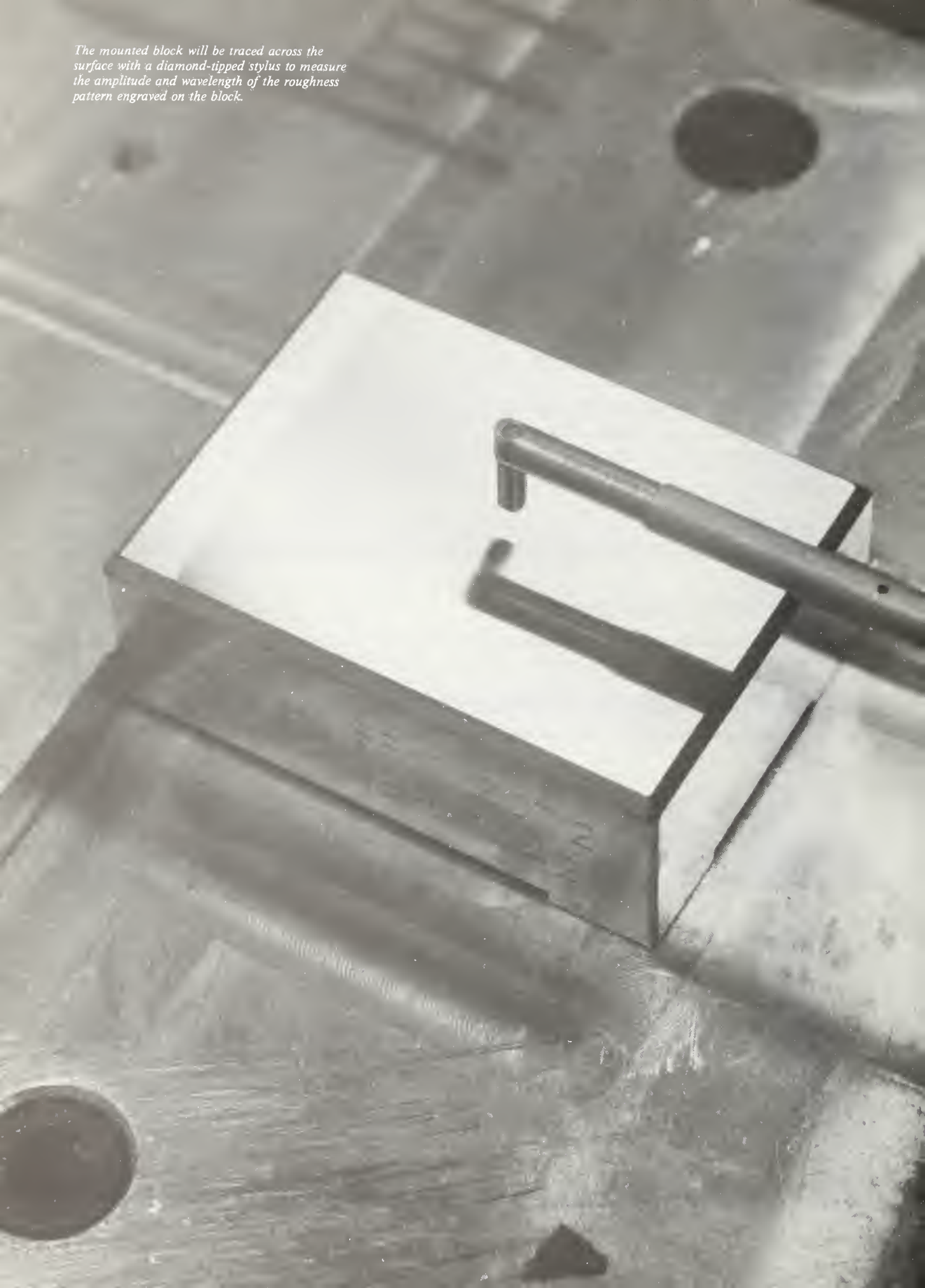
These SRM's are for calibrating and standardizing conductivity cells and meters used in water purity determinations. They are solutions of high-purity potassium chloride in de-ionized water in equilibrium with atmospheric carbon dioxide.

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

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



The mounted block will be traced across the surface with a diamond-tipped stylus to measure the amplitude and wavelength of the roughness pattern engraved on the block.

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
386j	Styrene-butadiene 1500	34 kg	75
388n	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
384e	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
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	2.1 m^2/g	50 g
8006	Alpha Alumina	0.3 m^2/g	50 g
8007	Alpha Alumina	0.1 m^2/g	50 g
8008	Alpha Alumina	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

Radiographic Image Quality

This SRM is for determining the radiographic image quality of x-ray radiographic systems, or x-ray system components such as film.

SRM	Type	Unit of Issue
1844	Radiographic Quality Image Indicator	Set of 4 plates

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	Unit of Issue
2071	Sinusoidal Roughness	0.3 μm	IN PREP
2072	Sinusoidal Roughness	1.0 μm	IN PREP
2073	Sinusoidal Roughness	3.0 μm	Block, 24×33 mm

Ted Vorburger adjusts a diamond-tipped stylus used to measure the patterns on a precision roughness SRM.

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 re-measured 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 NBS 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 NBS 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 NBS 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 NBS 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 NBS 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)
7487	Flexible Disk Cartridge	500 K bytes	130 mm (5.25 in)
8630	Flexible Disk Cartridge	1600 K bytes	130 mm (5.25 in)
8860	Flexible Disk Cartridge	1000 K bytes	90 mm (3.5 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

FIRE RESEARCH

Surface Flammability

SRM 1002c, 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
1002c	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
1006b	Non-flaming Exposure Condition (α-cellulose)	Dm (corr.)=183	3 sheets
1007a	Flaming Exposure Condition (plastic)	Dm (corr.)=421 to 493	3 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

NBS SPECIAL PUBLICATIONS IN THE 260 SERIES

Seward, R. W., ed., NBS Standard Reference Materials Catalog (1988–89 edition), NBS Spec. Publ. 260 (January 1988)——SN003–003–02558–5.

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Oscillator Characterization	J. E. Gray	(303) 497-3209

Several thousand optical SRM's and their storage containers are made in the NBS shops. From left: (top) Huang Nguyen, Billy Thompson, Dana Strawbridge, and Richard Brundel; (right) Jack Fuller, Jeff Anderson, Rick Snurr, and Dave Wilmering; (bottom) Mike Kennedy, Ray Trulli, Gene Leatherman, and Jeff Norris.

Stutso, secretary, and [illegible] Seword, manager, work on the index for the 1988–[illegible] Catalog.

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1159	Electronic and Magnetic Alloy	Aug 81	32
1160	Electronic and Magnetic Alloy	Aug 81	32
1171	Stainless Steel (AISI 321)	Jul 71	22
1172	Stainless Steel (AISI 348)	Jul 71	22
1173	Steel, Ni–Cr–Mo–V	May 83	26
C1173	Steel, Cast 3	Feb 81	26
1199	High Temperature Alloy—L605	Aug 74	23
1200	High Temperature Alloy—S816	Aug 74	23
1217	Steel, Nickel (SAE 4820)	Nov 84	18
1218	Steel, Silicon, Low C & S	Nov 84	18
1219	Stainless Steel (AISI 413)	Sep 85	22
C1221	Steel, Resulfurized/Rephosphorized	Jan 82	18
1223	Stainless Steel, High S (AISI 416)	Sep 85	22
1224	Steel, Carbon (AISI 1078)	Feb 81	18
1225	Steel, Low-Alloy (AISI 4130)	Mar 83	18
1226	Steel, Low-Alloy (HY 130)	Dec 82	18
1227	Steel, BOH 1.0 C	Mar 83	18
1228	Steel, BOH 0.1 C	Sep 82	18
1230	High Temperature Alloy	Jun 87	23
1233	Steel, Valve	Feb 86	23
1234	Zirconium A	Nov 80	35
1235	Zirconium B	Nov 80	35
1237	Zircaloy-4 D	Nov 80	35
1238	Zircaloy-4 E	Nov 80	35
1239	Zircaloy-4 F	Nov 80	35
1240	Aluminum Alloy 3004	Jul 85	28
1240a	Aluminum Alloy	Jul 85	28
1240b	Aluminum Alloy	Jul 85	28
1241a	Aluminum Alloy 5182	Aug 85	28
1241b	Aluminum Alloy 5182	Aug 85	28
1243	Waspaloy	*	32
1244	Inconel 600	May 84	23
1245	Inconel 625	May 84	23
1246	Inconel 800	May 84	23
1247	Inconel 825	May 84	23
C1248	Nickel Copper Alloy	Dec 86	32
1250	Pyromet	Jun 87	23
C1251	Phosphorized Copper (Cu VIII)	Sep 80	31
C1252	Phosphorized Copper (Cu IX)	Sep 80	31
C1253	Phosphorized Copper (Cu X)	Sep 80	31
1254	Steel, Silicon (Ca only)	Apr 82	18
1255a	Aluminum Casting Alloy 356	Nov 86	28
1256a	Aluminum Casting Alloy 380	Nov 86	28
C1257	High Purity Aluminum	Jan 87	28, 37
1258	Aluminum Alloy 6011 (mod)	May 78	28
1259	Aluminum Alloy 7075	May 78	28
1261a	Steel, AISI 4340	Feb 81	18
1262a	Steel, AISI 94B17 (mod)	Feb 81	18
1263a	Steel, Cr–V (mod)	Feb 81	18
1264a	Steel, High Carbon (mod)	Feb 81	18
1265a	Iron, Electrolytic	Feb 81	18
1267	Stainless Steel (AISI 446)	Jan 78	22
1269	Steel (AISI 1526) Line Pipe (mod)	Jun 81	18
1270	Steel, A336 (F-22) 2.3Cr–1Mo	Jun 81	18
1275	Cupro-Nickel (CDA 706)	Mar 80	30
1276	Cupro-Nickel (CDA 715)	Mar 80	30
C1285	Steel, A242 (mod)	Jun 82	18
1286	Steel, Low Alloy (HY 80)	Jun 82	18
C1287	Steel, ACI HK (AISI 310 mod)	Jun 81	22
C1288	Steel, ACI CN-7M (A-743)	Aug 81	22
C1289	Steel, ACI CA-6NM (AISI 414 mod)	Jun 81	22
C1290	Iron, White Cast (HC-250+V)	Jan 85	26
C1291	Iron, White Cast (Ni–Hard, Type I)	Jan 85	26
C1292	Iron, White Cast (Ni–Hard, Type IV)	Jan 85	26
1357	Cu–Cr Coating (nonmagnetic) on Steel	Aug 84	80
1358	Cu–Cr Coating (nonmagnetic) on Steel	Aug 84	80
1359	Cu–Cr Coating (nonmagnetic) on Steel	May 84	80

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1360	Cu–Cr Coating (nonmagnetic) on Steel	May 84	80
1361a	Cu–Cr Coating (nonmagnetic) on Steel	May 84	80
1362a	Cu–Cr Coating (nonmagnetic) on Steel	May 84	80
1363a	Cu–Cr Coating (nonmagnetic) on Steel	May 84	80
1364a	Cu–Cr Coating (nonmagnetic) on Steel	May 84	80
1365a	Nickel (magnetic) on Steel	May 84	80
1366a	Nickel (magnetic) on Steel	May 84	80
1379	Ultra-thin Gold on Nickel 0.35 mg	May 84	81
1380	Ultra-thin Gold on Nickel 0.55 mg	May 84	81
1387	Gold Coating on Nickel 2.2 mg	Sep 85	81
1398a	Gold Coating on Fe–Ni–Co Alloy (set)	May 84	81
1399b	Gold Coating on Nickel (set)	May 84	81
1411	Soft Borosilicate Glass	Aug 85	71
1412	Multicomponent Glass	Aug 85	71
1413	Glass Sand, High Alumina	Aug 85	68
1450b	Thermal Resistance, Fibrous Glass Board	May 85	93
1451	Thermal Resistance, Fibrous Glass Blanket	May 85	93
1452	Thermal Resistance, Fibrous Glass Batt	Apr 86	93
1457	Superconducting Critical Current Nb–Ti Wire	Jun 84	107
1461	Thermal Conductivity and Electrical Resistivity, Stainless Steel	May 84	93, 106
1462	Thermal Conductivity and Electrical Resistivity, Stainless Steel	May 84	93, 106
1470	Gas Transmission, Polyester Film	Feb 82	105
1475	Linear Polyethylene (52k mol wt)	Dec 78	86, 88
1476	Branched Polyethylene (viscosity)	Nov 69	86
1478	Polystyrene (37k mol wt)	Jan 79	86
1479	Polystyrene (1M mol wt)	Mar 81	86
1482	Linear Polyethylene (13k mol wt)	Oct 76	86
1483	Linear Polyethylene (32k mol wt)	Mar 76	86
1484	Linear Polyethylene (119k mol wt)	Oct 76	86
1489	Poly (methylmethacrylate)	Mar 86	86
1490	Polyisobutylene Solution in Cetane, Rheology	Dec 77	87
1495	Rubber, Isobutylene-Isoprene (Butyl) (Low Mooney Viscosity)	Mar 81	109
1496	Polythylene Resin (Natural)	*	86
1497	Polythylene Resin (Pigmented))	*	86
1507	THC in Freeze-Dried Urine	*	57
1514	Thermal Analysis Purity (DSC)	Jul 84	88
1521	Boron-doped Silicon Slices for Resistivity (0.1 & 10 ohm·cm)	Feb 85	106
1522	Silicon Power Device Level Resistivity (25, 75, & 180 ohm·cm)	Sep 84	106
1523	Silicon Resistivity for Eddy Current Testers (0.01 & 1.0 ohm·cm)	Feb 85	106
1543	GC/MS System Performance	Aug 84	60
1547	Organics in Cod Liver Oil	*	57
1549	Non-Fat Milk Powder	Jul 85	47
1563	Cholesterol and Fat Soluable Vitamins in Cod Liver Oil	*	57
1566a	Oyster Tissue	*	47
1567a	Wheat Flour	*	47
1568	Rice Flour	Jan 78	47
1569	Brewers Yeast (Cr only)	Sep 76	47

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1572	Citrus Leaves	Dec 82	48
1573	Tomato Leaves	Oct 76	48
1575	Pine Needles	Oct 76	48
1577a	Bovine Liver	Feb 85	47
1579	Powdered Lead-Based Paint (Pb only)	Jan 73	54
1580	Organics in Shale Oil	Nov 80	57
1581	Polychlorinated Biphenyls in Oil	Jan 82	57
1582	Petroleum Crude Oil	Jan 84	57
1583	Chlorinated Pesticides in 2,2,4–Trimethylpentane	Feb 85	57
1584	Priority Pollutant Phenols in Methanol	Apr 84	57
1585	Chlorinated Biphenyls	Jan 86	57
1586	Isotopically Labeled and Unlabeled Priority Pollutants in Methanol	Oct 84	57
1587	Nitrated Polycyclic Aromatic Hydrocarbons in Methanol	Jun 85	57
1589	PCB's in Human Serum	Nov 85	45, 57
1590	Stabilized Wine	Dec 80	48
1595	Tripalmitin	Jul 83	45
1596	Dinitropyrene Isomers and 1-Nitropyrene in Methylene Chloride	*	57
1597	Complex Mixture of Polycyclic Aromatic Hydrocarbons	*	57
1598	Inorganic Constituents in Bovine Serum	*	45
1599	Anticonvulsant Drug Level Assay	Aug 82	45
1600	Secondary Standard Magnetic Tape Cassette (Computer Amplitude)	Mar 74	114
1614	Dioxin in *Iso*octane	Jul 85	57
1616	Sulfur in Kerosene	*	55
1617	Sulfur in Kerosene	*	55
1618	V and Ni in Residual Fuel Oil	May 85	54
1619	Sulfur in Residual Fuel Oil (0.7%)	Dec 81	55
1620a	Sulfur in Residual Fuel Oil (4.5%)	Dec 81	55
1621c	Sulfur in Residual Fuel Oil (0.9%)	Sep 86	55
1622c	Sulfur in Residual Fuel Oil (1.9%)	Sep 86	55
1623a	Sulfur in Residual Fuel Oil (0.2%)	Dec 81	55
1624a	Sulfur in Distillate (Diesel) Fuel Oil (0.1%)	Dec 81	55
1625	Sulfur Dioxide Permeation Tube, 10 cm	Jan 73	52
1626	Sulfur Dioxide Permeation Tube, 5 cm	Aug 71	52
1627	Sulfur Dioxide Permeation Tube, 2 cm	Aug 71	52
1629a	Nitrogen Dioxide Perm Device, 10 cm	Apr 81	52
1630	Trace Mercury in Coal	Aug 79	54
1632b	Trace Elements in Coal (Bituminous)	Jun 85	56
1633a	Trace Elements in Coal Fly Ash	Jan 85	56
1634b	Trace Elements in Fuel Oil	Feb 86	56
1635	Trace Elements in Coal (Subbituminous)	Aug 79	56
1636a	Lead in Reference Fuel	Feb 80	54
1638b	Lead in Reference Fuel	Aug 86	54
1639	Halocarbons (in methanol) for Water Analysis	Apr 83	57
1641b	Mercury in Water (μg/mL)	Apr 83	54
1642b	Mercury in Water (ng/mL)	Jun 82	54
1643b	Trace Elements in Water	May 84	56
1644	Generator Columns for Polynuclear Aromatic Hydrocarbons	Apr 81	57
1646	Estuarine Sediment	Jun 82	56
1647	Priority Pollutant Polynuclear Aromatic Hydrocarbons	Dec 81	57
1648	Urban Particulate Matter	May 82	56

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1649	Urban Dust/Organics	Apr 82	57
1650	Diesel Particulate Matter	Feb 85	57
1651	Heat-Source Powder for Calorimetry Zirconium-Barium Chromate, 1460	Nov 68	88
1652	Heat-Source Powder for Calorimetry Zirconium-Barium Chromate, 1632	Nov 68	88
1653	Heat Source for Calorimetry Zirconium-Barium Chromate, 1762	Nov 68	88
1655	Potassium Chloride for Solution Calorimetry	Mar 81	87
1656	Thianthrene, Combustion Calorimetry	Jan 85	87
1657	Synthetic Refuse-Derived Fuel, Combustion Calorimetry	Mar 85	87
1658a	Methane in Air, 1ppm	Mar 81	50
1659a	Methane in Air, 10ppm	Mar 81	50
1660a	Methane (4) and Propane (1) in Air	Mar 81	50
1661a	Sulfur Dioxide in Nitrogen, 500ppm	*	50
1662a	Sulfur Dioxide in Nitrogen, 1000ppm	*	50
1663a	Sulfur Dioxide in Nitrogen, 1500ppm	Mar 81	50
1664a	Sulfur Dioxide in Nitrogen, 2500ppm	Mar 81	50
1665b	Propane in Air, 3ppm	*	50
1666b	Propane in Air, 10ppm	*	50
1667b	Propane in Air, 50ppm	*	50
1668b	Propane in Air, 100ppm	Jan 80	50
1669b	Propane in Air, 500ppm	Jan 80	50
1670	Carbon Dioxide in Air, 330ppm	Dec 82	50
1671	Carbon Dioxide in Air, 340ppm	Dec 82	50
1672	Carbon Dioxide in Air, 350ppm	Dec 82	50
1674b	Carbon Dioxide in Nitrogen, 7%	Jan 80	50
1675b	Carbon Dioxide in Nitrogen, 14%	Jan 80	50
1677c	Carbon Monoxide in Nitrogen, 10ppm	Jan 80	50
1678c	Carbon Monoxide in Nitrogen, 50ppm	Jan 80	50
1679c	Carbon Monoxide in Nitrogen, 100ppm	Jan 80	50
1680b	Carbon Monoxide in Nitrogen, 500ppm	Jan 80	50
1681b	Carbon Monoxide in Nitrogen, 1000ppm	Jan 80	50
1683b	Nitric Oxide in Nitrogen, 50ppm	*	50
1684b	Nitric Oxide in Nitrogen, 100ppm	*	50
1685b	Nitric Oxide in Nitrogen, 250ppm	Jan 80	50
1686b	Nitric Oxide in Nitrogen, 500ppm	Jan 80	50
1687b	Nitric Oxide in Nitrogen, 1000ppm	Jan 80	50
1690	Polystyrene Spheres, 1 μm	Dec 82	110
1691	Polystyrene Spheres, 0.3 μm	May 84	110
1693a	Sulfur Dioxide in Nitrogen, 50ppm	*	50
1694a	Sulfur Dioxide in Nitrogen, 100ppm	*	50
1696	Sulfur Dioxide in Nitrogen, 3500ppm	Jul 84	50
1700a	Carbon Dioxide in Nitrogen, 10% Blood Gas	*	45, 50
1701a	Carbon Dioxide and Oxygen in Nitrogen, 5% and 12%, Blood Gas	*	45, 50
1702a	Carbon Dioxide and Oxygen in Nitrogen, 5% and 20%, Blood Gas	*	45, 50
1703a	Carbon Dioxide and Oxygen in Nitrogen, 10% and 7%, Blood Gas	*	45, 50
1761	Steel, Low Alloy	*	18
1762	Steel, Low Alloy	*	18
1763	Steel, Low Alloy	*	18
1764	Steel, Low Alloy	*	18
1765	Steel, Low Alloy	*	18
1766	Steel, Low Alloy	*	18
1767	Steel, Low Alloy	*	18
1805	Benzene in Nitrogen, 0.25ppm	Dec 82	50
1806	Benzene in Nitrogen, 10ppm	Dec 82	50
1808	Tetrachloroethylene in Nitrogen, 0.25 ppm	Jun 83	50
1809	Tetrachloroethylene in Nitrogen, 10 ppm	Jun 83	50
1810a	Linerboard	*	115
1811	Aromatic Gases in Nitrogen 0.25 ppm	Nov 85	50
1812	Aromatic Gases in Nitrogen 10 ppm	Nov 85	50
1813	Aliphatic Organic Gases in Nitrogen 0.25 ppm	Mar 87	50
1814	Aliphatic Organic Gases in Nitrogen 10 ppm	Mar 87	50
1815a	n-Heptane, Reference Fuel	Mar 85	106
1816a	*Iso*octane, Reference Fuel	Mar 85	106
1817a	Catalyst Package for Lubricant Oxidation	Oct 86	64
1818	Chlorine in Lube Base Oil	Apr 86	63
1819	Sulfur in Lubricating Base Oil	Jul 85	63
1822	Refractive Index Glass, Soda-Lime	Nov 84	97
1823	Refractive Index Silicone Liquids	Dec 76	97
1828	Ethanol-Water Solutions	Jun 85	48
1829	Alcohols in Reference Fuel	Mar 86	55
1830	Soda-Lime Float Glass	Jul 82	71
1831	Soda-Lime Sheet Glass	Jul 82	71
1832	Thin Glass Film on Polycarbonate for X-ray Fluorescence	May 84	61
1833	Thin Glass Film on Polycarbonate for X-ray Fluorescence	May 84	61
1836	Nitrogen in Lube Base Oil	*	63
1837	Methanol and t-Butanol in Reference Fuels	Mar 86	55
1838	Ethanol in Reference Fuels	Mar 86	55
1839	Methanol in Reference Fuels	Mar 86	55
1840	Silicon Density, 100 g	May 82	84
1841a	Silicon Density, 200 g	May 82	84
1844	Radiographic Image Quality Indicator	Nov 84	112
1850	Penetrant Test Block	Dec 80	111
1851	NDE Penetrant Test Block (Matte)	Apr 84	111
1855	Ultrasonic Power Transducer	Jan 86	85
1856	Acoustic Emission Transducer	Jul 85	85
1857	Tool Steel Abrasive Wear	Mar 83	104
1860	Al, Eddy Current 60% IACS	Aug 82	107
1862	Al, Eddy Current 41% IACS	Aug 82	107
1871	Pb-Si Glasses for Microanalysis	May 84	38
1872	Pb-Ge Glasses for Microanalysis	May 84	38
1873	Ba-Zn-Si Glasses for Microanalysis	May 84	38
1874	Li-Al-Bo Glasses for Microanalysis	Dec 84	38
1875	Al-Mg-P Glasses for Microanalysis	Dec 84	38
1876a	Chrysotile Asbestos Fibers	Jun 83	62
1878	Respirable Alpha Quartz	Nov 83	62
1880	Portland Cement, black	Feb 84	72
1881	Portland Cement, white	Feb 84	72

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1882	Ca–Al Cement	Jul 86	72
1883	Ca–Al Cement	Jul 86	72
1890	Stainless Steel for Pitting or Crevice Corrosion	May 83	104
1891	Co–Cr–Mo Alloy for Pitting of Crevice Corrosion	Sep 85	104
1893	Cu Microhardness Knoop	Feb 84	84
1894	Cu Microhardness Vickers	Feb 84	84
1895	Ni Microhardness Knoop	Feb 84	84
1896	Ni Microhardness Vickers	Feb 84	84
1901	Centerline Drawings for Optical Character Recognition-Type B	Mar 76	114
1905	Ni Microhardness Knoop-300	Aug 86	84
1906	Ni Microhardness Knoop-500	Sep 86	84
1907	Ni Microhardness Knoop-1000	Sep 86	84
1911	Benzene Permeation Device	Aug 82	52
1912	Tetrachloroethylene Perm Device	Sep 85	52
1920	Near Infrared Reflectance Wavelength	Jul 86	96
1930	Glass Filters, Transmittance	*	95
1931	Fluorescence Corrected Emission Spectrum	*	95
1939	Polychlorinated Biphenyls in Sediment	*	57
1940	Polychlorinated Biphenyls in Sediment	*	57
1941	Organics in Marine Sediment	*	57
1951	Cholesterol in Human Serum (Frozen)	*	45
1952	Cholesterol in Human Serum (Freeze-dried)	*	45
1960	Polystyrene Spheres, 10 μm	Apr 85	110
1961	Polystyrene Spheres, 30 μm	Jan 87	110
1965	Polystyrene Spheres, 10 μm	Jan 87	110
1967	High-Purity Platinum Thermoelement	Feb 77	92
1968	Gallium Melting Point	Jun 77	91
1969	Rubidium Triple Point	Jan 84	91
1970	Succinonitrile Triple Point	Mar 85	91
1971	Indium Melting Point	Feb 87	91
2003	Aluminum Mirror, First Surface, Reflectance	May 85	96
2009a	Didymium Glass Filter, Wavelength	Jul 84	95
2011	Gold Mirror, First Surface, Reflectance	*	96
2015	White Opal Glass Diffuse Spectral Reflectance	May 82	96
2016	White Opal Glass Diffuse Spectral Reflectance	May 82	96
2019d	White Ceramic Tile for Directional-Hemispherical Reflect	Oct 83	96
2020c	White Ceramic Tile for Directional-Hemispherical Reflect	Nov 84	96
2021	Black Porcelain Enamel, Directional-Hemispherical Reflect	Sep 80	96
2023a	Aluminum Mirror, Second Surface, Reflectance	*	96
2025	Aluminum Mirror with Wedge, Second Surface, Reflectance	Feb 82	96
2031	Metal-on-Quartz Filters for Spectrophotometry	Oct 84	95
2032	Potassium Iodide Stray Light	Oct 79	95
2033	KI Stray Light with Attenuator	May 80	95
2034	Holmium Oxide Solution Wavelength	Jun 85	95
2063	Microanalysis Thin Film Mg–Si–Ca–Fe	Aug 87	38
2069a	SEM Performance Standard	Feb 85	78
2071	Sinusoidal Roughness	*	112
2072	Sinusoidal Roughness	*	112
2073	Sinusoidal Roughness	Nov 84	112
2083	Socketed Ball Bar	Aug 85	111
2106	Centroid Color Charts	none	113
2135b	Ni/Cr Thin-Film Depth Profile	*	79
2136	Cr/CrO_2 Depth Profile	*	79
2137	Boron Implant in Silicon Depth Profile	*	79
2141	Urea	Aug 70	41
2142	o-Bromobenzoic Acid	Sep 70	41
2143	p-Fluorobenzoic Acid	Jan 82	41
2144	m-Chlorobenzoic Acid	Apr 73	41
2151	Nicotinic Acid (Calorimetry)	Jan 85	87
2152	Urea (Calorimetry)	Jan 85	87
2161	Low Alloy Steel	*	15
2162	Low Alloy Steel	*	15
2163	Low Alloy Steel	*	15
2164	Low Alloy Steel	*	15
2165	Low Alloy Steel	*	15
2166	Low Alloy Steel	*	15
2167	Low Alloy Steel	*	15
2185	Potassium Hydrogen Phthalate, pD	Nov 84	77
2186I	Potassium Dihydrogen Phosphate, pD	May 68	77
2186II	Disodium Hydrogen Phosphate, pD	May 68	77
2191a	Sodium Bicarbonate, pD	Nov 84	77
2192a	Sodium Carbonate, pD	Nov 84	77
2201	Sodium Chloride, pNa & pCl	Mar 84	78
2202	Potassium Chloride, pK & pCl	Mar 84	78
2203	Potassium Fluoride, pF	May 73	78
2211	Toluene 8mL	Mar 85	84, 97
2212	Toluene 25mL	Mar 85	84, 97
2213	2,2,4–Trimethylpentane 25mL	Mar 85	84, 87, 97
2220	Tin, Temp and Enthalpy of Fusion	Oct 85	88
2221	Zinc, Temp and Enthalpy of Fusion	Oct 85	88
2222	Biphenyl, Temp and Enthalpy of Fusion	Sept 87	88
2223	Potassium Nitrate, Temp and Enthalpy of Fusion	*	88
2350	Potential & Thickness Step	Aug 85	104
C2400	High Alloy Steel (ACI 17/4 PH)	Feb 86	23
C2401	High Alloy Steel (ACI–CD–4M–Cu)	Feb 86	23
C2402	Hasteloy C	Feb 86	23
C2423	Ductile Iron	Nov 85	26
C2423a	Ductile Iron	Nov 85	26
C2424	Ductile Iron	Jul 85	26
C2424a	Ductile Iron	Jul 85	26
C2425	Ductile Iron	Jul 85	26
C2425a	Ductile Iron	Jul 85	26
C2430	Scheelite Ore	Jan 87	65
2526	111 p–Type Si, Spreading Resistance	Aug 83	106
2527	111 n–Type Si, Spreading Resistance	Aug 83	106
2528	100 p–Type Si, Spreading Resistance	Jan 84	106
2529	100 n–Type Si, Spreading Resistance	May 84	106
2530-1	Ellipsometrically Derived Thickness and Refractive Index for SiO_2 on Silicon Wafer	*	81
2530-2	Ellipsometrically Derived Thickness and Refractive Index for SiO_2 on Silicon Wafer	*	81
2530-3	Ellipsometrically Derived Thickness and Refractive Index for SiO_2 on Silicon Wafer	*	81
2607	Carbon Dioxide/Nitrous Oxide in Air	Sep 85	50
2608	Carbon Dioxide/Nitrous Oxide in Air	Sep 85	50
2609	Carbon Dioxide/Nitrous Oxide in Air	Sep 85	50
2610	Carbon Dioxide/Nitrous Oxide in Air	Sep 85	50
2612a	Carbon Monoxide in Air (10ppm)	Jan 80	50

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2613a	Carbon Monoxide in Air (20ppm)	Jan 80	50
2614a	Carbon Monoxide in Air (45ppm)	Jan 80	50
2619a	Carbon Dioxide in Nitrogen (0.5%)	Jan 80	50
2620a	Carbon Dioxide in Nitrogen (1.0%)	Jan 80	50
2621a	Carbon Dioxide in Nitrogen (1.5%)	Jan 80	50
2622a	Carbon Dioxide in Nitrogen (2.0%)	Jan 80	50
2623a	Carbon Dioxide in Nitrogen (2.5%)	Jan 80	50
2624a	Carbon Dioxide in Nitrogen (3.0%)	Jan 80	50
2625a	Carbon Dioxide in Nitrogen (3.5%)	Jan 80	50
2626a	Carbon Dioxide in Nitrogen (4.0%)	Jan 80	50
2627a	Nitric Oxide in Nitrogen (5ppm)	Jun 82	50
2628a	Nitric Oxide in Nitrogen (10ppm)	Jun 82	50
2629a	Nitric Oxide in Nitrogen (20ppm)	Jun 82	50
2630	Nitric Oxide in Nitrogen (1500ppm)	May 79	50
2631	Nitric Oxide in Nitrogen (3000ppm)	May 79	50
2633	Carbon Dioxide in Nitrogen (400ppm)	Apr 79	50
2634	Carbon Dioxide in Nitrogen (800ppm)	Apr 79	50
2635a	Carbon Monoxide in Nitrogen (25ppm)	*	50
2636a	Carbon Monoxide in Nitrogen (250ppm)	*	50
2637a	Carbon Monoxide in Nitrogen (2500ppm)	Mar 87	50
2638a	Carbon Monoxide in Nitrogen (5000ppm)	Mar 87	50
2639a	Carbon Monoxide in Nitrogen (1%)	Mar 87	50
2640	Carbon Monoxide in Nitrogen (2%)	Jul 79	50
2641	Carbon Monoxide in Nitrogen (4%)	Jul 79	50
2642a	Carbon Monoxide in Nitrogen (8%)	Mar 87	50
2645a	Propane in Nitrogen (500ppm)	May 80	50
2646a	Propane in Nitrogen (1000ppm)	May 80	50
2647a	Propane in Nitrogen (2500ppm)	May 80	50
2648a	Propane in Nitrogen (5000ppm)	May 80	50
2649	Propane in Nitrogen (10,000ppm)	May 80	50
2650	Propane in Nitrogen (20,000ppm)	May 80	50
2651	Propane and Oxygen in Nitrogen	Jul 80	50
2652	Propane and Oxygen in Nitrogen	Jul 80	50
2654	Nitrogen Dioxide in Air (500ppm)	Jun 82	50
2655	Nitrogen Dioxide in Air (1000ppm)	Jun 82	50
2656	Nitrogen Dioxide in Air (2500ppm)	Jun 82	50
2657a	Oxygen in Nitrogen (2%)	*	50
2658a	Oxygen in Nitrogen (10%)	*	50
2659a	Oxygen in Nitrogen (20%)	*	50
2670	Toxic Metals in Freeze-Dried Urine	Mar 85	61
2671a	Freeze-Dried Urine for Fluorine	Dec 82	61
2672a	Freeze-Dried Urine for Mercury	May 83	61
2676c	Metals on Filter Media (Cd–Mn–Pb–Zn)	Feb 87	62
2677	Be & As on Filter Media	Oct 85	62
2679a	Quartz on Filter Media	May 84	62
2682	Sulfur in Coal (0.5)	Feb 85	55, 87
2683	Sulfur in Coal (1.9)	Feb 85	55, 87
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