DEPARTMENT OF COMMERCE PUBLICATION

NBS SPECIAL PUBLICATION 260

JULY 1970 EDITION

Catalog of STANDARD REFERENCE MATERIALS

U.S. DEPARTMENT OF COMMERCE
National Bureau of Standards

NATIONAL BUREAU OF STANDARDS

The National Bureau of Standards [1] was established by an act of Congress March 3, 1901. Today, in addition to serving as the Nation's central measurement laboratory, the Bureau is a principal focal point in the Federal Government for assuring maximum application of the physical and engineering sciences to the advancement of technology in industry and commerce. To this end the Bureau conducts research and provides central national services in four broad program areas. These are: (1) basic measurements and standards, (2) materials measurements and standards, (3) technological measurements and standards, and (4) transfer of technology.

The Bureau comprises the Institute for Basic Standards, the Institute for Materials Research, the Institute for Applied Technology, the Center for Radiation Research, the Center for Computer Sciences and Technology, and the Office for Information Programs.

THE INSTITUTE FOR BASIC STANDARDS provides the central basis within the United States of a complete and consistent system of physical measurement; coordinates that system with measurement systems of other nations; and furnishes essential services leading to accurate and uniform physical measurements throughout the Nation's scientific community, industry, and commerce. The Institute consists of an Office of Measurement Services and the following technical divisions:

Applied Mathematics—Electricity—Metrology—Mechanics—Heat—Atomic and Molecular Physics—Radio Physics [2]—Radio Engineering [2]—Time and Frequency [2]—Astrophysics [2]—Cryogenics.[2]

THE INSTITUTE FOR MATERIALS RESEARCH conducts materials research leading to improved methods of measurement standards, and data on the properties of well-characterized materials needed by industry, commerce, educational institutions, and Government; develops, produces, and distributes standard reference materials; relates the physical and chemical properties of materials to their behavior and their interaction with their environments; and provides advisory and research services to other Government agencies. The Institute consists of an Office of Standard Reference Materials and the following divisions:

Analytical Chemistry—Polymers—Metallurgy—Inorganic Materials—Physical Chemistry.

THE INSTITUTE FOR APPLIED TECHNOLOGY provides technical services to promote the use of available technology and to facilitate technological innovation in industry and Government; cooperates with public and private organizations in the development of technological standards, and test methodologies; and provides advisory and research services for Federal, state, and local government agencies. The Institute consists of the following technical divisions and offices:

Engineering Standards—Weights and Measures — Invention and Innovation — Vehicle Systems Research—Product Evaluation—Building Research—Instrument Shops—Measurement Engineering—Electronic Technology—Technical Analysis.

THE CENTER FOR RADIATION RESEARCH engages in research, measurement, and application of radiation to the solution of Bureau mission problems and the problems of other agencies and institutions. The Center consists of the following divisions:

Reactor Radiation—Linac Radiation—Nuclear Radiation—Applied Radiation.

THE CENTER FOR COMPUTER SCIENCES AND TECHNOLOGY conducts research and provides technical services designed to aid Government agencies in the selection, acquisition, and effective use of automatic data processing equipment; and serves as the principal focus for the development of Federal standards for automatic data processing equipment, techniques, and computer languages. The Center consists of the following offices and divisions:

Information Processing Standards—Computer Information — Computer Services — Systems Development—Information Processing Technology.

THE OFFICE FOR INFORMATION PROGRAMS promotes optimum dissemination and accessibility of scientific information generated within NBS and other agencies of the Federal Government; promotes the development of the National Standard Reference Data System and a system of information analysis centers dealing with the broader aspects of the National Measurement System, and provides appropriate services to ensure that the NBS staff has optimum accessibility to the scientific information of the world. The Office consists of the following organizational units:

Office of Standard Reference Data—Clearinghouse for Federal Scientific and Technical Information [3]—Office of Technical Information and Publications—Library—Office of Public Information—Office of International Relations.

---

[1] Headquarters and Laboratories at Gaithersburg, Maryland, unless otherwise noted; mailing address Washington, D.C. 20234.
[2] Located at Boulder, Colorado 80302.
[3] Located at 5285 Port Royal Road, Springfield, Virginia 22151.

UNITED STATES DEPARTMENT OF COMMERCE Maurice H. Stans, *Secretary*
NATIONAL BUREAU OF STANDARDS Lewis M. Branscomb, *Director*

Catalog of Standard Reference Materials

Office of Standard Reference Materials
National Bureau of Standards
Washington, D.C. 20234

CAUTION: The values given in the following sections are listed primarily as a guide to purchaser. The values shown are nominal and may differ from those shown on the certificates. Space limitations have required that some values be omitted. For these reasons, the certificates issued with the standards should always be consulted to obtain the certified values.

U.S. National Bureau of Standards, Special Publication 260
Issued July 1970
(Supersedes NBS Spec. Publ. 260—1969 Edition)

Nat. Bur. Stand. (U.S.), Spec. Publ. 260—1970 ed., 84 pages (July 1970)
CODEN: XNBSA

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (Order by SD Catalog No. C 13.10:260—1970 ed.) - Price 75 cents.

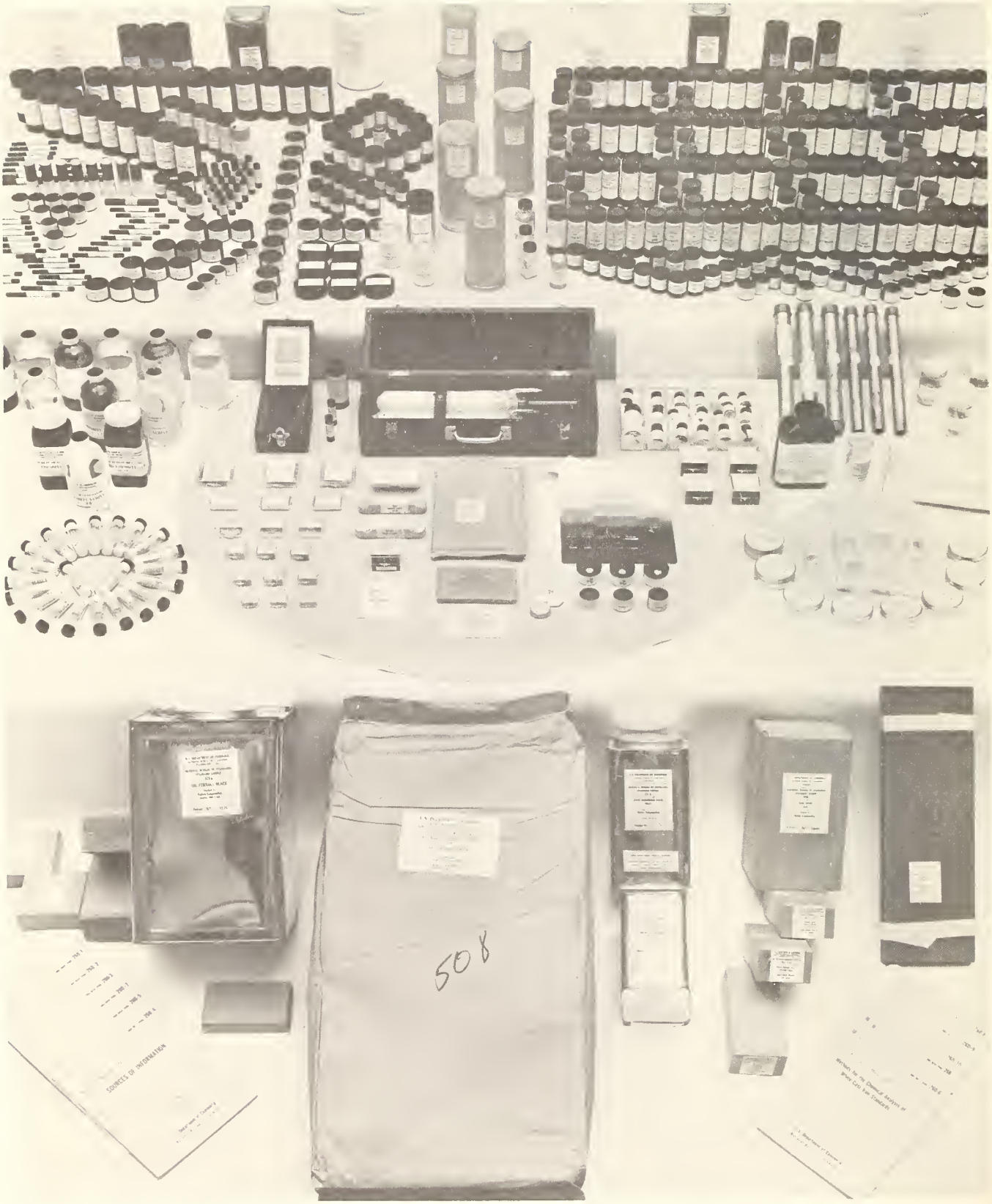
PREFACE TO THE 1970 EDITION OF THE STANDARD REFERENCE MATERIALS CATALOG

Several important changes have been introduced with this edition of the NBS-SRM Catalog. The catalog has been extensively revised to improve readability, ease of use, and to reflect a more rational ordering of the more than 650 SRMs listed. A subject index, in addition to the numerical listing by SRM number, has been added. Tables of certified values (please note: these are nominal values; the certified value appears only on the Certificate or Certificate of Analysis) have been arranged for easier readability. A major reordering of the various categories of materials offered has been installed. Categories with an initial "3" are SRMs certified for chemical composition and although we have maintained "metal-ferrous", "metal-nonferrous", etc. categories, new sections ordered by element (alphabetically) have been introduced. Categories with an initial "4" refer to SRMs certified for one or more physical properties which have been ordered under the traditional subject-headings of heat, electricity, radioactivity, etc. Initial "5" categories are reserved for SRMs falling under "engineering" standards, such as the rubber, plastics, etc. SRMs.

Finally, it should be noted that prices have been omitted from the catalog. These are now contained only in the current "Supplement to the Catalog", and therefore are not an integral part of the catalog proper. In the supplement are listed: current prices, current SRMs in inventory, all SRMs added to inventory after the closing date of the latest catalog edition, all SRMs out of stock. New editions of the catalog can thus be issued bi- or triannually instead of yearly. Supplements to make the catalog current are issued semiannually in January and July.

The Office of Standard Reference Materials welcomes suggestions and comments with a view to further improvement of this catalog.

J. Paul Cali, Acting Chief
Office of Standard Reference Materials
National Bureau of Standards
Washington, D. C. 20234


SOURCES OF INFORMATION
508

CONTENTS

Standard Reference Materials

Issued by the National Bureau of Standards

A descriptive listing of the various standard reference materials distributed at the present time by the National Bureau of Standards is given. These materials are used to calibrate measurement systems and to provide a central basis for uniformity and accuracy of measurement. The unit and quantity, the type, and the certified characterization are listed for each material, as well as directions for ordering. Announcements of new and renewal materials are made in the NBS Technical News Bulletin, and in scientific and trade journals. The current status and price will be indicated by insert sheets available at timely intervals from the Bureau.

Key words: Analysis; characterization; composition; property of material; standard reference material; standards.

1. General Information

1.1. Introduction

This publication lists and describes the standard reference materials issued by the National Bureau of Standards and provides information on their procurement. Each of these materials bears a distinguishing name and number, by which it is permanently identified. Each sample bearing a given designation is of identical characterization with every other sample bearing the same designation, within the limits required by the use for which it is intended; or if necessary, is given a serial number and an individual calibration.

The first standard materials issued by the Bureau were a group of ores, irons, and steels certified for chemical composition, and by custom they came to be called "standard samples." At present, more than 670 standard reference materials are available, covering a wide range of chemical and physical properties, and the latter designation seems a more appropriate one. As the variety of materials has increased, new subcategories such as clinical laboratory standards, nuclear materials, glass-viscosity standards, rubber and rubber compounding materials, color standards, and thickness of coating standards have been established. These are now listed for convenience under the headings (a) Standards of certified chemical composition, (b) Standards of certified physical properties, and (c) Engineering type standards. Subcategories of materials under these general headings can be conveniently found in the Table of Contents. An index provides for the location of a particular standard reference material by SRM number or descriptive type designation.

The detailed listing of materials indicates the nominal certification for which the standard is issued, but the certificate must be consulted for the actual certification. A number of standard reference materials are issued for which it is not feasible to supply numerical values, or for which such certification would not be useful. These materials do provide assurance of identity among all samples with the same designation, and permit standardization of test procedures and referral of physical or chemical data on unknown materials to a common basis.

1.2. Renewal and Discontinued Standard Reference Materials

The preparation of "renewal" SRMs is intended to be completed at the time the existing supply of each kind of material is exhausted, but owing to delays in obtaining a proper grade of material and for other reasons, this is not always possible. The renewal will not usually be identical to its predecessor, but will be quite similar especially with regard to the characteristics certified, and generally the renewal can be used in place of its predecessor. As an example, when the first 0.1 percent carbon Bessemer steel was prepared in 1909 it was assigned SRM No. 8. During the following years, a number of renewal batches 8a, 8b, etc. were prepared; and the 8i now available represents the 9th renewal batch of 0.1 percent carbon Bessemer steel. While each of these batches differ somewhat in detailed analysis from one batch to another, all retain the relatively high level of phosphorus, sulfur, and nitrogen, and low alloy metal content characteristic of this type of material. It is not possible to supply preceding numbers of a renewal series when the stock is exhausted. If little demand exists or an alternate source of supply has become available for a material, production may be discontinued permanently or until sufficient justification is obtained to warrant renewal.

1.3. New Standard Reference Materials

New SRMs are issued from time-to-time, and announcements are made through the NBS Technical News Bulletin, and through news releases to scientific, technical, and trade publications.

1.4. Supplemental Insert Sheets

Supplemental insert sheets are prepared at timely intervals to up-date the listing in regard to new, renewal, out-of-stock, and discontinued SRMs. Insert sheets are also issued for pricing of these materials. A detachable form in Appendix II of this listing is available to request your inclusion on the distribution list for these publications as they are issued. Also included in this listing as Appendix III is a "Guide for the Submission of Requests for the Development of New or Renewal Standard Reference Materials." It is not possible to produce all materials that are requested, but requests are welcomed and used to justify production of those for which the greatest need can be demonstrated.

2. Procurement Procedures

2.1. Ordering

Purchase orders should be addressed:
Office of Standard Reference Materials
National Bureau of Standards
Washington, D.C. 20234.

SRMs desired should be indicated by units, number, and name as given in the detailed listings as: 2 units, SRM 911, cholesterol, when ordering. SRMs of a smaller size than those listed are not supplied, and larger quantities are supplied only in multiples of the basic unit.

Orders received for "out-of-stock" materials are cancelled and returned if only out-of-stock items are ordered. On other orders, shipment is made of available materials and out-of-stock items are cancelled. Back-orders are not accepted for out-of-stock materials, but a renewal lot of material will be automatically furnished if available.

2.2. Terms

Prices are given in a separate supplement as a part of the listing of available materials. These are subject to revision and orders will be billed for prices in effect at the time of shipment. Revised schedules, when issued, are sent to users who have made purchases during the preceding twelve months, and to persons or organizations who request them. Discounts are not given on purchases of standard reference materials. Prepaid orders are usually processed within five days.

Remittances of the purchase price need not accompany purchase orders for firms or persons in the North American continent or agents in the United States of foreign firms, or foreign firms with established credit. Payment of invoices is expected within 30 days of receipt of an invoice. Payment on foreign orders may be made by any of the following:

(a) UNESCO coupons,
(b) banker's draft against U.S.A. bank,
(c) bank to bank transfer to a U.S.A. bank,
(d) letter of credit on a U.S.A. bank, or
(e) by International Money Order.

Pro-forma invoice service will frequently require 6 to 8 weeks to process, and will be furnished only to those requiring such service, or when credit has not been established.

2.3. Shipment

2.3.1. Domestic Shipments

Shipments of material (except for certain restricted categories, e.g., hydrocarbons, special nuclear materials, compressed gases, organic sulfur compounds and radioactive standards) intended for the United States, Mexico, and Canada are normally shipped prepaid air parcel post (providing that the parcel does not exceed the weight limits as prescribed by Postal Laws and Regulations) unless the purchaser requests a different mode of shipment, in which case the shipment will be sent collect. It is impractical for the Bureau to prepay shipping charges and add this cost to the billing invoice. Hydrocarbons, organic sulfur compounds, compressed gases, rubber compounding materials, radioactive standards, and similar materials are shipped express collect.

2.3.2. Foreign Shipments

Small weight shipments over $100 in value and prepaid will be shipped by prepaid air parcel post. Shipments exceeding the parcel post weight limit must be handled through an agent (shipping or brokerage firm) located in the U.S.A. as designated by the purchaser. Parcels will be packed for overseas shipment and forwarded via express collect to the U.S.A. firm designated as agent.

Non-prepaid orders will be shipped by prepaid International Parcel Post, subject to size, weight, and category of material limitations. Any other mode of shipment requested by customer must be paid for by the customer. (Shipments excluded from International Parcel Post for any reason, must be handled through an agent [shipping or brokerage firm] located in the U.S.A. as designated by the purchaser. These parcels will be packed for overseas shipment and forwarded via express collect to the U.S.A. firm designated as agent.)

3. Standards of Certified Chemical Composition

3.1. Steels (Chip Form)

This group of standard reference materials has been prepared for the steel industry primarily for use with methods involving solution of the sample in checking chemical methods of analysis both for production control and for customer acceptance. The group consists of nominal composition steel alloys selected to provide a wide range of analytical values for the various elements which are of vital concern to the chemist. They are furnished in chips, usually sized between 16- and 40-mesh sieves, prepared from selected portions of commercial ingots.

SRM Nos.	Name	Wt/Unit (grams)	C	Mn	P	S		Si
						Grav	Comb	
8i	Bessemer, 0.1 C	150	0.077	0.511	0.080	0.063	0.063	0.020
10g	Bessemer, 0.2 C	150	.240	.850	.086	.109	.109	.020
15g	Basic Open Hearth, 0.1 C	150	.097	.485	.005	-----	.026	.095
335	Basic Open Hearth, 0.1 C (C only)	300	.092	-----	-----	-----	-----	-----
11h	Basic Open Hearth, 0.2 C	150	.200	.510	.010	-----	.026	.211
12h	Basic Open Hearth, 0.4 C	150	.407	.842	.018	-----	.027	.235
152a	Basic Open Hearth, 0.5 C, 0.03 Sn	150	.486	.717	.012	-----	.030	.202
13g	Basic Open Hearth, 0.6 C	150	.61	.85	.006	-----	.030	.355
14e	Basic Open Hearth, 0.8 C	150	.753	.404	.008	-----	.039	.177
16e	Basic Open Hearth, 1.1 C	150	1.09	.381	.021	-----	.029	.20
337	Basic Open Hearth, 1.1 C (C only)	300	1.07	-----	-----	-----	-----	-----
178	Basic Oxygen, 0.4 C	150	0.395	.824	.012	-----	.014	.163
19g	Acid Open Hearth, 0.2 C	150	.223	.554	.046	.032	.033	.186
51b	Electric Furnace, 1.2 C	150	1.21	.573	.013	.014	.014	.246
65d	Basic Electric, 0.3 C	150	0.264	.730	.015	.010	.010	.370
100b	Manganese (SAE T1340)	150	.397	1.89	.023	.029	.028	.210
105	High-Sulfur, 0.2 C (C only)	150	.193	-----	-----	-----	-----	-----
30f	Cr-V (SAE 6150)	150	.49	0.79	.010	-----	.010	.28
32e	Ni Cr (SAE 3140)	150	.409	.798	.008	.022	.021	.278
33d	Ni-Mo (SAE 4820)	150	.173	.537	.006	.010	.011	.253
72f	Cr-Mo (SAE X4130)	150	.301	.545	.014	.024	.024	.256
111b	Ni-Mo (SAE 4620)	150	.193	.706	.012	.015	.015	.302
106b	Cr-Mo-Al (Nitralloy G)	150	.326	.506	.008	.016	.017	.274
139a	Cr-Ni-Mo (AISI 8640)	150	.404	.780	.013	.019	.019	.241
50c	W18-Cr4-V1(Tool)	150	.719	.342	.022	.010	.009	.311
132a	Mo5-W6-Cr4-V2 (Tool)	150	.825	.268	.029	.005	.006	.190
134a	Mo8-W2-Cr4-V1 (Tool)	150	.808	.218	.018	.007	.007	.323
153a	Co8-Mo9-W2-Cr4-V2 (Tool)	150	.902	.192	.023	.007	.007	.270
155	Cr0.5-W0.5 (Low Alloy)	150	.905	1.24	.015	.010	.011	.322
73c	Stainless (Cr13) (SAE 420)	150	.310	0.330	.018	-----	.036	.181
133a	Stainless (Cr13-Mo0.3-S0.3)	150	.120	1.03	.026	3.26	.330	.412
121c	Cr18-Ni10-Ti0.4 (SAE 32a)	150	.038	1.31	.028	-----	.009	.64
160b	Cr18-Ni12-Mo2.4 (AISI 316)	150	.046	1.64	.020	-----	.018	.509
339	Cr17-Ni9-0.2Se (SAE 303Se)	150	.052	0.738	.129	-----	.013	.654
343	Stainless (SAE 431)	150	.150	-----	-----	-----	-----	-----
346	Valve (Cr22-Ni4-Mn9)	150	.541	9.15	.018	-----	.063	.239
126b	Ni36 (High Nickel)	150	.090	0.380	-----	-----	-----	.200
36b	Cr2-Mo1 (Low Alloy)	150	.114	.404	.007	-----	.019	.258
131b	Low-Carbon Silicon (C only)	100	.0018	-----	-----	-----	-----	-----
344	Cr15-Ni7-Mo2-Al1	150	.069	.57	.018	-----	.019	.395
345	Cr16-Ni4-Cu3	150	.048	.224	.018	0.012	.012	.610
348	Ni26-Cr14.5 (A 286)	150	.044	1.48	.015	-----	.002	.54

3.1. Steels (Chip Form) (Continued)

The certificate of analysis, provided with each of the standards, gives the chemical composition as determined at the National Bureau of Standards; most certificates also include values obtained by industrial and other laboratories which cooperated in the certification of the standards.

Cu	Ni	Cr	V	Mo	W	Co	Ti	Sn	Al (Total)	Nb	N	Other	SRM Nos.
0.016	0.009	0.009	0.012	0.003	------	-----	-----	-----	------	----------	0.018	--------	8i
.008	.005	.008	.007	.002	------	-----	-----	-----	------	----------	.015	--------	10g
-----	------	------	-----	-----	------	-----	-----	-----	------	----------	-------	--------	15g
-----	------	------	-----	-----	------	-----	-----	-----	------	----------	-------	--------	335
-----	------	------	-----	-----	------	-----	-----	-----	------	----------	-------	--------	11h
.073	.032	.074	.003	.006	------	-----	-----	-----	------	----------	.006	--------	12h
.023	.056	.046	.001	.036	------	-----	-----	0.032	------	----------	-------	--------	152a
-----	------	------	-----	-----	------	-----	-----	-----	------	----------	-------	--------	13g
.072	.053	.071	.002	.013	------	-----	-----	-----	0.060	----------	-------	--------	14e
-----	------	------	-----	-----	------	-----	-----	-----	------	----------	-------	--------	16e
-----	------	------	-----	-----	------	-----	-----	-----	------	----------	-------	--------	337
.032	.010	.016	.001	.003	------	-----	-----	-----	------	----------	-------	--------	178
.093	.066	.374	.012	.013	------	0.012	0.027	.008	.031	0.026	-------	--------	19g
.071	.053	.455	.002	.014	------	-----	-----	.008	------	----------	.011	--------	51b
.051	.060	.049	.002	.025	------	-----	-----	.004	.059	Al_2O_3 .009	.013	--------	65d
.064	.030	.063	.003	.237	------	-----	-----	-----	------	----------	.004	--------	100b
-----	------	------	-----	-----	------	-----	-----	-----	------	----------	-------	--------	105
.076	.071	.05	.18	-----	------	-----	-----	-----	------	----------	-------	--------	30f
.127	1.19	.678	.002	.023	------	-----	-----	.011	------	----------	.009	--------	32e
.123	3.58	.143	.002	.246	------	-----	-----	-----	------	----------	(.011)	--------	33d
.062	0.055	.891	.005	.184	------	-----	-----	-----	------	----------	.009	--------	72f
.028	1.81	.070	.003	.255	------	-----	-----	-----	.043	----------	-------	--------	111b
.117	0.217	1.18	.003	.199	------	-----	-----	-----	1.07	----------	-------	--------	106b
.096	.510	0.486	.003	.183	------	-----	-----	-----	------	----------	.008	--------	139a
.079	.069	4.13	1.16	.082	18.44	-----	-----	.018	------	----------	.012	As 0.022	50c
.120	.137	4.21	1.94	4.51	6.20	-----	-----	-----	------	----------	-------	--------	132a
.101	.088	3.67	1.25	8.35	2.00	-----	-----	-----	------	----------	-------	--------	134a
.094	.168	3.72	2.06	8.85	1.76	8.47	-----	-----	------	----------	.024	--------	153a
.083	.100	0.485	0.014	0.039	0.517	-----	-----	-----	------	----------	-------	--------	155
.080	.246	12.82	.030	.091	------	-----	-----	-----	------	----------	.037	--------	73c
.118	.241	12.89	.026	.294	------	-----	-----	-----	------	----------	.032	--------	133a
.14	10.51	17.58	.048	.16	------	-----	.42	-----	------	----------	-------	--------	121c
.172	12.26	18.45	.047	2.38	------	0.101	-----	-----	------	----------	.039	Pb 0.001	160b
.199	8.89	17.42	.058	0.248	------	.096	-----	-----	------	----------	-------	Se 0.247	339
-----	2.14	15.76	.036	-----	------	-----	-----	-----	------	----------	.074	--------	343
-----	3.94	21.61	.058	-----	------	-----	-----	-----	------	----------	.441	--------	346
.082	35.99	0.066	(.001)	(.006)	------	.032	-----	-----	------	----------	-------	--------	126b
.179	0.203	2.18	.004	.996	------	-----	-----	-----	------	----------	-------	--------	36b
-----	-----	------	-----	-----	------	-----	-----	-----	------	----------	-------	--------	131b
.106	7.28	14.95	.040	2.40	------	-----	.076	-----	1.16	----------	-------	--------	344
3.44	4.24	16.04	.041	0.122	------	.089	-----	-----	------	.231	-------	Ta .002	345
0.22	25.8	14.54	.25	1.3	------	-----	2.24	-----	0.23	----------	B .0031	Fe 53.3	348

3.1.1. Steels (Granular Form)

These granular-form standard reference materials are prepared by a pre-alloyed powder metallurgical process which generally includes argon atomization and hydrogen annealing. The material normally is sized between 25 and 200 mesh sieves to ensure satisfactory homogeneity.

SRM Nos.	Name	Wt/Unit (grams)	C	Mn	P	S	Si	Cu	Ni
163	Low Alloy, 1.0 Cr	100	0.933	0.897	0.007	0.027	0.488	0.087	0.081
101f	Stainless, (AISI 304L)	100	.014	.087	.008	.008	.876	.030	9.96

3.2. Steels (Solid Form)

Several groups of standards have been prepared and designed to meet the basic needs of the steel industry for analytical control primarily by optical emission and x-ray spectroscopic methods of analysis. Both nominal composition and analytical range standards are provided for ingot iron, low-alloy steel, stainless steel, tool steel and specialty steel.

These standard reference materials are furnished in three basic forms. The 400 series is intended for optical emission spectroscopic methods of analysis utilizing the "point-to-point" technique. The 800 and 1100 series are intended for "point-to-plane" optical emission spectroscopic methods of analysis. The D800 series, and the 1100 series also, are intended for x-ray spectroscopic methods of analysis.

3.2.1. Ingot Iron and Low-Alloy Steels

The preparation of these original spectroscopic standard reference materials began in about 1944 when the cores remaining after lathe cutting the materials for chip form standards were tested for homogeneity. Those found satisfactory were fabricated to the final shapes and sizes. To meet the urgent need in the mid-1950's for calibration standards for x-ray spectroscopic methods of analysis, portions of the material from five of these SRMs were converted to the

SRM Nos.				Chemical Composition (Nominal Weight Percent)				
7/32 in D × 4 in Long	1/2 in D × 2 in Long	1 1/4 in D × 1/4 in Disk	Name	Mn	Si	Cu	Ni	Cr
----	803a	D803a	Acid Open Hearth, 0.6C	1.04	0.34	0.096	0.190	0.101
404a	804a	----	Basic Electric	0.88	.44	.050	.040	.025
405a	805a	D805a	Medium Manganese	1.90	.27	.032	.065	.037
407a	807a	D807a	Chromium-Vanadium	0.76	.29	.132	.169	.92
408a	808a	----	Chromium-Nickel	.76	.28	.10	1.20	.655
409b	809b	D809b	Nickel	.46	.27	.104	3.29	.072
----	810a	----	Cr2-Mo1	----	.36	.11	0.24	2.39
413	----	----	Acid Open Hearth, 0.4C	.67	.22	.25	.18	0.055
414	----	----	Cr-Mo (SAE 4140)	.67	.26	.11	.080	.99
417a	817a	----	Basic Open Hearth, 0.4C	.78	----	.13	.062	.050
418	----	----	Cr-Mo (SAE X4130)	.52	.28	----	.11	.96
418a	----	----	Cr-Mo (SAE X4130)	.52	.27	.040	.125	1.02
420a	820a	D820a	Ingot Iron	.017	----	.027	.0092	0.0032
----	821	----	Cr-W, 0.9C	1.24	----	.080	.10	.49
427	827	----	Cr-Mo (SAE 4150) (B only)	----	----	----	-----	-----

3.1.1. Steels (Granular Form) (Continued)

The certificate of analysis, provided with each of these standards, gives the chemical composition as determined at the National Bureau of Standards; also included are values obtained by industrial and outside laboratories who cooperated in certification of the standards.

Cr	V	Mo	W	Co	N	As	Sb	Ga	SRM Nos.
0.982	-----	0.029	-----	-----	0.007	-----	-----	-----	163
18.49	0.034	.007	(0.0002)	0.088	-----	(0.003)	(0.0009)	(0.004)	101f

3.2. Steels (Solid Form) (Continued)

Because of the special homogeneity requirements, most of these materials have been prepared by using the most modern techniques of melting, casting, fabrication, and heat treatment to ensure adequate uniformity of composition. A certificate of analysis, which gives the chemical composition, as determined at the National Bureau of Standards, is furnished for each standard; many certificates also include values obtained by outside laboratories which cooperated in the certification of the standards. (Values in parentheses are not certified, but are given for additional information on the chemical composition.)

3.2.1. Ingot Iron and Low-Alloy Steels (Continued)

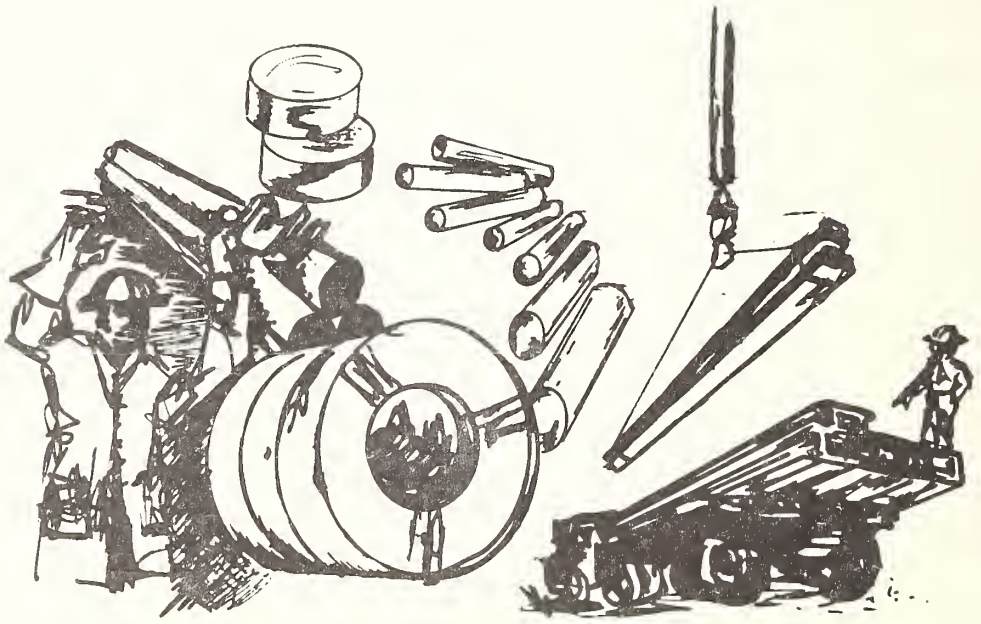
applicable disk form. Although entirely satisfactory for conventional spectroscopic methods of analysis, these standard reference materials generally do not meet the stringent requirements for homogeneity necessary for use with the newer microchemical methods of analysis. These standards will be discontinued when the supply is exhausted.

Chemical Composition (Nominal Weight Percent)							SRM Nos.		
V	Mo	W	Co	Sn	Al Total	B	7/32 in D × 4 in Long	1/2 in D × 22 in Long	1 1/4 in D × 1/4 in Disk
0.005	0.033	----	-----	------	-----	------	----	803a	D803a
.002	.007	----	-----	------	-----	------	404a	804a	----
-----	.005	----	-----	------	0.056	------	405a	805a	D805a
.146	-----	----	-----	------	-----	------	407a	807a	D807a
.002	.065	----	-----	------	-----	------	408a	808a	----
.002	.009	----	0.025	0.012	-----	------	409a	809a	D809a
-----	.91	----	-----	------	-----	------	----	810a	----
.007	.006	----	-----	------	-----	------	413	----	----
.003	.32	----	-----	.014	.020	------	414	----	----
-----	.013	----	-----	.036	-----	------	417a	817a	----
-----	.22	----	-----	------	-----	------	418	----	----
-----	.21	----	-----	------	-----	------	418a	----	----
-----	.0013	----	.006	.0017	.003	------	420a	820a	D820a
.012	.040	0.52	-----	------	-----	------	----	821	----
-----	-----	----	-----	------	-----	0.0027	427	827	----

3.2.2. Special Ingot Irons and Low-Alloy Steels

The planning of these standard reference materials began in late 1952 to meet critical requirements of calibration in the iron and steel industry. Steel for the standards was prepared by the most modern melting, casting, and fabrication techniques to provide large quantities of material of the highest possible homogeneity. The materials were fully characterized and included investigations carried out by means of electron probe microanalysis and quantitative metallographic techniques. It was concluded for example that SRMs 461 and 463 are sufficiently homogeneous that any present microanalytical technique can be carried out with little chance of inaccuracy due to inhomogeneity. Details of the metallographic and homogeneity characteriza-

SRM Nos.			Chemical Composition (Nominal Weight Percent)								
7/32 in D× 4 in Long	1 1/4 in D× 3/4 in Disk	Name	C	Mn	P	S	Si	Cu	Ni	Cr	V
461	----	Low Alloy A	0.15	0.36	0.053	(0.02)	0.047	0.34	1.73	0.13	0.024
462	----	Low Alloy B	.40	.94	.045	(.02)	.28	.20	0.70	.74	.058
463	1163	Low Alloy C	.19	1.15	.031	(.02)	.41	.47	.39	.26	.10
464	----	Low Alloy D	.54	1.32	.017	(.02)	.48	.094	.135	.078	.295
465	1165	Ingot Iron E	.037	0.032	.008	(.01)	.029	.019	.026	.004	.002
466	1166	Ingot Iron F	.065	.113	.012	(.01)	.025	.033	.051	.011	.007
467	1167	Low Alloy G	.11	.275	.033	(.01)	.26	.067	.088	.036	.041
468	1168	Low Alloy H	.26	.47	.023	(.02)	.075	.26	1.03	.54	.17
----	1170	Selenium(0.3 Se)	.089	.79	.109	.207	.163	Se 0.29	-----	-----	-----

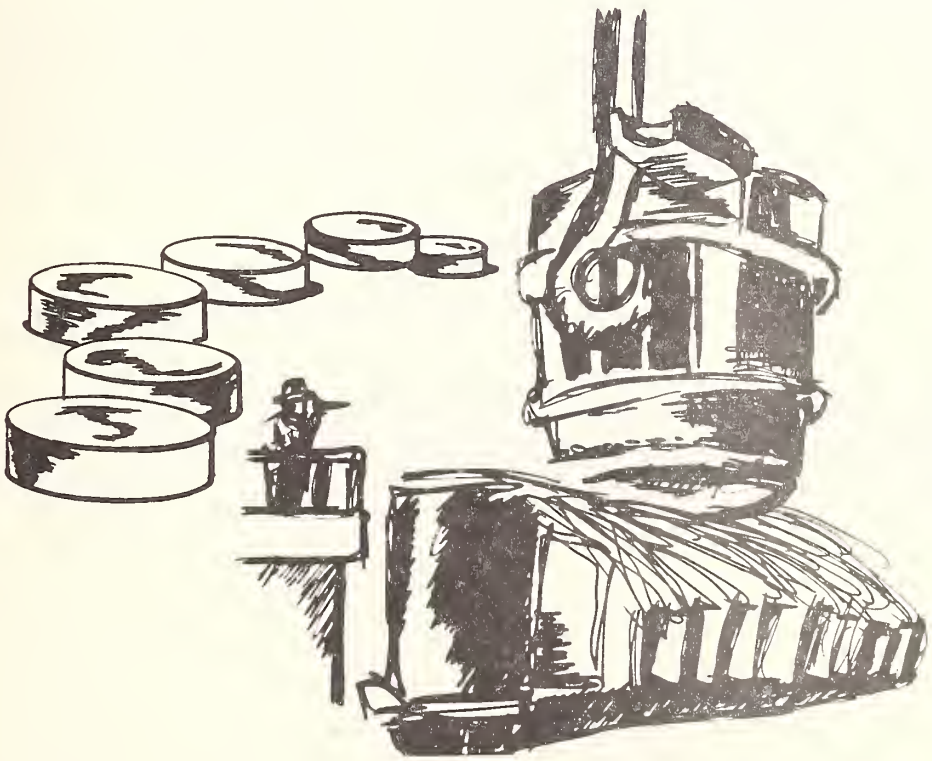


tion are given in NBS Miscellaneous Publication 260-3 and 260-10 respectively (see inside back cover for ordering instructions).

These standards first were issued in 1957 and they have been in widespread demand since that time. Several years ago it became apparent, although adequate supplies of the 400 series still were available, that supplies of some of the 1100 series would be exhausted. To remedy this situation, planning of a new series of 5 was undertaken; the melting and casting of these has now been completed. The replacement series will be SRM Nos. 1261 through 1265 with most being available for issue by mid-1970.

Chemical Composition (Nominal Weight Percent)												SRM Nos.	
Mo	W	Co	Ti	As	Sn	Al (Total)	Nb	Ta	B	Pb	Zr	7/32 in D × 4 in Long	1 1/4 in D × 3/4 in Disk
0.30	0.012	0.26	(0.01)	0.028	0.022	(0.005)	0.011	0.002	0.0002	(0.003)	(<0.005)	461	----
.080	.053	.11	.037	.046	.066	.023	.096	.036	.0005	.006	.063	462	----
.12	.105	.013	.010	.10	.013	.027	.195	.15	.0012	.012	.20	463	1163
.029	.022	.028	.004	.018	.043	.005	.037	.069	.005	.020	.010	464	----
.005	(.001)	.008	.20	.010	.001	.19	(.001)	.001	.0001	(<.0005)	(.002)	465	1165
.011	(.006)	.046	.057	.014	.005	.015	.005	.002	(.0002)	(.0013)	(<.005)	466	1166
.021	.20	.074	.26	.14	.10	.16	.29	.23	(.0002)	.0006	.094	467	1167
.20	.077	.16	.011	.008	.009	.042	.006	.005	.009	(<.0005)	(<.005)	468	1168
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	1170

Note: Certificate also provides chemical information for Ag, Ge, O, and N.



3.2.3. Stainless Steels

Three groups of stainless steel standard reference materials designed primarily for calibration in spectroscopic methods of analysis are available.

Group I, SRM 442 through 444, consists of three standards of the 18 Cr - 8 Ni type stainless steel available only in rod form for use with the "point-to-point" technique in emission spectroscopy.

Group II is comprised of six standards, each available in three different physical forms; the 400, the 800, and the D800 series.

GROUP I

SRM Nos. 7/32 in D× 4 in Long	Name	Chemical Composition (Nominal Weight Percent) Mn	Si	Cu	Ni	Cr	V	Mo	W	Co
442	Cr16-Ni10	2.88	(0.09)	0.11	9.9	16.1	0.032	0.12	(0.08)	0.13
443	Cr18.5-Ni9.5	3.38	(.15)	.14	9.4	18.5	.064	.12	(.09)	.12
444	Cr20.5-Ni10	4.62	(.65)	.24	10.1	20.5	.12	.23	(.17)	.22

GROUP II

SRM Nos. 7/32 in D × 4 in Long	1/2 in D × 2 in Long	1 1/4 in D × 1/4 in Disks	Name	Chemical Composition (Nominal Weight Percent) Mn	Si	Cu	Ni	Cr	V
445	845	D845	Cr13-Mo0.9 (Mod. AISI 410)	0.77	0.52	0.065	0.28	13.31	(0.05)
446	846	D846	Cr18-Ni9 (Mod. AISI 321)	.53	1.19	.19	9.11	18.35	(.03)
447	847	D847	Cr24-Ni13 (Mod. AISI 309)	.23	0.37	.19	13.26	23.72	(.03)
448	----	D848	Cr9-Mo0.3 (Mod. AISI 403)	2.13	1.25	.16	.52	9.09	(.02)
449	849	D849	Cr5.5-Ni6.5	1.63	0.68	.21	6.62	5.48	(.01)
450	850	D850	Cr3-Ni25	----	.12	.36	24.8	2.99	(.006)

GROUP III

SRM Nos. 1 1/4 in D × 3/4 in Disks	Name	Chemical Composition (Nominal Weight Percent) C	Mn	P	S	Si	Cu	Ni	Cr	V
1152	(Cr18-Ni10)	0.163	1.19	0.017	0.017	0.654	0.497	10.21	18.49	0.044
1154	(Cr19-Ni10)	.094	1.74	.038	.033	1.09	.560	10.25	19.58	.061
1155	(AISI 316)	.046	1.63	.020	.018	0.50	.169	12.18	18.45	.047
1185	(AISI 316)	.11	1.22	.019	.016	.40	.067	13.18	17.09	----

Both Group I and Group II standards have been extensively tested for homogeneity and found satisfactory for application in conventional spectroscopic methods of analysis. Neither group, however, has been tested for microanalytical methods and their use in these applications is not recommended.

Group III consists of four stainless steels available only in disk form for the "point-to-plane" technique of emission spectroscopy and for x-ray spectroscopy. They were prepared by melting, casting, and fabrication techniques known to produce material of high homogeneity.

(Values in parentheses are not certified but are given for additional information on the chemical composition.)

GROUP I (Continued)

Chemical Composition (Nominal Weight Percent)								SRM Nos.
Ti	Sn	Nb	Ta	B	Pb	Zr	Zn	7/32 in D × 4 in Long
0.002	0.0035	0.032	(0.0006)	0.0005	0.0017	(0.004)	(.003)	442
.003	.006	.056	(.0008)	.0012	.0025	------	(.005)	443
.019	.014	.20	(.004)	.0033	.0037	(.011)	(.004)	444

GROUP II (Continued)

Chemical Composition (Nominal Weight Percent)						SRM Nos.		
Mo	W	Ti	Sn	Nb	Ta	7/32 in D × 4 in Long	1/2 in D × 2 in Long	1 1/4 in D × 1/4 in Disks
0.92	(0.42)	(0.03)	----	0.11	(0.002)	445	845	D845
.43	(.04)	(.34)	(0.02)	.60	(.030)	446	846	D846
.059	(.06)	(.02)	----	.03	(.002)	447	847	D847
.33	(.14)	(.23)	(.05)	.49	(.026)	448	----	D848
.15	(.19)	(.11)	(.07)	.31	(.021)	449	849	D849
----	(.21)	(.05)	(.09)	.05	(.002)	450	850	D850

GROUP III (Continued)

Chemical Composition (Nominal Weight Percent)											SRM Nos.
Mo	Co	Ti	As	Sn	Al	Nb	Ta	B	Pb	Zr	1 1/4 in D × 3/4 in Disks
0.366	(0.095)	(0.12)	(0.01)	(0.004)	(0.003)	(0.20)	(0.085)	(0.005)	(0.001)	(0.03)	1152
.463	(.12)	(.48)	(.03)	(.023)	(.035)	(.26)	(.045)	(.0006)	(.012)	(.022)	1154
2.38	.101	----	----	----	----	----	----	----	.001	----	1155
2.01	----	<.001	----	----	----	<.001	<.001	----	----	----	1185

3.2.4. Tool Steels

A group of six high-speed tool steel standards is available in three different physical forms. A wide concentration range is covered by combining the concentration ranges of three American Iron and Steel Institute (AISI) designations with three other tool steels of tailored composition.

SRM Nos.				Chemical Compositions (Nominal Weight Percent)							
7/32 in D× 4 in Long	1/2 in D× 2 in Long	1 1/4 in D× 1/4 in Disk	Name	Mn	Si	Cu	Cr	V	Mo	W	Co
436	836	D836	Special (Cr6-Mo3-W10)	0.21	0.32	0.075	6.02	0.63	2.80	9.7	----
437	837	D837	Special (Cr8-Mo2-W3-Co3)	.48	.53	-----	7.79	3.04	1.50	2.8	2.9
438	838	D838	Mo High Speed (AISI-SAE-M30)	.20	.17	.17	4.66	1.17	8.26	1.7	4.9
439	839	D839	Mo High Speed (AISI-SAE-M36)	.18	.21	.12	2.72	1.50	4.61	5.7	7.8
440	840	D840	Special W High Speed (Cr2-W13-Col 12)	.15	.14	.059	2.12	2.11	0.070	13.0	11.8
441	841	D841	W High Speed (AISI-SAE-TI)	.27	.16	.072	4.20	1.13	.84	18.5	----

3.2.5. Maraging Steel

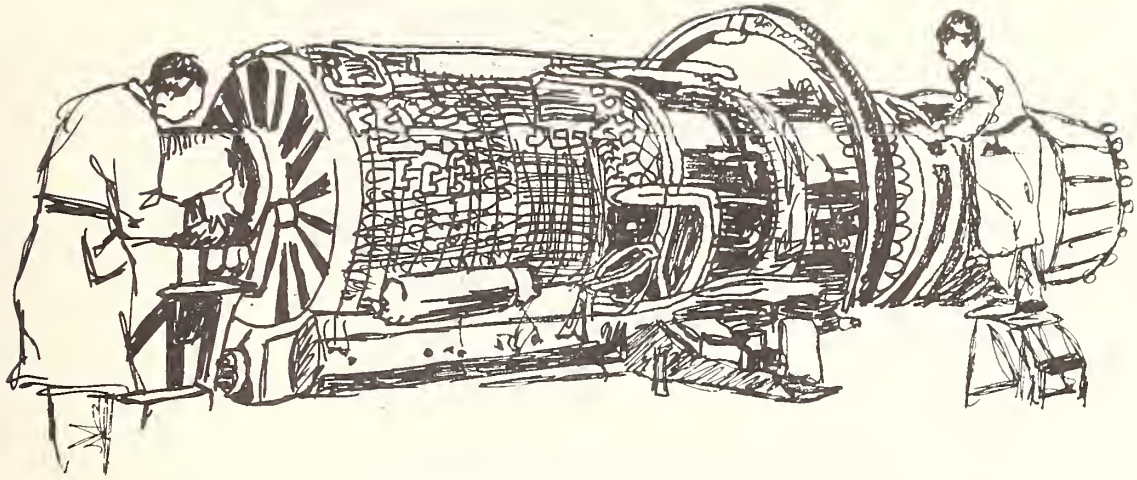
This alloy derives its name from the formation of martensite on age hardening. They attain remarkable metallurgical properties by a simple heat treatment. Extensive use of these alloys is expected, particularly in submarines, missiles and aircraft. This Maraging Steel, SRM No. 1156, of

SRM Nos.		Chemical Compositions (Nominal Weight Percent)					
1 1/4 in D× 3/4 in Disk	Name	C	Mn	P	S	Si	Cu
1156	Maraging, (Ni 19)	0.023	0.21	0.011	0.012	0.184	0.025

3.2.6. High-Temperature Alloys (Solid Form)

High-temperature alloy standards are prepared to meet the critical needs of industry, particularly the aerospace industries, and government agencies, for alloy standard reference materials of this type. These standards are useful in instrument calibration, primarily for x-ray and optical

SRM Nos. 1 1/4 in D× 3/4 in Disk	Name	Chemical Composition (Nominal Weight Percent)							
		C	Mn	P	S	Si	Cu	Ni	Al
1194	A 286	0.81	0.67	0.011	0.008	0.71	0.047	24.06	1.45
1185	Cr17-Ni13 (AISI 316, AMS 5360A)	.11	1.22	.019	.016	.40	.067	13.18	----
1155	Cr18-Ni12-Mo2 (AISI 316)	.046	1.63	.020	.018	.502	.169	12.18	----



3.2.5. Maraging Steel (Continued)

the 19 percent nickel type, is designed primarily for calibration in optical emission and x-ray spectroscopic methods of analysis.

Chemical Composition (Nominal Weight Percent)									SRM Nos.
Ni	Cr	Mo	Co	Ti	Al	Zr	B	Ca	1 1/4 in D × 3/4 in Disk
19.0	0.20	3.1	7.3	0.21	0.047	0.004	0.003	<0.001	1156

3.2.6. High-Temperature Alloys (Solid Form) (Continued)

emission spectroscopic methods of analysis. Additional new high-temperature alloy standards will be prepared, and issued as needs are recognized and documented.

Chemical Composition (Nominal Weight Percent)											SRM Nos.
Fe	Cr	V	Mo	Co	Ti	Nb	Ta	Pb	Zr	B	1 1/4 in D × 3/4 in Disk
51.3	16.35	0.32	1.27	2.77	1.45	-----	------	-----	0.026	0.0090	1194
----	17.09	-----	2.01	-----	<0.001	<0.001	<0.001	-----	-----	------	1185
----	18.45	.047	2.38	0.101	------	------	------	0.001	-----	------	1155

3.2.7. Oxygen Standards

Standard reference materials, SRM Nos. 1090 through 1094, are available for the determination of oxygen by vacuum fusion, inert gas fusion, and neutron activation methods.

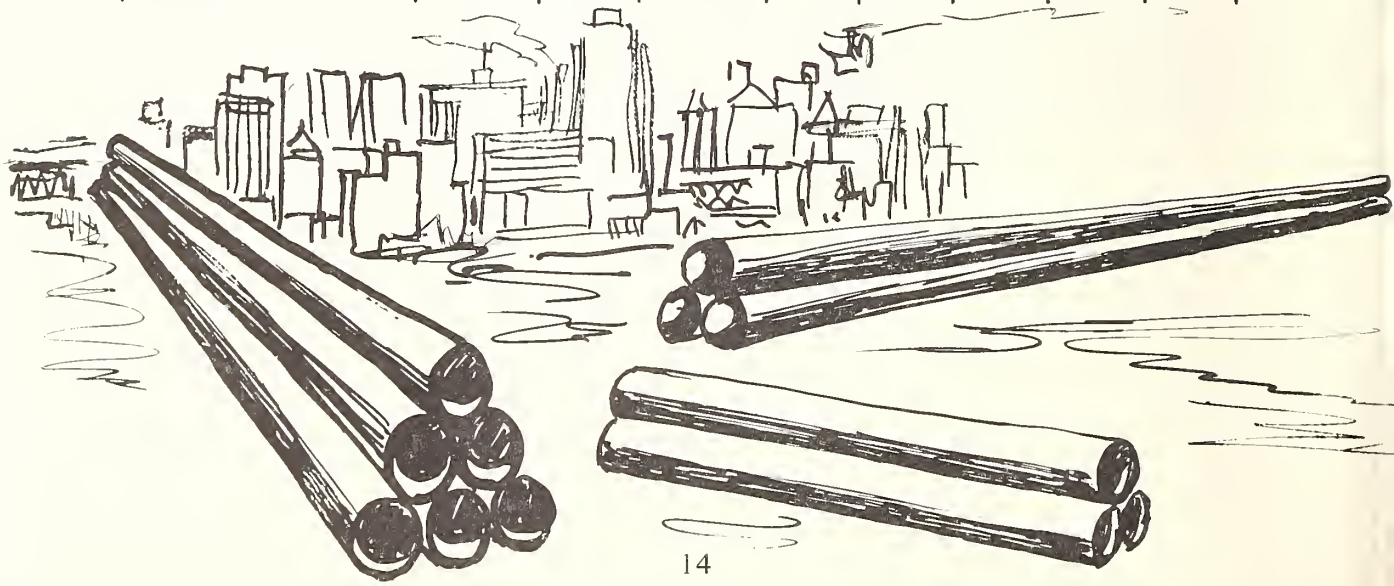
Details on the preparation and analysis of SRMs 1090, 1091, and 1092 are given in NBS Misc. Publ. 260-14. (See inside back cover for ordering instructions.)

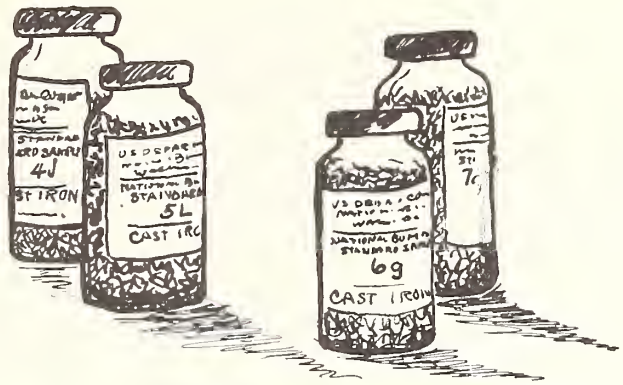
SRM Nos.	Name	Unit	Oxygen (ppm)	Nitrogen (ppm)
1090	Ingot iron	Rods 1/4 in D × 4 in Long	491	(60)
1091	Stainless Steel (AISI 431)	Rods 5/16 in D × 4 in Long	131	(945)
1092	Vacuum-melted steel	Rods 1/4 in D × 4 in Long	28	(4)
1093	Valve steel	Rods 1/4 in D × 4 in Long	60	(4807)
1094	Maraging steel	Rods 1/4 in D × 4 in Long	4.5	(71)

3.3. Cast Irons (Chip Form)

This group of cast iron standard reference materials is similar to the steels described in Section 3.1. and has been prepared for use in checking chemical methods in the cast iron industry. These materials are furnished in the form of chips, usually sized between 16- and 25-mesh sieves. They are prepared by lathe cutting of chips with a multiple-tooth cutting tool from thin-wall

			Chemical Composition (Nominal Weight Percent)							
			C				S			
SRM Nos.	Name	Wt/Unit (grams)	Total	Graphitic	Mn	P	Grav.	Comb.	Si	Cu
3b	White	110	2.44	----	0.353	0.086	-----	0.088	1.04	0.050
4j	Cast	150	2.99	2.38	.79	.17	-----	.062	1.31	.24
5L	Cast	150	2.59	1.99	.68	.280	-----	.123	1.83	1.01
6g	Cast	150	2.84	2.00	1.06	.56	-----	.123	1.06	0.50
7g	Cast (High Phosphorus)	150	2.69	2.59	0.612	.794	0.061	.060	2.41	.128
55e	Ingot	150	0.0112	----	.035	.003	.012	.011	0.001	.065
82b	Cast (Ni-Cr)	150	2.85	2.37	.745	.025	-----	.007	2.10	.038
107b	Cast (Ni-Cr-Mo)	150	2.75	1.87	.510	.058	.067	.067	1.35	.235
115a	Cast (Cu-Ni-Cr)	150	2.62	1.96	1.00	.086	.064	.065	2.13	5.52
122e	Cast (Car Wheel)	150	3.51	2.78	0.528	.349	-----	.074	0.510	0.033
341	Ductile	150	1.81	1.23	.92	.024	.007	.007	2.44	.152
342	Nodular	150	2.45	2.14	.369	.020	.014	.014	2.85	.14
342a	Nodular	150	1.86	1.38	.275	.018	-----	.006	2.73	.14



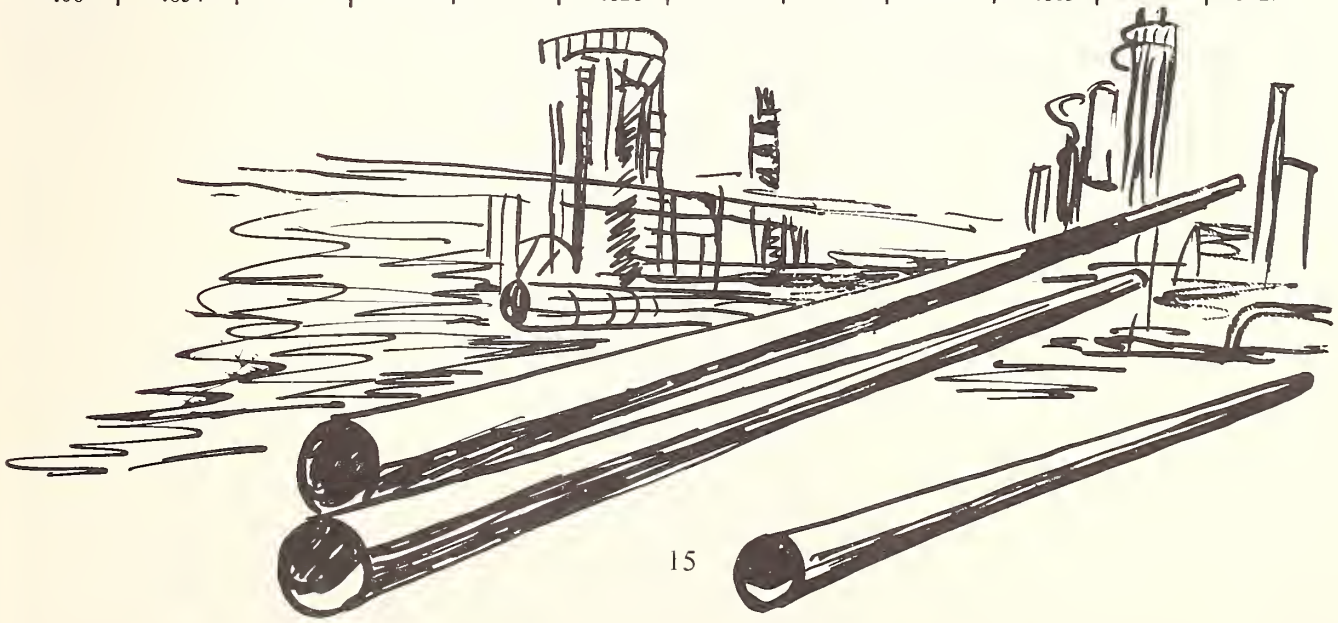


3.3. Cast Irons (Chip Form) (Continued)

cylindrical castings especially made for the purpose. Supplied with each material is a certificate of analysis listing the chemical composition as determined at the National Bureau of Standards and in other laboratories which have cooperated in their certification.

Chemical Composition (Nominal Weight Percent)

Ni	Cr	V	Mo	Co	Ti	As	Sn	Al (Total)	Mg	N	SRM Nos.
0.010	0.052	0.006	0.002	-----	------	------	-----	-----	-----	-----	3b
.068	.09	.03	.080	-----	0.05	0.03	-----	-----	-----	-----	4j
.086	.15	.036	.020	-----	.05	<.005	-----	-----	-----	0.006	5L
.136	.37	.06	.035	-----	.06	.04	-----	-----	-----	.006	6g
.120	.048	.010	.012	-----	.044	.014	-----	-----	-----	.004	7g
.038	.006	<.001	.011	0.007	------	.007	0.007	0.002	-----	.004	55e
1.22	.333	.027	.002	-----	.027	------	-----	-----	-----	-----	82b
2.12	.560	.008	.750	-----	.016	------	-----	-----	-----	(.008)	107b
14.49	1.98	.014	.050	-----	.020	------	-----	-----	-----	-----	115a
0.080	(0.038)	(.032)	(.001)	-----	(.026)	(.018)	-----	-----	-----	(.009)	122e
20.32	1.98	.012	.010	-----	.018	------	-----	-----	0.068	-----	341
0.023	0.032	.005	.009	-----	.019	------	-----	-----	.053	-----	342
.06	.034	------	-----	-----	.020	------	-----	-----	.069	-----	342a



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

These chill-cast standard reference materials were prepared for use in analytical control of cast steels and cast irons by rapid instrumental methods. Although employed in x-ray spectroscopic analysis, they are particularly useful for calibrating vacuum optical emission spectrometers because they permit the determination of carbon, phosphorus, and sulfur in addition to the metallic elements.

SRM Nos. 1 1/4 in thick 1/2 in Disk	Name	Chemical Composition (Nominal Weight Percent)									
		C	Mn	P	S	Si	Cu	Ni	Cr	V	Mo
1174a	White (Special 1)	3.45	0.180	0.168	0.168	0.283	0.170	0.035	0.018	0.008	0.008
1175a	White (Special 2)	1.98	1.62	.648	.018	3.47	1.50	2.99	2.41	.222	1.49
1147	White (4i)	3.60	0.78	.160	.059	1.31	0.23	0.070	0.093	.032	0.078
1148	White (5L)	2.89	.66	.300	(.11)	1.82	.99	.091	.146	.036	.022
1149	White (6g)	3.28	1.05	.564	.127	1.04	.49	.138	.363	.055	.036
1140	Ductile (No. 1)	3.18	0.725	.0070	.010	1.92	.10	.028	.030	.030	.090
1141	Ductile (No. 2)	3.64	.480	.072	.020	1.11	.21	.54	.145	.0090	.05
1142	Ductile (No. 3)	2.94	.18	.20	.015	3.33	1.02	1.65	.053	.006	.022
1138	Cast Steel (No. 1)	0.120	.43	.053	.053	0.34	0.09	0.10	.12	.020	.05
1139	Cast Steel (No. 2)	.792	.98	.011	.013	.85	.40	.93	1.96	.24	.51
1143	Blast Furnace (No. 1) ...	3.91	.414	.158	.028	1.68	.144	.115	0.145	.008	(.005)
1144	Blast Furnace (No. 2) ...	4.27	1.33	.112	.021	0.276	.090	.021	.019	.004	.007

3.5. Steelmaking Alloys

These standard reference materials provide standards of known chemical composition primarily for checking chemical methods of analysis for the major constituents and for selected minor elements covered by ASTM specifications. They are furnished as fine powders, sized to about 100 mesh or finer. A certificate of analysis accompanies each standard.

SRM Nos.	Name	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent)						
			C	Mn	P	S	Si	Cu	Ni
57	Refined Silicon	60	0.087	0.034	0.008	0.005	96.80	0.02	0.002
59a	Ferrosilicon-50%	50	.04	.76	.016	-----	48.2	.05	.03
64b	Ferrochromium (High Carbon) ...	100	4.30	.208	.012	.062	1.42	----	-----
196	Ferrochromium (Low Carbon) ...	100	0.035	.28	------	-----	.38	----	-----
71	Calcium Molybdate	60	-----	-----	------	-----	-----	----	-----
90	Ferrophosphorus	75	-----	-----	26.2	-----	-----	----	-----
340	Ferroniobium	100	.060	1.71	.035	-----	4.39	----	-----

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

These standards are furnished as chill-cast sections. Details of the preparation and intended use of the standards are given in the NBS Miscellaneous Publication 260-1, (see inside back cover for ordering instructions).

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

Chemical Composition (Nominal Weight Percent)														SRM Nos.
Co	Ti	As	Sb	Sn	Al	Te	Zr	B	Bi	Ce	Y	Pb	Mg	1 1/4 in thick 1/2 in Disk
0.009	0.011	0.024	0.17	0.23	(0.001)	0.072	(0.02)	0.040	(0.008)	------	-------	(0.01)	-----	1174a
.11	.35	.19	.022	.025	(.03)	.009	(.03)	.005	(.017)	------	-------	.006	-----	1175a
-----	.049	.022	-----	-----	------	.016	-----	-----	------	------	-------	-----	-----	1147
-----	.050	(.022)	-----	-----	------	.015	-----	-----	------	------	-------	-----	-----	1148
-----	.062	.036	-----	-----	------	.013	-----	-----	------	------	-------	-----	-----	1149
-----	.10	(.07)	-----	-----	(.01)	-----	-----	-----	------	(0.09)	(<0.002)	-----	0.019	1140
-----	.013	(.04)	-----	-----	(.005)	-----	-----	-----	------	(.05)	.040	-----	.044	1141
-----	.008	(.015)	-----	-----	(.09)	-----	-----	-----	------	(.015)	.01	-----	.10	1142
-----	-----	------	-----	-----	------	-----	-----	-----	------	------	-------	-----	-----	1138
-----	-----	------	-----	-----	------	-----	-----	-----	------	------	-------	-----	-----	1139
-----	.17	(.004)	-----	-----	------	.020	-----	-----	------	------	-------	-----	-----	1143
-----	.44	(.004)	-----	-----	------	.020	-----	-----	------	------	-------	-----	-----	1144

3.5. Steelmaking Alloys (Continued)

These standards are finding increasing application in x-ray (and optical emission) spectroscopic methods of analysis when procedures are used in which the samples to be analyzed are in the same form or can be converted to the same form; that is, to pellets, solutions, or powders.

Chemical Composition (Nominal Weight Percent)												SRM Nos.
Cr	V	Mo	Ti	Al	Nb	Zr	Ca	Mg	Fe	B	N	
0.025	----	----	0.10	0.67	-----	0.025	0.73	0.01	0.65	----	-----	57
.08	----	----	----	.35	-----	-------	.04	----	50.0	0.06	-----	59a
68.03	0.15	----	----	----	-----	-------	----	----	-----	----	0.033	64b
70.87	.12	----	----	----	-----	-------	----	----	-----	----	-----	196
------	----	35.3	.06	----	-----	-------	----	----	1.92	----	-----	71
------	----	----	----	----	-----	-------	----	----	-----	----	-----	90
------	----	----	.89	----	57.51	Ta 3.73	----	----	-----	----	-----	340

3.6. Nonferrous Alloys (Chip Form)

These SRMs provide materials of known composition for checking the performance of chemical methods of analysis, both for production control and for customer acceptance. The aluminum-, magnesium-, and zinc-base alloys are furnished in the form of approximately 10- to 20-mesh chips. The remaining standards are furnished as approximately 14- to 40-mesh chips prepared by cutting thin wall castings or wrought bar stock. Certificates of Analysis provided with these standards give the composition as determined at NBS, and most also give values obtained by industrial and other outside laboratories cooperating in certification of the standards.

3.6.1. Aluminum-Base Alloys

SRM Nos.	Name	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent)												
			Mn	Si	Cu	Ni	Cr	V	Ti	Sn	Ga	Fe	Pb	Mg	Zn
85b	Wrought	75	0.61	0.18	3.99	0.084	0.211	0.006	0.022	----	0.019	0.24	0.021	1.49	0.030
86c	Casting	75	.041	.68	7.92	.030	.029	-----	.035	----	-----	.90	.031	0.002	1.50
87a	Al-Si	75	.26	6.24	0.30	.57	.11	<.01	.18	0.05	.02	.61	.10	.37	0.16

3.6.2. Cobalt-Base Alloys

SRM No.	Name	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent)					
			Co	Ni	Cr	Mo	W	Nb
168	Co41-Mo4-Nb3-Tal-W4 ..	150	41.20	20.25	20.33	3.95	3.95	2.95

3.6.3. Copper-Base Alloys

SRM Nos.	Name	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent)					
			Mn	P	S	Si	Cu	Ni
37e	Brass, Sheet	150	-----	-----	-----	----	69.61	0.53
52c	Bronze, Cast	150	-----	0.001	0.002	----	89.25	.76
124d	Bronze, Ounce Metal ..	150	-----	.02	.093	----	83.60	.99
157a	Nickel Silver	135	0.174	.009	-----	----	58.61	11.82
158a	Bronze, Silicon	150	1.11	.026	-----	3.03	90.93	0.001
184	Bronze, Leaded Tin ...	150	-----	.009	-----	----	88.96	.50

3.6.4. Lead-Base Alloys

SRM Nos.	Name	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent)						
			Cu	Ni	As	Sn	Sb	Bi	Ag
127b	Solder (Pb60-Sn40) ...	150	0.011	0.012	0.01	39.3	0.43	0.06	0.01

Also available in solid form as SRM 1131, see Section 3.7.4.

3.6.2. Cobalt-Base Alloys (Continued)

Chemical Composition (Nominal Weight Percent)										SRM
Ta	Fe	Mn	C	P	S	Si	Cu	V	Ti	No.
0.95	3.43	1.50	0.37	0.008	0.005	0.80	0.035	0.03	0.06	168

3.6.3. Copper-Base Alloys (Continued)

Chemical Composition (Nominal Weight Percent)									SRM
Co	As	Sn	Fe	Al	Pb	Sb	Ag	Zn	Nos.
-----	----	1.00	0.004	----	1.00	----	----	27.85	37e
-----	----	7.85	.004	----	0.011	----	----	2.12	52c
-----	0.02	4.56	.18	----	5.20	0.17	0.02	5.06	124e
0.022	----	0.021	.174	----	0.034	----	----	29.09	157a
-----	----	.96	1.23	0.46	.097	----	----	2.08	158a
-----	----	6.38	0.005	----	1.44	----	----	2.69	184

3.6.5. Magnesium-Base Alloys

SRM Nos.	Name	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent)							
			Mn	Si	Cu	Ni	Al	Pb	Fe	Zn
171	Alloy	100	0.45	0.0118	0.0112	0.0009	2.98	0.0033	0.0018	1.05

3.6.6. Nickel-Base Alloys

SRM Nos.	Name	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent)							
			C	Mn	P	S	Si	Cu	Ni	Cr
162a	Monel-type (Ni64-Cu31) ...	150	0.079	1.60	-----	0.007	0.93	30.61	63.95	0.042
349	Ni57-Cr20	150	.08	0.43	0.002	-----	.29	0.006	57.15	19.50

3.6.6.1. Nickel Oxide

The nickel oxide standard reference materials are available primarily for application in the electronics industry to the analysis of cathode grade nickel. The "Standard Method for Spectrochemical Analysis of Thermionic Nickel Alloys by the Powder-D-C Arc Technique," ASTM designation (E129) is based on calibration with these standards. The values given are for the percentage of the element in nickel oxide.

SRM Nos.	Name	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	.095	.11	.018	.003	.55	.009	.004	.079	.020
673	Oxide 3	25	.0037	.006	.002	.0003	.016	.003	.001	.029	.003

3.6.10. Selenium Base

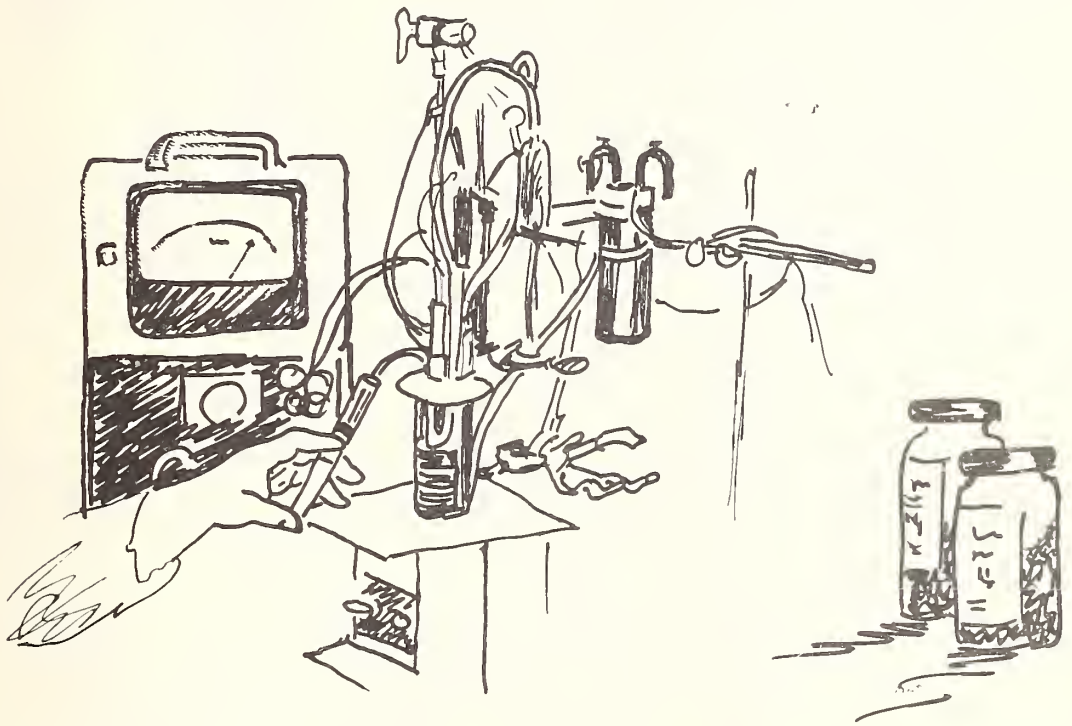
This standard reference material is intended to bridge the gap between commercial materials available in bulk and selenium available in primary or purer grades. It should prove useful to the small research laboratory, or to the individual engaged in purification, as a characterized starting

SRM Nos.	Name	Wt/Unit (grams)	Chemical Composition (Nominal Parts Per Million)									
			Mn	S	Cu	Ni	Cr	V	Mo	Co	As	Sn
726	Selenium, Intermediate Purity	450	<0.3	12 ± 3	<1	<0.5	<1	N.D.	<0.3	N.D.	<2	<1

3.6.6. Nickel-Base Alloys (Continued)

Chemical Composition (Nominal Weight Percent)

V	Mo	W	Co	Ti	Al	B	Ca	Fe	Nb	Ta	Zr	SRM Nos.
-----	----	-----	0.076	0.005	0.50	------	0.013	2.19	-----	-----	-----	162a
0.081	4.04	<0.01	13.95	3.05	1.23	0.0046	-----	0.13	<0.01	<0.01	0.081	349



3.6.10. Selenium-Base Alloy (Continued)

material. It should be useful also as a homogeneous material in analytical procedures when a high-purity primary grade is neither necessary nor available.

Chemical Composition (Nominal Parts Per Million)

Al	B	Pb	Bi	Ag	Ca	Mg	Te	Fe	Cl	Tl	Be	Cd	In	SRM Nos.
<1	<1	<1	N.D.	<1	<1	<1	0.3 ± 0.1	1	<0.5	<0.5	N.D.	N.D.	N.D.	726

N.D. = Not detected at limits of detection of <0.5 ppm.

3.6.12. Tin-Base Alloys

SRM No.	Name	Chemical Composition (Nominal Weight Percent)								
		Pb	Sn	Sb	Bi	Cu	Fe	As	Ag	Ni
54d	Bearing metal	0.62	88.57	7.04	0.044	3.62	0.027	0.088	0.0032	0.0027

3.6.13. Titanium-Base Alloys

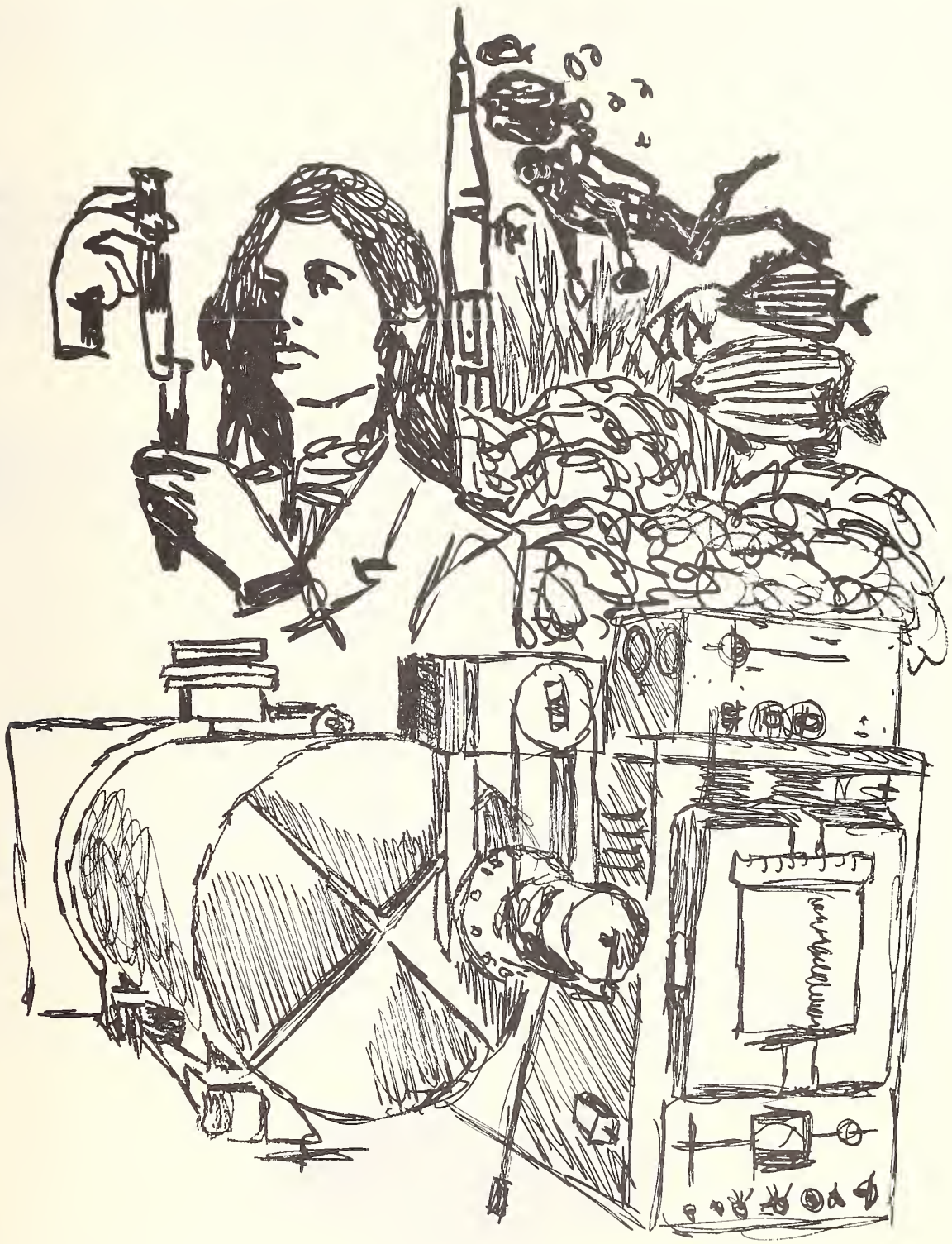
SRM Nos.	Name	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent)									
			C	Mn	Si	Cu	V	Mo	Sn	Al	Fe	N
173a	6Al-4V	100	0.025	------	0.037	0.002	4.06	0.005	----	6.47	0.15	0.018
174	4Al-4Mn	100	-----	4.57	.015	-----	----	------	----	4.27	.175	.012
176	5Al-2.5Sn	100	.015	0.0008	-----	.003	----	.0003	2.47	5.16	.070	.010

3.6.14. Zinc-Base

SRM Nos.	Name	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent)										
			Mn	Cu	Ni	Sn	Al	Cd	Fe	Pb	Ag	Mg	Ti
94b	Die Casting Alloy	150	0.014	1.01	0.006	0.006	4.07	0.002	0.018	0.006	-------	0.042	--------
728	Zinc	450	-----	0.00057	-----	(.000002)	----	.00012	.00027	.00111	0.00011	-----	--------

3.6.15. Zirconium-Base

SRM Nos.	Name	Wt/Unit (grams)	Chemical Composition (Nominal Parts Per Million)										
			C	Mn	Si	Cu	Ni	Cr	Ti	Sn (Wt %)	Fe	N	U
360a	Zircaloy-2	100	136	3	51	140	554	1060	27	1.42	1441	43	0.15



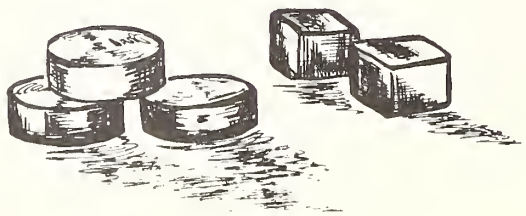
3.7. Nonferrous (Solid Form)

Several groups of standard reference materials have been prepared. They are designed to fill the basic needs of the nonferrous primary and secondary metals industries for analytical control, primarily with optical emission and x-ray spectroscopic methods. Both nominal chemical composition and analytical range standards have been prepared for many of the commercially important nonferrous alloy systems.

3.7.2. Copper-Base Alloys

Eight groups of copper-base alloy standards have been prepared to provide for analytical control by rapid instrumental methods in the copper industry. These standards are intended primarily for calibration of optical emission and x-ray spectroscopic equipment, and have been prepared in chill-cast form for the producer, and in wrought form for the consumer. Both forms have nearly identical chemical compositions. Each of the eight principal copper-base alloys are covered by three standard reference materials comprised of a "nominal-composition" together

SRM Nos.		Name	Chemical Composition (Nominal Weight Percent)								
			Cu	Zn	Pb	Fe	Sn	Ni	Al	Sb	As
----	C1100	Cartridge Brass A	67.43	32.20	0.106	0.072	0.055	0.052	0.008	0.018	0.019
1101	C1101	Cartridge Brass B	69.50	30.30	.05	.037	.016	.013	.0006	.012	.009
1102	C1102	Cartridge Brass C	72.85	27.10	.020	.011	.006	.005	.0007	.005	.004
1103	C1103	Free-Cutting Brass A	59.23	35.7	3.73	.26	.88	.16	-----	------	------
1104	C1104	Free-Cutting Brass B	61.33	35.3	2.77	.088	.43	.070	------	------	------
1105	C1105	Free-Cutting Brass C	63.7	34.0	2.0	.044	.21	.043	------	------	------
1106	C1106	Naval Brass A	59.08	40.08	0.032	.004	.74	.025	------	------	------
1107	C1107	Naval Brass B	61.21	37.34	.18	.037	1.04	.098	------	------	------
1108	C1108	Naval Brass C	64.95	34.42	.063	.050	0.39	.033	------	------	------
1109	C1109	Red Brass A	82.2	17.4	.075	.053	.10	.10	------	------	------
1110	C1110	Red Brass B	84.59	15.20	.033	.033	.051	.053	------	------	------
1111	C1111	Red Brass C	87.14	12.81	.013	.010	.019	.022	------	------	------
1112	C1112	Gilding Metal A	93.38	6.30	.057	.070	.12	.100	------	------	------
1113	C1113	Gilding Metal B	95.03	4.80	.026	.043	.064	.057	------	------	------
1114	C1114	Gilding Metal C	96.45	3.47	.012	.017	.027	.021	------	------	------
1115	C1115	Commercial Bronze A ...	87.96	11.73	.013	.13	.10	.074	------	------	------
1116	C1116	Commercial Bronze B ...	90.37	9.44	.042	.046	.044	.048	------	------	------
1117	C1117	Commercial Bronze C ...	93.01	6.87	.069	.014	.021	.020	------	------	------
1118	C1118	Aluminum Brass A	75.1	21.9	.025	.065	------	------	2.80	.010	.007
1119	C1119	Aluminum Brass B	.77.1	20.5	.050	.030	------	------	2.14	.050	.040
1120	C1120	Aluminum Brass C	.80.1	18.1	.105	.015	------	------	1.46	.100	.090
1121	C1121	Beryllium Copper CABRA alloy 165-170 ..	.97.49	(0.01)	(.002)	.085	.01	.012	0.07	------	------
1122	C1122	Beryllium Copper CABRA alloy 25-172 ...	97.45	(.01)	(.003)	.16	(.01)	(.01)	.17	------	------
1123	C1123	Beryllium Copper CABRA alloy 10-175 ...	97.10	(.01	(.001)	.04	(.01)	(.01)	.02	------	------



Also, a growing list of high-purity metals is becoming available for use in research and in the development of more rapid and more meaningful methods of analysis and production quality control.

3.7.2. Copper-Base Alloys (Continued)

with a low- and a high-composition standard. To make the standards more widely applicable, a number of trace elements were purposely added to the cartridge brass series. This series has been certified for these elements. The beryllium copper standards are representative of the nominal chemical composition of three Copper and Brass Research Association (CABRA) alloy designations, Nos. 165-170, 25-172, and 10-175 respectively. (Values in parentheses are not certified, but are given for additional information on the chemical composition.)

Chemical Composition (Nominal Weight Percent)											
Be	Bi	Cd	Mn	P	Si	Ag	Te	Co	Cr	SRM Nos.	
0.0015	0.0010	0.013	0.003	0.010	(0.010)	0.019	0.0035	------	------	----	C1100
.00055	.0004	.0055	.0055	.0020	(.005)	.003	.0015	------	------	1101	C1101
.00003	.0005	.0045	.0045	.0048	(.002)	.0010	.0003	------	------	1102	C1102
------	------	------	------	.003	------	------	------	------	-- ---	1103	C1103
------	------	------	------	.005	------	------	------	------	------	1104	C1104
------	------	------	------	.003	------	------	------	------	------	1105	C1105
------	------	------	.005	------	------	------	------	------	------	1106	C1106
------	------	------	------	------	------	------	------	------	------	1107	C1107
------	------	------	.025	------	------	------	------	------	------	1108	C1108
------	------	------	------	.006	------	------	------	------	------	1109	C1109
------	------	------	------	------	------	------	------	------	------	1110	C1110
------	------	------	------	------	------	------	------	------	------	1111	C1111
------	------	------	------	.009	------	------	------	------	------	1112	C1112
------	------	------	------	.008	------	------	------	-----	-------	1113	C1113
------	------	------	------	.009	------	------	------	------	------	1114	C1114
------	------	------	------	.005	------	------	------	------	------	1115	C1115
------	------	------	------	.008	------	------	------	------	------	1116	C1116
------	------	------	------	.002	------	------	------	------	------	1117	C1117
------	------	------	------	.13	.0021	------	------	------	------	1118	C1118
------	------	------	------	.070	.0015	------	------	------	------	1119	C1119
------	------	------	------	.018	.0011	------	------	------	------	1120	C1120
1.90	------	------	(.004)	(.005)	.11	(.005)	------	0.295	(0.002)	1121	C1121
1.75	------	------	(.004)	(.004)	.17	(.005)	------	.220	(.002)	1122	C1122
0.46	------	------	(.002)	(.002)	.03	(.009)	------	2.35	(.002)	1123	C1123

3.7.3. Gold-Base Alloys

High purity gold, in wire and rod form, has been certified for chemical composition. This standard reference material was prepared primarily for applications in quantitative spark mass spectroscopic methods; it also is useful for analysts working at trace level concentrations of elements in high-purity metals. Detailed information is given in Section 3.8.2., High-Purity Metals.

Two series of gold-base alloy wires, are available, each consisting of a set of six wires, color coded for identification, approximately 0.5 mm in diameter and 5 cm long. These consist of high-purity gold, four intermediate alloys in steps of approximately 20 weight per cent of copper and silver respectively and a high-purity copper and a high-purity silver wire. These standard reference materials, sold only in sets, are intended primarily for reference points in quantitative electron microprobe methods of analysis. Detailed information is given in Section 3.8.3., Microprobe Standards.

Also available is a high-purity gold wire calibrated as a vapor pressure standard reference material. Detailed information is in Section, 4.23., Vapor Pressure.

3.7.4. Lead-Base Alloy

At present there is only one lead-base, solid form, standard reference material, No. 1131, available from the National Bureau of Standards certified for chemical composition. This is a solder prepared to meet specifications of alloy 40B in ASTM Designation B32. The material for the standard was prepared in powder form, with a particle size small enough to pass through a 200 mesh sieve, cold compacted at 13 tons psi to billets and cold extruded to rods from which disks were cut.

The same stock of powder was used for the preparation of granular form SRM 127b listed in Section 3.6.4.

SRM Nos.	Name	Unit Size	Chemical Composition (Nominal Weight Percent)						
			Cu	Ni	As	Sn	Sb	Bi	Ag
1131	Solder PB60-Sn40	1 1/4 in D × 3/4 in thick	0.011	0.012	0.01	39.3	0.43	0.06	0.01

3.7.5. Nickel-Base Alloys

These standards are designed primarily for calibration in optical emission and x-ray spectroscopic methods of analysis. They are issued in disk form.

SRM Nos.	Name	Unit Size	Chemical Composition (Nominal Weight Percent)									
			C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Co	Fe
1159	Ni48, balance Fe	1 1/4 in D × 3/4 in thick	0.007	0.305	0.003	0.003	0.32	0.038	48.2	0.06	0.010	0.022	51.0
1160	Ni80, Mo4, balance Fe	1 1/4 in D × 3/4 in thick	.019	.550	.003	.001	.37	.021	80.3	.05	4.35	.054	14.3

3.7.6. Platinum-Base Alloys

Two platinum standard reference materials, SRM Nos. 680 and 681, in wire form, have been prepared and certified to provide homogeneous reference materials for analysis of high-purity platinum. Prices and detailed information are given in Section 3.8.2., High-Purity Metals.

3.7.9. Silver-Base Alloys

A set of six silver-gold alloy wires are available color coded for easy identification, and approximately 0.5 mm in diameter and 5 cm. long. This set is intended primarily for use in quantitative electron probe microanalysis. Detailed information is given in Section 3.8.3., Microprobe Standards.

3.7.10. Tin-Base Alloys

This tin metal standard reference material has been prepared primarily for the tin-plate industry; it is useful for the calibration of optical emission spectroscopic equipment by the "point-to-point" technique. It is furnished in the form of rods.

A 40 Sn-60 Pb solder also is available, in solid form, as SRM 1131 and, in granular form, as SRM 127b. These are listed in Section 3.7.4. and 3.6.4. respectively.

SRM Nos.	Name	Unit Size	Chemical Composition (Nominal Weight Percent)									
			Cu	Ni	Co	As	Pb	Sb	Bi	Ag	Zn	Cd
432	Tin B ...	Rod-1/4 in D × 4 in long	0.097	0.020	0.011	0.075	0.094	0.095	0.0098	0.0095	0.020	0.0095

3.7.11. Titanium-Base Alloys

A number of titanium-base alloy standard reference materials, primarily for the aerospace industries are available for analytical control and equipment calibration purposes. Included are materials in disk form intended as calibration materials for optical emission and x-ray spectroscopic methods of analysis of similar materials.

SRM Nos.	Name	Unit Size	Chemical Composition (Nominal Weight Percent)					
			Mn	Cr	Fe	Mo	Al	V
641	8Mn (A)	1 1/4 in D × 3/4 in Disks	6.68	----	----	----	----	----
642	8Mn (B)	1 1/4 in D × 3/4 in Disks	9.08	----	----	----	----	----
643	8Mn (C)	1 1/4 in D × 3/4 in Disks	11.68	----	----	----	----	----
644	2Cr-2Fe-2Mo (A) ...	1 1/4 in D × 3/4 in Disks	-----	1.03	1.36	3.61	----	----
645	2Cr-2Fe-2Mo (B) ...	1 1/4 in D × 3/4 in Disks	-----	1.96	2.07	2.38	----	----
646	2Cr-2Fe-2Mo (C) ...	1 1/4 in D × 3/4 in Disks	-----	3.43	2.14	1.11	----	----
654	6Al-4V (B)	1 1/4 in D × 3/4 in Disks	-----	----	----	----	6.03	3.83

3.7.11.1. Titanium-Base Alloys – Oxygen and Hydrogen Only

Standard reference materials, intended for determination of hydrogen and oxygen in titanium-base alloys are available in sheet and rod form. These were designed primarily for calibration of vacuum fusion or inert gas fusion equipment.

A group of iron-base alloys certified for oxygen also are available. These are listed in Section 3.2.7..

SRM Nos.	Name	Unit Size	Wt/Unit (grams)	Oxygen (ppm)	Hydrogen (Wt %)
352	Unalloyed titanium for hydrogen	1/4 in square × 0.05 in thick	20	----	0.0032
353	Unalloyed titanium for hydrogen	1/2 in square × 0.05 in thick	20	----	.0098
354	Unalloyed titanium for hydrogen	1/2 in square × 0.05 in thick	20	----	.0215
355	Unalloyed	Rod-1/2 in D × 2 in long	-----	3031	------
356	Alloy, 6Al-4V	Rod-.425 in D × 1 3/4 in long	-----	1332	------

3.7.12. Tungsten-Base Alloy

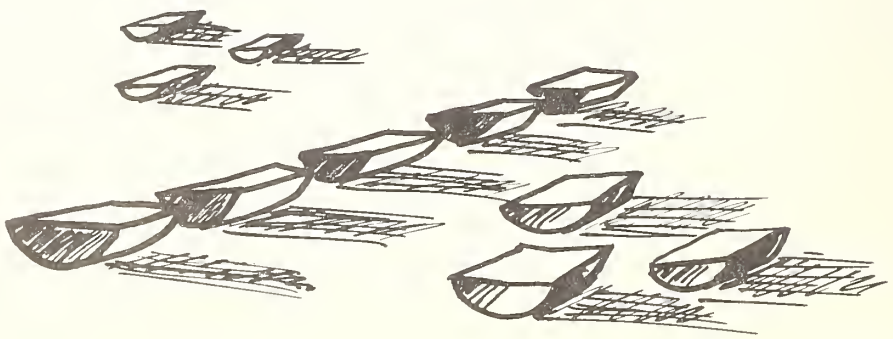
A composite wire is available in the form of 1 mm thick wafers consisting of a tungsten-20 percent molybdenum wire embedded in a pure molybdenum jacket onto which has been electroplated a layer of pure tungsten. Intended primarily as a standard for quantitative electron microprobe analysis, it is listed in Section 3.8.3., Microprobe Standards.

3.7.13. Zinc-Base Alloys

Zinc-base alloy standard reference materials are available ranging from very high-purity zinc to commercial materials such as spelter and die-casting alloy compositions. They are supplied as bar segments (disks) intended for calibrating and checking optical emission and x-ray spectroscopic techniques. The certificate of analysis supplied with each gives the chemical composition as determined at the National Bureau of Standards and values determined by outside laboratories who, in most cases, have cooperated in certification of the standards.

3.7.13.1. High-Purity Zinc

Two high-purity zinc standards, SRM 682 and 683, are available as semicircular bar segments. Detailed information is given in Section 3.8.2., High-Purity Metals. Also a Freezing Point Standard, of high purity zinc, is available as SRM 740. Details are given in Section 4.21.1.



3.7.13.2. Die Casting Alloys and Spelter

Zinc-base die casting alloys and a spelter standard are available. They were designed for calibration of optical emission spectroscopic techniques primarily for analysis of such alloys as ASTM designations AG 40A and AC 41A. The standard reference materials were prepared by a continuous chill-casting process into square bars which then were cut into segments. The certified portion of each segment is that part included between 3/16 inch and 11/16 inch from each side. The center core, 3/16 inch square, and the outer rim, 3/16 inch from the outer surface, are parts which may differ in chemical composition for some elements from the certified portion, and should not be used.

(Values in parentheses are not certified, but are given for additional information on chemical compositions.)

SRM Nos.	Name	Unit Size	Chemical Composition (Nominal Weight Percent) Cu	Al	Mg	Fe	Pb	Cd
625	Zinc-base A-ASTM AG 40A ..	1 3/4 in square × 3/4 in thick	0.034	3.06	0.070	0.036	0.0014	0.0007
626	Zinc-base B-ASTM AG 40A ..	1 3/4 in square × 3/4 in thick	.056	3.56	.020	.103	.0022	.0016
627	Zinc-base C-ASTM AG 40A ..	1 3/4 in square × 3/4 in thick	.132	3.88	.030	.023	.0082	.0051
628	Zinc-base D-ASTM AC 41A ..	1 3/4 in square × 3/4 in thick	.611	4.59	.0094	.066	.0045	.0040
629	Zinc-base E-ASTM AC 41A ..	1 3/4 in square × 3/4 in thick	1.50	5.15	.094	.017	.0135	.0155
630	Zinc-base F-ASTM AC 41A ..	1 3/4 in square × 3/4 in thick	0.976	4.30	.030	.023	.0083	.0048
631	Zinc spelter (modified)	1 3/4 in square × 3/4 in thick	.0013	0.50	(<.001)	.005	(.001)	.0002

SRM Nos.	Chemical Composition (Nominal Weight Percent) Sn	Cr	Mn	Ni	Si	In	Ga	Ca	Ag	Ge
625	0.0006	0.0128	0.031	0.0184	0.017	-------	------	------	--------	-------
626	.0012	.0395	.048	.047	.042	-------	------	------	--------	-------
627	.0042	.0038	.014	.0029	.021	-------	------	------	--------	-------
628	.0017	.0087	.0091	.030	.009	-------	------	------	--------	-------
629	.012	.0008	.0017	.0075	.078	-------	------	------	--------	-------
630	.0040	.0031	.0106	.0027	.022	-------	------	------	--------	-------
631	.0001	.0001	.0015	(<.0005)	<.002	(0.0023)	(0.002)	<0.001	(<0.0005)	(0.0002)

3.7.14. Zirconium-Base Alloys

A zirconium metal standard reference material, certified at the parts-per-million level, is available in the form of a wrought disk for checking and calibration of optical emission and x-ray spectroscopic instruments used in the analytical control of trace level constitents of zirconium for use in nuclear power applications.

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

SRM Nos.	Name	Unit Size	Chemical Composition (Nominal Parts Per Million) Mn	Si	Cu	Ni	Cr	W	Ti	Al	B	U	Fe
1210	Zirconium A	1 1/4 in D × 3/4 in thick	(5)	(30)	10	8	95	(4)	26	(60)	(<0.25)	1.8	2500

3.8. Miscellaneous Metals

3.8.1. Gases in Metals

Sections 3.1., 3.1.1., and 3.3. list steels, and cast irons, respectively, chip form, certified for nitrogen.

Sections 3.6.13 and 3.7.11.1. list titanium-base alloys, chip form and solid form, respectively, certified for hydrogen, oxygen, or nitrogen.

Section 3.2.7. lists steels, solid form, certified for oxygen and nitrogen.

Certified for Nitrogen

Steels, (Chip Form), See Section 3.1. for details.

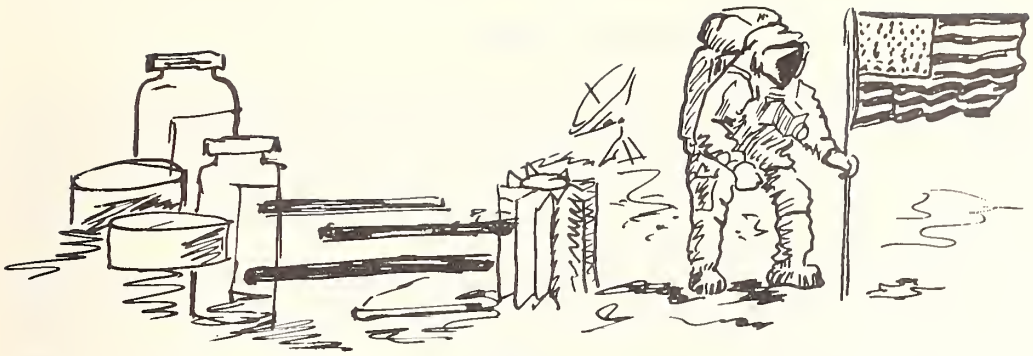
SRM Nos.	Name	Nitrogen (Wt %)
8i	Bessemer	0.018
10g	Bessemer	.015
12h	Basic Open Hearth, 0.4C	.006
32e	Ni-Cr (SAE 3140)	.009
33d	Ni-Mo (SAE 4820)	(.011)
50c	W18-Cr4-V1	.012
51b	Electric Furnace, 1.2C	.011
65d	Basic Electric Furnace, 0.3C	.013
72f	Cr-Mo (SAE X4130)	.009
73c	Stainless (Cr13) (SAE 420)	.037
100b	Manganese (SAE T1340)	.004
133a	Stainless (Cr13-Mo0.3-S0.3)	.032
139a	Cr-Ni-Mo (AISI 8640)	.008
153a	Co8-Mo9-W2-Cr4-V2 (Tool)	.024
160b	Stainless (AISI 316)	.039
343	Stainless (SAE 431)	.074
346	Valve (Cr22-Ni4-Mn9)	.441

Steel, (Granular Form), See Section 3.1.1. for details.

SRM Nos.	Name	Nitrogen (Wt %)
163	Low alloy, Cr1	0.007

Cast Irons (Chip Form), See Section 3.3. for details.

SRM Nos.	Name	Nitrogen (Wt %)
5L	Cast iron	0.006
6g	Cast iron	.006
7g	Cast iron (high phosphorus)	.004
55e	Ingot iron	.004
107b	Cast iron (Ni-Cr-Mo)	(.008)



3.8.1. Gases in Metals (Continued)

Titanium Base (Chip Form), See Section 3.6.13, for details.

SRM Nos.	Name	Nitrogen (Wt %)
173a	6Al-4V	0.018
174	4Al-4Mn	.012
176	5Al-2.5Sn	.010

Zirconium Base Alloys, (Chip Form), See Section 3.6.15, for details.

SRM Nos.	Name	Nitrogen (Wt %)
360a	Zircaloy-2	0.0043

Certified for Oxygen and Nitrogen or Hydrogen

Steels (solid form), See Section 3.2.7. for details.

Values in parentheses are not certified but are given for additional information on composition.

SRM Nos.	Name	Oxygen (ppm)	Nitrogen (ppm)
1090	Ingot iron	491	(60)
1091	Stainless steel (AISI 431)	131	(945)
1092	Vacuum melted steel	28	(3.6)
1093	Valve steel	60	(4807)
1094	Maraging steel	4.5	(71)

Certified for Hydrogen or Oxygen

Titanium Base (solid form), See Section 3.7.11.1., for details.

SRM Nos.	Name	Hydrogen (Wt %)	Oxygen (ppm)
352	Unalloyed	0.0032	----
353	Unalloyed	.0098	----
354	Unalloyed	.0215	----
355	Unalloyed	------	3031
356	6Al-4V Alloy	------	1332

3.8.2. High-Purity Metals

Very high-purity metals are being made available to fill the needs of analysts working with determination of impurity elements in high-purity metal materials. They are intended to serve as bench marks in calibration of methods and equipment; also they are expected to be valuable in the development of new or improved methods and techniques for extending the sensitivity of detection in the determination of trace constituents in various materials by chemical, optical emission and solids mass spectroscopy, activation and resistivity methods.

The certificate of analysis supplied with each high-purity metal gives the state of the art information on chemical composition in the cooperating laboratories for the various trace determinations reported.

Available in the series of high-purity metals are gold, platinum and zinc which provide homogeneous reference materials for these important elements.

The gold is available in the form of wire and rod. The wire form, designated by (W), is intended for applications such as in spark source mass spectroscopic techniques. The low levels of impurities make it important for evaluating instrument and system blanks. The rod form, designated by (R), is intended for application in other methods of characterization.

The platinum is available as a high-purity material and as a doped composition material in wire form only.

The zinc is available in a high-purity and in a less pure version. Both were prepared from the same starting material. The high-purity material is the result of further purification by vacuum distillation, zone refining, and degasification. The zinc is supplied in the form of semicircular bar segments.

SRM Nos.	Name	Unit Size	Chemical Compositions (Nominal Parts Per Million by Weight) Cu	Ni	Sn	Pb	Zr
685W	High-Purity Gold (Wire)	1.4mm D × 102mm long	0.1	----	----	----	----
685R	High-Purity Gold (Rod)	5.9mm D × 25mm long	.1	----	----	----	----
680L1	High-Purity Platinum (Wire)	0.51mm D × 102mm long	.1	<1	----	<1	<0.1
680L2	High-Purity Platinum (Wire)	0.51mm D × 1.0m long					
681L1	Doped-Platinum (Wire)	0.51mm D × 102mm long	5.1	0.5	----	12	11
681L2	Doped-Platinum (Wire)	0.51mm D × 1.0m long					
682	High-Purity Zinc	Semi circular segments 57mm D × 19mm long	0.042	----	(0.02)	----	----
683	Zinc Metal	Semi circular segments 57mm D × 19mm long	5.9	----	(.02)	11.1	----

SRM Nos.	Chemical Compositions (Nominal Parts Per Million by Weight) Ag	Mg	In	Fe	O	Pd	Au	Rh	Ir	Cd	Tl
685W*	[0.1]	---	0.007	0.3	[2]	---	---	----	-----	----	----
685R*	[.1]	---	.007	2	[<2]	---	---	----	-----	----	----
680L1 680L2	.1	<1	-----	0.7	4	0.2	<1	<0.2	<0.01	----	----
681L1 681L2	2.0	12	-----	5	7	6	9	9	11	----	----
682*	(0.02)	---	-----	(0.1)	----	---	---	----	-----	(0.1)	----
683*	1.3	---	-----	2.2	----	---	---	----	-----	1.1	(0.2)

*Certificate gives upper limits for other elements found to be present.

3.8.3. Microprobe Standards

These standard reference materials provide a highly homogeneous material at about the micrometer of spatial resolution. They are intended primarily for use in calibration of quantitative electron microprobe analytical techniques.

Tungsten – 20% Molybdenum

The tungsten-20% molybdenum alloy, SRM 480, consists of a core of tungsten-20% molybdenum wire embedded in pure molybdenum onto which pure tungsten has been deposited by electroplating to provide a composite. The certificate supplied with this standard gives the values for tungsten and molybdenum as determined by analysis and a summary of homogeneity testing results from approximately 1500 determinations for tungsten and molybdenum by electron probe microanalysis. Additional details on homogeneity characterization are given in NBS Misc. Publ. 260-16. (See inside back cover for ordering instructions).

Gold-Silver

Six color-coded wires comprise this set, SRM 481, of standard reference materials. The wires consist of a high-purity gold and a high-purity silver wire and four wires with nominal chemical composition differences in steps of 20%. The certificate of analysis supplied with each set gives the results of a cooperative program of analysis and a summary of the extensive homogeneity testing carried out in certification of the wires.

Although designed for quantitative elemental microprobe analysis, the wires should be equally useful for other microtechniques.

Gold-Copper

This set of color-coded wires, SRM 483, is similar to the gold-silver set. In both sets, special precautions were taken to achieve homogeneity on a microscopic scale.

SRM Nos.	Name	Unit Size	Chemical Composition (Nominal Weight Percent)				
			Au	Cu	Ag	W	Mo
480	Tungsten-20 Mo Alloy	Wafer-1 mm D × 1 mm thick	------	------	------	78.5	21.5
481	Au100 A	Wire-0.5mm D × 50 mm long	100.00	------	------	----	----
	Au80-Ag20 B	Wire-0.5mm D × 50 mm long	80.05	------	19.96	----	----
	Au60-Ag40 C	Wire-0.5mm D × 50 mm long	60.05	------	39.92	----	----
	Au20-Ag80 E	Wire-0.5mm D × 50 mm long	22.43	------	77.58	----	----
	Ag100 F	Wire-0.5mm D × 50 mm long	------	------	100.00	----	----
482	Au100 A	Wire-0.5mm D × 50 mm long	100.00	------	------	----	----
	Au80-Ag20 B	Wire-0.5mm D × 50 mm long	80.15	19.83	------	----	----
	Au60-Cu40 C	Wire-0.5mm D × 50 mm long	60.36	39.64	------	----	----
	Au40-Cu60 D	Wire-0.5mm D × 50 mm long	40.10	59.92	------	----	----
	Au20-Cu80 E	Wire-0.5mm D × 50 mm long	20.12	79.85	------	----	----
	Cu100 F	Wire-0.5mm D × 50 mm long	------	100.00	------	----	----

3.41. Primary, Working, and Secondary Standard Chemicals

These SRMs 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 [Rf. 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 Nos.	Name	Wt/Unit (grams)	Certified Use	Purity on basis of titration
17	Sucrose	60	Polarimetric Value	[a]
40h	Sodium Oxalate	60	Reductometric Value	99.95
41a	Dextrose (D-glucose)	70	Reductometric Value	[b]
83c	Arsenic trioxide	75	Reductometric Value	99.99
84h	Acid potassium phthalate	60	Acidimetric Value	99.99
136c	Potassium dichromate	60	Oxidimetric Value	99.98
350	Benzoic Acid	30	Acidimetric Value	99.98
950a	Uranium oxide (U_3O_8)	25	Uranium Oxide Standard Value	99.94
951	Boric Acid	100	Acidimetric and Boron Isotopic Value	100.00

[a]Sucrose - Moisture <0.01 percent, Reducing Substances <0.02 percent, Ash 0.003 percent.

[b]Dextrose - Moisture <0.2 percent, Ash <0.01 percent.

3.42. Micro-analysis Standards

This group of materials is furnished as fine crystals of suitable homogeneity for use as standards for conventional microchemical methods of analysis employing samples of approximately 5 mg. See also Section 3.8.3., Microprobe Standards.

SRM Nos.	Name	Wt/Unit (grams)	Elements Certified
140b	Benzoic acid	2	C,H
141b	Acetanilide	2	N,C,H
142	Anisic acid	2	Methoxyl(CH_3O-)
143b	Cystine	2	S,C,H,N
147	Triphenyl phosphate	2	P
148	Nicotinic acid	2	N,C,H

3.43. Clinical Laboratory Standards

These standard reference materials are intended for use in the calibration of apparatus and checking methods of analysis used in clinical and pathological laboratories, and to assist manufacturers of clinical products in meeting the chemical and physical specifications required for clinical chemicals.

SRM Nos.	Name	Purity (%)	Wt/Unit (grams)
911	Cholesterol	99.4	0.5
912	Urea	99.7	25
913	Uric acid	99.7	10
914	Creatinine	99.8	10
915	Calcium carbonate	99.9	20

3.44. Metallo-organic Compounds

This group of standard reference materials is intended for the preparation of solutions in oils of known and reproducible concentrations of metals. Since "matrix" effects do occur it is desirable to prepare the standard solutions in oil identical with or similar to the oil being studied. Possession of an adequate collection of these metallo-organic standard reference materials permits the preparation of any desired blend of known concentrations of metal in the appropriate lubricating oil. They are used primarily for the calibration of spectrochemical equipment used in the determination of metals in lubricating oil. This technique is used extensively in the defense program, the transportation industry, and other industries where the consequences of failure of a moving metal part may range from inconvenient to catastrophic. Details of the selection, preparation, and analysis of the compounds can be found in NBS monograph 54. (See inside back cover for ordering instructions).

A certificate is supplied with each standard reference material giving the percentage of the element of interest and directions for preparing a solution of known concentration in lubricating oil.

SRM Nos.	Constituent Certified		Wt/Unit (grams)	Name
	Element	(wt. pereent)		
1075a	Al	8.1	5	Aluminum 2-ethylhexanoate
1051b	Ba	28.7	5	Barium cyclohexanebutyrate
1063a	B	2.4	5	Menthyl borate
1053	Cd	24.0	5	Cadmium cyclohexanebutyrate
1074a	Ca	12.5	5	Calcium 2-ethylhexanoate
1078a	Cr	9.7	5	Tris(1-phenyl-1,3-butanediono)chromium(III)
1055b	Co	14.8	5	Cobalt cyclohexanebutyrate
1080	Cu	16.5	5	Bis(1-phenyl-1,3-butanediono)copper(II)
1079b	Fe	10.3	5	Tris(1-phenyl-1,3-butanediono)iron(III)
1059b	Pb	36.7	5	Lead cyclohexanebutyrate
1060a	Li	4.1	5	Lithium cyclohexanebutyrate
1061b	Mg	6.5	5	Magnesium cyclohexanebutyrate
1062a	Mn	13.8	5	Manganous cyclohexanebutyrate
1064	Hg	36.2	5	Mercuric cyclohexanebutyrate
1065b	Ni	13.9	5	Nickel cyclohexanebutyrate
1071a	P	9.5	5	Triphenyl phosphate
1066a	Si	14.1	5	Octaphenylcyclotetrasiloxane
1076	K	10.1	5	Potassium erucate
1077a	Ag	42.6	5	Silver 2-ethylhexanoate
1069b	Na	12.0	5	Sodium cyclohexanebutyrate
1070a	Sr	20.7	5	Strontium cyclohexanebutyrate
1057b	Sn	23.0	5	Dibutyltin bis(2-ethylhexanoate)
1052b	V	13.0	5	Bis(1-phenyl-1,3-butanediono)oxovanadium(IV)
1073b	Zn	16.7	5	Zinc cyclohexanebutyrate

3.45. Microstandard Ion-Exchange Beads

This standard reference material is an ion-exchange resin containing a known absorbed quantity of metallic counterion. The actual amount of the counterion may be calculated from the diameter of the resin bead. The individual beads are supplied in quantities of 100 or more cast on a glass slide. A certificate is supplied which describes the method for ascertaining the absolute amount of counterion absorbed on each individual bead.

SRM Nos.	Counterion	Unit	Counterion/Bead (grams)
1800	Ion-exchange beads-calcium	100 Beads	10^{-9} to 10^{-11}

3.51. Analyzed Gases

These standard reference materials are intended for the calibration of apparatus used for the measurement of various components in gas mixtures. Each sample is certified accurately within limits and is primarily intended to monitor and correct for long-term drifts in instruments used.

SRM Nos.	Name	Vol/Unit (Liters as STP)	Constituents Certified
1601	Carbon dioxide in nitrogen ...	68	CO_2, 308 ± 3 ppm
1602	Carbon dioxide in nitrogen ...	68	CO_2, 346 ± 3 ppm
1603	Carbon dioxide in nitrogen ...	68	CO_2, 384 ± 4 ppm
1604	Oxygen in nitrogen	68	O_2, 3 ppm
1605	Oxygen in nitrogen	68	O_2, 10 ppm
1606	Oxygen in nitrogen	68	O_2, 112 ppm
1607	Oxygen in nitrogen	68	O_2, 212 ppm
1608	Oxygen in nitrogen	68	O_2, 978 ppm
1609	Oxygen in nitrogen	68	O_2, 20.95 mole percent

3.52. Analyzed Liquids

These materials are intended for use as standard reference materials for the analysis of liquids for individual elements.

SRM Nos.	Name	Element Certified	Weight percent	Vol/Unit (ml)
1621	Residual fuel oil ...	S	1.05	100
1622	Residual fuel oil ...	S	2.14	100

3.53. Hydrocarbon Blends

Eight standard hydrocarbon blends are available for calibration of mass spectrometers and gas chromatographic procedures used in the analysis of gasolines, naphthas and blending stocks. The even numbered standard reference materials, SRM Nos. 592, 594, 596, and 598, are representative of typical virgin napthas and the odd numbered ones, SRM Nos. 593, 595, 597, and 599, are representative of typical catalytically cracked naphthas in the C_7 and C_8 paraffin and cycloparaffin series.

Each standard reference material is supplied in a unit of ten sealed ampoules. Each ampoule contains 0.03 ml of the blend. Each ampoule is intended to provide material for only one calibration analysis so that possible fractionation of components will be avoided.

For individual components present in the mixtures in the amount of 10% or less (by volume), the limits of error in composition are not greater than ± 0.01 percent and for components present in more than 10 percent, the limits of error are not greater than ± 0.10 percent.

SRM Nos.	592	593	594	595	596	597	598	599
Blend No.	1	2	3	4	5	6	7	8
Unit (Ampoules)	10	10	10	10	10	10	10	10
Hydrocarbon	Volume Percent (Nominal)							
n-Heptane	45	17	----	----	----	----	----	----
2-Methylhexane	23	25	----	----	----	----	----	----
3-Methylhexane	16	30	----	----	----	----	----	----
2,2-Dimethylpentane	4	----	----	----	----	----	----	----
2,3-Dimethylpentane	6	20	----	----	----	----	----	----
2,4-Dimethylpentane	5	8	----	----	----	----	----	----
3,3-Dimethylpentane	1	----	----	----	----	----	----	----
n-Octane	----	----	39	12	----	----	----	----
2-Methylheptane	----	----	19	25	----	----	----	----
3-Methylheptane	----	----	16	23	----	----	----	----
4-Methylheptane	----	----	8	8	----	----	----	----
3-Ethylhexane	----	----	3	3	----	----	----	----
2,3-Dimethylhexane	----	----	4	9	----	----	----	----
2,4-Dimethylhexane	----	----	5	5	----	----	----	----
2,5-Dimethylhexane	----	----	6	9	----	----	----	----
3,4-Dimethylhexane	----	----	----	6	----	----	----	----
Methylcyclohexane	----	----	----	----	57	32	----	----
Ethylcyclopentane	----	----	----	----	9	14	----	----
1,1-Dimethylcyclopentane	----	----	----	----	4	3	----	----
1,trans-2-Dimethylcyclopentane	----	----	----	----	14	30	----	----
1,trans-3-Dimethylcyclopentane	----	----	----	----	16	21	----	----
Ethylcyclohexane	----	----	----	----	----	----	20	17
1,trans-2-Dimethycyclohexane	----	----	----	----	----	----	18	7
1,cis-3-Dimethylcyclohexane	----	----	----	----	----	----	25	19
1,trans-4-Dimethylcyclohexane	----	----	----	----	----	----	11	14
1-Methyl-cis-2-ethylcyclopentane	----	----	----	----	----	----	7	20
1,1,3-Trimethylcyclopentane	----	----	----	----	----	----	5	4
1,trans-2-cis-3-Trimethylcyclopentane	----	----	----	----	----	----	9	6
1,trans-2-cis-4-Trimethylcyclopentane	----	----	----	----	----	----	5	13

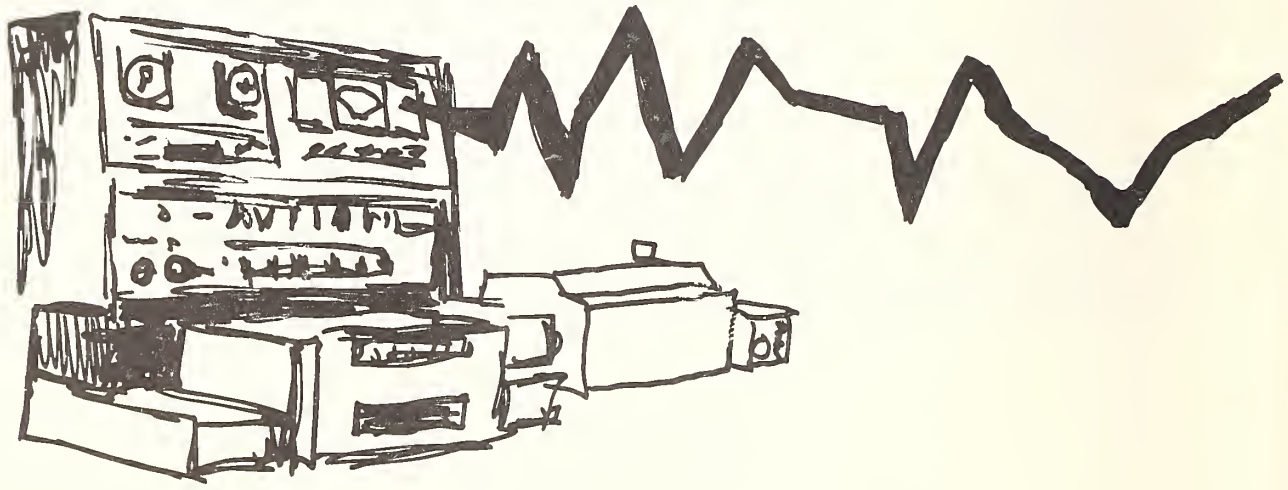
3.54. Ores

These materials are intended for use in checking the accuracy of assay methods. They are certified for their content of elements of economic interest, and occasionally, have additional data given as a matter of information. These standard reference materials are supplied in the form of fine powders, usually passing a 100-mesh or finer sieve.

SRM Nos.	Name	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent) Fe	Mn	P	P_2O_5	SiO_2	Li_2O	Sn	Zn	Available Oxygen
27e	Iron, (Sibley)	100	66.58	------	0.042	----	3.65	----	----	----	----
28a	Iron, (Norrie)	50	-----	0.435	-----	----	----	----	----	----	----
181	Lithium, (Spodumene)	45	-----	------	-----	----	----	6.4	----	----	----
182	Lithium, (Petalite)	45	-----	------	-----	----	----	4.3	----	----	----
183	Lithium, (Lepidolite)	45	-----	------	-----	----	----	4.1	----	----	----
25c	Manganese	100	-----	57.85	-----	0.22	2.36	----	----	----	16.7
138	Tin (N.E.I. Concentrate)	50	-----	------	-----	----	----	----	74.8	----	----
113	Zinc (Tri-State Concentrate)	50	-----	------	-----	----	----	----	----	61.1	----

SRM Nos.	Name	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent as the Oxide) Al_2O_3	Fe_2O_3	TiO_2	ZrO_2	P_2O_5	V_2O_5	SiO_2
69a	Bauxite	50	55.0	5.8	2.78	0.18	0.08	0.03	6.01

SRM Nos.	Chemical Composition (Nominal Weight Percent as the Oxide) Cr_2O_3	CaO	BaO	MgO	MnO	Na_2O	K_2O	SO_3	Loss on Ignition
69a	0.05	0.29	0.01	0.02	<0.01	<0.01	<0.01	0.04	29.55



3.55. Cements

These materials are furnished as standards for x-ray spectroscopic analysis and for chemical analysis of cements and related materials. Because these materials are hygroscopic, each unit consists of three sealed vials each containing approximately 5 g of material.

SRM Nos.	Name	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent as the Oxide) SiO_2	Al_2O_3	Fe_2O_3	TiO_2	P_2O_5
1011	Portland	15	21.03	5.38	2.07	0.25	0.33
1013	Portland	15	24.17	3.30	3.07	.20	.20
1014	Portland	15	19.49	6.38	2.50	.25	.32
1015	Portland	15	20.65	5.04	3.27	.26	.05
1016	Portland	15	21.05	4.97	3.71	.34	.13

3.56. Minerals, Refractories, Carbides and Glasses

This group of standards is supplied in the form of powders, usually 100 mesh or finer. They are intended to provide materials for checking the accuracy of methods used in the analysis of similar materials, primarily in the glass, ceramics, and steel industries.

3.56.1. Minerals

SRM Nos.	Name	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent as the Oxide) SiO_2	Fe_2O_3	Al_2O_3	TiO_2	MnO	CaO
1b	Limestone, argillaceous	50	4.92	0.75	1.12	0.046	0.20	50.9
88a	Limestone, dolomitic	50	1.20	.28	0.19	.02	.03	30.1
70a	Feldspar, potash	40	67.1	.075	17.9	.01	----	0.11
99a	Feldspar, soda	40	65.2	.065	20.5	.007	----	2.14
97a	Clay, flint	60	43.7	.45	38.8	1.90	----	0.11
98a	Clay, plastic	60	48.9	1.34	33.2	1.61	----	.31

3.56.2. Refractories

SRM Nos.	Name	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent as the Oxide) SiO_2	Al_2O_3	Total as Fe_2O_3	FeO	TiO_2
103a	Chrome refractory	60	4.6	29.96	----	12.43	0.22
198	Silica refractory	45	----	0.16	0.66	-----	.02
199	Silica refractory	45	----	.48	.74	-----	.06
104	Burned magnesite	60	2.54	.84	7.07	-----	.03

3.55. Cements (Continued)

(Values in parentheses are not certified but are given to provide additional information on the chemical composition.)

Chemical Composition (Nominal Weight Percent as the Oxide)									Loss on Ignition	SRM Nos.
CaO (+SrO)	SrO	MgO	SO_3	Mn_2O_3	Na_2O	K_2O	Li_2O	Rb_2O		
66.60	0.11	1.12	1.75	0.03	0.08	0.26	(0.002)	(0.001)	1.13	1011
64.34	.08	1.39	1.80	.05	.20	.32	(.001)	(.004)	0.99	1013
63.36	.26	2.80	2.70	.07	.24	.99	(.005)	(.007)	.81	1014
61.48	.11	4.25	2.28	.06	.16	.87	(.004)	(.005)	1.70	1015
65.26	.25	0.42	2.27	.04	.55	.04	(.012)	(<.001)	1.20	1016

3.56.1. Minerals (Continued)

Chemical Composition (Nominal Weight Percent as the Oxide)											Loss on Ignition	SRM Nos.
SrO	MgO	Cr_2O_3	Na_2O	K_2O	Li_2O	ZrO_2	BaO	Rb_2O	P_2O_5	CO_2		
0.14	0.36	----	0.04	0.25	-----	-----	-----	----	0.08	40.4	41.1	1b
.01	21.3	----	.01	.12	-----	-----	-----	----	.01	46.6	46.7	88a
-----	-----	----	2.55	11.8	-----	-----	0.02	0.06	----	----	0.40	70a
-----	0.02	----	6.2	5.2	-----	-----	.26	----	0.02	----	0.25	99a
.18	.15	0.03	0.037	0.50	0.11	0.063	.078	----	.36	----	13.32	97a
.039	.42	.03	.082	1.04	.070	0.042	.03	----	.11	----	12.44	98a

3.56.2. Refractories (Continued)

Chemical Composition (Nominal Weight Percent as the Oxide)									Loss on Ignition	SRM Nos.
ZrO_2	MnO	P_2O_5	Cr_2O_3	CaO	MgO	Li_2O	Na_2O	K_2O		
0.01	0.11	0.01	32.06	0.69	18.54	-----	-----	-----	----	103a
<.01	.008	.022	------	2.71	0.07	0.001	0.012	0.017	0.21	198
.01	.007	.015	------	2.41	.13	.002	.015	.094	.17	199
----	.43	.057	0.026	3.35	85.67	.001	.015	.015	----	104

3.56.3. Carbides

SRM Nos.	Name	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent) Carbon Total	Carbon Free	Silicon Total	Silicon SiC	Fe	Al	Ti	Zr	Ca	Mg
112	Silicon carbide	85	29.10	0.09	69.11	96.85	0.45	0.23	0.025	0.027	0.03	0.02

3.56.4. Glasses

SRM Nos.	Name	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent as the Oxide) SiO_2	PbO	Al_2O_3	Fe_2O_3	ZnO	MnO	TiO_2	ZrO_2	CaO	BaO
89	Lead-barium ..	45	65.35	17.50	0.18	0.049	----	0.088	0.01	0.005	0.21	1.40
91	Opal	45	67.53	0.097	6.01	.081	0.08	.008	.019	.010	10.48	----
92	Low-boron ...	45	-----	------	----	-----	----	-----	-----	-----	-----	----
93	High-boron ...	45	80.60	------	1.94	.076	----	-----	.027	.013	-----	----

SRM Nos.	Chemical Composition (Nominal Weight Percent as the Oxide) MgO	K_2O	Na_2O	B_2O_3	P_2O_5	As_2O_5	As_2O_3	SO_3	Cl	F	Loss on Ignition
89	0.03	8.40	5.70	-----	0.23	0.36	0.03	0.03	0.05	----	0.32
91	.008	3.25	8.48	-----	.022	.10	.091	-----	.014	5.72	----
92	-----	----	----	0.70	-----	----	-----	-----	-----	----	----
93	.026	0.16	4.16	12.76	-----	.14	.085	.009	.036	----	----

3.61. Nuclear Materials

3.61.1. Special Nuclear Materials

This group of standards consists of a plutonium sulfate tetrahydrate issued to provide a secondary standard for the assay of plutonium materials, a plutonium sulfate hydrate isotopic standard with an isotopic analysis by mass spectrometry and intended for the calibration of mass spectrometers, and a group of 16 uranium oxide standards ranging from 0.5% U-235 to 93.27% U-235. Certificates of analysis giving isotopic percentage determined by mass spectrometry are furnished and the standards are intended to serve as calibration materials for the standardization of mass spectrometers.

Standards are available to AEC contractors, AEC or State Licensees, and foreign governments which have entered an Agreement for Cooperation with the U.S. Government concerning the Civil Uses of Atomic Energy. The purchase request for these standards must be made on special forms obtainable from the National Bureau of Standards, Office of Standard Reference Materials, Washington, D. C. 20234.

SRM Nos.	Name	Certified for	Wt/Unit (grams)	Weight Percent (Pu)
944	Plutonium sulfate tetrahydrate	Plutonium content	0.5	47.50

SRM Nos.	Name	Wt/Unit (grams)	Isotopic Abundance (Atom Percent)				
			^{238}Pu	^{239}Pu	^{240}Pu	^{241}Pu	^{242}Pu
948	Plutonium sulfate hydrate	0.25 Pu	0.011	91.477	7.910	0.569	0.0330

SRM Nos.	Uranium Oxide (U_3O_8)	Wt/Unit (grams)	Atom Percent			
			^{234}U	^{235}U	^{236}U	^{238}U
U-005	Depleted	1.0	0.00218	0.4895	0.00466	99.504
U-010	Enriched	1.0	.00541	1.0037	.00681	98.984
U-015	Enriched	1.0	.00850	1.5323	.0164	98.443
U-020	Enriched	1.0	.0125	2.038	.0165	97.933
U-030	Enriched	1.0	.0190	3.046	.0204	96.915
U-050	Enriched	1.0	.0279	5.010	.0480	94.915
U-100	Enriched	1.0	.0676	10.190	.0379	89.704
U-150	Enriched	1.0	.0993	15.307	.0660	84.528
U-200	Enriched	1.0	.1246	20.013	.2116	79.651
U-350	Enriched	1.0	.2498	35.190	.1673	64.393
U-500	Enriched	1.0	.5181	49.696	.0755	49.711
U-750	Enriched	1.0	.5923	75.357	.2499	23.801
U-800	Enriched	1.0	.6563	80.279	.2445	18.820
U-850	Enriched	1.0	.6437	85.137	.3704	13.848
U-900	Enriched	1.0	.7777	90.196	.3327	8.693
U-930	Enriched	1.0	1.0812	93.336	.2027	5.380

3.61.2. Neutron Density

This standard is provided as a reference source of a cobalt-in-aluminum alloy to serve as a neutron density monitor wire standard. Accurate determination of thermal neutron densities is essential in irradiation tests in obtaining a basis for comparison of densities among reactors, in applying data in the design of reactors, in understanding the mechanisms of radiation damage, and for use in neutron activation analysis. The wire is 0.5 mm in diameter and is available in one meter lengths (approximately 0.6 g), or in multiples thereof (continuous length).

SRM Nos.	Name	Unit	Cobalt Content (Weight Percent)
953	Neutron density monitor wire (Co in Al)	Wire 0.5 mm D × 1 meter long or continuous multiples thereof	0.116

3.62. Isotopic Reference Standards

Standard reference materials for isotopic ratio are natural-ratio materials, unless otherwise noted, and are furnished with a certificate of isotopic composition.

The isotopic composition of all the standards has been determined by mass spectrometry, by comparison with mixtures prepared from high-purity separated isotopes. They are useful as standard reference materials for those looking for small variations in the isotopic composition of the elements, and for the evaluation of mass discrimination effects encountered in the operation of mass spectrometers.

A description of the methods used in the characterization of the normal and enriched boric acid, SRM 951 and 952, is given in NBS Special Publication 260-17. (See inside of back cover for ordering instructions.)

SRM Nos.	Name	Element Certified	Wt/Unit (grams)
727	Rubidium chloride	Rubidium	1.0
951	Boric acid	Boron	100
952	Boric acid (95 percent Boron-10)	Boron	0.25
975	Sodium chloride	Chlorine	.25
976	Copper metal	Copper	.25
977	Sodium bromide	Bromine	.25
978	Silver nitrate	Silver	.25
979	Chromium nitrate	Chromium	.25
980	Magnesium metal	Magnesium	.25
981	Lead metal, natural	Lead	1.0
982	Lead metal, equal atom (206/208)	Lead	1.0
983	Lead metal, radiogenic (92 percent lead-206)	Lead	1.0

3.66. Ion Activity Standards

These standard reference materials are intended for use in the preparation of solutions for the calibration of specific-ion electrodes. This includes the pH and pD measuring systems.

3.66.1. pH Standards

These materials are furnished as crystals for the preparation of solutions of known hydrogen ion concentration for calibrating and checking the performance of commercially available pH materials and instruments. They are furnished with certificates giving directions for preparation of the solutions and tables of pH values at various temperatures.

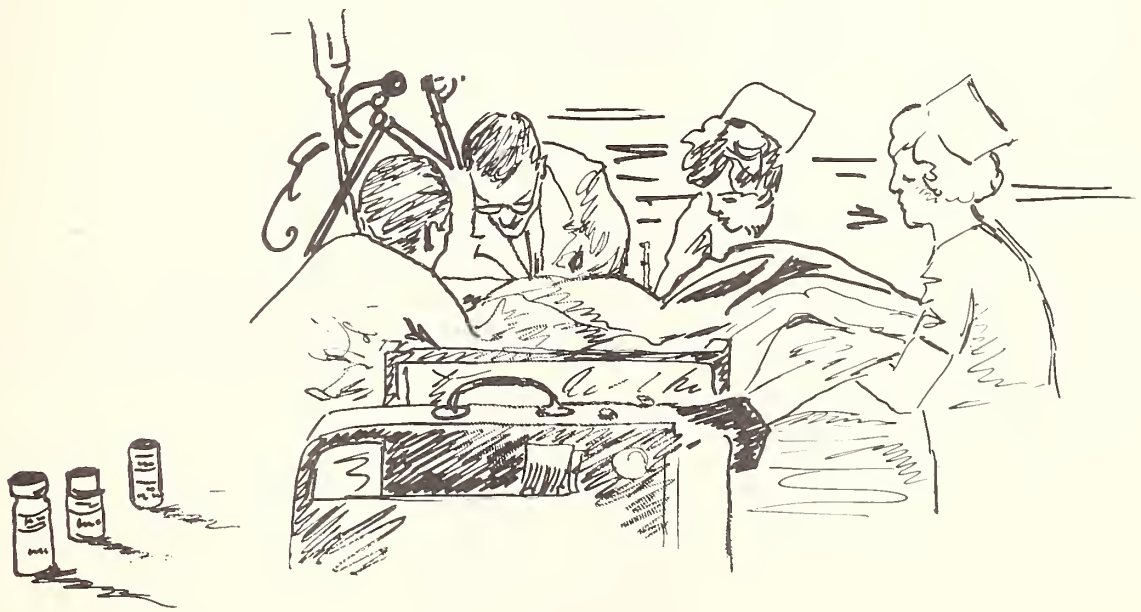
The standards, 186Ic and 186IIb are certified for use in admixture only. At an equimolar (0.025 molal) mixture of the two salts a pH(S) of 6.865 at 25 °C is obtained. Directions also are furnished for the preparation of a physiological reference solution having a pH(S) of 7.413 at 25 °C.

SRM Nos.	Name	pH(S) (at 25 °C)	Wt/Unit (grams)
185d	Acid potassium phthalate	4.004	60
186Ic	Potassium dihydrogen phosphate	see above	30
186IIb	Disodium hydrogen phosphate	see above	30
187a	Borax	9.180	30
188	Potassium hydrogen tartrate	3.557	60
189	Potassium tetroxalate	1.679	65
191	Sodium bicarbonate	10.01	30
192	Sodium carbonate		30

3.66.2. pD Standards

These materials are furnished as crystals for preparation of solutions of known deuterium ion concentration for the calibration and correction of pH indicating equipment to indicate pD data.

SRM Nos.	Name	pD(S) Values	Wt/Unit (grams)
2186-I	Potassium dihydrogen phosphate	7.43	30
2186-II	Disodium hydrogen phosphate		30
2191	Sodium bicarbonate	10.74	30
2192	Sodium carbonate		30



3.71. Reference Organics

These chemicals are intended for use in identifying the products of organic or biochemical reactions. They may also be used in reactions where small amounts of these rare or high-purity organic chemicals are necessary for starting material.

Hydrocarbon blends prepared for the calibration of mass spectrometers and other instrumental procedures are listed in Section 3.53.

3.71.1. Rare Organic Compounds

These compounds are intended for use in identifying products of organic or biochemical reaction. They may also be useful in reactions where small amounts of these rare or high-purity organic chemicals are necessary for starting material.

SRM Nos.	Name	Wt/Unit (mg)
1591	1,2-O-Isopropylidene-β-L-idofuranose	15
1592	1,2-O-Isopropylidene-β-D-threo-pentulose (xylulose)	50
1593	L-Inositol	250
1594	Quebrachitol	500

3.71.2. Labelled Organic Compounds

These compounds are intended for use in identifying deuterated or partially-deuterated products resulting from reactions, principally physico-chemical, of deuterium substituted compounds.

SRM Nos.	Name	Volume/Unit cm^3 at STP
2175	Ethane-d_6	5
2176	Propane-1,1,1-d_3	5

4. Standards of Certified Physical Properties

Mechanical and Metrology Standards

These standard reference materials are intended to relate measurement units made in industrial, university and government laboratories to the mechanical and metrological units related through a National Measurement System[1] to the base units of mass, length, and time.

[1] "Concept of a National Measurement System," Science 158, 67-71 (1967).

4.1. Coating Thicknesses

Nominal thickness only is given below. The certified thickness appears on the cards accompanying the samples.

4.1.1. Nonmagnetic Coatings on Steel, or Nickel on Nonmagnetic Substrate

These standards are intended to be used to calibrate coating thickness gages of the magnetic type for the measurement of the thickness of nonmagnetic coatings on steel, nickel on steel, or nickel on nonmagnetic substrate. The steel substrate has the magnetic properites of AISI 1010 steel and the nickel coatings have the magnetic properties of an annealed Watts nickel electrodeposit free of cobalt and iron.

The certified thickness is within ± 5 percent of the true thickness except for numbers 1301, 1302, 1303, and 1304, which have an uncertainty of ± 0.00003 in.

Sets of either two or four standards mounted on one card are available in the specific combinations that are requested most frequently.

SRM Nos.	Prev. Desig.	Nominal Thickness (inch)	Coating	Substrate
	Type I	**0–0.08**	**Nonmagnetic**	**Magnetic**
1301		0.00010	copper + chromium	steel
1302	AA	.00025	do	do
1303	AB	.00050	do	do
1304	AM	.00075	do	do
1305	AC	.0010	do	do
1306	CA	.0015	do	do
1307	AD	.0020	do	do
1308		.0025	do	do
1309	CM	.0027	do	do
1310	CB	.0032	do	do
1311	CC	.0055	do	do
1312	CD	.0080	do	do
1313	DA	.010	do	do
1314	DB	.015	do	do
1315	DC	.020	do	do
1316	DD	.025	do	do
1317	HA	.03	do	do
1318	HB	.04	do	do
1319	HC	.06	do	do
1320	HD	.08	do	do
	Type II	**0–0.0025**	**Magnetic**	**Magnetic**
1331	BA	0.00012	nickel	steel
1332	BB	.00035	do	do
1333	BC	.00055	do	do
1334	BD	.00075	do	do
1335	EA	.0010	do	do
1336	EB	.0013	do	do
1337	EC	.0016	do	do
1338	ED	.0020	do	do
1339	EE	.0025	do	do
	Type III	**0–0.002**	**Magnetic**	**Nonmagnetic**
1341	FA	0.00012	nickel/chromium	brass
1342	FB	.00035	do	do
1343	FC	.00065	do	do
1344	FD	.0010	do	do
1345	FE	.0015	do	do
1346	FF	.0020	do	do

4.1.1. Nonmagnetic Coatings on Steel, or Nickel on Nonmagnetic Substrate (Continued)

	(Sets of Two Standards Mounted on One Card)
1351	One each of 1307 and 1311
1352	One each of 1332 and 1334
1353	One each of 1335 and 1339
	(Sets of Four Standards Mounted on One Card)
1361	One each of 1302, 1303, 1305 and 1307
1362	One each of 1306, 1310, 1311 and 1312
1363	One each of 1313, 1314, 1315 and 1316
1364	One each of 1317, 1318, 1319 and 1320
1365	One each of 1331, 1332, 1333 and 1334
1366	One each of 1335, 1336, 1337 and 1338
1367	One each of 1341, 1342, 1343 and 1344

4.1.2. Gold Coating Thickness Standards (Various Substrates)

These standards are suitable for calibrating thickness gages of the beta-backscatter type for the measurement of the thickness of gold coatings. The weight of gold per unit area is certified. Thickness equivalents are computed assuming a density of 19.3 g/cm^3 for the gold coating. Each standard is a 15 mm square and is mounted on a card with the certified weight per unit area and equivalent thickness printed below it. The certified coating weights are within ± 5 percent of the actual weight per unit area at the center of the specimen.

Sets of either two or four standards are available in the specific combinations that are requested most frequently. Gold assay: 99.9%, certified.

SRM Nos.	Nominal Coating Weight (mg/cm^2)	Nominal Thickness (microinches)	Substrate Material
1371	1.5	30	Fe-Ni-Co Glass Sealing Alloy[a]
1372	3.0	60	Fe-Ni-Co Glass Sealing Alloy
1373	6.0	120	Fe-Ni-Co Glass Sealing Alloy
1374	14.0	280	Fe-Ni-Co Glass Sealing Alloy

[a]The sealing alloy conforming to ASTM Designation F15; 53% iron, 29% nickel, and 17% cobalt (available under various trade names), is commonly used for making hermetic seals to glass in electronic applications.

	(Sets of two standards mounted on one card)
1381	One each of 1371 and 1372
1382	One each of 1372 and 1373
1383	One each of 1373 and 1374
	(Sets of four standards mounted on one card)
1398	One each of 1371, 1372, 1373, and 1374

SRM Nos.	Nominal Coating Weight (mg/cm^2)	Thickness (microinches)	Substrate Material
1375	1.5	30	Nickel[b]
1376	3.0	60	Nickel
1377	6.0	120	Nickel
1378	17.0	350	Nickel

[b]The gold coating is electrodeposited on either an all nickel substrate about 15 mils thick or on a 2-mil thick nickel coating that has been electrodeposited on steel (AISI 1010). The nickel for either substrate is electrodeposited from a Watts nickel plating solution and buffed prior to the gold plating.

	(Sets of Two Standards Mounted on One Card)
1384	One each of 1375 and 1376
1385	One each of 1376 and 1377
1386	One each of 1377 and 1378
	(Sets of Four Standards Mounted on One Card)
1399	One each of 1375, 1376, 1377 and 1378

4.2. Density Standards

These standard reference materials are certified with respect to values of density, for air-saturated material at 1 atm , at 20, 25, and 30 °C, to ± 0.00002 g/ml. These standards may be used to calibrate picnometers, and density balances. A certificate is supplied with each of these samples. SRM 217b-8S is contained in a special ampoule with an internal breakoff tip, the others are sealed "in vacuum" in plain glass ampoules.

SRM Nos.	Name	Approx.d^{20}	Amount, ml
217b-5	2,2,4-Trimethylpentane	0.6918	5
217b-8S	2,2,4-Trimethylpentane	.6918	8
217b-25	2,2,4-Trimethylpentane	.6918	25
217b-50	2,2,4-Trimethylpentane	.6918	50

4.3. Glass Spheres for Particle Size

See Section 5.3.1., page 60.

4.4. Glass Viscosity Standards

Standard reference materials 710, 711, and 717 are furnished as rectangular-shaped bars, and are certified for viscosity between values of 10_2 and 10_{12} poises. They are furnished to check the performance of high-temperature viscosity equipment (rotating cylinders) and low-temperature viscosity equipment (fiber elongation). In addition, values are furnished for the softening point, annealing point, and strain point by ASTM Designations (C388-61 and C336-61). Certificates of data from 8 laboratories are furnished for these two glasses.

Standards 712, 713, 714, 715, and 716 are furnished in cone, gobs, or patties as listed, and are certified only for softening point, annealing point, and strain point. Certificates of data from three laboratories are furnished for these glasses.

SRM Nos.	Name	Unit of Issue
710	Soda-lime silica glass-type 523/586	2 lb
711	Lead-silica glass-type 617/366	3 lb
712	Mixed alkali lead silicate glass, 1/4 in patties (6 pcs.)	0.5 lb
713	Dense barium crown 620/603 glass, 1 3/8 in diam × 5/8 in thick gobs (4 pcs.)	.5 lb
714	Alkaline earth alumina silicate glass, 1/4 in diam cane (16 pcs–6 in long)	.5 lb
715	Alkali-free aluminosilicate glass, 1/4 in diam cane (13 pcs–6 in long)	200 g
716	Neutral (borosilicate) glass, 1/2 in diam cane (6 pcs–6 in long)	250 g
717	Borosilicate glass, 4.2 cm × 4.2 cm × 12.5 cm bar	500 g

SRM Nos.	Viscosity (Poises at Indicated Temperature (° C)											Softening Point °C	Annealing Point °C	Strain Point °C
	10^2	10^3	10^4	10^5	10^6	10^7	10^8	10^9	10^{10}	10^{11}	10^{12}			
710	1434.3	1181.7	1019.0	905.3	821.5	757.1	706.1	664.7	630.4	601.5	576.9	724	546	504
711	1327.1	1072.8	909.0	794.7	710.4	645.6	594.3	552.7	518.2	489.2	464.5	602	432	392
712	----	----	----	----	----	----	----	----	----	----	----	528	386	352
713	----	----	----	----	----	----	----	----	----	----	----	738	631	599
714	----	----	----	----	----	----	----	----	----	----	----	908	710	662
715	----	----	----	----	----	----	----	----	----	----	----	961	764	714
716	----	----	----	----	----	----	----	----	----	----	----	794	574	530
717	1545.1	1248.8	1059.4	927.9	831.2	757.1	698.6	651.1	611.9	579.0	550.9	720	516	471

4.5. Polystyrene Molecular Weight Standards

Two samples of polystyrene are available for use in calibrating non-absolute techniques of measuring the number-average (M_n) and weight-average (M_w) molecular weights. Also these polymeric samples can be used for determining the feasibility of some fractionating techniques since the ratios of the M_n, M_w, and Z-average molecular weight are also given. The intrinsic viscosities at a high rate of shear both in benzene and cyclohexane are also stated.

In addition, these samples represent highly purified polystyrene samples for polymeric research requiring the following chemical characteristics:

Standard 705 has a relatively narrow molecular weight distribution with a M_w 1.8×10^5. The sample was prepared by the polymerization of styrene in benzene using butyl lithium as an initiator. Ash content and volatiles are 0.05 and 0.5 percent, respectively. The polystyrene is in pellet form, each pellet weighing about 10 mg.

Standard 706 has a reasonably broad molecular weight distribution, the ratio M_w/M_n being 2.1, and an M_w of 2.7×10^5. The sample was prepared by the thermal polymerization of styrene at 140 °C to 37 percent conversion. Ash content and volatile content are 0.001 percent and 0.8 percent respectively. The polystyrene is in pellet form, each pellet weighing about 80 mg.

SRM Nos.	Description	Wt/Unit (grams)
705	Polystyrene, narrow molecular weight distribution	2
706	Polystyrene, broad molecular weight distribution	18

Heat Standards

These standard reference materials are intended to relate heat and temperature measurements made in industrial, university and government laboratories with the International Practical Temperature Scale[1] and with units of work associated with the mechanical equivalent of heat.

[1] International Practical Temperature Scale of 1968, Metrologia, 5, 35-44 (1969).

4.21. Freezing-Point Standards

4.21.1. Defining fixed points – International Practical Temperature Scale

These standard reference materials are of such purity that they are suitable for defining fixed points for the International Practical Temperature Scale of 1968.[1]

[1] "Concept of a National Measurement System," Science 158, 67-71 (1967).

SRM Nos.	Kind	Value assigned to defining fixed point °C (IPTS-1968)	Wt/Unit (grams)
740	Zinc	419.58	350

4.21.2. Secondary Reference Points

These standard reference materials are intended for use in calibration of thermometers, thermocouples, and other temperature measuring devices. The temperatures certified are in accord with the International Practical Temperature Scale of 1968.

These are intended for the calibration of resistance thermometers and thermocouples.

SRM Nos.	Name	Determined freezing point °C (IPTS-1948)	Wt/Unit (grams)
44e	Aluminum	660.0	200
45d	Copper	1083.3	450
49e	Lead	327.417	600
42f	Tin	231.88	350

4.22. Calorimetric Standards

These standard reference materials 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 National Measurement System. This System uses the units prescribed by the International System of Units (SI).[1] The unit for energy and work under this system is the joule, which is related to the historically defined calorie by the equation: 4.184 joule = 1 calorie.

[1]NBS Handbook 102 "ASTM Metric Practice Guide," Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20604. Price 40 cents.

4.22.1. Combustion Calorimetric Standards

These standards are issued primarily to check the performance of calorimetric methods for the determination of the heat of combustion. Standard Reference Material 217b-8S is contained in a special ampoule with an internal break-off tip, the others are sealed "in vacuum" in a plain glass ampoule.

SRM Nos.	Name	Unit Amount
39i	Benzoic acid, 26.434 absolute kilojoules/gram	30 g
217b-5	2,2,4-Trimethylpentane, 47.713 absolute kilojoules/gram	5 ml
217b-8S	2,2,4-Trimethylpentane	8 ml
217b-25	2,2,4-Trimethylpentane	25 ml
217b-50	2,2,4-Trimethylpentane	50 ml
1651	Zirconium-barium chromate heat source powder (ca 350 cal/g)	50 g
1652	Zirconium-barium chromate heat source powder (ca 390 cal/g)	50 g
1653	Zirconium-barium chromate heat source powder (ca 425 cal/g)	50 g

4.22.2. Solution Calorimetric Standards

This standard is issued primarily to check the performance of calorimetric methods used for the determination of heats of solution and heats of reactions in solution.

SRM Nos.	Name	Unit Amount
724	Tris(hydroxymethyl)aminomethane	50 g

4.22.3. Heat Source Calorimetric Standards

These standards are intended primarily for the calibration of calorimeters used to determine the change of energy or work with changes of temperature and changes in physical state.

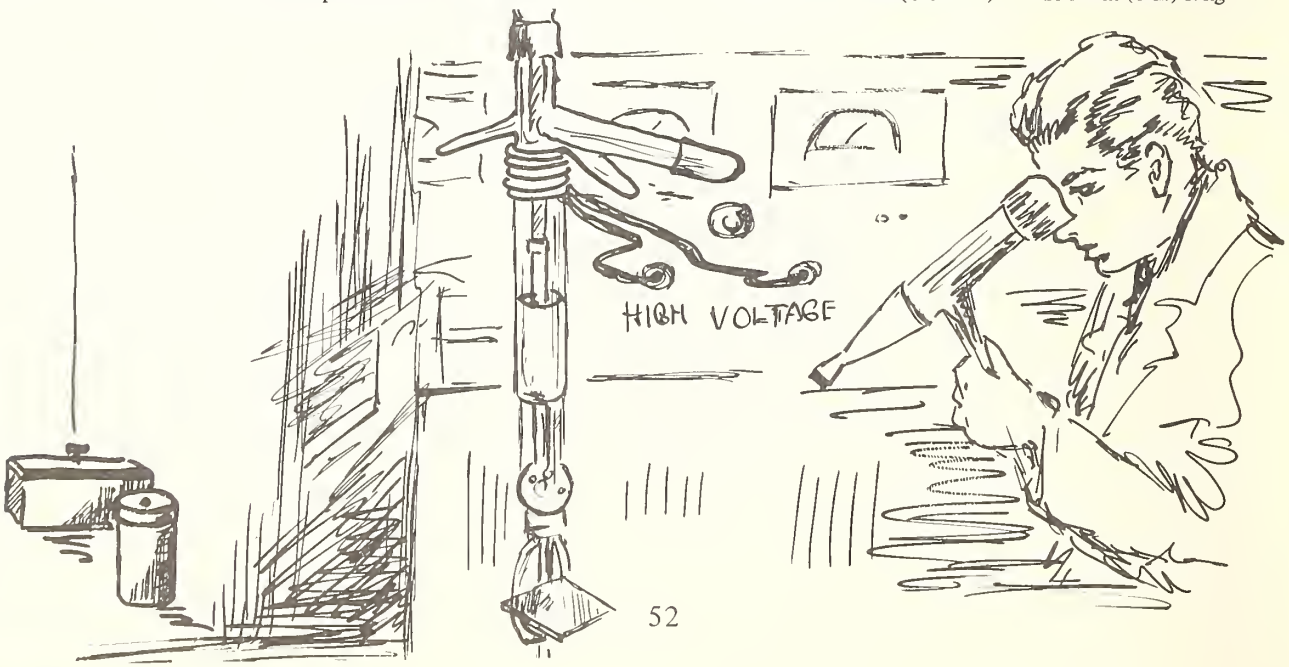
4.23. Vapor Pressure Standards

These materials are intended for use in the testing and calibration of vapor pressure measurement apparatus and techniques. The materials ultimately will include gold, cadmium, platinum, silver and tungsten, and will cover a temperature range of 600 to 3,000 °K.

4.23.1. Gold

The vapor pressure of high-purity gold SRM 745 has been accurately determined over the pressure range 10.3 to 10.8 atm and over the temperature range 1300 to 2100 °K. SRM 745 should be of particular interest to laboratories making high-temperature vapor pressure measurements using the Knudsen, torque Knudsen, or mass spectrometric techniques.

SRM Nos.	Description	Unit Size
745	Gold-Vapor Pressure Standard	Wire 1.44 mm (0.055 in) D x 152 mm (6 in) long



4.41. Color Standards for Spectrophotometer–Tristimulus Integrator Systems

This set of 5 transparent colored glass standards is available to check the performance of spectrophotometer-tristimulus integrator systems, the automatic recording and computing devices used in routine color measurements. The set consists of five 2-inch (5 cm) square glass filters (approximately 3.0 mm thick) with polished faces. A chart of tristimulus values for CIE sources A, B, and C, representing incandescent-lamp light, noon sunlight, and average daylight; and a detailed report on the changes in tristimulus values caused by errors in the 100-percent and zero adjustments of the photometric scale, wavelength errors, slit-width errors, errors due to stray energy, and inertia errors of the recording mechanisms are furnished with each set of glasses. Through the use of these standards the user of a spectrophotometer-integrator combination will be able not only to determine when the instrument goes out of adjustment, but also from the pattern of the discrepancies between measured and reported tristimulus values, to obtain some clue as to the type of maladjustment.

The glasses are available only in sets of five.

SRM Nos.	Name	Unit Size
2101	Orange-red glass	Supplied only as a set - one each of 5 filters
2102	Signal yellow glass	
2103	Sextant green glass	
2104	Cobalt blue glass	
2105	Selective neutral glass	

4.42. Phosphors

These materials are issued without certification. They are issued so that those interested in developing methods of measurement for phosphor materials can work on a common source of materials. Technical Note 417, "Spectral Emission Properties of NBS Standard Phosphor Samples Under Photo-Excition," which may be purchased from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, price 25 cents, provides detailed information on these materials.

SRM Nos.	Name	Wt/Unit (grams)
1020	Zinc sulfide phosphor	14
1021	Zinc silicate phosphor	28
1022	Zinc sulfide phosphor	14
1023	Zinc-cadmium sulfide phosphor (Ag activator)	14
1024	Zinc-cadmium sulfide phosphor (Cu activator)	14
1025	Zinc phosphate phosphor	28
1026	Calcium tungstate phosphor	28
1027	Magnesium tungstate phosphor	28
1028	Zinc silicate phosphor	28
1029	Calcium silicate phosphor	14
1030	Magnesium arsenate phosphor	28
1031	Calcium halophosphate phosphor	28
1032	Barium silicate phosphor	28
1033	Calcium phosphate phosphor	28

4.43. Thermal Emittance Standards

Standards of normal spectral emittance are available in three materials, platinum-13 percent rhodium alloy having low emittance, sandblasted and oxidized Kanthal (an iron-chromium-aluminum alloy) having intermediate emittance, and sandblasted and oxidized Inconel (a nickel-chromium-iron alloy) having high emittance. Standards of all three materials have been calibrated for normal spectral emittance at 800 and 1100 K; the Kanthal and Inconel standards at 1300 K and the platinum-13 percent rhodium at 1400 and 1600 K. Normal spectral emittance data is supplied at 156 wavelengths in the one to fifteen micron range for all the combinations listed above. In addition, data for the platinum-13 percent rhodium standards is supplied in the fifteen to thirty-five micron range at 1100 K.

SRM Nos.	Name	Unit Size
1402	Emittance standards	1/2 in disks Pt-13% Rh
1403	Emittance standards	7/8 in disks Pt-13% Rh
1404	Emittance standards	1 in disks Pt-13% Rh
1405	Emittance standards	1 1/8 in disks Pt-13% Rh
1406	Emittance standards	1 1/4 in disks Pt-13% Rh
1407	Emittance standards	2 in x 2 in squares Pt-13% Rh
1408	Emittance standards	1 in x 10 in strips Pt-13% Rh
1409	Emittance standards	3/4 in x 10 in strips Pt-13% Rh
1420	Emittance standards	1/2 in disks Kanthal
1421	Emittance standards	7/8 in disks Kanthal
1422	Emittance standards	1 in disks Kanthal
1423	Emittance standards	1 1/8 in disks Kanthal
1424	Emittance standards	1 1/4 in disks Kanthal
1425	Emittance standards	2 in x 2 in squares Kanthal
1427	Emittance standards	3/4 in x 10 in strips Kanthal
1428	Emittance standards	1/4 in x 8 in strips Kanthal
1440	Emittance standards	1/2 in disks Inconel
1441	Emittance standards	7/8 in disks Inconel
1442	Emittance standards	1 in disks Inconel
1443	Emittance standards	1 1/8 in disks Inconel
1444	Emittance standards	1 1/4 in disks Inconel
1445	Emittance standards	2 in x 2 in squares Inconel

4.44. Refractive Index Standards

These standard reference materials are certified for refractive index for each of seven wavelengths (helium 668 and 502, hydrogen 656(C) and 486(F), mercury 546(e) and 436(g), and sodium 589(D_1,D_2) at 20, 25, and 30 °C to ±0.00002. A certificate is supplied with each of these samples. 217b-8S is contained in a special ampoule with an internal breakoff tip, the others are sealed "in vacuum" in plain glass ampoules.

SRM Nos.	Name	Approx. n_D^{20}	Quantity (ml)
217b-5	2,2,4-Trimethylpentane	1.3915	5
217b-8S	2,2,4-Trimethylpentane	1.3915	8
217b-25	2,2,4-Trimethylpentane	1.3915	25
217b-50	2,2,4-Trimethylpentane	1.3915	50

These standards are also certified for density. For details see Section 4.2.

4.51. Radioactivity Standards

Because of the nature of these materials, all, except the carbon-14 dating standard, are shipped only by express or air freight (shipping charges collect).

A certificate containing pertinent information is sent under separate cover. Information concerning the standard appears on the standard or container.

4.51.1. Alpha Standards

These samples consist of a practically weightless deposit of the nuclide on a thin platinum foil 1.27-cm in diameter, which is cemented onto a monel disk 2.54-cm in diameter and 0.16-cm thick. Those samples marked with an asterisk can only be distributed to those who hold specific Byproduct Material, Source Material or Special Nuclear Material licenses from the AEC, and a copy of the license must be on file at the National Bureau of Standards before orders can be filled.

SRM Nos.	Radionuclide	Nominal Activity at Time of Calibration (Month, Year)
4906	Plutonium-238	1.4×10^3 to 3.4×10^4 nt/s (4/69)

4.51.2. Beta-Ray and Gamma-Ray Gas Standards

These samples contain Krypton-85 in inactive krypton at a pressure of about one atmosphere in a glass break-seal ampoule. The activity is such that a copy of the purchasers current Byproduct Material License as required by the Atomic Energy Act of 1954 is required.

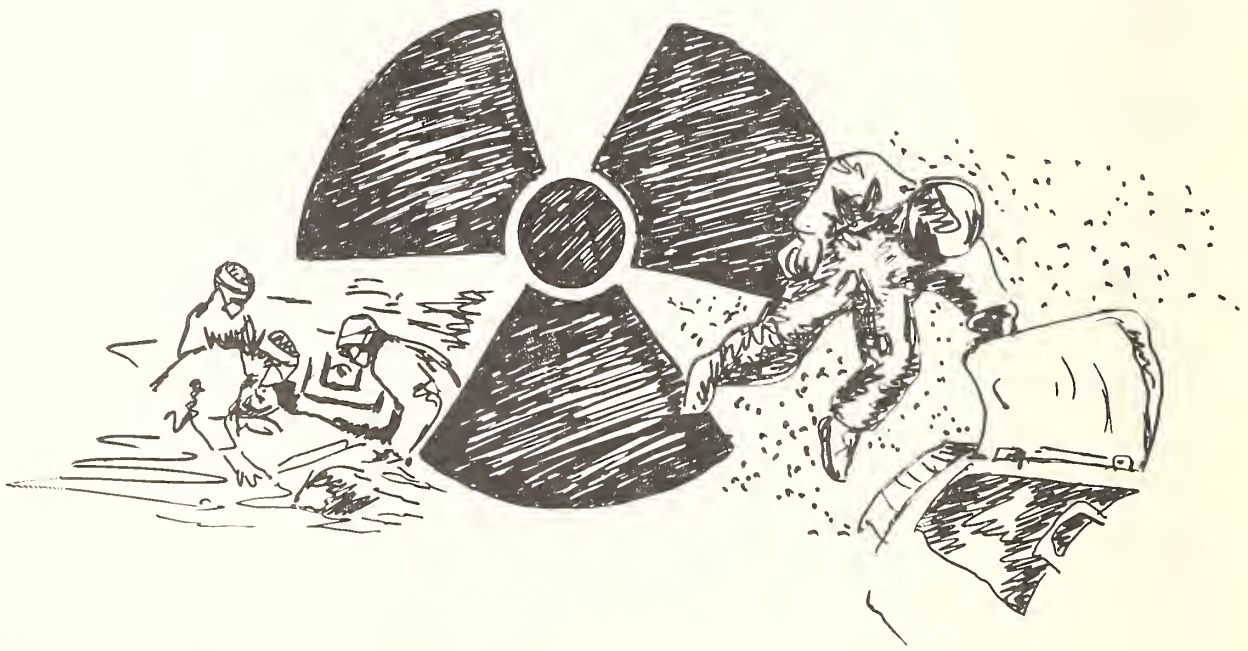
SRM Nos.	Radionuclide	Calibration Radiation	Approximate Activity or Emission Rate at Time of Calibration (Month, Year)	Approx. Volume
4935-C	Krypton-85	β^-	7×10^7 nt/s per mole (7/69)	10 ml
*4235	Krypton-85	γ	1×10^7 nt/s (9/69)	3 ml

4.51.3. Beta-Ray, Gamma-Ray, and Electron-Capture Solution Standards

These standard reference materials are contained in flame-sealed ampoules. The calibration radiation listed is the radiation for which the radionuclide is intended to be used as a standard.

Those samples with the identification number marked by an asterisk require a copy of the purchaser's current AEC Byproduct Material License as required by the Atomic Energy Act of 1954. Total activity of the other samples is such that they may be ordered singly under the general licensing provisions.

SRM Nos.	Radionuclide	Calibration Radiation	Approximate Activity or Emission Rate at Time of Calibration (Month, Year)	Approximate Weight of Solution (grams)
4921-C	Sodium-22	β^+	1×10^4 β^+/s/g (8/64)	3
4922-E	Sodium-22	γ	2×10^5 β^+/s/g (3/67)	5
4924	Carbon-14 (Water)	β^-	1×10^3 d/s/g (7/58)	25
4925	Carbon-14 (benzoic acid in toluene)	β^-	2×10^4 d/s/g (7/58)	3
4926	Hydrogen-3 (Water)	β^-	9×10^3 d/s/g (9/61)	25
4927	Hydrogen-3 (Water)	β^-	9×10^5 d/s/g (9/61)	3
4929-B	Iron-55	X	2×10^4 d/s/g (5/64)	3
4940-B	Promethium-147	β^-	5×10^4 d/s/g (11/67)	3
4941-C	Cobalt-57	γ	3×10^5 nt/s/g (3/69)	5
4943	Chlorine-36	β^-	1×10^4 β7s/g (1962)	3
4947	Hydrogen-3 (Tritiated toluene)	β^-	3×10^5 d/s/g (2/64)	4
4948	Cerium-Praseodymium-144	β^-	2×10^5 d/s/g (12/65)	3.3
4222	Carbon-14 (n-hexadecane)	β^-	4×10^4 d/s/g (6/67)	3
4223	Carbon-14 (n-hexadecane)	β^-	4×10^3 d/s/g (6/67)	3
4224	Carbon-14 (n-hexadecane)	β^-	4×10^2 d/s/g (6/67)	3
4225	Tin-113-Indium-113m	γ	1×10^5 γ/s/g (4/68)	5
*4226	Nickel-63	β^-	1.5×10^6 nt/s/g (5/68)	4



4.51.4. Point-Source Gamma-Ray Standards

This group of standard reference materials is usually prepared by depositing the activity between two layers of polyester tape approximately 0.006-cm thick and mounted on aluminum annuli, 0.8-cm wide and 5.5-cm outside diameter. The thorium standards are between gold foil which is sandwiched between two double layers of polyurethane-film tape.

Those samples with the identification number marked by an asterisk require a copy of the purchaser's current Byproduct Material License as required by the Atomic Energy Act of 1954. The total activity of the other samples is such that they may be ordered singly under the general licensing provisions.

SRM Nos.	Radionuclide	Approximate Emission Rate at Time of Calibration (Month, Year)
4991-C	Sodium-22	6×10^4 - 1.28-MeV γ/s (4/69)
4995-C	Mercury-203	1.5×10^5 γ/s (6/69)
4996-B	Sodium-22	3×10^5 - 1.28-MeV γ/s (6/69)
4997-D	Manganese-54	5×10^4 γ/s (6/66)
4998-E	Yttrium-88	1×10^5 - 1.84-MeV γ/s (5/69)
4999-D	Cerium-139	2×10^5 γ/s (7/67)
4200-B	Cesium-137	6×10^4 γ/s (12/68)
4202	Cadmium-109	1×10^5 γ/s (12/67)
4203-A	Cobalt-60	3×10^5 γ/s (8/66)
*4203-B	Cobalt-60	7×10^5 γ/s (8/66)
4205	Thorium-228	2×10^4 - 2.615-MeV γ/s (8/68)
4206	Thorium-228	2×10^5 - 2.615-MeV γ/s (8/68)
*4207	Cesium-137	4×10^5 γ/s (12/68)
4208	Mercury-203	6×10^5 γ/s (6/69)
4209	Yttrium-88	4×10^5 - 1.84-MeV γ/s (5/69)
*4210	Cobalt-60	2×10^6 γ/s (4/69)

4.51.5. Radium Solution Standards (for Radon Analysis)

These samples are contained in flame-sealed glass ampoules.

SRM Nos.	Nominal Radium Content (in micrograms)	Approximate weight, grams
4955	0.1	5
4956	0.2	5
4957	0.5	5
4958	1.0	5
4959	2.0	5
4960	10	5
4961	10	5
4962	20	5
4963	50	5
4964-B	102	5

4.51.6. Radium Gamma-Ray Solution Standards (Recalibrated as of September 1967)

These samples are contained in flame-sealed glass ampoules.

SRM Nos.	Radium Content (in grams)	Approximate weight, grams
4950-B	10^{-9}	20
4951	10^{-11}	100
4952-A	Blank solution	100
4953	10^{-8}	20

4.51.7. Contemporary Standard for Carbon-14 Dating Laboratories

SRM No.	Description
4990-B	1 lb of oxalic acid; no specific activity is given NOTE: These samples are shipped parcel post, prepaid to domestic and overseas purchasers.

4.86. Mossbauer Standards

This standard reference material is intended to furnish a base (zero) point for Mossbauer spectrometry. It is furnished as a platelet 1 cm × 1 cm × 0.0775 cm cut from a single crystal of sodium nitroprusside along the 100 crystal plane. The natural iron concentration is 25.0 mg/cm^2 ± 4 percent. This standard reference material has an average value for the chemical shift of 0.0000 ± 0.0002 cm/sec, and an average value for the electric quadrupole splitting of 0.1726 ± 0.0002 cm/sec at 25 °C.

SRM No.	Name
725	Mossbauer Differential Chemical Shift for Iron-57 (Sodium Nitroprusside)

5. Engineering Type Standards

These standard reference materials are intended to relate measurements used for production or quality control data to a central point of reference. The values certified for these materials are in some cases empirical and do not necessarily relate to the National Measurement System.

5.1. Standard Rubbers and Rubber-Compounding Materials

These standard reference materials 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 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 since the properties of different lots are not the same. Replacement lots of rubber-compounding materials impart essentially the same characteristics to rubber vulcanizates so that certificates are not issued for these materials.

5.1.1. Standard Rubbers

SRM Nos.	Name	Wt/Unit (grams)
385b	Natural	34,000
386g	Styrene-butadiene, type 1500	34,000
388e	Butyl	34,000
389	Styrene-butadiene, type 1503	34,000
391	Acrylonitrile-butadiene	25,000

5.1.2. Rubber Compounding Materials

SRM Nos.	Name	Wt/Unit (grams)
370d	Zinc oxide	8,000
371f	Sulfur	6,000
372g	Stearic acid	3,200
373e	Benzothiazyl disulfide	2,000
375f	Channel Black	28,000
376a	Light magnesia	450
377	Phenyl-beta-naphthylamine	600
378a	Oil furnace black	28,000
379	Conducting black	5,500
380	Calcium carbonate	6,000
381	Calcium silicate	4,000
382a	Gas furnace black	40,000
383	Mercaptobenzothiazole	3,200
384	N-tertiary-Butyl-2-benzo-thiazolesulfenamide	3,200

5.2. Electric and Magnetic Standards

5.2.1. Reference Magnetic Tapes

These reference magnetic tapes are intended for use in evaluating the performance of magnetic computer tapes and maintaining control over their production.

SRM Nos.	Name	Unit of Issue
3200	Secondary standard magnetic tape—computer amplitude reference	Reel

5.3. Sizing Standards

5.3.1. Glass Spheres for Particle Size

SRM Nos.	Name	Wt/Unit (grams)
1003	Calibrated glass spheres (5-30 micron)	40-45
1019	Calibrated glass spheres (for calibrating sieves No. 8-18)	100

5.3.2. Turbidimetric and Fineness Standard

This standard reference material 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 ten units. Each unit consists of two sealed vials, each containing approximately 10 grams of cement. This standard is supplied only in sets of ten units or multiples thereof.

SRM Nos.	Kind	Certification		Unit of Issue
114L	Turbidity and fineness standard, cement .	Residue on No. 325 sieve, bronze cloth, wet method	6.8 percent	Set of ten units (20 vials)
		Residue on No. 325 sieve, electroformed sheet (44.0 μm), wet method	12.2 percent	
		Surface area (Wagner turbidimeter)	1820 cm^2/g	
		Surface area (Air-permeability)	3380 cm^2/g	
		Mean particle diameter (Air-permeability)	5.64 μm	

5.4. Color Standards

5.4.1. The ISCC-NBS Centroid Color Charts

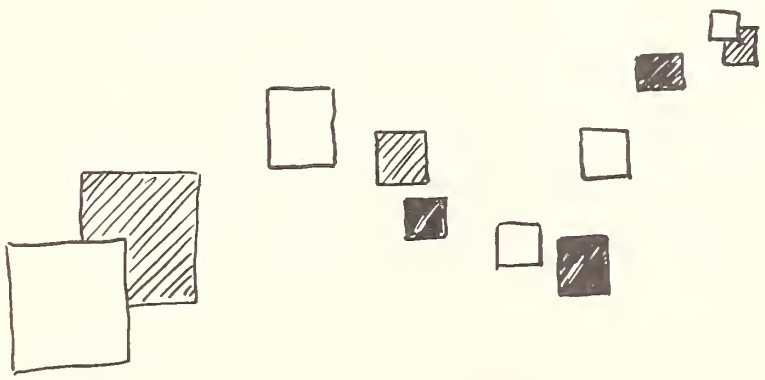
The ISCC-NBS centroid colors are available to illustrate a characteristic color for each of the ISCC-NBS color-name blocks in the Color Names Dictionary, NBS Circular 553. The Color Names Dictionary, NBS Circular 553, "The ISCC-NBS Method of Designating Colors and a Dictionary of Color Names" may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, price $2. The color chart set, along with the table containing the history of the color-names project, the centroid number and the Munsell renotation of each of the 251 color chips included, constitutes the Supplement of the Color Names Dictionary. Each chart set contains 18 constant-hue centroid color charts. These centroid colors represent a systematic sampling of the whole color solid, each color of which has been carefully measured. Each centroid color has its own specification and can be used as a color standard. The centroid color charts can also be used for approximate color specifications wherever the ISCC-NBS color designations are applicable, for statistical studies of trends in industrial color usage, or for planning lines of merchandise intended to have coordinated colors.

SRM Nos.	Name	Unit of Issue
2106	Centroid color charts	Set of 18 charts

5.4.2. Standard Colors for Kitchen and Bathroom Accessories

These commercial standards establish certain colors having the greatest general acceptance. They provide references whereby manufacturers can produce, and buyers can stock, items of colored kitchen and bathroom accessories with assurance that the purchaser can obtain from different sources and at different times, materials that will match one another in color.

SRM Nos.	Name	Unit of Issue
1000	Enameled iron plaques, 3 by 5 inches, in accordance with Commercial Standards CS62-38 and CS63-38.	Set of 10



5.4.3. Paint Pigment Standards for Color and Tinting Strength

Material standards are the most practical means of designating color, tinting strength, and character of tint of paint pigments. The present series of color pigment standards has been developed for that purpose. Reference is made to these standard materials in the Federal Specifications for pigments. Methods of making the required color comparisons between standard and the delivered product are set forth in detail in the certificate supplied with each sample. The procedures given are similar to those covered by Methods 4220 and 4221 of Federal Standard 141 and by ASTM Designation D387-60.

SRM Nos.	Name	Wt/Unit (grams)	SRM Nos.	Name	Wt/Unit (grams)
300	Toluidine red toner	40	315	Yellow iron oxide, lemon	20
301	Yellow ocher	45	316	Yellow iron oxide, orange	25
302	Raw sienna	45	317	Yellow iron oxide, dark orange	40
303	Burnt sienna	50	318	Lampblack	15
304	Raw umber	45	319	Primrose chrome yellow	65
305	Burnt umber	50	320	Lemon chrome yellow	60
306	Venetian red	60	321	Medium chrome yellow	65
307	Metallic brown	60	322	Light chrome orange	100
308	Indian red	50	323	Dark chrome orange	100
309	Mineral red	65	324	Ultramarine blue	35
310	Bright red oxide	50	325	Iron blue	25
311	Carbon black (high color)	10	326	Light chrome green	60
312	Carbon black (all-purpose)	20	327	Medium chrome green	50
313	Black iron oxide	42	328	Dark chrome green	45
314	Yellow iron oxide, light lemon	20			

5.4.4. Phosphors

A series of 14 phosphors are available, without certification, to provide a common source of materials for persons working with methods for measurement of phosphor materials.

Details are given in Section 4.42.

5.4.5. Light-Sensitive Papers and Plastic Chips

5.4.5.1. Light-Sensitive Papers

Standard light-sensitive paper and booklets of standard faded strips of this paper are available for use in standardizing the dosage of radiant energy when testing textiles for color fastness by exposure in commercial carbon-arc fading lamps. The paper is distributed in units of 100 pieces 2 5/8 by 3 1/4 in. The booklets contain six strips of the paper 1 1/4 in wide that have been faded by exposure in the NBS master lamp. A copy of NBS Misc. Publ. 260-15, which describes the preparation and use of the materials, is furnished with each booklet.

SRM Nos.	Name	Unit of Issue
700b	Light-sensitive paper	Pkg. of 100 pieces - 2 5/8 in x 3 1/4 in
701b	Standard faded strips	Booklet - 6 strips 1 1/4 in wide

5.4.5.2. Light-Sensitive Plastic Chips

Standard light-sensitive plastic chips are available for use in calibration and standardization of artificial weathering and fading apparatus. These chips are distributed in two thicknesses (0.060 and 0.124 in) in units of five plates 2 in by 4 1/8 in, and have been standardized by the measurement of the change of transmittance as a function of exposure (in standard fading hours) to the NBS master lamps.

SRM Nos.	Name	Unit of Issue
702	Light-sensitive plastic chips . .	Package of 5 chips 0.124 in thick
703	Light-sensitive plastic chips . .	Package of 5 chips 0.060 in thick

5.50. Miscellaneous Standards

5.50.1. Microcopy Resolution Test Charts

These charts are used to test the resolving power of cameras or of whole microcopying systems. They are printed photographically on paper, and have 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 Nos.	Name	Unit of Issue
1010a	Microcopy resolution test charts	Set of 5 charts

5.50.2. Surface Flammability Standard

This standard is issued for checking the operation of radiant panel test equipment in accordance with the procedures outlined in ASTM Standard E162-67. Flame spread Index, $I_S = 210$; Heat Evolution Factor, $Q = 46.8$.

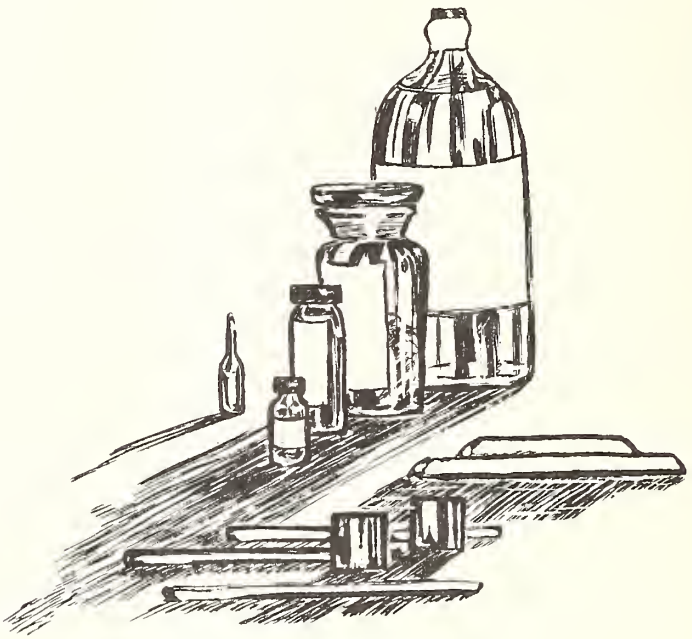
SRM Nos.	Name	Unit of Issue
1002b	Hardboard sheet	4 specimens, 6 x 18 inches

5.50.3. Internal Tearing Resistance Standard Paper

This standard is available for calibration of instruments used for the determination of the internal tearing resistance of paper according to methods ASTM Designation D689 and TAPPI Standard T414. Sufficient material is furnished in each unit to provide 40 or more measurements. Initial distribution is in a set of twelve packages, one package shipped at approximately monthly intervals. Packages are also available on a four month cycle. The tearing strength value of the material is approximately 40 g. The exact value will be given in the certificate accompanying the standard.

This standard is sold only on a subscription basis in sets of four packages or multiples thereof.

SRM Nos.	Name	Unit of Issue
704a	Internal tearing resistance paper	Sets of 4 packages



U. S. Department of Commerce
Maurice H. Stans
Secretary

National Bureau of Standards
L. M. Branscomb, Director

Certificate of Analysis

STANDARD REFERENCE MATERIAL 122e

Cast Iron Car Wheel

ANALYSTS	C		Mn	P	S	Si	Cu	Ni	Cr	V	Mo	Ti	N	As
	Total	Graphitic	Persulfate-arsenite		Combustion-Iodate	Perchloric acid dehydration	Photometric				Photometric	Photometric	Distillation-titration	
1	3.50	2.78	0.527	0.347[a]	0.073	0.511[b]	0.034[c]	0.078[d]	0.038[e]	0.032[f]	0.001	0.026[g]	0.009	0.018[h]
2	3.52	2.77	.528	.351[i]	.074	.510	.032[j]	.082[k]	—	—	—	—	—	—
Average	3.51	2.78	0.528	0.349	0.074	0.510	0.033	0.080	—	—	—	—	—	—

[a] Molybdenum-blue photometric method.
[b] Double dehydration.
[c] Diethyldithiocarbamate photometric method.
[d] Dimethylglyoxime photometric method.
[e] Chromium separated from the bulk of the iron in a 10-g sample by hydrolytic precipitation with $NaHCO_3$. Persulfate oxidation and potentiometric titration with ferrous ammonium sulfate solution.
[f] Vanadium separated from the bulk of the iron by mercury cathode, oxidized with $KMnO_4$ and titrated potentiometrically with ferrous ammonium sulfate solution.
[g] Diantipyrylmethane photometric method.
[h] Activation analysis.
[i] Alkalimetric method.
[j] Neocuproine photometric method.
[k] Weighed as nickel dimethylglyoxime.

List of Analysts

1. J. R. Baldwin, B. B. Bendigo, S. A. Wicks, and B. A. Thompson, Analytical Chemistry Division, Institute for Materials Research, National Bureau of Standards.
2. R. N. Smith and R. E. Deas, American Cast Iron Pipe Company, Birmingham, Alabama.

The overall direction and coordination of the technical measurements leading to certification were performed under the chairmenship of O. Menis and J. I. Shultz.

The technical and support aspects involved in the preparation, certification and issuance of this Standard Reference Material were coordinated through the Office of Standard Reference Materials by R. E. Michaelis.

The iron for the preparation of this standard was furnished by the American Cast Iron Pipe Company, Birmingham, Alabama.

Washington, D. C. 20234
November 6, 1969

J. Paul Cali, Acting Chief
Office of Standard Reference Materials

APPENDIX II.

GUIDE FOR THE SUBMISSION OF REQUESTS FOR THE DEVELOPMENT OF NEW OR RENEWAL STANDARD REFERENCE MATERIALS

August 20, 1964
(June 1, 1970 - Revised)

INTRODUCTION

The National Bureau of Standards presently has available more than 650 standard reference materials. It is also working on the development of about 150 new ones and has on hand requests for the preparation of many others. The requests have always far exceeded the Bureau's capacity to produce and certify these materials.

POLICY

One of the main functions of the NBS Institute for Materials Research is to develop, produce, and distribute standard reference materials which provide a basis for comparison of measurements on materials and aid in the control of production processes in industry. To help carry out this function the Office of Standard Reference Materials evaluates the requirements of science and industry for carefully characterized reference materials, and directs their production and distribution. Emphasis is given to providing NBS Standard Reference Materials (a) where attainment of needed accuracy of analysis or accuracy of measurement of characteristics is not economically or technically feasible elsewhere, and where such accuracy is generally important to users, (b) where industry-wide standards for commerce are needed from a neutral supplier who is not otherwise available, and (c) where continuing availability of highly characterized material from a common source is important to science or industry.

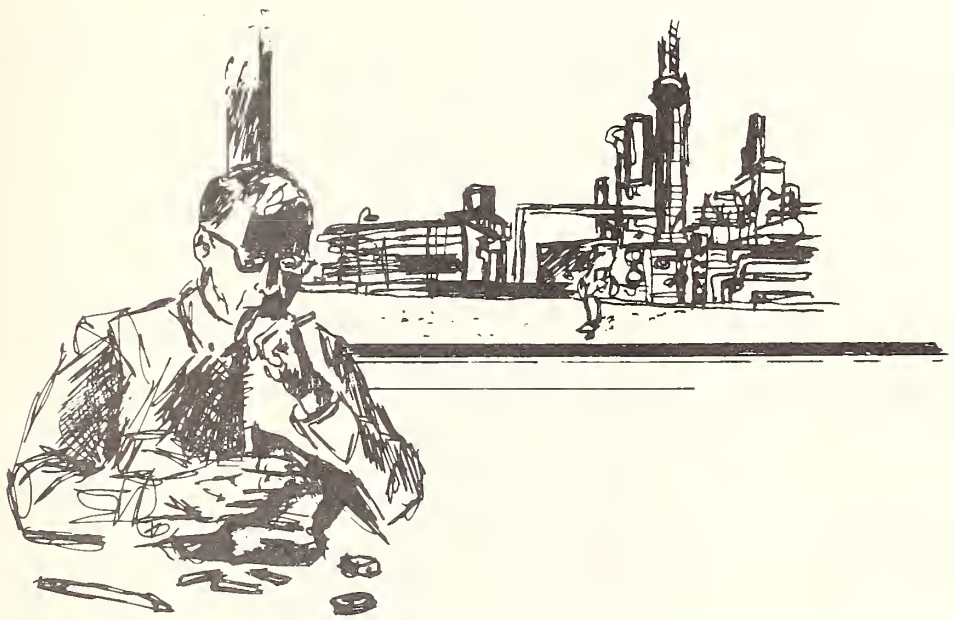
The National Bureau of Standards recognizes and has responded to the need for broadening the present program on reference materials to include all types of well-characterized materials that can be used to calibrate a measurement system or to produce scientific data that can be readily referred to a common base. With this broadening, however, it still remains apparent that the demand for new Standard Reference Materials will continue to far exceed the Bureau's capacity for development. Therefore, requests for new Standard Reference Materials which will have limited use and for which the need is not very great will have to be passed by in favor of requests clearly showing a critical need. For the purpose of determining which requests are to receive top priority, the National Bureau of Standards will need, and will rely heavily upon, the information supplied by industry, either through its own representatives or through interested committees, such as those of the American Society for Testing and Materials, the American National Standards Institute, the International Organization for Standardization, etc.

Accordingly, while the Bureau welcomes all requests for the development of new Standard Reference Materials, it will help both the Bureau, and industry as well, if requests are accompanied by such information as will permit an assessment of the urgency and importance of proposed new reference materials.

INFORMATION NEEDED

Those requesting the development of new Standard Reference Materials should supply as much as possible of the following information:

(1) Short title of Standard Reference Material.
(2) Purpose for which the new standard material is needed.
(3) Reasons why the new standard material is needed.
(4) Special characteristics and/or requirements for the material. Include additional requirements and reasons, if more than one standard material is necessary for standardization in this area.
(5) Your estimate of the possible present and future (10 year) demand for this new standard in your own operations and elsewhere.
(6) Whether this standard, or a similar standard, can be produced by, or obtained from a source other than the National Bureau of Standards. If so, give reasons to justify its preparation by NBS.
(7) Miscellaneous pertinent comments to aid justification for the new standard reference material, such as: (a) an estimate of the range of application, monetary significance, and scientific and/or technological significance including when feasible estimates of the impact upon industrial productivity or growth, and (b) supporting letters from industry leaders, trade organizations, interested committees and others.



INDEX

INDEX BY SRM NUMBER

SRM No.	Category No.	Page	SRM No.	Category No.	Page	SRM No.	Category No.	Page
379	5.1.2.	59	628	3.7.13.2.	29	837	3.2.4.	12
380	5.1.2.	59	629	3.7.13.2.	29	D837	3.2.4.	12
381	5.1.2.	59	630	3.7.13.2.	29	838	3.2.4.	12
382a	5.1.2.	59	631	3.7.13.2.	29	D838	3.2.4.	12
383	5.1.2.	59	641	3.7.11.	27	839	3.2.4.	12
384	5.1.2.	59	642	3.7.11.	27	D839	3.2.4.	12
385b	5.1.1.	59	643	3.7.11.	27	840	3.2.4.	12
386g	5.1.1.	59	644	3.7.11.	27	D840	3.2.4.	12
388e	5.1.1.	59	645	3.7.11.	27	841	3.2.4.	12
389	5.1.1.	59	646	3.7.11.	27	D841	3.2.4.	12
391	5.1.1.	59	654	3.7.11.	27	845	3.2.3.	10
404a	3.2.1.	6	671	3.6.6.1.	20	D845	3.2.3.	10
405a	3.2.1.	6	672	3.6.6.1.	20	846	3.2.3.	10
407a	3.2.1.	6	673	3.6.6.1.	20	D846	3.2.3.	10
408a	3.2.1.	6	680 L-1	3.8.2.	32	847	3.2.3.	10
409b	3.2.1.	6	680 L-2	3.8.2.	32	D847	3.2.3.	10
413	3.2.1.	6	681 L-1	3.8.2.	32	D848	3.2.3.	10
414	3.2.1.	6	681 L-2	3.8.2.	32	849	3.2.3.	10
417a	3.2.1.	6	682	3.8.2.	32	D849	3.2.3.	10
418	3.2.1.	6	683	3.8.2.	32	850	3.2.3.	10
420a	3.2.1.	6	685-R	3.8.2.	32	D850	3.2.3.	10
427	3.2.1.	6	685-W	3.8.2.	32	911	3.43.	35
432	3.7.10.	27	700b	5.4.5.1.	62	912	3.43.	35
436	3.2.4.	12	701b	5.4.5.1.	62	913	3.43.	35
437	3.2.4.	12	702	5.4.5.2.	63	914	3.43.	35
438	3.2.4.	12	703	5.4.5.2.	63	915	3.43.	35
439	3.2.4.	12	704a	5.50.3.	64	944	3.61.1.	43
440	3.2.4.	12	705	4.5.	50	948	3.61.1.	43
441	3.2.4.	12	706	4.5.	50	950a	3.41.	34
442	3.2.3.	10	710	4.4.	49	951	3.62.	34
443	3.2.3.	10	711	4.4.	49	952	3.62.	44
444	3.2.3.	10	712	4.4.	49	953	3.61.2.	44
445	3.2.3.	10	713	4.4.	49	975	3.62.	44
446	3.2.3.	10	714	4.4.	49	976	3.62.	44
447	3.2.3.	10	715	4.4.	49	977	3.62.	44
448	3.2.3.	10	716	4.4.	49	978	3.62.	44
449	3.2.3.	10	717	4.4.	49	979	3.62.	44
450	3.2.3.	10	724	4.22.2.	52	980	3.62.	44
461	3.2.2.	8	725	4.86.	58	981-3	3.62.	44
462	3.2.2.	8	726	3.6.10.	20	1000	5.4.2.	61
463	3.2.2.	8	727	3.62.	44	1002b	5.50.2.	63
464	3.2.2.	8	728	3.6.14.	22	1003	5.3.1.	60
465	3.2.2.	8	740	4.21.1.	50	1010a	5.50.1.	63
466	3.2.2.	8	745	4.23.1.	52	1011	3.55.	40
467	3.2.2.	8	803a	3.2.1.	6	1013	3.55.	40
468	3.2.2.	8	D803a	3.2.1.	6	1014	3.55.	40
480	3.8.3.	33	804a	3.2.1.	6	1015	3.55.	40
481	3.8.3.	33	805a	3.2.1.	6	1016	3.55.	40
482	3.8.3.	33	807a	3.2.1.	6	1019	5.3.1.	60
592	3.53.	37	808a	3.2.1.	6	1020	4.42.	53
593	3.53.	37	809b	3.2.1.	6	1021	4.42.	53
594	3.53.	37	D809b	3.2.1.	6	1022	4.42.	53
595	3.53.	37	810a	3.2.1.	6	1023	4.42.	53
596	3.53.	37	817a	3.2.1.	6	1024	4.42.	53
597	3.53.	37	820a	3.2.1.	6	1025	4.42.	53
598	3.53.	37	D820a	3.2.1.	6	1026	4.42.	53
599	3.53.	37	821	3.2.1.	6	1027	4.42.	53
625	3.7.13.2.	29	827	3.2.1.	6	1028	4.42.	53
626	3.7.13.2.	29	836	3.2.4.	12	1029	4.42.	53
627	3.7.13.2.	29	D836	3.2.4.	12	1030	4.42.	53

SRM No.	Category No.	Page	SRM No.	Category No.	Page	SRM No.	Category No.	Page
1031	4.42.	53	1115	3.7.2.	24	1315	4.1.1.	47
1032	4.42.	53	C1115	3.7.2.	24	1316	4.1.1.	47
1033	4.42.	53	1116	3.7.2.	24	1317	4.1.1.	47
1051b	3.44.	35	C1116	3.7.2.	24	1318	4.1.1.	47
1052b	3.44.	35	1117	3.7.2.	24	1319	4.1.1.	47
1053a	3.44.	35	C1117	3.7.2.	24	1320	4.1.1.	47
1055b	3.44.	35	1118	3.7.2.	24	1331	4.1.1.	47
1057b	3.44.	35	C1118	3.7.2.	24	1332	4.1.1.	47
1059b	3.44.	35	1119	3.7.2.	24	1333	4.1.1.	47
1060a	3.44.	35	C1119	3.7.2.	24	1334	4.1.1.	47
1061b	3.44.	35	1120	3.7.2.	24	1335	4.1.1.	47
1062a	3.44.	35	C1120	3.7.2.	24	1336	4.1.1.	47
1063a	3.44.	35	1121	3.7.2.	24	1337	4.1.1.	47
1064	3.44.	35	C1121	3.7.2.	24	1338	4.1.1.	47
1065b	3.44.	35	1122	3.7.2.	24	1339	4.1.1.	47
1066a	3.44.	35	C1122	3.7.2.	24	1341	4.1.1.	47
1069b	3.44.	35	1123	3.7.2.	24	1342	4.1.1.	47
1070a	3.44.	35	C1123	3.7.2.	24	1343	4.1.1.	47
1071a	3.44.	35	1131	3.7.4.	26	1344	4.1.1.	47
1073b	3.44.	35	1138	3.4.	16	1345	4.1.1.	47
1074a	3.44.	35	1139	3.4.	16	1346	4.1.1.	47
1075a	3.44.	35	1140	3.4.	16	1351	4.1.1.	48
1076	3.44.	35	1141	3.4.	16	1352	4.1.1.	48
1077a	3.44.	35	1142	3.4.	16	1353	4.1.1.	48
1078a	3.44.	35	1143	3.4.	16	1361	4.1.1.	48
1079a	3.44.	35	1144	3.4.	16	1362	4.1.1.	48
1080	3.44.	35	1147	3.4.	16	1363	4.1.1.	48
1090	3.2.7.	14	1148	3.4.	16	1364	4.1.1.	48
1091	3.2.7.	14	1149	3.4.	16	1365	4.1.1.	48
1093	3.2.7.	14	1152	3.2.3.	10	1366	4.1.1.	48
1094	3.2.7.	14	1154	3.2.3.	10	1367	4.1.1.	48
C1100	3.7.2.	24	1155	3.2.3.	10	1371	4.1.2.	48
1101	3.7.2.	24	1156	3.2.5.	12	1372	4.1.2.	48
C1101	3.7.2.	24	1159	3.7.5.	26	1373	4.1.2.	48
1102	3.7.2.	24	1160	3.7.5.	26	1374	4.1.2.	48
C1102	3.7.2.	24	1163	3.2.2.	8	1375	4.1.2.	48
1103	3.7.2.	24	1165	3.2.2.	8	1376	4.1.2.	48
C1103	3.7.2.	24	1166	3.2.2.	8	1377	4.1.2.	48
1104	3.7.2.	24	1167	3.2.2.	8	1378	4.1.2.	48
C1104	3.7.2.	24	1168	3.2.2.	8	1381	4.1.2.	48
1105	3.7.2.	24	1170	3.2.2.	8	1382	4.1.2.	48
C1105	3.7.2.	24	1174a	3.4.	16	1383	4.1.2.	48
1106	3.7.2.	24	1175a	3.4.	16	1384	4.1.2.	48
C1106	3.7.2.	24	1185	3.2.3.	10	1385	4.1.2.	48
1107	3.7.2.	24	1194	3.2.6.	10	1386	4.1.2.	48
C1107	3.7.2.	24	1210	3.7.14.	29	1398	4.1.2.	48
1108	3.7.2.	24	1301	4.1.1.	47	1399	4.1.2.	48
C1108	3.7.2.	24	1302	4.1.1.	47	1402	4.43.	54
1109	3.7.2.	24	1303	4.1.1.	47	1403	4.43.	54
C1109	3.7.2.	24	1304	4.1.1.	47	1404	4.43.	54
1110	3.7.2.	24	1305	4.1.1.	47	1405	4.43.	54
C1110	3.7.2.	24	1306	4.1.1.	47	1406	4.43.	54
1111	3.7.2.	24	1307	4.1.1.	47	1407	4.43.	54
C1111	3.7.2.	24	1308	4.1.1.	47	1408	4.43.	54
1112	3.7.2.	24	1309	4.1.1.	47	1409	4.43.	54
C1112	3.7.2.	24	1310	4.1.1.	47	1420	4.43.	54
1113	3.7.2.	24	1311	4.1.1.	47	1421	4.43.	54
C1113	3.7.2.	24	1312	4.1.1.	47	1422	4.43.	54
1114	3.7.2.	24	1313	4.1.1.	47	1423	4.43.	54
C1114	3.7.2.	24	1314	4.1.1.	47	1424	4.43.	54

SRM No.	Category No.	Page
1425	4.43.	54
1427	4.43.	54
1428	4.43.	54
1440	4.43.	54
1441	4.43.	54
1442	4.43.	54
1443	4.43.	54
1444	4.43.	54
1445	4.43.	54
1591	3.71.1.	46
1592	3.71.1.	46
1593	3.71.1.	46
1594	3.71.1.	46
1601	3.51.	36
1602	3.51.	36
1603	3.51.	36
1604	3.51.	36
1605	3.51.	36
1606	3.51.	36
1607	3.51.	36
1608	3.51.	36
1609	3.51.	36
1621	3.52.	36
1622	3.52.	36
1651	4.22.1.	51
1652	4.22.1.	51
1653	4.22.1.	51
1800	3.45.	36
2101-S	4.41.	53
2106	5.4.1.	61
2175	3.71.2.	46
2176	3.71.2.	46
2186-I	3.66.2.	45
2186-II	3.66.2.	45
2191	3.66.2.	45
2192	3.66.2.	45
3200	5.2.1.	60
4200-B	4.51.4.	57
4202	4.51.4.	57
4203-A	4.51.4.	57
4203-B	4.51.4.	57
4205	4.51.4.	57
4206	4.51.4.	57
4207	4.51.4.	57
4208	4.51.4.	57
4209	4.51.4.	57
4210	4.51.4.	57
4222	4.51.3.	56
4223	4.51.3.	56
4224	4.51.3.	56
4225	4.51.3.	56
4226	4.51.3.	56
4235	4.51.2.	55
4906	4.51.1.	55
4921-C	4.51.3.	56
4922-E	4.51.3.	56
4924	4.51.3.	56
4925	4.51.3.	56
4926	4.51.3.	56
4927	4.51.3.	56
4929-B	4.51.3.	56
4935-C	4.51.2.	55
4940-B	4.51.3.	56
4941-C	4.51.3.	56
4943	4.51.3.	56
4947	4.51.3.	56
4948	4.51.3.	56
4950-B	4.51.6.	58
4951	4.51.6.	58
4952-A	4.51.6.	58
4953	4.51.6.	58
4955	5.51.5.	57
4956	5.51.5.	57
4957	5.51.5.	57
4958	5.51.5.	57
4959	5.51.5.	57
4960	5.51.5.	57
4961	5.51.5.	57
4962	5.51.5.	57
4963	5.51.5.	57
4964-B	5.51.5.	57
4990-B	4.51.7.	58
4991-C	4.51.4.	57
4995-C	4.51.4.	57
4996-B	4.51.4.	57
4997-D	4.51.4.	57
4998-E	4.51.4.	57
4999-D	4.51.4.	57
U-005	3.61.1.	43
U-010	3.61.1.	43
U-015	3.61.1.	43
U-020	3.61.1.	43
U-030	3.61.1.	43
U-050	3.61.1.	43
U-100	3.61.1.	43
U-150	3.61.1.	43
U-200	3.61.1.	43
U-350	3.61.1.	43
U-500	3.61.1.	43
U-750	3.61.1.	43
U-800	3.61.1.	43
U-850	3.61.1.	43
U-900	3.61.1.	43
U-930	3.61.1.	43

TECHNICAL CONTACT POINT
FOR STANDARD REFERENCE MATERIALS (SRM's) FROM NBS

Please complete and return to:

Office of Standard Reference Materials
National Bureau of Standards
Washington, D. C. 20234

Please add my name to your technical mailing list to receive information concerning new and renewed Standard Reference Materials (SRM's), updated values, revised instructions for use, and technical publications pertaining to SRM's.

Name: _____ Title: _____

Department or Division: _____

Company or Organization: _____

Street or P.O. Box: _____

City: _____ State: _____

Country _____ Zip Code: _____

Cut here

AREAS OF INTEREST AND/OR USE

(Check pertinent boxes)

- ☐ Isotopic
- ☐ Metals, Ferrous
- ☐ Polymers, Plastics
- ☐ Color
- ☐ Permittivity
- ☐ Nuclear and Radioactivity
- ☐ Rubber and Rubber Compounding
- ☐ High Purity Metals and Compounds
- ☐ Clinical
- ☐ Metals, Non-ferrous
- ☐ Viscosity
- ☐ Coating Thickness
- ☐ Structure: eg., Mossbauer
- ☐ Gases, including Air-pollution
- ☐ Organics and Metallo-organics
- ☐ Copying and Photographic Processes
- ☐ Ores, Cements, Ceramics, Pigment, Phosphors
- ☐ Primary Chemical Standards, including pH, pD, Microchemical
- ☐ Thermodynamic Properties, including Heat, Thermal Emittance, Calorimetry, Melting and Freezing Point
- ☐ Paper, including Light Sensitivity and Tearing Tests
- ☐ Particle Size, including Turbidimetric and Fineness
- ☐ Others (specify): _____

Please send me a Catalog ☐

☆ U.S. GOVERNMENT PRINTING OFFICE : 1970 431-988/10

(Use additional forms for additional names)

U.S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

October 1, 1965

QUARTERLY INSERT SHEETS FOR NBS MISCELLANEOUS PUBLICATION 260-STANDARD REFERENCE MATERIALS

Catalog and Price List of Standard Materials Issued by the National Bureau of Standards

New and renewal Standard Reference Materials are continuously being prepared while the supply of others is gradually depleted. This Quarterly Addendum is issued to bring the Catalog and Price List up-to-date as of October 1, 1965.

NEW STANDARD REFERENCE MATERIALS

4.6.2—Rubber Compounding Materials (p. 30)

Sample No.	Kind	Weight	Price
384	N-tertiary-Butyl-2-benzothiazolesulfenamide	800 g	$5.00

4.18—Glass Spheres for Sieve Calibration (p. 35)

Sample No.	Kind	Weight	Price
1003	5–30 Micron Glass Spheres	40–45 g	$15.00

4.5.5—Point-Source Gamma-Ray Standards (p. 29)

Sample No.	Kind	Weight	Price
4201	Niobium-94 1×10^4 dps (>65)	Point source	$55.00

4.21—Coating Thickness (p. 35)

Sample No.	Nominal thickness (in inches)	Coating	Substrate	Price
1302	0.00025	Nonmagnetic (copper + chromium)	Steel	$7.50

Coating Thickness (Cont'd)

Sample No.	Nominal thickness (in inches)	Coating	Substrate	Price
1304	.00050	Nonmagnetic (copper + chromium)	Steel	7.50
1305	.00075	do	do	7.50
1306	.0010	do	do	7.50
1307	.0015	do	do	7.50
1309	.0020	do	do	7.50
1310	.0025	do	do	7.50
1311	.0032	do	do	7.50
1313	.0055	do	do	7.50
1314	.008	do	do	7.50
1315	.010	do	do	7.50
1317	.015	do	do	7.50
1318	.020	do	do	7.50
1320	.025	do	do	7.50
1321	.03	do	do	7.50
1322	.04	do	do	7.50
1324	.06	do	do	7.50
1326	.08	do	do	7.50
1332	.00012	Nickel	Steel	7.50
1334	.00035	do	do	7.50
1335	.00055	do	do	7.50
1336	.00075	do	do	7.50
1338	.0010	do	do	7.50
1339	.0013	do	do	7.50
1340	.0016	do	do	7.50
1341	.0020	do	do	7.50
1342	.0025	do	do	7.50
1347	.00012	Nickel	Nonmagnetic (brass)	7.50
1348	.00035	do	do	7.50
1349	.00065	do	do	7.50
1350	.0010	do	do	7.50

RENEWALS OF EARLIER MATERIALS

3.16—Ceramic Materials (p. 21)

Sample No.	Kind	Weight	Price
70a	Feldspar, potash	40 g	$10.00
99a	Feldspar, soda	40 g	10.00

4.6.2—Rubber Compounding Materials (p. 30)

Sample No.	Kind	Weight	Price
371e	Sulfur	1,400 g	$4.50

4.5.3—Beta-ray, gamma-ray and electron-capture solution standards (p. 28)

Sample No.	Kind	Weight	Price
4946-B	Cerium-141 7×10^4 dps/g(4/65)	5 g	$53.00

4.5.8—Radium Gamma-Ray Solution Standards (p. 30)

Sample No.	Kind	Weight	Price
4964B	Radium 226 Gamma-Ray Solution Std.	5 g	$43.00

4.5.5—Point Source Gamma-Ray Standards (p. 29)

Sample No.	Kind	Weight	Price
4991-B	Sodium-22 6×10^4 γ/s(1/65)	Point source	$57.00
4992-C	Zinc-65 5×10^4 γ/s(1/65)	Point source	50.00
4998-C,D	Yttrium-88 1×10^4 γ/s(3/65)	Point source	53.00
4999-C	Cerium-139 1×10^5 γps	Point source	56.00

MATERIAL TEMPORARILY OUT OF STOCK

3.1—Steels (Chip Form) (p. 3)

Sample No.	Kind
11g	Basic Open Hearth Steel, 0.2% C (Renewal about March, 1966)
12g	Basic Open Hearth Steel, 0.4% C (Renewal available by Oct. 15, 1965)
15f	Basic Open Hearth Steel, 0.1% C (Renewal available by Oct. 15, 1965)
30e	CrV (SAE 6150) Steel (Renewal planned but probably not before July, 1966)
152	Basic Open Hearth Steel (Tin Bearing 0.4% C) (Renewal available by Oct. 15, 1965)

4.6.1—Standard Rubbers (p. 30)

Sample No.	Kind
385b	Natural Rubber

3.4—White Cast Iron (Solid Form) (p. 10)

Sample No.	Kind
1176	White Cast Iron—Piston Ring (Will be replaced by 1174 and 1175—available about Nov., 1965)
1178	White Cast Iron—Die (Will be replaced by 1174 and 1175—available about Nov., 1965)
1181	White Cast Iron—Special 1 (Will be replaced by 1174 and 1175—available about Nov., 1965)

MATERIAL OUT OF STOCK—DISCONTINUED

3.19—Microchemical Standards (p. 24)

Sample No.	Kind
145	Iodobenzoic Acid

3.1—Steel (Chip Form) (p. 3)

Sample No.	Kind
159	Chromium-Molybdenum-Silver Steel

3.10—Tin Metal (Solid Form) (p. 16)

Sample No.	Kind
433	Tin C
434	Tin D
833	Tin C

3.2—Steels (Solid Form) (p. 9)

Sample No.	Kind
1042	Bessemer, Rimming

3.2—Steels (Solid Form) (p. 8)

Sample No.	Kind
1153	Stainless Steel

PRICE CHANGES

3.19—Microchemical Standards (p. 24)

Sample No.	Kind	New Price
143b	Cystine	$11.50

3.1—Steels (Chip Form) (p. 3)

Sample No.	Kind	New Price
339	Stainless Steel, Selenium	$20.00
346	Valve Steel	20.00

4.6.2—Rubber Compounding Materials (p. 30)

Sample No.	Kind	New Price
373e	Benzothiazyl Disulfide	$ 9.00

4.15—Light-Sensitive Papers (p. 34)

Sample No.	Kind	New Price
701a	Booklet of Standard Faded Paper	$60.00

4.17—Microscopy Resolution Test Chart (p. 34)

Sample No.	Kind	New Price
1010	Resolution Chart for Testing the Resolving Power of Microscopying Cameras (add $2.00 per order for handling).	$ .60

3.7—Copper-Base Alloys (Solid Form) (p. 14)

Sample No.	Kind	New Price
C1100	Cartridge Brass A	$35.00
1101	Cartridge Brass B	35.00
C1101	Cartridge Brass B	35.00
1102	Cartridge Brass C	35.00
C1102	Cartridge Brass C	35.00
1103	Free-Cutting Brass A	35.00
C1103	Free-Cutting Brass A	35.00
1104	Free-Cutting Brass B	35.00

3.7—Copper-Base Alloys (Solid Form) (Cont'd)

Sample No.	Kind	New Price
C1104	Free-Cutting Brass B	35.00
1105	Free-Cutting Brass C	35.00
C1105	Free-Cutting Brass C	35.00
1106	Naval Brass A	35.00
C1106	Naval Brass A	35.00
1107	Naval Brass B	35.00
C1107	Naval Brass B	35.00
1108	Naval Brass C	35.00
C1108	Naval Brass C	35.00
1109	Red Brass A	35.00
C1109	Red Brass A	35.00
1110	Red Brass B	35.00
C1110	Red Brass B	35.00
1111	Red Brass C	35.00
C1111	Red Brass C	35.00
1112	Gilding Metal A	35.00
C1112	Gilding Metal A	35.00
1113	Gilding Metal B	35.00
C1113	Gilding Metal B	35.00
1114	Gilding Metal C	35.00
C1114	Gilding Metal C	35.00
1115	Commercial Bronze A	35.00
C1115	Commercial Bronze A	35.00
1116	Commercial Bronze B	35.00
C1116	Commercial Bronze B	35.00
1117	Commercial Bronze C	35.00
C1117	Commercial Bronze C	35.00
1118	Aluminum Brass A	35.00
C1118	Aluminum Brass A	35.00
1119	Aluminum Brass B	35.00
C1119	Aluminum Brass B	35.00
1120	Aluminum Brass C	35.00
C1120	Aluminum Brass C	35.00

4.5.8—Radium Gamma-Ray Solution Standards (p. 30)

Sample No.	Kind	New Price
4955	Radium Gamma-Ray Solution Standard	$34.00
4956	Radium Gamma-Ray Solution Standard	34.00
4957	Radium Gamma-Ray Solution Standard	34.00

4.5.8—Radium Gamma-Ray Solution Standards (Cont'd)

Sample No.	Kind	New Price
4958	Radium Gamma-Ray Solution Standard	34.00
4959	Radium Gamma-Ray Solution Standard	34.00
4960	Radium Gamma-Ray Solution Standard	34.00
4961	Radium Gamma-Ray Solution Standard	34.00
4962	Radium Gamma-Ray Solution Standard	34.00
4963	Radium Gamma-Ray Solution Standard	34.00

4.8.1—CGS Units (p. 31)

Sample No.	Kind	New Price
Oil L	Viscometer Calibrating Liquid L	$22.50
Oil M	Viscometer Calibrating Liquid M	20.00
Oil N	Viscometer Calibrating Liquid N	25.00
Oil OB	Viscometer Calibrating Liquid OB	37.50
Oil SB	Viscometer Calibrating Liquid SB	8.00
Oil SF	Viscometer Calibrating Liquid SF	8.00

Other NBS Publications of Interest to SRM Users

NBS Misc. Publ. 260-1, Standard Reference Materials: Preparation of NBS White Cast Iron Spectrochemical Standards, June 1964. 30 cents.

NBS Misc. Publ. 260-2, Standard Reference Materials: Preparation of NBS Copper-Base Spectrochemical Standards, October 1964. 35 cents.

NBS Misc. Publ. 260-6, Standard Reference Materials: Methods for the Chemical Analysis of White Cast Iron Standards, July 1965. 45 cents.

NBS Misc. Publ. 260-7, Standard Reference Materials: Methods for the Chemical Analysis of NBS Copper-Base Spectrochemical Standards, October 1965. 60 cents.

NBS Misc. Publ. 260-9, Standard Reference Material: Half Lives of Materials Used in the Preparation of Standard Reference Materials of Nineteen Radioactive Nuclides Issued by the National Bureau of Standards, November 1965. 15 cents.

NBS Misc. Publ. 260-10, Standard Reference Materials: Homogeneity Characterization of NBS Spectrometric Standards II: Cartridge Brass and Low-Alloy Steel, December 1965. 30 cents.

NBS Misc. Publ. 260-11, Standard Reference Materials: Viscosity of a Standard Lead-Silica Glass, November 1966. 25 cents.

NBS Misc. Publ. 260-12, Standard Reference Materials: Homogeneity Characterization of NBS Spectrometric Standards III: White Cast Iron and Stainless Steel Powder Compact, September 1966. 20 cents.

NBS Misc. Publ. 260-13, Standard Reference Materials: Mossbauer Spectroscopy Standard for Chemical Shift of Iron Compounds, July 1967. 40 cents.

NBS Misc. Publ. 260-14, Standard Reference Materials: Determination of Oxygen in Ferrous Materials SRM 1090, 1091, and 1092, September 1966. 30 cents.

NBS Misc. Publ. 260-15, Standard Reference Materials: Recommended Method of Use of Standard Light-Sensitive Paper for Calibrating Carbon Arcs Used in Testing Textiles for Colorfastness to Light, July 1967. 20 cents.

NBS Spec. Publ. 260-16. Standard Reference Materials: Homogeneity Characterization of NBS Spectrometric Standards IV: Preparation and Microprobe Characterization of W-20% Mo Alloy Fabricated by Powder Metallurgical Methods, January 1969. 35 cents.

NBS Spec. Publ. 260-17, Standard Reference Materials: Boric Acid Isotopic and Assay Standard Reference Materials, December 1969. 65 cents.

NBS Spec. Publ. 260-18, Standard Reference Materials: Calibration of NBS Secondary Standard Magnetic Tape (Computer Amplitude Reference) Using the Reference Tape Amplitude Measurement "Process A," November 1969. 50 cents.

NBS Monograph 54 "Analytical Standards for Trace Elements in Petroleum Products." 25 cents.

Send orders for the above, with remittance, to: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Remittances from foreign countries should include an additional one-fourth of the purchase price for postage.

U.S. DEPARTMENT OF COMMERCE
WASHINGTON, D.C. 20230

OFFICIAL BUSINESS

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE