NBS MISC. PUBL. 260

Standard Reference Materials:

CATALOG AND PRICE LIST OF STANDARD MATERIALS ISSUED BY THE NATIONAL BUREAU OF STANDARDS

U.S. Department of Commerce

National Bureau of Standards

THE NATIONAL BUREAU OF STANDARDS

The National Bureau of Standards 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. Its responsibilities include development and maintenance of the national standards of measurement, and the provisions of means for making measurements consistent with those standards; determination of physical constants and properties of materials; development of methods for testing materials, mechanisms, and structures, and making such tests as may be necessary, particularly for government agencies; cooperation in the establishment of standard practices for incorporation in codes and specifications; advisory service to government agencies on scientific and technical problems; invention and development of devices to serve special needs of the Government; assistance to industry, business, and consumers in the development and acceptance of commercial standards and simplified trade practice recommendations; administration of programs in cooperation with United States business groups and standards organizations for the development of international standards of practice; and maintenance of a clearinghouse for the collection and dissemination of scientific, technical, and engineering information. The scope of the Bureau's activities is suggested in the following listing of its four Institutes and their organizational units.

Institute for Basic Standards. Applied Mathematics. Electricity. Metrology. Mechanics. Heat. Atomic Physics. Physical Chemistry. Laboratory Astrophysics.* Radiation Physics. Radio Standards Laboratory:* Radio Standards Physics; Radio Standards Engineering. Office of Standard Reference Data.

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Central Radio Propagation Laboratory.* Ionospheric Telecommunications. Tropospheric Telecommunications. Space Environment Forecasting. Aeronomy.

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UNITED STATES DEPARTMENT OF COMMERCE • John T. Connor, *Secretary*
NATIONAL BUREAU OF STANDARDS • A. V. Astin, *Director*

Standard Reference Materials:

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

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

CAUTION: The values given in the following sections are listed primarily as a gnide to pnrchaser. In some cases, the valnes shown are provisional and may differ from those shown on the certificates. Space limitations havc required that some valnes be omitted. For these reasons, the certificates issned with the standards should always be consulted to obtain the certified valnes.

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Preface

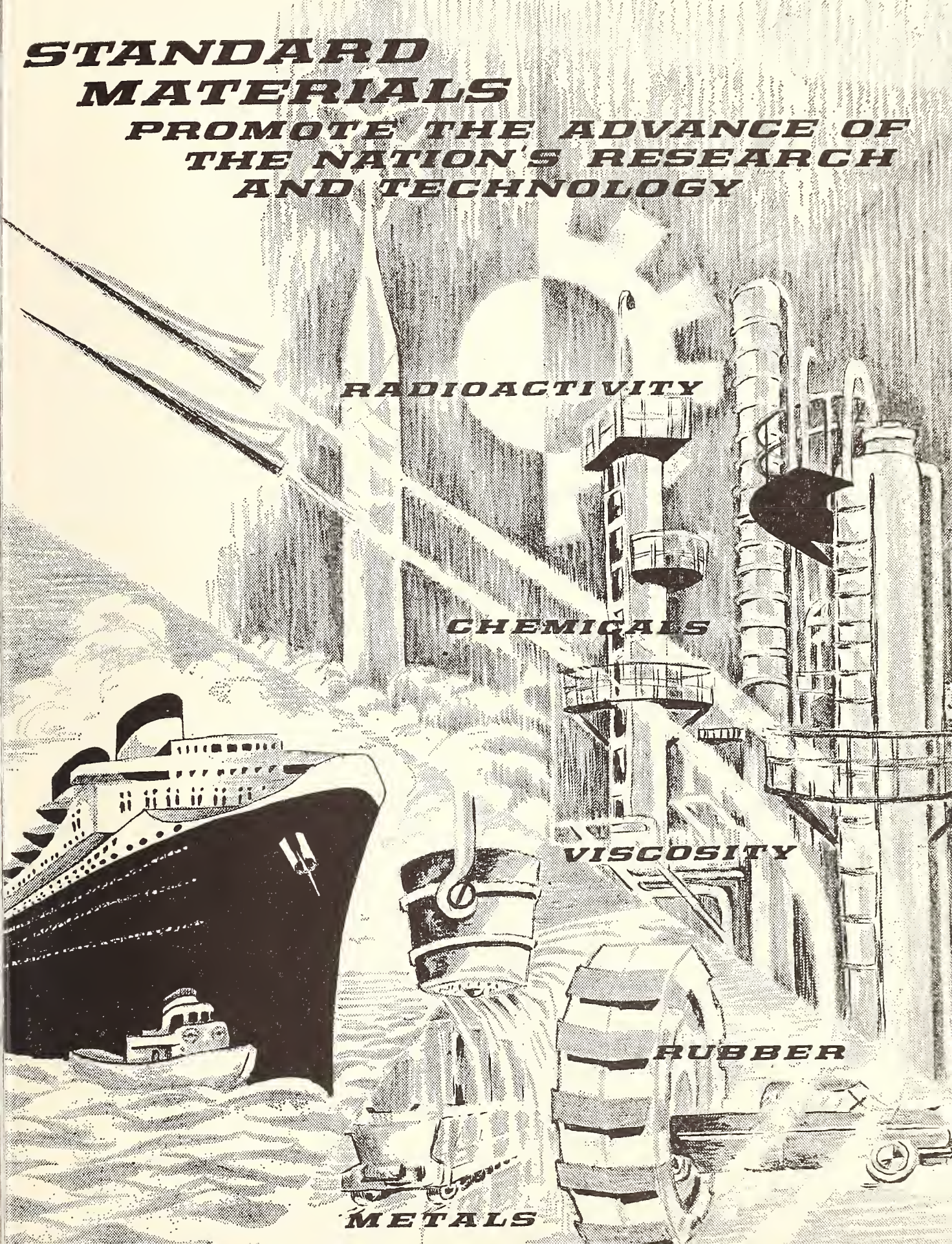
Within the framework of the NBS Institute for Materials Research the area of standard reference materials is a broad and important one, including the preparation, characterization, and distribution of a wide variety of materials in such diverse fields as metallurgy, polymers, and inorganic materials. In carrying out such a program there is much interaction with representatives of industry and science, beginning with discussions as to which primary standard materials will do most to advance technology, the furnishing of materials and fabrication of samples, and the characterization and certification of the materials by cooperative efforts. The many groups participating in a standards program are very interested in detailed information on specific aspects of the program—but to date there has been no publication outlet for such written discussions.

To meet this need, the NBS Miscellaneous Publication 260 Series has been reserved for papers in the general area of "standard reference materials". This series begins with a descriptive price list of standard materials available. Succeeding publications present the results of studies and investigations undertaken within the Institute for Materials Research with emphasis on the preparation and characterization of standard reference materials. This subject-oriented series provides a means for rapid dissemination of this detailed information and we hope will stimulate the use of standard reference materials in science and industry.

W. Wayne Meinke, Chief
Office of Standard Reference Materials

STANDARD MATERIALS

PROMOTE THE ADVANCE OF THE NATION'S RESEARCH AND TECHNOLOGY



Contents

Standard Reference Materials

Issued by the National Bureau of Standards

A descriptive listing is given of the many different Standard Reference Materials issued by the National Bureau of Standards to calibrate a measurement system, or to produce scientific data that can be referred to a common base. A schedule of prices and amounts, as well as directions for ordering, is included. For composition standards summary tables of analyses are presented, to indicate the type of standards presently available. Announcements of new standard reference materials will be made in the Federal Register, in scientific and trade journals, and in the Technical News Bulletin of the National Bureau of Standards. The current status of the various standards will be indicated by an *insert sheet* available quarterly from the Bureau.

1. General Information

1.1. Introduction

This publication lists the standard reference materials issued by the National Bureau of Standards, their prices and directions for ordering.

The NBS Standard Reference Materials Program provides all types of well-characterized materials that are needed to calibrate a measurement system or to produce scientific data that can be readily referred to a common base.

Some of the principal uses of NBS standard reference materials are: Calibrating and standardizing spectrometers, spectrographs, colorimeters, pH meters, Geiger counters, scintillators, ionization chambers, pyrometers, polarimeters, refractometers, viscometers, and other laboratory and plant instruments; checking methods of analysis and analytical techniques; standardizing solutions for volumetric analysis; developing new or improved methods of analysis and evaluating the accuracy of analytical methods.

The first standard materials issued by the Bureau were a small group of metals certified with respect to their chemical composition. Because of their use as standards in chemical analysis, the term "Standard Samples" was applied to them. This term was extended first to similar composition standards, and later to cover materials certified with respect to chemical purity or to some physical or chemical property. By usage the term has been extended also to certain materials that are issued without certification of composition or properties. More recently, the term "Standard Sample" has been replaced with the more apt description "Standard Reference Material".

In this publication the materials are classified into groups according to the purposes for which they are intended and the kind of certification, if any, that applies to them. More than 500 different standards of metals, ores, ceramics, chemicals, and hydrocarbons are now available for distribution. About 380 of these are certified for chemical composition. Some 177 of the composition standards have been prepared specifically for use in spectroscopic analysis. Other standard materials include those certified for such properties as acidity (pH), viscosity, freezing-point, density, index of refraction, and heat of combustion. Each standard material is accompanied by a certificate of characterization. An example of such a certificate is shown in Appendix I.

1.2. Standards Out of Stock

The preparation of "renewals" is intended to be completed at the time each kind of material becomes exhausted, but owing to delays encountered in obtaining a proper grade of material, and for other reasons, this is not always possible. If orders are received for standard reference materials that are out of stock, notice will be mailed to that effect. The composition of a "renewal" will not usually be identical with that of its predecessor, but it will be quite similar, especially with regard to the characteristic constituent or constituents.

1.3. New Standards

When new standard reference materials or renewals of old ones are issued, announcement will be made in scientific and trade journals, in the Standard Materials column of National Bureau of Standards Technical News Bulletin, and in the Federal Register. This information will also be given in the Quarterly *insert sheet* for this catalog available from the Bureau. If you wish to be placed on a mailing list to receive these inserts as they are issued, please complete the post card included at the end of this catalog, detach it, and mail to the National Bureau of Standards.

The Office of Standard Reference Materials welcomes suggestions for new standard materials. While it is not possible to produce all of the materials that will be requested by science and industry throughout the country, we will try to make those for which there is the greatest demonstrated need. Thus we have prepared a "Guide for the Submission of Requests for the Development of New or Renewal Standard Reference Materials" which delineates Bureau policy in this area and establishes a standard format for such requests. This "Guide" is reproduced for your information in Appendix II (page 40) of this publication.

NBS calibrating and testing services for a wide variety of standards and instruments are given in a separate publication: NBS Misc. Publ. 250, Calibrating and Testing Services, price 70 cents.

2. Purchase Procedure

2.1. Identification of Standards

The standards are listed by groups; the numbers represent the issuance of the first representative sample of each kind. Renewals are indicated by the original number with an added letter to denote the relation. Thus, 11a is the first, 11b the second, 11c is the third renewal of No. 11 Basic Open-Hearth Steel, 0.2 percent carbon. In this way, a particular number always represents a material of fixed or approximately fixed composition.

2.2. Ordering

Orders should be addressed to the Office of Standard Reference Materials, National Bureau of Standards, Washington, D.C., 20234, and should give the amount, number and name of the standards requested. For example: 150 grams of No. 11g Basic Open-Hearth Steel, 0.2 percent C. The list of standard materials, their numbers, prices and composition or intended use are given on the pages which follow. These materials are distributed only in the units listed.

2.3. Terms and Shipping

2.3.1. Domestic Shipments

Shipments of material (other than hydrocarbons, organic sulfur compounds and radioactive standards) intended for the United States, Mexico, and Canada are normally shipped prepaid 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, rubber compounding materials, viscometer calibrating oils, and radioactive standards are shipped express collect. No discounts are given on NBS Standard Reference Materials.

2.3.2. Foreign Shipments

Small shipments will be forwarded as a United States Government shipment via International Parcel Post, providing that the parcel does not exceed the weight limits as prescribed by Postal Laws and Regulations to foreign countries. Shipments exceeding the parcel post weight limit must be handled through an agent (shipping or brokerage firm) located in the United States as designated by the purchaser. Parcels will be packed for overseas shipment and forwarded via express collect to the United States firm designated as agent.

2.3.3. Payment for Foreign Orders

Remittances in payment of foreign orders must be made payable to the National Bureau of Standards, and are *required in advance.* These remittances must be drawn on a bank in the United States and payable at the standard rate of United States currency.

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 in checking chemical methods of analysis both for production control, and for customer acceptance. The group consists of nominal composition steel alloys and is 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 150 g units of chips, usually sized between 16- and 40-mesh sieves, prepared from selected portions of commercial ingots.

Certificates of analyses, provided with these standards, give the composition as determined at the National Bureau of Standards, and most also include values obtained by industrial and other outside laboratories cooperating in the certification of the standards.

Sample Nos.	Kind	Price	Sample Nos.	Kind	Price
8i	Bessemer, 0.1 C	$12.00	111b	Ni-Mo (SAE 4620)	$12.00
10g	Bessemer, 0.2 C	12.00	36a	Cr2-Mol	12.00
170a	Basic Open Hearth, 0.05 C, 0.3 Ti	12.00	106b	Cr-Mo-Al (Nitralloy G)	12.00
15f	Basic Open Hearth, 0.1 C	12.00	139a	Cr-Ni-Mo (AISI 8640)	12.00
11g	Basic Open Hearth, 0.2 C	12.00	156	Cr-Ni-Mo (NE 9450)	12.00
12g	Basic Open Hearth, 0.4 C	12.00	159	Cr1-Mo 0.4-Ag 0.1	12.00
152	Basic Open Hearth, 0.5 C, 0.04 Sn	12.00	50c	W18-Cr4-V1	15.00
13f	Basic Open Hearth, 0.6 C	12.00	132a	Mo5-W6-Cr4-V2	15.00
14e	Basic Open Hearth, 0.8 C	12.00	134a	Mo8-W2-Cr4-V1	15.00
16d	Basic Open Hearth, 1.0 C	12.00	153a	Co8-Mo9-W2-Cr4-V2	15.00
19g	Acid Open Hearth, 0.2 C	12.00	155	Cr 0.5-W 0.5	15.00
20f	Acid Open Hearth, 0.4 C	12.00	73b	Stainless (Cr13) (SAE 420)	15.00
51b	Electric furnace, 1.2 C	12.00	133a	Stainless (Cr13-Mo0.3-S0.3)	15.00
65d	Basic electric, 0.3 C	12.00	101e	Cr18-Ni9 (SAE 304)	15.00
100b	Manganese (SAE T1340)	12.00	121c	Cr18-Ni10 (Ti-bearing) (SAE 321)	15.00
105	High-sulfur, 0.2 C (carbon only)	6.00	123b	Cr-Ni-Nb 0.7-Ta 0.2 (SAE 347)	15.00
125a	High-silicon, 3 Si	12.00	160a	Cr19-Ni14-Mo3 (SAE 316)	15.00
129b	High-sulfur, (SAE X1112)	12.00	166b	Cr19-Ni9 (carbon only)	15.00
130a	Lead-bearing, 0.2 Pb	12.00	339	Cr17-Ni9-0.2Se (SAE 303Se)	15.00
131a	Low-carbon, silicon	12.00	343	Cr16-Ni2 (SAE 431)	15.00
151	Boron-bearing, 0.003 B	6.00	344	Cr15-Ni7-Mo2-Al 1	15.00
30e	Cr-V (SAE 6150)	12.00	345	Cr16-Ni4-Cu3	15.00
32e	Ni-Cr (SAE 3140)	12.00	346	Valve (Cr22-Ni4-Mn9)	15.00
33d	Ni-Mo (SAE 4820)	12.00	126b	Ni 36 (High nickel)	15.00
72f	Cr-Mo (SAE X4130)	12.00			

3.1. Steels (Chip Form)—Continued

ANALYSES

Sample Nos.	Kind	C	Mn	P	S		Si	Cu	Ni
					Grav.	Comb.			
8i	Bessemer	0.077	0.511	0.080	0.063	0.063	0.020	0.016	0.009
10g	Bessemer	.240	.850	.086	.109	.109	.020	.008	.005
170a	B.O.H. (Ti-bearing)	.052	.325	.005	.021	.021	.036	.059	.026
15f	B.O.H.	.084	.390	.006	.032	.032	.042	.085	.029
11g	B.O.H.	.191	.513	.008	.026	.026	.203	.046	.020
12g	B.O.H.	.389	.716	.014	.030	.030	.187	.125	.060
152	B.O.H. (Tin-bearing)	.466	.782	.019	.027	.027	.244	.127	.062
13f	B.O.H.	.629	.889	.020	.016	.016	.236	.103	.113
14e	B.O.H.	.751	.404	.008	.039	.039	.177	.072	.052
16d	B.O.H.	1.01	.439	.014	.033	.033	.188	.052	.022
19g	A.O.H.	0.223	.554	.046	.032	.033	.186	.093	.066
20f	A.O.H.	.380	.754	.028	.034	.034	.299	.238	.243
51b	Electric furnace	1.21	.573	.013	.014	.014	.246	.071	.053
65d	Basic electric	0.264	.730	.015	.010	.010	.370	.051	.060
100b	Manganese (SAE T1340)	.397	1.89	.023	.029	.028	.210	.064	.030
105	High-sulfur (Carbon only)	.193							
125a	High-silicon	.032	0.052	.006	.013		3.32	.084	.053
129b	High-sulfur (SAE X1112)	.094	.763	.085	.221	.226	0.021	.015	.013
130a	Lead-bearing	.182	.753	.016	.019	.019	.173	.027	.010
131a	Low-carbon silicon	.0044							
151	Boron								
30e	Cr-V steel (SAE 6150)	.505	.786	.026	.035	.036	.269	.094	.027
32e	Ni-Cr steel (SAE 3140)	.409	.798	.008	.022	.021	.278	.127	1.19
33d	Ni-Mo steel (SAE 4S20)	.173	.537	.006	.010	.011	.253	.123	3.58
72f	Cr-Mo steel (SAE X4130)	.301	.545	.014	.024	.024	.256	.062	0.055
111b	Ni-Mo Steel (SAE 4620)	.193	.706	.012	.015	.015	.302	.028	1.81
36a	Cr2-Mol	.120	.432	.014	.016	.018	.356	.114	0.243
106b	Cr-Mo-Al (Nitralloy G)	.326	.506	.008	.016	.017	.274	.117	.217
139a	Cr-Ni-Mo (AISI 8640)	.404	.780	.013	.019	.019	.241	.096	.510
156	Cr-Ni-Mo (NE 9450)	.515	1.40	.032	.017	.018	.226	.053	.475
159	Cr 1-Mo 0.4-Ag 0.1	.521	0.807	.036	.027	.026	.258	.181	.137
50c	W18-Cr4-V1	.719	.342	.022	.010	.009	.311	.079	.069
132a	Mo5-W6-Cr4-V2	.825	.268	.029	.005	.006	.190	.120	.137
134a	Mo8-W2-Cr4-V1	.808	.218	.018	.007	.007	.323	.101	.088
153a	Co8-Mo9-W2-Cr4-V2	.902	.192	.023	.007	.007	.270	.094	.168
155	Cr 0.5-W 0.5	.905	1.24	.015	.010	.011	.322	.083	.100
73b	Cr13 (SAE 420)	.355	0.361	.019	.006	.006	.437	.125	.197
133a	Cr13-Mo 0.3-S 0.3	.120	1.03	.026	.326	.330	.412	.118	.241
101e	Cr18-Ni9 (SAE 304)	.054	1.77	.025	.010	.010	.43	.359	9.48
121c	Cr18-Ni 10-Ti 0.4 (SAE 321)	.038	1.31	.028		.009	.64	.14	10.51
123b	Cr-Ni-Nb-Ta (SAE 347)			.024			.52		
160a	Cr19-Ni14-Mo3 (SAE 316)	.062	1.62	.027	.015	.016	.605	.174	14.13
166b	Cr19-Ni9 (Carbon only)	.0191							
339	Cr17-Ni9-Se (SAE 303Se)	.052	0.738	.129		.013	.654	.199	.889
343	Cr16-Ni2 (SAE 431)	.150							2.14
344	Cr15-Ni7-Mo2-Al 1	.069	.57	.018		.019	.395	.106	7.28
345	Cr16-Ni4-Cu3	.048	.224	.018	.012	.012	.610	3.44	4.24
346	Valve (Cr22-Ni4-Mn9)	.541	9.15	.018		.063	.234		3.94
126b	Ni 36	.090	.380				.200	0.082	35.99

3.1. Steels (Chip Form)—Continued

ANALYSES—Continued

Sample Nos.	Cr	V	Mo	W	Co	Ti	As	Sn	Al (total)	N	Nb	Ta	B	Se
8i	0.009	0.012	0.003							0.018				
10g	.008	.007	.002							.015				
170a	.014	.009	.005	Zirconium 0.037		0.281		0.006	0.046	.005				
15f	.009	.001	.006							.005				
11g	.015	.001	.005					.004		.006				
12g	.046	.002	.010							.003				
152	.050	.001	.013					.036		.004				
13f	.129	.002	.033							.004				
14e	.072	.002	.013						.059					
16d	.042	.002	.006							.003				
19g	.374	.012	.013		0.012	.027		.008	.031		0.026			
20f	.097	.007	.058					.021		.005				
51b	.455	.002	.014					.008		.011		Acid-insoluble Al as Al_2O_3 0.009		
65d	.049	.002	.025					.004	.059	.013				
100b	.063	.003	.237							.004				
105														
125a	.023	.001	.007			<0.01		.007	<0.01	.002			<0.001	
129b	.016	.004	.003							.014				
130a	.012	.001	.004		Lead 0.228					.008				
131a														
151													.0027	
30e	.934	.149	.007							.007				
32e	.678	.002	.023					.011		.009				
33d	.143	.002	.246							.011				
72f	.891	.005	.184							.009				
111b	.070	.003	.255						.043					
36a	2.41	.006	.920					.011						
106b	1.18	.003	.199						1.07					
139a	0.486	.003	.183							.008				
156	.429	.002	.138											
159	1.00	.054	.414						Silver 0.090					
50c	4.13	1.16	.082	18.44			0.022	.018		.012				
132a	4.21	1.94	4.51	6.20										
134a	3.67	1.25	8.35	2.00										
153a	3.72	2.06	8.85	1.76	8.47					.024				
155	0.485	0.014	0.039	0.517										
73b	12.82	.032	.014							.052				
133a	12.89	.026	.294							.032				
101e	17.98	.043	.426	.056	0.18			.020		.039	.013			
121c	17.58	.048	.16			.42								
123b		.05	.17	.18		.006					.75	0.20		
160a	18.74	.051	2.83		.071			.013		.051	(Lead	0.001)		
166b														
339	17.42	.058	0.248		.096									0.247
343	15.76	.036								.074				
344	14.95	.040	2.40			.076			1.16					
345	16.04	.041	0.122		.089						.231	.002		
346	21.61	.058								.441				
126b	0.066	.001	.006		.032									

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, and tool steel.

These standard reference materials are furnished in three basic forms: (1) rods $\frac{7}{32}$ inch in diameter, 4 inches long (400 series); (2) rods $\frac{1}{2}$ inch in diameter, 2 inches long (800 series); and (3) disks $1\frac{1}{4}$ inches in diameter and either $\frac{3}{4}$ inch or $\frac{1}{4}$ inch thick (1100 series or D 800 series). 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 D 800 series, and the 1100 series also, are intended for x-ray spectroscopic methods of analysis.

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 insure adequate uniformity of composition. The standards are furnished with a certificate of analysis which gives the composition as determined at the National Bureau of Standards; some also include values by outside laboratories cooperating in the certification of the standards. (Values in parentheses are not certified, but are given for additional information on the composition.)

Ingot Iron and Low-Alloy Steels

Sample Nos.			Kind	Price	
				400 & 800 series	D800 series
------	802	--------	B.O.H., 0.8C---	$10.00	--------
------	803a	D803a	A.O.H., 0.6C---	10.00	$15.00
404a	804a	--------	Basic electric---	10.00	--------
405a	805a	D805a	Medium manganese---	10.00	15.00
407a	807a	D807a	Chromium-vanadium ---	10.00	15.00
408a	808a	--------	Chromium-nickel-------	10.00	--------
409b	809b	D809b	Nickel--------	$10.00	$15.00
410a	810a	--------	Cr2-Mo1------	10.00	--------
------	811a	--------	Cr-Mo (SAE X4130) ------	10.00	--------
------	812a	--------	Cr-Ni-Mo (NE 8637)----	10.00	--------

Sample Nos.		Kind	Price 400 &800 series
413	--------	A.O.H., 0.4C----------	$10.00
414	--------	Cr-Mo (SAE 4140)----------	10.00
417a	817a	B.O.H., 0.4C----------	10.00
418	--------	Cr-Mo (SAE X4130)--------	10.00
418a	818a	Cr-Mo (SAE X4130)--------	10.00
420a	820a	D820a	Ingot iron-----	$10.00	$15.00
421	821	--------	Cr-W, 0.9C----	10.00	--------
427	827	--------	Cr-Mo (SAE 4150) (boron only)-------	10.00	--------

Analyses

Sample Nos.			Mn	Si	Cu	Ni	Cr	V	Mo	W	Co	Sn	Al Total	B
-----	802	--------	0.46	0.060	0.025	0.010	0.025	-------	--------	------	-------	--------	-------	------
-----	803a	D803a	1.04	.34	.096	.190	.101	0.005	0.033	------	-------	--------	-------	------
404a	804a	--------	0.88	.44	.050	.040	.025	.002	.007	------	-------	--------	-------	------
405a	805a	D805a	1.90	.27	.032	.065	.037	-------	.005	------	-------	--------	0.056	------
407a	807a	D807a	0.76	.29	.132	.169	.92	.146	--------	------	-------	--------	-------	------
408a	808a	--------	.76	.28	.10	1.20	.655	.002	.065	------	-------	--------	-------	------
409b	809b	D809b	.46	.27	.104	3.29	.072	.002	.009	------	0.025	0.012	-------	------
410a	810a	--------	-------	.36	.11	0.24	2.39	-------	.91	------	-------	--------	-------	------
-----	811a	--------	-------	.29	.105	.24	0.93	.002	.22	------	-------	--------	-------	------
-----	812a	--------	.87	.30	.090	.56	.55	-------	.18	------	-------	--------	-------	------
413	------	--------	.67	.22	.25	.18	.055	.007	.006	------	-------	--------	-------	------
414	------	--------	.67	.26	.11	.080	.99	.003	.32	------	-------	.014	.020	------
417a	817a	--------	.78	-------	.13	.062	.050	-------	.013	------	-------	.036	-------	------
418	------	--------	.52	.28	-------	.11	.96	-------	.22	------	-------	--------	-------	------
418a	818a	--------	.52	.27	.040	.125	1.02	-------	.21	------	-------	--------	-------	------
420a	820a	D820a	.017	-------	.027	.0092	0.0032	-------	.0013	------	.006	.0017	.003	------
421	821	--------	1.24	-------	.080	.10	.49	.012	.040	0.52	-------	--------	-------	------
427	827	--------	-------	-------	-------	-------	-------	-------	--------	------	-------	--------	-------	0.0027

3.2. Steels (Solid Form)—Continued

Special Ingot Irons and Low-Alloy Steels

Sample Nos.		Kind	Price	
			400 series	1100 series
461	1161	Low-alloy steel A (modified TS46B12)	$15.00	$35.00
462	1162	Low-alloy steel B (modified TS86B45)	15.00	35.00
463	1163	Low-alloy steel C (modified TS94B17)	15.00	35.00
464	1164	Low-alloy steel D (modified 14B52)	15.00	35.00

Sample Nos.		Kind	Price	
			400 series	1100 series
465	1165	Ingot iron E	$15.00	$35.00
466	1166	Ingot iron F	15.00	35.00
467	1167	Low-alloy steel G (modified C1010)	15.00	35.00
468	1168	Low-alloy steel H (modified TS4720)	15.00	35.00
-------	1169	Leaded steel (0.2% Pb)	----------	35.00

Analyses

Sample Nos.		C	Mn	P	S	Si	Cu	Ni	Cr	V	Mo	W	Co	Ti	As
461	1161	0.15	0.36	0.053	(0.02)	0.047	0.34	1.73	0.13	0.024	0.30	0.012	0.26	(0.01)	0.028
462	1162	.40	.94	.045	(.02)	.28	.20	0.70	.74	.058	.080	.053	.11	.037	.046
463	1163	.19	1.15	.031	(.02)	.41	.47	.39	.26	.10	.12	.105	.013	.010	.10
464	1164	.54	1.32	.017	(.02)	.48	.094	.135	.078	.295	.029	.022	.028	.004	.018
465	1165	.037	0.032	.008	(.01)	.029	.019	.026	.004	.002	.005	(.001)	.008	.20	.010
466	1166	.065	.113	.012	(.01)	.025	.033	.051	.011	.007	.011	(.006)	.046	.057	.014
467	1167	.11	.275	.033	(.01)	.26	.067	.088	.036	.041	.021	.20	.074	.26	.14
468	1168	.26	.47	.023	(.02)	.075	.26	1.03	.54	.17	.20	.077	.16	.011	.008
-------	1169	(.08)	.99	.064	.32	.011	.083	0.031	.015	------	.008	-------	------	-------	-----

Sample Nos.		Sn	Al (total)	Nb	Ta	B	Pb	Zr	Ag	Ge	O	N
461	1161	0.022	(0.005)	0.011	0.002	0.0002	(0.003)	(<0.005)	(0.0015)	(0.0015)	(0.020)	(0.006)
462	1162	.066	.023	.096	.036	.0005	.006	.063	(<.0002)	(.0030)	(.006)	(.008)
463	1163	.013	.027	.195	.15	.0012	.012	.20	(<.0002)	(.0025)	(.007)	(.006)
464	1164	.043	.005	.037	.069	.005	.020	.010	(.0030)	(.0015)	(.006)	(.007)
465	1165	.001	.19	(.001)	.001	.0001	(<.0005)	(.002)	(.00025)	(.0035)	(.003)	(.005)
466	1166	.005	.015	.005	.002	(.0002)	(.0013)	(<.005)	(.00045)	(.0030)	(.005)	(.006)
467	1167	.10	.16	.29	.23	(.0002)	.0006	.094	(.0040)	(.0030)	(.004)	(.004)
468	1168	.009	.042	.006	.005	.009	(<.0005)	(<.005)	(<.0002)	(.0010)	(.004)	(.006)
---------	1169	------	--------	-------	------	--------	.23	----------	----------	--------	-------	------

Stainless Steels

Sample Nos.	Kind (Group 1)	Price
442	Cr16–Ni10	$15.00
443	Cr18.5–Ni9.5	15.00
444	Cr20.5–Ni10	15.00

Sample Nos.			Kind (Group 2)	Price		
				400 series	800 series	D800 series
445	845	D845	Cr13–Mo0.9 (Modified AISI 410)	$15.00	$20.00	$25.00
446	846	D846	Cr18–Ni9 (Modified AISI 321)	15.00	20.00	25.00
447	847	D847	Cr24–Ni13 (Modified AISI 309)	15.00	20.00	25.00
448	848	D848	Cr9–Mo0.3 (Modified AISI 403)	15.00	20.00	25.00
449	849	D849	Cr5.5–Ni6.5	15.00	20.00	25.00
450	850	D850	Cr3–Ni25	15.00	20.00	25.00

Sample Nos.	Kind (Group 3)	Price
1151	Stainless Steel, A	$35.00
1152	Stainless Steel, B	35.00
1153	Stainless Steel, C	35.00
1154	Stainless Steel, D	35.00

Stainless Steels Group 1—Analyses

Sample Nos.	Mn	Si	Cu	Ni	Cr	V	Mo	W	Co	Ti	Sn	Nb	Ta	B	Pb	Zr	Zn
442	2.88	(0.09)	0.11	9.9	16.1	0.032	0.12	(0.08)	0.13	0.002	0.0035	0.032	(0.0006)	0.0005	0.0017	(0.004)	(0.003)
443	3.38	(.15)	.14	9.4	18.5	.064	.12	(.09)	.12	.003	.006	.056	(.0008)	.0012	.0025	-------	(.005)
444	4.62	(.65)	.24	10.1	20.5	.12	.23	(.17)	.22	.019	.014	.20	(.004)	.0033	.0037	(.011)	(.004)

Stainless Steels Group 2—Analyses

Sample Nos.			Mn	Si	Cu	Ni	Cr	V	Mo	W	Ti	Sn	Nb	Ta
445	845	D845	0.77	0.52	0.065	0.28	13.31	(0.05)	0.92	(0.42)	(0.03)	-------	0.11	(0.002)
446	846	D846	.53	1.19	.19	9.11	18.35	(.03)	.43	(.04)	(.34)	(0.02)	.60	(.030)
447	847	D847	.23	0.37	.19	13.26	23.72	(.03)	.059	(.06)	(.02)	-------	.03	(.002)
448	848	D848	2.13	1.25	.16	0.52	9.09	(.02)	.33	(.14)	(.23)	(.05)	.49	(.026)
449	849	D849	1.63	0.68	.21	6.62	5.48	(.01)	.15	(.19)	(.11)	(.07)	.31	(.021)
450	850	D850	-----	.12	.36	24.8	2.99	(.006)	------	(.21)	(.05)	(.09)	.05	(.002)

Stainless Steels Group 3—Analyses

Sample Nos.	C	Mn	P	S	Si	Cu	Ni	Cr	V	Mo
1151	0.026	2.17	0.011	0.034	0.37	0.25	7.03	22.13	0.062	0.76
1152	.163	1.19	.017	.017	.65	.50	10.21	18.49	.044	.36
1153	.218	0.61	.053	.032	.82	.26	12.02	16.61	.13	.21
1154	.094	1.74	.038	.032	1.09	.56	10.25	19.58	.062	.46

Sample Nos.			Kind	Price		
				400 series	800 series	D800 series
436	836	D836	Special (Cr6–Mo3–W10)	$15.00	$20.00	$25.00
437	837	D837	Special (Cr8–Mo2–W3–Co3)	15.00	20.00	25.00
438	838	D838	Mo High Speed (AISI–SAE–M30)	15.00	20.00	25.00
439	839	D839	Mo High Speed (AISI–SAE M36)	15.00	20.00	25.00
440	840	D840	Special W High Speed (Cr2–W13–Co12)	15.00	20.00	25.00
441	841	D841	W High Speed (AISI–SAE T1)	15.00	20.00	25.00

Analyses

Sample Nos.			Mn	Si	Cu	Cr	V	Mo	W	Co
436	836	D836	0.21	0.32	0.075	6.02	0.63	2.80	9.7	----------
437	837	D837	.48	.53	----------	7.79	3.04	1.50	2.8	2.9
438	838	D838	.20	.17	.17	4.66	1.17	8.26	1.7	4.9
439	839	D839	.18	.21	.12	2.72	1.50	4.61	5.7	7.8
440	840	D840	.15	.14	.059	2.12	2.11	0.070	13.0	11.8
441	841	D841	.27	.16	.072	4.20	1.13	.84	18.5	----------

Carbon Steels (Certified for Oxygen and Nitrogen Only)

This group of standards is intended to provide material of known composition for checking analytical methods for the determination of oxygen and nitrogen only. The materials are supplied in rods one inch in diameter and three inches long. Because some of these materials are radially segregated, care must be taken so that the sample used for the analysis represents the entire cross section of the bar.

Sample Nos.	Kind	O	N	Price
1041	Medium-carbon	0.017	0.004	$20.00
1042	Bessemer, rimming	.017	.014	20.00
1044	Low-carbon, Si-killed	.009	.004	20.00
1045	Medium-carbon, Si-killed	.007	.004	20.00

3.3. Cast Iron (Chip Form)

This group of standard reference materials is similar to the steels described in 3.1 and has been prepared for use in checking chemical methods in the cast iron industry. These materials, except White Iron No. 3a, are furnished as 150 g portions in the form of chips, usually sized between 16- and 25-mesh sieves. They are prepared from thin-wall cylindrical castings specially made for this purpose by lathe cutting the chips with a multiple-tooth cutting tool. Supplied with each material is a Certificate of Analyses listing the composition as determined at the National Bureau of Standards and by outside laboratories.

Sample Nos.	Kind	Price	Sample Nos.	Kind	Price
3a	White iron (approx. wt. 110 g)	$15.00	107b	Nickel-chromium-molybdenum cast iron	$15.00
4i	Cast iron	15.00			
5k	Cast iron	15.00	115a	Copper-nickel-chromium cast iron	15.00
6f	Cast iron	15.00	122d	Cast iron (car-wheel)	15.00
7g	Cast iron (high phosphorus)	15.00	341	Ductile iron	15.00
55e	Ingot iron	15.00	342	Nodular iron	15.00
82a	Nickel-chromium cast iron	15.00			

Sample Nos.	C		Mn	P	S		Si	Cu	Ni	Cr	V	Mo
	Total	Graphitic			Grav.	Comb.						
3a	2.30	-------	0.317	0.118	0.082	0.083	1.12	0.121	0.017	0.048	0.006	0.006
4i	3.26	2.64	.793	.130	.054	.053	1.45	.253	.062	.104	.013	.003
5k	2.71	1.99	.536	.263	.100	.100	2.08	1.50	.051	.109	.014	.007
6f	2.91	2.19	.499	.530	.106	.106	1.85	0.252	.060	.442	.032	.009
7g	2.69	2.59	.612	.794	.061	.060	2.41	.128	.120	.048	.010	.012
55e	0.0112	-------	.035	.003	.012	.011	0.001	.065	.038	.006	<.001	.011
82a	2.24	1.71	.649	.053	.102	.103	2.07	.076	1.07	.323	.019	.008
107b	2.75	1.87	.510	.058	.067	.067	1.35	.235	2.12	.560	.008	.750
115a	2.62	1.96	1.00	.086	.064	.065	2.13	5.52	14.49	1.98	.014	.050
122d	3.28	2.49	0.504	.280	.092	.091	0.624	0.054	0.029	0.032	.011	.004
341	1.81	1.23	.92	.024	.007	.007	2.44	.152	20.32	1.98	.012	.010
342	2.45	2.14	.369	.020	.014	.014	2.85	.14	0.023	0.032	.005	.009

Sample Nos.	Co	Ti	As	Sn	Al (Total)	Mg	N
3a	--------	--------	--------	--------	--------	--------	0.008
4i	--------	0.026	0.018	--------	--------	--------	.006
5k	--------	.028	.027	--------	--------	--------	.009
6f	--------	.063	.032	--------	--------	--------	.005
7g	--------	.044	.014	--------	--------	--------	.004
55e	0.007	--------	.007	0.007	0.002	--------	.004
82a	--------	.065	--------	--------	--------	--------	--------
107b	--------	.016	--------	--------	--------	--------	.008
115a	--------	.020	--------	--------	--------	--------	--------
122d	--------	.007	.021	--------	--------	--------	.004
341	--------	.018	--------	--------	--------	0.068	--------
342	--------	.019	--------	--------	--------	.053	--------

3.4. White Cast Iron (Solid Form)

This group of white cast iron standards has been prepared for the cast iron industry to meet the urgent needs for analytical control by rapid instrumental methods. Although they are often employed in x-ray spectroscopic analysis, these standards are also particularly useful for the primary calibration of vacuum optical emission spectrometers in that they permit the determination of carbon, phosphorus, and sulfur in addition to the other metallic elements.

These materials are furnished as chill-cast sections approximately 1¼ inches square and ¾ inch thick. Details of the preparation and intended use of the standards will be found in the National Bureau of Standards Misc. Publ. 260-1, Preparation of NBS White Cast Iron Spectrochemical Standards by R. E. Michaelis and LeRoy L. Wyman (1964). The standards are furnished with a provisional certificate of analyses.

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

Sample Nos.	Kind	Price	Sample Nos.	Kind	Price
1176	White-cast iron A, piston ring	$35.00	1180	White-cast iron E, Mold	$35.00
1177	White-cast iron B, wear plate	35.00	1181	White-cast iron F	35.00
1178	White-cast iron C, die	35.00	1182	White-cast iron G	35.00
1179	White-cast iron D, brake drum	35.00	1183	White-cast iron H	35.00

Analyses

Sample Nos.	C	Mn	P	S	Si	Cu	Ni	Cr	V	Mo	Ti
1176	3.47	0.63	0.42	0.061	3.19	0.76	0.055	0.51	0.17	0.59	0.20
1177	2.74	.37	.61	.037	0.88	.087	2.97	1.39	.005	1.49	.080
1178	3.11	.86	.115	.026	1.91	.16	2.25	0.89	.017	0.94	.17
1179	3.35	.64	.23	.165	1.34	.41	1.31	.23	.036	.31	.030
1180	3.28	1.12	.055	.086	3.04	.20	0.044	.14	.26	.155	.53
1181	3.63	1.32	.29	.052	2.54	1.47	.11	2.04	.11	.042	(.04)
1182	1.97	0.45	.85	.046	0.31	0.49	.22	0.029	.060	.018	.034
1183	3.05	.91	.011	.025	1.76	1.01	.53	.077	.080	.029	.009

Sample Nos.	As	Sb	Sn	Co	Te	B	Bi	Zr	Pb	Al
1176	0.008	(0.3)	0.006	0.006	(0.014)	(0.001)	0.007	(<0.01)	0.002	(<0.01)
1177	(.01)	(.1+)	(.02)	.105	(.014)	(.025)	.017	<.01)	.002	(<.01)
1178	.024	.11	.086	.060	(.004)	(.11)	.013	(.014)	.004	(.016)
1179	(.05)	.11	.12	.031	(.024)	(.05)	.0045	(<.01)	.013	(<.01)
1180	.060	.063	.025	.035	(.024)	(.002)	.0025	(<.01)	.0043	(.040)
1181	.067	.005	.041	.012	(.025)	(.0014)	.0027	(.025)	(.008)	(.015)
1182	(.15)	(.004)	.016	.004	(.009)	(.009)	.006	(.010)	.0046	(<.01)
1183	.17	(.005)	.155	.017	(.022)	(.006)	.016	.124	.0055	(.017)

3.5. Steel-Making Alloys

These standard reference materials are intended to provide materials of known composition to check the performance of chemical methods of analysis for the major constituents and for those selected minor elements covered by specifications. They are furnished as fine powders, sized to about 100 mesh or finer. A Certificate of Analyses accompanies each material.

Sample Nos.	Kind	Approx. wt. in grams	Price
57	Refined silicon	60	$10.00
61a	Ferrovanadium	100	10.00
64b	Ferrochromium (high carbon)	100	10.00
66a	Spiegeleisen	100	10.00
71	Calcium molybdate	60	10.00
90	Ferrophosphorus	75	10.00
172	Ferroboron	100	10.00

Analyses

Sample Nos.	C	Mn	P	S	Si	Mo	Ti	Al	Ca
57	0.087	0.034	0.008	0.005	96.8		0.10	0.67	0.73
61a	1.06	1.78	.119	.005	5.12			.02	
64b	4.30	0.208	.012	.062	1.42				
66a	4.39	19.77	.049	.021	2.26				
71						35.3	.06		
90			26.2						
172	0.234				3.63			.05	

Sample Nos.	Fe	Cr	B	V	N	Cu	Ni	Zr	Mg
57	0.65	0.025				0.02	0.002	0.025	0.01
61a		.68		50.19					
64b		68.03		0.15	0.033				
71	1.92								
172			13.68						

3.6. Nonferrous Alloys (Chip Form)

These standard reference materials are intended to provide materials of known composition to check the performance of chemical methods of analysis. The bearing-metal and solder standards are furnished as approximately 60- to 200-mesh powders prepared by air-blowing a stream of molten metal. The aluminum-, magnesium-, and zinc-base alloys are furnished in the form of approximately 10- to 20-mesh chips. The remaining standards in the group are furnished as approximately 14- to 40-mesh chips prepared by cutting thin-wall castings or wrought bar stock. A Certificate of Analyses accompanies each material.

Sample Nos.	Kind	Approx. wt. in grams	Price	Sample Nos.	Kind	Approx. wt. in grams	Price
85b	Aluminum alloy, wrought	75	$10.00	158a	Bronze, silicon	150	$15.00
86c	Aluminum alloy, casting	75	10.00	167	Co43-Mo4-Nb3-W4	150	15.00
87a	Aluminum-silicon alloy	75	10.00	168	Co41-Mo4-Nb3-Ta1-W4	150	15.00
53d	Bearing metal, lead-base	170	15.00	349	Nickel-base (Ni57-Co14-Cr20)	150	15.00
54d	Bearing metal, tin-base	170	15.00	157a	Nickel silver (Cu58-Ni12-Zn29)	135	15.00
37e	Brass, sheet	150	15.00	161	Nickel-base casting alloy	150	15.00
52c	Bronze, cast	150	15.00	162a	Monel-type (Ni64-Cu31)	150	15.00
184	Bronze, leaded-tin	150	15.00	169	Ni77-Cr20 alloy	150	15.00
62d	Bronze, manganese	150	15.00	171	Magnesium-base alloy	100	10.00
164a	Bronze, aluminum	150	15.00	127a	Solder (Pb70-Sn30)	170	15.00
124d	Bronze (Cu85-Pb5-Sn5-Zn5) ounce metal	150	15.00	94b	Zinc-base die-casting alloy	150	10.00

Aluminum-Base Alloy Analyses

Sample Nos.	Cu	Mn	Si	Mg	Fe	Ti	Zn	Pb	V	Ga	Ni	Cr	Sn
85b	3.99	0.61	0.18	1.49	0.24	0.022	0.030	0.021	0.006	0.019	0.084	0.211	------
86c	7.92	.041	.68	0.002	.90	.035	1.50	.031	------	------	.030	.029	------
87a	0.30	.26	6.24	.37	.61	.18	0.16	.10	<0.01	.02	.57	.11	0.05

Copper-Base Alloy Analyses

Sample Nos.	Cu	Zn	Sn	Pb	Ni	Fe	Al	Mn
37e	69.61	27.85	1.00	1.00	0.53	0.004	------	------
52c	89.25	2.12	7.85	0.011	.76	.004	------	------
62d	59.07	37.14	0.38	.23	.28	.86	1.23	0.66
124d	83.60	5.06	4.56	5.20	.99	.18	------	------
158a	90.93	2.08	0.96	0.097	.001	1.23	0.46	1.11
164a	82.25	0.07	.04	.04	3.72	4.05	9.59	0.22
184	88.96	2.69	6.38	1.44	0.50	0.005	------	------
157a	58.61	29.09	0.021	0.034	11.82	.174	------	.174

Sample Nos.	Sb	As	Ag	Si	S	P	Co
52c	------	------	------	------	0.002	0.001	------
62d	------	------	------	0.075	------	------	------
124d	0.17	0.02	0.02	------	.093	.02	------
158a	------	------	------	3.03	------	.026	------
164a	------	------	------	0.03	------	------	<0.01
184	------	------	------	------	------	.009	------
157a	------	------	------	------	------	.009	.022

Cobalt-Base Alloy Analyses

Sample Nos.	Co	Ni	Cr	Mo	W	Nb	Ta	Fe	Mn	C	P
167	42.90	20.65	20.00	3.90	4.50	3.15	0.08	2.13	1.64	0.38	0.010
168	41.20	20.25	20.33	3.95	3.95	2.95	.95	3.43	1.50	.37	.008

Sample Nos.	S	Si	Cu	V	Ti
167	0.007	0.44	0.03	0.01	----
168	.005	.80	.035	.03	0.06

Lead- and Tin-Base Alloy Analyses

Sample Nos.	Pb	Sn	Sb	Bi	Cu	Fe	As	Ag	Ni
53d	----	4.94	9.92	0.135	0.268	----	0.045	----	0.0022
127a	----	30.03	0.79	.036	.004	----	.129	0.004	.002
54d	0.62	88.57	7.04	.044	3.62	0.027	.088	.0032	.0027

Magnesium-Base Alloy Analysis

Sample No.	Al	Zn	Mn	Si	Cu	Pb	Fe	Ni
171	2.98	1.05	0.45	0.0118	0.011	0.0033	0.0018	0.0009

Nickel-Base Alloy Analyses

Sample Nos.	Ni	Cu	Mn	Si	Co	Fe	Cr	Al	Ti	C	S
161	64.29	0.045	1.28	1.56	0.47	15.01	16.88	----	----	0.342	0.006
169	77.26	.015	0.073	1.42	.19	0.54	20.26	0.095	0.006	.043	.002
162a	63.95	30.61	1.60	0.93	.076	2.19	0.042	.50	.005	.079	.007
349	57.15	0.006	0.43	.29	13.95	0.13	19.50	1.23	3.05	.08	----

Sample Nos.	P	Zr	V	Ca	N	Mo	W	B	Nb	Ta
161	0.012	----	0.029	----	0.027	0.005	----	----	----	----
169	----	0.042	.018	0.015	.031	----	----	----	----	----
349	.002	.081	----	----	----	4.04	<0.01	0.0046	<0.01	<0.01

Zinc-Base Die-Casting Alloy Analysis

Sample No.	Al	Cu	Mg	Fe	Mn	Pb	Ni	Sn	Cd
94b	4.07	1.01	0.042	0.018	0.014	0.006	0.006	0.006	0.002

3.7. Copper-Base Alloys (Solid Form)

Several 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 wrought form for the consumer—both forms having identical (or nearly identical) composition. Seven principal copper-base alloys are covered by a "nominal-composition" together 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, and these have been certified.

The materials are furnished in two basic forms: (1) unidirectional chill-cast samples (C1100 series) in the form of solid sections 1¼ inches square, ¾ inch thick, and (2) wrought material (either forged or hot-extruded) in the form of disks 1¼ inches in diameter, ¾ inch thick (1100 series). Details on the preparation and use of the materials can be found in National Bureau of Standards Misc. Publ. 260-2, Preparation of NBS Copper-Base Spectrochemical Standards by R. E. Michaelis, LeRoy L. Wyman, and Richard Flitsch.

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

Sample Nos.		Kind	Price	Sample Nos.		Kind	Price
------	C1100	Cartridge Brass A	$30.00	1112	C1112	Gilding Metal A	$30.00
1101	C1101	Cartridge Brass B	30.00	1113	C1113	Gilding Metal B	30.00
1102	C1102	Cartridge Brass C	30.00	1114	C1114	Gilding Metal C	30.00
1103	C1103	Free-Cutting Brass A	30.00	1115	C1115	Commercial Bronze A	30.00
1104	C1104	Free-Cutting Brass B	30.00	1116	C1116	Commercial Bronze B	30.00
1105	C1105	Free-Cutting Brass C	30.00	1117	C1117	Commercial Bronze C	30.00
1106	C1106	Naval Brass A	30.00	1118	C1118	Aluminum Brass A	30.00
1107	C1107	Naval Brass B	30.00	1119	C1119	Aluminum Brass B	30.00
1108	C1108	Naval Brass C	30.00	1120	C1120	Aluminum Brass C	30.00
1109	C1109	Red Brass A	30.00				
1110	C1110	Red Brass B	30.00				
1111	C1111	Red Brass C	30.00				

ANALYSES

Sample Nos.		Cu	Zn	Pb	Fe	Sn	Ni	Al	Sb	As
------	C1100	67.43	32.20	0.106	0.072	0.055	0.052	0.008	0.018	0.019
1101	----------	69.60	30.26	.05	.037	.016	.013	.0006	.012	.009
------	C1101	69.50	30.34	.05	.037	.016	.013	.0006	.012	.009
1102	C1102	72.85	27.10	.020	.011	.006	.005	.0007	.005	.004
1103	----------	59.27	35.7	3.73	.26	.88	.16	----------	----------	----------
------	C1103	59.19	35.7	3.81	.26	.88	.16	----------	----------	----------
1104	C1104	61.33	35.3	2.76	.090	.43	.071	----------	----------	----------
1105	----------	63.7	34.0	2.0	.044	.21	.043	----------	----------	----------
------	C1105	63.72	34.0	2.01	.044	.21	.043	----------	----------	----------
1106	C1106	59.08	40.08	0.032	.004	.74	.025	----------	----------	----------
1107	C1107	61.21	37.34	.18	.037	1.04	.098	----------	----------	----------
1108	C1108	64.95	34.42	.063	.050	0.39	.033	----------	----------	----------
1109	----------	82.2	17.4	.075	.053	.10	.10	----------	----------	----------
------	C1109	82.22	17.43	.075	.053	.10	.10	----------	----------	----------
1110	C1110	84.59	15.20	.033	.033	.051	.053	----------	----------	----------
1111	C1111	87.14	12.81	.013	.010	.019	.022	----------	----------	----------
1112	C1112	93.38	6.30	.057	.070	.12	.100	----------	----------	----------
1113	C1113	95.03	4.80	.026	.043	.064	.057	----------	----------	----------
1114	C1114	96.45	3.47	.012	.017	.027	.021	----------	----------	----------
1115	C1115	87.96	11.73	.013	.13	.10	.074	----------	----------	----------
1116	C1116	90.37	9.44	.042	.046	.044	.048	----------	----------	----------
1117	C1117	93.01	6.87	.069	.014	.021	.020	----------	----------	----------
1118	----------	75.1	21.9	.025	.065	----------	----------	2.80	.010	.007
------	C1118	75.07	21.91	.024	.068	----------	----------	2.80	.010	.007
1119	----------	77.1	20.5	.050	.030	----------	----------	2.14	.050	.040
------	C1119	77.12	20.53	.051	.032	----------	----------	2.14	.053	.040
1120	----------	80.1	18.1	.105	.015	----------	----------	1.46	.100	.090
------	C1120	80.14	18.10	.105	.015	----------	----------	1.46	.104	.088

Analyses

Sample Nos.		Be	Bi	Cd	Mn	P	Si	Ag	Te
	C1100	0.0015	0.0010	0.013	0.003	0.010	(0.010)	0.019	0.0035
1101	C1101	.00055	.0004	.0055	.0055	.0020	(.005)	.003	.0015
1102	C1102	.00003	.0005	.0045	.0045	.0048	(.002)	.0010	.0003
1103	C1103					.003			
1104	C1104					.005			
1105	C1105					.003			
1106	C1106				.005				
1107	C1107								
1108	C1108				.025				
1109	C1109					.006			
1110	C1110								
1111	C1111								
1112	C1112					.009			
1113	C1113					.008			
1114	C1114					.009			
1115	C1115					.005			
1116	C1116					.008			
1117	C1117					.002			
1118						.13	.0021		
	C1118					.125	.0021		
1119	C1119					.070	.0015		
1120	C1120					.018	.0011		

3.8. High Temperature Alloys (Solid Form)

High temperature alloy standards have been prepared to meet the critical needs of industry and government, particularly the Department of Defense and the aerospace industries, for alloys of this type. These standards are useful in instrument calibration, primarily for optical emission and x-ray spectroscopic methods of analysis.

Some samples are issued in the wrought form (1184, 1185, and 1189) of disks 1¼ inches in diameter and ¾ inch thick; others in the chill-cast form (1190, 1203, 1204, and 1205) of sections 1¼ inches square and ¾ inch thick.

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

Sample Nos.	Kind	Price	Sample Nos.	Kind	Price
1184	19-9DL	$35.00	1203	Inco 713–A	$35.00
1185	AMS 5360A, AISI 316	35.00	1204	Inco 713–B	35.00
1189	Nimonic 80a	35.00	1205	Inco 713–C	35.00
1190	Udimet 500	35.00			

Analyses

Sample Nos.	C	Mn	Si	Cr	Ni	Co	Mo	W	Nb
1184	(0.25	1.04	0.70	19.44	9.47		1.46	1.39	0.49
1185	.11	1.22	.40	17.09	13.18		2.01		<.001
1189	.041	.81	.92	20.30	72.60	0.06			
1190	0.10)	0.61	.22	17.00	51.9	19.1	3.80	0.08	<.01
1203	(0.01)	.31	.86	11.90	75.5		3.01	<.01	1.00
1204	(0.03)	.41	.56	12.75	70.6		4.28	.028	1.31
1205	(0.19)	.29	.63	13.82	67.5		5.75	.019	1.95

Sample Nos.	Ti	Al	Fe	P	S	Cu	Ta	Zr
1184	0.056			0.015	0.012		0.022	
1185	<.001			.019	.016	0.067	<.001	
1189	2.52	1.21	1.40					
1190	3.57	2.83	(0.6)			.093	<.01	0.11
1203	1.09	4.34	(1.4)			.19	.34	.055
1204	0.63	5.60	(3.1)			.12	.46	.12
1205	.36	6.68	(1.55)			.056	.67	.46

3.9. Nickel Oxides

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

Sample Nos.	Kind	Price
671	Nickel oxide 1	$15.00
672	Nickel oxide 2	15.00
673	Nickel oxide 3	15.00

ANALYSES

Sample Nos.	Co	Cu	Fe	Mg	Mn	Si	Ti	Al	Cr
671	0.31	0.20	0.39	0.030	0.13	0.047	0.024	0.009	0.025
672	.55	.018	.079	.020	.095	.11	.009	.004	.003
673	.016	.002	.029	.003	.0037	.006	.003	.001	.0003

3.10. Tin Metal (Solid Form)

Several tin metal standard reference materials have been prepared primarily for the tin-plate industry and are useful for calibration of optical emission spectroscopic equipment.

This group of tin metal standards is supplied in two forms: (1) rods ¼ inch in diameter and 4 inches long (400 series), intended for calibration in optical emission spectroscopic methods by the "point-to-point" technique; and (2) rods ½ inch in diameter and 2 inches long (800 series), intended for calibration by the "point-to-plane" technique. A provisional certificate of analysis is furnished with each standard.

Sample Nos.	Kind	Price	Sample Nos.	Kind	Price
431	Tin A	$15.00			
432	Tin B	15.00	832	Tin B	$25.00
433	Tin C	15.00	833	Tin C	25.00
434	Tin D	15.00	834	Tin D	25.00
435	Tin E	15.00			

ANALYSES

Sample Nos.		Cu	Pb	As	Sb	Ni	Zn	Ag	Bi	Cd	Co
431	----	0.19	0.19	0.16	0.19	0.038	0.041	0.015	0.020	0.020	0.021
432	832	.097	.094	.075	.095	.020	.020	.0095	.0098	.0095	.011
433	833	.055	.055	.047	.050	.0095	.0095	.0055	.0052	.0053	.0045
434	834	.019	.022	.019	.019	.0044	.0046	.0018	.0020	.0020	.0020
435	----	.0077	.015	.0090	.010	.0024	.0020	.0010	.0011	.0011	.0011

3.11. 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 intended for chemical analysis, for spectroscopic analysis, and for vacuum fusion analysis.

Titanium-base alloy standards 173a, 175, and 176 are furnished in 100-g portions as chips sized between 16 and 35 mesh sieves, and are intended to furnish material of known composition to check the accuracy of chemical methods of analysis of these alloys. Standards 641, 642, 643, 644, 645, 646, 653, and 654 are furnished in the forms of disks 1¼ inches in diameter ¾ inch thick, and are intended as calibration materials for optical emission and x-ray spectroscopic methods of analysis of similar materials. Standards 352, 353, and 354 are furnished in 20-g portions of ¼ inch squares cut from a sheet about 0.05 inch thick, and are intended to check methods for the determination of hydrogen only.

Sample Nos.	Kind (Approx. wt. 100 g)	Price	Sample No.	Kind (Approx. wt. 100 g)	Price
173a	6Al–4V	$15.00	176	5Al–2.5Sn	$15.00
174	4Al–4Mn	15.00			

Analyses

Sample Nos.	Al	V	Mn	Fe	Cr	Si	Mo	C	N
173a	6.47	4.06		0.15		0.037	0.005	0.025	0.018
174	4.27		4.57	.175		.015			.012
176	5.16		0.0008	.070			.0003	.015	.010

Sample Nos.	Sn	Ni	Cu
173a			0.002
176	2.47		.003

Sample Nos.	Kind (disks)	Price	Sample Nos.	Kind (disks)	Price
641	8Mn (A)	$25.00	646	2Cr–2Fe–2Mo (C)	$25.00
642	8Mn (B)	25.00	653	6Al–4V (A)	25.00
643	8Mn (C)	25.00	654	6Al–4V (B)	25.00
644	2Cr–2Fe–2Mo (A)	25.00			
645	2Cr–2Fe–2Mo (B)	25.00			

Analyses

Sample Nos.	Mn	Cr	Fe	Mo	Al	V
641	6.68					
642	9.08					
643	11.68					
644		1.03	1.36	3.61		
645		1.96	2.07	2.38		
646		3.43	2.14	1.11		
653					7.25	2.58
654					6.03	3.83

Sample Nos.	Kind	Price	Sample No.	Kind	Price
352	Unalloyed titanium for hydrogen	$20.00	354	Unalloyed titanium for hydrogen	$20.00
353	Unalloyed titanium for hydrogen	20.00			

ANALYSES

Sample Nos.	Composition percent hydrogen
352	0.0032
353	.0098
354	.0215

3.12. Zirconium-Base Alloys

Several zirconium-base standard reference materials of particular importance to the field of atomic energy have been prepared and are available for analytical control and instrumental calibration. A number of trace elements at the parts-per-million level critical to the application of zirconium metal and Zircaloy-2 have been certified in the standards.

Standard 360 is furnished in the form of chips (18- to 40-mesh) to check chemical methods of analysis for Zircaloy-2. Standards 1210, 1211, 1213, 1214, and 1215 are furnished as wrought disks 1¼ inch in diameter, ¾ inch thick, to provide material of known composition for the calibration of optical emission and x-ray spectroscopic methods of analysis for zirconium metal (NBS Nos. 1210 and 1211) and Zircaloy-2 (NBS Nos. 1213, 1214, and 1215).

Sample No.	Kind	Price
360	Zircaloy-2	$30.00

ANALYSIS

Sample No.	Kind	Mn	Fe	Cr	C	Sn	Ni	Cu
360	Zircaloy-2	0.001	0.156	0.114	<0.01	1.43	0.052	0.001

Sample No.	Kind	Mo	Si	Ti	W	U
360	Zircaloy-2	<0.0005	0.0045	0.0009	0.0015	0.00007

Sample Nos.	Kind	Price	Sample Nos.	Kind	Price
1210	Zirconium metal A	$60.00	1214	Zircaloy-2 E	$60.00
1211	Zirconium metal B	60.00	1215	Zircaloy-2 F	60.00
1213	Zircaloy-2 D	60.00			

Sample Nos.	Parts per million											Percent
	Al	B	Cr	Cu	Mn	Mo	Ni	Si	Ti	U	W	Fe
1210	(60)	(<0.25)	95	10	(5)	------	8	(30)	26	1.8	(4)	0.25
1211	(90)	----------	95	44	(7)	22	26	(100)	50	2.3	(40)	0.102

Sample Nos.	Parts per million								Percent			
	Al	Cu	Mn	Mo	Si	Ti	U	W	Sn	Cr	Fe	Ni
1213	(50)	22	(6)	------	(30)	(33)	2.0	---------	1.76	0.052	0.068	0.018
1214	--------	55	38	30	(120)	(50)	45	(40)	1.60	0.108	0.067	0.051
1215	--------	140	------	(100)	(350)	------	9	---------	0.95	0.190	0.259	0.097

3.13. Zinc-Base Die-Casting Alloys and Zinc Spelter (Solid Form)

These standards, widely used in the automotive industry, are intended for instrument calibration by optical emission spectroscopic methods of analysis primarily for ASTM alloys AG40A and AC41A. The materials are supplied as bar segments 1¾ inches square and ¾ inch thick. They were prepared by a continuous chill-casting process. The certified portion of each standard is that part included between 3/16 inch and 11/16 inch from each side of the square sample. The center core, 3/16 inch square; and the outer portion, 3/16 inch from the outer surface, are parts which may differ in composition for some elements from the certified portion, and should not be used.

A certificate of analysis supplied with the standard gives the composition as determined at the National Bureau of Standards, and all except the spelter include values obtained by outside laboratories cooperating in the certification of the standards.

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

Sample Nos.	Kind	Price	Sample Nos.	Kind	Price
625	Zinc-base A	$25.00	629	Zinc-base E	$25.00
626	Zinc-base B	25.00	630	Zinc-base F	25.00
627	Zinc-base C	25.00	631	Zinc spelter (modified)	25.00
628	Zinc-base D	25.00			

ANALYSES

Sample Nos.	Cu	Al	Mg	Fe	Pb	Cd	Sn	Cr	Mn	Ni	Si
625	0.034	3.06	0.070	0.036	0.0014	0.0007	0.0006	0.0128	0.031	0.0184	0.017
626	.056	3.56	.020	.103	.0022	.0016	.0012	.0395	.048	.047	.042
627	.132	3.88	.030	.023	.0082	.0051	.0042	.0038	.014	.0029	.021
628	.611	4.59	.0094	.066	.0045	.0040	.0017	.0087	.0091	.030	.009
629	1.50	5.15	.094	.017	.0135	.0155	.012	.0008	.0017	.0075	.078
630	0.976	4.30	.030	.023	.0083	.0048	.0040	.0031	.0106	.0027	.022

Sample No.	Kind	Al	Fe	In	Cu	Cd	Mn	Cr	Sn
631	Zinc spelter (modified)	0.50	0.005	0.0023	0.0013	0.0002	0.00015	0.0001	0.0001
		Ga	Si	Pb	Mg	Ca	Ni	Ag	Ge
		(0.002)	(<0.002)	(0.001)	(<0.001)	(<0.001)	(<0.0005)	(<0.0005)	(0.0002)

3.14. Ores

These materials of known composition are intended for use in checking the accuracy of assay methods. They are certified for the element(s) of economic interest, and occasionally have additional data given as a matter of information. This group is furnished in the form of fine powders, usually passing a 100–mesh or finer sieve.

Sample Nos.	Kind	Approximate wt.	Price	Sample Nos.	Kind	Approximate wt.	Price
69a	Bauxite	50 g	$10.00	183	Lithium ore (Lepidolite)	45 g	$10.00
27e	Iron ore, Sibley	100 g	10.00	25c	Manganese ore	100 g	10.00
28a	Iron ore, Norrie	50 g	5.00	120a	Phosphate rock	45 g	10.00
181	Lithium ore (Spodumene)	45 g	10.00	138	Tin ore (N.E.I. concentrate)	50 g	10.00
182	Lithium ore (Petalite)	45 g	10.00	113	Zinc ore (Tri-State concentrate)	50 g	10.00

Analyses

Sample Nos.	Kind	Elements Certified
27e	Iron, Sibley	Fe, 66.58; P, 0.042; SiO_2, 3.65
28a	Iron, Norrie	Mn, 0.435
181	Lithium (Spodumene)	Li_2O, 6.4
182	Lithium (Petalite)	Li_2O, 4.3
183	Lithium (Lepidolite)	Li_2O, 4.1
25c	Manganese	Mn, 57.85; available O_2, 16.70
138	Tin (N.E.I. concentrate)	Sn, 74.8
113	Zinc (Tri-State concentrate)	Zn, 61.1

Bauxite Analysis

Sample No.	Kind	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	ZrO	MnO	P_2O_5	Cr_2O_3
69a	Bauxite	6.0	55.0	5.8	2.8	0.18	<0.01	0.08	0.05

CaO	BaO	MgO	Na_2O	K_2O	SO_3	Loss on ignition
0.29	0.01	0.02	<0.01	<0.01	0.04	29.55

Phosphate Rock Analysis

Sample No.	P_2O_5	Fe_2O_3	Al_2O_3	CaO	MgO	F	MnO	Na_2O	K_2O	TiO_2	CO_2
120a	34.4	1.00	0.94	50.3	0.26	3.92	0.02	0.41	0.10	0.12	3.18

3.15. 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 grams of material.

Sample Nos.	Kind	Price	Sample Nos.	Kind	Price
1011	Portland cement	$10.00	1015	Portland cement	$10.00
1013	Portland cement	10.00	1016	Portland cement	10.00
1014	Portland cement	10.00			

Analyses

Sample Nos.	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	P_2O_5	CaO (+SrO)	SrO	MgO	SO_3	Mn_2O_3	Na_2O	K_2O	Loss on ignition
1011	21.03	5.38	2.07	0.25	0.33	66.60	0.11	1.12	1.75	0.03	0.08	0.26	1.13
1013	24.17	3.30	3.07	.20	.20	64.34	.08	1.39	1.80	.05	.20	.32	0.99
1014	19.49	6.38	2.50	.25	.32	63.36	.26	2.80	2.70	.07	.24	.99	.81
1015	20.65	5.04	3.27	.26	.05	61.48	.11	4.25	2.28	.06	.16	.87	1.70
1016	21.05	4.97	3.71	.34	.13	65.26	.25	0.42	2.27	.04	.55	.04	1.20

3.16. Ceramic Materials

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 and steel industries. Note that Silica brick No. 102 is a density sample with density of 2.33 g/cm³ at 25 °C.

Sample Nos.	Kind	Approximate weight	Price	Sample Nos.	Kind	Approximate weight	Price
76	Burned refractory (40% Al_2O_3)	60 g	$10.00	92	Glass, low boron	45 g	$10.00
77	Burned refractory (60% Al_2O_3)	60 g	10.00	93	Glass, high boron	45 g	10.00
78	Burned refractory (70% Al_2O_3)	60 g	10.00	165	Glass sand (low iron)	60 g	10.00
103a	Chrome refractory	60 g	10.00	1a	Limestone, argillaceous	50 g	10.00
198	Silica refractory (0.2% Al_2O_3)	45 g	10.00	102	Silica brick	60 g	10.00
199	Silca refractory (0.5% Al_2O_3)	45 g	10.00	104	Burned magnesite	60 g	10.00
89	Glass, lead-barium	45 g	10.00	112	Silicon carbide	85 g	10.00
91	Glass, opal	45 g	10.00	154a	Titanium dioxide	40 g	10.00

Analyses

Sample Nos.	Kind	SiO_2	Al_2O_3	Fe_2O_3	FeO	TiO_2	ZrO_2	MnO	P_2O_5
76	Alumina refractory	54.7	37.7	2.4	-------	2.2	0.07	-------	0.07
77	Alumina refractory	32.4	59.4	0.90	-------	2.9	.09	-------	.45
78	Alumina refractory	20.7	70.0	.79	-------	3.4	.12	-------	.62
103a	Chrome refractory	4.6	29.96	-------	12.43	0.22	.01	0.11	.01
198	Silica refractory	-------	0.16	.66	-------	.02	<.01	<.01	.02
199	Silica refractory	-------	.48	.74	-------	.06	.01	<.01	.01

Sample Nos.	Kind	V_2O_5	Cr_2O_3	CaO	MgO	Li_2O	Na_2O	K_2O	Loss on ignition
76	Alumina refractory	0.02	-------	0.27	0.58	0.11	0.15	1.54	0.22
77	Alumina refractory	.03	-------	.26	.50	.35	.06	2.11	.21
78	Alumina refractory	.05	-------	.38	.51	.20	.06	2.83	.26
103a	Chrome refractory	-------	32.06	.69	18.54	-------	-------	-------	-------
198	Silica refractory	-------	-------	2.71	0.07	.001	.01	0.02	.21
199	Silica refractory	-------	-------	2.41	.13	.002	.01	.09	.17

Glass Analyses

Sample Nos.	Kind	SiO_2	PbO	Al_2O_3	Fe_2O_3	ZnO	MnO	TiO_2	ZrO_2	CaO	BaO	Loss on ignition
89	Lead-barium	65.35	17.50	0.18	0.049		0.088	0.01	0.005	0.21	1.40	0.32
91	Opal	67.53	0.097	6.01	.081	0.08	.008	.019	.01	10.48		
93	High-boron	80.60		1.94	.076			.027	.013			

Sample Nos.	Kind	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	Lead-barium	0.03	8.40	5.70		0.23	0.36	0.03	0.03	0.05		0.32
91	Opal	.008	3.25	8.48		.022	.102	.091		.014	5.72	
92	Low-boron				0.70							
93	High-boron	.026	0.16	4.16	12.76		.14	.085	.009	.036		

Glass Sand Analysis

Sample No.	Fe_2O_3
165	0.019

Limestone, Silica Brick, Burned Magnesite and Titanium Dioxide Analyses

Sample Nos.	Kind	SiO_2	Fe_2O_3	Al_2O_3	TiO_2	MnO	CaO	SrO	MgO	Na_2O
1a	Limestone	14.11	1.63	4.16	0.16	0.038	41.32	0.23	2.19	0.39
102	Silica brick	93.94	0.66	1.96	.16	.005	2.29		0.21	.015
104	Burned magnesite	2.54	7.07	0.84	.03	.43	3.35		85.67	.015
154a	Titanium dioxide				99.6					

Sample Nos.	Kind	K_2O	SO_3	S	P_2O_5	CO_2	C	Loss on ignition	Density
1a	Limestone	0.71	0.04	0.25	0.15	33.53	0.61	34.55	
102	Silica brick	.32			.025			0.38	2.33 g/cm³ at 25 °C.
104	Burned magnesite	.015			.057				

Silicon Carbide Analysis

Sample No.	Total Si	Total C	Free C	SiC	Fe	Al	Ti	Zr	Ca	Mg
112	69.11	29.10	0.09	96.85	0.45	0.23	0.025	0.027	0.03	0.02

3.17. Hydrocarbon Blends

These standard hydrocarbon blends were prepared for calibration of mass spectrometric and other instrumental procedures used in the analysis of gasolines, naphthas, and blending stocks. Each sample comprises ten ampoules, each ampoule containing about 0.03 ml of the blend. To retard the effects of possible fractionation of the components after the ampoule is opened, each ampoule is intended to provide material for only one calibration analysis. For the individual components present in the mixtures in the amount of 10 percent or less, the limits of error in composition are not greater than ±0.01 percent and for components present in over 10 percent, the limits of error are not greater than ±0.10 percent. The composition of each blend is given in volume percent. A certificate is supplied with each of these samples.

Sample Nos.	Kind	Unit of issue	Price
592	Blend no. 1. C_7 Paraffins in typical virgin naphthas	10 ampoules	$12.00
593	Blend no. 2. C_7 Paraffins in typical catalytically cracked naphthas	10 ampoules	12.00
594	Blend no. 3. C_8 Paraffins in typical virgin naphthas	10 ampoules	12.00
595	Blend no. 4. C_8 Paraffins in catalytically cracked naphthas	10 ampoules	12.00
596	Blend no. 5. C_7 Cycloparaffins in typical virgin naphthas	10 ampoules	12.00
597	Blend no. 6. C_7 Cycloparaffins in catalytically cracked naphthas	10 ampoules	12.00
598	Blend no. 7. C_8 Cycloparaffins in typical virgin naphthas	10 ampoules	12.00
599	Blend no. 8. C_8 Cycloparaffins in catalytically cracked naphthas	10 ampoules	12.00

Analyses

Sample Nos.	592	593	594	595	596	597	598	599
Blend No.	1	2	3	4	5	6	7	8
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-Dimethylcyclohexane							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

3.18. Metallo-Organic Compounds

This group of standards is intended to provide oil-soluble materials of known and reproducible composition, so that possession of an adequate collection will permit preparation of any desired blend of known concentration in any appropriate lubricating oil. It has been prepared primarily for the transportation industry and the defense program for the analysis of lubricating oils to determine wear of engine parts. Details of the selection, preparation, and analysis of the compounds can be found in National Bureau of Standards Monograph 54, Analytical Standards for Trace Elements in Petroleum Products (1962).

A certificate is supplied with each standard giving the amount of the element of interest present, and directions for the preparation of a solution of known concentration in lubricating oil.

Sample Nos.	Kind (approximate wt. 5 grams)	Constituents determined	%	Price
1075	Aluminum 2-ethylhexanoate	Al	7.5	$15.00
1051a	Barium cyclohexanebutyrate	Ba	29.1	15.00
1063a	Menthyl borate	B	2.4	15.00
1053	Cadmium cyclohexanebutyrate	Cd	24.0	15.00
1074	Calcium 2-ethylhexanoate	Ca	13.4	15.00
1078	Tris(1-phenyl-1,3-butanediono)chromium (III)	Cr	9.6	15.00
1055a	Cobalt cyclohexanebutyrate	Co	17.4	15.00
1056a	Cupric cyclohexanebutyrate	Cu	16.1	15.00
1079	Tris(1-phenyl-1,3-butanediono)iron (III)	Fe	10.3	15.00
1059a	Lead cyclohexanebutyrate	Pb	36.9	15.00
1060a	Lithium cyclohexanebutyrate	Li	4.1	15.00
1061a	Magnesium cyclohexanebutyrate	Mg	6.8	15.00
1062a	Manganous cyclohexanebutyrate	Mn	13.8	15.00
1064	Mercuric cyclohexanebutyrate	Hg	36.2	15.00
1065a	Nickel cyclohexanebutyrate	Ni	16.8	15.00
1071a	Triphenyl phosphate	P	9.5	15.00
1066	Octaphenylcyclotetrasiloxane	Si	14.1	15.00
1076	Potassium erucate	K	10.1	15.00
1077	Silver 2-ethylhexanoate	Ag	42.4	15.00
1069a	Sodium cyclohexanebutyrate	Na	11.9	15.00
1070a	Strontium cyclohexanebutyrate	Sr	20.7	15.00
1057a	Dibutyltin bis(2-ethylhexanoate)	Sn	23.2	15.00
1052a	Bis(1-phenyl-1,3-butanediono)oxovanadium (IV)	V	13.1	15.00
1073a	Zinc cyclohexanebutyrate	Zn	16.7	15.00

3.19. Microchemical Standards

This group of materials is furnished, primarily for the drug industry, as fine crystals of suitable homogeneity for the conventional microchemical methods employing samples of approximately 5 mg.

Sample Nos.	Kind	Constituents determined or intended use	Approximate weight of sample in grams	Price
140b	Benzoic acid	C, H	2	$9.00
141a	Acetanilide	N, C, H	2	9.00
142	Anisic acid	Methoxyl	2	9.00
143b	Cystine	S, C, H, N	2	9.00
145	2-Iodobenzoic acid	I	2	9.00
147	Triphenyl phosphate	P	2	9.00

3.20. Chemicals

These chemicals are primary standards. The sucrose and dextrose, standards 17 and 41, are useful as primary standards in the assay of sugar-containing materials. The remaining standards are furnished for the preparation or standardization of solutions used in titrimetric methods of chemical analysis.

Sample Nos.	Kind		Approx. wt. in grams	Price
84g	Acid potassium phthalate	Acidimetric value	60	$6.00
350	Benzoic acid	Acidimetric value	30	6.00
40g	Sodium oxalate	Oxidimetric value	60	6.00
83c	Arsenic trioxide	Oxidimetric value	75	6.00
136b	Potassium dichromate	Oxidimetric value	75	6.00
17	Sucrose (cane sugar)	Saccharimetric value	60	6.00
41	Dextrose (glucose)	Reducing value	70	6.00
950a	Uranium oxide (U_3O_8)	Uranium standard	25	7.50

Sample Nos.	Kind	Purity on basis of titration
		%
84g	Acid potassium phthalate	99.98
350	Benzoic acid	99.98
40g	Sodium oxalate	99.95
83c	Arsenic trioxide	99.99
136b	Potassium dichromate	99.98
950a	Uranium oxide U_3O_8	99.94

SUGARS

Sample Nos.	Kind	Moisture	Reducing substances	Ash
		%	%	%
17	Sucrose	<0.01	<0.02	0.003
41	Dextrose	<.01		.003

3.21. Special Nuclear Materials

This group of standards consists of a plutonium metal standard issued to check chemical methods of assay, a plutonium sulfate isotopic standard with an isotopic analysis by mass spectrometry and intended for the calibration of such instruments, and a group of 16 uranium oxide isotopic 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.

Sample No.	Kind	Certified for	Unit	Price
		Plutonium content	*Pu*	
949a	Plutonium metal	99.91%	0.5 g	$34.00

Sample Nos.	Kind	Isotopic abundance (wt. %)				Unit	Price
		Pu-239	*Pu-240*	*Pu-241*	*Pu-242*	*Pu*	
948	Plutonium sulfate hydrate	91.329	7.937	0.700	0.0334	0.25g	$40.00
	Uranium oxide U_3O_8	*U-234*	*U-235*	*U-236*	*U-238*	*U*	
U-005	U-235-depleted	0.0023	0.483	0.0046	99.51	1.0 g	20.50
U-010	U-235-enriched	.0054	.991	.0067	98.99	1.0	20.50
U-015	U-235-enriched	.009	1.51	.016	98.47	1.0	20.50
U-020	U-235-enriched	.012	2.01	.016	97.96	1.0	21.00
U-030	U-235-enriched	.018	3.01	.020	96.95	1.0	21.00
U-050	U-235-enriched	.028	4.95	.048	94.98	1.0	21.00
U-100	U-235-enriched	.067	10.07	.038	89.82	1.0	22.00
U-150	U-235-enriched	.099	15.13	.065	84.71	1.0	23.00
U-200	U-235-enriched	.125	19.80	.209	79.86	1.0	23.50
U-350	U-235-enriched	.249	34.89	.170	64.69	1.0	26.50
U-500	U-235-enriched	.512	49.38	.0755	50.03	1.0	29.00
U-750	U-235-enriched	.593	75.12	.252	24.03	1.0	33.50
U-800	U-235-enriched	.660	80.07	.246	19.02	1.0	34.00
U-850	U-235-enriched	.64	84.99	.37	14.00	1.0	35.00
U-900	U-235-enriched	.77	90.10	.33	8.80	1.0	36.00
U-930	U-235-enriched	1.08	93.27	.205	5.44	1.0	37.50

3.22. Isotopic Reference Standards

This group of standards are natural-ratio materials, and will serve as standard reference materials for those looking for small variations in the isotopic composition of the elements, and for the measurement of mass-discrimination effects encountered in the operation of mass spectrometers. The isotopic composition has been determined by mass spectrometry by comparison with mixtures prepared from high-purity isotopes. The standards are furnished in 0.25 g units with a certificate of isotopic composition.

Sample Nos.	Kind	Element	Price
975	Sodium chloride	Chlorine	$20.00
976	Copper metal	Copper	20.00
977	Sodium bromide	Bromine	20.00
978	Silver nitrate	Silver	20.00

4. Standards of Certified Properties and Purity

4.1. *p*H 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 *p*H materials. The samples are furnished with certificates giving directions for preparation of the solutions and tables of *p*H values at various temperatures.

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

Sample Nos.	Kind	*p*H (S) (at 25 °C)	Approx. wt. in grams	Price
185d	Acid potassium phthalate	4.004	60	$5.00
186Ib	Potassium dihydrogen phosphate	See above	30	5.00
186IIb	Disodium hydrogen phosphate	See above	30	5.00
187a	Borax	9.180	30	5.00
188	Potassium hydrogen tartrate	3.557	60	5.00
189	Potassium tetroxalate	1.679	65	5.00

4.2. Freezing-Point Standards

These materials are furnished in ingot forms of approximately 50 milliliters volume and are intended for the calibration of resistance thermometers and thermocouples.

Sample Nos.	Kind	Freezing Point °C	Approx. wt. in grams	Price
44e	Aluminum	660.0	200	$12.00
45d	Copper	1083.3	450	12.00
49e	Lead	327.417	600	12.00
42f	Tin	231.88	350	12.00

4.3. Thermometric Cells

These cells are primarily intended for calibration of solidification point thermometers used in certain ASTM test procedures. The reference temperatures are realized under conditions of slow freezing of the liquid. Directions for their use are provided with each cell, together with a report of the maximum measured reference temperatures. It is not intended to renew production of these standard cells when the present supply is exhausted. It is planned, however, to continue to make available the pure materials used in preparation of the cells.

Sample Nos.	Kind	Price
940	Phenol thermometric cell near 40.8 °C	$50.00
941	Naphthalene thermometric cell near 80.2 °C	50.00
942	Pthlalic anhydride thermometric cell near 131.1 °C	50.00
943	Benzoic acid thermometric cell near 122.36 °C	
	Set of certified cell, companion cell, and case	400.00

4.4. Calorimetric Standards

These standards are issued primarily to check the performance of calorimetric methods for the determination of heat of combustion. Standard 217b is certified for density and index of refraction at 20, 25, and 30 °C. 217b–8S is in a special ampoule with an internal break-off tip, the others are sealed "in vacuum" in a plain glass ampoule.

Sample Nos.	Kind	Amount	Price	Sample Nos.	Kind	Amount	Price
39i	Benzoic acid, 26.434 absolute kilojoules	30 g	$ 6.00	217b–8S	2, 2, 4-Trimethylpentane	8 ml	$ 60.00
				217b–25	2, 2, 4-Trimethylpentane	25 ml	175.00
217b-5	2, 2, 4-Trimethylpentane, 47.713 absolute kilojoules	5 ml	35.00	217b–50	2, 2, 4-Trimethylpentane	50 ml	325.00

4.5. Radioactivity Standards

Because of the nature of these materials, all, except the radium rock samples and the carbon 14 dating standard, are shipped by express only (shipping charges collect) to destinations in the United States and Canada.

In the case of shipments to other countries, consignee should apply to the National Bureau of Standards for pro forma invoices, and establish credit in advance at any bank in the United States, or send payment by international money order or UNESCO coupons, to cover the cost of the standards. Consignee can either appoint an agent in the United States to handle shipments abroad, or shipments can be made by air freight or express (shipping charges collect) subject to the laws and regulations of the importing country.

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

Prices of certain materials may change as current stocks are depleted and are replaced by new issues. In these instances, buyers will be notified before orders are filled.

4.5.1. Alpha-Ray Standards

Samples Nos. 4900, 4901, and 4902 consist of practically weightless deposits of polonium 210 on monel disks 2.54 cm in diameter and 0.16 cm thick. The activity per sample is restricted to a 0.3 cm-diameter area in the center of the disk.

Sample No. 4904–A consists of a practically weightless deposit of americium 241 on a platinum foil 1.27 cm in diameter, 0.015 cm thick. This foil is cemented onto a monel disk 2.54 cm in diameter and 0.16 cm thick. The activity is restricted to a 0.3 cm-diameter area in the center of the foil. These samples can now be distributed under the general licensing provisions of the Atomic Energy Act of 1954. (Please refer to Amendments to Title 10, Chapter 1, Part 30, Licensing of By-Product Material, General Licenses for Americium 241, 29 Federal Register 5882, May 5, 1964.)

Sample Nos.	Radionuclide	Apprioxmate α-particle emission rate in 2π geometry	Price
4900	Polonium-210	100 αps	$50.00
4901	Polonium-210	250 αps	50.00
4902	Polonium-210	500 αps	50.00
4904-A	Americium-241	20 αps	60.00

4.5.2. Beta-Ray and Gamma-Ray Solution Standards

The samples are contained in flame-sealed glass ampoules. The total activity of standards 4924 and 4925 (carbon-14) is such that they may be ordered singly under the general licensing provisions of the Atomic Energy Act of 1954.

Sample Nos.	Radionuclide	Calibration radiation (d)	Approximate activity or emission rate at time of calibration (month, year)	Approximate weight of solution	Price
4921-C	Sodium-22	β^+	1×10^4 β^+ps/g (8/64)	3 g	$37.00
4922-D	Sodium-22	γ	1×10^5 β^+ps/g (6/64)	5 g	37.00
4924	Carbon-14 (water)	β^-	1×10^3 dps/g (7/58)	25 g	32.00
4925	Carbon-14 (toluene)	β^-	2×10^4 dps/g (7/58)	3 g	32.00

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

The calibration radiation is radiation for which the nuclide is intended to be used as a standard. The samples are contained in flame-sealed glass ampoules. The total activity of all except 4932–C (mercury-203) is such that they may be ordered singly under the general licensing provisions of the Atomic Energy Act of 1954. Standard 4932–C (mercury-203) can be issued only under the special licensing provisions of the Atomic Energy Act of 1954 and it is therefore required that a copy of the purchaser's current AEC By-Product Material License be on file at the National Bureau of Standards.

Sample Nos.	Radionuclide	Calibration radiation	Approximate activity or emission rate at time of calibration (month, year)	Approximte weight of solution	Price
4926	Hydrogen-3 (water)	β^-	9×10^3 dps/g (9/61)	25 g	$45.00
4927	Hydrogen-3 (water)	β^-	9×10^5 dps/g (9/61)	3 g	45.00
4929–B	Iron-55	x-ray	2×10^4 dps/g (5/64)	3 g	46.00
4932–C	Mercury-203	γ	3×10^6 dps/g (5/64)	5 g	49.00
4940	Promethium-147	β^-	8×10^4 dps/g (5/61)	3 g	40.00
4941–B	Cobalt-57	γ	3×10^4 dps/g (7/62)	5 g	24.00
4943	Chlorine-36	β^-	1×10^4 βps/g (1962)	3 g	26.00
4944–B	Iodine-125	x-ray	7×10^4 dps/g (4/64)	5 g	50.00
4945–B	Strontium-89	β^-	3×10^3 dps/g (9/64)	3 g	30.00
4946	Cerium-141	β^-		Temporarily	out of stock
4947	Hydrogen-3 (toluene)	β^-	3×10^5 dps/g (2/64)	4 g	30.00

4.5.4. Beta Gas Standard

Sample No. 4935–B contains approximately 10 ml of krypton–85 in inert krypton at a pressure of approximately one atmosphere in a break-seal glass ampoule.

Sample No.	Radionuclide	Calibration radiation	Approximate activity at time of calibration (month, year)	Volume	Price
4935–B	Krypton-85	β^-	6×10^7 dps per gram mole (10/62)	10 ml	$23.00

4.5.5. Point-Source Gamma-Ray Standards

These standards are deposited 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. Total activity of these standards is such that they may be ordered singly under the general licensing provisions of the Atomic Energy Act of 1954. (Please refer to Federal Register, Volume 21, p. 213, January 11, 1956.)

Sample Nos.	Radionuclide	Approximate emission rate at time of calibration (month, year)	Price per sample
4991	Sodium-22	1×10^4 γps (12/59)	$32.00
4992–B	Zinc-65	4×10^4 γps (1/62)	30.00
4997–C	Manganese-54	5×10^4 γps (1/64)	54.00
4998	Yttrium-88		Temporarily out of stock
4999–B	Cerium-139	2×10^4 γps (6/64)	45.00
4200	Cesium-137	5×10^4 γps (8/63)	46.00

4.5.6. Radium Rock Samples

Each sample consists of 100 g of pulverized rock taken from bulk material analyzed for radium content. Petrographic data and the chemical analysis of a typical specimen of the rock is also given in a certificate accompanying each sample. These samples are shipped parcel post prepaid.

Sample Nos.	Rock	Average radium content (picogram of radium per gram of rock)	Price
4978	Columbia River Basalt	0.33 ± 0.03	$11.00
4982	Gabbro-Diorite	0.18 ± 0.02	11.00
4984	Triassic Diabase	0.18 ± 0.03	11.00

4.5.7. Radium Solution Standards (for Radon Analysis)

These samples are contained in flame-sealed glass ampoules.

Sample Nos.	Radium content (in grams) as of 1956	Approximate weight	Price
4950–A	10^{-9}	100 g	$42.00
4951	10^{-11}	100 g	32.00
4952	Blank solution	100 g	7.50

4.5.8. Radium Gamma-Ray Solution Standards

These samples are contained in flame-sealed glass ampoules.

Sample Nos.	Radium content (in micrograms) as of 1947	Approximate weight	Price per sample
4955	0.1	5 g	$32.00
4956	0.2	5 g	32.00
4957	0.5	5 g	32.00
4958	1.0	5 g	32.00
4959	2.0	5 g	32.00
4960	5.0	5 g	32.00
4961	10	5 g	32.00
4962	20	5 g	32.00
4963	50	5 g	32.00
4964	100	5 g	32.00

4.5.9. Contemporary Standard for Carbon-14 Dating Laboratories

This sample consists of 1 lb of oxalic acid, no specific activity is given. These samples are shipped parcel post prepaid

Sample No.	Kind	Price
4990–A	Carbon-14 dating standard	$4.00

4.6. Standard Rubbers and Rubber Compounding Materials

These standards have been established 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.

4.6.1. Standard Rubbers

Sample Nos.	Kind	Approx. wt. in grams	Price
385b	Natural	31,500	$32.00
386d	Styrene-butadiene, type 1500	34,000	48.00
388c	Butyl	25,000	58.00

4.6.2. Rubber Compounding Materials

Sample Nos.	Kind	Approx. wt. in grams	Price	Sample Nos.	Kind	Approx. wt. in grams	Price
370c	Zinc oxide	2,000	$ 6.50	377	Phenyl-beta-naphthylamine	600	$8.00
371e	Sulfur	1,400	4.50	378a	Oil furnace black	7,000	7.00
372d	Stearic acid	600	3.80	379	Conducting black	5,500	7.00
373e	Benzothiazyl-disulfide	500	9.00	380	Calcium carbonate	6,000	5.00
374b	Tetramethylthiuram-disulfide	500	8.00	381	Calcium silicate	4,000	5.00
375c	Channel black	7,000	14.00	382	Gas furnace black	7,500	7.00
376a	Light magnesia	450	4.80	383	Mercaptobenzothiazole	800	5.50

4.7. 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 sheer 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 $\times$ 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 $\times$ 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.

Sample Nos.	Kind	Weight in grams	Price
705	Polystyrene, narrow molecular weight distribution	2	$18.00
706	Polystyrene, broad molecular weight distribution	18	12.00

4.8. Viscometer Calibrating Liquids

These oils are not intended for use as permanent viscosity standards, are not suitable for stockroom items, and should be ordered only for immediate use. They are available only in containers of normal 1-pint capacity, as this quantity is sufficient for the calibration of most viscometers. In cases where a larger quantity (duplicate sample) is required, a nominal explanation of the need for the larger quantity must be given in the order or an accompanying letter. All available liquids are hydrocarbons and are listed below. Because of the nature of the materials, all samples will be shipped by railway express, express charges collect.

4.8.1. CGS Units

Oils for use with viscometers calibrated in CGS units are supplied with a report containing values for viscosity, kinematic viscosity and density at the listed temperatures. Viscosity values at other temperatures in the range of 20 to 100 °C (30 to 100 °C for oil P) are supplied as a special service. For oils D through N, the charge for this special service is $15.00 per sample per temperature. For oils OB and P, the charge is $32.00 per sample per temperature. These special service charges are in addition to the charge for the sample and usual report.

Further details on the composition and properties of these oils, a description of the procedure used in their calibration, and a discussion of their use in the calibration of capillary viscometers, is given in NBS Monograph 55, "NBS Viscometer Calibrating Liquids and Capillary Tube Viscometers" by R. C. Hardy (1962).

Oil	Viscosity, in poises, at—				Kinematic viscosity, in stokes, at—				Price F.O.B Washington, D.C.
	20 °C	25 °C	100 °F	210 °F	20 °C	25 °C	100 °F	210 °F	
D	0.020	0.018	0.014	0.006	0.026	0.023	0.019	0.008	$20.00
H	.074	.063	.044	.013	.091	.078	.055	.017	20.00
I	.12	.10	.066	.017	.14	.12	.081	.022	20.00
J	.21	.17	.11	.023	.25	.21	.13	.028	20.00
K	.41	.32	.18	.032	.48	.38	.22	.040	20.00
L	1.0	.74	.37	.049	1.1	.84	.43	.060	20.00
M	3.0	2.1	1.0	.099	3.4	2.4	1.1	.12	20.00
N	14.0	9.6	4.0	.25	16.0	11.0	4.6	.30	20.00

	20 °C	25 °C	30 °C	40 °C	50 °C	20 °C	25 °C	30 °C	40 °C	50 °C	
OB	300	200		55		350	210		60		32.00
P			450	200	95			510	220	100	32.00

4.8.2. Saybolt Units

Oils for use with Saybolt viscometers are supplied with a report containing a value for viscosity at the indicated temperature. Viscosity values at other temperatures or in other units are not supplied. Saybolt viscosity values are based on determined values for kinematic viscosity and the standard conversion tables published by the American Society for Testing and Materials.

Oil	Temperature °F	Viscosity	Price F.O.B. Washington, D.C.
SB	100	300 seconds, Saybolt Universal	$6.50
SF	122	110 seconds, Saybolt Furol	6.50

4.9. Glass Viscosity Standards

These standard glasses 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 C338–61 and C336–61. Certificates of data from 8 laboratories are furnished for each glass.

Sample Nos.	Kind	Unit of issue	Price
710	Soda-lime silica glass-type 523/586	2 lb	$40.00
711	Lead-silica glass-type 617/366	3 lb	60.00

CERTIFIED PROPERTIES

Viscosity poises	Temperature °C standard 710	Temperature °C standard 711
10^2	1434.3	1327.1
10^3	1181.7	1072.8
10^4	1019.0	909.0
10^5	905.3	794.7
10^6	821.5	710.4
10^7	757.1	645.6
10^8	706.1	594.3
10^9	664.7	552.7
10^{10}	630.4	518.2
10^{11}	601.5	489.2
10^{12}	576.9	464.5
Softening point	724	602
Annealing point	546	432
Strain point	504	392

4.10. 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 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 mechanism, 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.

Sample Nos.	Kind	Price
2101	Orange-red glass	$250.00 per set.
2102	Signal yellow glass	
2103	Sextant green glass	
2104	Cobalt blue glass	
2105	Selective neutral glass	

4.11. 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. This 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, constitute the Supplement to 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.

Sample No.	Kind	Price per set
2106	Centroid color charts	$3.00

4.12. 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. Calibration of these standards for use with 3-filter reflectometers may be obtained by applying to NBS.

Sample No.	Kind	Unit of issue	Price per set
1000	Enameled iron plaques, 3 by 5 inches, in accordance with Commercial Standards CS62-38 and CS63-38.	Set of 10	$10.00

4.13. 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 the 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 D 387-60.

Paint-Pigment Standards for Color and Tinting Strength Only

Sample Nos.	Kind	Approx. wt. in grams	Price	Sample Nos.	Kind	Approx. wt. in grams	Price
300	Toluidine red toner	40	$3.00	314	Yellow iron oxide, light lemon	20	$3.00
301	Yellow ocher	45	3.00	315	Yellow iron oxide, lemon	20	3.00
302	Raw sienna	45	3.00	316	Yellow iron oxide, orange	25	3.00
303	Burnt sienna	50	3.00	317	Yellow iron oxide, dark orange	40	3.00
304	Raw umber	45	3.00	318	Lampblack	15	3.00
305	Burnt umber	50	3.00	319	Primrose chrome yellow	65	3.00
306	Venetian red	60	3.00	320	Lemon chrome yellow	60	3.00
307	Metallic brown	60	3.00	321	Medium chrome yellow	65	3.00
308	Indian red	50	3.00	322	Light chrome orange	100	3.00
309	Mineral red	65	3.00	323	Dark chrome orange	100	3.00
310	Bright red oxide	50	3.00	324	Ultramarine blue	37	3.00
311	Carbon black (high color)	10	3.00	325	Iron blue	25	3.00
312	Carbon black (all-purpose)	20	3.00	326	Light chrome green	60	3.00
313	Black iron oxide	42	3.00	327	Medium chrome green	50	3.00
				328	Dark chrome green	45	3.00

4.14. 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.

Sample Nos.	Kind	Approx. wt. in grams	Price	Sample Nos.	Kind	Approx. wt. in grams	Price
1020	Zinc sulfide phosphor	14	$3.00	1026	Calcium tungstate phosphor	28	$3.00
1021	Zinc silicate phosphor	28	3.00	1027	Magnesium tungstate phosphor	28	3.00
1022	Zinc sulfide phosphor	14	3.00	1028	Zinc silicate phosphor	28	3.00
1023	Zinc-cadmium sulfide phosphor (Ag activator)	14	3.00	1029	Calcium silicate phosphor	14	3.00
1024	Zinc-cadmium sulfide phosphor (Cu activator)	14	3.00	1030	Magnesium arsenate phosphor	28	3.00
1025	Zinc phosphate phosphor	28	3.00	1031	Calcium halophosphate phosphor	28	3.00
				1032	Barium silicate phosphor	28	3.00
				1033	Calcium phosphate phosphor	28	3.00

4.15. 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 2⅝ inches by 3¼ inches. The booklets contain six strips of the paper 1¼ inches wide that have been faded by exposure in the NBS master lamp. A copy of Letter Circular LC 1036, which describes the preparation and use of the materials, is furnished with each of the booklets.

Sample Nos.	Kind	Unit of issue	Price
700a	Light-sensitive paper	Pkg. of 100 pieces	$ 5.00
701a	Booklet of standard faded strips	Booklet	60.00

4.16. 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, or by individual package. The tearing strength value of the material is approximately 40 grams. The exact value will be given in the certificate accompanying the standard.

Sample No.	Kind	Price
704	Internal tearing resistance of paper	$4.00 per package

4.17. Microcopy Resolution Test Chart

This chart is used to test the resolving power of whole microcopying systems. It is printed photographically on paper, and has high-contrast five line patterns ranging in spatial frequency from one cycle per millimeter to ten cycles per millimeter. Instructions for the use of this chart are supplied with each order.

Sample No.	Kind	Unit of issue (minimum)	Price per chart
1010	Resolution chart for testing the resolving power of microcopying cameras	5 charts	$0.40

4.18. Glass Spheres for Sieve Calibration

These standards are issued for evaluating the effective openings of testing sieves in the size range U.S. Standard No. 8 through No. 270. These standards are used by placing the entire sample on a clean sieve or on the top of a stack of clean sieves and shaking them in a shaking device or by hand. Each of the sieve fractions of glass spheres is weighed to the nearest 0.01 gram, and the weight percent retained on each sieve is calculated. The effective opening of each sieve is then determined from the calibration data on the certificate supplied with each sample. The reproducibility of calibrations made with these standards varies from ±2 to ±5 percent of the nominal width of the sieve openings.

Sample Nos.	Kind	Weight in grams	Price
1017	Calibrated glass spheres (for calibrating sieves No. 70–270)	22	$9.50
1018	Calibrated glass spheres (for calibrating sieves No. 20–70)	40	9.50
1019	Calibrated glass spheres (for calibrating sieves No. 8–18)	100	9.50

4.19. Turbidimetric and Fineness Standard

This standard 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 unit consists of two sealed vials, each containing approximately 10 grams of cement.

Sample No.	Kind	Certification	Price
114k	Cement	No. 325 sieve residue, 7.1 percent Surface area, 1780 cm²/g (Wagner turbidimeter) Air permeability, 3030 cm²/g Mean particle diameter (air permeability), 6.29 microns	$2.50

4.20. Surface Flammability Standard

This standard is issued for checking the operation of radiant panel test equipment in accordance with Interim Federal Standard No. 00136 and later revisions. Flame spread Index, I_s, = 131; Heat Evolution Factor, Q, = 27.0; Smoke Deposit, weight in mg, = 0.7.

Sample No.	Unit	Price
1002a	Hardboard sheet, 4 specimens, 6 x 18 inches	$8.00

5. Index By Sample Number

Sample No.	Page No.	Sample No.	Page No.	Sample No.	Page No.
1041	9	C1111	14	1215	18
1042	9	1112	14	2101	32
1044	9	C1112	14	2102	32
1045	9	1113	14	2103	32
1051a	24	C1113	14	2104	32
1052a	24	1114	14	2105	32
1053	24	C1114	14	2106	33
1055a	24	1115	14	4200	29
1056a	24	C1115	14	4900	28
1057a	24	1116	14	4901	28
1059a	24	C1116	14	4902	28
1060a	24	1117	14	4904-A	28
1061a	24	C1117	14	4921-C	28
1062a	24	1118	14	4922-D	28
1063a	24	C1118	14	4924	28
1064	24	1119	14	4925	28
1065a	24	C1119	14	4926	28
1066	24	1120	14	4927	28
1069a	24	C1120	14	4929-B	28
1070a	24	1151	8	4932-C	28
1071a	24	1152	8	4935-B	29
1073a	24	1153	8	4940	28
1074	24	1154	8	4941-B	28
1075	24	1161	7	4943	28
1076	24	1162	7	4944-B	28
1077	24	1163	7	4945-B	28
1078	24	1164	7	4946	28
1079	24	1165	7	4947	28
C1100	14	1166	7	4950-A	29
1101	14	1167	7	4951	29
C1101	14	1168	7	4952	29
1102	14	1169	7	4955	30
C1102	14	1176	10	4956	30
1103	14	1177	10	4957	30
C1103	14	1178	10	4958	30
1104	14	1179	10	4959	30
C1104	14	1180	10	4960	30
1105	14	1181	10	4961	30
C1105	14	1182	10	4962	30
1106	14	1183	10	4963	30
C1106	14	1184	15	4964	30
1107	14	1185	15	4978	29
		1189	15		
C1107	14	1190	15	4982	29
1108	14	1203	15	4984	29
C1108	14	1204	15	4990-A	30
1109	14	1205	15	4991	29
C1109	14	1210	18	4992-B	29
1110	14	1211	18	4997-C	29
C1110	14	1213	18	4998	29
1111	14	1214	18	4999-B	29

6. Appendix I. Typical Certificate of Characterization

U. S. Department of Commerce
John T. Connor, Secretary

National Bureau of Standards
A. V. Astin, Director

Certificate of Analysis

Standard Reference Material 131a

Low-Carbon Silicon Steel

ANALYST*	METHOD	CARBON
		Percent
1	Combustion-conductometric [a]	0.004 1
2	Combustion-conductometric [a]	.004 4
3	Combustion-conductometric [a]	.004 2
4	Combustion-conductometric [a]	.004 4
5	Combustion-conductometric [a]	.004 4
6	Combustion-conductometric [a]	.004 5
7	Combustion-thermal conductivity [a]	.004 3
8	Combustion-conductometric [a]	.004 3
9	Combustion-conductometric [a]	.004 5
	Average	0.004 4

[a] 1-g sample.

*List of Analysts

1. E. R. Deardorff and J. I. Shultz, Division of Analytical Chemistry, National Bureau of Standards.
2. D. P. Bartell and R. B. Fricioni, Allegheny Ludlum Steel Corp., Brackenridge Works, Brackenridge, Pa.
3. T. D. McKinley, E. I. Du Pont de Nemours and Co., Pigments Department, Experimental Station, Wilmington, Del.
4. W. F. Harris and R. N. Revesz, Westinghouse Electric Corp., Research and Development Center, Pittsburgh, Pa.
5. R. R. Ralston and K. P. Kreis, General Electric Co., Transformer Division, Pittsfield, Mass.
6. L. M. Melnick, J. F. Martin, and J. B. Ferons, United States Steel Corp., Applied Research Laboratory, Monroeville, Pa.
7. L. M. Melnick and M. J. Nardozzi, United States Steel Corp., Applied Research Laboratory, Monroeville, Pa.
8. P. P. Eismont, United States Steel Corp., Duquesne Works, Duquesne, Pa.
9. Armco Steel Corporation, Research and Technology, Chemical Laboratory, Arba Thomas, in charge. Analyses by L. C. Bartels and D. E. Swanger.

The material for the preparation of this standard was furnished by the Allegheny Ludlum Steel Corp., Brackenridge, Pa.

WASHINGTON, D. C. 20234
March 10, 1965.

W. Wayne Meinke, Chief
Office of Standard Reference Materials.

U.S. DEPARTMENT OF COMMERCE—NATIONAL BUREAU OF STANDARDS
INSTITUTE FOR MATERIALS RESEARCH
OFFICE OF STANDARD REFERENCE MATERIALS

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

August 20, 1964

Introduction

The National Bureau of Standards presently has available more than 500 standard reference materials. It is also working on the development of about 50 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 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 Standards Association, 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.

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