NBS SPECIAL PUBLICATION 260-57

U.S. DEPARTMENT OF COMMERCE / National Bureau of Standards

Standard Reference Materials:

GUIDE TO UNITED STATES REFERENCE MATERIALS

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[2] Located at Boulder, Colorado 80302.

Standard Reference Materials:
GUIDE TO UNITED STATES REFERENCE MATERIALS

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Issued February 1978

Library of Congress Cataloging in Publication Data

Cali, J. Paul.

Guide to United States reference materials.

(Standard reference materials) (National Bureau of Standards special publication ; 260-57)

Supt. of docs. no.: C13.10:260-57.

1. Materials—Standards—United States. 2. Physical measurements. 3. Chemical tests and reagents—Specifications—United States. I. Plebanski, Tomasz, joint author. I. Title. II. Series: United States. National Bureau of Standards. Standard reference materials. III. Series: United States. National Bureau of Standards. Special publication ; 260-57.

QC100.U57 no. 260-57 [TA404.5] 602'.1s [602'.1] 77-28819

National Bureau of Standards Special Publication 260-57

Nat. Bur. Stand. (U.S.), Spec. Publ. 260-57, 55 pages (Feb. 1978)

CODEN: XNBSAV

U.S. GOVERNMENT PRINTING OFFICE

WASHINGTON: 1978

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (Order by SD Catalog No. C13.10:260–57). Stock No. 003–003–01883–0 Price $2.20 (Add 25 percent additional for other than U.S. mailing).

PREFACE

Standard Reference Materials (SRM's) as defined by the National Bureau of Standards are "well-characterized materials, produced in quantity, that calibrate a measurement system to assure compatibility of measurement in the nation." SRM's are widely used as primary standards in many diverse fields in science, industry, and technology, both within the United States and throughout the world. In many industries traceability of their quality control process to the national measurement system is carried out through the mechanism and use of SRM's. For many of the nation's scientists and technologists it is therefore of more than passing interest to know the details of the measurements made at NBS in arriving at the certified values of the SRM's produced. An NBS series of papers, of which this publication is a member, called the NBS Special Publication - 260 Series is reserved for this purpose.

This 260 Series is dedicated to the dissemination of information on all phases of the preparation, measurement, and certification of NBS-SRM's. In general, much more detail will be found in these papers than is generally allowed, or desirable, in scientific journal articles. This enables the user to assess the validity and accuracy of the measurement processes employed, to judge the statistical analysis, and to learn details of techniques and methods utilized for work entailing the greatest care and accuracy. It is also hoped that these papers will provide sufficient additional information not found on the certificate so that new applications in diverse fields not foreseen at the time the SRM was originally issued will be sought and found.

Inquiries concerning the technical content of this paper should be directed to the author(s). Other questions concerned with the availability, delivery, price, and so forth will receive prompt attention from:

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

J. Paul Cali, Chief
Office of Standard Reference Materials

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Catalog of NBS Standard Reference Materials (1975-76 edition), R. W. Seward, ed., NBS Spec. Publ. 260 (June 1975). $1.50* SN003-003-01445-1

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Standard Reference Materials:

GUIDE TO UNITED STATES REFERENCE MATERIALS

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Summarized is a list of reference materials produced and distributed by U.S. manufacturers, both public and private. Extensive tables are indexed by use to which reference materials may be put. Properties covered include: chemical composition (analytical chemical purposes), chemical composition (high purity), physical properties, engineering and technological properties, and biochemical properties. Names and addresses of 93 U.S. producers and/or distributors are included.

Key words: Measurement; reference materials; standardization; Standard Reference Materials.

GUIDE TO UNITED STATES REFERENCE MATERIALS

I. Background

In 1976, the Council Committee on Reference Materials (REMCO) of the International Organization for Standardization proposed as the term "reference materials" the following definition: "A material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus or for the verification of a measurement method." "A certified reference material (CRM) is further defined as: "A RM accompanied by, or traceable to, a certificate stating the property value(s) concerned, issued by an organization, public or private, which is generally accepted as technically competent." A careful reading of this definition will lead the reader to the conclusion that a great many materials will rest comfortably under its umbrella. Thus, for an analytical chemist any pure chemical used to prepare what are usually called "standard solutions" can be considered to be a reference material. Simple devices, such as accurately calibrated optical filters, also are covered by this definition. Where to draw the line to exclude various chemicals or devices is somewhat arbitrary and no hard and fast rules have been developed to date. Weights used to calibrate or check balances are, e.g., not considered reference materials, even though they obviously fit the definition very well. For this reason then the reference materials listed herein are somewhat arbitrary. In fact, the inclusion or exclusion of a particular supplier's reference materials is first and foremost simply a function of whether or not he replied to our inquiry for information.

The current great interest in reference materials as an important means for helping to assure measurement compatibility in a wide variety of applications dates from 1969. In that year the National Bureau of Standards (NBS) and the International Committee on Weights and Measures (CIPM) cosponsored a meeting where the desirability of establishing a formal program internationally was explored. Representatives from 15 countries and 4 international agencies agreed unanimously that such a course of action would be desirable. The need for a central distributing agency for exchange of information on reference materials, preferably through an international agency was stressed. The CIPM was asked to assume this (and other) responsibilities. Subsequently however, the CIPM with regret had to decline due to a lack of resources and a misfit with regard to its scope. (1)

However, the matter was not dead for following the first large scale SRM Symposium held at NBS in 1973 - see reference (2), a meeting called by the International Organization for Legal Metrology was held to reactivate the matter. As a result of this meeting, attended by representatives of 12 countries and 7 international agencies, ISO subsequently agreed to provide secretariat services for international agencies interested in the exchange of information concerning reference materials.

Thus, ISO established REMCO in 1974 to coordinate reference material information exchange activities. Since one of the authors (J. P. Cali) is the U.S.-American National Standards Institute (ANSI) representative on REMCO, this report was prepared to provide information on reference material activity and availability in the U.S. for dissemination in international channels, as well as information of value to U.S. science, technology, and industry directly.

The other author (T. Plebanski) spent one year at NBS under a UNESCO fellowship studying RM's. With this work in place he helped gather, collate, and prepare for publication information on U.S. available reference materials. To this end, NBS contracted with him in 1974 to perform these functions.

II. Purpose of Guide

All measurement networks need to be compatible. By this we mean that producer and consumer, or regulator and those regulated, need to be able to measure the property(ies) of the same sample in such a way that, within agreed on limits of uncertainty, all obtain identical numerical values of the property(ies) under measurement. Cali, among others, has shown (see 3 or 4 e.g.) that when measurement systems are based on accuracy that measurement compatibility must logically ensue. However, to achieve accuracy in measurement, especially when the property under consideration is that of composition, five basic components of the measuring process need to be available or present (see, e.g., 5). One of these is reference materials and called at NBS for historical reasons Standard Reference Materials (SRM).

Thus, a knowledge of where to obtain reference materials is important. This then is the basic rationale and principal purpose for this guide.

III. Scope and Structure of Guide

Listed in the body of the report are over 17,000 reference materials. Of these approximately 7,200 fall into

the class "certified reference materials" (see Section IV, below). These 17,000 reference materials are either the direct product of or are distributed by the 93 U.S. companies and/or organizations who responded to the NBS request for information. The information supplied was primarily in the form of catalogues, product lists, etc.

Of the 17,000 reference materials listed, about 2,000 are produced in foreign countries, principally Japan and countries of Europe. There is, of course, considerable duplication among the reference materials. The duplication is especially strong in these classes: high purity elements and inorganic chemicals; spectrochemical mixtures, powders, and alloys; and, standard solutions and mixtures for atomic absorption calibration. We estimate there are listed approximately 10,000 different reference materials produced in the U.S.

No attempt has been made to make a quality assessment of either the producers or of their reference materials.

Two classes of reference materials have been listed: general reference materials (RM) and certified reference materials (CRM). These have been defined above. In attempting to decide whether a particular material was, in fact, suitable for use as a reference material, the general criteria listed by Cali in reference 6 were applied. Some of these criteria are: purity, homogeneity, stability, continuity of both supply and information, availability, and extent of certification process. Other factors considered were: (1) whether the producer states in his literature that his product is suitable for reference purposes (as calibrating material, e.g.); (2) whether the producer guarantees his product in some meaningful way; (3) whether useful technical information is supplied with his product (e.g., actual lot analysis); (4) by comparison of the same product from different sources; and/or, (5) by some evidence that traceability to national or international standards has been established. Thus, it is apparent that a considerable degree of subjective judgment was used by the authors. The ultimate test, of course, as to whether a particular material can serve usefully as a reference material must lie with the user.

The properties embodied in the reference materials are classified in five categories:

1. Chemical composition (Analytical RM) - multicomponent (usually) reference materials, often mixtures or solutions, used in chemical analytical systems. This class will include alloys, mixtures, natural materials, etc.

2. Chemical composition (High Purity RM) - single component (usually) reference materials of high purity used in chemical analytical systems. However, they may also serve for the realization or determination of other properties, e.g., physico-chemical, thermochemical, electrical, etc. Others, e.g., platinum, cesium, kryton serve as primary RM in defining international scales. These latter RM are certified for total purity of the main component and for trace impurities present.

3. Physical properties - reference materials characterized for optical, heat, radiation, etc. properties.

4. Engineering and technological properties - reference materials embodying properties as hardness, smoke density, etc.

5. Biochemical properties - reference materials of botanical, biological, clinical, bionuclear substances.

These categories are not necessarily mutually exclusive. Often RM's will be characterized for more than one property and thus will be found in the appropriate categories. E.g., some bionuclear RM's might be found in category(ies) 1, 3, and 5 if characterized for chemical composition, radioactivity, and biological activity.

Two tables are presented:

Table A: Index of Reference Materials. In this table are incorporated both matrices and properties of interest arranged in the five categories listed above. It would have been impractical to list individually every RM by chemical name or specific material. Therefore, we have tried to use classes or groups to lead the user to a supplier who can provide more specific information with regard to highly specific chemicals, matrices, or properties. In other words, the principal utility of this listing is to provide general guidance to the user to assist in shortening his search time and to make him aware of RM supplies he might otherwise have missed. Only in the catalogs of the various suppliers will be found the specific information usually required for the ultimate end-use.

Table B: Index of Suppliers. In this table we give the names and addresses of the suppliers who replied to our request for information. The addresses shown are those given by the supplier at the time his catalogues were delivered to NBS. Each is given a supplier number, an internal NBS file number, and the approximate number of RM's, either general or certified, produced or distributed.

IV. Disclaimer

In issuing this guide NBS makes no warranty, explicit or implied, that any RM listed will perform or not as claimed by the producer or distributor.† Neither does NBS, through the inclusion or exclusion of any RM producer or distributor, impute either directly or indirectly the technical, scientific, or economic value or worth of the RM's referenced. This guide is issued by NBS for information only to provide RM users or potential users to RM sources in the U.S. NBS, an agency of the U.S. Government, assumes no liability for damages resulting from the use or misuse of any of the information given in the guide or from use or misuse of the RM's referenced.

V. Updating of Guide

It is our intention to update the guide from time to time as interest and demand warrant. RM producers, suppliers, and distributors may send catalogues and pertinent information, together with suggestions to improve the usefulness of the guide to:

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

†Excepting RM's and CRM's directly produced by NBS itself (Supplier #86).

A. INDEX OF REFERENCE MATERIALS

Category 1: Chemical Composition - Analytical Reference Materials — Supplier No.

Category 2: Chemical Composition - High Purity Reference Materials

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		Alfa Products--see Ventron Corp. Alfa Prod.		
4	72/4	Alpha Analytical Laboratories Division of Alpha Metals Inc. 56 Water Street Jersey City, N. J. 07304	180	117
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8	72/9	Amersham/Searle Corporation 2636 S. Clearbrook Drive Arlington Heights, IL 60005	145	622
9	72/126	Analytical Supplies Development Corp. 48 Notch Road Little Falls, N. J. 07424	45	
10	72/10	Angstrom, Inc. 678 E. Huron River Drive P. O. Box 248 Belleville, Michigan 48111	16	40
11	72/11	Apache Chemicals, Inc. P. O. Box 17 Rockford, IL 61105	70	307
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		Baker--See J. T. Baker Company		
17	72/112	Bio-Rad Laboratories 32nd and Griffin Avenue Richmond, Calif. 94804		46
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19	72/16	Brammer Standard Company 213 Essex Knoll Drive Coraopolis, Pa. 15108	548	613
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37	72/28	G. Frederick Smith Chemical Company P. O. Box 23344 Columbus, Ohio 43223	68	17
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NOTES

NBS-114A (REV. 11-77)

U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET	1. PUBLICATION OR REPORT NO. NBS SP 260-57	2. Gov't Accession No.	3. Recipient's Accession No.

4. TITLE AND SUBTITLE

Standard Reference Materials:
GUIDE TO UNITED STATES REFERENCE MATERIALS

5. Publication Date: February 1978

6. Performing Organization Code

7. AUTHOR(S)
J. Paul Cali and Tomasz Plebanski

8. Performing Organ. Report No.

9. PERFORMING ORGANIZATION NAME AND ADDRESS

NATIONAL BUREAU OF STANDARDS
DEPARTMENT OF COMMERCE
WASHINGTON, D.C. 20234

10. Project/Task/Work Unit No.

11. Contract/Grant No.

12. Sponsoring Organization Name and Complete Address *(Street, City, State, ZIP)*

Same as item 9.

13. Type of Report & Period Covered

14. Sponsoring Agency Code

15. SUPPLEMENTARY NOTES

Library of Congress Catalog Card Number: 77-28819

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17. KEY WORDS *(six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons)*

Measurement; reference materials; standardization; Standard Reference Materials.

18. AVAILABILITY

[x] Unlimited

[ ] For Official Distribution. Do Not Release to NTIS

[x] Order From Sup. of Doc., U.S. Government Printing Office Washington, D.C. 20402, SD Stock No. SN003-003-

[ ] Order From National Technical Information Service (NTIS) Springfield, Virginia 22151

19. SECURITY CLASS (THIS REPORT): UNCLASSIFIED

21. NO. OF PAGES: 55

20. SECURITY CLASS (THIS PAGE): UNCLASSIFIED

22. Price: $2.20

USCOMM-DC 66035-P78

☆ U. S. GOVERNMENT PRINTING OFFICE : 1978--261-238/452

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