National Institute of Standards and Technology
U.S. Department of Commerce

Date of Issue:
14 November 2023

Standard Reference Material® 2583

Trace Elements in Indoor Dust

(Nominal Mass Fraction of 90 mg/kg Lead)

CERTIFICATE OF ANALYSIS

Purpose: This Standard Reference Material (SRM) is intended for use in the evaluation of methods and for the calibration of apparatus used to determine lead and other trace elements in dust.

Description: SRM 2583 is composed of dust collected from vacuum cleaner bags used in the routine cleaning of interior dwelling spaces. A unit of SRM 2583 consists of 8 g of particulate material, 99+ % of which passes a 100 µm (No. 145) sieve.

Certified Values: The certified values and uncertainties for five elements in SRM 2583 are listed in Table 1 . A certified value is a value for which NIST has the highest confidence in its accuracy in that all known or suspected sources of bias have been investigated or accounted for [1,2]. The certified mass fractions of the elements in Table 1 are metrologically traceable to the International System of Units (SI) unit of mass fraction expressed as milligrams per kilogram on a dry-mass basis.

Table 1. Certified Mass Fractions (Dry-Mass Basis) for Elements in SRM 2583

Element	Mass Fraction[(a)] (mg/kg)		
Arsenic (As)	7.0	±	1.6
Cadmium (Cd)	7.3	±	3.7
Chromium (Cr)	80	±	22
Lead (Pb)	85.9	±	7.2
Mercury (Hg)	1.56	±	0.19

[(a)] Values are expressed as $x \pm U_{95\%}(x)$, where x is the certified value and $U_{95\%}(x)$ is the expanded uncertainty of the certified value [3].

Additional Information: Methods used for the analysis of SRM 2583 and additional information are provided in Appendix A.

Period of Validity: The certified values delivered by **SRM 2583** are valid within the measurement uncertainty specified until **31 October 2033**. The certified values are nullified if the material is stored or used improperly, damaged, contaminated, or otherwise modified.

Maintenance of Certified Values: NIST will monitor this SRM over the period of its validity. If substantive technical changes occur that affect the certification, NIST will issue an amended certificate through the NIST SRM website (https://www.nist.gov/srm) and notify registered users. SRM users can register online from a link available on the NIST SRM website or fill out the user registration form that is supplied with the SRM. Registration will facilitate notification. Before making use of any of the values delivered by this material, users should verify they have the most recent version of this documentation, available through the NIST SRM website (https://www.nist.gov/srm).

Carlos A. Gonzalez, Chief
Chemical Sciences Division

Steven J. Choquette, Director
Office of Reference Materials

Certificate Revision History on Page 2

Safety: SRM 2583 is intended for research use. Please consult the Safety Data Sheet for this product.

Storage: SRM 2583 is packaged as a dry material in glass bottles. The SRM must be stored in its original bottle at climate-controlled room temperature (20 °C ± 5 °C) away from fumes and direct sunlight.

Use: To relate analytical determinations to the certified values on this Certificate of Analysis, a minimum sample mass of 100 mg should be used, and the sample should be dried according to the Instructions for Drying. Sample preparation procedures should also be designed to effect complete dissolution in order to relate the determined value to the certified value.

Instructions for Drying: When nonvolatile elements (cadmium, chromium, and lead) are to be determined, samples should be oven dried for 2 h at 110 ºC. Volatile elements (arsenic and mercury) should be determined on samples as-received; separate samples should be dried according to these instructions to obtain a correction factor for moisture. Moisture corrections are then made to measurement values before comparing them to the certified values. At NIST, mass loss on drying at the time of certification was found to be 3.9 % with a standard deviation (n = 6) of 0.6 %.

REFERENCES

[1] Beauchamp, C.R.; Camara, J.E.; Carney, J.; Choquette, S.J.; Cole, K.D.; DeRose, P.C.; Duewer, D.L.; Epstein, M.S.; Kline, M.C.; Lippa, K.A.; Lucon, E.; Molloy, J.; Nelson, M.A.; Phinney, K.W.; Polakoski, M.; Possolo, A.; Sander, L.C.; Schiel, J.E.; Sharpless, K.E.; Toman, B.; Winchester, M.R.; Windover, D.; *Metrological Tools for the Reference Materials and Reference Instruments of the NIST Material Measurement Laboratory*; NIST Special Publication 260-136, 2021 edition; National Institute of Standards and Technology, Gaithersburg, MD (2021); available at https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.260-136-2021.pdf (accessed Oct 2023).

[2] Thompson, A.; Taylor, B.N.; *Guide for the Use of the International System of Units (SI)*; NIST Special Publication 811; U.S. Government Printing Office: Washington, DC (2008); available at http://www.nist.gov/pml/pubs/sp811/index.cfm (accessed Oct 2023).

[3] JCGM 100:2008; *Evaluation of Measurement Data - Guide to the Expression of Uncertainty in Measurement*; (GUM 1995 with Minor Corrections), Joint Committee for Guides in Metrology (JCGM) (2008); available at http://www.bipm.org/utils/common/documents/jcgm/JCGM_100_2008_E.pdf (accessed Oct 2023); see also Taylor, B.N.; Kuyatt, C.E.; *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*; NIST Technical Note 1297, U.S. Government Printing Office: Washington, DC (1994); available at http://www.nist.gov/pml/pubs/index.cfm (accessed Oct 2023).

Certificate Revision History: 14 November 2023 (Change of period of validity; updated format; editorial changes); 29 January 2016 (Change of expiration date; editorial changes); 30 November 2010 (Change of expiration date; editorial changes); 22 June 1998 (Addition of round robin data and editorial revision of Table B1); 30 December 1996 (Original certification date).

Certain commercial equipment, instruments, or materials may be identified in this Certificate of Analysis to adequately specify the experimental procedure. Such identification does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the materials or equipment identified are necessarily the best available for the purpose.

Users of this SRM should ensure that the Certificate of Analysis in their possession is current. This can be accomplished by contacting the Office of Reference Materials 100 Bureau Drive, Stop 2300, Gaithersburg, MD 20899-2300; telephone (301) 975-2200; e-mail srminfo@nist.gov; or the Internet at https://www.nist.gov/srm.

* * * * * * * End of Certificate of Analysis * * * * * * *

APPENDIX A

Collection: The bulk of the material for this SRM was obtained from households, cleaning services, motels, and hotels from North Carolina, Maryland, Ohio, and New Jersey. The vacuum cleaner bags were collected under the direction of the Research Triangle Institute and the U.S. Environmental Protection Agency. The collection process was coordinated by E.D. Hardison and D.A. Binstock, of the Research Triangle Institute (RTI) (Research Triangle Park, NC), under the leadership of W.F. Gutknecht.

Preparation: The bags were labeled to provide source identification, boxed and sent to Neutron Products, (Dickerson, MD), for radiation sterilization, and then shipped to NIST for processing. The initial screening and preparation to select suitable material were directed by P.A. Pella and performed by A.F. Marlow, C. Desai, P. Seo, and D. Lillian of the NIST Chemistry Sciences Division. A sample of dust from each bag was passed through a 100 µm nylon sieve and measured by laboratory X-ray fluorescence. Only bags containing dust measuring 60 µg/g to 300 µg/g of lead were retained for preparing this SRM. The selected bags were processed by passing the contents of each bag through a coarse screen (2 mm hole size) to remove cotton and debris. Using a vibrating stainless steel sieve apparatus, the resultant material was screened in two successive steps, first through a 250 µm sieve and then a 100 µm sieve. All material passing a 100 µm sieve was combined, resieved five times through a 250 µm sieve to remove hairs, blended in cone blender and then bottled.

Analysis: Certification analyses were performed in the NIST Chemical Sciences Division. Analytical methods used for this SRM are given in Table A1.

Table A1. Methods Used for the Analysis of SRM 2583

Element	Methods[(a)]
Arsenic	**FIA-HGAAS**, **INAA**
Cadmium	**ID-ICP-MS**
Chromium	**INAA**, **ICP-MS**
Lead	**ID-ICP-MS**
Mercury	**FIA-CVAAS**, **INAA**

[(a)] Methods:

FIA-CVAAS	Flow injection analysis cold vapor atomic absorption spectrometry
FIA-HGAAS	Flow injection hydride generation atomic absorption spectrometry
ICP-AES	Inductively coupled plasma atomic emission spectrometry
ICP-MS	Inductively coupled plasma mass spectrometry
ID-ICP-MS	Isotope dilution inductively coupled plasma mass spectrometry
INAA	Instrumental neutron activation analysis

NIST Analysts: E.S. Beary, P.A. Pella, M.S. Epstein, M.S. Rearick, E.A. Mackey, A.F. Marlow , G.C. Turk, J.R. Moody, L.J. Wood, K.E. Murphy, and R. Saraswati (Guest scientist from the Defense Metallurgical Research Laboratory, India).

* * * * * * * * * * * End of Appendix A * * * * * * * * * * *