National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 1886a

Portland Cement

(White Portland Cement with Low Iron)

This Standard Reference Material (SRM) is intended primarily for use in evaluating chemical methods of analysis and in the calibration of instrumental methods for analysis of cements and materials of similar matrix. A unit of SRM 1886a consists of four sealed vials, each containing approximately 5 g of white portland cement ground to pass a 75 µm (No. 200) sieve.

Certified Mass Fraction Values: The certified values for SRM 1886a, expressed as mass fractions [1] on an as-received basis, are provided in Table 1. A NIST 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 taken into account [2]. The certified values listed are based on the results of analyses performed at NIST, Construction Technology Laboratories[(1)], Inc. (CTL, Skokie, IL) and the United States Geological Survey (USGS, Denver, CO) using X-ray fluorescence spectrometry, atomic absorption spectrophotometry, inductively coupled plasma emission spectrometry, and reference methods given in ASTM C 114-00 Standard Test Methods for Chemical Analysis of Hydraulic Cement [3]. Homogeneity testing was performed at NIST using X-ray fluorescence spectrometry. The uncertainty listed with each value is an expanded uncertainty, with coverage factor 2, calculated by combining a between-method variance [4] with a pooled, within-method variance following the ISO/JCGM Guide [5].

Reference Mass Fraction Values: Reference values for SrO and Cl expressed as mass fractions on an as-received basis are provided in Table 2. Reference values are noncertified values that are the best estimate of the true value; however, the values, which are based on determinations that do not meet the NIST criteria for certification, are provided with associated uncertainties that may reflect only measurement precision and may not include all sources of uncertainty [2].

Information Values: Information values for ZnO, F, Insoluble Residue, Loss On Ignition (LOI), Free CaO, and the Total of all constituents are provided in Table 3. These are noncertified values with no uncertainty assessed. Information values cannot be used to establish metrological traceability.

Expiration of Certification: The certification of this SRM is valid, within the uncertainty specified, until **01 January 2024** provided the SRM is handled and stored in accordance with the instructions given in this certificate (see "Instructions for Handling, Storage, and Use"). However, the certification will be nullified if the SRM is damaged, contaminated, or modified.

Maintenance of SRM Certification: NIST will monitor this SRM over the period of its certification. If substantive technical changes occur that affect the certification before the expiration of this certificate, NIST will notify the purchaser. Registration (see attached sheet or register online) will facilitate notification.

Coordination of technical measurements for certification was accomplished under the direction of J.R. Sieber of the NIST Chemical Sciences Division.

Carlos A. Gonzalez, Chief
Chemical Sciences Division

Gaithersburg, MD 20899
Certificate Issue Date: 05 February 2016
Certificate Revision History on Last Page

Steven J. Choquette, Acting Director
Office of Reference Materials

[(1)] Certain commercial equipment, instruments or materials are identified in this certificate 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.

Statistical consultation for this SRM was provided by S.D. Leigh of the NIST Statistical Engineering Division.

Analytical measurements for certification of this SRM were performed by A.F. Marlow and J.R. Sieber of the NIST Chemical Sciences Division; B. Angelakos, M. Bharucha, D. Broton, R. Naamane, S. Nettles, and C. Wedzicha of CTL, and J.E. Taggart and S.A. Wilson of USGS.

Support aspects involved in the issuance of this SRM were coordinated through the NIST Office of Reference Materials.

INSTRUCTIONS FOR HANDLING, STORAGE, AND USE

Cement powder is hygroscopic. To relate analytical determinations to the assigned values in this Certificate of Analysis, a minimum test portion of 500 mg should be used. Samples taken from the vial should be used immediately. If cement powder remains, the vial should be recapped immediately and returned to the labeled aluminized pouch and stored in a desiccator over magnesium perchlorate.

When a sample is used after storage in a previously opened vial, the total loss on ignition (LOI) at 950 °C for that sample should be determined in accordance with ASTM C114 Standard Test Methods for Chemical Analysis of Hydraulic Cement [3] and the mass of the sample corrected for any additional moisture, combined water, or carbonate above the value reported in this certificate for total LOI at 950 °C.

When a sample is used after storage in a previously opened vial, the LOI for that sample should be determined in accordance with ASTM C 114 and the weight of the sample corrected for any additional moisture, combined water, or carbonate above the LOI value reported in this certificate.

Certified Mass Fraction Values: The measurands are the total mass fractions of constituents in cement listed in Table 1. The certified values are metrologically traceable to the derived SI unit for mass fraction, expressed as percent. The constituents listed in this Certificate of Analysis are expressed as the chemical forms and in the order given in ASTM C 114-00, Section 3, Table 1 [3].

Table 1. Certified Values for SRM 1886a

Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
SiO_2	22.38 ± 0.27	Na_2O	0.021 ± 0.003
Al_2O_3	3.875 ± 0.035	K_2O	0.093 ± 0.004
Fe_2O_3	0.152 ± 0.013	TiO_2	0.084 ± 0.009
CaO	67.87 ± 0.26	P_2O_5	0.022 ± 0.004
MgO	1.932 ± 0.040	Mn_2O_3	0.0073 ± 0.0004
SO_3	2.086 ± 0.080	Cr_2O_3	0.0024 ± 0.0008

Reference Mass Fraction Values: The measurands are the mass fractions of constituents in cement listed in Table 2 as determined by the methods. The reference values are metrologically traceable to the derived SI unit for mass fraction, expressed as percent. The constituents listed in this Certificate of Analysis are expressed as the chemical forms and in the order given in ASTM C 114-00, Section 3, Table 1 [3].

Table 2. Reference Values for SRM 1886a

Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
SrO	0.018 ± 0.006	Cl	0.0042 ± 0.0004

Table 3. Information Values for SRM 1886a

Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
ZnO	0.001	F	0.02
LOI at 950 °C	1.56	Insoluble Residue	0.23
Free CaO	2.16	Total[(a)]	100.12

[(a)] A correction has been made for the amount of fluoride present. This correction, which was subtracted from the gross total, was determined by multiplying the percent fluoride by the ratio of the atomic weight of oxygen to the molecular weight of fluorine (0.421). The total does not include Insoluble Residue or Free CaO.

REFERENCES

[1] 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 Feb 2016).

[2] May, W.; Parris, R.; Beck II, C.; Fassett, J.; Greenberg, R.; Guenther, F.; Kramer, G.; Wise, S.; Gills, T.; Colbert, J.; Gettings, R.; MacDonald, B.; *Definition of Terms and Modes Used at NIST for Value-Assignment of Reference Materials for Chemical Measurements*; NIST Special Publication 260-136 U.S. Government Printing Office: Washington, DC (2000); available at http://www.nist.gov/srm/upload/SP260-136.PDF (accessed Feb 2016).

[3] ASTM C 114-00, Standard Test Methods for Chemical Analysis of Hydraulic Cement, *Annu. Book ASTM Stand.*, 04.01, West Conshohocken, PA.

[4] Levenson, M.S.; Banks, D.L.; Eberhardt, K.R.; Gill, L.M.; Guthrie, W.F.; Liu, H.K.; Vangel, M.G.; Yen, J.H.; Zhang, N.F.; *An Approach to Combining Results from Multiple Methods Motivated by the ISO GUM*; J. Res. Natl. Inst. Stand. Technol., Vol. 105, pp. 571–579 (2000).

[5] 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 Feb 2016); 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 Feb 2016).

Certificate Revision History: 05 February 2016 (Editorial changes); 14 February 2002 (Original certificate date).

Users of this SRM should ensure that the Certificate of Analysis in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200; fax (301) 948-3730; e-mail srminfo@nist.gov; or via the Internet at http://www.nist.gov/srm.