



# Certificate of Analysis

## Standard Reference Material<sup>®</sup> 951a

### Boric Acid Isotopic Standard

This Standard Reference Material (SRM) is intended for use as an isotopic reference material for the calibration of mass spectrometers. The material consists of highly purified boric acid of high homogeneity. A unit of SRM 951a consists of 10 g of powder.

**Certified Values and Uncertainty:** The certified values for the absolute abundance ratio  $^{10}\text{B}/^{11}\text{B}$ , and the atom fraction of  $^{10}\text{B}$  and  $^{11}\text{B}$  are listed 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 accounted for by NIST. A certified value is the best estimate of the true value based on the results of analyses performed at NIST and cooperating laboratories. Value assignment categories are based on the definition of terms and modes used at NIST for chemical reference materials [1]. The uncertainty listed with the value is an expanded uncertainty (95 % confidence interval) and is calculated according to the methods in the ISO Guide [2].

Table 1. Certified Values for SRM 951a Boric Acid

Absolute Abundance Ratio, $^{10}\text{B}/^{11}\text{B}$	0.2473 ± 0.0002
Boron-10, atom percent	19.827 ± 0.013
Boron-11, atom percent	80.173 ± 0.013

**Expiration of Certification:** The certification of **SRM 951a** is valid indefinitely, within the uncertainty specified, provided the SRM is handled and stored in accordance with the instructions given in this certificate (see "Instructions for Handling, Storage, and Use"). Accordingly, periodic recalibration or recertification of this SRM is not required. However, the certification is nullified if the SRM is damaged, contaminated, or otherwise 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 certification, NIST will notify the purchaser. Registration (see attached sheet) will facilitate notification.

The technical matters related to the issuance of this certificate were coordinated by R.D. Vocke, Jr. of the NIST Analytical Chemistry Division.

Support aspects involved in the issuance of this SRM were coordinated through the NIST Measurement Services Division.

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Analytical Chemistry Division

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Gaithersburg, MD 20899  
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*Certificate Revision History on Last Page*

## INSTRUCTIONS FOR HANDLING, STORAGE, AND USE

**Stability:** As received, this lot of boric acid was slightly deficient (approximately 0.01 %) in moisture, but adjusts to a stoichiometric composition in about 30 minute exposure to a normal room humidity (approximately 35 % relative humidity). Once adjusted to composition, the material is relatively insensitive (<0.01 %) to moisture changes between 0 % and 60 % relative humidity, and absorbs only about 0.02 % excess moisture in room temperature humidity as high as 90 %. The material cannot be heated as it decomposes with the loss of considerable water. This material is considered to be stable during the period of certification when stored in its original container in a cool, dry location.

**Material Preparation:**<sup>(1)</sup> The material was prepared by the J.T. Baker Company (Phillipsburg, NJ) for the Argonne National Laboratory. Separated isotopes were purified and solutions prepared by K.M. Sappenfield and T.J. Murphy; coulometric titrations were made by G. Marinenko and C.E. Champion, and mass spectrometric measurements were made by E.J. Catanzaro and E.L. Garner all of the NIST Analytical Chemistry Division. The technical measurements leading to certification were under the chairmanship of W.R. Shields. The various procedures developed have been published and are available in NIST Special Publication 260-17 [3].

The abundance ratio was determined by single filament, thermal ionization mass spectrometry using the  $\text{Na}_2\text{BO}_2^+$  ion. Mixtures of known  $^{10}\text{B}/^{11}\text{B}$  ratio (at a 1:4, 1:1, and 4:1 ratio) were prepared from high purity separated isotope solutions and used as comparison standards. Correction was determined for the  $^{16}\text{O}/^{17}\text{O}$  ratio ( $^{10}\text{B}/^{11}\text{B}$  ratio correction, -0.00079) by measuring mass 91 using the high purity  $^{11}\text{B}$  separated isotope. The atomic weight of the boron, calculated from the absolute abundance ratio using the nuclidic masses 10.0129 and 11.0093, is 10.812.

## REFERENCES

- [1] May, W.E.; Parris, R.M.; Beck II, C.M.; Fassett, J.D.; Greenberg, R.R.; Guenther, F.R.; Kramer, G.W.; Wise, S.A.; Gills, T.E.; Colbert, J.C.; Gettings, R.J.; MacDonald, B.S.; *Definitions 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: Gaithersburg, MD (2000); available at <http://www.nist.gov/srm/publications.cfm> (accessed Aug 2011).
- [2] JCGM 100:2008; *Evaluation of Measurement Data - Guide to the Expression of Uncertainty in Measurement* (ISO GUM 1995 with Minor Corrections); Joint Committee for Guides in Metrology (2008); available at [http://www.bipm.org/utils/common/documents/jcgm/JCGM\\_100\\_2008\\_E.pdf](http://www.bipm.org/utils/common/documents/jcgm/JCGM_100_2008_E.pdf) (accessed Aug 2011); 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://physics.nist.gov/Pubs/> (accessed Aug 2011).
- [3] Catanzaro, E.J.; Champion, C.E.; Garner, E.L.; Marinenko, G.; Sappenfield, K.M.; Shields, W.R.; *Standard Reference Materials: Boric Acid; Isotopic and Assay Standard Reference Materials*; NBS Special Publication 260-17, p. 70, U.S. Government Printing Office: Washington, DC (1970); available at <http://www.nist.gov/srm/publications.cfm> (accessed Aug 2011).

**Certificate Revision History:** 29 August 2011 (Unit size updated; editorial changes); 19 February 2008 (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 at: telephone (301) 975-2200; fax (301) 926-4751; e-mail [srminfo@nist.gov](mailto:srminfo@nist.gov); or via the Internet at <http://www.nist.gov/srm>.*

<sup>(1)</sup> Certain commercial equipment, instrumentation 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.