



National Institute of Standards and Technology

# Certificate of Analysis

Standard Reference Material® 2899a

Ethanol-Water Solution

(Nominal Mass Fraction 25 %)

This Standard Reference Material (SRM) is a solution of ethanol (ethyl alcohol: Chemical Abstracts Service [CAS] Registry Number 64-17-5) in water at a nominal concentration of 25 % by mass. SRM 2899a is intended primarily for use in the calibration of instruments and techniques used for the determination of ethanol in breath. A unit of SRM 2899a consists of five 10-milliliter ampoules, each containing approximately 10 mL of solution.

**Certified Mass Fraction of Ethanol:** The certified concentration value given below is based on results obtained from the gravimetric preparation of the solution and from the analytical results determined using gas chromatography. 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.

Ethanol Certified Mass Fraction Value: 24.95 %  $\pm$  0.52 %

The results are expressed as the certified value  $\pm$  the expanded uncertainty. The certified value is the mean of the concentrations determined by gravimetric and chromatographic measurements. The expanded 95 % uncertainty uses a coverage factor of 2 and includes both correction for estimated purity and allowance for differences between the concentration determined by gravimetric preparation and chromatographic measurements [1]. The measurand is the certified value of ethanol and is metrologically traceable to the SI derived unit of mass fraction (expressed as percent).

**Expiration of Certification:** The certification of SRM 2899a is valid, within the measurement uncertainties specified, until **28 February 2032**, 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 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 this certificate, NIST will notify the purchaser. Registration (see attached sheet or register online) will facilitate notification.

Coordination of the technical measurements leading to the certification of this SRM was under the direction of M.M. Schantz and L.C. Sander of the NIST Chemical Sciences Division.

Preparation of and analytical measurements on the SRM were performed by M.M. Schantz.

Consultation on the statistical design of the experimental work and evaluation of the data were provided by S.D. Leigh of the NIST Statistical Engineering Division.

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

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Chemical Sciences Division

Gaithersburg, MD 20899  
Certificate Issue Date: 23 August 2017  
*Certificate Revision History on Last Page*

Steven J. Choquette, Director  
Office of Reference Materials

## INSTRUCTIONS FOR HANDLING, STORAGE, AND USE

**Handling:** The solution contains ethanol in water at the stated concentration. Use proper disposal methods.

**Storage:** Sealed ampoules, as received, should be stored in the dark at temperatures between 10 °C and 30 °C.

**Use:** Sample aliquots for analysis should be withdrawn **immediately** after opening the ampoules and should be processed without delay for the certified concentration value to be valid within the stated uncertainty. Because of the volatility of ethanol, the certified concentration value is **NOT** applicable to material stored in ampoules that have been opened for more than 2 min, even if they are resealed.

## PREPARATION AND ANALYSIS<sup>(1)</sup>

The solution was prepared at NIST by weighing and mixing known masses of ethanol and organic-free water. The solution was mixed overnight (a minimum of 16 hours). The total mass of the solution was measured, and the concentration was calculated from this gravimetric procedure. The gravimetric concentration was adjusted for the purity estimation of the ethanol, which was determined using flame ionization capillary gas chromatography with two stationary phases of different polarities, differential scanning calorimetry, and Karl Fischer analysis for water content. The bulk solution was chilled slightly, and 10 mL aliquots were dispensed into 10-milliliter glass ampoules, which were then flame sealed.

Aliquots from nine ampoules, selected using a stratified random sampling scheme, were analyzed in duplicate by using capillary gas chromatography with flame ionization detection on a relatively polar DB-wax column, 15 m × 0.45 mm id, 0.85 µm film thickness (Agilent Technologies, Wilmington; DE). The internal standard added to each sample for quantification purposes was 1-propanol. Calibration solutions consisting of weighed amounts of ethanol and the internal standard compound in organic-free water were chromatographically analyzed to determine analyte response factors.

## REFERENCES

- [1] 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/utis/common/documents/jcgm/JCGM\\_100\\_2008\\_E.pdf](http://www.bipm.org/utis/common/documents/jcgm/JCGM_100_2008_E.pdf) (accessed Aug 2017); 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 Aug 2017).

<b>Certificate Revision History:</b> 23 August 2017 (Change of expiration date; editorial changes); 10 December 2009 (Original certificate date).
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*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](mailto:srminfo@nist.gov); or via the Internet at <http://www.nist.gov/srm>.*

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<sup>(1)</sup> Certain commercial equipment, instruments, or materials are identified in this certificate in order to specify adequately 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.