



# National Institute of Standards & Technology

## Certificate of Analysis

Standard Reference Material<sup>®</sup> 1680b

Carbon Monoxide in Nitrogen

(Nominal Amount-of-Substance Fraction, 500  $\mu\text{mol/mol}$ )

*This certificate reports the certified values for Lot 2-J-XX*

This Standard Reference Material (SRM) is a primary gas mixture for which the amount-of-substance fraction (expressed as concentration [1]), may be related to secondary working standards. The SRM is intended for the calibration of instruments used for carbon monoxide determinations and for other uses.

This SRM mixture is supplied in a DOT 3AL specification aluminum (6061 alloy) cylinder with a water volume of 6 L. Mixtures are shipped with a nominal pressure exceeding 12.4 MPa (1800 psig) which provides the user with 0.70 m<sup>3</sup> of useable mixture. The cylinder is the property of the purchaser and is equipped with a CGA 350 valve, which is the recommended outlet for this carbon monoxide mixture.

**Certified Value:** This SRM mixture has been certified for carbon monoxide concentration. The certified value, given below, applies to the identified cylinder and NIST sample number.

Carbon Monoxide Concentration: 490.4  $\mu\text{mol/mol} \pm 2.0 \mu\text{mol/mol}$

Cylinder Number: Sample

NIST Sample Number: Sample

Hydrotest Date: October 2008

Blend date: October 2008

The uncertainty of the certified value includes the estimated uncertainties in the NIST standards, the analytical comparisons to the lot standard (LS), and the uncertainty of comparing the LS with each of the mixtures comprising the lot. The uncertainty is expressed as an expanded uncertainty  $U = ku_c$  with  $u_c$  determined by experiment and a coverage factor  $k$  equal to 2. The true value for the carbon monoxide amount-of-substance is asserted to lie in the interval defined by the certified value  $\pm U$  with a level of confidence of approximately 95 % [2].

**Cylinder and Gas Handling Information:** A high-purity, two-stage pressure regulator with a stainless steel diaphragm and CGA 350 outlet should be used to safely reduce the pressure and to deliver this SRM mixture to the instrument. The regulator should be purged to prevent accidental contamination of the SRM by repeatedly (minimum three times) opening the valve and pressurizing the regulator, then closing the valve and releasing the pressure safely into a vent line. This SRM should not be used after the internal pressure drops below 0.7 MPa (100 psig). This SRM should be stored under normal laboratory conditions within the temperature range of 15 °C and 30 °C.

**Expiration of Certification:** The certification of **SRM 1680b Lot No. 2-J-XX** is valid from the certificate issue date, within the measurement uncertainties specified, until **20 February 2017**, provided the SRM is handled and stored in accordance with the instructions given in this certificate (see "Cylinder and Gas Handling Information"). The certification is nullified if the SRM is damaged, contaminated, or otherwise modified.

Stephen A Wise, Chief  
Analytical Chemistry Division

Gaithersburg, MD 20899  
Certificate Issue Date: 21 July 2009

Robert L. Watters, Jr., Chief  
Measurement Services Division

**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) will facilitate this notification.

The overall direction and coordination of the technical work required for this SRM's certification was performed by F.R. Guenther of the NIST Analytical Chemistry Division.

The analytical measurements leading to the certification of this current SRM lot were performed by W.R. Miller of the NIST Analytical Chemistry Division.

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

**Mixture Preparation:** The gas mixtures comprising this SRM lot were prepared in accordance with NIST technical specifications by a commercial specialty gas vendor under contract to NIST. The specifications stipulate that each SRM mixture be identical in carbon monoxide concentration and stable with time.

**Analytical Methods:** Analyses of the carbon monoxide concentration for this lot of cylinders were conducted by intercomparing each cylinder mixture to a representative cylinder chosen from the lot, the lot standard (LS), using gas chromatography with a flame ionization detector and methanation (GC/Meth/FID). Assignment of the carbon monoxide concentration to the LS was accomplished by intercomparison to primary gravimetric standards using GC/Meth/FID.

**Homogeneity Analysis:** Each of the carbon monoxide mixtures which comprise this SRM lot was compared to the LS using GC/Meth/FID. A statistical analysis of the analytical results indicated that sample-to-sample carbon monoxide concentration differences were not statistically significant. This indicates that within the precision of the NIST measurements, all of the cylinders comprising this SRM lot have identical carbon monoxide concentrations. Therefore, one concentration has been assigned to the entire SRM lot.

**Carbon Monoxide Concentration Value Assignment:** The certified carbon monoxide concentration for this SRM lot was computed from the assigned concentration for the lot standard and the homogeneity analysis.

**CAS Registry Numbers:** This SRM is certified for carbon monoxide in nitrogen. The relevant CAS Registry numbers for these components are: carbon monoxide CAS Registry 630-08-0; nitrogen CAS Registry 7727-37-9.

## 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://physics.nist.gov/Pub/>.
- [2] JCGM 100:2008; *Guide to the Expression of Uncertainty in Measurement*; (ISO GUM 1995 with Minor Corrections), Joint Committee for Guides in Metrology: BIPM, Sevres Cedex, France (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); 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/Pub/>

*Users of this SRM should ensure that the certificate 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>.*