



National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material[®] 2620a

Carbon Dioxide in Nitrogen

(Nominal Amount-of-Substance Fraction - 1.0 % mol/mol)

This certificate reports the certified values for Lot 31-F-XX.

This Standard Reference Material (SRM) is a primary gas mixture that, 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 dioxide 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 psi), which provides the user with 0.73 m³ (25.8 ft³) of useable mixture. The cylinder is the property of the purchaser and is equipped with a CGA-580 brass valve, which is the recommended outlet for this carbon dioxide mixture. NIST recommends that this cylinder not be used below 0.7 MPa (100 psi).

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

Carbon Dioxide Concentration: 0.9710 % mol/mol $\pm$ 0.0011 % mol/mol

Cylinder Number:

NIST Sample Number:

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 $k = 2$. The true value for the carbon dioxide 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].

Expiration of Certification: This certification is valid until **17 July 2009**, within the measurement uncertainties specified, provided the SRM is handled and stored in accordance with the instructions given in this certificate. However, the certification will be nullified if the SRM is contaminated or modified.

Hydrotest Date: 04/96

Blend Date: 09/96

Cylinder and Gas Handling Information: NIST recommends the use of a high purity, two-stage pressure regulator with a stainless steel diaphragm and CGA-580 outlet to safely reduce the pressure and to deliver this SRM mixture to the instrument. The regulator should be purged several times to prevent accidental contamination of the sample.

The overall direction and coordination of the technical work required for the certification of this SRM were 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 G.C. Rhoderick of the NIST Analytical Chemistry Division.

Willie E. May, Chief
Analytical Chemistry Division

John Rumble, Jr., Chief
Measurement Services Division

Gaithersburg, MD 20899
Certificate Issue Date: 28 October 2003
See Certificate Revision History on Last Page

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Support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the NIST Standard Reference Materials Program by B.S. MacDonald of 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 dioxide concentration and stable with time.

Analytical Methods: Analyses of the carbon dioxide 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 thermal conductivity detector (GC/TCD). Assignment of the carbon dioxide concentration to the LS was accomplished by intercomparison to primary gravimetric standards using GC/TCD.

Homogeneity Analysis: Each of the carbon dioxide mixtures, which comprise this SRM lot was compared to the LS using GC/TCD. An analysis of variance indicated that sample-to-sample carbon dioxide concentration differences were statistically insignificant. This indicates that within the precision of the NIST measurements, all of the cylinders comprising this SRM lot have identical carbon dioxide concentrations. Therefore, one concentration has been assigned to the entire SRM lot.

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

Stability: Periodic analyses of SRM units from this lot are performed at NIST to monitor stability. If significant changes in the carbon dioxide concentration are observed, the purchaser will be notified. Refer to the *Cylinder and Gas Handling Information* section for proper handling of this SRM.

REFERENCES

- [1] Taylor, B.N.; *Guide for the Use of the International System of Units (SI)*; NIST Special Publication 811, 1995 Ed. (1995).
- [2] *Guide to the Expression of Uncertainty in Measurement*, ISBN 92-67-10188-9, 1st Ed. ISO, Geneva, Switzerland (1993); 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/>.

Certificate Revision History: 28 October 2003 (This technical revision reports a change in the expiration date); 13 October 2000 (Change in the expiration date); 23 June 1997 (Original certificate date).

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) 975-6776; fax (301) 926-4751; e-mail srminfo@nist.gov; or via the Internet <http://www.nist.gov/srm>.