



Certificate of Analysis

Standard Reference Material[®] 1804c

Toxic Volatile Organic Compounds in Nitrogen

(Nominal Amount-of-Substance Fraction – 5.0 nmol/mol)

This certificate reports the certified values for this sample from Lot 118-C-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 volatile organic compound (VOC) determinations and for the development and evaluation of methods used for air monitoring measurements.

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 0.73 m³ (25.8 ft³) of useable mixture. The cylinder is the property of the purchaser and is equipped with a CGA-350 brass valve, which is the recommended outlet for this VOC mixture.

Certified Value: This SRM mixture has been certified for individual VOC concentration. The certified values, given in Table 1, apply to the identified cylinder and 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 this gas mixture. The uncertainty is expressed as an expanded uncertainty $U = ku_c$ with u_c determined from experiment and a coverage factor $k = 2$. The true value for the individual VOC amount-of-substance fraction is asserted to lie in the interval defined by the certified value $\pm U$ with a level of confidence of approximately 95 % [2].

Maintenance of 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 notification.

Cylinder and Gas Handling Information: NIST recommends the use of a high purity, two-stage pressure regulator with a stainless steel diaphragm and CGA-350 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. This SRM should **NOT** be used after the internal pressure drops below 2.8 MPa (400 psig). This SRM should be stored under normal laboratory conditions within the temperature range of 15 °C and 30 °C.

The analytical measurements leading to the certification of this current SRM sample were performed by G.C. Rhoderick of the NIST Analytical Chemistry Division.

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

Statistical analyses were performed by J.H. Yen of the NIST Statistical Engineering Division.

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

Stephen A. Wise, Chief
Analytical Chemistry Division

Robert L. Watters, Chief
Measurement Services Division

Gaithersburg, MD 20899
Certificate Issue Date: 29 January 2008
See Certificate Revision History on 2nd Page

Mixture Preparation: The gas mixtures comprising this SRM lot, including this sample, were prepared in accordance with NIST technical specifications by NIST. The specifications stipulate that each SRM mixture be individually certified and stable with time.

Analytical Methods: Analyses of the VOC concentrations for this lot of cylinders were conducted by comparing each cylinder mixture to a representative cylinder chosen from the lot (the LS) using a gas chromatograph (GC) with a flame ionization detector (FID) and cryogenic preconcentration. Assignment of individual VOC concentrations to the LS was accomplished by comparison to primary gravimetric standards using GC-FID and cryogenic preconcentration.

Homogeneity Analysis: Each of the VOC mixtures, which comprise this SRM lot, was compared to the LS using GC-FID and cryogenic preconcentration. An analysis of variance indicated that sample-to-sample VOC concentration differences were statistically significant. This indicates that, within the precision of the NIST measurements, all of the cylinders comprising this SRM lot have different VOC concentrations. Therefore, an individual concentration has been assigned to each sample in the entire SRM lot.

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

REFERENCES

- [1] 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 (1995).
- [2] ISO; *Guide to the Expression of Uncertainty in Measurement*; ISBN 92-67-10188-9, 1st ed.; International Organization for Standardization: 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/>.

<p>Certificate Revision History: 29 January 2008 (Extension of certification period); 18 January 2007 (Editorial Change); 07 November 2006 (Update of expiration date); 29 September 2004 (Correct the original certificate date); 28 June 2004 (Editorial changes); 31 October 2003 (Original certificate date).</p>
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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 at <http://www.nist.gov/srm>.

Table 1

Volatile Organic Compound	Certified Values SRM 1804c Concentration, nmol/mol (ppb)
Dichlorodifluoromethane	4.05 ± 0.08
Chloromethane	4.38 ± 0.09
1,2-Dichlorotetrafluoroethane	3.84 ± 0.08
Vinyl chloride	3.09 ± 0.25
Chloroethane	4.81 ± 0.10
Trichlorofluoromethane	4.76 ± 0.10
1,1-Dichloroethene	4.78 ± 0.10
Dichloromethane	4.91 ± 0.10
1,1-Dichloroethane	4.90 ± 0.10
cis-1,2-Dichloroethene	4.80 ± 0.10
Chloroform	4.90 ± 0.10
1,1,1-Trichloroethane	4.83 ± 0.10
Carbon tetrachloride	4.84 ± 0.10
Benzene	4.83 ± 0.10
Trichloroethylene	4.92 ± 0.10
1,2-Dichloropropane	4.85 ± 0.10
Toluene	4.83 ± 0.10
1,1,2-Trichloroethane	4.82 ± 0.20
Tetrachloroethylene	4.86 ± 0.10
Chlorobenzene	4.86 ± 0.10
Ethylbenzene	4.88 ± 0.10
para-Xylene	4.97 ± 0.10
ortho-Xylene	4.60 ± 0.18
1,1,2,2-Tetrachloroethane	4.99 ± 0.26
1,3,5-Trimethylbenzene	4.87 ± 0.20
1,2,4-Trimethylbenzene	5.04 ± 0.20
1,3-Dichlorobenzene	5.00 ± 0.25
1,2-Dichlorobenzene	4.97 ± 0.25
1,2,4-Trichlorobenzene	4.09 ± 0.41
Hexachloro-1,3-butadiene	4.41 ± 0.44

Table 2. Cylinder Information

Cylinder Number:	SAMPLE
NIST Sample Number:	SAMPLE
Hydrotest Date:	March 2000
Blend Date:	April 2002

Expiration of Certification: This certification is valid, within the measurement uncertainties specified, until **12 September 2011**, provided the SRM is handled and stored in accordance with the instructions give in this certificate (see “Cylinder and Gas Handling Information”). The certification is nullified if the SRM is damaged, contaminated or otherwise modified.