



# Certificate of Analysis

## Standard Reference Material<sup>®</sup> 1718

### Nitrous Oxide in Air

(Nominal Amount-of-Substance Fraction 1  $\mu\text{mol/mol}$ )

*This certificate reports the certified values for Lot 1718-A-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. This SRM is intended for the calibration of instruments used for nitrous oxide determinations in air.

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 m<sup>3</sup> (25.8 ft<sup>3</sup>) of useable mixture. The cylinder is the property of the purchaser and is equipped with a CGA-590 brass valve, which is the recommended outlet for this nitrous oxide mixture.

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

Nitrous Oxide Concentration: 0.9948  $\mu\text{mol/mol}$   $\pm$  0.0010  $\mu\text{mol/mol}$

Cylinder Number: «Cylinder\_Number»

NIST Sample Number: «Sample\_Number»

Hydrotest Date: May 2013

Blend Date: December 2013

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 taken into account [2]. 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 this 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 nitrous oxide 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 % [3].

**Expiration of Certification:** The certification of **SRM 1718 Lot No. 1718-A-XX** is valid, within the measurement uncertainty specified, until **12 August 2018**, 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.

**Cylinder and Gas Handling Information:** NIST recommends the use of a high-purity, two-stage pressure regulator with a stainless steel diaphragm and CGA-590 outlet 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 to 30 °C.

Overall direction and coordination of the technical work required for certification of this SRM were performed by F.R. Guenther of the NIST Chemical Sciences Division.

Carlos A. Gonzalez, Chief  
Chemical Sciences Division

Gaithersburg, MD 20899  
Certificate Issue Date: 21 October 2014

Robert L. Watters, Jr., Director  
Office of Reference Materials

Analytical measurements leading to the certification of this SRM were performed by M.E. Kelley of the NIST Chemical Sciences Division.

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

**Notice to Users:** Certified values are not valid to calibrate a spectroscopic instrument measuring nitrous oxide in a balance gas other than air, as bias may be introduced due to band broadening.

**Traceability:** The measurand is the total concentration of nitrous oxide in air and the certified value is metrologically traceable to the SI unit of micromoles of nitrous oxide per total moles of nitrous oxide and air.

**Maintenance of SRM Certification:** Periodic analyses of SRM units from this lot are performed at NIST to monitor stability. If significant 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.

**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 nitrous oxide concentration and stable with time.

**Analytical Methods:** Analyses of the nitrous oxide concentration for this lot of cylinders were conducted by comparing each cylinder mixture to a representative cylinder chosen from the lot, the LS, using cavity enhanced adsorption spectroscopy (CEAS). Assignment of the nitrous oxide concentration to the LS was accomplished by comparison to primary gravimetric standards using CEAS.

**Homogeneity Analysis:** Each of the nitrous oxide mixtures that comprise this SRM lot was compared to the LS using CEAS. A statistical analysis of the analytical results indicated that sample-to-sample nitrous oxide 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 nitrous oxide concentrations. Therefore, one concentration has been assigned to the entire SRM lot.

**Nitrous oxide Concentration Value Assignment:** The certified nitrous oxide concentration for this SRM lot was determined from the assigned concentration for the lot standard and the homogeneity analysis.

**CAS Registry Numbers:** This SRM is certified for nitrous oxide in air. The relevant CAS Registry numbers for these components are: nitrous oxide CAS Registry 10024-97-2; air CAS Registry 132259-10-0.

**Information Values:** Results for additional analyses performed during the certification process are given below. The concentrations reported are **NOT** certified values. These values are given for informational purposes only. An information value is considered to be a value that will be of interest to the SRM user, but for which insufficient information is available to assess adequately the uncertainty associated with the value, or only a limited number of analyses were performed [2]. Information values cannot be used to establish metrological traceability.

Constituent	Concentration	Method	CAS Registry
Argon	0.97 % mol/mol	Gas chromatography (GC)	7440-37-1
Carbon Dioxide	404 $\mu$ mol/mol	Cavity ring down spectroscopy (CRDS)	124-38-9
Carbon Monoxide	155 nmol/mol	CEAS	630-08-0
Oxygen	20.94 % mol/mol	Oxygen paramagnetism	7782-44-7
Total Hydrocarbons (THC as CH <sub>4</sub> )	0.02 $\mu$ mol/mol	Total hydrocarbon analyzer	74-82-8
Water	0.15 $\mu$ mol/mol	Moisture analyzer	7732-18-5

## 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://www.nist.gov/pml/pubs/sp811/index.cfm> (accessed Oct 2014).
- [2] May, W.; Parris, R.; Beck, C.; Fassett, J.; Greenberg, R.; Guenther, F.; Kramer, G.; Wise, S.; Gills, T.; Colbert, J.; Gettings, R.; MacDonald, B.; *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; Washington, DC (2000); available at <http://www.nist.gov/srm/upload/SP260-136.PDF> (accessed Oct 2014).
- [3] 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 (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 Oct 2014); 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 Oct 2014).

*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>.*