



National Institute of Standards & Technology

Certificate of Analysis Standard Reference Material 2609

Carbon Dioxide and Nitrous Oxide in Air

(Nominal Concentration 380 ppm CO₂ and 330 ppb N₂O)

(Atmospheric Standard)

This Standard Reference Material (SRM) is intended for the calibration of instruments and the evaluation of methods used for the determination of carbon dioxide and nitrous oxide in the atmosphere. It is not intended as a working standard, but rather as a primary laboratory standard, to which the concentration of carbon dioxide and/or nitrous oxide in other working standards may be related.

SRM 2609 is supplied in an aluminum cylinder which has a deliverable volume of approximately 3.68 m³ (130 cubic feet) of gas at STP. The aluminum cylinder conforms to DOT specifications and is equipped with a packless CGA-660 stainless steel valve. The cylinder becomes the property of the purchaser.

Carbon dioxide concentration: \pm $\mu\text{mole/mole}(\text{ppm})$

Nitrous oxide concentration: \pm $\text{nmole/mole}(\text{ppb})$

Cylinder Number: Sample Number:

The concentrations of carbon dioxide and nitrous oxide are relative to all other constituents of this gas mixture. The uncertainty shown is the estimated upper limit of error of the certified components and is the 95 percent confidence interval based on allowances for known sources of possible error.

The certified values given above apply only to the contents of the cylinder identified by cylinder number and sample number on this certificate.

The certified values on this certificate are valid for two years from the date of shipment from the National Institute of Standards and Technology (NIST). A validation sticker is supplied with the cylinder to validate its certification period. Please affix this sticker to the cylinder upon receipt of the SRM.

CAUTION: Care must be taken to avoid accidental contamination of the sample during the use of the cylinder with any gas-handling system.

The preparation of the primary standards and/or the analytical measurements leading to the certification of this SRM were performed in the Gas and Particulate Science Division by R.C. Myers, G.A. Sleater, J.W. Elkins, and P.A. Johnson.

The overall direction and coordination of the technical measurements leading to the certification of this SRM were performed under the chairmanship of W.D. Dorko of the Gas and Particulate Science Division.

The technical and support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Office of Standard Reference Materials by T.E. Gills.

Gaithersburg, MD 20899
November 7, 1988
(Revision of certificate dated 9-3-85)

Stanley D. Rasberry, Chief
Office of Standard Reference Materials

(over)

Material Preparation

This SRM is one of a group or "lot" of cylinders that was prepared commercially according to rigid specifications to ensure that the lot is homogeneous and stable. A lot consists of a minimum of 26 cylinders. Each cylinder of gas within the lot is individually analyzed at NIST for conformity to NIST specifications and is certified according to NIST protocols and procedures.

Analysis

The carbon dioxide and nitrous oxide concentrations of the SRM were determined by comparison to NIST working standards that had been previously intercompared with a set of primary gravimetric standards. The method of intercomparison for carbon dioxide was a nondispersive infrared spectrophotometric method. For nitrous oxide, a gas chromatograph equipped with an electron capture detector was employed. Tunable diode laser absorption spectroscopy was used for confirmation of results.

Constituents other than those certified were also determined in representative samples from this SRM lot and are listed below. The concentration values are not certified but given for information only to describe more completely the contents of the cylinder.

Constituent	Estimated Concentration in samples of this lot
Oxygen	20.95 mole percent
Water Vapor	ppm by mole*
Methane	ppm by mole
Trichlorofluoromethane (Halocarbon F-11)	ppt** by mole
Dichlorodifluoromethane (Halocarbon F-12)	ppt** by mole

* maximum

** ppt, parts per trillion

Uncertainty

The estimated upper limits of the total uncertainty at 95% confidence for the carbon dioxide concentration and the nitrous oxide concentration are given on the first page of this certificate. These estimates are based on systematic errors associated with gravimetric standards, the random errors associated with the comparison of the gravimetric standards to the NIST working standards, and the comparison of the NIST working standards to the SRM.

The Geophysical Monitoring for Climatic Change Laboratory (GMCC) of the National Oceanic and Atmospheric Administration (NOAA) determined the carbon dioxide concentration in a sample from this SRM lot. The NOAA/GMCC Laboratory used reference standards from the Scripps Institution of Oceanography which is the CO₂ Central Calibration Laboratory of the World Meteorological Organization. The concentration determined by NOAA agreed with the certified value within the combined errors of the two independent methods employed.

Stability

As stated on the first page of this certificate, the certified values for carbon dioxide and nitrous oxide are valid two years from the date of shipment from NIST. However, when this SRM is used as a standard in a long-term program for determining atmospheric carbon dioxide, it may be necessary to confirm the original certification during or at the end of the certification period. Samples from similar SRM's of carbon dioxide in air have exhibited an increase in concentration when the cylinder pressure fell below 1.04 MPa (150 psi). Therefore it is recommended that the sample not be used as an analytical standard after the pressure has fallen below 2.76 MPa (400 psi).

Periodic reanalyses of representative samples from this lot will be performed at NIST, and if significant changes in the certified values are observed, the purchasers of cylinders from this SRM lot will be notified.

Reanalysis

The NIST will reanalyze this SRM for the original purchaser at a cost not to exceed the cost of similar SRM's available at the time of the request for reanalysis. The original purchaser should contact R.C. Myers (301) 975-3939, of the NIST Gas and Particulate Science Division, to arrange for reanalysis.