



# National Institute of Standards & Technology

## Certificate of Analysis

### Standard Reference Material 1670

#### Carbon Dioxide in Air

(Nominal Concentration 330 ppm)

(Atmospheric Carbon Dioxide Standard)

This Standard Reference Material (SRM) is intended primarily for the calibration of instruments and the evaluation of methods used for the determination of carbon dioxide 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 in working standards may be related.

The SRM is supplied in a cylinder with a deliverable volume of approximately  $0.76 \text{ m}^3$  (27 cubic feet) at STP. The cylinder conforms to DOT specifications and is equipped with a packless CGA-580 brass valve. The cylinder becomes the property of the purchaser.

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

Cylinder Number: Sample Number:

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

The certified value above applies only to the cylinder identified by cylinder number and sample number on this certificate.

The certified value on this certificate is 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 gas cylinder that specifies its certification period. Please affix this sticker to the cylinder upon receipt.

**CAUTION:** Care must be taken to avoid 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 and G.A. Sleater.

The overall direction and coordination of the technical measurements leading to certification 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 14, 1988  
(Revision of certificate dated 12-9-82)

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 content of this SRM was determined by comparison to NIST working standards that had been previously intercompared with a set of primary gravimetric standards. The method of intercomparison was a non-dispersive infrared spectrophotometric method.

The nitrous oxide and oxygen concentrations were also determined in representative samples from this lot of SRM's. The concentrations listed below are not certified but are given for information only to describe more completely the contents of the cylinder.

<u>Constituent</u>	<u>Estimated Concentration in Samples of this Batch</u>
Oxygen	20.95 mole percent
Nitrous Oxide	0.06 ppm by mole

Note: Water vapor was also determined in a number of samples and while the concentration varied from sample to sample the maximum observed concentration in a full cylinder was 24 parts per million by mole.

### Uncertainty

The estimated upper limit of total uncertainty at 95% confidence for the carbon dioxide concentration is given on the first page of this certificate. This estimate is 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 standards from the Scripps Institution of Oceanography which is the Central Calibration Laboratory (CCL) of the World Meteorological Organization. The carbon dioxide concentration of that sample was found to be within the combined errors of the two independent methods employed.

### Stability

As stated on the first page of this certificate, the certified value for carbon dioxide is valid for two years from the date of shipment from NIST. 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 such a monitoring 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 samples from the 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 materials available at the time of the request for reanalysis. The original purchaser should contact R.C. Myers, (301) 975-3939, of the Gas and Particulate Science Division to arrange for reanalysis.