



National Institute of Standards & Technology  
Certificate of Analysis  
Standard Reference Material 2728

Carbon Dioxide, Carbon Monoxide, and Propane in Nitrogen

(Nominal Concentrations: CO<sub>2</sub>, 14 mole percent;  
CO, 8 mole percent; C<sub>3</sub>H<sub>8</sub>, 3000 μmol/mol)

(Auto Emission Inspection/Maintenance Gas)

This Standard Reference Material (SRM) is intended for the calibration of instruments and the evaluation of methods used for the measurement of carbon dioxide, carbon monoxide, and propane in mobile source emissions. It is not intended as a working standard, but rather as a primary standard to which the concentration of carbon dioxide, carbon monoxide, and propane in other working standards may be related.

This SRM is supplied in an aluminum cylinder with a deliverable volume of approximately 0.85 m<sup>3</sup> (30 ft<sup>3</sup>) of gas at normal temperature and pressure. The aluminum cylinder conforms to DOT specifications and is equipped with a CGA-350 packless brass valve with tapered threads. The cylinder becomes the property of the purchaser.

Carbon Dioxide	±	mol/mol
Carbon Monoxide	±	mol/mol
Propane	±	μmol/mol

Cylinder Number:

Sample Number:

Each uncertainty shown is the estimated upper limit of error of the analyte concentration and is expressed as the 95 percent confidence interval. The uncertainty includes the estimated inaccuracy of the primary standards and the imprecision of the analysis of the SRM versus the primary standards.

Representative samples from the lot were examined for the presence of other hydrocarbons. The estimated concentration of total other hydrocarbons (TOHC), expressed as propane, is 8 μmol/mol.

Each cylinder of gas in the SRM lot is individually analyzed and the certified values above apply to the content of the cylinder identified by cylinder number and sample number on this certificate.

The certified values on this certificate are valid for four 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 NIST Organic Analytical Research Division by G.C. Rhoderick and P.A. Johnson.

The overall direction and coordination of the technical measurements leading to the certification of this SRM were performed by W.D. Dorko and W.E. May of the NIST Organic Analytical Research Division.

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

### Certification Information

This SRM is one of a group or "lot" of cylinders. A lot contains a minimum of 20 cylinders that is prepared commercially according to rigid specifications to ensure that the lot is homogeneous and stable. 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, carbon monoxide, and propane content of each cylinder in the lot were determined by comparison to NIST batch standards that had been previously intercompared with a set of primary gravimetric standards. The method of intercomparison was gas chromatography coupled to a thermal conductivity detector for carbon dioxide and carbon monoxide and gas chromatography coupled to a flame ionization detector for propane. The method separates the components of the gas mixture and enables quantitation of each with no interference from the other. This is important as these mixtures may be used with analyzers that are not as specific for the individual components and are therefore employed to ascertain the magnitude of interferences.

The upper limit of uncertainty for each of the analytes was estimated from 1) the inaccuracy of the sets of primary standards, 2) the imprecision of the analysis of the "batch" standards using the primary standards, and 3) the imprecision of the intercomparison of the SRM with the batch standard.

The other hydrocarbons in this SRM were determined by gas chromatography coupled to a flame ionization detector. The total hydrocarbon content of this SRM is equal to the sum of the propane concentration and the TOHC concentration.

The water vapor was determined in representative samples from this SRM lot using a trace moisture analyzer, which is an electrochemical measurement of water with phosphorus pentoxide. The average water content was found to be 3  $\mu\text{mol/mol}$ . The water content is not certified but given as additional information on the contents of each cylinder.

### Stability

Samples from similar SRMs 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 2.1 MPa (300 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 SRMs available at the time of the request for reanalysis. The original purchaser should contact the NIST Organic Analytical Research Division (301) 975-3108 to arrange for this service.