

APEL-RIEMER ENVIRONMENTAL, INC

REFERENCE GASES AND ATMOSPHERIC CHEMISTRY

Certificate of Analysis

Gas-phase Calibration Standard

This gas-phase standard is intended to be used as a reference material for the calibration of instruments.

Statement about preparation and traceability:

Standards are gravimetrically prepared in high-pressure aluminum cylinders (Luxfer, Inc., Riverside, California). Cylinders are cleaned and treated to eliminate contamination and ensure inertness. Standards are prepared in N150 cylinders (~4000 Liters calibration gas), N033 cylinders (~800 Liters calibration gas), or N006 cylinders (~125 Liters calibration gas) at a pressure of 2000 psia UHP nitrogen. Valves are high purity stainless steel (Ceodeux, Lintgen, Luxembourg) with a CGA-350 or CGA-180 outlet fitting. Pure compounds as liquids and gases are obtained from a number of sources. All lot numbers are cataloged. The gravimetric preparation is performed using calibrated microbalances (Mettler-Toledo, Columbus, Ohio) and microsyringes (Hamilton, Reno, Nevada and SGE, Austin, Texas) for measuring the compounds and cylinder balances (Mettler-Toledo, Columbus, Ohio) for the balance gas. Balances are calibrated with NIST traceable weights.

We prepare each cylinder individually. Accuracy is better than +/- 5%. Analysis confirms the accuracy of the gravimetric preparation. We use a series of NIST, NIST-traceable, NPL, and in-house gravimetric standards to perform the instrument calibrations.

Stability varies depending on the compound, concentration, and cylinder size. Many compounds are stable for several years.

The calibration gas mixture in cylinder CC523143 is certified from the analysis date for 12 months.



Daniel D. Riemer, Ph.D.

September 13, 2022

Date

Cylinder: CC523143
 Cylinder Date: 03/22
 Valve: CGA350 SS 22/227831
 Lot No.: 22228.1
 Cylinder Pressure: 2000 psia
 Analysis Date: September 13, 2022

Multi-component calibration mixture in ultra-pure nitrogen

Compound	CAS#	Concentration (ppb)	Uncertainty
Acetaldehyde	75-07-0	108.0	±5%
Methanol	67-56-1	109.2	±5%
Ethanol	64-17-5	97.1	±5%
Acetonitrile	75-05-8	105.7	±5%
Acetone	67-64-1	101.3	±5%
Acrylonitrile	107-13-1	102.1	±5%
Isoprene	78-79-5	108.1	±5%
Dimethylsulfide	75-18-3	108.6	±5%
Methyl Vinyl Ketone	78-94-4	103.6	±5%
Methyl Ethyl Ketone	78-93-3	104.5	±5%
Benzene	71-43-2	101.5	±5%
Toluene	108-88-3	98.0	±5%
<i>m</i> -Xylene	108-38-3	101.0	±5%
α -Pinene	80-56-8	101.6	±5%
1,2,4-Trimethylbenzene	95-63-6	99.5	±5%
Octamethylcyclotetrasiloxane (D4)	556-67-2	104.9	±5%
Decamethylcyclopentasiloxane (D5)	541-02-6	93.6	±5%
1,2,4-Trichlorobenzene	120-82-1	103.8	±5%
β -Caryophyllene	87-44-5	98.9	±5%

Uncertainty is a conservative estimate of the combination of the uncertainties of the gravimetric preparation and analysis.

Chromatogram

100-meter DB-1, 0.25 mm id, 3.1 mL min⁻¹ Helium carrier gas – constant flow
 Temperature Program: 35°C, 3.5 min → 4.5°C min⁻¹ → 180 °C, 6 min

