



DECLARATION OF EQUIVALENCE

**Material Measurement Laboratory
National Institute of Standards and Technology - NIST
Gaithersburg, MD 20899, United States of America**

and

**VSL
National Metrology Institute
Delft, The Netherlands**

NIST and VSL declare that on July 1, 2024 the suites of Primary Standard Gas Mixtures (PSMs), including dynamically prepared Standard Gas Mixtures, developed and maintained in both the Institutes, comprising a range of analyte amount fractions in the stated diluent gas as listed in Annex 1, can be considered as equivalent within the stated uncertainties. This declaration shall expire on July 1, 2026 at which time a new declaration shall take effect.

This declaration is based on the results of both BIPM (CCQM) Key Comparisons and intercomparisons carried out between the two Institutes. A continuous program of intercomparisons has been agreed to in order to maintain this declaration and is outlined in a mutual Memorandum of Cooperation, effective July 1, 2018.

Carlos A. Gonzalez,
Chief, Chemical Sciences Division
Material Measurement Laboratory
National Institute of Standards and Technology
Gaithersburg, MD 20899 USA

Date



Fabienne (F.J.M.) van Booma
General Director
VSL B.V.
Delft, The Netherlands

Date

Annex 1: NIST and VSL suites of Primary Standard Gas Mixtures which are declared to be equivalent

Component	Mole Fractions (mol/mol)	Maximum allowable difference	Date of Next Assessment
Carbon dioxide in nitrogen	$10 \cdot 10^{-6}$ to $20 \cdot 10^{-2}$	0.3 % relative	2025
Carbon dioxide in air	$100 \cdot 10^{-6}$ to $1000 \cdot 10^{-6}$	0.2 % relative	2024
Carbon monoxide in nitrogen	$1 \cdot 10^{-6}$ to $10 \cdot 10^{-2}$	0.3 % relative	2025
Carbon monoxide in air	$10 \cdot 10^{-6}$ to $10 \cdot 10^{-2}$	0.3 % relative	2026
Ethanol in nitrogen / air	$75 \cdot 10^{-6}$ to $1000 \cdot 10^{-6}$	0.5 % relative	2026
Oxygen in nitrogen	$10 \cdot 10^{-6}$ to $100 \cdot 10^{-6}$ $100 \cdot 10^{-6}$ to $25 \cdot 10^{-2}$	1 % relative 0.2 % relative	2025
Propane in nitrogen / air	$1 \cdot 10^{-6}$ to $1 \cdot 10^{-2}$	0.3 % relative	2025
Nitric oxide in nitrogen	$0.5 \cdot 10^{-6}$ to $1 \cdot 10^{-2}$	0.5 % relative	2025
Nitrogen dioxide in nitrogen / air	$10 \cdot 10^{-6}$ - $1000 \cdot 10^{-6}$	2 - 0.5 % relative	2025
Sulfur dioxide in nitrogen	$1 \cdot 10^{-6}$ to $1 \cdot 10^{-2}$	0.5 % relative	2024
Sulfur dioxide in air	$10 \cdot 10^{-6}$ to $1 \cdot 10^{-2}$	0.5 % relative	2025
VOC's (ethane, ethene, propane, propene, iso-butane, iso-butene, 1-butene, n-butane, 2-methyl butane, n-pentane, 1-pentene, 1,3-butadiene, trans-2-pentene, 2-methylpentane,	$1 \cdot 10^{-9}$ to $1 \cdot 10^{-6}$	5 % to 2 % relative	2026

Component	Mole Fractions (mol/mol)	Maximum allowable difference	Date of Next Assessment
2,2,4-trimethylpentane, n-hexane, n-heptane, benzene, toluene, n-octane, o-xylene) in nitrogen			
Hydrogen sulfide in nitrogen	$1 \cdot 10^{-6}$ to $1000 \cdot 10^{-6}$	1 % relative	2026
Ammonia in nitrogen	$10 \cdot 10^{-6}$ to $300 \cdot 10^{-6}$	3 % relative	2025
Stack gas (NO, CO, CO ₂ , C ₃ H ₈ , SO ₂) in nitrogen	Typical	1 % relative (CO, CO ₂ and C ₃ H ₈ 0.3 % relative)	2025
HCl in nitrogen	$10 \cdot 10^{-6}$ to $300 \cdot 10^{-6}$	5 % relative	2024
CH ₄ in nitrogen / air	$1.7 \cdot 10^{-6}$ to $10 \cdot 10^{-2}$	0.1 % relative	2025
N ₂ O in nitrogen/ air	$0.3 \cdot 10^{-6}$ to $1000 \cdot 10^{-6}$	1 % relative	2025

Exploratory comparisons

Component	Mole Fractions (mol/mol)	Maximum allowable difference	Date of Next Assessment
CO in air	$1 \cdot 10^{-6}$ to $10 \cdot 10^{-6}$		Planned for 2025
Halogenated VOCs in nitrogen	$10 \cdot 10^{-9}$ to $100 \cdot 10^{-9}$		No date for reassessment.
Zero gas - Several impurities NO ₂	$1 \cdot 10^{-9}$ to $100 \cdot 10^{-9}$	1–20 % relative	No date for reassessment.

Component	Mole Fractions (mol/mol)	Maximum allowable difference	Date of Next Assessment
NO SO ₂ CO CO ₂ C ₃ H ₈ H ₂ O N ₂ O	1·10 ⁻⁹ to 100·10 ⁻⁹ 1·10 ⁻⁹ to 100·10 ⁻⁹ 10·10 ⁻⁹ to 1000·10 ⁻⁹ 0.1·10 ⁻⁶ to 1·10 ⁻⁶ 3·10 ⁻⁹ to 100·10 ⁻⁹ 1·10 ⁻⁶ to 5·10 ⁻⁶ 0.5·10 ⁻⁹ to 5·10 ⁻⁹		
Formaldehyde in nitrogen	1·10 ⁻⁶ to 10·10 ⁻⁶		No date for reassessment.
OVOC in nitrogen	100·10 ⁻⁹ to 1· 10 ⁻⁶		To be reviewed 2025.
Mercury in air	30 µg/m ³ to 200 µg/m ³		Comparison in 2024