

DECLARATION OF EQUIVALENCE

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

and

**National Physical Laboratory - NPL
Teddington, United Kingdom**

NIST and NPL declare that on January 1, 2023, the suites of Primary Reference materials (PRMs) or 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 January 1, 2025, 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 January 1, 2019.



2-2-2023

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Date



7-2-2023

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Date

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

Component	Amount Fractions (mol/mol)	Maximum allowable difference ¹	Date of Next Assessment
Carbon dioxide in nitrogen or air	10·10 ⁻⁶ to 25·10 ⁻²	0.23 % relative	2025
Carbon monoxide in nitrogen or air	5·10 ⁻⁶ to 10·10 ⁻⁶ 10·10 ⁻⁶ to 20·10 ⁻²	0.66 % relative 0.53 % relative	2025
Ethanol in nitrogen or air	50·10 ⁻⁶ to 500·10 ⁻⁶	2.09 % relative	2023
Oxygen in nitrogen	10·10 ⁻⁶ to 27·10 ⁻²	0.30 % relative	2025
Propane in nitrogen or air	5·10 ⁻⁹ to 500·10 ⁻⁹ 10·10 ⁻⁶ to 2.5·10 ⁻²	5.00 % relative 0.33 % relative	2025
Nitrogen monoxide in nitrogen	10·10 ⁻⁶ to 1·10 ⁻² 0.45·10 ⁻⁶ to 10·10 ⁻⁶	0.40 % relative 5.44 % relative	2025
Nitrogen dioxide in nitrogen or air	10·10 ⁻⁶ to 100·10 ⁻⁶	3.00 % relative	2023
Sulfur dioxide in nitrogen or air	5·10 ⁻⁶ to 10·10 ⁻⁶ 10·10 ⁻⁶ to 1·10 ⁻²	1.26 % relative 0.63 % relative	2025
Hydrogen sulfide in nitrogen	10·10 ⁻⁶ to 500·10 ⁻⁶	3.00 % relative	2024
Methane in nitrogen	1·10 ⁻⁶ to 10·10 ⁻⁶ 10·10 ⁻⁶ to 10·10 ⁻²	0.60 % relative 0.24 % relative	2025
Methane in air	1·10 ⁻⁶ to 10·10 ⁻⁶ 10·10 ⁻⁶ to 125·10 ⁻⁶	2.40 % relative 0.54 % relative	2025

VOC's (ethane, propane, iso-butane, n-butane, n-pentane, n-hexane, n-heptane, benzene, toluene, ethylbenzene, o-xylene) in nitrogen	$1 \cdot 10^{-9}$ to $500 \cdot 10^{-9}$	4.00 % relative	2025
VOC terpenes (limonene, α -pinene, b-pinene 1,8-cineole, 3-carene) in nitrogen	$2.5 \cdot 10^{-9}$ to $500 \cdot 10^{-9}$	4.00 % relative	2025

¹ This is the maximum allowable difference between the NPL and NIST reference values to ensure equivalence. It is determined from the sum of the NPL and NIST expanded uncertainties ($k=2$) published in the Key Comparison Database (<https://www.bipm.org/kcdb>), representing best capability.