



## 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, 2021 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 January 1, 2023 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.

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Date

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28-08-2020

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

<b>Component</b>	<b>Mole Fractions (mol/mol)</b>	<b>Maximum allowable difference</b>	<b>Date of Next Assessment</b>
Carbon dioxide in nitrogen or air	$10 \cdot 10^{-6}$ to $20 \cdot 10^{-2}$	0.3 % relative	2021
Carbon monoxide in nitrogen or air	$1 \cdot 10^{-6}$ to $10 \cdot 10^{-2}$ $1 \cdot 10^{-7}$ to $1 \cdot 10^{-6}$	0.3 % relative 2.0 % relative	2021
Ethanol in nitrogen or air	$50 \cdot 10^{-6}$ to $1000 \cdot 10^{-6}$	0.5 % relative	2021
Oxygen in nitrogen	$10 \cdot 10^{-6}$ to $25 \cdot 10^{-2}$	0.2 % relative	2023
Propane in nitrogen or air	$1 \cdot 10^{-6}$ to $1 \cdot 10^{-2}$	0.3 % relative	2022
Nitric oxide in nitrogen	$10 \cdot 10^{-6}$ to $1 \cdot 10^{-2}$ $0.4 \cdot 10^{-6}$ to $10 \cdot 10^{-2}$	0.5 % relative 1.0 % relative	2022
Nitrogen dioxide in nitrogen or air	$10 \cdot 10^{-6}$ to $1 \cdot 10^{-2}$	0.5% relative	2021
Sulfur dioxide in nitrogen or air	$10 \cdot 10^{-6}$ to $1 \cdot 10^{-2}$ $0.4 \cdot 10^{-6}$ to $10 \cdot 10^{-6}$	0.5 % relative 2.0 % relative	2023
Hydrogen sulfide in nitrogen or air	$10 \cdot 10^{-6}$ to $1000 \cdot 10^{-6}$	1.0 % relative	2023
Methane in nitrogen or air	$1.7 \cdot 10^{-6}$ to $10 \cdot 10^{-2}$	0.2 % relative	2023
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 $1 \cdot 10^{-6}$	2.0 % relative	2022

VOC terpenes (limonene, $\alpha$ -pinene, 1,8-cineole, 3-carene) in nitrogen	$1 \cdot 10^{-9}$ to $1 \cdot 10^{-6}$	0.5 % relative	2022
Stack gas (NO, CO, CO <sub>2</sub> , C <sub>3</sub> H <sub>8</sub> , SO <sub>2</sub> ) in nitrogen	Typical	3 % relative	2022