



## 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, 2022 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, 2024 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.

06/14/2022

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15 June 2022  
Date

**Annex 1: NIST and VSL 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	$10 \cdot 10^{-6}$ 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	2023
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	2024
Ethanol in nitrogen / air	$75 \cdot 10^{-6}$ to $1000 \cdot 10^{-6}$	0.5 % relative	2022
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	$10 \cdot 10^{-6}$ to $1 \cdot 10^{-2}$	0.5% relative	2022
Sulfur dioxide in nitrogen	$1 \cdot 10^{-6}$ to $1 \cdot 10^{-2}$	0.5 % relative	2023
Sulfur dioxide in air	$10 \cdot 10^{-6}$ to $1 \cdot 10^{-2}$	0.5 % relative	2023
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-methyl pentane, 2,2,4-trimethyl	$1 \cdot 10^{-9}$ to $1 \cdot 10^{-6}$	5 % to 2 % relative	2024

pentane, 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	2025
Ammonia in nitrogen	$10 \cdot 10^{-6}$ to $300 \cdot 10^{-6}$	3 % relative	2025
Stack gas (NO, CO, CO <sub>2</sub> , C <sub>3</sub> H <sub>8</sub> , SO <sub>2</sub> ) in nitrogen	Typical	1 % relative (CO, CO <sub>2</sub> and C <sub>3</sub> H <sub>8</sub> 0.3 % relative)	2024
HCl in nitrogen	$10 \cdot 10^{-6}$ to $300 \cdot 10^{-6}$	5 % relative	2022
CH <sub>4</sub> in nitrogen / air	$1.7 \cdot 10^{-6}$ to $10 \cdot 10^{-2}$	0.1 % relative	2023
N <sub>2</sub> O in nitrogen/ air	$0.3 \cdot 10^{-6}$ to $1000 \cdot 10^{-6}$	1 % relative	2025