National Institute of Standards and Technology
U.S. Department of Commerce

Date of Issue:
10 June 2022

Standard Reference Material® 2658a
Oxygen in Nitrogen

(Nominal Amount-of-Substance Fraction 10 % mol/mol)
Lot 72-E-XX

CERTIFICATE OF ANALYSIS

Purpose: The certified value delivered by this Standard Reference Material (SRM) is intended for use in producing metrologically traceable secondary standards for the calibration of instruments used for oxygen determinations.

Description: This SRM is a primary gas mixture supplied in a DOT 3AL-specification aluminum (6061 alloy) cylinder with a water volume of 6 L. Mixtures are shipped with a nominal pressure exceeding 12.4 MPa (1800 psig), which provides the user with 0.73 m^3 (25.8 ft^3) of useable mixture. The cylinder is the property of the purchaser and is equipped with a CGA-590 brass valve, which is the recommended outlet for this oxygen mixture.

Certified Values: A NIST certified value is a value for which NIST has the highest confidence in that all known or suspected sources of bias and imprecision have been accounted [1]. This SRM mixture has been certified for oxygen amount-of-substance fraction (mole fraction, sometimes termed "molar concentration"). This certified value is traceable to the International System of Units (SI) through the gravimetric primary standards and procedures used in the preparation of this mixture. The certified value given below applies to the identified cylinder and NIST sample number.

Oxygen Mole Fraction: 9.819 % mol/mol ± 0.015 % mol/mol[(a)]

Cylinder Number: FF64358	NIST Sample Number: 72-E-12
Hydrotest Date: April 2019	Blend Date: February 2020

[(a)] The certified value is expressed as $x \pm U_{95\%}(x)$, where x is the value and $U_{95\%}(x)$ is the expanded uncertainty of the value. The true value of the analyte lies within the interval $x \pm U_{95\%}(x)$ with 95 % confidence. For guidance in propagating this uncertainty, see reference 2.

Other Information: Appendix A lists information on other components in the mixture.

Period of Validity: The certified value delivered by **SRM 2658a Lot No. 72-E-XX** is valid within the measurement uncertainty specified until **23 March 2029**, provided the SRM is handled and stored in accordance with the instructions given in this certificate (see "Cylinder and Gas Handling Information"). The certification is nullified if the SRM is damaged, contaminated or otherwise modified, or if the internal pressure drops below 0.7 MPa (100 psig).

Maintenance of Certified Values: NIST will monitor this SRM over the period of its validity. If substantive technical changes occur that affect the certification, NIST will issue an amended certificate through the NIST SRM website (https://www.nist.gov/srm) and notify registered users. SRM users can register online from a link available on the NIST SRM website or fill out the user registration form that is supplied with the SRM. Registration will facilitate notification. Before making use of any of the values delivered by this material, users should verify they have the most recent version of this documentation, available through the NIST SRM website (https://www.nist.gov/srm).

Carlos A. Gonzalez, Chief
Chemical Sciences Division

Steven J. Choquette, Director
Office of Reference Materials

Storage: This SRM should be stored under normal laboratory conditions within the temperature range of 15 ºC to 30 ºC.

Cylinder and Gas Handling Information: NIST recommends the use of a high-purity, two-stage pressure regulator with a stainless-steel diaphragm and CGA-590 outlet to safely reduce the pressure and to deliver this mixture to the instrument. The regulator should be purged to prevent accidental contamination of the SRM by repeatedly (minimum three times) opening the valve and pressurizing the regulator, then closing the valve and releasing the pressure safely into a vent line.

Mixture Preparation: The gas mixtures comprising this SRM lot were prepared in accordance with NIST technical specifications by a commercial specialty gas vendor under contract to NIST. The specifications stipulate that each SRM mixture be identical in oxygen mole fraction and stable with time.

Analytical Method: Analyses of the oxygen mole fraction for this lot of cylinders were conducted by comparison to a representative cylinder chosen from the lot, designated as the SRM lot standard (LS). The LS was compared to NIST primary gravimetric standards using a paramagnetic analyzer. Each of the oxygen mixtures that comprise this SRM lot was then compared to the LS using a paramagnetic analyzer. Within the precision of the NIST measurements, all the cylinders comprising this SRM lot have identical oxygen mole fractions.

CAS Registry Numbers: This SRM is certified for oxygen in nitrogen. The relevant CAS Registry numbers for these components are: oxygen CAS Registry 7782-44-7; nitrogen (balance gas) CAS Registry 7727-37-9.

NOTICE TO USERS

NIST strives to maintain the SRM inventory supply, but NIST cannot guarantee the continued or continuous supply of any specific SRM. Accordingly, NIST encourages the use of this SRM as a primary benchmark for the quality and accuracy of the user's in-house reference materials and working standards. As such, the SRM should be used to validate the more routinely used reference materials in a laboratory. Comparisons between the SRM and in-house reference materials or working measurement standards should take place at intervals appropriate to the conservation of the SRM and the stability of relevant in-house materials. For further guidance on how this approach can be implemented, contact NIST by email at srms@nist.gov.

REFERENCES

[1] Beauchamp, C.R.; Camara, J.E.; Carney, J.; Choquette, S.J.; Cole, K.D.; DeRose, P.C.; Duewer, D.L.; Epstein, M.S.; Kline, M.C.; Lippa, K.A.; Lucon, E.; Molloy, J.; Nelson, M.A.; Phinney, K.W.; Polakoski, M.; Possolo, A.; Sander, L.C.; Schiel, J.E.; Sharpless, K.E.; Toman, B.; Winchester, M.R.; Windover, D.; *Metrological Tools for the Reference Materials and Reference Instruments of the NIST Material Measurement Laboratory*; NIST Special Publication (NIST SP) 260-136, 2021 edition; U.S. Government Printing Office: Washington, DC (2021); available at https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.260-136-2021.pdf (accessed Jun 2022).

[2] Possolo, A.M.; *Evaluating, Expressing, and Propagating Measurement Uncertainty for NIST Reference Materials;* NIST Special Publication (NIST SP) 260-202; U.S. Government Printing Office: Washington, DC (2020); available at https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.260-202.pdf (accessed Jun 2022).

If you use this SRM in published work, please reference:

Cecelski C, Harris K, Goodman C, Kimes W, Liu Q, Miller W, Carney J (2021) Certification of NIST Gas Mixture Standard Reference Materials. (National Institute of Standards and Technology, Gaithersburg, MD), NIST Special Publication (SP) 260-222. https://doi.org/10.6028/NIST.SP.260-222

Certain commercial equipment, instruments, or materials may be identified in this Certificate of Analysis to adequately specify the experimental procedure. Such identification does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the materials or equipment identified are necessarily the best available for the purpose.

Users of this SRM should ensure that the Certificate of Analysis in their possession is current. This can be accomplished by contacting the Office of Reference Materials 100 Bureau Drive, Stop 2300, Gaithersburg, MD 20899-2300; telephone (301) 975-2200; e-mail srminfo@nist.gov; or the Internet at https://www.nist.gov/srm.

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APPENDIX A

Trace Components: Trace components in SRM 2658a Lot 72-E-XX include:

Water: The mole fraction of water in this mixture is expressed as a maximum allowable purity level of <1 µmol/mol. While the best estimate of the water mole fraction lies within the interval [0 to 1] µmol/mol, this interval may not include the true value. Water was detected using an electrolytic analyzer; water CAS Registry 7732-18-5.

Argon: The mole fraction of argon in this mixture is expressed as an allowable purity level of <0.55 µmol/mol. While the best estimate of the argon mole fraction lies within the interval [0 to 0.55] µmol/mol, this interval may not include the true value. Argon was detected using gas chromatography with a thermal conductivity detector; argon CAS Registry 7440-37-1.

Total Hydrocarbons (expressed as Methane): The mole fraction of total hydrocarbons in this mixture is expressed as an allowable purity level of <50 nmol/mol. While the best estimate of the total hydrocarbons mole fraction lies within the interval [0 to 50] nmol/mol, this interval may not include the true value. Total hydrocarbons expressed as methane was detected using gas chromatography with a flame ionization detector; methane CAS Registry 74-82-8.

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