National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 2658a

Oxygen in Nitrogen

(Nominal Amount-of-Substance Fraction 10 % mol/mol)

This certificate reports the certified values for Lot 72-D-XX.

This Standard Reference Material (SRM) is a primary gas mixture for which the amount-of-substance fraction, expressed as concentration [1], may be related to secondary working standards. This SRM is intended for the calibration of instruments used for oxygen determinations and for other applications.

This SRM mixture is 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 Value: This SRM mixture has been certified for oxygen concentration. The certified value given below applies to the identified cylinder and NIST sample number.

Oxygen Concentration:	9.918 % mol/mol ± 0.022 % mol/mol
Cylinder Number: <<Sample>>	NIST Sample Number: <<Sample>>
Hydrotest Date: February 2006	Blend Date: March 2006

A NIST certified value is a value for which NIST has the highest confidence in its accuracy in that all known or suspected sources of bias have been investigated or taken into account [2]. The uncertainty of the certified value includes the estimated uncertainties in the NIST standards, the analytical comparisons to the lot standard (LS), and the uncertainty of comparing the LS with each of the mixtures comprising this lot. The uncertainty is expressed as an expanded uncertainty $U = ku_c$ with u_c determined by experiment and a coverage factor $k = 2$. The true value for the oxygen amount-of-substance fraction is asserted to lie in the interval defined by the certified value ± U with a level of confidence of approximately 95 % [3].

Expiration of Certification: The certification of **SRM 2658a Lot No. 72-D-XX** is valid from this certificate issue date, within the measurement uncertainty specified, until **03 February 2024**, 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.

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 SRM 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. This SRM should not be used after the internal pressure drops below 0.7 MPa (100 psig). This SRM should be stored under normal laboratory conditions within the temperature range of 15 ºC to 30 ºC.

Overall direction and coordination of the technical work required for certification of this SRM were performed by F.R. Guenther of the NIST Chemical Sciences Division.

Carlos A. Gonzalez, Chief
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Gaithersburg, MD 20899

Steven J. Choquette, Acting Director
Office of Reference Materials

Certificate Issue Date: 23 February 2016
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The analytical measurements leading to the certification of the current SRM lot were performed by M.E. Kelley of the NIST Chemical Sciences Division.

Support aspects involved in the issuance of this SRM were coordinated through the NIST Office of Reference Materials.

Traceability: The measurand is the total concentration of oxygen in nitrogen and the certified value is metrologically traceable to the SI unit for mass expressed as moles of oxygen per total moles of oxygen and nitrogen.

Maintenance of SRM Certification: NIST will monitor this SRM over the period of its certification. If substantive technical changes occur that affect the certification before the expiration of this certificate, NIST will notify the purchaser. Registration (see attached sheet or register online) will facilitate notification.

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 concentration and stable with time.

Analytical Methods: Analyses of the oxygen concentration for this lot of cylinders were conducted by comparing each cylinder mixture to a representative cylinder chosen from the lot, the LS, using an oxygen-specific paramagnetic process analyzer. Assignment of the oxygen concentration to the LS was accomplished by comparison to primary gravimetric standards using the paramagnetic analyzer.

Homogeneity Analysis: Each of the oxygen mixtures that comprise this SRM lot was compared to the LS using oxygen paramagnetic. A statistical analysis of the analytical results indicated that sample-to-sample oxygen concentration differences were not statistically significant. This indicates that, within the precision of the NIST measurements, all of the cylinders comprising this SRM lot have identical oxygen concentrations. Therefore, one concentration has been assigned to the entire SRM lot.

Oxygen Concentration Value Assignment: The certified oxygen concentration for this SRM lot was determined from the assigned concentration for the lot standard and the homogeneity analysis.

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 CAS Registry 7727-37-9.

Information Values: Results for additional analyses performed during the certification process are given below. The concentrations reported are **NOT** certified values. These values are given for informational purposes only. An information value is considered to be a value that will be of interest to the SRM user, but for which insufficient information is available to assess adequately the uncertainty associated with the value, or only a limited number of analyses were performed [2]. Information values cannot be used to establish metrological traceability.

Constituent	Concentration
Argon	40 µmol/mol
Water	0.8 µmol/mol
Carbon dioxide	0.3 µmol/mol
Carbon monoxide	0.1 µmol/mol
Total hydrocarbons	0.01 µmol/mol

REFERENCES

[1] Thompson, A.; Taylor, B.N.; *Guide for the Use of the International System of Units (SI)*; NIST Special Publication 811; U.S. Government Printing Office: Washington, DC (2008); available at http://www.nist.gov/pml/pubs/sp811/index.cfm (accessed Feb 2016).

[2] May, W.; Parris, R.; Beck, C.; Fassett, J.; Greenberg, R.; Guenther, F.; Kramer, G.; Wise, S.; Gills, T.; Colbert, J.; Gettings, R.; MacDonald, B.; *Definitions of Terms and Modes Used at NIST for Value-Assignment of Reference Materials for Chemical Measurements*; NIST Special Publication 260-136; U.S. Government Printing Office: Washington, DC (2000); available at: http://www.nist.gov/srm/publications.cfm (accessed Feb 2016).

[3] JCGM 100:2008; *Guide to the Expression of Uncertainty in Measurement*; (GUM 1995 with Minor Corrections), Joint Committee for Guides in Metrology (JCGM) (2008); available at http://www.bipm.org/utils/common/documents/jcgm/JCGM_100_2008_E.pdf (accessed Feb 2016); see also Taylor, B.N.; Kuyatt, C.E.; *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*; NIST Technical Note 1297; U.S. Government Printing Office: Washington, DC (1994); available at http://www.nist.gov/pml/pubs/index.cfm (accessed Feb 2016).

Certificate Revision History: 23 February 2016 (Change of expiration date; editorial changes); 17 September 2010 (This revision includes an extension of the certification period and minor editorial changes.); 12 July 2006 (Original certificate date).

Users of this SRM should ensure that the Certificate of Analysis in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200; fax (301) 948-3730; e-mail srminfo@nist.gov; or via the Internet at http://www.nist.gov/srm.