

Standard Reference Material® 1619b
Sulfur in Residual Fuel Oil
(Nominal Mass Fraction 0.7 %)
CERTIFICATE OF ANALYSIS

Purpose: The certified values delivered by this Standard Reference Material (SRM) are intended for calibrating instruments and evaluating methods used in the determination of total sulfur and mercury in fuel oils or materials of similar matrix.

Description: A unit of SRM 1619b consists of approximately 100 mL of commercial “No. 6” residual fuel oil as defined by ASTM D396-95 Standard Specification for Fuel Oils [1].

Certified Values: The certified sulfur and mercury mass fraction values are provided in the table below [2]. 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 [3]. The certified sulfur content value is based on analyses by isotope dilution thermal ionization mass spectrometry (ID-TIMS) [4]. The certified mercury content is based in cold vapor isotope dilution inductively coupled plasma mass spectrometry (CV-ID-ICP-MS) [5]. Homogeneity testing was performed using X-ray fluorescence (XRF) spectrometry. The uncertainty in the certified value is expressed as an expanded uncertainty and is calculated according to the method in the ISO/JCGM Guide [6]. The expanded uncertainty is based on a 95 % prediction interval [7].

Element	Mass Fraction
Sulfur	0.696 0 % $\pm$ 0.007 7 %
Mercury	3.46 ng/g $\pm$ 0.74 ng/g

Additional Information: Values of potential interest are provided in Appendix A.

Period of Validity: The certified values delivered by **SRM 1619b** are valid within the measurement uncertainty specified until **28 February 2030**. The certified values are nullified if the material is stored or used improperly, damaged, contaminated, or otherwise modified.

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>). 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>).

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Safety: Consult the Safety Data Sheet (SDS) Exemption Letter for hazard information.

Storage: The SRM should be stored under normal laboratory conditions (nominally 22 °C ± 5 °C), away from direct sunlight.

Use: Because of the viscosity of SRM 1619b, it is recommended that the SRM unit be warmed slowly to between 40 °C and 60 °C and then shaken, or stirred with a clean stirrer, before sampling. Care must be exercised to not introduce entrapped air, which could affect gravimetric measurements and XRF responses. A detailed study to determine if the sulfur components of SRM 1619b will segregate has not been performed at this time.

The SRM bottle should only be opened for the minimum time required to dispense the material. To relate analytical determinations to the certified value in this Certificate of Analysis, a minimum sample mass of 140 mg should be used. After use, the bottle should be tightly recapped and stored.

REFERENCES

- [1] ASTM D396-95; *Standard Specification for Fuel Oils*; Annual Book ASTM Standards, Vol. 05.01, ASTM, West Conshohocken, PA.
- [2] 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 <https://www.nist.gov/pml/special-publication-811> (accessed Jul 2026).
- [3] 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 Jul 2026).
- [4] Kelly, W.R.; Paulsen, P.J.; Murphy, K.E.; Vocke, R.D., Jr.; Chen, L.-T.; *Determination of Sulfur in Fossil Fuels by Isotope Dilution Thermal Ionization Mass Spectrometry*; Anal. Chem., Vol. 66, pp. 2505–2513 (1994).
- [5] Christopher, S.J.; Long, S.E.; Rearick, M.S.; *Development of High Accuracy Vapor Generation ICP-MS and Its Application to the Certification of Mercury in Standard Reference Materials*; Anal. Chem., Vol. 73, pp. 2190–2199 (2001).
- [6] JCGM 100:2008; *Evaluation of Measurement Data — Guide to the Expression of Uncertainty in Measurement*; Joint Committee for Guides in Metrology (JCGM) (2008); available at <https://www.bipm.org/en/committees/jc/jcgm/publications> (accessed Jul 2026); 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 <https://www.nist.gov/pml/nist-technical-note-1297> (accessed Jul 2026).
- [7] Hahn, G.J.; Meeker, W.Q.; *Statistical Intervals: A Guide for Practitioners*; John Wiley & Sons, Inc.: NY (1991).

Certificate Revision History: 06 July 2026 (Editorial changes, format update); 05 March 2026 (Change of expiration date; editorial changes); 29 April 2021 (Change of expiration date; editorial changes); 28 June 2013 (Certification period extended; editorial changes); 24 February 2010 (Corrected the unit for the certified value of mercury from ng/kg to ng/g; editorial changes); 22 July 2008 (Editorial changes); 28 January 2008 (Certification period extended; editorial changes); 01 March 2006 (Editorial changes); 24 January 2006 (Editorial changes); 29 November 2004 (Certified mercury value added); 27 July 1998 (Original certificate date).

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>.

***** End of Certificate of Analysis *****

APPENDIX A

Values of Potential Interest: A value of potential interest is considered to be a value that will be of interest and use 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 [3]. Additional properties of SRM 1619b are listed below. These properties were determined by a commercial firm under contract to NIST using ASTM methods. The results are **NOT** certified and are provided only as additional information on the matrix. Values of potential interest cannot be used to establish metrological traceability.

Physical Property Test	ASTM Standard Used	Result
Density @ 15 °C	D1250-80 (1990)	1010.1 kg/m ³
@ 60 °F	D287-92 (1995)	8.5 °API
Flash Point, PMCC	D93-94	93 °C
Pour Point	D97-93	0 °C
Heat of Combustion, Gross	D240-92 ^(a)	41.74 MJ/kg (17947 Btu/lb)
Kinematic Viscosity @ 40 °C	D445-94 ^(a)	322.9 × 10 ⁻⁶ m ² /s (322.9 cSt)
@ 50 °C	D445-94 ^(a)	151.1 × 10 ⁻⁶ m ² /s (151.1 cSt)
@ 100 °C	D445-94 ^(a)	16.17 × 10 ⁻⁶ m ² /s (16.17 cSt)
Carbon	D5291-92	88.0 %
Hydrogen	D5291-92	10.0 %

^(a) Only editorial changes were made to the previous issuance of the ASTM standard.

ASTM Standard Test Methods:

D93-94	Standard Test Methods for Flash Point by Pensky-Martens Closed Tester
D97-93	Standard Test Methods for Pour Point of Petroleum Products
D240-92 ^(a)	Standard Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter
D287-92 (1995)	Standard Test Method for API Gravity of Crude Petroleum and Petroleum Products (Hydrometer Method)
D445-94 ^(a)	Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)
D1250-80 (1990) ^(a)	Standard Guide for Petroleum Measurement Tables
D5291-92	Standard Test Methods for Instrumental Determination of Carbon, Hydrogen, and Nitrogen in Petroleum Products and Lubricants

^(a) Only editorial changes were made to the previous issuance of the ASTM standard.

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