National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 1634c

Trace Elements in Fuel Oil

This Standard Reference Material (SRM) is intended for use in the evaluation of methods and the calibration of apparatus used for the determination of trace elements in fuel oils and other materials of a similar matrix. Each SRM unit consists of 100 mL of the fuel oil.

The certified values for SRM 1634c were established using the equally weighted means of the results of two independent analytical methods. The values and their uncertainties are listed in Table 1. Noncertified values are given in Table 2 and are provided for information only. All values are reported as mass fractions [1].

SRM 1634c is a commercial "No. 6" residual fuel oil as defined by the American Society for Testing and Materials (ASTM) based on a kinematic viscosity value of 0.000301 m^2/s at 40 °C. The flash point of SRM 1634c is 43 °C. Viscosity and flash point values, which are based on analysis provided by a commercial laboratory using ASTM methods, are provided only as information to better characterize the SRM matrix.

NOTICE AND WARNINGS TO USERS

Expiration of Certification: The certification of this SRM lot is valid within the specified measurement uncertainties until **31 December 2012**, provided the SRM is handled and stored in accordance with the instructions given in this certificate. However, the certification will be nullified if the SRM is contaminated or otherwise modified.

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. Return of the attached registration card will facilitate notification.

Precautions: When the material is not in use, it should be stored in the tightly sealed bottle.

The overall direction and coordination of the analytical measurements leading to certification were performed by R.L. Watters, Jr., of the NIST Analytical Chemistry Division.

Additional analyses in support of this certification were performed by J. Sieber of Texaco, Inc., Beacon, NY, and by U. Reus, H. Buddeker, and A. Prange of GKSS Research Center, Geesthacht, Germany.

Statistical analysis was performed by S.B. Schiller of the NIST Statistical Engineering Division.

The technical and support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the NIST Standard Reference Materials Program by J.S. Kane (retired) and B.S. MacDonald.

Willie E. May, Chief
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Certificate Issue Date: 08 February 2002
See Certificate Revision History on Last Page

John Rumble, Jr., Acting Chief
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The homogeneity studies by X-ray fluorescence were performed by P.A. Pella and A.F. Marlow and certification analyses for the various elements were performed by D.A. Becker, R. Demiralp, J.D. Fassett, R.R. Greenberg, W.R. Kelly, K.E. Murphy, P.J. Paulsen, M.S. Rearick, R. Saraswati, G.C. Turk, L.J. Wood, and L. Yu of the NIST Analytical Chemistry Division.

Recommended Use: Because of the viscosity of "No. 6" residual fuel oil, the SRM unit must first be warmed to 40 °C on a water bath and then shaken vigorously, or stirred with a clean stirrer before sampling. Also, the oil contains particulate matter that causes it to be distinctly heterogeneous. Certification of SRM l634c is based on a well-mixed sample size of 1 g as determined by studies performed by X-ray fluorescence, as well as on data from certification analyses. Therefore, a minimum sample size of 1 g should be used for analysis to assure that results are representative of data that can be expected to fall within the uncertainties of the certified values shown on this certificate.

Table 1. Certified Values

Element	Mass Fractions (mg/kg)	Methods of Analysis
Arsenic	0.1426 ± 0.0064	FIA-HAAS, INAA
Cobalt	0.1510 ± 0.0051	ICP-MS, INAA
Nickel	17.54 ± 0.21	ID-ICPMS, LEI
Selenium	0.1020 ± 0.0038	FIA-HAAS, INAA
Vanadium	28.19 ± 0.40	ICP-AES, INAA

The expanded uncertainties of the certified values are at a level of confidence of approximately 95 % and include within-method sources of uncertainty, which were either statistically evaluated (Type A) or evaluated by other means (Type B) [2]. For arsenic, an allowance for the difference between the methods is also included.

SUPPLEMENTAL INFORMATION

The analytical values reported in Table 2 are not certified because of material heterogeneity. These values are provided for information only.

Table 2. Noncertified Values

Element	Mass Fraction (mg/kg)	(%)	Method of Analysis
Barium	1.8		INAA
Chlorine	45		INAA
Sodium	37		INAA
Sulfur		2	ID-TIMS

Methods:

FIA-HAAS	Flow-injection hydride generation atomic absorption spectrometry
ICP-AES	Inductively coupled plasma atomic emission spectrometry
ICP-MS	Inductively coupled plasma mass spectrometry
ID-ICPMS	Inductively coupled plasma dilution isotope mass spectrometry
ID-TIMS	Isotope dilution thermal ionization mass spectrometry
INAA	Instrumental neutron activation analysis
LEI	Laser-enhanced ionization

REFERENCES

[1] Taylor, B.N., *Guide for the Use of the International System of Units (SI)*, NIST Special Publication 811, 1995 Ed., (April 1995).

[2] *Guide to the Expression of Uncertainty in Measurement*, ISBN 72-67-10188-9, lst Ed., ISO, Geneva, Switzerland, (1993); see also Taylor, B.N. and 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://physics.nist.gov/Pubs.

Certificate Revision History: 08 February 2002 (This certificate revision reflects a change in the certification expiration date); 29 August 1995 (Nickel value corrected); 07 August 1995 (Original certificate date).

Users of this SRM should ensure that the certificate in their possession is current. This can be accomplished by contacting the SRM Program at: telephone (301) 975-6776; fax (301) 926-4751; e-mail srminfo@nist.gov; or via the Internet http://www.nist.gov/srm.