

National Bureau of Standards

Certificate of Analysis

Standard Reference Material 1634a

Trace Elements in Fuel Oil

This Standard Reference Material is intended for use in the evaluation of methods and the calibration of apparatus used in the analysis of fuel oils and other materials with similar matrices for trace elements. SRM 1634a is a commercial "No. 6" residual fuel oil as defined by the American Society for Testing and Materials (ASTM). This SRM was certified using two or more independent methods of analysis and a single method that has been carefully evaluated with respect to its accuracy and precision. Methods were selected to include those that are commonly used in the field and in laboratories.

The certified values are given in table 1 and are based on at least a 1.0 g sample of the material which is the minimum amount that should be used for analysis.

Table 1

Element ¹	Content ² $\mu\text{g/g}$	Element ¹	Content ² , Wt %
Lead ^a	2.80 \pm 0.08	Sulfur ^{f,g,h}	2.85 \pm 0.05
Manganese ^{b,c}	0.19 \pm 0.02		
Nickel ^{d,e}	29 \pm 1		
Selenium ^{b,c}	0.15 \pm 0.02		
Sodium ^{b,c}	87 \pm 4		
Vanadium ^{a,b,d}	56 \pm 2		
Zinc ^{b,d}	2.7 \pm 0.2		

1. Method of Analysis

- | | |
|---------------------------------------|--|
| a. Isotope Dilution Mass Spectrometry | e. Inductive Coupled Plasma Spectrometry |
| b. Neutron Activation Analysis | f. Gravimetry |
| c. Atomic Absorption Spectrometry | g. Ion Chromatography |
| d. Spark Source Mass Spectrometry | h. X-ray Fluorescence |

2. The uncertainties shown are expressed at the 95% confidence level and include any observed material heterogeneity, possible method differences, and errors of measurement.

NOTICE: The certification of SRM 1634a is valid for 3 years from date of purchase.

The statistical analysis of the certification data was performed by K.R. Eberhardt of the Statistical Engineering Division.

The overall direction and coordination of the analytical measurements leading to certification were performed in the Inorganic Analytical Research Division, E.L. Garner, Chief.

The technical and support aspects involved in the preparation, certification, and issuance of this Standard Reference Material were coordinated through the Office of Standard Reference Materials by T.E. Gills.

PREPARATION, TESTING, AND ANALYSIS

A random scheme for sample selection was used in assessing the homogeneity of this material. The elements calcium and vanadium were measured by x-ray fluorescence as indicators of homogeneity. Based on these elements, the material variability for this lot of 1634a is within $\pm 2\%$ relative.

Long-term stability of this SRM has not been rigorously established. When not in use, the material should be stored in the tightly sealed bottle. NBS will continue to monitor this material and any substantive change in its certification will be reported to the purchasers.

Analyses for the various elements were performed in the Center for Analytical Chemistry, Inorganic Analytical Research Division, by I. L. Barnes, T.A. Butler, E.R. Deardorff, J.W. Gramlich, S. Hanamura, H.M. Kingston, W.F. Koch, G.M. Lambert, R.M. Lindstrom, L.A. Machlan, J.R. Moody, P.J. Paulson, T.C. Rains, T.A. Rush, and R. Zeisler.

The homogeneity studies were performed in the Gas and Particulate Science Division by P.A. Pella and M. Watson.

The physical properties were measured by S. Weeks, Materials Chemistry Division, Center for Materials Science.

The values and physical properties data in table 2 are *not certified* because they are based on a non-reference method or were not determined by two or more independent methods. The values are included for information only.

Table 2

Supplemental Information

Element	Content, $\mu\text{g/g}$	Physical Properties
Arsenic	(0.12)	
Beryllium	(0.006)	Flash Point ^a 64 °C
Bromine	(<1)	
Cadmium	(0.002)	Kinematic Viscosity ^b 321.66
Calcium	(16)	at 50 °C
Chlorine	(31)	Pour Point ^c -10 °C
Chromium	(0.7)	
Cobalt	(0.3)	Density at 20 °C ^d 0.995 g/cm ³
Iron	(31)	
Mercury	(<0.002)	
Molybdenum	(0.12)	

Methods Used for Physical Tests

- a. ASTM D-93-80 Flash Point by Pensky-Martens Closed Tester
- b. ASTM D445-79 Kinematic Viscosity of Transparent and Opaque Liquids
- c. ASTM D97-66 (1978) Pour Point of Petroleum Oils
- d. ASTM D4052-81 Density and Relative Density of Liquids by Digital Density Meter (modified)