U. S. Department of Commerce
Frederick B. Dent
Secretary
National Bureau of Standards
Richard W. Roberts, Director

National Bureau of Standards Certificate of Analysis

Standard Reference Material 1632

Trace Elements in Coal

This Standard Reference Material is intended for use in the calibration of apparatus and methods used in analyses of coals and other materials with similar matrices for trace elements. This material should be dried without heat to a constant weight before using. Recommended procedures for drying are: (1) drying for 24 hours using a cold trap at or below −50 °C and a pressure not greater than 30 Pa (0.2 mm Hg); (2) drying in a desiccator over P_2O_5 or $Mg(ClO_4)_2$. When not in use, the material should be kept in a tightly sealed bottle and stored in a cool, dark place. Long term (> 1 year) stability of this SRM has not been rigorously established. NBS will continue to monitor this material and any substantive change will be reported to purchasers.

The certified values given below are based on at least a 250-mg sample of the dried material, the minimum amount that should be used for analysis.

Element[1]	Content[2] μg/g	Element[1]	Content[2] μg/g
Iron[g,i]	8700 ± 300	Selenium[d,e]	2.9 ± 0.3
Manganese[a,e]	40 ± 3	Uranium[c,f]	1.4 ± 0.1
Zinc[d,e]	37 ± 4	Thallium[c,d]	0.59 ± 0.03
Vanadium[b,e,g]	35 ± 3	Cadmium[d,e,i]	0.19 ± 0.03
Lead[a,c,i,d]	30 ± 9	Mercury[a,e,]	0.12 ± 0.02
Chromium[a,c,e]	20.2 ± 0.5		
Copper[a,d,g]	18 ± 2		
Nickel[c,g,i]	15 ± 1		
Arsenic[e,h]	5.9 ± 0.6		

1. Methods of Analyses:
   a. Atomic Absorption Spectrophotometry
   b. Flame Emission Spectrometry
   c. Isotope Dilution Mass Spectrometry
   d. Isotope Dilution Spark Source Mass Spectrometry
   e. Neutron Activation
   f. Nuclear Track Technique
   g. Photometric
   h. Photon Activation
   i. Polarography
2. The values are based on the results of 4 to 17 determinations by each of at least two analytical techniques. The estimated uncertainties include sample variations, possible method differences, and errors of measurement (but in no case less than the 95% confidence limits computed for the analyses).

The overall direction and coordination of the analytical measurements leading to this certificate were performed in the Analytical Chemistry Division under the chairmanship of P. D. LaFleur.

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 C. L. Stanley.

Washington, D. C. 20234
March 7, 1975

J. Paul Cali, Chief
Office of Standard Reference Materials

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PREPARATION, TESTING, and ANALYSIS

This material is a blend of commercially available coals supplied by five electric power plants: Tennessee Valley Authority, Stevenson, Alabama; Commonwealth Edison, Chicago, Illinois; Baltimore Gas and Electric Co., Baltimore, Maryland; Carolina Light and Power Co., Roxboro, North Carolina; and Potomac Electric Power Co., Washington, D. C. These plants were specially selected to provide coals that covered a broad spectrum of the coal mining industry. Some of the coals required regrinding to obtain a fine particle size. This was done under the auspices of Mr. Forrest Walker of the U. S. Bureau of Mines, Pittsburgh, Pennsylvania. The coals were then sieved and the portion passing through a 120 mesh sieve and retained on a 325 mesh sieve was taken (125 to 44 micrometers diameter). After sieving, the five coals were blended in a double-coned blender. After 1 hour the material was immediately removed and bottled.

A random scheme for sample selection was designed and a statistical analysis of the homogeneity data was performed by J. Mandel of the NBS Institute for Materials Research. Thirteen of 500 bottles were selected for homogeneity tests. These samples were analyzed for aluminum and manganese by nondestructive neutron activation analysis. Replicate analyses on 250-mg samples indicated homogeneity within ±5 (relative) based on these two elements. The homogeneity analyses were performed in the NBS Analytical Chemistry Division by T. E. Gills and S. H. Harrison. Analyses for the various elements were made in the NBS Analytical Chemistry Division by the following analysts: R. K. Bell, R. W. Burke, B. S. Carpenter, B. I. Diamondstone, L. P. Dunstan, M. S. Epstein, E. L. Garner, T. E. Gills, E. S. Gladney, J. W. Gramlich, G. J. Lutz, L. A. Machlan, E. J. Maienthal, L. T. McClendon, T. J. Murphy, E. Orvini, P. J. Paulsen, T. C. Rains, K. M. Sappenfield, S. A. Wicks.

The following values are not certified because they are based on a non-reference method, or were not determined by two or more independent methods. They are included for information only.

Element	Content ($\mu g/g$)
Titanium	(800)
Cobalt	(6)
Silicon	(3.2%)
Thorium	(3.0)
Beryllium	(1.5)
Silver	($\leq$0.1)
Tellurium	(<0.1)