



Designation: D4606 – 21<sup>ε1</sup>

## Standard Test Method for Determination of Arsenic and Selenium in Coal by the Hydride Generation/Atomic Absorption Method<sup>1</sup>

This standard is issued under the fixed designation D4606; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

<sup>ε1</sup> NOTE—Editorially corrected Table 1 in October 2024.

### 1. Scope

1.1 This test method<sup>2</sup> covers the determination of total arsenic in the range of 0.7 ug/g to 12 ug/g and selenium in the range of 0.6 ug/g to 5 ug/g in coal.

1.2 *Units*—The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

### 2. Referenced Documents

2.1 *ASTM Standards*:<sup>3</sup>

D2013 Practice for Preparing Coal Samples for Analysis

D3173 Test Method for Moisture in the Analysis Sample of Coal and Coke

D3180 Practice for Calculating Coal and Coke Analyses from As-Determined to Different Bases

D7582 Test Methods for Proximate Analysis of Coal and Coke by Macro Thermogravimetric Analysis

### 3. Summary of Test Method

3.1 Arsenic and selenium are determined by mixing a coal sample of known mass with Eschka mixture and igniting at 750 °C. The mixture is dissolved in hydrochloric acid and the gaseous hydride of each element is generated from the appropriate oxidation state and determined by atomic absorption spectrophotometry.

### 4. Significance and Use

4.1 This test method permits measurement of the total mass fraction of arsenic and selenium in coal for the purpose of evaluating these elements where they can be of concern, for example, in coal combustion. When coal samples are prepared for analysis in accordance with this test method, the arsenic and selenium are quantitatively retained and are representative of the total mass fraction in the coal.

### 5. Apparatus

5.1 *Atomic Absorption Spectrophotometer*, with background correction system and peak profile recording device.

5.2 *Hydride Generation Apparatus*, for producing the hydrides of arsenic and selenium.

5.3 *Burner or Heated Quartz Cell*, for thermal decomposition of the hydrides.

5.4 *Hotplate*, capable of maintaining a temperature of a solution at 60 °C to 90 °C.

5.5 *Ignition Crucibles*—Porcelain crucible of 30 mL capacity. Do not use a porcelain crucible in which the glaze is flaked.

5.6 *Analytical Balance*, capable of a resolution of 0.0001 g.

5.7 *Beakers*—150 mL and 500 mL.

5.8 *Polypropylene Flasks*—100 mL and 500 mL also used as a reaction vessel.

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D05 on Coal and Coke and is the direct responsibility of Subcommittee D05.29 on Major Elements in Ash and Trace Elements of Coal.

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<sup>2</sup> For information concerning experimental work on which this test method is based see: Bosshart, R. E., Price, A. A., and Ford, C. T., "Evaluation of the Effect of Coal Cleaning on Fugitive Elements, Phase II Final Report, Part II Analytical Methods," *ERDA Report No. C00-44727-35*, 1980, pp. 94–102; Fernandez, F. J., "Atomic Absorption Determination of Gaseous Hydrides Utilizing Sodium Borohydride Reduction," *Atomic Absorption Newsletter*, Vol 12, No. 4, 1973, pp. 93–97; and Brodie, K. G., "A Comparative Study—Determining Arsenic and Selenium by AAS," *American Laboratory*, March 1977, pp. 73–78.

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.