



Standard Guide for Part-Stream Sampling of Coal¹

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1. Scope

1.1 This guide covers general principles for obtaining a gross sample of coal by taking increments from part of a stream of coal rather than from the entire stream to be sampled. The usefulness of results from this guide will vary greatly depending on such factors as top size of the coal, size consistency of the coal, variability of the coal, and such logistical factors as the flow rate of the coal in process and physical accessibility of the sampling station.

1.2 The user is cautioned that samples of this type do not satisfy the minimum requirements for probability sampling and as such cannot be used to obtain any meaningful statistical inferences such as the sampling precision, standard error, or bias. This guide should be used only when it is not possible to use a method of sampling that produces a probability sample.

1.3 Sample preparation procedures involving crushing are contained in Method D 2013.

1.4 The values stated in SI units are to be regarded as standard. The values in parentheses are for information only.

1.5 *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 and health practices and determine the applicability of regulatory requirements prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

- D 121 Terminology of Coal and Coke²
- D 2013 Method of Preparing Coal Samples for Analysis²
- D 2234 Practice for Collection of a Gross Sample of Coal²
- D 4749 Test Method for Performing Sieve Analysis of Coal and Designating Coal Size²
- E 105 Practice for Probability Sampling of Materials³
- E 456 Terminology Relating to Quality and Statistics³

2.2 Federal Standards:

- Federal Mine and Safety and Health Act of 1977⁴
- Occupational Safety and Health Act of 1970⁴

¹ This guide is under the jurisdiction of ASTM Committee D05 on Coal and Coke and is the direct responsibility of Subcommittee D05.23 on Sampling. Current edition approved Nov. 10, 2000. Published January 2001.

² *Annual Book of ASTM Standards*, Vol 05.06.

³ *Annual Book of ASTM Standards*, Vol 14.02.

⁴ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

3. Terminology

3.1 *Definitions*—For additional definitions of terms, refer to Terminology D 121, Method D 2013, Terminology E 456, and Practice D 2234.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *part-stream sampling, n*—a method of coal sampling in which collection of individual increments does not encompass the full cross section of the coal stream.

4. Summary of Guide

4.1 Part-stream sampling is accomplished by collecting increments from part of a stream of coal for the purpose of acquiring a gross sample.

5. Significance and Use

5.1 This guide provides instructions for sampling by collecting individual increments from part of a cross section of a moving stream, part of a cross section of a free-falling stream, or part of a cross section of a columnar section of coal, as opposed to collection of individual increments by removal of a full cross section of material. The use of part-stream sampling, and the detailed procedures for each case, should be agreed upon in advance by all parties concerned. Samples collected by use of this guide are not probability samples.

5.2 All parties should be cautioned that manual sampling of coal from a moving stream might not enable sampling of the material that is furthest from the point of entry into stream by the sampling device.

6. Increment Collection Classification

6.1 Three distinct classifications of part-stream sampling methods are recognized by this guide, in order of preference, as listed below:

6.1.1 *Condition C-1*—The case in which groups of successive part-stream increments are taken so that the increments within each group encompass the full cross section of the coal stream.

6.1.2 *Condition C-2*—The case in which groups of successive part-stream increments are collected from different positions relative to the full cross section of the coal stream but the increments within each group do not encompass the full cross section.

6.1.3 *Condition C-3*—The case in which groups of successive part-stream increments are collected from the same

relative position to the full cross section of the coal stream.

7. Organization and Planning of Sampling Operations

7.1 Considerations When Sampling from a Coal Stream:

7.1.1 *Safety Considerations*—If the sampling device is to be used manually, safety and ease of operation should be carefully considered. For example, aluminum can be used to minimize the weight of the device and special handles fabricated to facilitate its use. Shovels with loop handles should be used only with extreme caution. There is the potential to catch and drag the sampling device and sampler while manually sampling a moving stream. Sampling personnel should be protected from moving parts such as conveyors or belt idlers. A safety harness for the sampling personnel may be an appropriate safety device in some sampling situations. The user of this guide must be aware that each sampling situation has its own unique safety requirements that should be thoroughly reviewed before the start of sample collection. This standard does not purport to address all safety requirements; however, users are urged to comply with all Federal requirements such as those contained in the Federal Mine Safety and Health Act of 1977, the Occupational Safety and Health Act of 1970, as well as state and local regulations and site specific safety policies and procedures.

7.1.2 *Width of Sampling Device*—The width of the sampling device shall be a minimum of 2½ times the nominal top size of the coal being sampled.

7.1.3 *Depth of Sampling Device*—When determining the depth of the sampling device, two considerations are: (1) top size of the coal and (2) feed rate of the coal. The depth of the sampling device shall be sufficient so that it does not overflow during increment collection. Thus, the higher feed rate, the greater the depth required and the larger the increment obtained. The increment may become too large for one person to handle even at moderate to low feed rates.

7.1.4 *Weight of Increments*—Dimensions and operations of the sampling device should ensure that increment weights are equal to, or in excess of, those contained in Table 2 of Practice D 2234.

7.2 *Location of Sampling Station*—Two factors that must be considered relative to location of the sampling when using the part-stream method are the location along the stream of coal to be sampled from which primary increments are collected, and the sampling pattern to be used at that point. This section contains general principles for determining the preferred options regarding location of the sampling station and the pattern to be used.

7.2.1 *Location Along the Coal Stream*—A sampling point, protected from environment (wind, rain, and so forth), is usually the best choice for locating the point of sampling. Certain other factors may also need to be considered, such as accessibility, the volume and velocity of falling material, the potential for particle rebounding, the relative location to the sample preparation equipment, and variations in the coal stream produced by crushers, screens, or other parts of the system.

7.2.2 *Sampling Pattern*—Ideally, a sampling pattern should ensure that all equal mass units in a lot being sampled have an equal chance of being selected by the primary increment

sampling device; however, this is not possible if all equal mass units are not available for selection as is the case when only part of the stream is sampled. Because of this, all interested parties should agree upon the details concerning the pattern to be used. Increments should be of approximately equal mass when obtained at the same flow rate. The type of increment collection should not be changed during the collection of a gross sample. A different sampling device may deliver different mass increments into the same gross sample and thus impair the ability of the sample to maintain the correct proportionality for the flow rate being sampled.

7.3 *Frequency of Increment Collection*—Although meaningful levels of precision cannot be obtained for non-probability samples, for the purpose of uniform sample collection, it is suggested that the frequency of primary increment collection be based upon the lot size of the coal. The following formula is suggested to determine the number of increments required for one gross sample. The number of increments specified in Eq 1 was arbitrarily chosen as 35. Note A in Table 2 of Practice D 2234 suggests that for part-stream sampling, these details of the sampling procedure should be agreed upon in advance by all parties concerned. Since meaningful levels of precision cannot be obtained for these samples, any multiplier can be considered valid in place of the number 35 in Eq 1 if agreed upon by the parties concerned.

$$N = 35 \sqrt{\frac{\text{Lot size to be sampled}}{908 \text{ metric tons or } 1000 \text{ tons}}} \quad (1)$$

where:

N = number.

7.3.1 The number of increments obtained for a given feed rate is determined by the frequency of increment collection. The frequency of increment collection is determined as follows:

$$T = a/R \quad (2)$$

where:

T = total sampling time (seconds, minutes, hours),

R = feed rate (weight/unit time; for example, metric tons/h),
and

a = lot size, in metric tons or (tons).

$$F = T/N \quad (3)$$

where:

F = frequency of increment collection (increment/unit time) and

N = number of increments required from Eq 1.

7.3.2 In some situations, the feed rate can vary over the sampling period. Effort should be made to ascertain if the change of feed rate will be maintained so that adjustment of increment frequency can be made. Record any variation of feed rate when adjustment of frequency is not possible. In cases of blended coals, all interested parties should be notified that the blend in the sample may not represent the blend of the lot sampled.

7.4 *Storage of Increments*—It is recommended that sample increments be adequately protected from moisture variation by the use of moisture-tight containers. Care must be taken to

assure that the integrity of the container, including any moisture seal, is not compromised during handling.

7.5 *Stratification*—It is recommended that, where significant stratification exists, a sampling plan should be designed to obtain a probability sample, rather than taking part-stream samples.

8. Apparatus and Equipment

8.1 All interested parties before the start of each sampling program must agree upon sampling equipment and sample containers (suitable for storage and transportation).

8.2 It is recommended that storage containers be both waterproof and strong enough to be transported to the preparation facility without damage. (For example, a commonly used container is a combination of a heavy woven plastic or heavy cotton outer bag with a plastic inner liner bag of at least 4-mm thickness.) The sealing of both bags with drawstrings or twist ties is recommended. Ten- or twelve-gallon metal containers with similar plastic bag inner linings and tight-fitting lids can also be used where appropriate.

8.3 Each storage container must be fully identified to keep it separate from any other container. Waterproof marking pens

and tags are useful for the purpose. Two tags are recommended, each fully marked with all identifying information for each container, one placed inside the inner liner plastic bag and one placed on the outside of the container.

9. Personnel

9.1 Sampling personnel should have an understanding of and a sense of responsibility for the potential effects on the sample of variations in sampling procedures.

9.2 All sampling personnel shall be trained and cautioned on all aspects of sampling safety before commencement of sampling.

10. Precision and Bias

10.1 The samples obtained using this guide are nonprobability samples and as such they cannot be used to obtain meaningful statistical inferences such as the levels of precision and bias.

11. Keywords

11.1 coal sampling; part-stream sampling

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