



Designation: E3355 – 23

Standard Guide for Characterization of Coal Combustion Products (CCPs) in Storage Area(s) for Beneficial Use¹

This standard is issued under the fixed designation E3355; 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 (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide provides a framework to characterize coal combustion products (CCPs) situated in active or inactive storage units for potential harvesting and beneficial use and may be considered a companion standard to Guide E3183.

1.2 A framework is provided in this guide to address critical aspects related to the characterization of CCPs placed in active (operational) and inactive storage of (closed or no longer receiving CCPs) storage area(s). These storage area(s) may be used for wet or dry CCPs.

1.3 This guide does not include information on how to determine what storage area(s) or facilities should be selected for potential characterization of CCPs as each entity may approach a characterization program in accordance with their own intent and regulatory requirements. In addition, it does not include information on how the user should evaluate inventories to determine the order of their storage area(s) for potential characterization including consideration of risk, performance, and cost. This guide for potential harvesting for beneficial use is intended to be used to evaluate the storage area(s) once the storage area(s) are selected for evaluation.

1.4 This guide does not include information on the permitting that may be required to implement CCP characterization activities or may be associated with the processing or end use(s). Therefore, additional approvals not discussed within this guide may be needed.

1.5 This guide is intended to help characterize CCPs that may be harvested while gaining understanding of their homogeneity within a given wet or dry storage area.

1.6 The CCPs that may be characterized include fly ash, bottom ash, and economizer ash; boiler slag; flue gas desulfurization material; fluidized bed combustion products as defined in Terminology E2201; cenospheres; or other materials suitable for beneficial use.

1.7 Laws and approval requirements governing the use of CCPs vary by locality, state, province, and country and generally do not yet include provisions for CCP characterization as described herein. The user of this guide is responsible for determining and complying with the applicable approval requirements, which may extend beyond characterization to include approval requirements or guidance on issues such as disturbance, storage, transportation, end use, and other concepts. This guide may complement approval programs in which guidance on characterization is unavailable or insufficient, thereby improving the chance that such storage area(s) may be repurposed for public or private benefit or both. It may be important to engage and educate the approval authority early and often throughout the planning, design, and implementation of the characterization activities. The project team may also consider affording an opportunity to solicit input from other stakeholders.

1.8 This guide should not be used to characterize (that is, environmentally assess) wet or dry CCP storage area(s) for ownership transfer, although portions of such information resulting from characterizing CCPs using this guide may supplement other environmental assessments that are used in such a transfer.

1.9 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

1.10 *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.*

1.11 *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.*

¹ This guide is under the jurisdiction of ASTM Committee E50 on Environmental Assessment, Risk Management and Corrective Action and is the direct responsibility of Subcommittee E50.03 on Beneficial Use.

Current edition approved June 1, 2023. Published July 2023. DOI: 10.1520/E3355-23

2. Referenced Documents

2.1 *ASTM Standards:*²

- C22/C22M** Specification for Gypsum
- C128** Test Method for Relative Density (Specific Gravity) and Absorption of Fine Aggregate
- C136** Test Method for Sieve Analysis of Fine and Coarse Aggregates
- C311/C311M** Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete
- C330** Specification for Lightweight Aggregates for Structural Concrete
- C471M** Test Methods for Chemical Analysis of Gypsum and Gypsum Products (Metric)
- C472** Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete
- C476** Specification for Grout for Masonry
- C566** Test Method for Total Evaporable Moisture Content of Aggregate by Drying
- C593** Specification for Fly Ash and Other Pozzolans for Use With Lime for Soil Stabilization
- C595** Specification for Blended Hydraulic Cements
- C618** Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
- C1325** Specification for Fiber-Mat Reinforced Cementitious Backer Units
- C1761** Specification for Lightweight Aggregate for Internal Curing of Concrete
- C1797** Specification for Ground Calcium Carbonate and Aggregate Mineral Fillers for use in Hydraulic Cement Concrete
- D653** Terminology Relating to Soil, Rock, and Contained Fluids
- D2940** Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports
- D3018** Specification for Class A Asphalt Shingles Surfaced with Mineral Granules
- D3462** Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules
- D4417** Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
- D4832** Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Cylindrical Test Specimens
- D4940** Test Method for Conductimetric Analysis of Water Soluble Ionic Contamination of Blast Cleaning Abrasives
- D5971** Practice for Sampling Freshly Mixed Controlled Low-Strength Material
- D6023** Test Method for Density (Unit Weight), Yield, Cement Content, and Air Content (Gravimetric) of Controlled Low-Strength Material (CLSM)
- D6024** Test Method for Ball Drop on Controlled Low Strength Material (CLSM) to Determine Suitability for Load Application

- D6044** Guide for Representative Sampling for Management of Waste and Contaminated Media
- D6103** Test Method for Flow Consistency of Controlled Low Strength Material (CLSM)
- D6155** Specification for Nontraditional Coarse Aggregates for Asphalt Paving Mixtures
- D7393** Practice for Indicating Oil in Abrasives
- E105** Guide for Probability Sampling of Materials
- E1527** Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process
- E2060** Guide for Use of Coal Combustion Products for Solidification/Stabilization of Inorganic Wastes
- E2201** Terminology for Coal Combustion Products
- E2278** Guide for Use of Coal Combustion Products (CCPs) for Surface Mine Reclamation: Revegetation and Mitigation of Acid Mine Drainage
- E3183** Guide for Harvesting Coal Combustion Products Stored in Active and Inactive Storage Areas for Beneficial Use

2.2 *ACI Standards:*³

- ACI 214-14** Guide for Structural Lightweight-Aggregate Concrete
- ACI 325.9R-15** Guide for Construction of Concrete Pavements
- ACI PRC-211.7-15** Guide for Proportioning Concrete Mixtures with Ground Limestone and Other Mineral Fillers
- ACI PRC 213-14** Guide for Structural Lightweight-Aggregate Concrete
- ACI PRC-229-13** Report on Controlled Low-Strength Materials
- ACI PRC 230.1-09** Report on Soil Cement
- ACI PRC 232.2-18** Report on the Use of Fly Ash in Concrete
- ACI PRC-232.3-14** Report on High-Volume Fly Ash Concrete for Structural Applications

2.3 *Other Standards:*

- 40 CFR 260.10** Definitions⁴
- 40 CFR 312.10** Definitions⁴
- AASHTO M295** Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete⁵
- EPA 530-R-16-011** Methodology for Evaluating Beneficial Uses of Industrial Non-Hazardous Secondary Materials⁶
- NIOSH Method 7500** Crystalline Silica Content⁷
- PennDoT MS-0450-0001** Anti-Skid for Municipal Use⁸

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from American Concrete Institute (ACI), 38800 Country Club Dr., Farmington Hills, MI 48331-3439, <http://www.concrete.org>.

⁴ Available from www.ecfr.gov.

⁵ Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001, <http://www.transportation.org>.

⁶ Available from the U.S. Environmental Protection Agency, Office of Resource Conservation and Recovery 1200 Pennsylvania Ave., NW (5306T), Washington DC 20460, www.epa.gov.

⁷ Available from the National Institute for Occupational Safety and Health, <https://www.cdc.gov/niosh/docs/2003-154/pdfs/7500.pdf>.

⁸ Available from the Pennsylvania Department of Transportation, Department of Transportation Bureau of Planning & Research, 400 North St., 6th Fl., Harrisburg, PA 17120, <https://www.dot.state.pa.us/public/PubsForms/Publications/Pub%20447.pdf>.