



Designation: E1266 – 12

# Standard Practice for Processing Mixtures of Lime, Fly Ash, and Heavy Metal Wastes in Structural Fills and Other Construction Applications<sup>1</sup>

This standard is issued under the fixed designation E1266; 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.

## 1. Scope

1.1 This practice provides descriptions and references of existing test methods and commercial practices relating to the processing of lime, fly ash, and heavy metal wastes in construction applications.

1.2 *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 limitations prior to use.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

- C5 Specification for Quicklime for Structural Purposes
- C25 Test Methods for Chemical Analysis of Limestone, Quicklime, and Hydrated Lime
- C109/C109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)
- C110 Test Methods for Physical Testing of Quicklime, Hydrated Lime, and Limestone
- C206 Specification for Finishing Hydrated Lime
- C207 Specification for Hydrated Lime for Masonry Purposes
- C311 Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete
- C400 Test Methods for Quicklime and Hydrated Lime for Neutralization of Waste Acid
- C593 Specification for Fly Ash and Other Pozzolans for Use With Lime for Soil Stabilization
- C618 Specification for Coal Fly Ash and Raw or Calcined

- Natural Pozzolan for Use in Concrete
  - C821 Specification for Lime for Use with Pozzolans
  - C911 Specification for Quicklime, Hydrated Lime, and Limestone for Selected Chemical and Industrial Uses
  - C977 Specification for Quicklime and Hydrated Lime for Soil Stabilization
  - D559 Test Methods for Wetting and Drying Compacted Soil-Cement Mixtures
  - D560 Test Methods for Freezing and Thawing Compacted Soil-Cement Mixtures
  - D1557 Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>))
  - D1633 Test Methods for Compressive Strength of Molded Soil-Cement Cylinders
  - D2434 Test Method for Permeability of Granular Soils (Constant Head)
  - D2435 Test Methods for One-Dimensional Consolidation Properties of Soils Using Incremental Loading
  - D3877 Test Methods for One-Dimensional Expansion, Shrinkage, and Uplift Pressure of Soil-Lime Mixtures
  - D3987 Practice for Shake Extraction of Solid Waste with Water
  - D4318 Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
  - D5681 Terminology for Waste and Waste Management
  - E850 Guide for Characterization of Inorganic Process Wastes for Use as Structural Fill
- ### 2.2 Environmental Protection Agency Documents:
- EPA/600/R-09-148 Technology Performance Review: Selecting and Using Solidification/Stabilization Treatment for Site Remediation,<sup>3</sup>
  - EPA Resource Conservation and Recovery Act (RCRA)<sup>4</sup>
  - EPA SW-846 Test Methods for Evaluating Solid Waste,

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee D34 on Waste Management and is the direct responsibility of Subcommittee D34.03 on Treatment, Recovery and Reuse.

Current edition approved Dec. 15, 2012. Published January 2013. Originally approved in 1988. Last previous edition approved in 2005 as E1266-88(2005). DOI: 10.1520/E1266-12.

<sup>2</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.

<sup>3</sup> National Risk Management Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH, November 2009, <http://www.epa.gov/nrmrl/pubs/600r09148/600r09148.pdf>

<sup>4</sup> Documents 12/18/78, 9/13/79, 5/26/82, 7/26/82, and 4/4/83, available from *Federal Register* U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, <http://www.access.gpo.gov>.

Physical/Chemical Methods<sup>5</sup>  
 EPA SW-872 Properties of Stabilized/Solidified Waste<sup>5</sup>  
 RCRA Document EPA-IAG-D4-0569 Guide to the Disposal  
 of Chemically Stabilized and Solidified Waste<sup>5</sup>  
 Hazardous and Solid Waste Amendments (HSWA)  
 Method 1311 Toxicity Characteristic Leaching Procedure<sup>5</sup>  
 Method 9095 Paint Filter Liquid Test (PFLT)<sup>5</sup>  
 EPA/530-R-93-007 Petitions to Delist Hazardous Waste: A  
 Guidance Manual (Second Edition), NTIS: PB 93-169-  
 365<sup>5</sup>

EPA/530-SW-86-016 OSWER Policy Directive No.  
 9487.00-2A, Prohibition on the Placement of Bulk Liquid  
 Hazardous Waste in Landfills Statutory Interpretive Guid-  
 ance [http://nepis.epa.gov/Exe/  
 ZyPURL.cgi?Dockey=9100MTR.txt](http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=9100MTR.txt)<sup>5</sup>

EPA/540-2-86-001 Handbook for Stabilization/  
 Solidification of Hazardous Waste, Superfund Document<sup>5</sup>

2.3 *Code of Federal Regulations:*

40 CFR 264 Subpart B, section 264.13, Hazardous Waste  
 Management System, Land Disposal Restrictions, Pro-  
 posed Rule, Dec. 11, 1988

40 CFR 268 Hazardous Waste Management System; Land  
 Disposal Restrictions; and California List Constituents

2.4 *Department of the Interior Document:*

U.S. Department of the Interior Earth Manual (Section  
 Edition), 1974<sup>6</sup>

2.5 *Corps of Engineers Document:*

1110-2-1906 Permeability of Fine Materials, Falling Head  
 Aug. 12, 1987.<sup>7</sup>

### 3. Terminology

3.1 *Definitions*—For definitions of terms used in this  
 practice, refer to Terminology D5681.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *heavy metal wastes*—industrial wastes containing  
 heavy metals such as arsenic, cadmium, chromium, barium,  
 lead, silver, selenium, and mercury; these wastes are generally  
 liquids, sludges, or filter cakes.

3.2.2 Heavy metal wastes may also contain small amounts  
 of organic compounds. Special provisions are referenced to  
 accommodate this class of material as stated in 8.4.

3.2.3 *lime*—a commercial product derived from the calcina-  
 tion of high calcium or dolomitic limestone. A number of  
 ASTM standards relating to lime are given in 2.1.

3.2.4 *monolithic mass*—a mass that has good dimensional  
 stability, to freezing and thawing resistance, low permeability,  
 a high bearing capacity, and resistance to attack by biological  
 agents.

3.2.5 *resource application*—use of stabilized products in  
 specific areas such as earth liners, foundations, road base,  
 backfills, embankments, earth dams, etc.

<sup>5</sup> Available from Environmental Protection Agency, U.S. Government Printing  
 Office, <http://www.access.gpo.gov>.

<sup>6</sup> Available from Bureau of Reclamation, Department of the Interior, Code  
 D/7923A, P.O. Box 25007, Denver, CO 80225. <http://www.usbr.gov>.

<sup>7</sup> Available from Department of the Army, U.S. Army Corps of Engineers, Public  
 Depot, 2803 52nd Ave., Hyattsville, MD 20781.

3.2.6 *resource structural products*—structural products pro-  
 duced by lime, fly ash, and heavy metal waste; examples are  
 block, brick, aggregates, gabions, and miscellaneous structural  
 shapes.

3.2.7 *solidification*—a binding physical and chemical treat-  
 ment process that transforms materials containing free liquids  
 into a solid, soil-like, or clayey material. This solid material  
 can be a monolithic block with structural integrity.

3.2.8 *stabilization*—a treatment process that involves both a  
 physical and chemical reaction for treating heavy metal waste.  
 Heavy metal wastes are considered stabilized when they meet  
 current applicable regulatory requirements.

3.2.9 *structural landfill*—man-made earth work meeting  
 engineered practices and structural requirements. The fill must  
 also be environmentally acceptable and meet EPA require-  
 ments. (See 40 CFR 268.)

### 4. Significance and Use

4.1 This practice provides users with current methods for  
 preconditioning, handling, processing, and means of character-  
 izing the materials that are produced.

4.2 Lime and fly ash, and mixtures of lime and fly ash can  
 be useful for treating hazardous and nonhazardous waste as  
 follows:

4.2.1 Treating hazardous waste for potential resource recov-  
 ery application,

4.2.2 Solidifying liquids and sludges that are banned from  
 land disposal because of excess free liquid content,

4.2.3 Treating hazardous waste that may require treatment  
 because of hazardous constituents prior to land disposal, and,

4.2.4 Treating hazardous waste for potential delisting to a  
 nonhazardous waste status. Each one of these applications,  
 however, must comply with requirements of the Resource  
 Recovery and Conservation Act and the Hazardous and Solid  
 Waste Amendments.

### 5. Properties and Uses of Materials Applicable to the Practice

5.1 *Commercial Lime*—The following are properties and  
 uses of commercial lime.

5.1.1 Neutralizes acids;

5.1.2 Provides hydroxide ions leading to reduced solubility  
 of heavy metals and precipitation of metal species;

5.1.3 Provides high absorption rates of aqueous and non-  
 aqueous liquids;

5.1.4 Solidifies and hardens a number of inorganic waste  
 sludges;

5.1.5 Reacts chemically with soils, particularly clays, and  
 thereby reduces plasticity; improves dimensional stability; and  
 develops and controls structural applications;

5.1.6 Develops cements when mixed with natural  
 pozzolans, such as diatomaceous earth, cherts, shales, volcanic  
 ash, and also fly ash formed in the combustion of pulverized  
 coal; and

5.1.7 Capable of increasing pH of heavy metal waste.

5.2 *Pulverized Coal Fly Ash*—The following are properties  
 and uses of pulverized coal fly ash.