



Standard Practice for Processing Mixtures of Lime, Fly Ash, and Heavy Metal Wastes in Structural Fills and Other Construction Applications¹

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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:²

- 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 - D559 Test Methods for Wetting and Drying Compacted Soil-Cement Mixtures (Withdrawn 2012)³
 - D560 Test Methods for Freezing and Thawing Compacted Soil-Cement Mixtures (Withdrawn 2012)³
 - D1557 Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³))
 - 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,⁴

¹ 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.

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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 The last approved version of this historical standard is referenced on www.astm.org.

⁴ 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>

EPA Resource Conservation and Recovery Act (RCRA)⁵
 EPA SW-846 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods⁶
 EPA SW-872 Properties of Stabilized/Solidified Waste⁶
 RCRA Document EPA-IAG-D4-0569 Guide to the Disposal of Chemically Stabilized and Solidified Waste⁶
 Hazardous and Solid Waste Amendments (HSWA)
 Method 1311 Toxicity Characteristic Leaching Procedure⁶
 Method 9095 Paint Filter Liquid Test (PFLT)⁶
 EPA/530-R-93-007 Petitions to Delist Hazardous Waste: A Guidance Manual (Second Edition), NTIS: PB 93-169-365⁶
 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 Guidance <http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=9100MTR.txt>⁶
 EPA/540-2-86-001 Handbook for Stabilization/Solidification of Hazardous Waste, Superfund Document⁶

2.3 Code of Federal Regulations:

40 CFR 264 Subpart B, section 264.13, Hazardous Waste Management System, Land Disposal Restrictions, Proposed 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), 1974⁷

2.5 Corps of Engineers Document:

1110-2-1906 Permeability of Fine Materials, Falling Head Aug. 12, 1987.⁸

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 calcination of high calcium or dolomitic limestone. A number of ASTM standards relating to lime are given in **2.1**.

⁵ 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>.

⁶ Available from Environmental Protection Agency, U.S. Government Printing Office, <http://www.access.gpo.gov>.

⁷ Available from Bureau of Reclamation, Department of the Interior, Code D/7923A, P.O. Box 25007, Denver, CO 80225. <http://www.usbr.gov>.

⁸ Available from Department of the Army, U.S. Army Corps of Engineers, Public Depot, 2803 52nd Ave., Hyattsville, MD 20781.

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.

3.2.6 *resource structural products*—structural products produced 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 treatment 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 requirements. (See 40 CFR 268.)

4. Significance and Use

4.1 This practice provides users with current methods for preconditioning, handling, processing, and means of characterizing 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 recovery 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;