



Designation: **E1266 – 12 E1266 – 20**

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

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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.3 *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: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/C311M 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^{154498/astm-e1266-20}

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/D559M Test Methods for Wetting and Drying Compacted Soil-Cement Mixtures

D560/D560M 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/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/D2435M 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 (Withdrawn 2017)³

D3987 Practice for Shake Extraction of Solid Waste with Water

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.

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 (Withdrawn 2019)³

2.2 *Environmental Protection Agency Documents:*

EPA/600/R-09-148 Technology Performance Review: Selecting and Using Solidification/Stabilization Treatment for Site Remediation, Remediation⁴

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=9100MTSR.txt>⁶

EPA/540-2-86-001 Handbook for Stabilization/Solidification of Hazardous Waste, Superfund Document⁶

2.3 *Code of Federal Regulations:*

~~4040 CFR 264 Subpart B, Section 264.13~~ CFR 264 Subpart B, section 264.13, Hazardous Waste Management System, Land Disposal Restrictions, Proposed Rule, Dec. 11, 1988

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

2.4 *Department of the Interior Document:*⁷

U.S. Department of the Interior Earth Manual (Section Edition), 1974 Department of the Interior Earth Manual (Section Edition); 1974⁷

2.5 *Corps of Engineers Document:*⁸

1110-2-1906 Permeability of Fine Materials, Falling Head Aug. 12, 1987:

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.

3.2.1.1 *Discussion*—<https://standards.iteh.ai/catalog/standards/sist/1935ef8d-4df9-41e8-8bd0-7dc157454498/astm-e1266-20>

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.

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3.2.2 *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.

3.2.3 *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.

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

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

3.2.6 *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.

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>

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.

3.2.7 *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.

3.2.8 *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~~; ~~application~~;

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

4.2.3 Treating hazardous waste that may require treatment because of hazardous constituents prior to land ~~disposal~~; ~~and 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~~; 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 nonaqueous 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~~; ash:

5.2.1 Serves as a filler in the treatment of liquid waste;

5.2.2 Provides siliceous glass that reacts with lime to form cementitious compounds (tobermorites);

5.2.3 Provides aluminous glass which reacts with lime and sulfates to form cementitious compounds (ettringites); and

5.2.4 Contributes to stabilizing heavy metals that are insolubilized with lime.

5.2.5 Fly ash is available in different classes depending on the type of coal. These classes are described in Specification **C618** and in Test ~~Method~~ Methods **E3HC311/C311M**. Class C contains some free calcium oxide that can generate considerable heat when mixed with water. In some applications, this type of fly ash may need to be preconditioned as described in 8.1.1. Standards pertaining to lime and lime/fly ash are Test Methods **C25**, **C110**, **E3HC311/C311M**, and **C400**; Specifications **C5**, **C206**, **C207**, **C593**, **C618**, **C821**, **C911**, and **C977**.

NOTE 1—Additional information may be found in Test Methods **C109/C109M**, **D1557**, **D1633**, **D2434**, ~~D2435~~ **D2435/D2435M**, **D3877**, and ~~D3987~~ **D4318**, and Practice ~~D4318~~ **D3987**.

6. Applications Pertaining to Hazardous Wastes

6.1 *Resource Recovery Application*—Lime fly ash mixtures can be used to solidify and stabilize the heavy metal waste and render these treated wastes suitable for use as a resource structural product. In this application, the lime and fly ash mixtures solidify the waste and stabilize the heavy metals contained in the waste.

6.2 *Solidifying Waste Liquids and Sludges*—Lime/fly ash mixtures may be useful for stabilizing/solidifying liquids and sludges that are banned from land disposal because they contain free liquids. Mixtures of lime/fly ash can be used to react with the aqueous portion of the waste, thereby solidifying it so that the treated waste will pass the EPA tests for free or released liquids (e.g., **SW-846 Method 9095**—(for example, **SW-846**, **Method 9095**, or **Method 9096**) and other RCRA regulatory requirements and thus be acceptable for disposal into hazardous waste landfills. In some cases, the liquid waste treated by the lime/fly ash mixtures may be required to also pass an unconfined compressive strength test. Requirements and guidance for the free or release liquids testing and compression testing can be found in EPA/530-SW-86-016.

6.3 *Treating of Hazardous Waste Prior to Land Disposal*—Lime and fly ash may be acceptable materials for treating selected heavy metal waste by stabilization/solidification when such waste requires treatment prior to land disposal because of specific hazardous constituents. More information on selection and use of solidification/stabilization technology for treatment of wastes is available in **EPA/600/R-09/148** **EPA/600/R-09/148**, while specific requirements are listed in EPA/530-SW-86-016.

6.4 *Delisting of Hazardous Waste*—In some cases, lime/fly ash mixtures may be useful in treating hazardous waste to render them nonhazardous and, therefore, potentially applicable for delisting. Appropriate mixtures of lime and fly ash for treating a waste