United States
Environmental Protection
Agency

Solid Waste and
Emergency Response
(OS-305)

EPA/530-SW-91-086
January 1992

Office of Solid Waste

EPA

Environmental Fact Sheet

EPA Guideline for Purchasing Cement And Concrete Containing Fly Ash

Coal fly ash, like portland cement and volcanic ash, is composed of mineral matter mainly in the form of oxide compounds derived from limestone, iron ore, silica sand, and clay. Fly ash has been used for decades in the production of durable and economical concrete, and can be purchased either in blended cement or as a mineral admixture for concrete.

Coal Fly Ash Uses

In the 1960s, the American Society for Testing and Materials (ASTM) developed standards for the use of fly ash in concrete that are updated annually (see box on Standards and Availability).

The application and performance of concrete containing fly ash has been documented by both the U.S. Bureau of Reclamation and the U.S. Army Corps of Engineers since the 1940s. Over the last 40 years, fly ash has been used in virtually every concrete market, including highways, airports, commercial and residential buildings, bridges, pipelines, and tunnels. Widely available in the United States, more than six million tons of coal fly ash are used annually in cement and concrete (see box on Standards and Availability).

Equal or reduced cost of total materials can be realized with the use of fly ash while maintaining or improving concrete properties. In cases where no cost savings are realized by using fly ash, it may be advantageous since fly ash can improve both the strength and durability of concrete.

Coal fly ash is also used in mixtures designated by ACI as controlled low-strength material (CLSM). CLSM mixtures are typically used to fill trenches or other excavations like mine shafts and in abandoned underground storage tanks. CLSM mixtures are proportioned with fly ash, sand, water, and small amounts of portland cement. A CLSM mixture is fluid and self-compacting, and can be proportioned to produce strengths equivalent to compacted soil.

Procurement Guideline

To increase the use of cement and concrete containing fly ash from coal combustion within both government and private sectors, on January 28, 1983, EPA issued a guideline for purchasing cement containing fly ash. It requires all federal agencies and all state and local government agencies and contractors that use federal funds to purchase cement and concrete to implement a preference program favoring the purchase of cement and concrete containing coal fly ash.

Coal Fly Ash Specifications

Coal fly ash reacts chemically with portland cement and water to form compounds possessing cementitious properties. The amount of fly ash in typical concrete applications is from 15 to 35 percent, by weight of total cementitious material, with amounts up to 70 percent and more in massive walls, girders, road bases, and dams.

Two general methods are used to incorporate coal fly ash in concrete mixtures: (1) a prescriptive method in which fly ash replaces a fixed portion of the portland cement and (2) a design method in which fly ash use is based on laboratory or field records to produce an optimum effect on concrete properties and performance. Each method has a valid place in engineering practice. With either method, the main requirement for assuring satisfactory workability, strength, and durability is not to exceed a maximum ratio of water to cementitious material [w/(c+f)], where w, c, and f represent the weights of water, portland cement, and fly ash, respectively. More information about fly ash use in concrete is available from the American Concrete Institute (ACI) (see Standards and Availability below).

Further Information

For further information, including copies of the cement and concrete procurement guideline, please contact EPA's procurement guidelines hotline at (703) 941-4452.

Information on Standards and Availability

ASTM C 595, "Standard Specification for Blended Hydraulic Cements," American Society for Testing and Materials, annual book of ASTM Standards, part 14.

ASTM C 618, "Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete," American Society for Testing and Materials, annual book of ASTM Standards, part 14.

NCHRP Synthesis 127, *Use of Fly Ash in Concrete*, National Cooperative Highway Research Program, Transportation Research Board, October 1986.

FHWA-DP-59-8, *Fly Ash Facts for Highway Engineers*, Federal Highway Administration, July 1986.

ACI 226.3R-87, "Use of Fly Ash in Concrete," American Concrete Institute, 1987.