

ASH PRODUCTS

FLY ASH | BOTTOM ASH | CENOSPHERES



The generation of solid by-products at coal fired electric power plants has increased in recent years due to the emphasis on reducing emissions and improving air quality. Coal burning power plants generate more than half of the electricity produced in the United States. As a result, approximately 100 million tons of coal combustion products (CCPs) are generated annually in the United States. CCPs include fly ash, flue gas desulfurization material (FGD), bottom ash and boiler slag and, in some cases, cenospheres. About 70% of these materials enter landfills while the remaining 30% are utilized successfully in various agricultural and construction processes.



Cholla Power Plant

Coal Combustion Products (CCPs)

CCPs are generated when coal is crushed, pulverized, and blown into a combustion chamber where it immediately ignites to heat boiler tubes. Inherent in the coal are inorganic impurities (minerals) that become the coal ash after ignition. Coarse particles of these impurities settle to the bottom of the combustion chamber (bottom ash and boiler slag) while the finer particles (fly ash) remain suspended in the flue gas stream. Before the flue gas stream is released into the atmosphere, fly ash is removed from the flue gas stream by electrostatic precipitators, bag houses or other mechanical means. Some plants are equipped with flue gas desulfurization (FGD) units that scrub the flue gas stream and thus generate FGD material.

Strategies

Effective strategies for successful handling of CCPs include (1) minimizing CCP generation, (2) maximizing CCP use, and (3) reducing the disposal of CCPs in landfills. Successful utilization of CCPs requires detailed understanding and knowledge of the material properties. Salt River Materials Group and its utility partners such as Arizona Public Service Company, Public Service Company of New Mexico and Tucson Electric Power, are actively pursuing a better understanding and building a knowledge base that maximizes CCP use and reduces the disposal of CCPs from several power plants in Arizona and New Mexico.

CCP Utilization

Evidence of successful utilization is found in the fact that Salt River Materials Group has marketed over 10 million tons of CCPs over the past 4 decades. Most of the CCP utilization is in the form of fly ash used as a partial cement replacement in concrete and concrete materials production. This includes the manufacturing of ASTM C 595 Type IP cement, which is a product made by combining cement and fly ash at the cement mill. Portland Pozzolan Type IP portland cement has been manufactured at our Clarkdale, AZ plant since 1972.

Salt River Materials Group (SRMG) Phoenix Fly Ash is considered by the U.S. Green Building Council (USGBC) as a 100% pre-consumer recycled content material. All SRMG coal combustion products will contribute to LEED® credit 4.1 and 4.2 RECYCLED CONTENT. Concrete materials assembled, harvested or recovered within 500 miles of a project location contribute to LEED® Credit 5.1 and 5.2 REGIONAL MATERIALS.



Fly Ash

Fly ash particles are glassy spheres made up mainly of silica and alumina. Due to the particle shape and size and chemical composition, fly ash imparts a number of benefits to concrete including:

- Reduced water demand
- Lower permeability
- Increased ultimate strength
- Improved durability
- Improved sulfate resistance
- ASR mitigation
- Improved pumping ability
- Improved homogeneity and cohesiveness

In addition, it is estimated that one ton of carbon dioxide (CO₂) is eliminated from being released into the atmosphere when one ton of fly ash is used to replace one ton of cement. This is due to the CO₂ emissions inherent in the cement manufacturing process.



Bottom Ash

Bottom ash resembles natural cinders mined in northern Arizona in terms of composition, size and shape. Metal content in bottom ash is also very similar to that found in cinders. Currently, cinders are utilized in concrete block construction, snow and ice control for roads and blotter for paving projects and fill applications. Salt River Materials Group is

committed to pursuing all opportunities to utilize bottom ash as an alternate to cinders. The mineral composition of bottom ash being the same as for fly ash makes it ideal as a feed material for cement manufacturing. Processed bottom ash has been successfully used as an alumina/silica source for cement manufacturing since 2000.

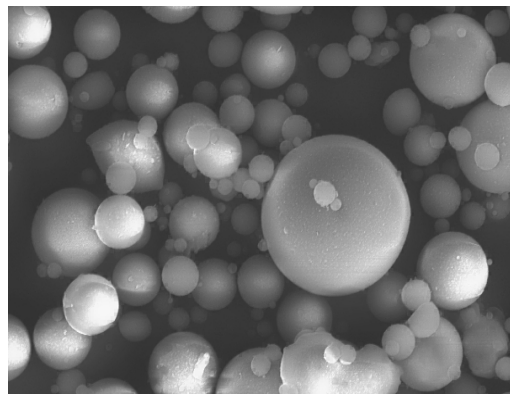
In addition to feed material, potential uses for bottom ash include:

- Ice and skid control material for roads
- Lightweight aggregate for concrete and concrete products production
- Fill (flowable and structural)
- Road-base and sub-base material

Cenospheres

Like fly ash, cenospheres are glassy, hollow spheres which, as a result, make an excellent filler material. Cenospheres have a high compressive strength, a low specific gravity (they float on water) and a high melt point. Applications where these properties make cenospheres particularly beneficial include:

- Masonry and cementitious products
- Industrial coatings
- Insulation blankets in refractories/foundries
- Thermoplastic filler
- Explosive filler
- Industrial putty filler



Micrograph of Cholla Fly Ash particles

Mission Statement

Creating Opportunities and Solutions with Quality Products and Exceptional People

Values

Profitability The Right Way... Integrity, Accountability, Excellence



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