FLY ASH FREQUENTLY ASKED QUESTIONS

WHAT IS FLY ASH?

Fly ash is one of the naturally-occurring products from the coal combustion process and is a material that is nearly the same as volcanic ash. Volcanic ash concrete was used thousands of years ago to produce Roman concrete structures that exist and function today; e.g., the Pantheon, Coliseum, and ancient aqueducts. When coal is burned in today's modern electric generating plants, combustion temperatures reach approximately 2800°F. The non-combustible minerals that naturally occur from burning coal form bottom ash and fly ash. Bottom ash is a light-weight aggregate material that falls to the boiler bottom for collection. Fly ash is the material that is carried off with the flue gases, where it is collected and can be stored in silos for testing and beneficial use classification.

HOW IS FLY ASH USED?

The most common use of fly ash is as a partial replacement for portland cement used in producing concrete. Replacement rates normally run between 20% to 30%, but can be higher. Fly ash reacts as a pozzolan with the lime in cement as it hydrates, creating more of the durable binder that holds concrete together. As a result, concrete made with fly ash is stronger and more durable than traditional concrete made exclusively with portland cement.

WHY USE FLY ASH?

Fly ash concrete has increased strength and durability, which means it can handle greater loads, is more resilient and lasts longer. Fly ash concrete can withstand harsher service environments than straight portland cement concrete. It is less susceptible to chemical attacks (de-icing salts, soil sulfates, etc.) and mitigates the negative impact of deleterious aggregates. This is especially true when using fly ash in infrastructure projects, such as roads, highways and bridges. A study conducted by the American Road and Transportation Builders Association in September of 2011, stated, "The cost to build roads, runways and bridges would increase by an estimated $104.6 billion over the next 20 years if fly ash were not available."

Fly ash concrete is easier to work with because of its spherical shape and its ability to moderate early concrete set time. The improved flowability, reduced hydration temperatures and delayed setting time of fly ash concrete are the main factors that contribute to ease of placement of concrete. Fly ash concrete also has lower permeability than traditional concrete, which means less water and chemicals can enter the concrete. Therefore, fly ash concrete has a longer service life and doesn't need to be repaired or replaced as often. Some states require the use of fly ash concrete to prevent premature deterioration. Fly ash is used to mitigate a problem called alkali silica reaction, which occurs when concrete deteriorates early due to issues with aggregate quality. This is a major issue for some states, and fly ash is the product most widely-used to combat this problem.

Fly ash concrete costs less. Depending on what area of the country you are in, fly ash can be 20% to 60% less expensive than portland cement. In some cases, portland cement can be more than twice as expensive. However, there have been few instances where fly ash was shipped long distances and sold for higher prices than local portland cement because the concrete durability requirements could only be met using fly ash.

The use of fly ash has positive environmental impacts, as it conserves landfill space, reduces energy and water consumption, and helps reduce greenhouse gases. The use of fly ash displaces portland cement production,

which emits approximately one ton of CO_2 for every ton of cement produced; i.e. for every ton of fly ash used, CO_2 emissions are reduced by one ton. According to a National Conference of State Legislatures' Briefing Paper entitled Recycling Fly Ash, "If all the fly ash generated each year were used in producing concrete, the reduction in CO_2 emissions would be equal to eliminating 25% of the world's vehicles."

IS FLY ASH SAFE?

Fly ash has similar chemical composition to that of portland cement, shale and volcanic ash. Similarly to these materials, fly ash contains naturally occurring trace elements that are also found in rock and soils. These trace elements are present in parts per million (mg/kg) levels and they account in total for less than 1% of fly ash. The levels of these trace elements in coal ash are similar in concentration to background levels in naturally occurring U.S. soils. In beneficial use applications, such as incorporating fly ash in hardened concrete, exposure would be far less than that assumed for residential soil and the potential risks would be below levels of concern.

WHAT DOES FLY ASH MEAN TO HEADWATERS?

Headwaters is a leader in the management of coal ash resources in the United States today. We have more than 100 utility locations and approximately 20 million tons of coal combustion products under management. Of those 20 million tons, approximately 8 million tons of high quality ash are available for beneficial use in products and construction materials.

In addition to the sale and marketing of fly ash as a partial replacement for portland cement, Headwaters has a long history of providing management and disposal services for coal combustion residuals and other industrial byproducts. As the complexity of managing these residuals increases, due mainly to new regulatory requirements, Headwaters is able to offer the experience and capabilities to create comprehensive disposal programs for utilities and other industries with coal ash and by-product management needs. Headwaters' site services activities complement managing and marketing fly ash by assisting utilities in comprehensive coal ash management.

For more information or answers to specific questions about the use of fly ash in concrete, contact your nearest Headwaters Construction Materials technical representative, call 1-888-236-6236, or visit us on-line at www.flyash.com.

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