# CHARACTERIZATION AND APPLICATION OF CLASS F FLY ASH COAL AND CLEAN-COAL ASH FOR CEMENT-BASED MATERIALS

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## ABSTRACT

The major objective of this project was to develop technology for high-volume applications of high-sulfur coal combustion by-products generated by using both conventional and clean coal technologies. A clean coal ash is defined as the ash derived from SO2 control technologies. High-sulfur coal ashes, particularly clean coal ashes are underutilized in the concrete industry. This project was primarily directed toward developing concrete products incorporating large amounts of coal ashes generated from combustion of high-sulfur coals. Fifteen coal ash samples were obtained from eight different sources burning high-sulfur coals to represent a spectrum of these coal ashes. These ashes were characterized for their physical, chemical, mineralogical, and microstructural properties. Based on these properties, two sources of both conventional (Class F) and clean coal ashes were selected for further investigation. Two additional ash samples were prepared by blending these selected conventional and clean coal ashes. Using these six different ash samples, nineteen concrete mixtures were proportioned for initial testing and evaluation. The results showed that structural-grade concrete can be manufactured using large amounts of conventional and clean coal ashes, as well as the blended ashes. Based on the results obtained from the initial testing, twenty-seven additional concrete mixtures were proportioned. Strength and durability testing of the final concrete mixtures revealed that structural- grade concrete can be manufactured having cement replaced with high-sulfur coal ashes (Class F and clean-coal ashes) and coal ash blends (Class F plus clean-coal ash blends) in the range of 0 to 60 percent. On the basis of results obtained in this investigation, several mixtures for the pilot scale manufacture of concrete were recommended.