Project Title: **DEVELOPMENT AND DEMONSTRATION OF DUST CONTROL SYSTEMS FOR FBC FLY ASHES**

ICCI Project Number: 96-1/3.1A-20  
Principal Investigator: B. C. Paul, Southern Illinois University at Carbondale  
Other Investigators: S. Chaturvedula, Southern Illinois University at Carbondale  
Project Manager: Dan Banerjee, ICCI

ABSTRACT

Fluidized bed combustion allows high sulfur Illinois coal to be burned with only minimal SO₂ emissions. Use of the technology in this area has more than doubled in the last 10 years. The FBC boilers produce about twice as much ash as conventional boilers and the ash is less useful for traditional cement products. Other projects sponsored by ICCI and other agencies have found many practical uses for FBC ash, many of them in liming and soil treatment. These types of applications require the ash to be spread over large land areas often away from developed plumbing, electrical and other infrastructure, and the equipment is required to move frequently. FBC fly ash can be very dusty and dust from unloading, spreading and mixing operations would render many of the potential markets for FBC ash environmentally out of reach.

This project was to develop commercial scale methods for control of dust from FBC fly ash during these unloading, spreading and mixing operations. Two approaches were developed. In the first the FBC fly ash is treated with foam using equipment that can be either fixed at the power station or mobile in the field. The developed system is rated to treat approximately 86 tons of ash per hour. The cost is estimated to range between $0.70 and $1.70 per ton including equipment, wear, reagent, and labor. In the second approach FBC fly ash unloading operations are conducted in a mobile containment facility. The cost is estimated at about $0.70/ton and the mobile containment system is estimated to handle about 50 tons of ash per hour. Both systems appeared to be fully effective when tested on two different types of FBC fly ash produced from the burning of Illinois coal.

Pages 4-19 contain proprietary information.

EXECUTIVE SUMMARY
The objective of this project was to demonstrate at a commercial scale the control of dust from unloading, distribution and use of FBC fly ash as a soil treatment over large land areas. Control was demonstrated using a auger cart equipped with foam generation equipment. An auger cart provides a mobile hopper while the screw augers used for discharge provide the mixing apparatus. The foam generator used was a commercial design by Polo Corporation. The screw augers of the cart proved to be an effective mixing apparatus capable of treating and discharging ash at 2 tons per minute. A foam with about a 100 to 1 expansion rate and 2.5 gallons of water per ton of ash with between a 1 to 2% surfactant addition proved effective in controlling dust for a period of about 3 hours following treatment. Heat is produced by contact with water but the heat build up is not excessive and the water addition is too small to cause setting, to inhibit flow from the truck bed, or to cause freezing in the winter. It is estimated that the cost of treating FBC fly ash by foam and auger is about $0.70/ton at the power plant and about $1.70/ton for a mobile system in the field without infrastructure support. The figures include equipment, wear, reagent, and labor costs.

A second approach to dust control was with a large mobile containment tent. The mobile tent serves the same function as a building at a fixed unloading point. Two frames were built as part of this project. A simple frame was made from galvanized water pipe and hardware store tarping material and was used to control dust from unloading of both full size frameless dump trailers and smaller tandem dumps. The larger 16 by 25 frame on wheels is in manufacturing. The estimated cost for field dust control with a mobile tent is about $0.70/ton. A single dust control tent is estimated to be able to handle about 50 tons an hour of FBC fly ash delivery.

The equipment described was tested on two different types of FBC fly ash. The first FBC boiler uses a great excess of sorbant to sulfur (about 3 to 1) and fires at about 1700 F. The ash from this boiler is very high in lime. The second FBC boiler is run very carefully to permit SO2 control with only about a 1.4 to 1 ratio of sorbant to sulfur. The boiler is run at about 1400 F. The ash from this boiler is much lower in lime. Although the two FBC ashes represent opposite ends of the spectrum with respect to boiler operations, the technologies were effective on both. Not surprisingly the high lime FBC ash gets hotter when treated, but the treated ash can still be held in ones hand.

The developed equipment should allow FBC fly ash to be taken from a power plant, delivered to a field site using regular dump trucks, and be distributed and worked into the construction project without fugitive dust problems. Three use scenarios seem probable. The first scenario is that ash is treated at the power plant, delivered to immediate area of use and dumped, is loaded by front end loader and retreated in a mobile auger cart system prior to being worked into the soil treatment project. The retreatment would usually be necessary because of the 3 hour time limitation on effectiveness of foaming. The second scenario is that ash is shipped from the power plant untreated in conventional dump trucks. It is unloaded under the mobile dust control tent into a hopper feeding a foamed screw auger and is loaded for final distribution to the field and working into the soil. Neither of the first two scenarios provide for on site storage of large amounts of FBC fly ash. In the last scenario the ash is delivered to an onsite storage facility equipped with silos. There are a variety of
methods by which ash could be delivered to such a facility including pneumatic trucks, pressure differential rail cars, or open trucks and rail cars unloaded in more permanent dust containment structures with dust suppression sprays. The cost would depend on the exact system used but such a facility would provide for significant onsite storage capability. The silos could be unloaded through a foamed screw auger and fed into trucks for distribution to the point of use and working into the soil.

“The remainder of this report contains proprietary information and is not available for distribution except to the sponsors of this project.”

OBJECTIVES