PROJECT facts

U.S. DEPARTMENT OF ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

ENVIRONMENTAL WATER AND RESOURCES

06/2000

LAND APPLICATION USES OF DRY FGD BY-PRODUCTS

PRIMARY PROJECT PARTNER

Dravo Lime Company
Pittsburgh, PA

MAIN SITE

Ohio Agricultural Research and Development Center
Wooster, OH
Fleming Abandoned Mine Site
Tuscarawas County, OH
Bob Evans Farms
Gallia County, OH
Ohio State Route 83
Cumberland, OH
Ohio State Route 541
Coshocton, OH

TOTAL ESTIMATED COST

$5,589,824

COST SHARING

DOE	$1,341,125
Non-DOE	$4,248,699

Description

By-products from flue gas desulfurization (FGD) systems at coal-fired power plants are typically treated as a waste material, at a high cost to both the generators and society as a whole. Dry FGD by-products from fluidized bed combustors or spray dryer systems typically contain significant amounts of lime and calcium sulfates, making them unattractive for use in cement and concrete products—the major market for most coal combustion by-products today. Developing alternate uses for these materials would provide economic benefits to both their producers and end users. Demonstration programs under this project have helped to familiarize planners, engineers, and regulators with the resource potential of dry FGD by-products.

Several potential applications for dry FGD by-products were evaluated in a series of demonstrations cofunded by the U.S. Department of Energy (DOE), the Ohio Coal Development Office, Dravo Lime, the Electric Power Research Institute (EPRI), Ohio Edison, American Electric Power, and Ohio State University. Demonstrations include the use of by-product materials as an agricultural lime substitute, as a construction material for road building and repair, for stabilizing soils in cattle feedlots, and for mine reclamation. Environmental and economic impacts of each of these uses were evaluated, and the market potential for different categories of uses was researched.

Four types of dry FGD by-products were evaluated, and a pressurized fluidized bed combustion (PFBC) ash from American Electric Power's Tidd Plant was selected for field demonstrations. The Tidd PFBC process burns a high sulfur eastern coal with a dolomite sorbent to control SO_x and NO_x emissions. The resulting solid by-products contain lime and magnesium oxide, calcium and magnesium carbonate, calcium and magnesium sulfates, and coal fly ash.

The alkalinity contributed by the oxides and carbonates in the ash is useful for counteracting soil acidity in agricultural and mine reclamation applications. The added alkalinity limits leaching of metals such as aluminum, iron, manganese, nickel, and zinc, eliminating phytotoxic conditions. The PFBC ash also contributes trace elements that may be beneficial for correcting soil deficiencies. Potential adverse effects were not observed, even at application rates twice the soil's liming requirement.

Feedlot stabilization with PFBC ash involved mixing ash into the surface soils and compacting the mixture, then spreading a 12-in. layer of conditioned ash over the surface. Compressive strengths of up to 1000 lb/in.^{2} or more may be obtained with good durability characteristics. Stormwater runoff analysis indicates that effects on water quality are limited to moderate increases in pH.

Land Application Uses of Dry FGD By-Products

The good structural properties of the PFBC ash are reflected in its use in road construction applications. The Ohio Department of Transportation successfully used more than 3000 tons of PFBC ash to repair a failed embankment on a state highway. The ash was placed in a trench at the base of the slope to act as a buttress against further slippage between saturated clay soils and bedrock.

Goal

To ensure the most cost-efficient delivery of electrical power, the DOE is conducting research and development to improve coal combustion by-product (CCB) management. The research program emphasizes characterization and reuse of CCBs to help stimulate markets for new materials such as those produced under the DOE's Clean Coal Technology program. Over the next 5 to 10 years, the program's goals are to develop processes leading to a 100% increase in the current FGD by-product utilization rate, a 10% increase in the national rate of overall CCB utilization, and a 25% increase in the number of CCB applications considered "allowable" under state regulations.

Benefits

- Increased use of FGD by-products will help maintain the economical use of high sulfur coal resources and will minimize the need for new and expensive landfill space.
- By-products can provide an effective and economical lime substitute for agricultural applications.
- By-products can be effective in controlling soil acidity, essential for reclaiming mined lands.
- By-products can be successfully used for road construction and soil stabilization.

CONTACT POINTS

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PROJECT PARTNERS

Dravo Lime Company
Pittsburgh, PA
(project management)

Ohio State University
Columbus, OH and Wooster, OH (main subcontractor)

Ohio Coal Development Office
Columbus, OH
(cofunding)

Electric Power Research Institute
Palo Alto, CA
(cofunding)

American Electric Power Company
Columbus, OH
(cofunding)

Ohio Edison Company
Akron, OH
(cofunding)

U. S. Geological Survey
Columbus, OH
(interagency agreement)