

COAL COMBUSTION BYPRODUCTS

A Report on Southern Company's Production and Safe Management of CCBs



2012 Update

Wallboard manufacturing is a major market for recycled CCBs.

INTRODUCTION

This is the third edition of the Southern Company Coal Combustion Byproducts Report, which has been published and updated annually since 2010 to inform stakeholders about the company's management of coal combustion byproducts (CCBs). CCBs include fly ash, bottom ash, boiler slag and flue gas desulfurization (scrubber) materials such as synthetic gypsum, which are produced when coal is burned for electricity generation.

The top priority of Southern Company and its operating subsidiaries* regarding CCBs is to ensure public safety. Therefore, a robust system is in place to meet or exceed all regulations governing CCB management and ensure safe operation of company facilities. In addition, a significant amount of CCBs from Southern Company's coal-based power generation plants are safely recycled for beneficial uses such as in concrete production and in road building.



An ash pond in Georgia.

Furthermore, to build on these programs, Southern Company is at the forefront of efforts to research and develop improved methods of safely managing and recycling CCBs.

In recent years, the U.S. Environmental Protection Agency (EPA) has conducted thorough inspections of CCB management facilities across the nation, including most of those operated by Southern Company subsidiaries. In a new section of the report, the results of the Southern Company facility inspections, including actions taken in response to the EPA findings, are detailed on pages 5-6.

**The power plants in the Southern Company system referred to in this report are owned and operated by the subsidiaries Alabama Power, Georgia Power, Gulf Power and Mississippi Power.*

Safe management of CCBs is part of Southern Company's commitment to environmental responsibility and transparency. We welcome your comments, questions and suggestions. Please send feedback about this report to ccbreport@southernco.com.

A COMMITMENT TO SAFE AND SECURE MANAGEMENT OF CCBs

Because of its abundance and proven effectiveness as an energy source, coal continues to be the fuel source for a significant amount of the electricity produced in the United States. Southern Company, which serves 4.4 million customers in the Southeast, utilizes a diverse mix of fuel sources including new nuclear, 21st century coal, natural gas, renewables and energy efficiency.

When coal is burned to make the steam that drives electricity generators, ash is the non-combustible mineral matter left behind. Ash is the most prevalent of CCBs. It takes the form of fly ash (fine, smaller particles) or bottom ash (coarse, larger particles that settle at the bottom of a boiler). Depending on the coal type, the amount of ash that remains is generally about 10 percent of the coal that is burned as fuel. Emission control technologies collect ash and prevent particles from being emitted into the atmosphere.

Some metals which occur naturally in the coal in trace amounts – such as arsenic, mercury and lead – remain in the ash. By using safe and proper management procedures, the metals are contained within ash management facilities on site at the power plants. The two most common types of ash management facilities are surface impoundments, also called wet ponds (in which ash settles at the pond bottom), and landfills, which are used to dispose of dry ash. Ash collected for beneficial reuse is in some cases stored in dry ash silos.

A market exists for ash to be safely recycled for concrete, road building and other beneficial uses. Therefore, not all of the collected ash remains on site. Although the amount varies from year to year because of economic conditions and other factors, about 30 percent of Southern Company's CCBs on average are sold for reuse. Safe and beneficial reuse of CCBs also conserves natural resources and reduces the amount that must be managed at power plants or disposed of in landfills.

Another type of CCB is gypsum. Gypsum is a byproduct from operating an emission control technology called a scrubber. Because gypsum is

not produced directly from coal, it is quite different from coal ash; it is similar in composition to naturally-mined gypsum. It too has a number of beneficial uses. Among the most common uses for power plant gypsum are as ingredients in commercial wallboard and cement manufacturing. It also has been demonstrated to safely promote the growth of certain plants, such as turf grass, peanuts, cotton and a variety of vegetables.

Southern Company's operating companies produced 4.6 million tons of ash and about 1.4 million tons of gypsum in 2011. The company and its subsidiaries currently own and operate 22 power plants* in four states (Alabama, Florida, Georgia and Mississippi) with CCB management facilities for fly ash and bottom ash and, in some cases, gypsum.



David Duncan, construction leader, alongside liner materials to be used at a gypsum landfill at Plant Wansley in Georgia.

Regardless of the management technology utilized, public safety and the security of the company's facilities are the highest priorities. Plants are in compliance with all applicable state regulations, and Southern Company has a rigorous program in place to ensure that its CCBs are safely managed. For example, impoundments are inspected at least once a year by company experts in dam and dike safety – the same people who inspect much larger hydropower dams – and trained plant personnel do so at least once a week. The inspections by the dam safety engineers are in-depth and include sophisticated

*One additional plant in Georgia has been retired and dismantled, and its CCB management facilities are closed.

evaluations of the containment structures to ensure that the integrity of the impoundments is fully maintained. Furthermore, procedures are continually evaluated to ensure the use of best practices. Southern Company, both independently and in partnerships, is involved in research to improve and expand beneficial reuse.

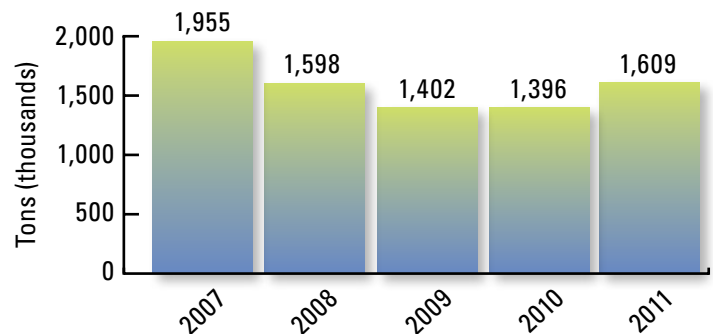
Southern Company CCB Production, 2011 (tons)

Fly Ash	Bottom Ash	Gypsum
3.6 million	976,000	1.4 million

Southern Company Ash Managed, 2011 (tons/percent of total)

Fly Ash	Bottom Ash
Wet - 1.52 million / 42%	Wet - 767,986 / 79%
Dry - 2.08 million / 58%	Dry - 208,277 / 21%

Southern Company CCB Recycling (e.g. Ash, Gypsum)



Regulation of CCBs has for many years been under the purview of individual states, which each have their own distinct requirements. The state environmental agencies in the four states in which Southern Company operates its retail electric utilities have provided effective oversight of operations to ensure the safe management of CCBs. For example, each state environmental agency requires a wastewater discharge permit which includes pollutant limits and monitoring and reporting requirements for any discharge from a surface impoundment. The results are reported to the appropriate regulatory agency on a regular basis. The states also have the authority to impose additional restrictions, if necessary, to protect human health or the environment. Southern Company's operating companies work closely with their respective state regulatory agencies to ensure that requirements for environmental protection are met. If site-specific issues are identified, state regulatory agencies assess the site to determine what, if any, additional actions or requirements are needed.

At the federal level, the EPA has proposed regulating CCBs either as a solid waste or as a hazardous waste. Southern Company filed comments to EPA in response to the proposal, stating that, based on a preliminary pre-screening cost analysis, compliance costs would substantially exceed EPA's estimates and would not provide added environmental benefits. In addition, Southern Company cautioned that the proposed rules would threaten the beneficial use of CCBs. EPA has received a significant number of public comments on the proposal. It is not known when a final rule will be issued.

Compliance with environmental laws and regulations is a cornerstone of Southern Company's operating philosophy and environmental policy. Safe and secure CCB management is part of a broad commitment to conducting business in an environmentally responsible manner. A more detailed discussion of Southern Company's activities relating to CCB management follows.

ENSURING DAM INTEGRITY

A key to safe and secure CCB management is ensuring the integrity of the containment system. Southern Company's dam safety program is comprehensive and includes inspections, reporting, analysis, regulatory compliance, emergency response preparedness, routine maintenance and vegetation control standards.

Inspections of dams and dikes are critical components, and are conducted on a regular basis – at least annually by dam safety engineers and at least weekly by trained plant personnel. In addition, inspections are performed after unusual events such as storms. The inspections provide assurance that the structures are sound and that action is taken, as needed, based on the findings.

Safety inspections include numerous checklist items. Specific items vary from site to site but may include observations of such things as pond levels, weather conditions, rainfall since the prior inspection, instrument readings, conditions of slopes and drains, erosion, animal damage, ant hills, alignment of retaining structures and more. Dam safety engineers assess instrument readings, inspect any maintenance or remediation performed since the previous inspection, check the status of work recommended at prior inspections, make sure that the posting of emergency notification information is up to date and evaluate any items noted during the plant personnel inspections.



Compliance specialists Christy Garrett and Ron Goldsby inspect a dam, part of the regimen to ensure safety.

In summary, major steps taken at Southern Company plants to ensure dam safety include:

- **Emergency Response** – Each plant has a dedicated dam safety referral phone number to notify appropriate company personnel rapidly in the event of an emergency. Emergency equipment and materials are available at each plant to provide immediate repair work.
- **Training** – Plant personnel who conduct inspections are trained by dam safety experts annually.
- **Vegetation Control** – Vegetation must be maintained and managed properly to facilitate adequate inspections. Dikes are kept free of trees and woody brush unless specific exceptions are made for beneficial vegetation or other situations as determined by a dam safety engineer.
- **Instrumentation** – Dam safety instrumentation is installed at sites as needed and can provide early warning for potential problems. Water level and other readings are taken on a specific schedule by trained personnel. Any abnormal readings are evaluated immediately.
- **Structural Modifications** – Any proposed new structure, modification to an existing structure, or change in the water level itself, must be reviewed and approved by professional engineers at Southern Company Generation prior to and during design and construction.

Although Southern Company's basic CCB management practices have proven to be effective for decades, they are regularly evaluated and refined as needed. In addition, following the accident at the Tennessee Valley Authority Kingston plant in 2008, Southern Company's

impoundments were reviewed by professional civil engineers from the company with expertise in dam and dike construction. Some impoundments were subject to improvements in response to those reviews. And, under direction from Southern Company’s chief production officer (who oversees all generation assets), Southern Company investigated its structures and reviewed its management practices and procedures. That process confirmed that all Southern Company CCB impoundments are structurally sound and subject to procedures to ensure continued safe and effective operation.

EPA INSPECTIONS

In recent years, EPA has undertaken an extensive process to collect information and conduct on-site inspections of electric utility coal ash surface impoundments across the country. This effort included all but three facilities in the Southern Company system. EPA posted on its website the results of these inspections, including ratings (from satisfactory, the highest possible, to unsatisfactory, the lowest) and any recommended actions that may have been needed.

The impoundment ratings are defined by EPA as follows:

- **Satisfactory** – No existing or potential management unit safety deficiencies are recognized. Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with the applicable criteria. Minor maintenance items may be required.
- **Fair** – Acceptable performance is expected under all required loading conditions in accordance with the applicable safety regulatory criteria. Minor deficiencies may exist that require remedial action and/or secondary studies or investigations.
- **Poor** – A management unit safety deficiency is recognized for a required loading condition in accordance with the applicable dam safety regulatory criteria. Remedial action is necessary. Poor also applies when further critical studies or investigations are needed to identify any potential dam safety deficiencies.
- **Unsatisfactory** – Considered unsafe. A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution. Reservoir restrictions may be necessary.

In addition, EPA compiled a list of 50 “high hazard potential” impoundments nationwide. “High hazard potential” is a technical term based on the height, volume and proximity of a structure to people and property – it does not refer to the stability of the dam itself. Among Southern Company

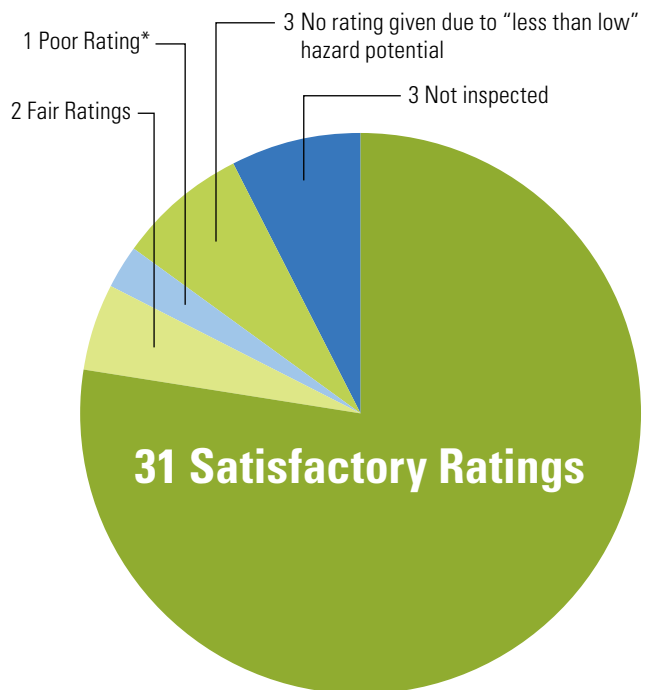
system facilities, three were categorized as high hazard potential.

The hazard potential ratings are defined as follows:

- **High Hazard Potential** – Failure or misoperation will probably cause loss of human life.
- **Significant Hazard Potential** – Failure or misoperation results in no probable loss of human life, but can cause economic loss, environment damage, disruption of lifeline facilities or impact other concerns.
- **Low Hazard Potential** – Failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner’s property.
- **Less Than Low Hazard Potential** – No high, significant or low hazard potential.

The table on pages 5-6 outlines the results of each inspection as well as EPA’s recommendations and completion status by the respective Southern Company operating subsidiaries. As can be seen in the accompanying pie chart, the vast majority of Southern Company facilities received the highest “satisfactory” rating.

*Southern Company CCB Impoundment Inspections by EPA
(37 impoundments inspected at 18 plants)*



**Poor rating at Georgia Power Plant Hammond ash pond 4 is conditional, and expected to be changed to satisfactory once recommended action, now in progress, is complete.*

Plant	Hazard Potential Classification	Impoundment Rating	EPA Inspection Recommendation(s)	Completion Status or Actions Taken
ALABAMA POWER				
Barry				
Ash Pond	Significant	Satisfactory	Provide maintenance to the embankment; continue regular monitoring and inspection activities.	Complete
Gadsden				
Ash Pond	Significant	Satisfactory	Minor maintenance noted for riprap in a specific location.	Complete
Gaston				
Ash Pond	Part High, Part Significant	Satisfactory	Repair minor erosion along embankment and downstream slopes.	Complete
Gorgas				
Ash Pond	Significant	Satisfactory	Combined recommendations: Continue to ensure appropriate vegetation control; clear a particular weir box; include log sheets on visual inspections.	Complete
Gypsum Pond	Significant	Satisfactory		
Greene County				
Ash Pond	Significant	Satisfactory	Continue to execute regular monitoring and inspection activities; continue to repair animal burrows.	Complete
Miller				
Ash Pond	Significant	Satisfactory	No recommendations.	
GEORGIA POWER				
Bowen				
Ash Pond	Significant	Satisfactory	Hydrologic evaluation and modification to one perimeter drainage ditch. Continue inspection and review instrument data after seismic events; continue piezometer monitoring and inspections.	Complete
Branch				
All Ponds			Combined recommendations: Repair and continue to monitor areas of animal activity; addition of certain data to site survey plans; perform hydrologic and hydraulic analyses for active ponds; evaluate flood storage availability in the ponds; continue inspections and piezometer monitoring.	Complete
Ash Pond B	Significant	Fair	Manage vegetation in certain areas; perform geotechnical analysis.	Complete
Ash Pond C	Significant	Satisfactory	Grading of a particular dike perimeter; evaluate an area of saturated soil; continue monitoring of new drains and non-uniform grading in particular areas; improvements to mitigate erosion in a particular area; perform stability analysis for rapid drawdown conditions.	Complete
Ash Pond D	Significant	Satisfactory	Grading at certain surface irregularities; perform stability analysis for rapid drawdown conditions and a surcharge pool / flood condition.	Complete
Ash Pond E	High	Satisfactory	Continued monitoring of certain areas; implement additional items to mitigate erosion.	Complete
Hammond				
All Ponds			Combined recommendations: Continue inspection program; evaluate piezometers and inclinometers on river side.	Complete
Ash Pond 1	Significant	Satisfactory	Combined recommendations.	Complete
Ash Pond 2	Significant	Satisfactory	Combined recommendations. Install surface water gauge.	Complete
Ash Pond 3	Significant	Satisfactory	Combined recommendations.	Complete

Plant	Hazard Potential Classification	Impoundment Rating	EPA Inspection Recommendation(s)	Completion Status or Actions Taken
GEORGIA POWER (continued)				
Hammond (continued)				
Ash Pond 4	Significant	Poor <i>(conditional, see page 4)</i>	Combined recommendations. Install surface water gauge. Flatten ash stacking slopes.	Complete In Progress
Kraft				
Ash Pond	Low	Satisfactory	No recommendations.	
McDonough				
Ash Pond 1	Low	Satisfactory	Continue monitoring programs and practices.	Complete
Ash Pond 2	Low	Satisfactory	Continue monitoring programs and practices.	Complete
Ash Pond 3	Low	Satisfactory	Continue monitoring programs and practices.	Complete
Ash Pond 4	High	Satisfactory	Continue monitoring programs and practices.	Complete
McIntosh				
Ash Pond	Low	Satisfactory	Continue regular monitoring program with attention to potential seep area.	Complete
Mitchell				
Ash Pond 1	Low	Satisfactory	Continue inspection program and practices.	Complete
Ash Pond 2	Significant	Satisfactory	Continue inspection program and practices.	Complete
Ash Pond A	Less than Low	Not Rated	Continue to maintain the ash ponds erosion and vegetation control.	Complete
Scherer				
Ash Pond	Significant	Satisfactory	Continue instrument monitoring and review practices; continue inspection program and practices.	Complete
Wansley				
Ash Pond	Low	Satisfactory	Continue current maintenance and inspection programs; continue monitoring for erosion control.	Complete
Yates				
Ash Pond 1	Low	Satisfactory	No recommendations.	
Ash Pond 2	Significant	Fair	Continue monitoring and inspection of peizometers; continue inspection program and practices.	Complete
Ash Pond 3	Low	Satisfactory	Continue inspection program and practices.	Complete
Ash Pond A	Low	Satisfactory	Continue to maintain pond for erosion and vegetation control; continue inspection program and practices.	Complete
Ash Pond B	Less than Low	Not Rated	Continue to maintain pond for erosion and vegetation control.	Complete
Ash Pond C	Less than Low	Not Rated	Continue to maintain pond for erosion and vegetation control.	Complete
Ash Pond B (Prime)	Low	Satisfactory	Continue inspection program and practices.	Complete
Gypsum Pond	Low	Satisfactory	No recommendations.	
GULF POWER				
Smith				
Ash Pond	Significant	Satisfactory	Develop action plan to address specific areas of erosion and deposition; verify adequate freeboard; address specific areas of animal activity and erosion in routine maintenance activities; continue to ensure appropriate vegetation control.	Complete
MISSISSIPPI POWER				
Watson				
Ash Pond	Significant	Satisfactory	Address certain areas of vegetation and continue to maintain vegetation on outboard slope of the structure; continue to participate in state inspections and annual inspections.	Complete

Plants Daniel, Crist, Scholtz and McManus were not inspected by the EPA.

CONTINUOUS IMPROVEMENT

Beyond actions related to the EPA inspections, Southern Company operating subsidiaries continue to evaluate facilities to identify steps that can enhance CCB management. Recent notable actions include:

- Alabama Power recently constructed scrubber gypsum storage facilities at three plants which include composite liners and leachate collection systems, which were not required by state regulations at the time.
- Georgia Power is in the process of closing an operating ash pond at one of its plants. Ash currently designated for this facility will instead be managed at a dry storage facility permitted by the state under non-hazardous waste regulations and constructed in 2006.
- As additional disposal capacity for CCBs is needed, Southern Company is constructing landfills. These landfills (one in Alabama, five in Georgia, two in Mississippi and three in Florida) have environmental controls comparable to municipal solid waste landfill standards, such as liners, leachate collection and groundwater monitoring. The landfills are inspected both by company and state regulatory personnel, and monitoring data is sent to state regulatory agencies for review.

TURNING CCBs INTO USEFUL PRODUCTS

A strong market for recycled coal ash and power plant gypsum has developed over many years, and new uses are being explored.

In all cases, the applications represent instances where the CCB material provides equal or greater technical performance, value and



Wallboard manufacturing was the largest market for recycled gypsum in 2011.



Power plant gypsum is similar in composition to naturally mined gypsum.

safety compared with other natural and byproduct materials. Southern Company ensures the safe use of CCBs by targeting applications which have a proven safety record, and purchasers are bound by contract to use these products only for intended purposes.

Among the most common beneficial uses of CCBs:

Cement and Concrete

The largest user of fly ash is the concrete industry. Concrete is the most widely used manmade building material in the world. It is used in sidewalks, roads, bridges, parking structures and in building structures such as foundations, floors and walls. Concrete is a mix of gravel,

Ash sold by Southern Company in 2011 was beneficially reused as follows:

- Concrete – 58 percent
- Raw feed for cement kiln – 20 percent
- Concrete blocks – 11 percent
- Other – 11 percent

Gypsum sold by Southern Company in 2011 was beneficially reused as follows:

- Wallboard – 49 percent
- Agriculture – 28 percent
- Cement – 22 percent
- Other – 1 percent

sand, cement and water. Cement is the “glue” that binds the material together to form a hardened product. It is also the most expensive component in concrete as it is a manufactured product made by mining several raw materials which are burned in an energy-intensive process.



Cement manufacturing is another key market for recycled CCBs.

In cement manufacturing, fly ash is used to replace typical raw feed materials such as limestone, sand, clay and iron. Because fly ash is largely silica, alumina and iron (plus calcium in some cases), it can replace a portion of these raw materials, resulting in less mining of natural resources and avoiding the associated carbon footprint of mining equipment and quarrying activities.*

Not only can fly ash be used in manufacturing cement, but it is commonly used to replace 15 percent to 20 percent of the cement in concrete, and can be as much as 40 percent for some ashes. One major environmental benefit for replacing cement with fly ash is that for every ton of cement replaced with fly ash approximately 1 ton of carbon dioxide emissions is avoided. Technical benefits include increased strength, workability and durability, as well as lower cost. Gypsum constitutes approximately 5 percent of the weight of cement, and helps keep the concrete from hardening too quickly. It is a standard component of cement manufacturing, and power plant gypsum is a well-established and cost-effective substitute for mined gypsum.

** One ton of fly ash used as a replacement for cement conserves enough landfill space to hold about 1,200 pounds of waste, the same amount of solid waste produced by one American over 270 days, reduces the equivalent of two months of an automobile’s carbon dioxide emissions, and saves enough energy to provide electricity to an average American home for 19 days. (U.S. Environmental Protection Agency. April 2005. Using Coal Ash in Highway Construction: A Guide to Benefits and Impacts. EPA-530-K-05-002).*

Concrete Blocks

Bottom ash is primarily used as a lightweight aggregate to replace expanded natural aggregates such as clay and shale. The use of bottom ash to replace these mined aggregates saves natural resources and provides another opportunity to reduce carbon dioxide emissions related to mining. This use also provides some of the same technical benefits seen in the use of fly ash for concrete.

Wallboard

Gypsum represents more than 95 percent of the solids weight in wallboard. Use of synthetic gypsum to replace mined gypsum is an established technology, with scrubber gypsum having advantages such as comparable purity and finer particle size. Other environmental and economic benefits include reduced carbon dioxide emissions compared with mining natural gypsum, and lower raw material and shipping costs.

Agriculture

Synthetic gypsum from scrubbers has a variety of acceptable uses as a soil additive for agricultural applications. Among the proven benefits are drought tolerance, increased water infiltration into soil, a source of calcium and sulfur for certain crops, increased root depth and mass and reduced soil erosion. The Southeast in particular has abundant soils, crops and businesses which can benefit from its use.



Proper management of CCBs is an important part of the process of providing reliable, affordable, and environmentally responsible energy.

RAISING THE BAR

Southern Company is a recognized leader in energy-related environmental technology research and development. This commitment to advanced technology extends to CCBs.

Southern Company is involved in several major initiatives to develop new and improved beneficial reuse of CCBs. A sampling of recent projects:

- **Gypsum in Agriculture** – Partnership with the University of Georgia, Pennsylvania State University, and agronomy consultant Malcolm Sumner.
- **Gypsum for Control of Soil Erosion and Phosphorus Runoff from Poultry Waste** – Partnership with U.S. Department of Agriculture to develop use of gypsum to treat highly erodible soils and to prevent excessive phosphorus runoff into surface waters when poultry litter is applied to farmland as a fertilizer.
- **Structural Fill Demonstration for Ash Use in Highway Construction** – Partnership with Georgia Department of Transportation, Georgia Environmental Protection Division and EPA.
- **Biomass and Coal Ash Use in Concrete and Brick Production** – Research projects with Georgia Tech which are investigating the feasibility of using ash from biomass-coal co-fired power generation in concrete and brick products.
- **Biomass Ash Use in Energy Crops and Row Crops** – Research with the University of Georgia in which 100 percent biomass ash is being used as a soil amendment to promote growth of certain row crops, as well as selected wood sources to be used as fuel for biomass-fired power generation.
- **Electric Power Research Institute** – Membership includes research and development programs related to CCB beneficial use and disposal.



Agricultural use is one of the areas of CCB research.

ABOUT SOUTHERN COMPANY

With 4.4 million customers and more than 43,000 megawatts of generating capacity, Atlanta-based Southern Company is the premier energy company serving the Southeast. A leading U.S. producer of electricity, Southern Company owns electric utilities in four states and a growing competitive generation company, as well as fiber optics and wireless communications. Southern Company brands are known for excellent customer service, high reliability and retail electric prices that are below the national average. Southern Company also is meeting the challenge to serve the ever-growing need for electricity while continuing to minimize the impact of electricity production on the environment. The company has managed more than \$740 million in research and development over the past decade, seeking innovative ways to improve the generation, delivery and use of electricity. For more information, visit southerncompany.com.