

Doubling dirt saves PPL more than \$2 million

Coal ash programs put company among the nation's best

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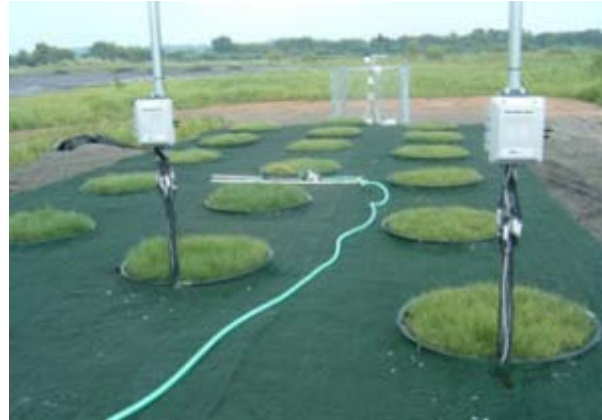
PPL employees cut in half the amount of dirt it needed to excavate for various projects around its power plants by mixing it with equal portions of bottom ash, a byproduct of coal power production. The mixture saved the corporation more than \$2 million in disposal and soil procurement costs last year.

Although PPL's Coal Combustion Products group began using bottom ash as a soil additive in 2002, last year was the first time 100 percent of the coal ash produced from the Montour and Brunner Island plants in Pennsylvania was used for beneficial purposes. Few other coal plants in the nation can boast percentages that high.

The U.S. Environmental Protection Agency is expected to increase its recommended percentage of coal ash that companies use beneficially to 50 percent by 2012.

"We're one of the few U.S. generation companies to be well-ahead of that voluntary recommendation," said Larry LaBuz, Coal Combustion Products supervisor. "It's a great way to contribute to the plants' bottom lines while being environmentally responsible."

The combustion of coal creates two products, fly ash and bottom ash. Fly ash is a powder-like substance. Bottom ash is composed of particles ranging in size from fine silt to coarse sand.



Using large underground containers, PPL tested how well grass would grow in the mixture of soil and coal ash.



Phoenix Links Golf Course uses a 50-50 mixture of soil and bottom ash silt to support the course's thick turf.

The group has been able to use or sell more than 95 percent of the products for beneficial uses over the past several years, with the exception of the silt-like portion of bottom ash. Being able to use the 40,000 tons of the finest particles of bottom ash generated every year at the two plants brings that percentage up to 100.

"The soil mixture retains water better than natural soil, so it's ideal for growing grass and improving an area's aesthetics," LaBuz said. "It's also basically inert, so it won't harm the environment."

The Coal Combustion Products group submitted data on the substance's chemical properties and its ability to support vegetation to the Pennsylvania Department of Environmental Protection two years ago. The DEP concurred with PPL that the soil mixture would not harm the environment.

Last year, PPL used the 50-50 soil blend on a number of company projects. Grass supported by the soil now helps ash basins at Montour and Brunner Island blend into their natural environments. The mixture also was used at the Phoenix Links Golf Course to cover the interesting terrain with top soil ideal for supporting the thick turf needed. In addition to environmental and economic benefits of use of Sand Fines as a partial soil substitute, the improvements in soil drainage and aeration can be expected to improve plant vigor and disease resistance and increase the number of days that the course has good playing conditions.

**Project Comments by John Buck, CPSSc, Soil Scientist and Project Manager
with Civil & Environmental Consultants, Inc.**

The use of bottom ash fines for soil amendment and soil extension purposes has been particularly rewarding because it produced such tangible economic, environmental, and agronomic benefits. Economic and environmental benefits were accrued by substituting about half of borrow soil needs with bottom ash, thereby reducing the need to mine soils from soil borrow sites. Laboratory and field studies demonstrated that the mixtures of bottom ash and soils had better agronomic performance – superior drainage and aeration - than the silty, clayey soils typical of the region.

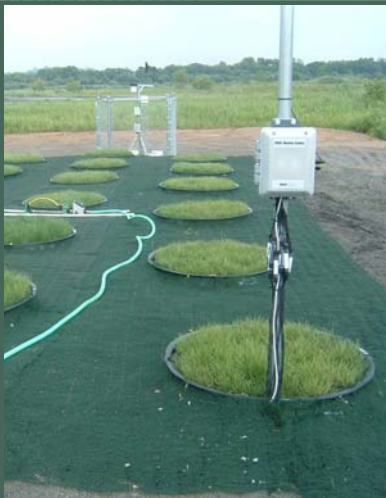
The combination of fine bottom ash with local soils created unique soils with two desirable soil properties that are often mutually exclusive: 1) fast drainage rates, and, 2) high plant-available water storage. Fast drainage rates are desirable because the soil will be saturated less frequently and for a shorter period of time, promoting good root zone aeration and plant health, less flash flow stormwater runoff, and, for recreational areas such as the Phoenix Links Golf Course, better playing conditions. High plant-available water storage (PAW) in soils is desirable because high PAW increases resistance to drought and reduces irrigation requirements. The superior properties of ash/soil mixtures over conventional soils were demonstrated in the laboratory and in highly controlled field studies where soil moisture and weather were monitored through drought periods and extreme rain events, including the 500-year Hurricane Ivan storm event.

In addition to the agronomic benefits, there were no environmental down-sides to beneficial use of PPL bottom ash fines in this application. Chemical and fertility testing of bottom ash fines and mixtures with soils indicated no environmental or agronomic concerns associated with the virtually-inert bottom ash.



CEC Services:

- Beneficial Use Permitting
- Agronomy/Soil Science
- Applied Research to Extend Beneficial Uses to Other Facilities



PPL Generation, LLC Brunner Island and Montour SES Sand Fines Beneficial Use

PPL now beneficially uses nearly 100 percent of the coal ash produced at its Brunner Island and Montour power plants. Until recently, about 40,000 tons of fines from washing bottom ash for the aggregate market had been a waste product. Laboratory studies by CEC demonstrated that bottom ash fines ("Sand Fines") could be mixed with fine textured soils to improve the plant-available water holding capacity (PAW) and permeability of soils and reduce borrow soil requirements. CEC successfully prepared a notification of Beneficial Use to PADEP. Beginning in 2002, 1:1 mixtures of Brunner Island Steam Electric Station (York Haven, Pennsylvania) Sand Fines and soil were successfully used for construction of the Phoenix Links golf course, which opened to the public in 2005. In total, about 66,000 tons of Sand Fines were used (equivalent to about 13 years of production), and an equal volume of borrow soil was not needed because of the soil extension role of the Sand Fines.

To help PPL develop quantitative data to support expanding the Sand Fines Beneficial Use program, and to identify the best ratios of Sand Fines and soils in mixtures, laboratory and outdoor mesocosm (110 gallon barrels used as pots) studies began in May 2004 using Sand Fines from Brunner Island and Montour (Washingtonville, PA) SES. These studies explored the agronomic and hydrologic performance of perennial ryegrass established in pure soil and several ratios of Sand Fines (25%, 50%, and 75%) and soil. Rainfall, other meteorological parameters, soil temperature, and soil volumetric moisture content were continuously monitored using an array of sensors in each barrel and are being used to compare water availability and rate of drainage in each of the soil treatments. Plant growth was also monitored. Following the mesocosm studies, beneficial use of Sand Fines was approved for construction of an athletic complex and for solid waste site closure at the Montour SES. CEC's services will extend the life of the site disposal facilities, allowing PPL to avoid borrow soil costs and avoid environmental impacts of unnecessary soil borrow extraction.



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