

# Managing Coal Combustion Residues in Mines

It is not surprising that coal plays a critical role in electricity production. It is the world's most abundant fossil fuel and the largest single fuel source for electricity generation in the United States—roughly 50% of our electricity derives from coal combustion at commercial power plants. But it might surprise some to know that the solid residues produced from coal combustion in the United States would fill one million railroad coal cars every year. The sheer volume of these residues presents challenges regarding how to dispose of it safely.



## WHAT ARE COAL COMBUSTION RESIDUES?

The burning of coal to produce electricity produces both exhausts and solid residues. These residues include non-combustible materials left in the furnaces and ash that is carried up the smokestacks and collected by air pollution control technologies. The use of more effective air pollution control equipment at coal-burning power plants during the last several decades has led to cleaner exhaust but, ironically, has also increased the amount of solid residues generated. Greater demand for power and cleaner exhaust from coal combustion will continue to increase the amount of residues produced, making residue management a very important issue.

Coal combustion residues can contain an array of metals and other elements, such as arsenic, cadmium, chromium, and lead, in quantities that can potentially be harmful to human health or the environment. Risks can occur when these contaminants enter the drinking water supplies or surface water bodies, or reach plants and animals.

## HOW ARE COAL COMBUSTION RESIDUES MANAGED?

Managing coal combustion residues to prevent release of harmful constituents into the environment requires responsible planning. There are both recycling and disposal options. Residues can be recycled for use in engineering applications and products such as cement or wallboard. In 2003, about 38 percent of coal combustion residue was recycled for various uses; this percentage has been steadily increasing over the last 30 years.

Historically, most residues have been disposed of in landfills or surface impoundments (natural depressions or diked basins). Disposal in coal mines (both active and abandoned) has been used in only about 5% of disposal cases. Nonetheless, mine placement is now considered to be a promising disposal option because 1) in contrast to landfills or impoundments, mine placement limits the environmental disturbance of undisturbed land, and 2) mine placement can help to satisfy existing regulations for reclamation by restoring mined land to approximate its original form. However, the potential human health and environmental impacts of coal mine disposal

must be carefully weighed against the impacts and the costs of other disposal options.

## WHO SETS RESIDUE DISPOSAL REGULATIONS?

Regulating residue placement in mines is challenging because no single federal regulatory act addresses the issue. The Office of Surface Mining's Surface Mining Control Reclamation Act (SMCRA) and the Environmental Protection Agency's Resource Conservation and Recovery Act (RCRA) are the basic federal laws for mine reclamation and environmental protection that can be applied to coal mine disposal. Neither of those acts, however, currently addresses the use or placement of combustion residues in an explicit manner. As a consequence, states vary in their approach and in the rigor with which they address coal mine disposal. Some states have expressed concern that they do not have the authority to impose performance standards specific to residues.

Regulation is further complicated by the fact that mining and environmental protection involve locally specific conditions, like the geology, the hydrologic system, climate, ecology and proximity to populated areas. These variables play a role in the behavior and impact of combustion residues once they are disposed of and can be difficult to address through national rules. Hence, the authority for implementing federal laws is delegated to the states.

## WHAT COULD BE DONE TO IMPROVE MANAGEMENT OF RESIDUES?

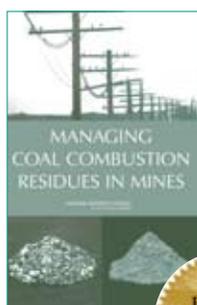
Coal mine disposal is a viable management option as long as (1) combustion residue placement

is properly planned and is carried out in a manner that avoids significant adverse environmental and health impacts and (2) the regulatory process for issuing permits includes clear provisions for public involvement. This can be achieved by identifying the characteristics of the residues, considering options for productive reuse of them, assessing the potential disposal sites, identifying management and engineering design of placement activities, and monitoring the site for potential contamination.

Federal standards for the disposal of combustion residues in mines should focus on ensuring that states have adequate, explicit authority and that they implement sufficient safeguards. The report provides three different regulatory options that could be pursued to develop enforceable standards that include changes to current regulations to address combustion residues specifically. Regardless of the regulatory mechanism selected, more coordination is needed between the Office of Surface Mining and EPA.

Even if the suggested changes are made to the regulations, much still remains unknown about the long-term behavior of combustion residues and their potential impacts in the mine setting. Research should be conducted in the following areas:

- The environmental behavior of residues at mine sites under different climatic and geologic settings to determine placement techniques most protective of human and ecological health.
- The potential ecological and human health effects of placing residues in mines.
- The continuous improvement and field validation of leaching tests to better predict the potential for contaminants from residues to migrate from the placement site.



**This brief was prepared by the National Research Council based on the report by the Committee on Mine Placement of Coal Combustion Wastes.** For more information, contact the Board on Earth Sciences and Resources at (202) 334-2744 or visit <http://nationalacademies.org/besr>. Copies of *Managing Coal Combustion Residues in Mines* are available from the National Academies Press, 500 Fifth Street, NW, Washington, D.C. 20001; (800) 624-6242; [www.nap.edu](http://www.nap.edu). Related reports from the National Research Council:

*Coal Waste Impoundments: Risks, Responses, and Alternatives* (2002)

*Evolutionary and Revolutionary Technologies for Mining* (2002)

*Vision 21: Fossil Fuel Options for the Future* (2000)

*Hardrock Mining on Federal Lands* (1999)

*Coal: Energy for the Future* (1995)

*Surface Coal Mining Effects on Ground Water Recharge* (1990)