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- Addressing environmental issues affecting the power industry, such as bodies of water being heated by once-through cooling water discharges, and cooling water intakes being fouled by invasive zebra mussels
- Addressing mining issues, such as acid mine drainage and reclamation of surface-mined lands

Program Focus Areas

Electricity deregulation, increasingly stringent environmental regulations, and requirements to control carbon dioxide and other greenhouse gases are driving the need for the development of advanced biological processes. In response, the Bioprocessing Program focuses on pursuit of critical R&D in three closely interrelated areas:

- **Bioprocessing** — Methods are being developed to create value-added products and chemicals from coal and coal waste products via microbial activity. For example, methods are being investigated for alternative fuel production by exploring biohydrogen generation from coal-derived carbon monoxide by extremophilic microorganisms. Producing hydrogen from coal, coal waste products, and biological organisms may provide a low-cost path toward a hydrogen-based transportation system of the future.
- **Bioremediation** — Technologies in this area remove contaminants from coal and coal waste products through microbial action, such as the biomodification of coal for the removal of mercury, iron, and sulfur via bacterial cultures prior to combustion. Research also is being conducted to evaluate microbial cycling of mercury in coal utilization by-products (CUBs) in landfills and settling ponds, with the goal of improving CUB disposal practices, concentrating and removing mercury from CUBs, and developing technologies for remediating mercury-contaminated soils.
- **Novel Approaches** — This key area focuses on the development of new technologies and applications for more effective and economical bioremediation and bioprocessing methods. Currently, novel microbial biosensors are being developed for detecting environmental contaminants in soils and water

Future Outcomes

The Bioprocessing Program accomplishes its R&D projects through joint participation with industry, other government research facilities, and institutions of higher education. Examples of projects presently under way or planned for coming years include the following:

- Genome sequencing and production of a cost-effective biotoxin for the control of zebra mussels in power plant intakes
- Identification and production of extremophilic/thermophilic microbes to catalyze the conversion of carbon monoxide and water to carbon dioxide and hydrogen for biohydrogen production
- Sampling and characterization of coal utilization by-products (CUBs) from disposal sites for determining the transport and fate of mercury from CUBs to the environment
- Removal, concentration, and recovery of mercury and other heavy metals from coal piles via bacterial action prior to combustion