PROJECT facts

U.S. DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

Environmental and Water Resources

11/2006

DEVELOPMENT OF ADVANCED ENVIRONMENTAL CONTROL TECHNOLOGY

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Background

Despite the steady improvement in the environmental performance of U.S. power plants since the passage of the Clean Air Act in 1970, emissions regulations for coal-fired power plants continue to tighten. Several of these proposals were multi-pollutant control bills, such as the Clean Air Interstate Rule (CAIR) and the Clean Air Mercury Rule (CAMR). CAIR will permanently cap emissions of sulfur dioxide (SO_x) and nitrogen oxides (NO_x) by 2015. CAMR builds on CAIR by mandating reductions in mercury emissions. To comply with emissions regulations for more than one pollutant, power plant operators are evaluating the use of multi-pollutant control technologies, which may provide a more cost-effective route to compliance than individual control technologies.

Mercury emissions control from coal-fired power plants is of particular interest because of the potential health effects of mercury ingestion. Elemental mercury is practically insoluble in water and is typically not captured by conventional pollution control devices. Ionic, or oxidized, mercury, on the other hand, is more readily captured because it is soluble in the liquids typically present in flue gas desulfurization scrubbers. Successful ionization of flue gas mercury, therefore, would enhance the integrated removal of mercury and sulfur in standard scrubbers.

Primary Project Goal

The primary goal of this project is to develop new or improved environmental control technologies for fossil-energy systems. Project research has emphasized reductions in control costs and improved performance through the integrated control of multiple pollutants and the mitigation of cross-media impacts.

PARTNER

Argonne National Laboratory

PERIOD OF PERFORMANCE

10/1/2003 to 9/30/2006

COST

Total Project Value
$400,000

DOE/Non-DOE Share
$400,000 / $0

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Objectives

- Further the fundamental understanding of mercury chemistry as it relates to emissions control processes.
- Investigate techniques for studying the role of particulate matter in the flue-gas chemistry of mercury.
- Study the chemistry of mercury absorbed by wet flue-gas desulfurization scrubbers with particular emphasis on the phenomenon of mercury re-emission that has been widely observed.

Accomplishments

- Characterization and comparison of activated carbons and other dry sorbents designed for duct injection
- Investigation of low-cost dry sorbents based on chemical treatment of inert substrates
- Evaluation of oxidants for changing mercury speciation in flue gas
- Development of a process to enhance mercury and NO_x removal using oxidants
- Performed a critical review of existing information on key chemical reactions with an emphasis on mechanisms that are important for mercury capture in current and future power systems.
- Development of a new technique to enhance the integrated control of mercury and nitrogen oxides emissions in flue-gas desulfurization systems

Benefits

Activities performed under this project directly support the continued production of low-cost, environmentally sound coal-based electric power in the United States. The fundamental scientific discoveries and technological advances made in this project have potential cross-cutting applications in various industrial sectors and remediation activities.