TOXECON Retrofit for Mercury and Multi-Pollutant Control on Three 90-MW Coal-Fired Boilers

CCPI-1

Emissions Control

Mercury	■	NO_x	■
SO_2	■	$PM_{2.5}$	■

Participant

Wisconsin Electric Power Company (We Energies)

Additional Team Members

ADA-ES — Management Support/Design Input

Cummins & Barnard — A/E Services/Construction Management

Wheelabrator Air Pollution Control, Inc. — Baghouse Design and Installation

Electric Power Research Institute — Technology supplier

Location

Marquette, Marquette County, MI (Wisconsin Electric's Presque Isle Power Plant Units 7, 8, and 9)

Technology

TOXECON sorbent injection process

Capacity

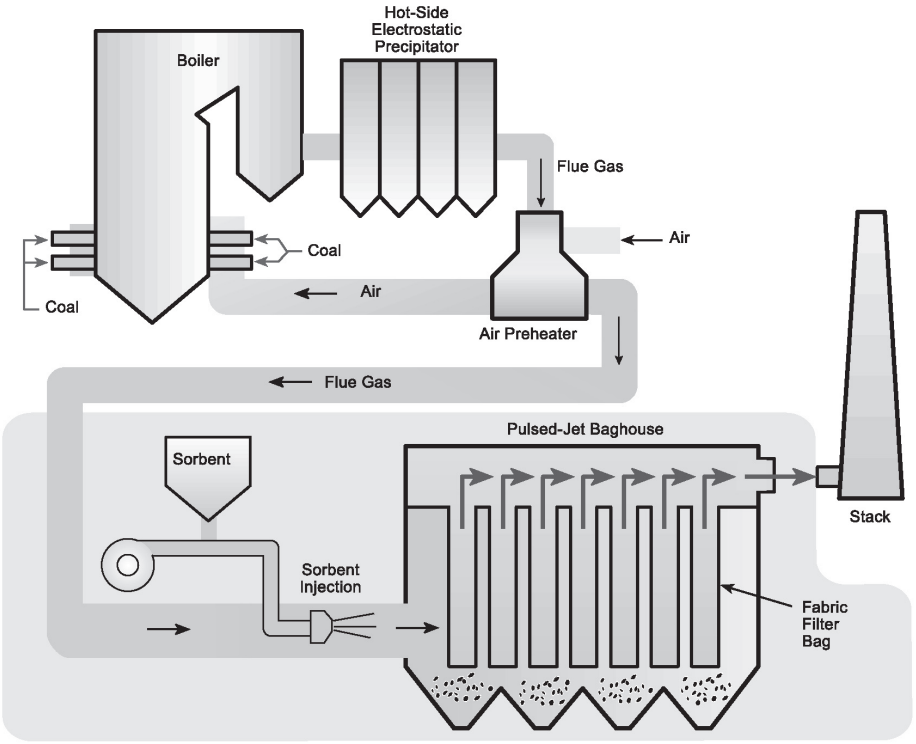
270 MW

Coal

Powder River Basin subbituminous

Project Funding

Total	$52,978,115	100%
DOE	24,859,578	47
Participant	28,118,537	53

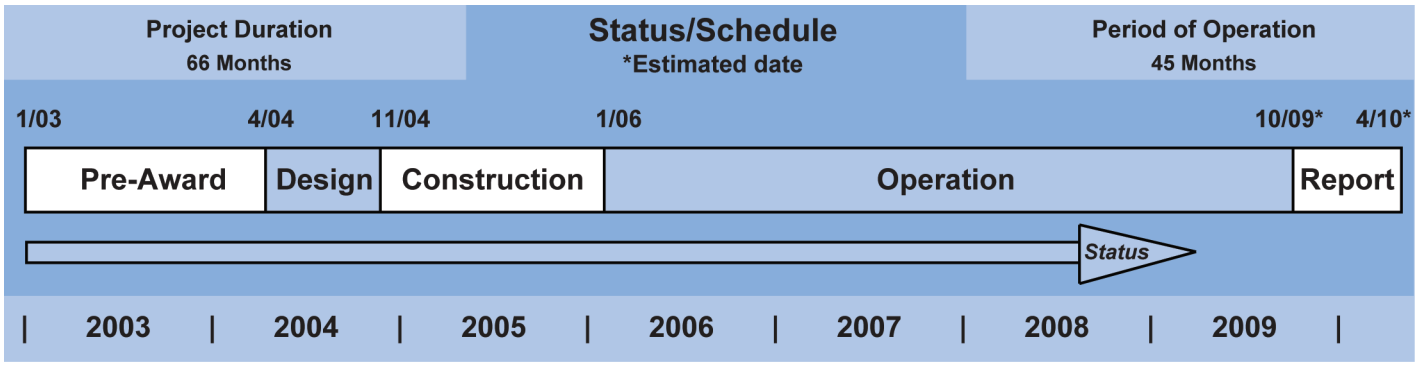


Objectives

To achieve 90 percent mercury removal through injection of activated carbon; increase particulate matter (PM) collection efficiency (particularly for PM of 2.5 microns or less in size); to reduce already low sulfur dioxide (SO_2) and nitrogen oxide (NO_x) emissions at the plant by an additional 70 percent and 30 percent, respectively; to recover 90 percent of mercury captured in the sorbent; to achieve 100 percent fly ash utilization; to advance the reliability of mercury continuous monitors; and to successfully integrate the entire system.

Technology/Project Description

The project will demonstrate the TOXECON sorbent injection process for multi-pollutant control of a combined flue gas stream from three units totaling 270 MW. TOXECON, an Electric Power Research Institute (EPRI)-patented process, injects activated carbon and sodium-based sorbents into a pulsed-jet baghouse installed downstream of a plant's PM control device, which in this application is a hot-side electrostatic precipitator. The primary PM control device removes the bulk of the PM. The TOXECON process is placed downstream of the air preheater to operate at relatively cool temperatures conducive to mercury and other pollutant absorption. Activated carbon and sodium-based sorbents are injected into the ductwork upstream of the pulsed-jet baghouse, where they mix and absorb pollutants in the flue gas. Upon entering the pulsed-jet baghouse, in-flight pollutant absorption continues and is significantly enhanced by fixed-bed absorption as pollutants pass through a sorbent filter cake that forms on the fabric filter bags in the baghouse. Sorbent captured in the baghouse is processed to recover up to 90 percent of the mercury to enable 100 percent fly ash utilization.



Benefits

The TOXECON process leverages the high PM capture efficiency inherent in pulsed-jet baghouses and baghouse location to effectively utilize proven sorbents in achieving high mercury capture efficiency and added SO_2 and NO_x control, and to retain the sales value of fly ash as a cement additive. The advantages of this approach include: affording enhanced contact between sorbents and dilute phase pollutants; providing a temperature regime conducive to pollutant absorption; and requiring application to only a small portion of the fly ash. Demonstrating the TOXECON process on Powder River Basin (PRB) coal is an excellent test of the technology and representative of a broad market application. PRB coal is widely used and, as with other western subbituminous coals, contains high percentages of elemental mercury that, because of its vapor state upon combustion, is more difficult to remove than solid state oxides of mercury (the form more common in bituminous coals). The TOXECON process has application to an estimated 167 gigawatts of existing coal-fired capacity. This TOXECON project alone is expected to remove annually 97 pounds of mercury, 4,020 tons of SO_2, and 32 tons of fine PM.

Status/Accomplishments

The project is demonstrating long-term reliability by continuously operating the powdered activated carbon (PAC) injection system. Over a two year period, We Energies consistently demonstrated over 90 percent mercury removal based on monthly averages. Ash handling and dust control process issues have been resolved. Long-term testing indicates that frequent pulse cleaning of the baghouse keeps fresh, effective carbon on the bags and enhances mercury capture.

Results from injection testing using a sodium-based sorbent (hydrated sodium bicarbonate carbonate) indicated 70 percent SO_2 removal, no effect on NO_x, virtually no effect on opacity but a net decrease in mercury capture at the normal activated carbon injection rate. An activated carbon injection rate 2.5 times higher than normal was required to obtain 90 percent mercury capture while injecting the sodium-based sorbent.

The project is continuing to investigate cost improvements while maintaining greater than 90 percent mercury removal as well as improvements for control of PM, NO_x and SO_2 emissions. Also, PM loading in the baghouse is being optimized for mercury removal efficiency.

NEPA was satisfied with a Finding of No Significant Impact (FONSI) in September 2003.

The Superior Watershed Partnership in Marquette, Michigan presented its 2006 Corporate Conservation Award to We Energies in recognition of the project's significant mercury reduction accomplishments.

Ash from the TOXECON process is being evaluated for use in conductive concrete applications.

Contacts

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