DOE/NETL Mercury Control Technology Conference
Presentation Summary

Presentation Title: Evaluation of MerCAP for Power Plant Mercury Control

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Topic Area: Other Mercury Control Technology

Summary

This presentation summarizes results from Cooperative Agreement DE-FC26-03NT41993 titled "Evaluation of MerCAP™ for Power Plant Mercury Control" being conducted by URS Group, Inc. The project objective is to evaluate EPRI's MerCAP™ technology for removing mercury from coal fired flue gas. This project is primarily funded by the DOE National Energy Technology Laboratory (NETL) and is being co-funded by EPRI, Great River Energy, Southern Company, and Georgia Power. URS GROUP and Apogee Scientific Inc are executing the project.

This presentation discusses the project status including initial results from Site 2 the second phase of this program where MerCAP™ technology is installed downstream of a wet scrubber treating low-sulfur Eastern bituminous flue gas. Final results from the first phase of this large-scale demonstration, where gold-based MerCAP™ technology was installed downstream of a spray dryer - baghouse (SDA/BH) combination treating either North Dakota lignite (NDL) or Powder River Basin (PRB) flue gas, are also discussed along with plans for future testing.

This project is focused on evaluating the ability of a gold-based Mercury Control Adsorption Process (MerCAP™) to control mercury in flue gas downstream of dry and wet scrubbers. MerCAP™ uses fixed structure sorbents configured directly in a flue gas stream to adsorb mercury. The use of gold-coated substrates as the MerCAP™ sorbent takes advantage of gold's natural tendency to form a stable amalgam with mercury providing it with a relatively high adsorption capacity for the metal. When the fixed sorbent surfaces become saturated, they can be thermally regenerated and the mercury can be recovered. MerCAP™ technology is targeted as the primary mercury control process for plants burning low-rank coals and as a polishing technology for plants with wet scrubbers or employing other mercury control technologies.

In the first phase of this program, a gold MerCAP™ structure was retrofitted into a single baghouse compartment at Great River Energy's (GRE's) Stanton Station Unit 10 (Site 1). Each compartment treats 6 mega-watt (MWe) equivalence of flue gas. After 1735 hours of operation, a fuel switch to PRB sub-bituminous coal occurred providing the unique

opportunity to evaluate the MerCAP™ technology on a full-scale basis for a second fuel type on the same unit.

Initial performance of the reactor array was quite good, achieving mercury capture in excess of 90%. The removal dropped off over the first few days of operation and stabilized in a range of 30 to 45% removal for an extended period of operation. The plant switched from NDL to PRB coal after approximately 1735 hours of continuous MerCAP™ operation. The resulting changes in plant operation had a significant effect on the performance of the MerCAP™ array. Overall gas temperatures increased from an average of 180°F while burning NDL to well over 220°F with PRB. In addition, wide temperature variations, observed at the test location appeared to affect the mercury removal performance of the array; mercury removal ranged from 5 to 55% during an extended period with PRB fired. Comparison of MerCAP™ performance data to plant process data indicated that baghouse temperature and the extent of lime scrubbing across the SD/BH both had pronounced impacts on mercury removal.

In the second phase, a MerCAP™ test reactor was installed on a slipstream at the outlet of a Chiyoda jet bubbler reactor (JBR) flue gas desulfurization scrubber at Southern Company's Georgia Power Plant Yates Unit 1 (Site 2). The reactor treats approximately 1 mega-watt (MWe) flue gas as it exits the mist eliminator on the back pass of the scrubber. Tests will be performed at both sites to evaluate the ability to thermally or chemically regenerate the gold-coated plates. These tests will be carried out using a smaller extractive pilot probe to evaluate the effects of multiple regeneration cycles on the sorbent performance.

When the Site 2 system was first started the MerCAP™ array was able to remove nearly all of the flue gas mercury. The removal slowly diminished to approximately 75% over the first 48 hours. An equipment problem resulted in unscrubbed flue gas being flowed across the array; this was confirmed by speciated mercury measurements that matched those of the FGD inlet flue gas. Although the MerCAP™ unit was able to effectively capture mercury (both oxidized and elemental forms) from the unscrubbed flue gas for a relatively short period of time, the performance quickly dropped off to a very low level. Further evaluation indicated permanent damage to the fixed gold structures due to exposure to the acidic flue gas. This resulted in the need to replace much of the array. After performing some equipment modifications and installing a semi-continuous rinse system in the reactor, the Site 2 testing was resumed. Tests are on-going and future tests will examine the impact of the gold spray washing system as well as activation/regeneration of the substrates by chemical methods.