Demonstration of Amended Silicates™ for Mercury Control at Miami Fort Unit 6

Project Status

July 12, 2005

Presented to DOE NETL-
Mercury Control Technology R&D
Program Review

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Outline

- Project overview
- Project team and recent addition
- Accomplishments
- Mercury measurements
- Next steps
- Commercialization approach

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41988 Project Objective

- ***Primary:*** Demonstrate ability of Amended Silicates sorbent to remove mercury from flue gas in a commercial-scale installation in a 30-day trial.
- ***Secondary:*** Deliver commercial quantities of Amended Silicates sorbent for use in the demonstration.

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Host Site Description

- Cinergy Miami Fort station in North Bend, OH
- Unit 6: 175 MW(e) capacity
- Eastern bituminous coal (WV and KY sources) delivered by barge
- Equipped with 3 ESPs in series, each less than 200 SCA
- Mercury measurements to be made between second and third ESP, since first two ESPs are conjoined

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41988 Project

- Project team: Amended Silicates, LLC; ADA Technologies, Inc.; CH2M HILL; Engelhard Corp.; Cinergy; subcontractors
- DOE technical monitor: Andrew O'Palko
- Scope: $1.6 million total cost, $900K from DOE
- Phase I: Preparation
- Phase II: Demonstration
- Phase III: Analysis

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41988 Project Team

- ***Amended Silicates, LLC:*** prime contractor and administrator of first- and second- tier subcontracts
- ***ADA Technologies, Inc.:*** sorbent developer and lead organization for field operations
- ***CH2M HILL:*** lead organization for site engineering
- ***Cinergy Power Generation Services, LLC:*** Provider of host site and cost-share partner
- ***Engelhard Corporation:*** Strategic manufacturing partner and Licensee for Amended Silicates sorbent
- ***DOE/NETL:*** Andrew O'Palko, technical project officer

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Phase I: Preparation

- Project Planning
  - ☑ Place subcontracts with project team members
  - ☑ Detailed coordination with host site, project team
- Site Preparation and Sorbent Acquisition
  - CFD modeling of injection to optimize layout
  - Location of equipment, routing of transfer lines
- Injection System Installation and Checkout
- Mercury Monitoring System Installation and Checkout (UNDEERC)

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Status: Phase I Preparation

- Prepared draft site access agreement for review and comment by Cinergy
- Drafted statements of work for ADA and CH2M HILL (organizations who will perform work)
- Executed subcontract with UNDEERC for mercury measurement work and QA/QC planning
- Executed subcontract with WKU for O-H wet chemistry sampling of mercury concentrations
- Planned with Boral their participation in analysis of fly ash plus sorbent samples: protocols and sample sizes
- Negotiating additional fly ash tests by Separation Technologies, LLC

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Status: Phase I Preparation

- Conducted site survey to identify prime injection location options, equipment locations, contact personnel at plant site
- Prepared preliminary design for injection lances to use in CFD modeling
- Completed initial CFD modeling study of sorbent injection to determine number and location of injection ports
- Prepared draft demonstration plan and distributed for comment
- Added Engelhard to team to lead sorbent production effort

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Phase II: Demonstration

- Baseline Mercury removal characterization and Mercury CEMS operation throughout trial
- Ontario Hydro Sampling for comparison with CEMS data and QA/QC evaluation
- Amended Silicates Trial
  - Parametric Investigation
  - Extended Injection Evaluation
- Activated Carbon Trial
  - Use as basis for comparison

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Status: Phase II Demonstration

- Subcontracts in place for UNDEERC and WKU participation in mercury measurements
- Data for target mercury control level determination to be obtained in parametric evaluation (both Amended Silicates and powdered activated carbon)

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Phase III: Analysis

- QA/QC Planning and Execution
  - ☑ UNDEERC as QA/QC lead
- Analysis of Data from Demonstration Trials
  - Establish project data base
  - Transfer mercury measurement and operating data to data base
  - Analyze fly ash samples for concrete, leachate properties
  - ID trends and significant parameters in sorbent performance
- Reporting
  - Preparation of conference papers and project reports
- Project Management
  - Establish project website for coordination among team members and means to share data
  - Manage overall project activities with respect to scope, schedule, and budget

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Status: Phase III Analysis

- QA/QC plan drafted, reviewed, finalized
- Hazardous substance plan submitted
- Quarterly reports submitted
- Discussions held with Boral Materials Technologies regarding evaluation of fly ash plus sorbent samples
- Additional fly ash/sorbent evaluation for use in concrete being negotiated with Separation Technology, LLC

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QA/QC Plan

- UNDEERC as lead organization in preparing draft> leverage their front-line work in developing QA/QC protocols for CEMs
- Focus on mercury measurement with CEMS and Ontario-Hydro wet chemistry
- Also addressed solids sampling and sorbent injection system
- Comments incorporated into final QA/QC plan document
- Plan forwarded to DOE

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Demo Plan Utility

- Serves as the guidance document for the project field activities
  - Injection protocol, including unit operation during runs
  - Protocols for coal, flyash, pond water sampling
  - QA/QC elements to be executed
- Plan to successfully conduct demonstration cases
  - Presents objectives for the demo effort
  - Details the tasks to be performed
  - Identifies required data to record during runs

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Sorbent Production Status

- Analyzed intermediate process samples from 3,500-lb batch to determine consistency of preparation process on a larger scale
- Short-term trial in 2004 indicated issues with scale-up process
- Decision was to seek strategic partner with experience in large-scale manufacturing
- Identified Engelhard as ideal candidate and negotiated joint development effort now under way
- Engelhard will supply 100,000 lb of Amended Silicates sorbent for trial

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Mercury Measurement

- UNDEERC mercury continuous emissions monitors
  - Tekran or PS Analytical units installed upstream of sorbent injection and downstream of second ESP
  - Pretreatment of samples to assure accurate measurement
  - 2-5 minute interval measurements, contiguous during injection and monitoring periods
  - Daily calibration of instruments
  - Daily data download to project website
  - Comprehensive QA/QC of CEM data

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Mercury Measurement

- Western Kentucky University Ontario-Hydro sampling
  - Four campaigns during trial
  - One baseline test, three Amended Silicates tests
  - Sampling to follow ASTM D22.03.01
  - Apex instruments for sampling

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Mercury Measurement

- Coal samples to be acquired on a routine basis for mercury analysis
- Fly ash samples will be taken for mercury analysis during all trials of the Demonstration Phase
- Larger-quantity fly ash samples (5-gal size) to be acquired for DOE/NETL analysis
- TCLP and SPLP testing of mercury leachability from fly ash samples

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Milestones

- April 2004- project start
- September 2004- subcontracts in place
- October 2004- expand search for manufacturing strategic partner
- February 2005- Site visit to locate hardware, injection ports, sampling locations
- April 2005- Addition of Engelhard as strategic manufacturing partner
- September 2005- Sorbent preparation process finalized with manufacture of 250-lb batch for pilot testing
- October 2005- 1,000 lb batch preparation
- December 2005- Completion of 100,000 lb production run for demonstration

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Milestones (continued)

- Q1 2006 start of injection
  - Baseline mercury removal
  - 2 weeks Amended Silicates injection at range of rates (parametric testing)
  - 30 days Amended Silicates for long-term evaluation
  - 1 week activated carbon injection
- Q2 2006- analyses of fly ash plus sorbent samples for concrete properties
- Q2 2006- leachate testing complete
- Q2 2006- data analyses complete
- 2006-7- presentations at conferences of results and analyses

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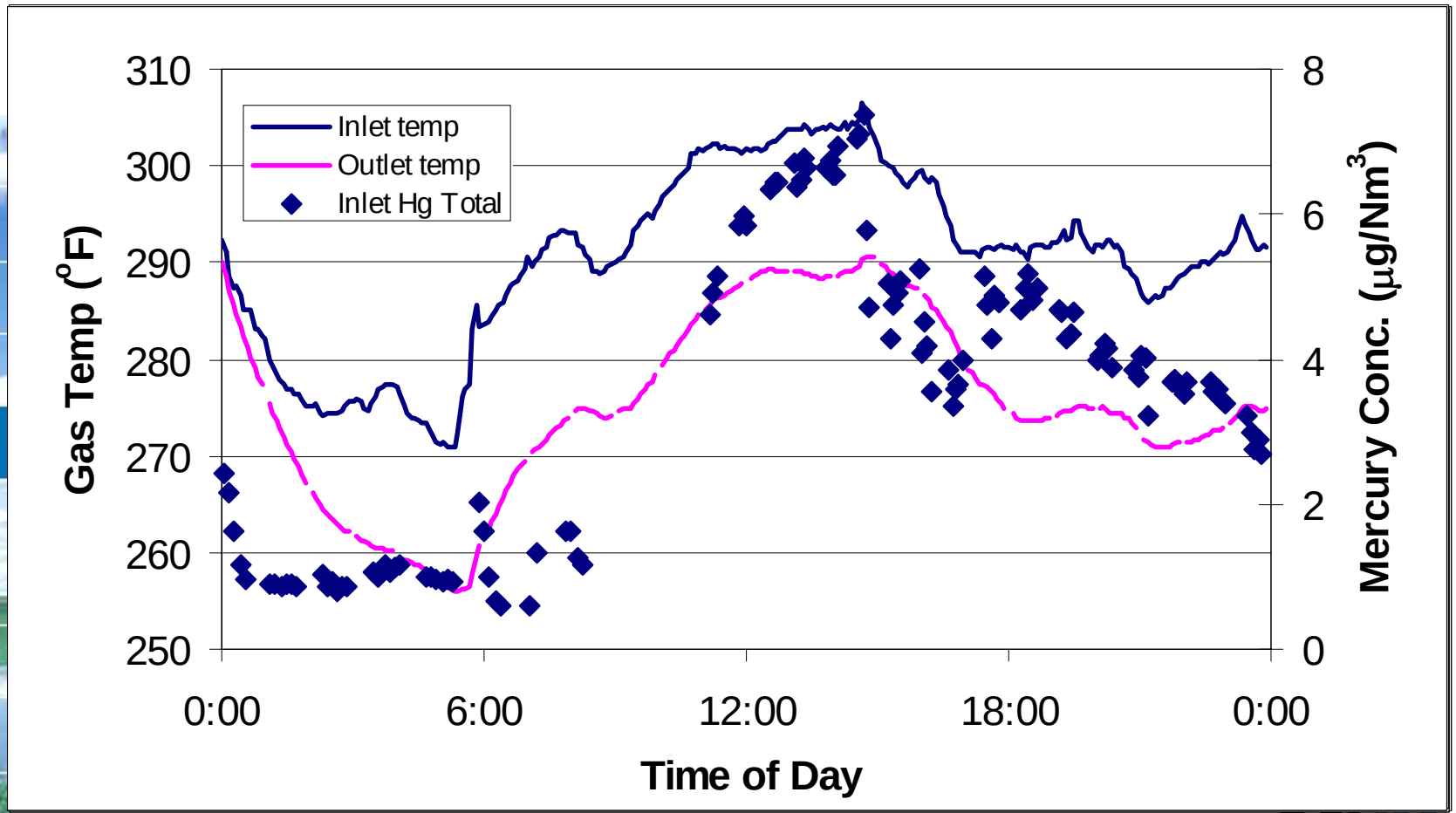
Impact of Boiler Operation on Mercury Emissions



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Next Steps

- Continued progress on sorbent manufacturing via joint development with Engelhard
- Review and finalize demonstration plan
- Complete preparations at host site including installation of injection system in late 2005
- Installation of mercury S-CEMS at host site in December 2005
- Delivery of 100,000 lb of sorbent before year-end

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Commercialization Approach

- Amended Silicates, LLC will team with Engelhard to manufacture and sell Amended Silicates
- Target markets identified for initial product roll-out
- Anticipate that state regulations on mercury emissions will dominate early adoption decisions
- Amended Silicates sorbent will have significant cost advantage for plants with interest in continued fly ash sales

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