

***Demonstration of Amended  
Silicates™ for Mercury Control at  
Miami Fort Unit 6- DOE Project  
41988***

***Mercury Control Technology  
R&D Program Review***

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**AMENDED**SILICATES™

# *Presentation Outline*

- Project Objective
- Project Team
- Host Site Description
- Project Overview
- Project Status
- Ongoing Task Activities
- Project Schedule



# 41988 Project Objective

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

# 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 sorbent preparation and site engineering
- ***Cinergy Power Generation Services, LLC:*** Provider of host site and cost-share partner

# *Project Team- second-tier subcontractors*

- ***UNDEERC:*** QA/QC contractor and mercury CEMS monitoring during sorbent injection
- ***WKURF:*** Ontario-Hydro sampling at selected times during sorbent injection
- ***Boral Materials Technologies, Inc.:*** Analysis of fly ash plus sorbent samples to assess effect of sorbent on use of fly ash as a pozzolan additive

# *Host Site Description*

- Cinergy Miami Fort station in North Bend, OH
- Unit 6: 175 MW(e) capacity
- Eastern bituminous coal (WV and KY sources)
- Equipped with 3 ESPs in series, each less than 200 SCA
- Mercury measurements to be made after first ESP to be representative of small-ESP plant configuration

# *41988 Project Overview*

- Scheduled for completion in 16 months after contract signature
  - April 2004 contract signed
  - March 2005 start of injection trial
- Scope: \$1.76 million total cost
- Phase I: Preparation
- Phase II: Demonstration
- Phase III: Analysis

# *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)



# *Phase II: Demonstration*

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



# *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



# *Mercury Measurement*

- UNDEERC mercury continuous emissions monitors
  - Tekran or PS Analytical units installed upstream of sorbent injection and downstream of first 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



# *Mercury Measurement*

- Western Kentucky University  
Ontario-Hydro sampling
  - Four campaigns during trial
  - One baseline test, one carbon test, two Amended Silicates tests
  - Sampling to follow ASTM D22.03.01
  - Apex instruments for sampling
  - On-site analysis of impinger solutions



# *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 EPA analysis
- Fly ash samples acquired for evaluation in concrete testing by Boral Materials Technologies: ASTM methods for air entrainment in mortar, air entrainment in concrete, concrete performance
- TCLP and SPLP testing of mercury leachability from fly ash samples



# Milestones

- April 2004- project start
- August 2004- subcontracts in place
- January 2005- start installation at site
- March 2005- deliver sorbents to site
- March 2005 start of injection
  - Baseline mercury removal
  - 2 weeks activated carbon injection
  - 2 weeks Amended Silicates injection at range of rates (parametric testing)
  - 30 days Amended Silicates for long-term evaluation

# *Milestones (continued)*

- June 2005- analyses of fly ash plus sorbent samples for concrete properties
- July 2005- leachate testing complete
- August 2005- data analyses complete
- 2005-6- presentations at conferences of results and analyses

# *Amended Silicates™ Sorbent Technology Status*

## ■ Sorbent Formulation

- Refinements to initial composition identified in ongoing lab work
- G2 Amended Silicate now in lab testing
- G2 sorbent scheduled for pilot tests in August

## ■ Sorbent Preparation

- Scale up engineering in past six months
- Preparation of 100-lb batch in November
- Upgraded to 3,500-lb batch in February
- Extensive sampling in each production run to gather data on uniformity and quality control
- “Lessons learned” compiled for use in preparation of 50-ton batch

# *Status: Phase I Preparation*

- Prepared draft project schedule for review by team members
- 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
- Discussed with Boral their participation in analysis of fly ash plus sorbent samples: protocols and sample sizes



# *Status: Phase I Preparation*

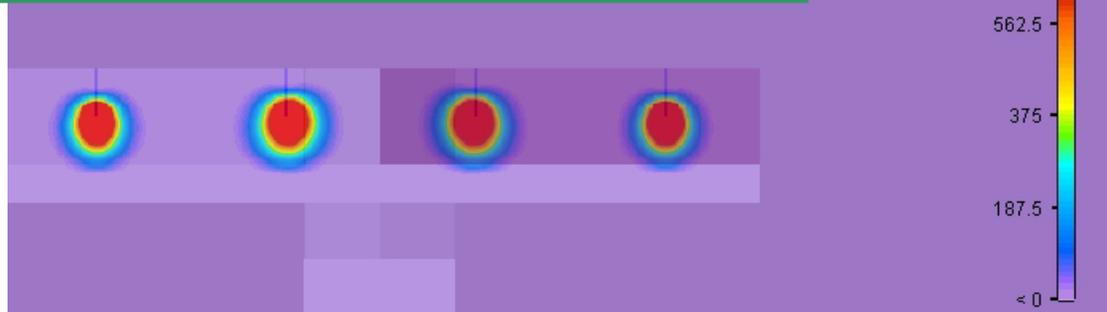
- Conducted initial site survey to identify prime injection location options, equipment locations, contact personnel at plant site
- Submitted draft site access agreement to Cinergy for review and comment
- Prepared preliminary design for injection lances to use in CFD modeling
- Developed case definition for CFD model- duct drawings and flows, injection system layout
- Commissioned CFD study of sorbent injection



# *Injection System Design*

- Core of system is lease of Norit Porta-PAC equipment
- May require some modification of feedscrew due to difference in densities of carbon and Amended Silicate material
- Preliminary design employs four injection lances with multiple nozzles on each
- Design calculations performed to provide input to CFD model cases

# *CFD Sample Results*



***Sorbent concentration 10 ft downstream***



***Sorbent concentration 40 ft downstream***

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# *CFD Modeling Status*

- Defining additional cases to refine lance layout and mixing scheme
- Building lances to evaluate design options
- Final decisions on configuration by September



# *Sorbent Production Status*

- Analyzed samples from 3,500-lb batch to determine consistency of preparation process on a larger scale
- Developing modified preparation protocol to reflect results of first production
- Qualifying candidate toll manufacturers for production of 50-ton run of Amended Silicate sorbent



# *Project Management*

- Assigned project team personnel and roles (from ADA and CH2 staff members)
- Established communication with DOE technical project officer
- Set up project accounting and tracking
- Initiated negotiation of subcontracts and agreements
- Seeking additional cost-share partners with interest in maintaining fly ash sales

# *Next Steps*

- Finalize host site agreement with Cinergy, including scope of in-kind contribution
- Conduct project kickoff meeting with DOE
- Prepare project QA/QC plan
- Select vendor for production of 50-ton quantity of Amended Silicate sorbent for trial
- Finalize injection system design, schedule fabrication and installation