Full-Scale Field Trial of Low-Temperature Mercury Control Process

DE-FC26-06NT42777

Process Background

- CONSOL-developed process for controlling mercury emissions from coal-fired power plants.
- Piloted at AE Mitchell Station in 2003 – 2005.
- Capable of achieving >90% mercury removal.
- Relatively simple concept; low capex and opex expected.
- Best suited for bituminous coal-fired plants that have high levels of unburned carbon.

Process Background

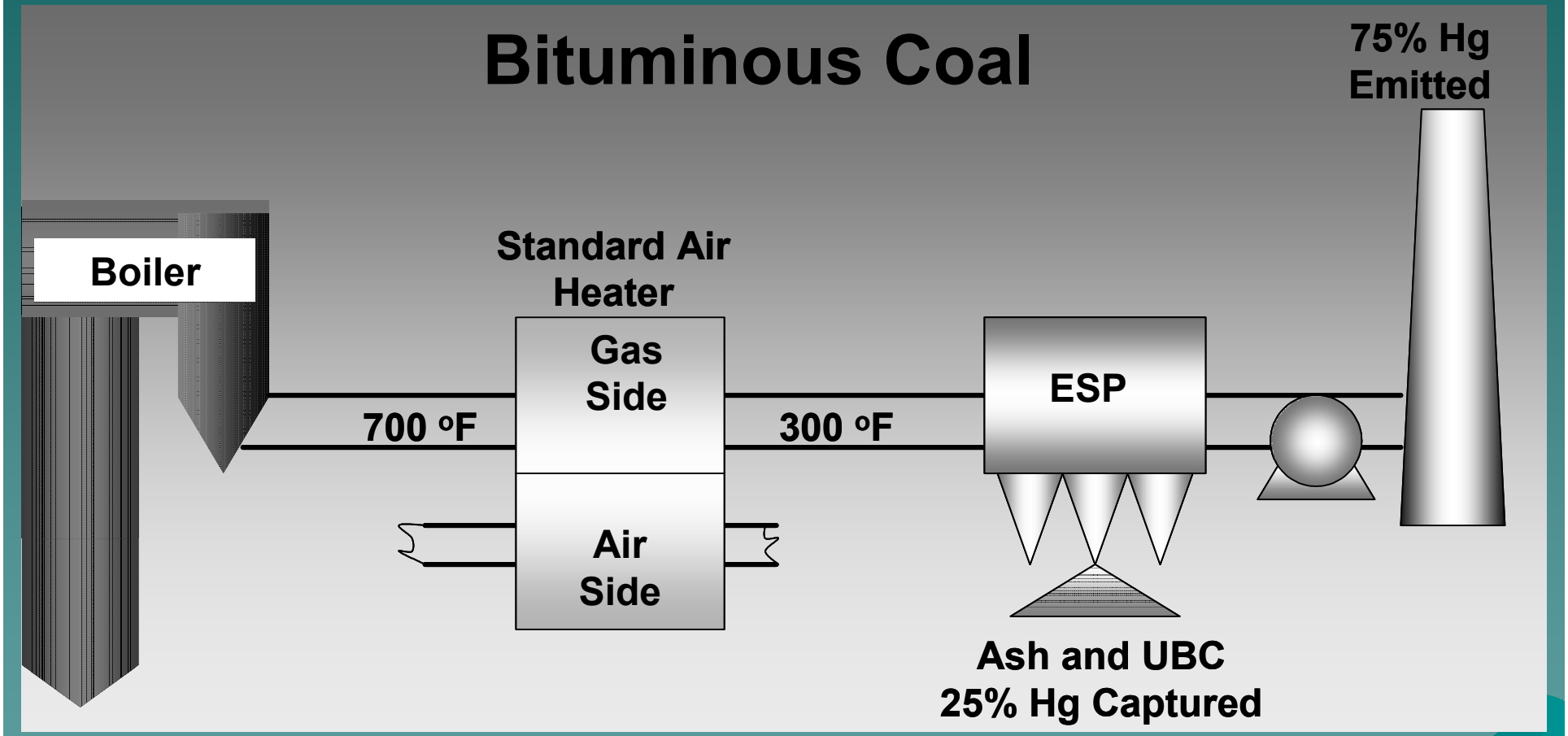
- Applicability depends on plant geometry, configuration, other site-specific considerations.
- Co-removal of sulfur trioxide; potential to improve heat rate.
- Provisional patent filed July 13, 2006.
- DOE selected the project, full-scale test at PPL Martins Creek Unit 1 (half flow) award in February 2006.
- Team:
  - PPL Martins Creek, LLC
  - Lechler, Inc.
  - Martin Marietta Magnesia Specialties
  - CONSOL Energy Inc., Research & Development
  - U.S. Dept. of Energy, NETL

Potential Market Size

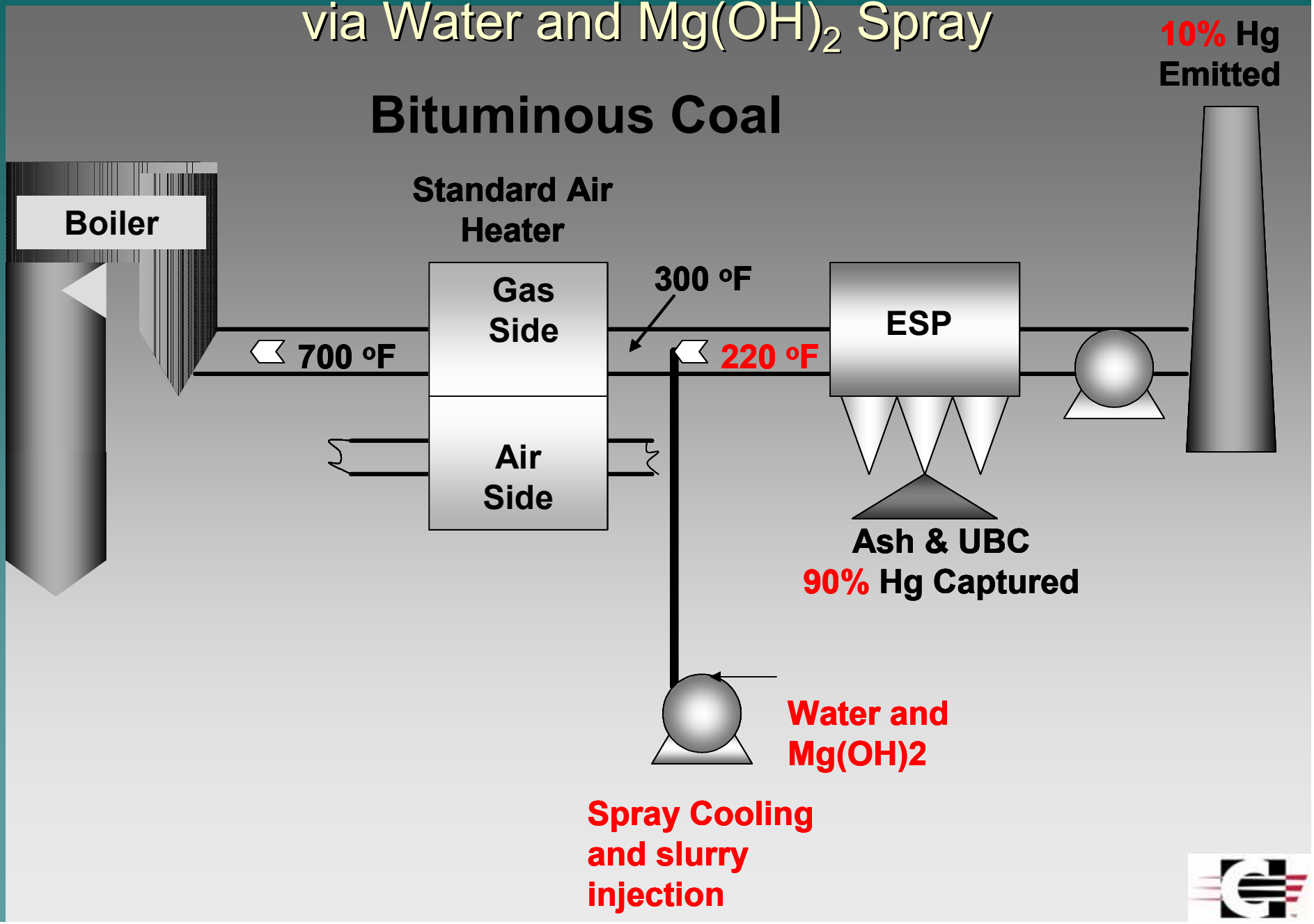
	No. of Units	Capacity, MWe
U.S. coal-fired EGUs >25 MWe	1143	328,052
- Elim. >400 MWe	-319	-206,863
- Elim. status ex. "OP" (EIA)	-44	-2,684
- Elim. FGD and FBC (EIA, ICR, EPA-AR)	-173	-27,903
- Elim. Units in ICR, but not in EIA and EPA-AR	-37	-2,981
- Elim. west of Miss. River	-26	-2,233
- Elim. FGD announced (EV)	-83	-17,665
Candidate units*	316	42,151

*Additional candidates include steam-only units and small EGUs.

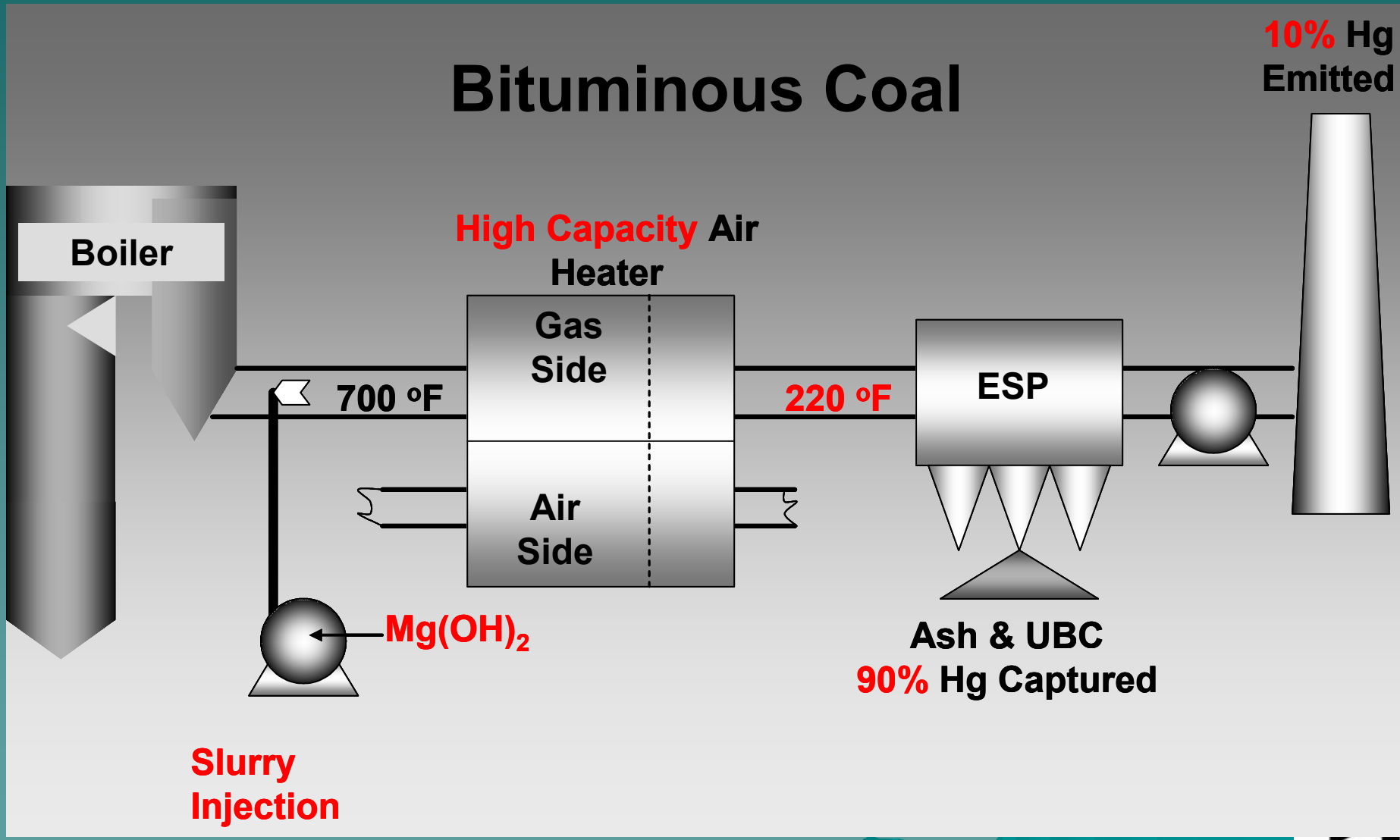
Conventional Operation



Mercury Removal with Deep Cooling of Flue Gas via Water and $Mg(OH)_2$ Spray



Mercury Removal with Deep Cooling of Flue Gas via Air Heater



Martins Creek LTMC Project

- Unit No. 1, nominal 130 MWe, 2% S coal fired
- Dual air heaters & dual ESP inlet ducts
- $Mg(OH)_2$ and water injections into “A” duct, “B” duct untreated
- Target 200-240 °F ESP inlet
- Mercury measurement (CEMS) on each duct
- Testing to begin May 2007, with a 2-6 Month operation period

Statement of Project Objectives

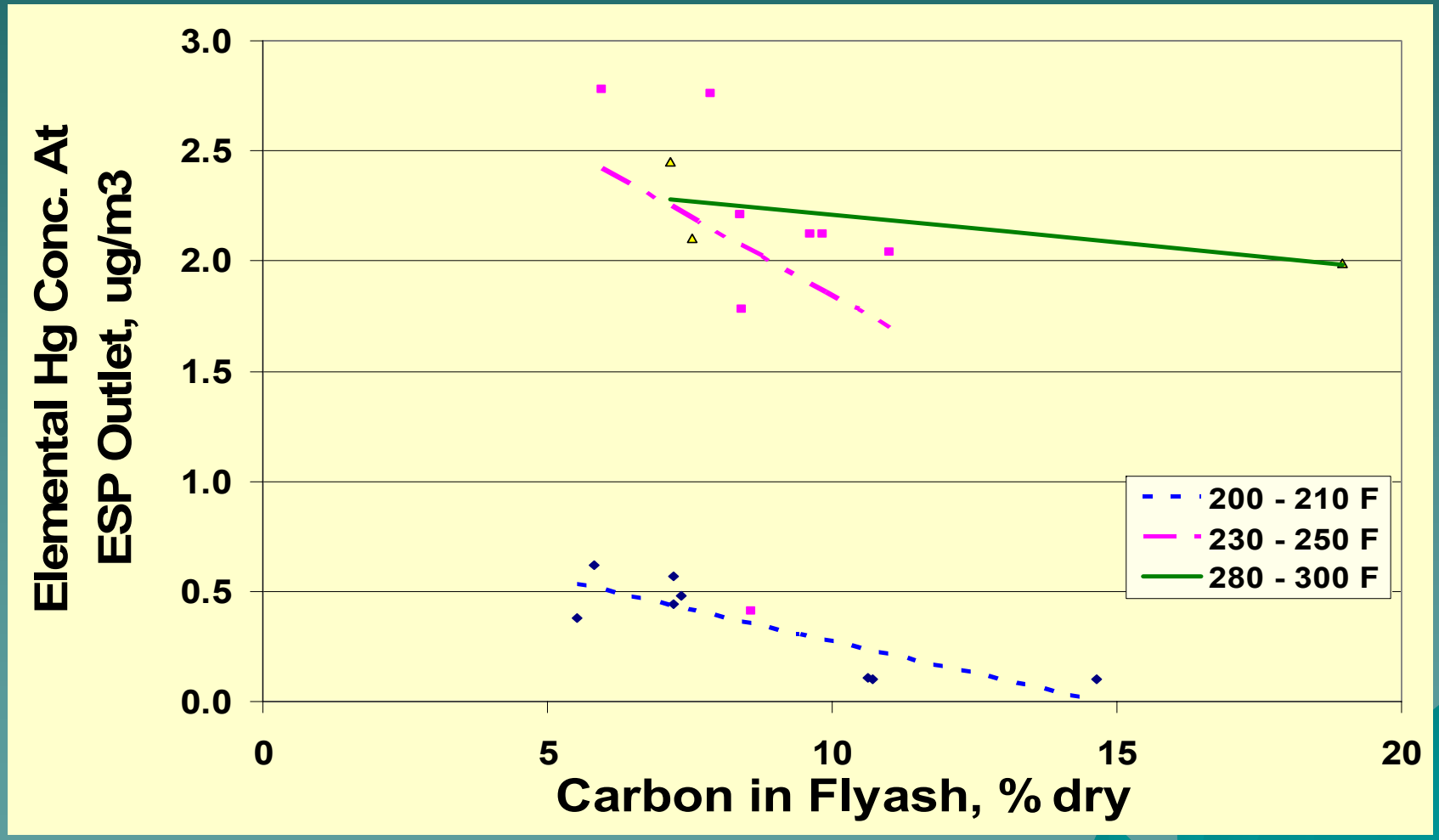
- Determine the performance, operability, and economics of the LTMC process on a full scale utility boiler.
- Demonstrate that magnesium hydroxide slurry injection into the flue gas with the humidification water can reduce SO_3 concentration to avoid corrosion at the low-temperature conditions.
- Demonstrate that water spray humidification can maintain ESP performance under low-SO_3 conditions.

Work Plan

- **Phase 1** Preparatory Activities, to prepare for installation and operation of the process
- **Phase 2** Installation/Construction, to design, procure, construct and install the magnesium-hydroxide and water injection systems
- **Phase 3** Process Testing, to achieve greater than 90% mercury removal and maintain ESP performance
- **Phase 4** Post-Test Activities, to analyze process data, report results, and dismantle the equipment

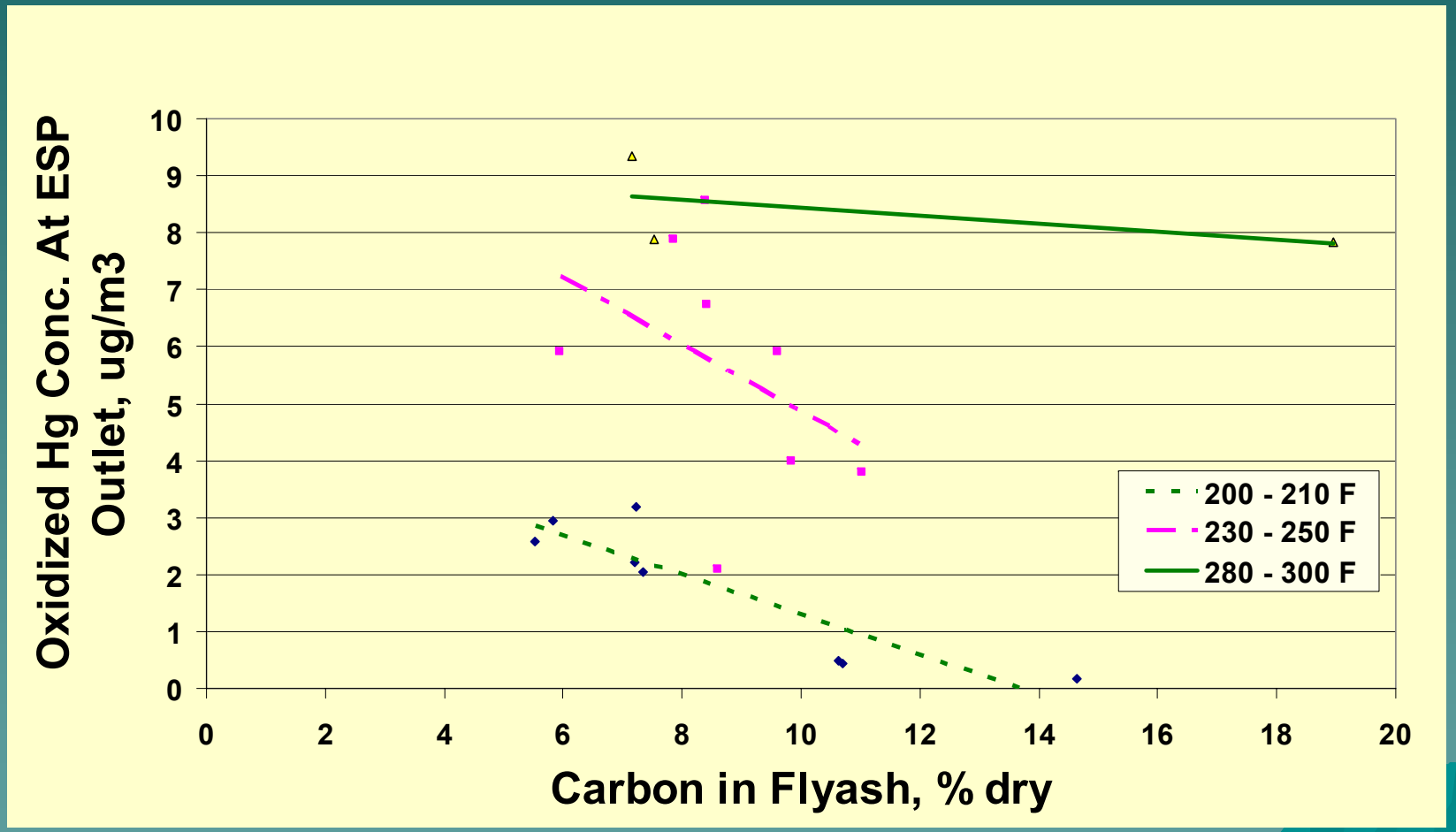
Elemental Hg Removed As Temperature Is Reduced

Pilot Plant

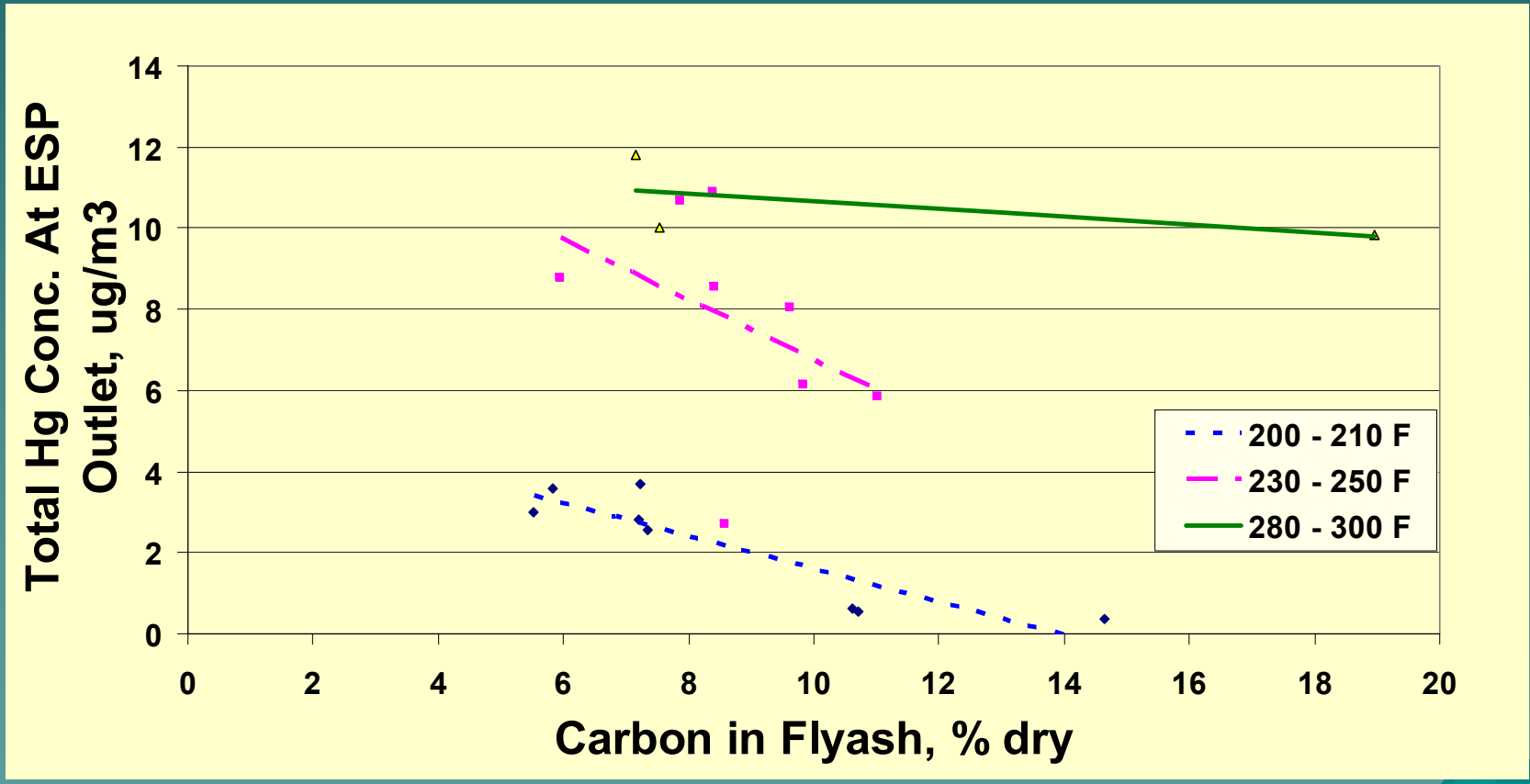


Oxidized Hg Removed As Temperature Is Reduced

Pilot Plant

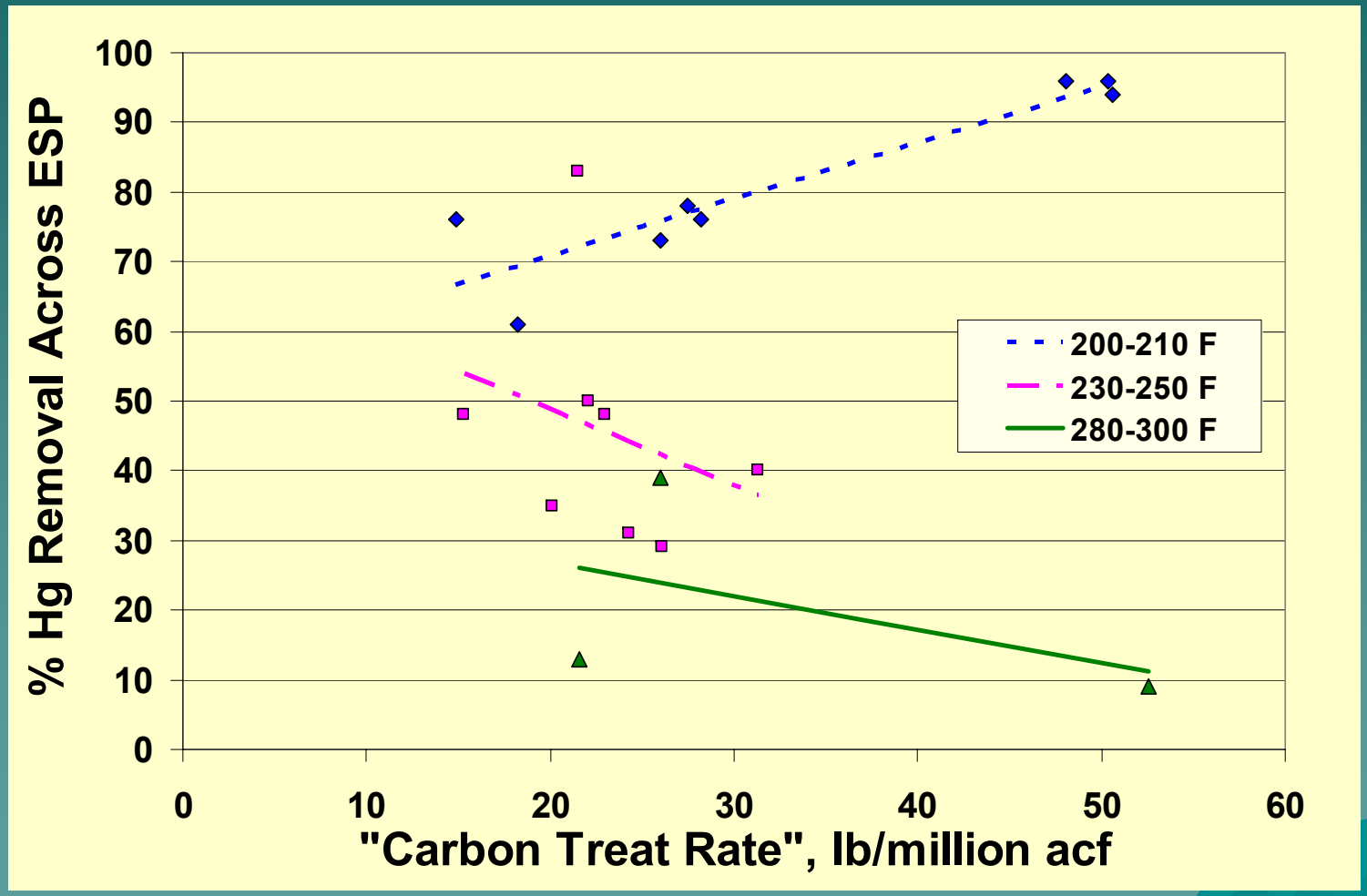


Total Hg Removed
As Temperature Is Reduced
Pilot Plant



Hg Removal Vs “Carbon Treat Rate”

Pilot Plant



Martin's Creek LTMC Project
ESP inlet Duct

Dick Winschel, Director Research Services
4000 Brownsville Rd.
South Park PA 15129
412-854-6683

Roy Scandrol, Business Dev. Mgr.
4000 Brownsville Rd.
South Park PA 15129
412-854-6643