

# Evaluation of Gold MerCAP™ Process for Flue Gas Mercury Removal

Mercury Control Technology R&D  
Program Review Meeting  
July 12-14, 2005



**URS**



NDIC

GREAT RIVER ENERGY<sup>R</sup>  
A Touchstone Energy<sup>®</sup> Cooperative



# Presentation Outline

- **Project Description and Objectives**
- **Host Site 1 (Spray-Dryer Application)**
  - Installation
  - Operation
  - Results
- **Host Site 2 (Wet-Scrubber Application)**
  - Installation
  - Schedule
- **Project Status**
  - Future plans

# DOE/NETL Financial Assistance Programs

- **Evaluation of MerCAP™ Technology**
  - **DE-FC26-03NT41993**
  - Polishing technology - downstream of dry or wet scrubber
  - Six-month flue gas exposure tests
- **Total Program Cost - \$1.73 MM**

# MerCAP™

## Project Objectives

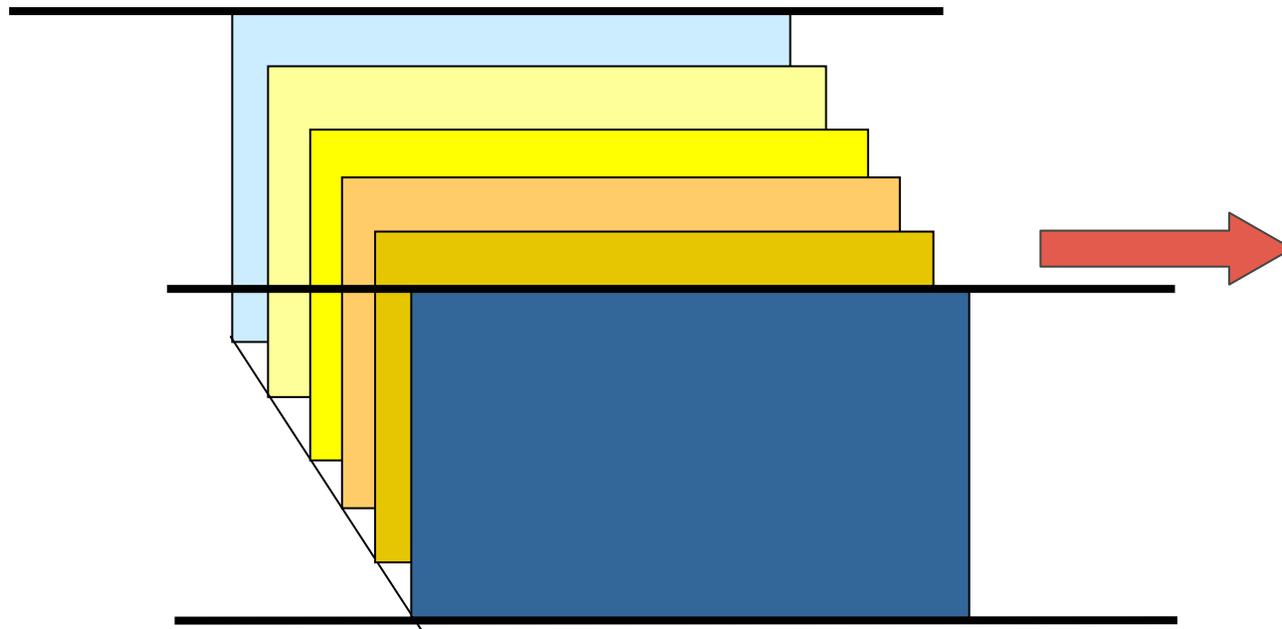
**Evaluate gold MerCAP™ performance in flue gas derived from ND lignite and bituminous coal**

- **Great River Energy Stanton Station**
  - Installed in single compartment of full-scale baghouse
  - 6 MW equivalent (20,000 acfm)
- **Georgia Power Plant Yates**
  - Installed downstream of pilot wet scrubber
  - 1 MW equivalent

# MerCAP™ Basic Concept

(Mercury Control via Adsorption Process)

Parallel plates with  
sorbent-coated surfaces



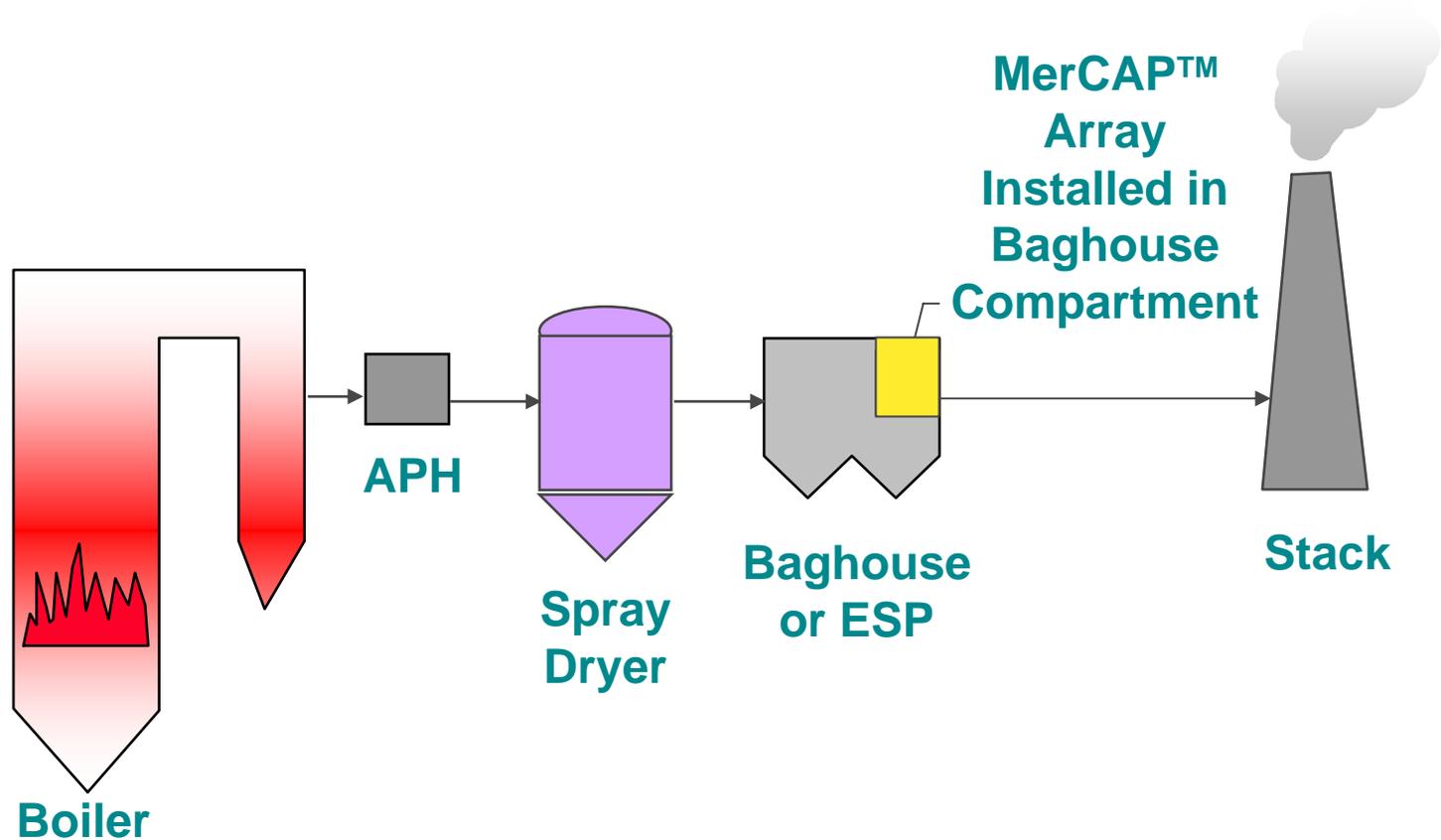
EPRI

# Mercury Control by MerCAP™

## Summary of Previous Results

- **Promising Results Downstream of SD-BH**
  - Hg removal demonstrated for extended period in lignite-derived flue gas
  - Regeneration appears feasible (laboratory tests)
- **High Removal Downstream of Wet FGD Absorber**
  - Demonstrated during short-term tests in scrubbed bituminous flue gas
- **Lower Removal in Unscrubbed Gases**

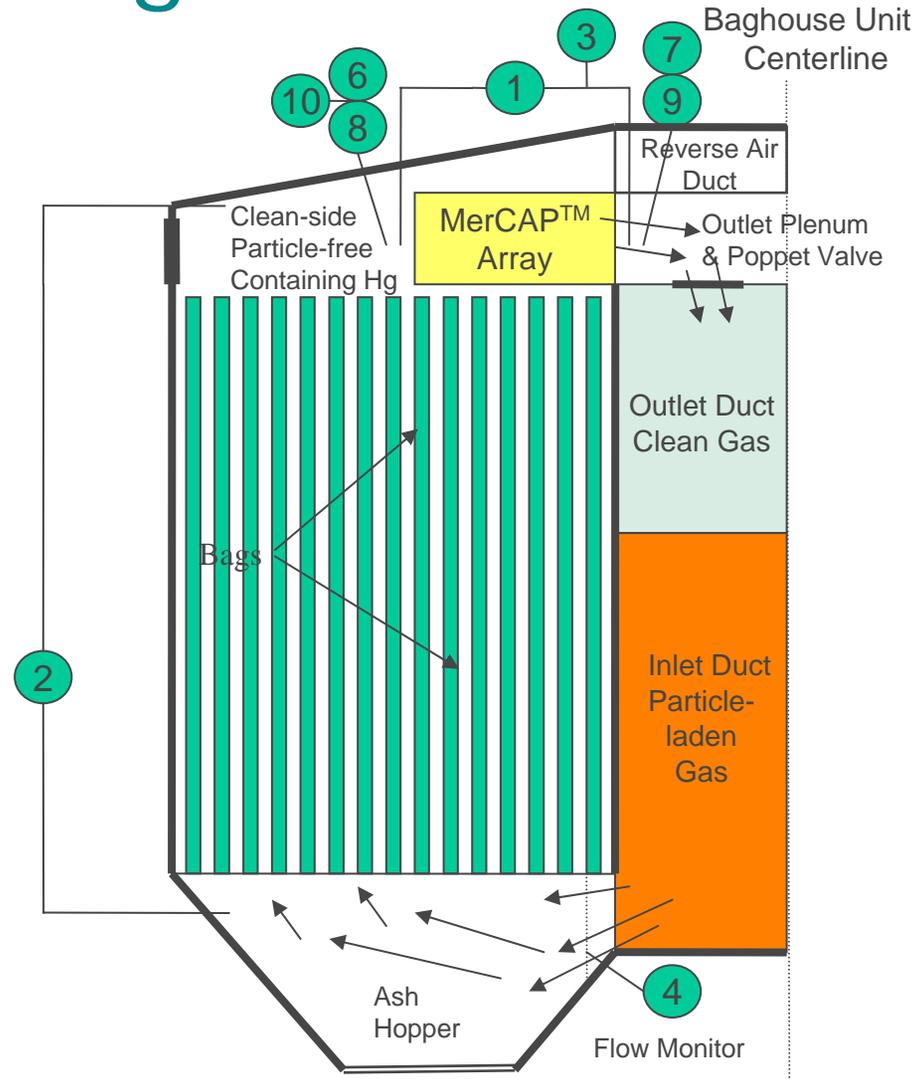
# MerCAP™ Installation - Stanton Unit 10 Baghouse Outlet



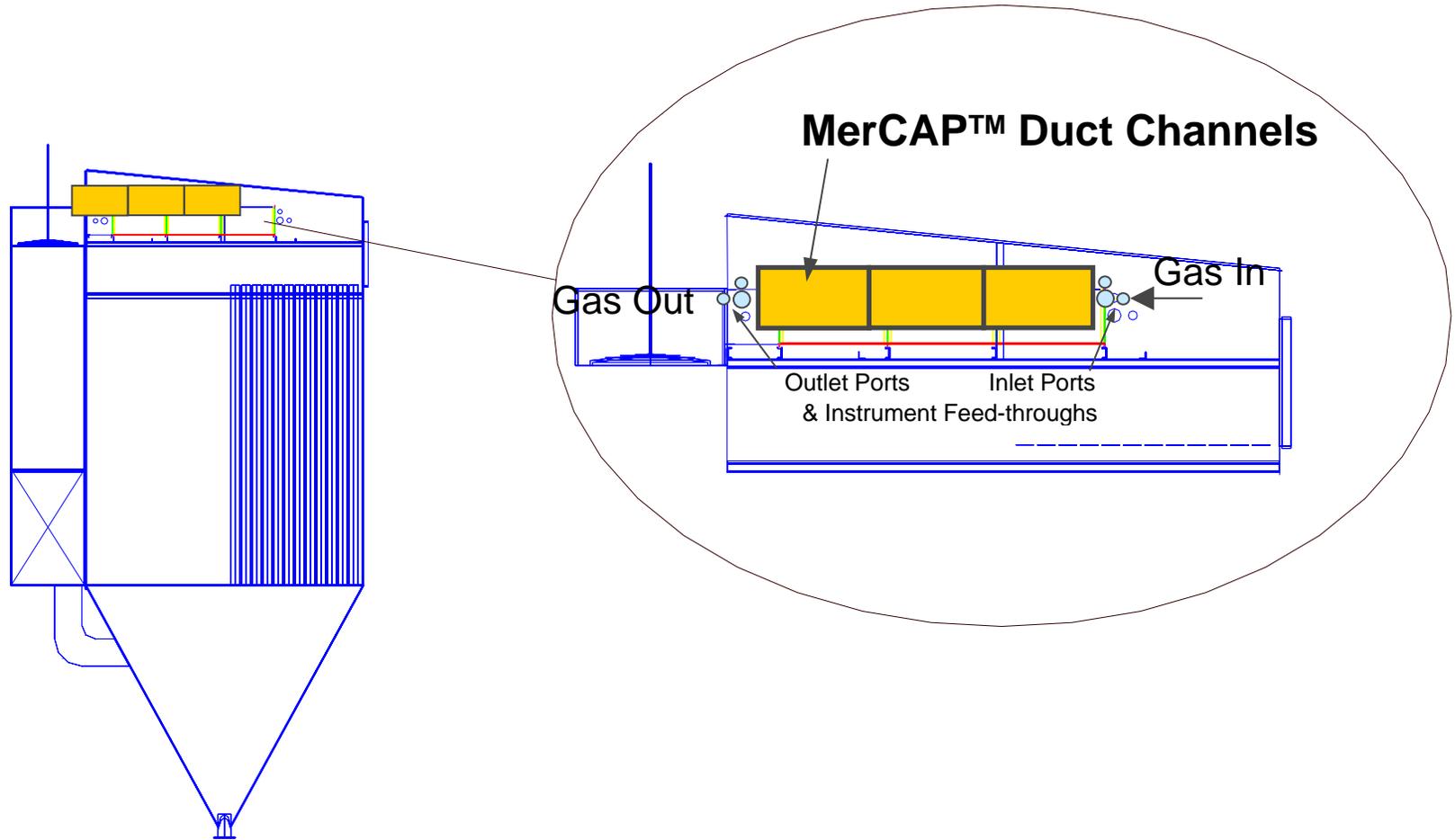
# MerCAP™ Installation - Stanton Unit 10 Baghouse Outlet

## Measurements and Sampling Locations

1. MerCAP™ Array dP
2. Compartment dP
3. Compartment Static Pressure
4. Compartment Flow
5. Adjacent Compartment dP  
(not shown)
6. MerCAP™ Inlet Temperature
7. MerCAP™ Outlet Temperature
8. Inlet MerCAP™ Hg  
Concentration
9. Outlet MerCAP™ Hg  
Concentration
10. HCl Measurement Location



# Baghouse Cross-Section



# MerCAP™ Design Parameters

- **Target Mercury Removal Rate of 55%**
- **10-foot Active Length**
- **1-inch Spacing Between Substrates**
- **25-feet per Second Gas Face Velocity**
- **Expected Pressure Drop of 0.3 inches H<sub>2</sub>O**

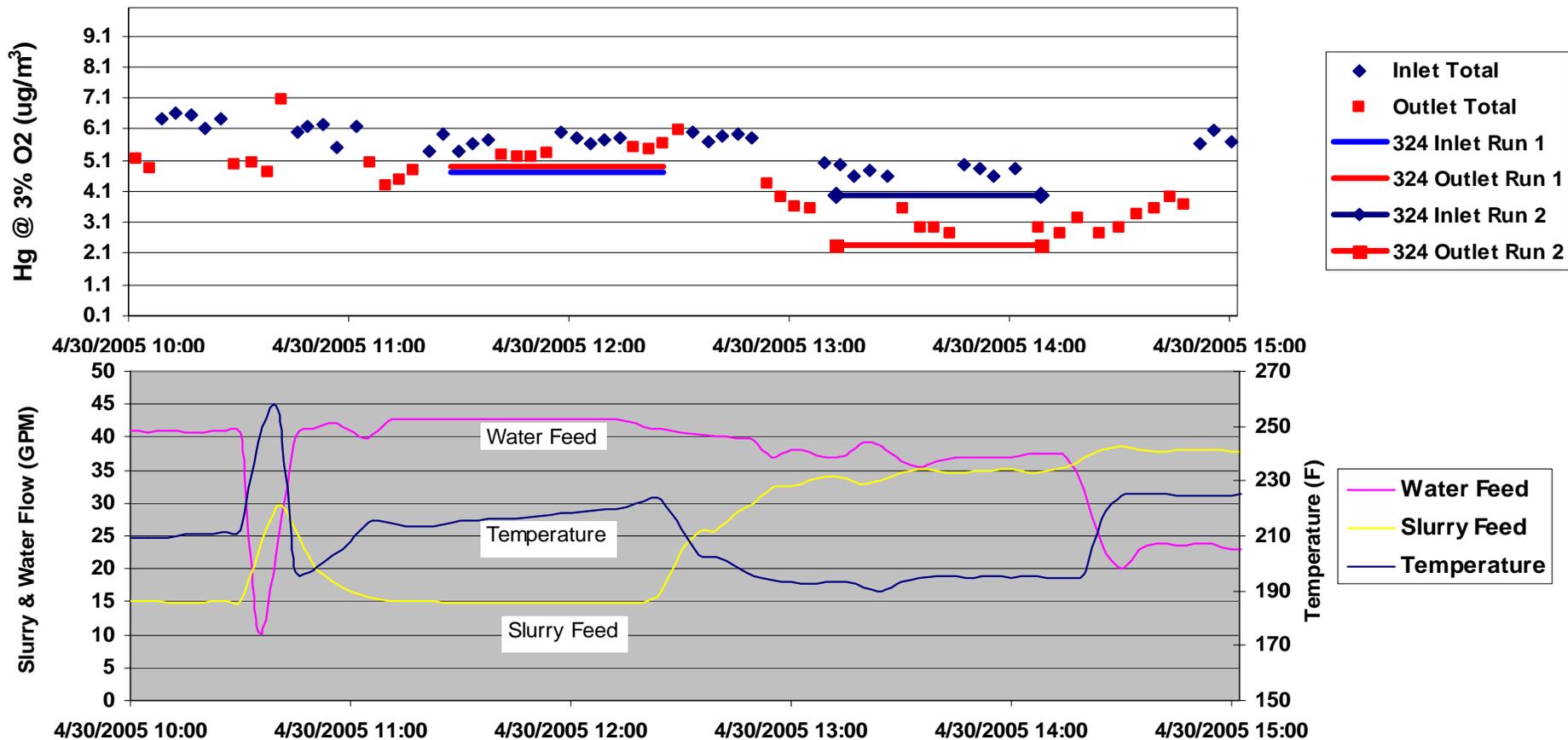
# MerCAP™ Installation - Stanton

## Duct 1 of 4





# Hg Removal Performance related to SD Operation



# Measurement Comparisons

## CEM and Method 324

Run Date	Mercury CEM (ug/nm <sup>3</sup> )			Method 324 (ug/nm <sup>3</sup> )		
	Inlet Total	Outlet Total	Removal (%)	Inlet Total	Outlet Total	Removal (%)
1/25/05	4.29	3.35	22.0	4.56	3.48	23.7
4/30/05 #1	5.73	5.38	6.0	4.71	4.92	-4.6
4/30/05 #2	4.77	3.02	36.7	3.96	2.40	39.4

**4/30/05 #1** was conducted during minimal spray dryer SO<sub>2</sub> scrubbing conditions

**4/30/05 #2** was conducted during optimal spray dryer SO<sub>2</sub> scrubbing conditions

# Measurement Comparisons

## CEM and OH Method

<b>Mercury CEM (ug/nm<sup>3</sup>)</b>			<b>Ontario Hydro Method (ug/nm<sup>3</sup>)</b>		
<b>Inlet Total</b>	<b>Outlet Total</b>	<b>Removal (%)</b>	<b>Inlet Total</b>	<b>Outlet Total</b>	<b>Removal (%)</b>
<b>8.24 (.71)</b>	<b>6.68 (.16)</b>	<b>18.9</b>	<b>8.38 (.61)</b>	<b>7.73 (.57)</b>	<b>7.8</b>

**Value in parenthesis is (Standard Deviation)**

# Regeneration Results

- **Thermal regeneration (3 cycles) conducted on same gold substrate section.**
- **Post regeneration mercury removal performance has been comparable or better than that measured prior to regeneration.**
- **Ten gold substrate modules installed in the full-scale test compartment were subjected to chemical regeneration (acid bath) and demonstrated improved performance when returned to service.**
- **Analysis of acid bath showed minimal loss of gold coating demonstrating this as an alternative regeneration technique.**

# MerCAP™ Status

## Full-scale SD-BH Demonstration Complete

- Over 7000 Hours of Operation
  - 1700 Hours on North Dakota Lignite
  - 5300 Hours on Subbituminous (PRB)
- Removal levels ranging from 65%-5%
- Removal performance demonstrated wide variability. The primary identified variable is slurry feed to the scrubber unit indicating a possible acid gas constituent or concentration level that limits or degrades the Hg capture performance.
- Non-ideal operating conditions do not cause permanent degradation of the gold substrate.

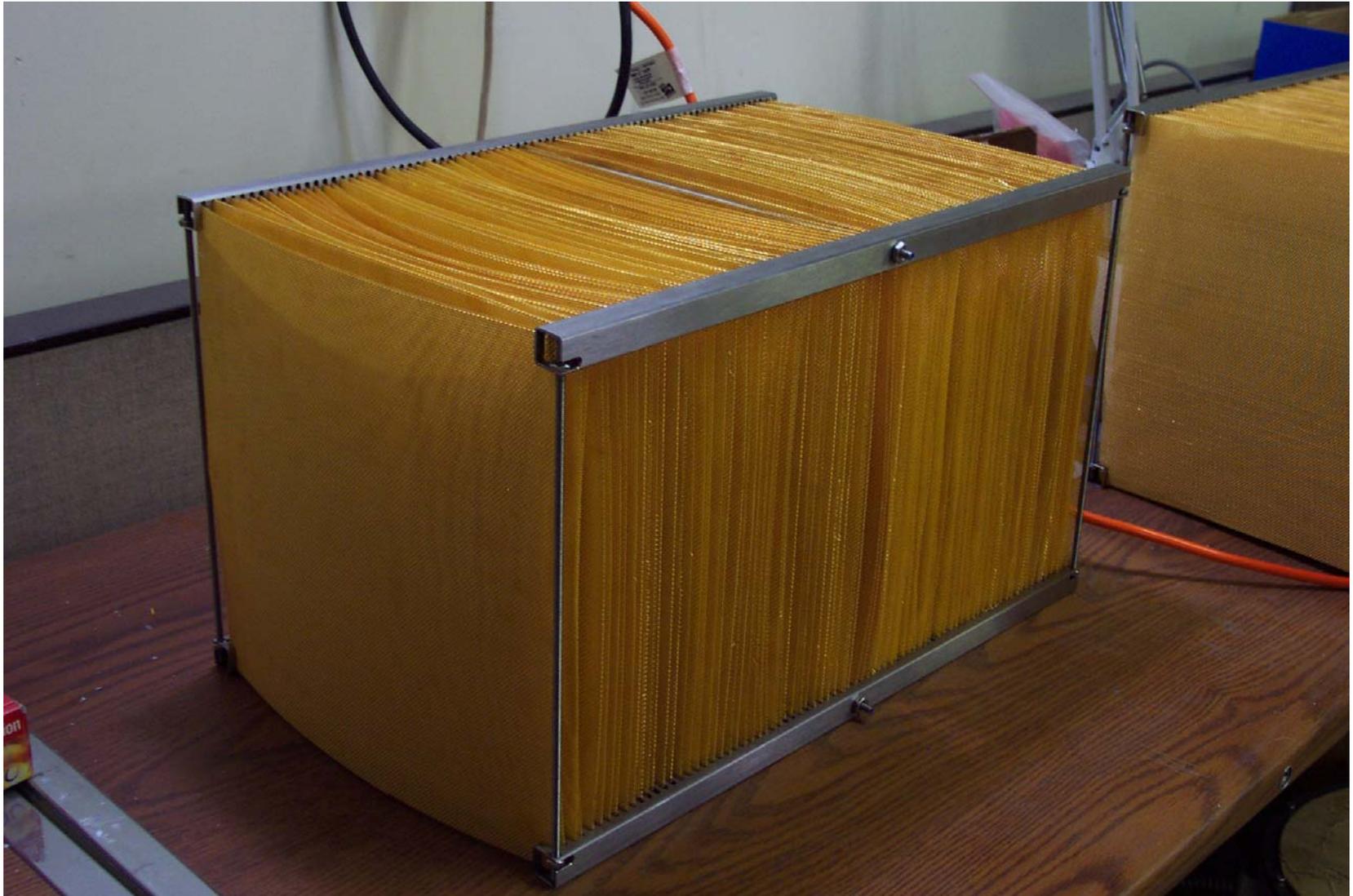
# MerCAP™ Installation-Plant Yates Southern Company Pilot Unit



# MerCAP™ Test Setup for Wet Scrubbers



# MerCAP™ Screen Module



# Plant Yates Proposed Schedule

- **Installation in August 2005**
- **Initial Startup in September 2005**
- **Planned Operation for 6 Months**
  - Plant outage scheduled for Oct. 1 – Nov. 20
  - Unit will be isolated during outage and restarted in November

# MerCAP™ Status

## **Wet Scrubber Demonstration**

- Installation August 2005
- Demonstration thru Fall/Winter of 2005/2006

# Mercury Control by MerCAP™

- **Information Needed to Further Determine MerCAP™ Applicability**
  - Better identify / establish relationship of interferents
  - Investigate alternative amalgamation coatings
  - Improve overall removal efficiencies (>70%)
- **Economic Analysis**
  - Full-scale regeneration costs (thermal/chemical)
  - Optimize geometry for retrofits
  - Gold integrity - Substrate life