



*GE Power  
Systems*

# **Preliminary Field Evaluation of Mercury Control Using Combustion Modifications**

**DOE Contract No. DE-FC26-03NT41725**

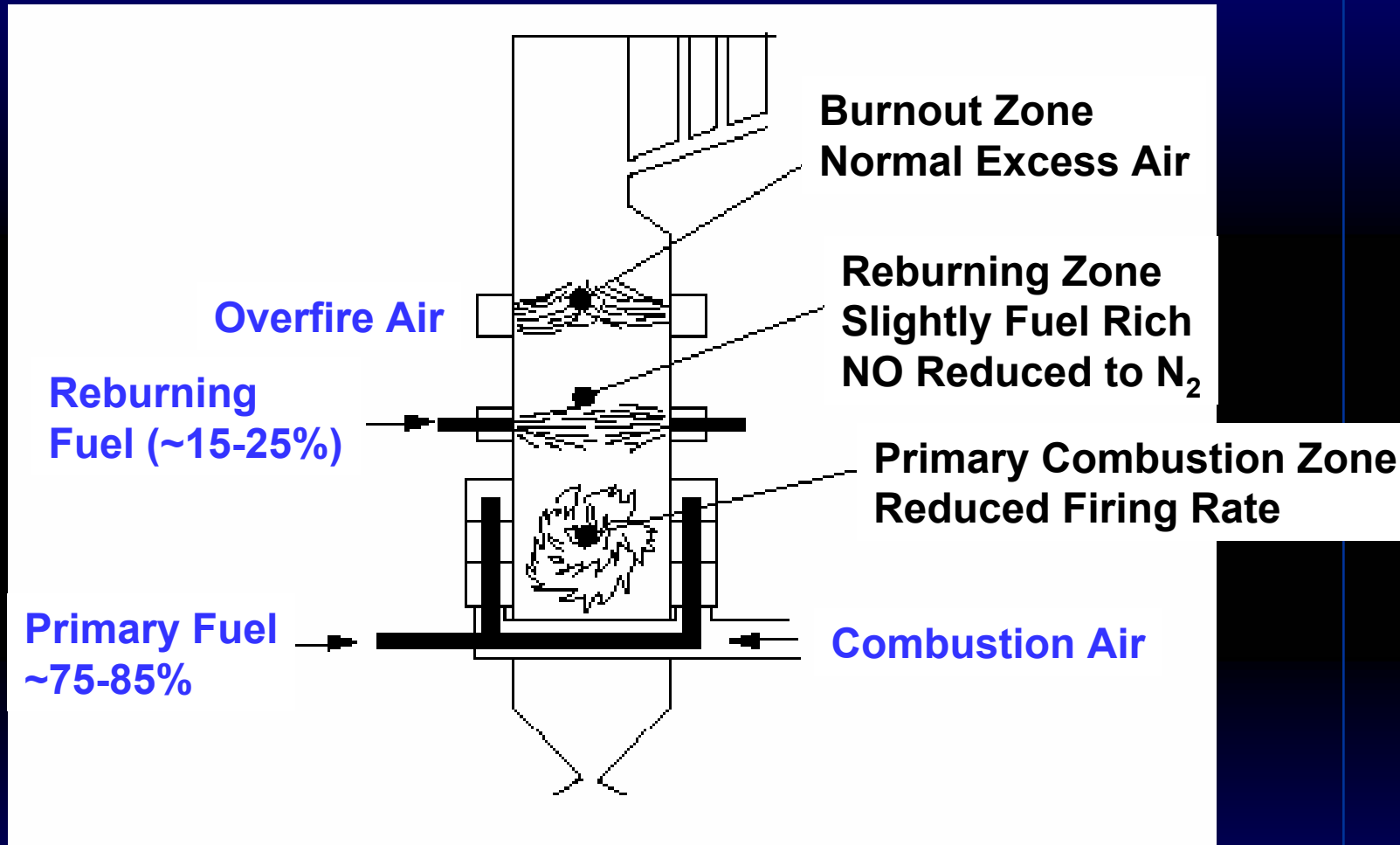
**Energy and Environmental Research  
Irvine, CA**

***Mercury Control Technology  
R&D Program Review Meeting  
Pittsburgh, PA  
August 12-13, 2003***

# NO<sub>x</sub>/Mercury Control at Green Station

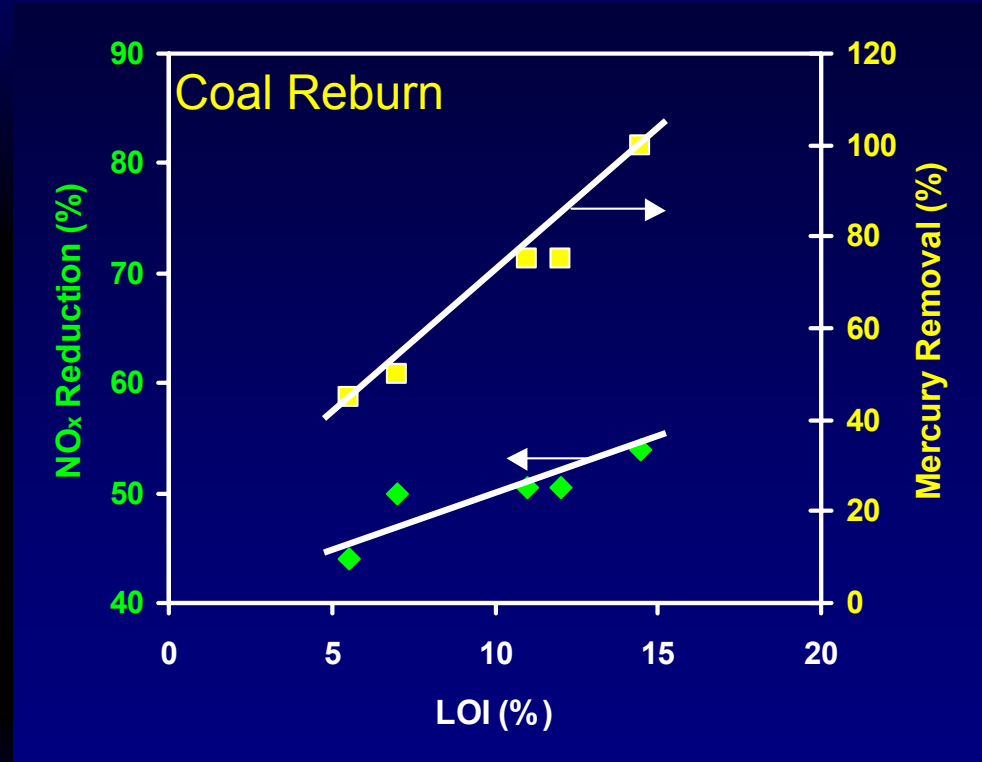
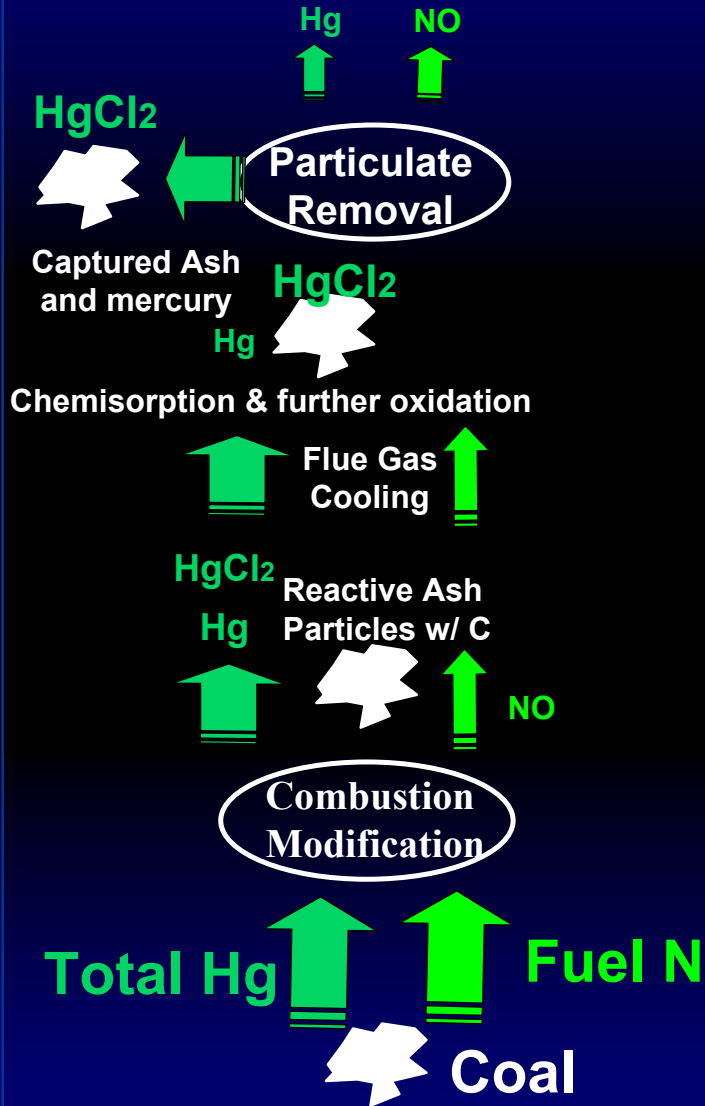
<b><u>Objective:</u></b>	<b>Preliminary evaluation of Hg/NO<sub>x</sub> control via coal reburning</b>
<b><u>Location:</u></b>	<b>Green Station Unit 2 near Henderson, Kentucky</b>
<b><u>Unit:</u></b>	<b>250 MW wall-fired</b>
<b><u>Equipment:</u></b>	<b>ESP and wet scrubber</b>
<b><u>Fuel:</u></b>	<b>blend of bituminous coals</b>
<b><u>Period:</u></b>	<b>January 2003 – July 2004</b>

# Application of Coal Reburn to Green Unit 2



The design of the reburning fuel and overfire air injectors must provide rapid mixing of the reburning fuel and the overfire air in order to maximize emissions control and to minimize unburned carbon and carbon dioxide emissions

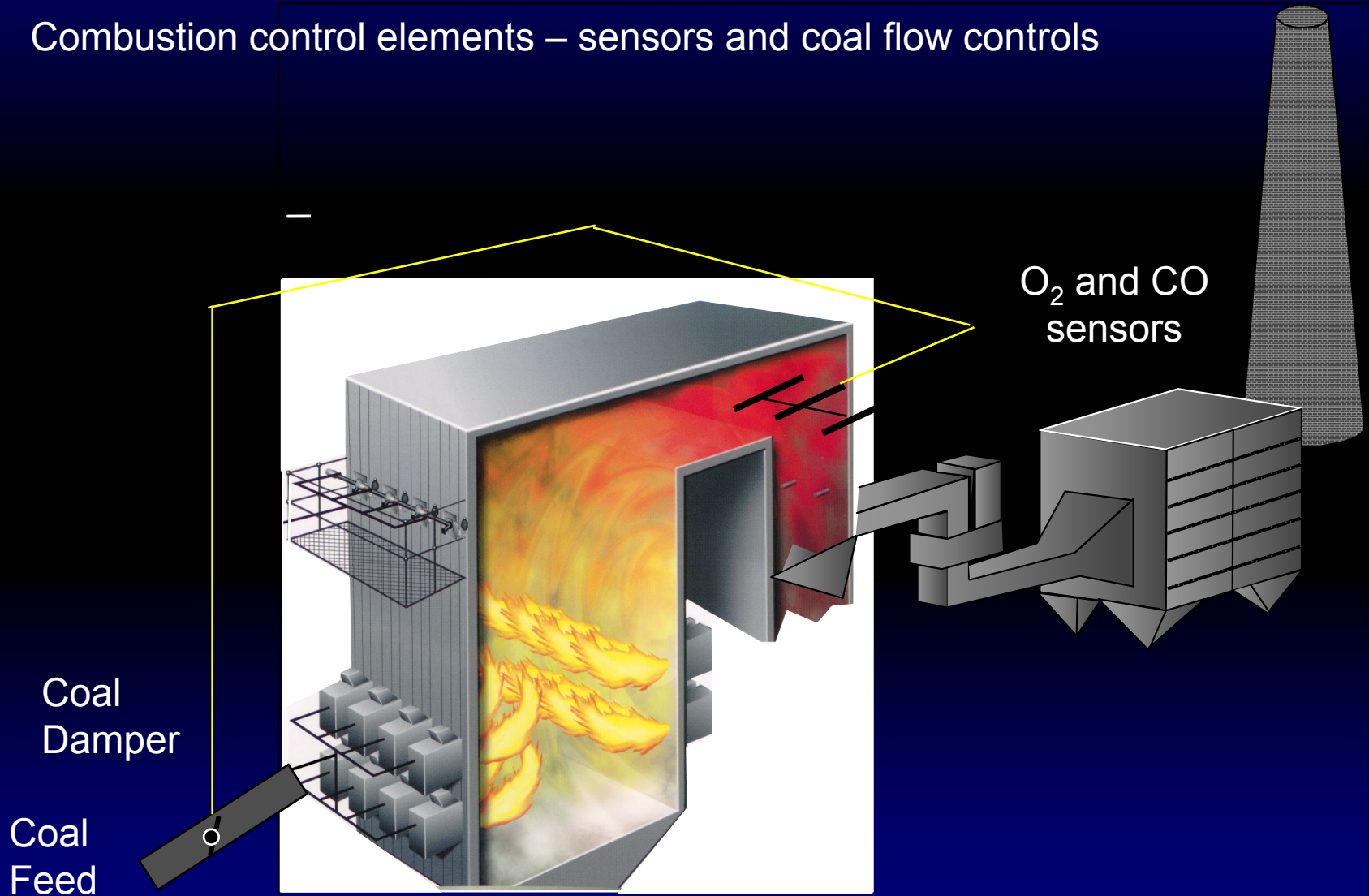
# Coal Reburn for NO<sub>x</sub> and Mercury Control



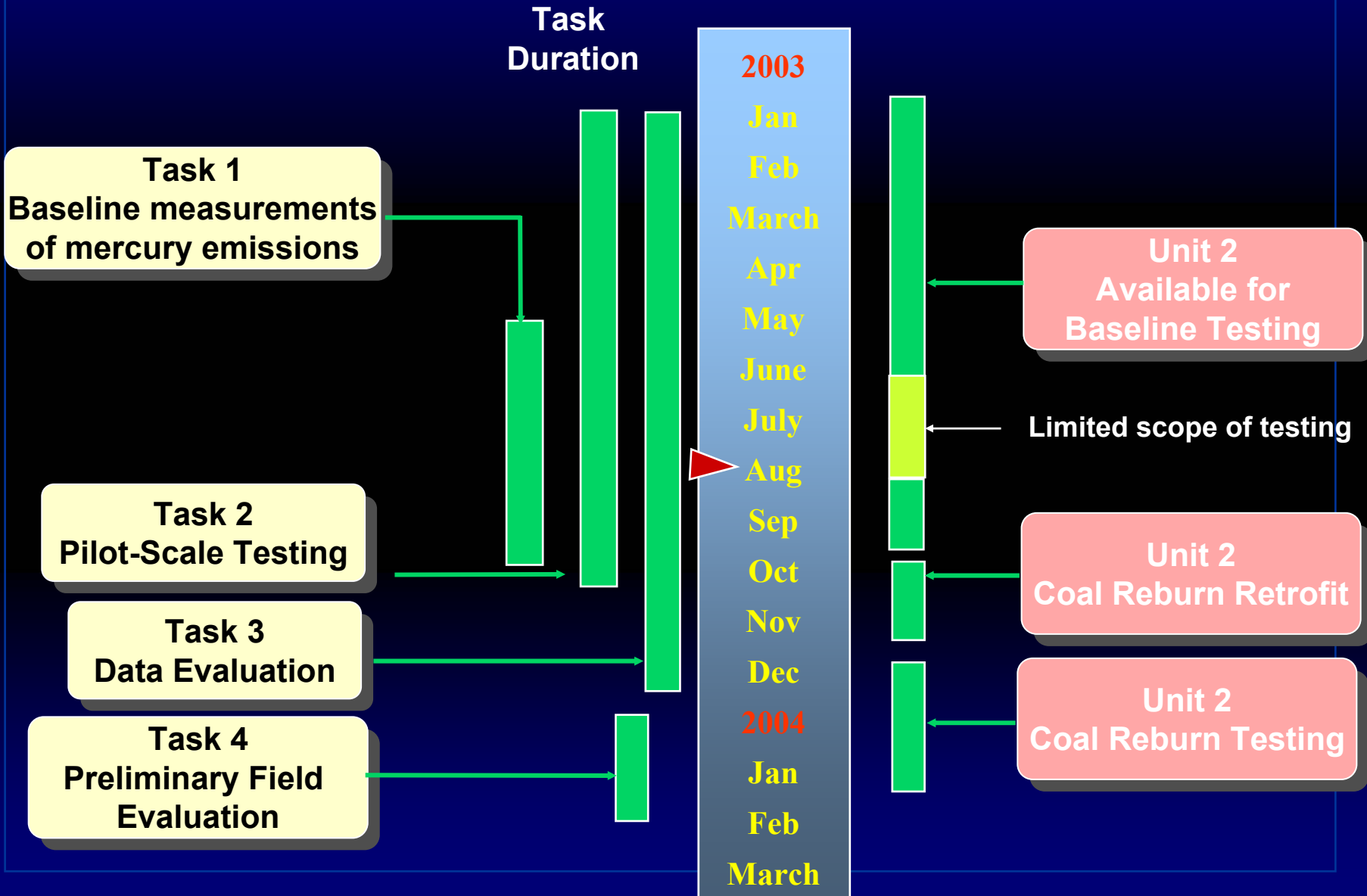
**Combustion Optimization Improves Mercury and NO<sub>x</sub> Control**

# Combustion Control In Unit 2

Combustion control elements – sensors and coal flow controls



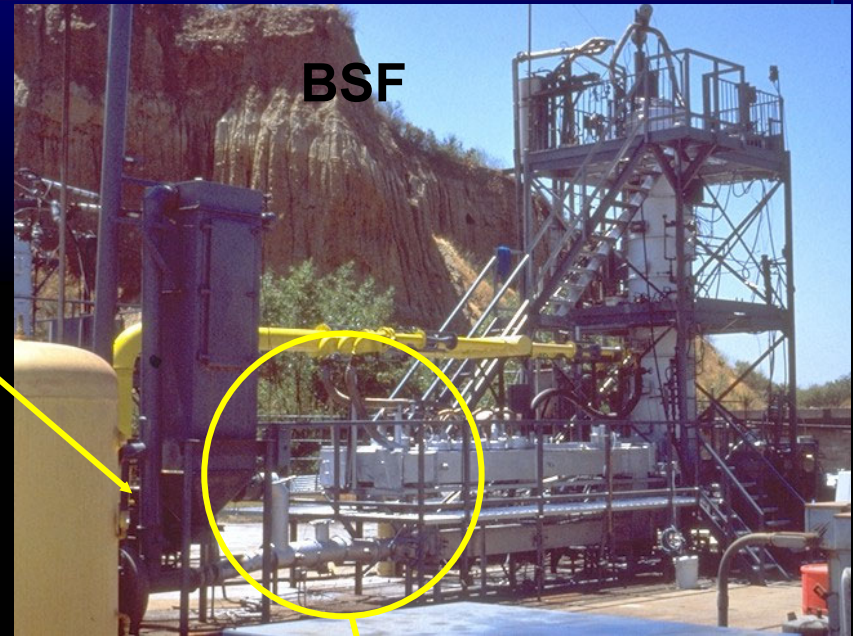
# Schedule of the Mercury Control Program



# Coal Mercury Evaluations Prior to Green Project

- One MMBtu/hr (300kW) Boiler Simulator Facility (BSF)
- Simulation of combustion conditions and time-temperature profile in a full-scale utility boiler
- Pilot-scale ESP and Fabric Filter
- Test variables include combustion conditions, coal type and coal blending

**Sampling Probe**



**Analyzer**



**Speciation Modules**



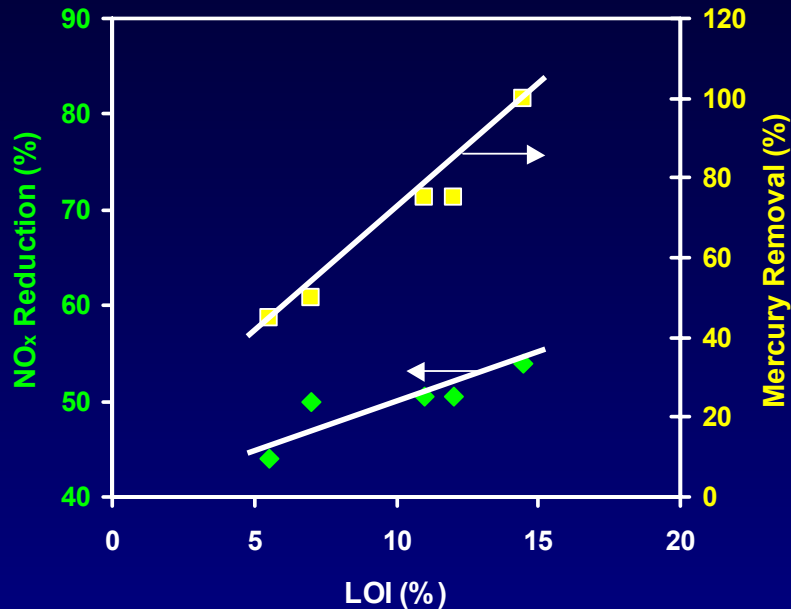
# Mercury Analysis

- **Online Hg analyzer from PS Analytical (The Sir Galahad II)**
  - » Atomic fluorescence
  - » Wet chemical converter
  - » Elemental and total mercury
  - » Two channels (ESP inlet and outlet)
- **Inertia probe for fly ash separation**
- **Manual methods**
  - » EPA method PRE-003 (Ontario Hydro)
  - » EPA method 101A
- **Mercury in coal and fly ash**
  - » Total concentration
  - » Leachable (TCLP)

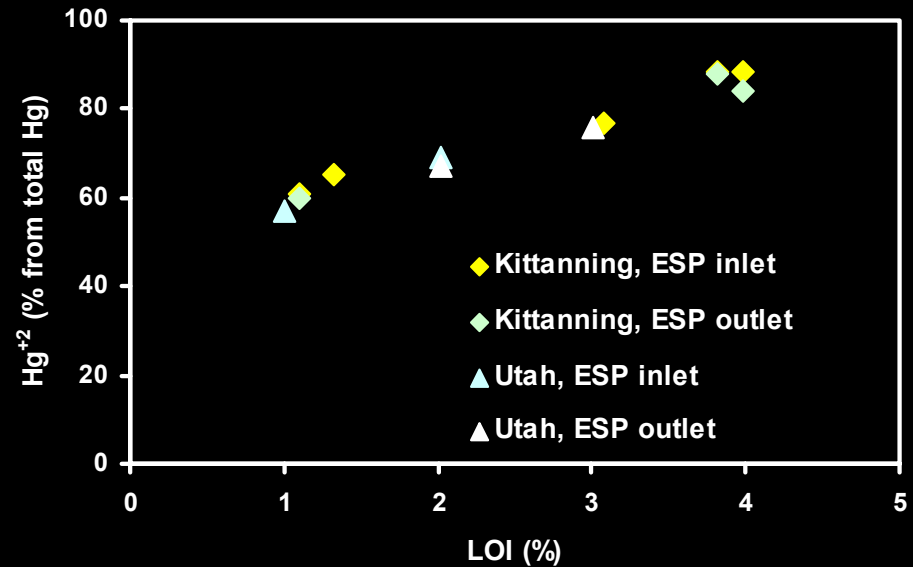


# EER Pilot-Scale Data for Bituminous Coal

## Mercury Removal



## Mercury Speciation



- ❑ 60-70% mercury removal across ESP
- ❑ Up to 100% mercury removal with ESP and wet FGD

# Parameters Affecting Mercury Removal

## Efficiency of Mercury Removal depends on:

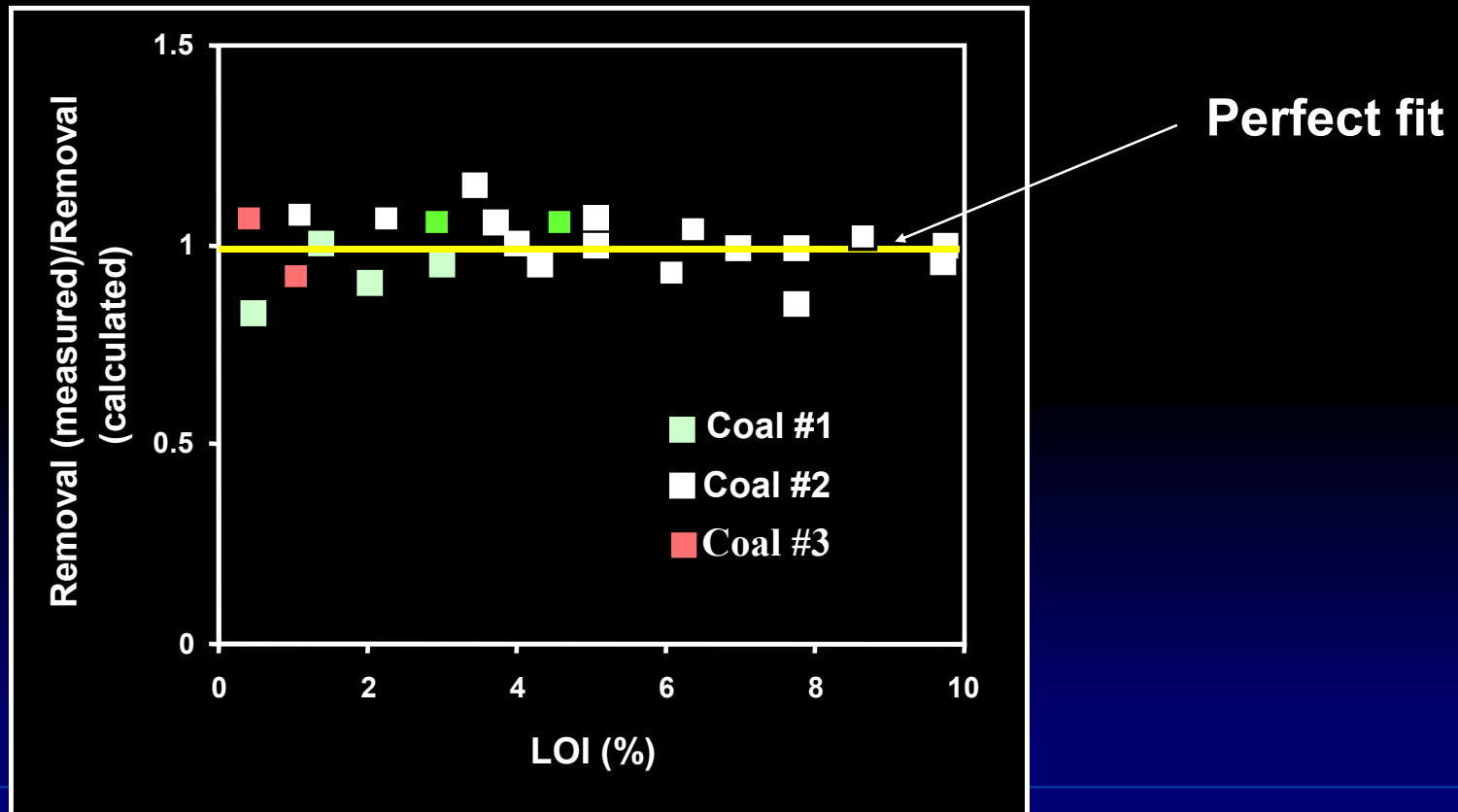
- Coal type
- Coal composition (Cl, alkali, Ca, S, volatility, mineral matter)
- LOI
- Particulate control device (PCD)
- Temperature in PCD
- Combustion conditions
- SO<sub>2</sub> control equipment

Control Parameter	Target	Before Retrofit	After Retrofit
LOI	$\geq 8$	4 – 15	9 – 12
ESP Temperature	$\leq 360$ F	330 F	330 F

# Engineering model

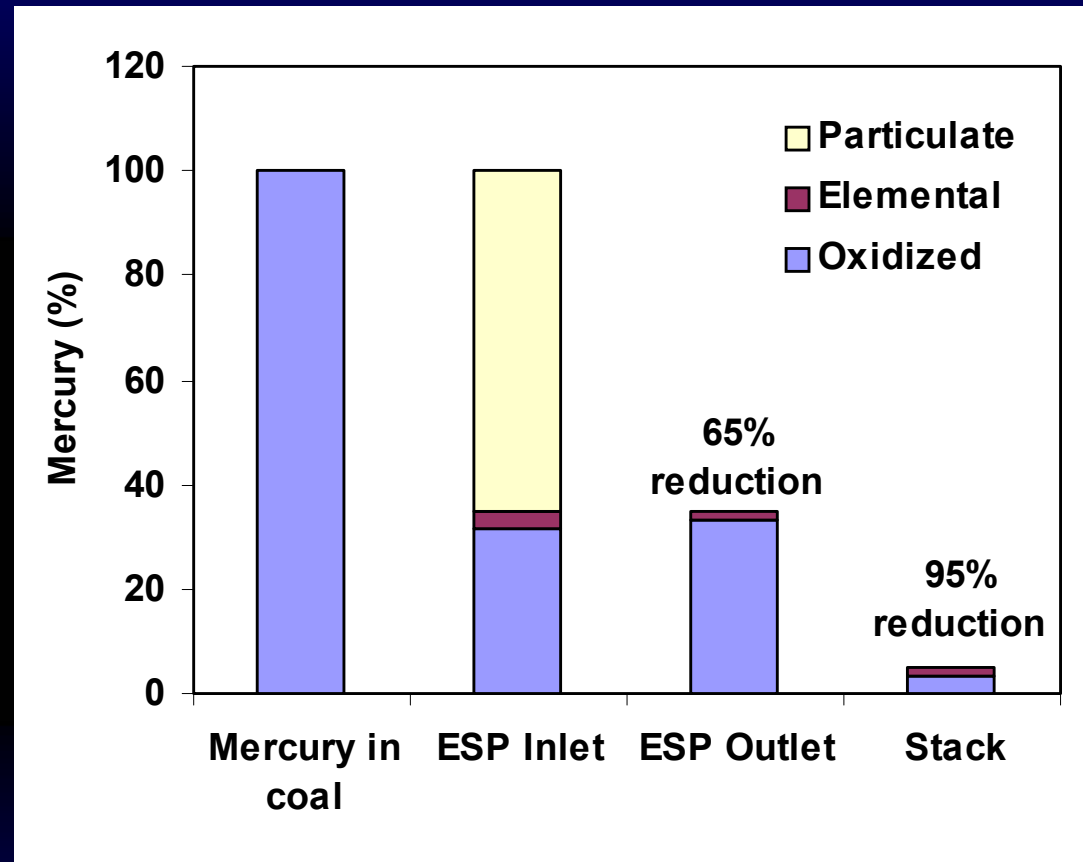
Hg emissions are predicted as function of:

- Coal properties (Cl, S, volatility)
- LOI
- ESP temperature



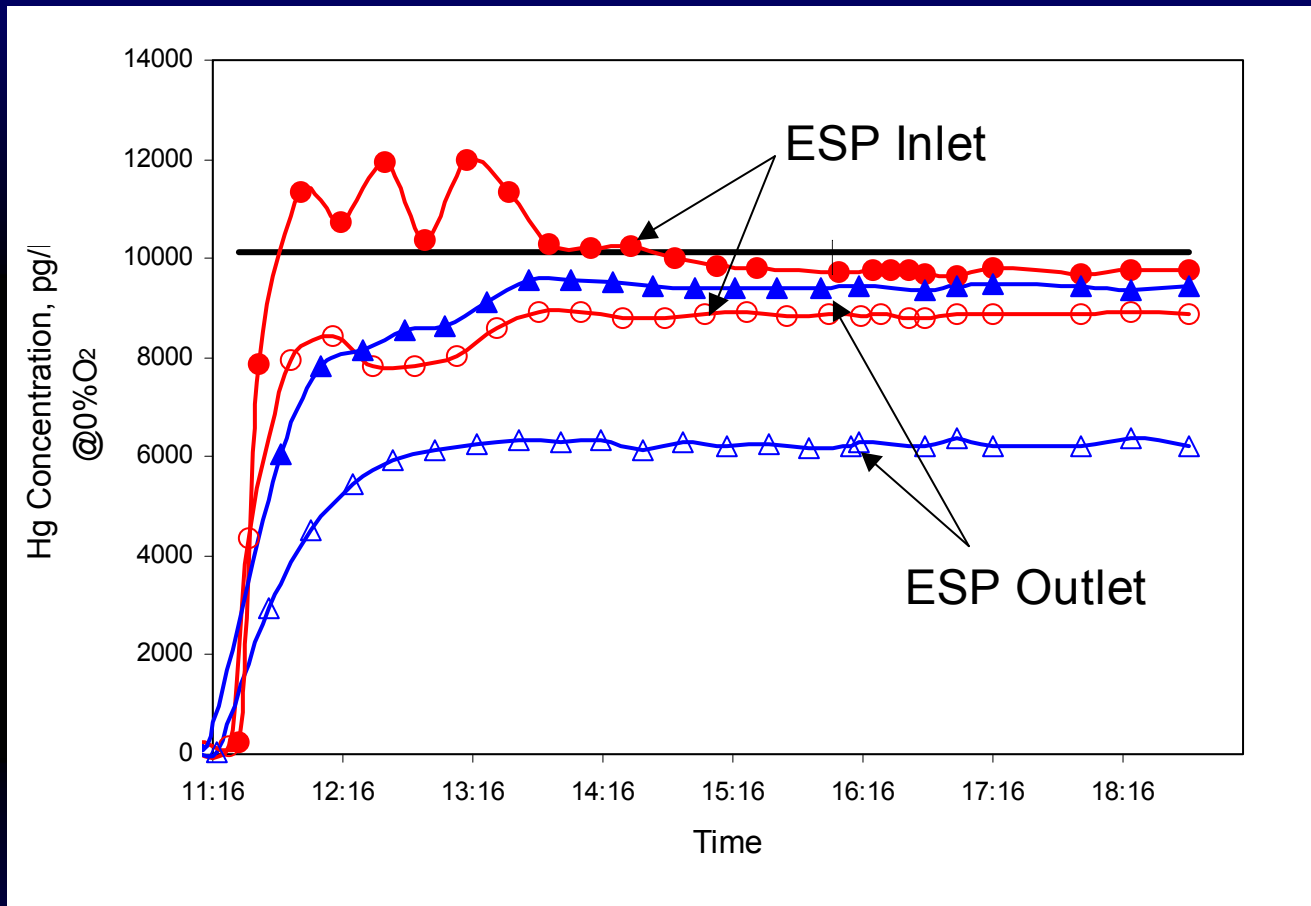
# Predictions for Green Unit 2

LOI=9%  
 $T_{ESP}=330\text{ }^{\circ}\text{F}$



**About 65% mercury reduction across ESP**  
**About 95% mercury reduction at stack**

# Mercury CEM and Inertia Probes



- Calibration of inertia probes
- Cleaning of inertia probes

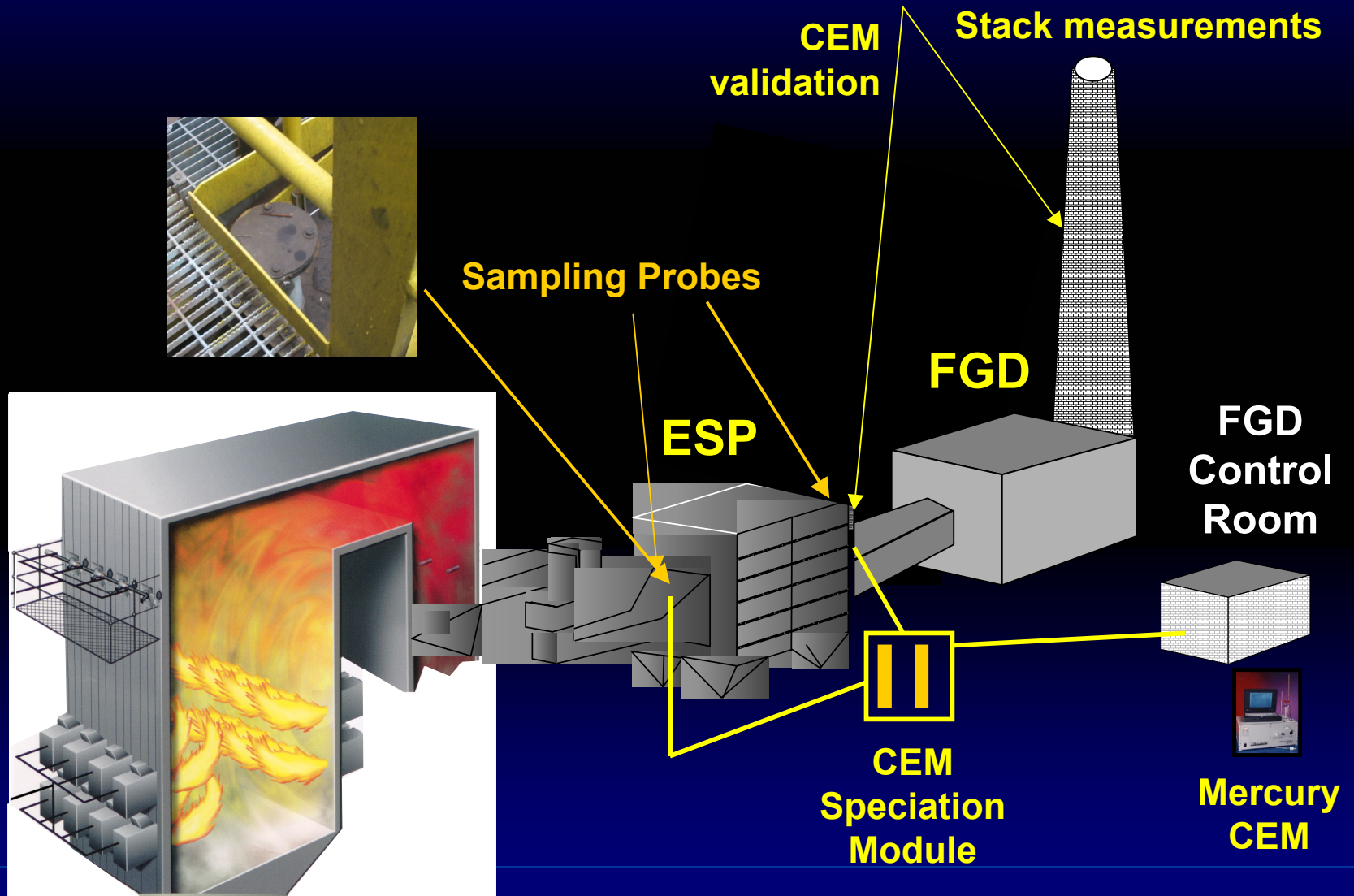
# Baseline Measurements of Mercury Emissions in Unit 2

## Goals:

- ❑ Measure mercury emissions before reburn retrofit
  - Stack emissions
  - Emissions after ESP
- ❑ Determine effect of fuel on mercury emissions
- ❑ Determine effect of ESP temperature

# Baseline Mercury Measurements

## Modified Ontario Hydro



- ❑ **Several meetings between EER and WKE to discuss mercury program were held**
  - **Program schedule defined**
  - **Test matrix for baseline measurements finalized**
- ❑ **Two channel Sir Galahad PSA mercury analyzer and sampling probes from Baldwin Environmental have been purchased and tested**
- ❑ **Vendors for Ontario Hydro mercury sampling were contacted**
- ❑ **Team structure for field measurements finalized**
- ❑ **Preparation for field measurements are in progress**
- ❑ **Preparation for pilot-scale testing is in progress**



# Contact Information

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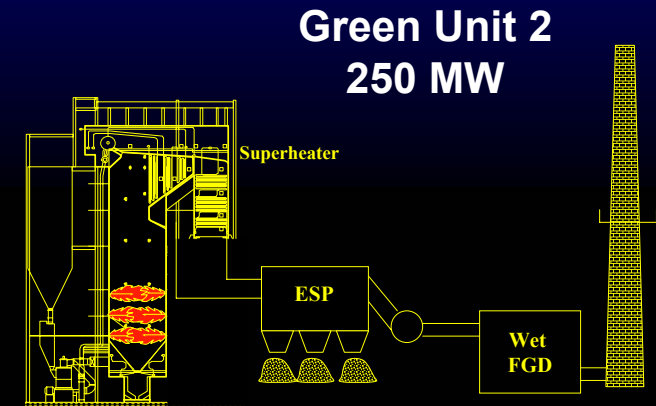
# Project Structure

300 kW Combustor



Task 1  
Field Measurements

Task 2  
Pilot-Scale Testing

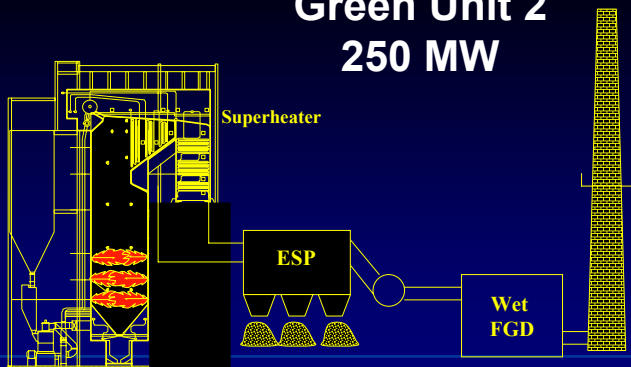


Green Unit 2  
250 MW

Task 3  
System Design



Green Unit 2  
250 MW



Task 4  
Preliminary Field  
Evaluation