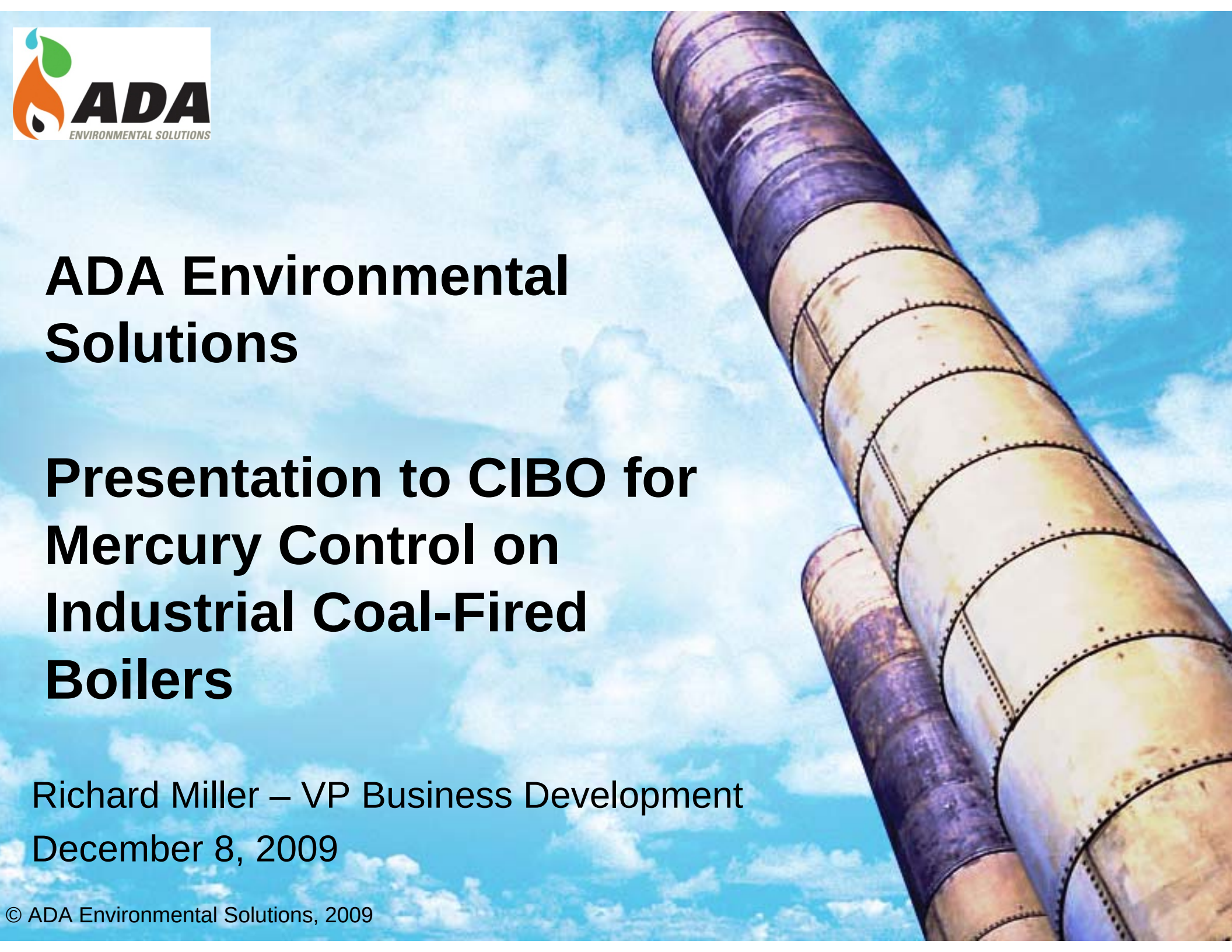


ADA Environmental Solutions

Presentation to CIBO for Mercury Control on Industrial Coal-Fired Boilers

Richard Miller – VP Business Development

December 8, 2009

Who Is ADA?

Technology Development And Services

Mercury Measurement
Mercury Control
Flue Gas Conditioning
Beneficial use of Ash
Clean Coal Additives
CO_2 Capture

Emission Control Systems

Mercury Control (ACI)
SO_3 Management
Flue Gas Conditioning

Activated Carbon

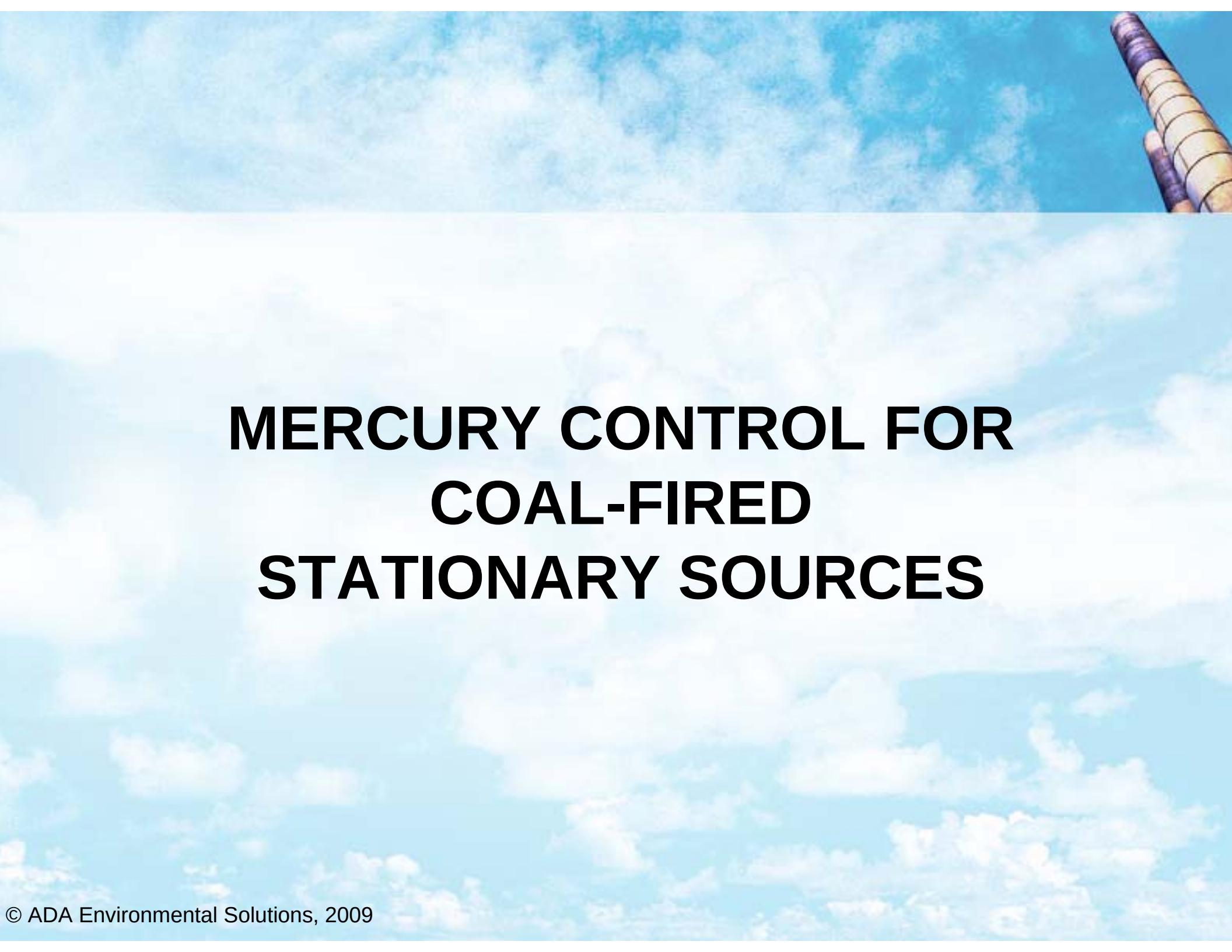
Interim Processing
Production Facilities
Logistics

*ADA **develops and commercializes innovative technologies** to sustain the viability of coal as a critical national resource.*

(NASDAQ: ADES)

New Activated Carbon Production

- Building largest AC plant(s) to date
- First line will produce approx.150+ MPY
- Permitted for two lines or 350 MPY
- Under construction and on schedule
- Red River, LA plant startup target: mid-2010
- Currently processing and shipping carbons (up to 60 MPY) from interim facility in LA.



MERCURY CONTROL FOR COAL-FIRED STATIONARY SOURCES

New Drivers for Mercury Control

- Power Generation:
  - o EPA Section 112 MACT or legislation by congress, 90% control expected
- Cement Kilns:
  - o New rule proposed by EPA
    Reduction target of 11,600 lbs (81%)
- Industrial Boilers:
  - o Promulgation scheduled for December 2010
    70 to 80% control expected

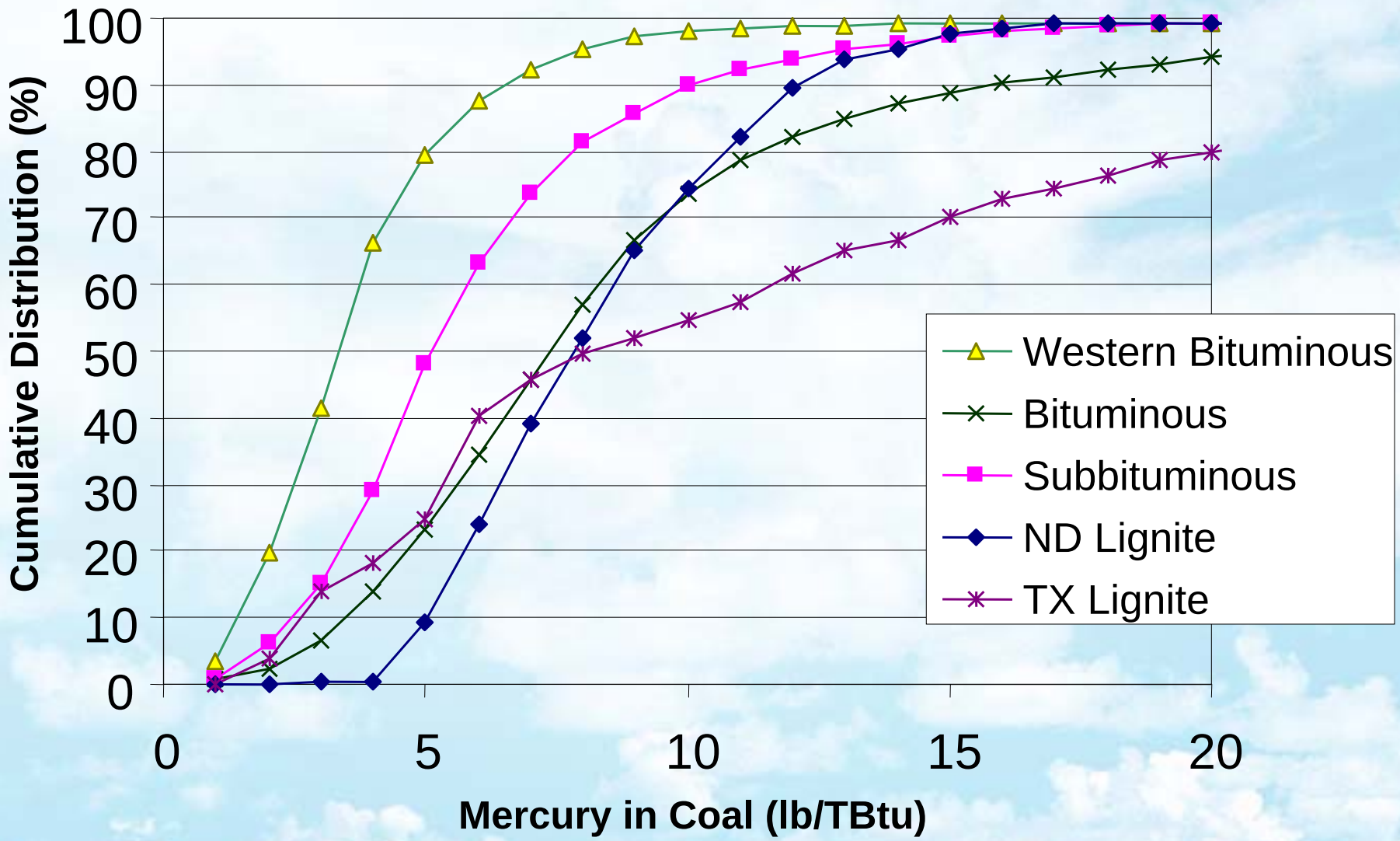
Factors Affecting Native Mercury Removal

- Coal Type
  - Halogen content (Cl, Br, other)
  - Sulfur content
- Flue Gas
  - Acid Gases (HCl, SO_2, SO_3)
  - Gas Temperature
  - Unburned carbon (LOI)
- Emission Control Equipment

Typical Emission Controls

- Particulate Matter
  - Fabric filters, ESP
- Acid gases (HCl, SO_2)
  - Scrubbers (wet or dry)
- NOx
  - LNB, SCR, SNCR

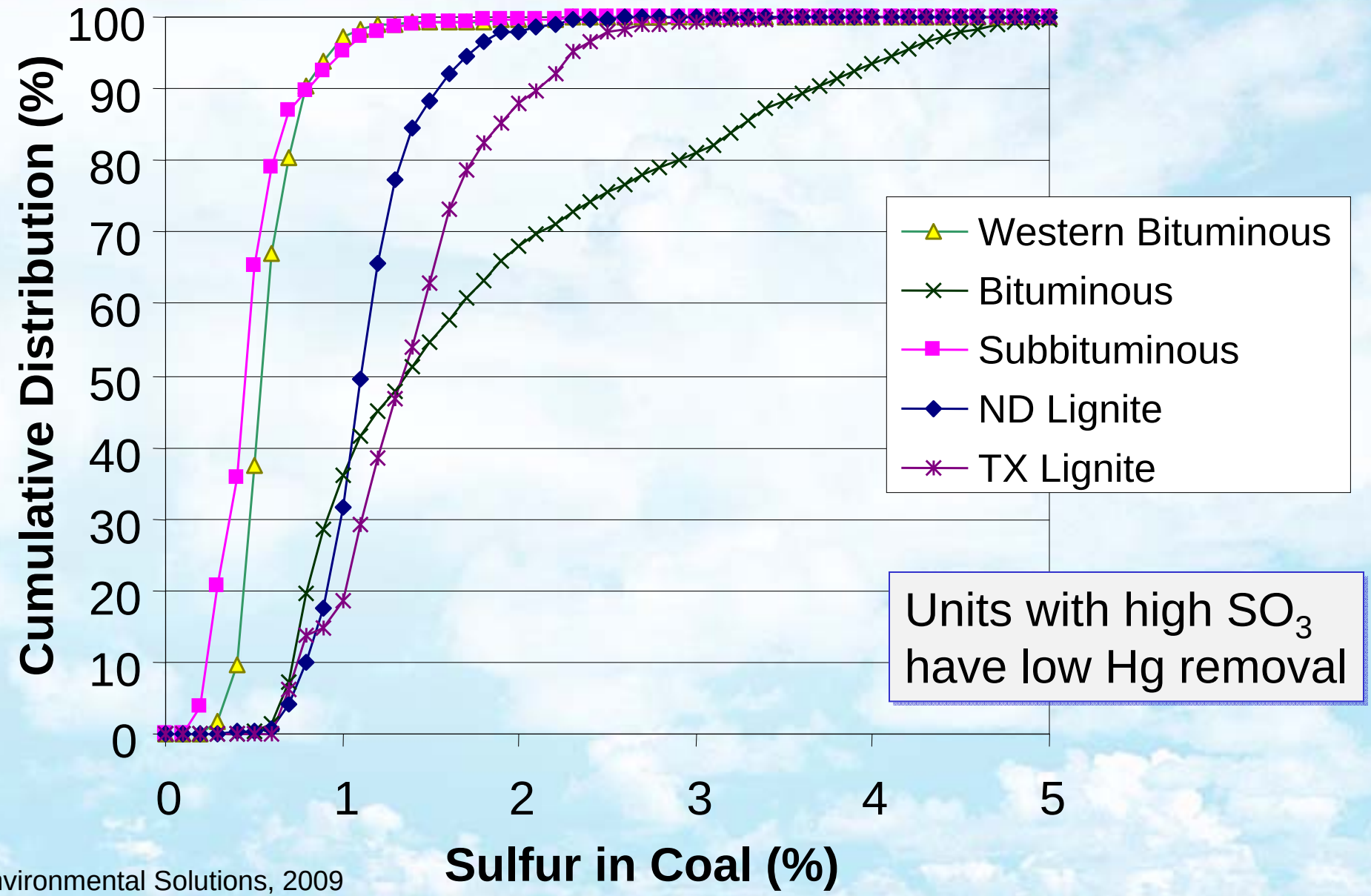
Distribution of Mercury in Coals



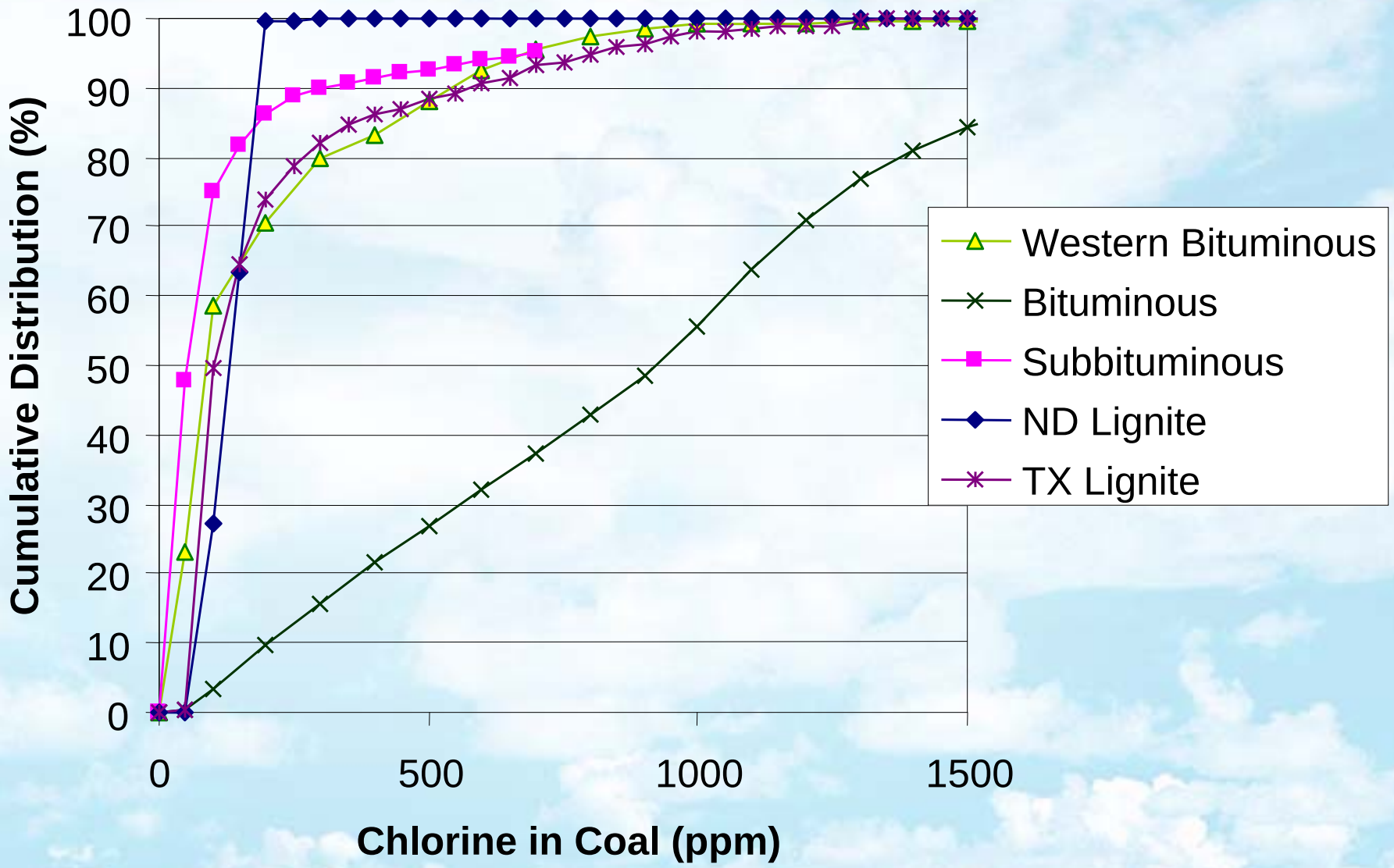
Mercury Fundaments: Speciation

- Mercury forms into different species in the boiler
  - Elemental mercury
  - Non-elemental mercury
- We cannot identify different forms of non-elemental Hg
- The amount of non-elemental mercury depends on:
  - Coal chemistry
  - Equipment characteristics (exposure to catalytic surfaces)
    - For example, tubular APH seem to have greater percentages of non-elemental Hg than rotary APH
  - Increases as the gas moves downstream
- Some of the non-elemental mercury can be removed in a wet scrubber while other forms pass through scrubbers

Distribution of Sulfur in Coals



Distribution of Chlorine in Coals



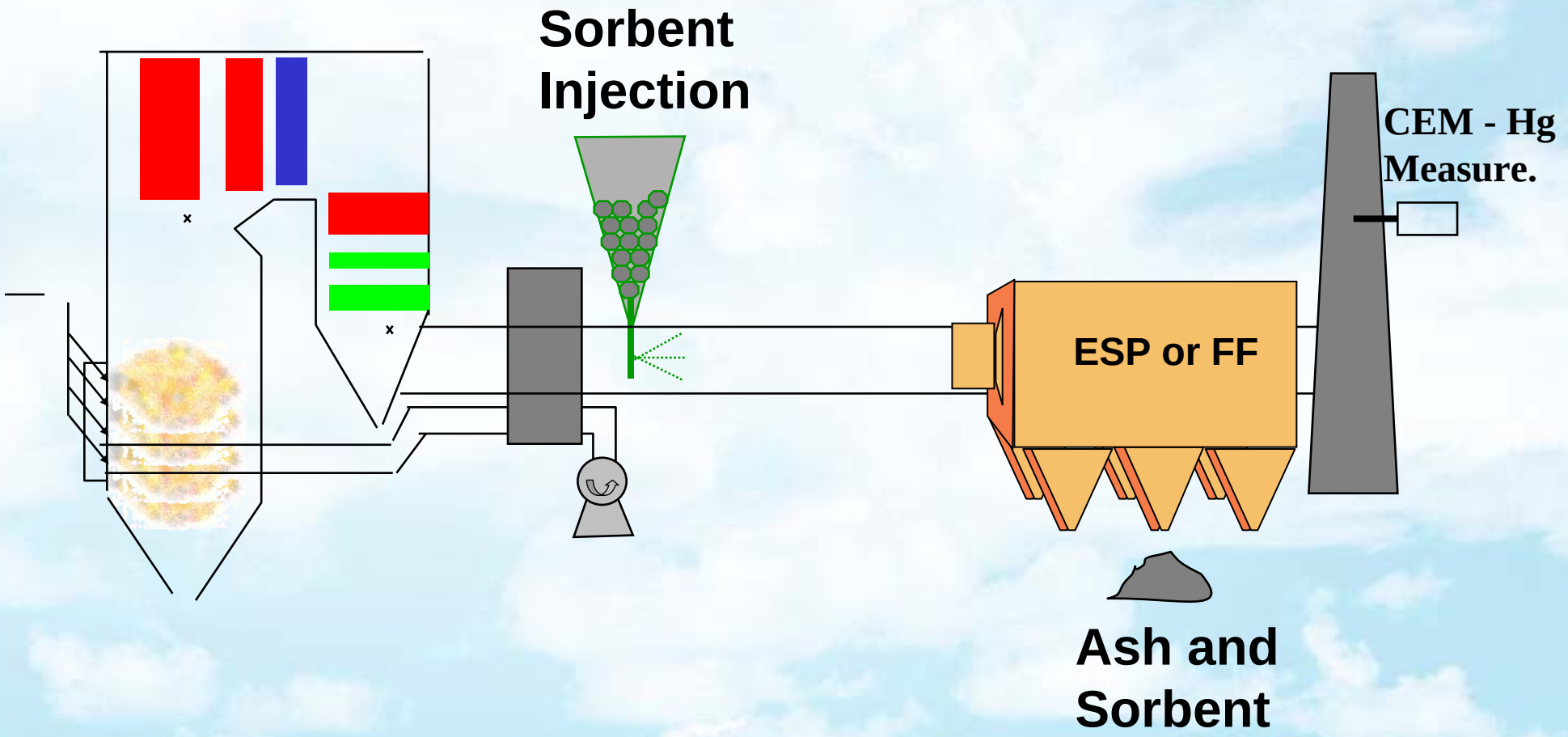
Control of Mercury in Wet FGD Scrubbers

- Oxidized Mercury is water soluble and can be captured in wet scrubbers
  - ~70 to 90% typically removed
  - Some captured mercury gets re-emitted
- Elemental mercury cannot be captured by scrubbers

Unburned Carbon (LOI) and Mercury Removal

- LOI can be effective at removing mercury
  - LOI properties and capture can vary with changes to process conditions
  - LOI has a capacity for mercury that is ten to a hundred times lower than activated carbon
- Effectiveness of LOI suffers from SO_3 in flue gas

Activated Carbon Injection Technology for Controlling Mercury Emissions



Powdered Activated Carbon Specifications

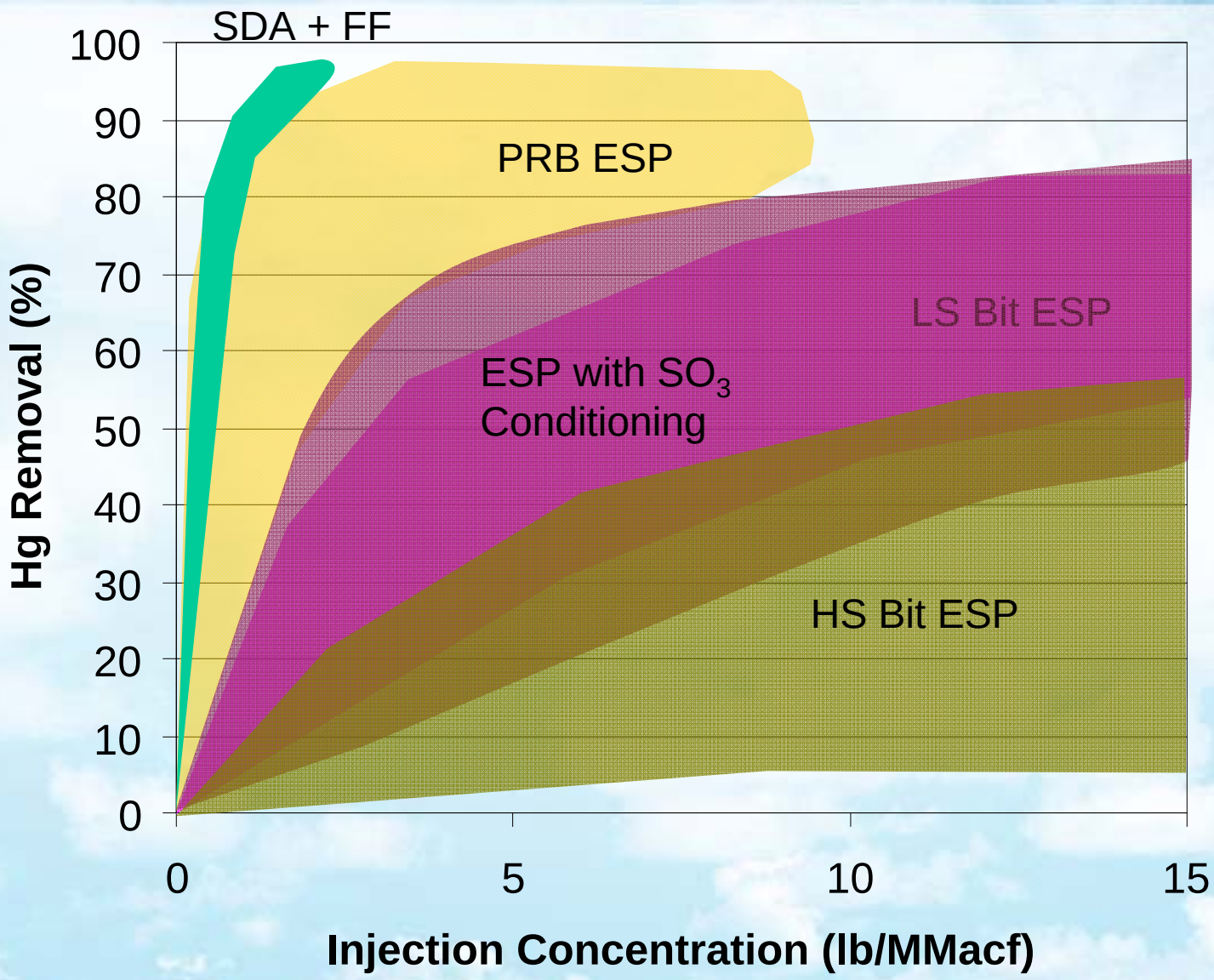
- Particle size: 15-25 µm
- Surface Area: Typical > 500 m^2/g
- Treated sorbents effective for low-halogen flue gas applications such as PRB-fired units with ESPs or SDA/FFs
- Emerging activated carbon sorbents for high SO_3 flue gas

Factors Affecting ACI Performance

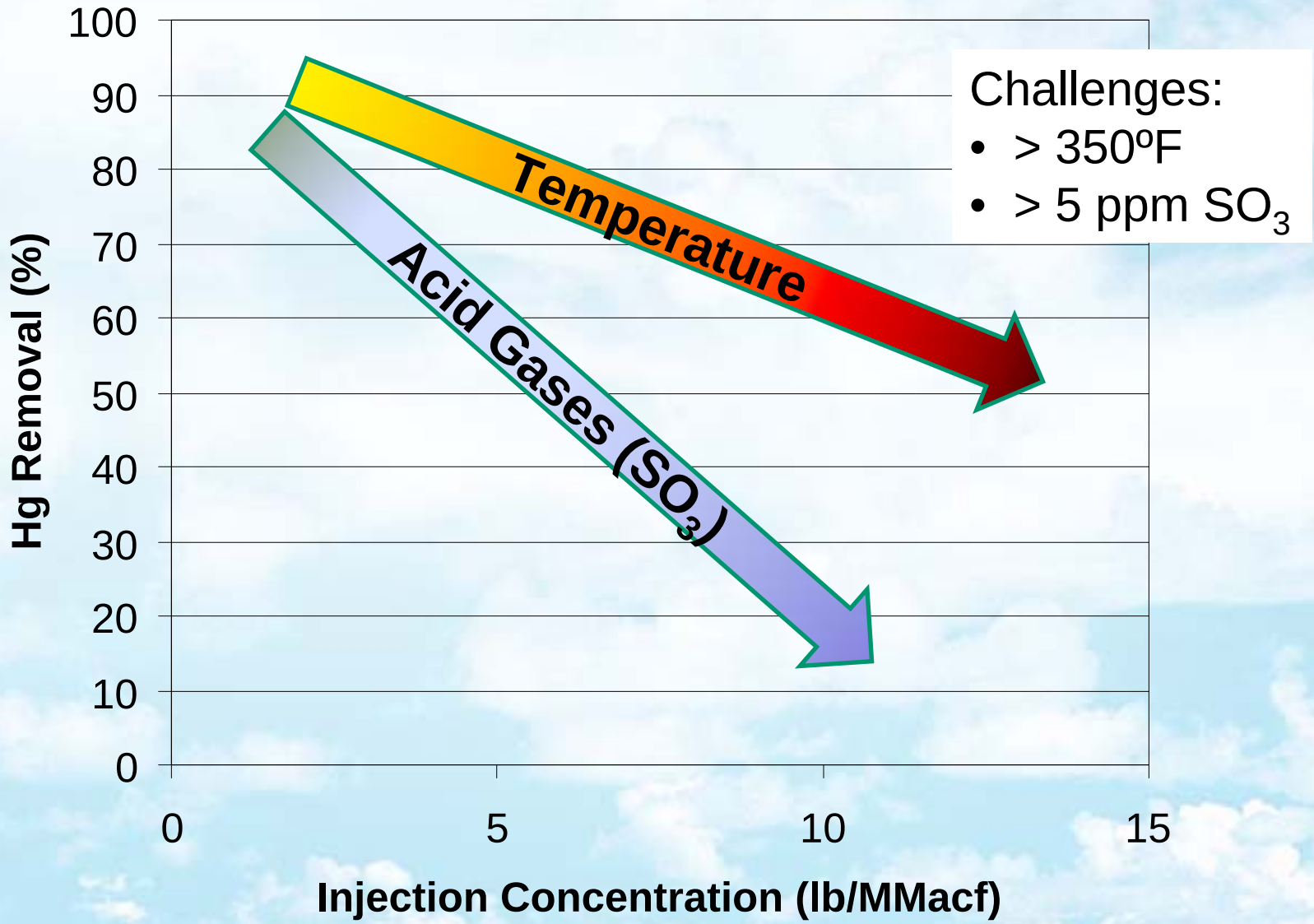
- Coal Type
  - Halogen content (Cl, Br, other)
  - Sulfur content
- Flue Gas
  - Acid Gases (HCl, SO_2, SO_3)
  - Gas Temperature
- Emission Control Equipment
- ACI Design
  - Distribution
  - Residence time
  - Sorbent characteristics

Similar factors affect native Hg removal

Activated Carbon Injection – Summary of Results



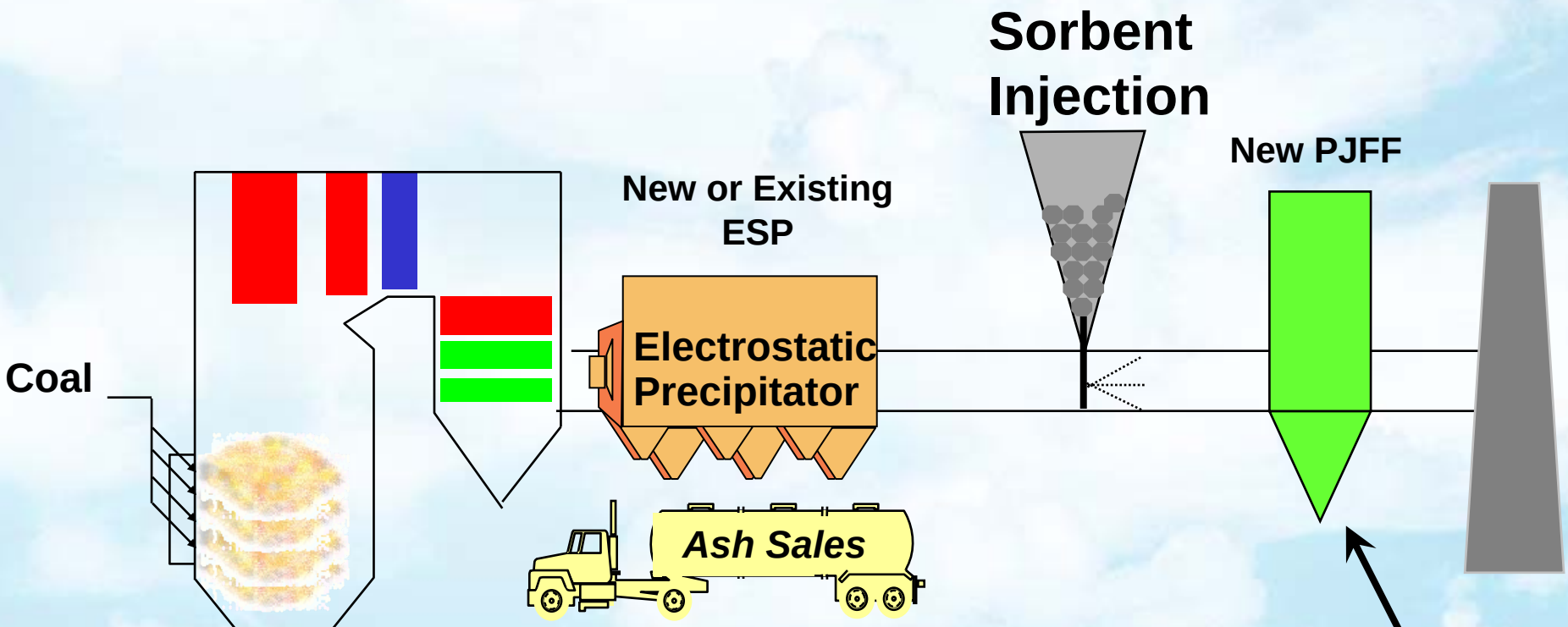
Activated Carbon Effectiveness



Potential Mercury Control Issues Facing Industrial Boilers

- Coal types fired in boilers
- Flue gas operating temperatures
- SO_3 levels in the flue gas exiting boilers and entering particulate control systems
- Existing APC configuration and particulate control systems in-place. (ESP, FF, Scrubbers)
- Possible ammonia slip from NOx systems
- May need to add additional FF's downstream of existing ESP's (TOXECON)

Typical TOXECON™ Configuration



99% of Fly Ash Sell for use in concrete

Fly Ash (1%) + PAC

Tools for Evaluating ACI Performance

ADA Owns 11 Hg CEMS

Portable Hg CEMS and Calibration Units

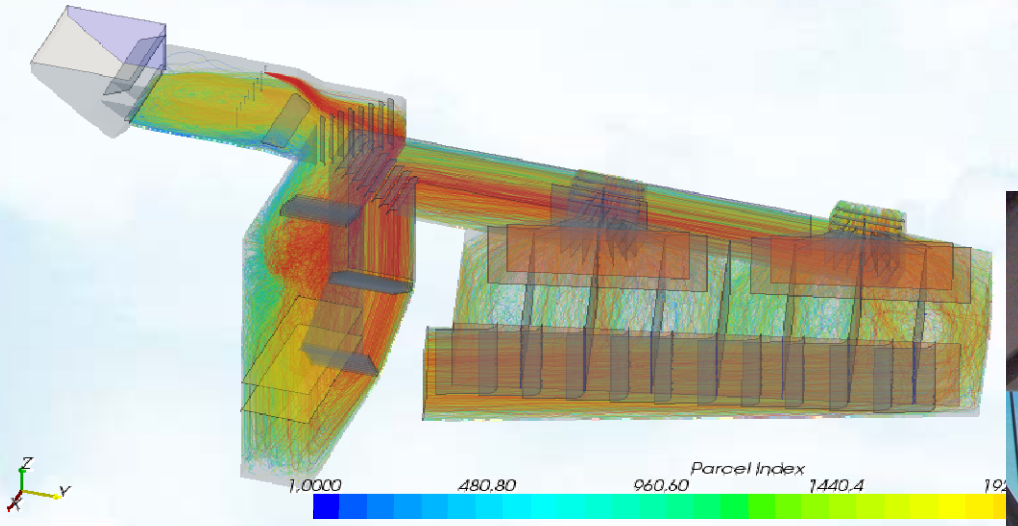
ADA Activated Carbon Injection (ACI) Systems

ADA Brings Full-Scale Commercial ACI Experience

ADA ACI System

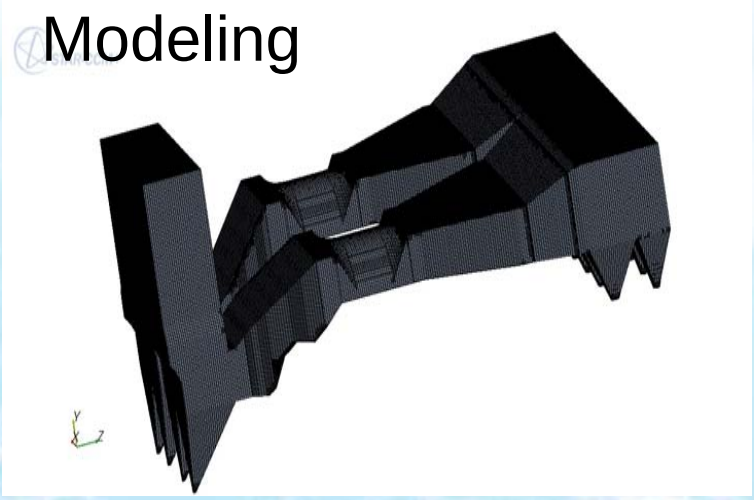
- Sorbent delivered in pneumatic trucks or rail cars
- Silo(s) with up to three product take-offs
  - 2 x 100% or 3 x 50% feed trains for spare capacity
- Worry-free PAC flow from silo
- Custom fluidizing system designed for PAC
- Modular approach
  - PAC storage
  - Electrical room
  - Feeder room
  - Blower room
- Dilute-phase pneumatic conveying
- Custom engineered distribution manifolds
- Custom injection lances
- Site-specific control schemes

PAC Distribution

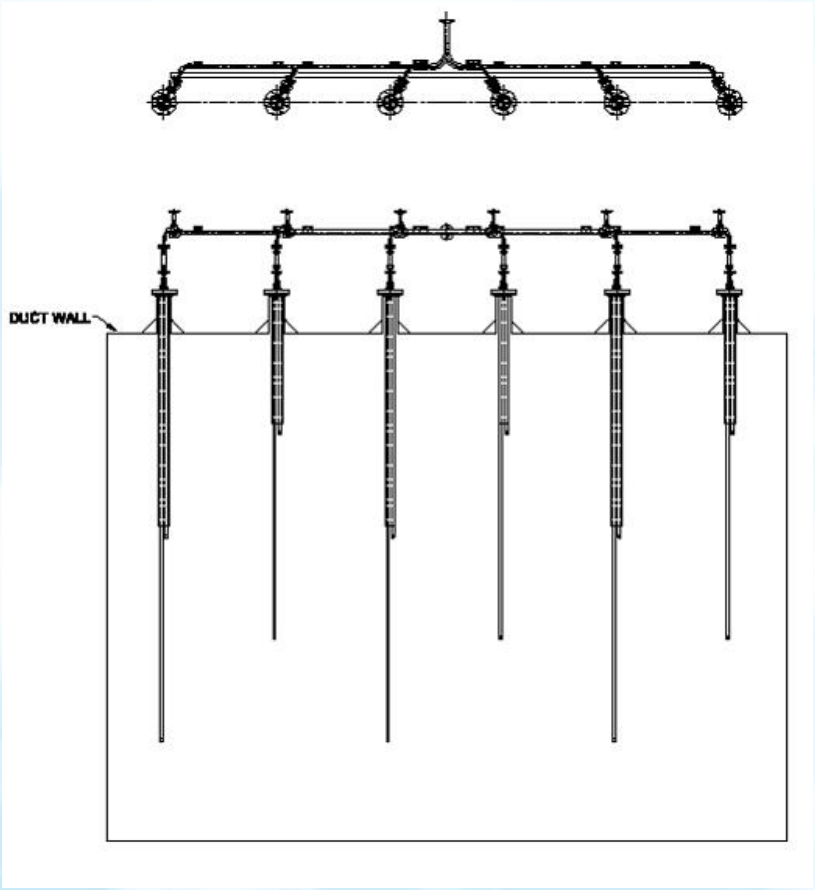


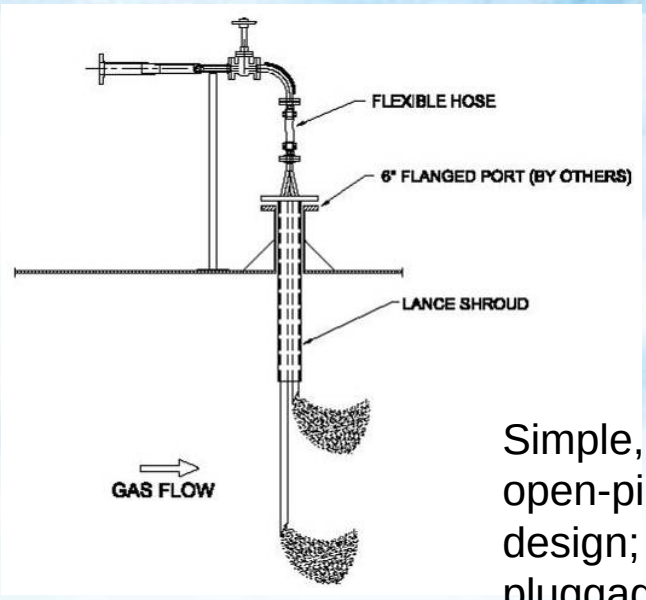
PAC Distribution Manifold

ADA In-House CFD Modeling



Typical Open-Pipe Lance Design





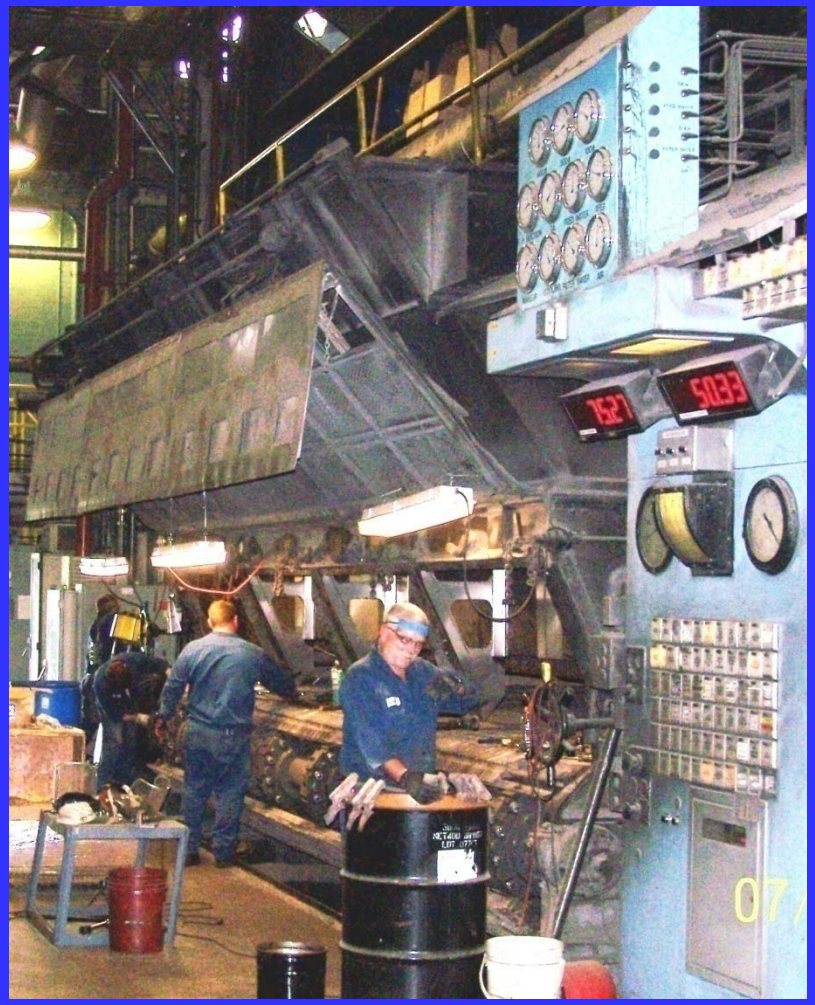
Simple, low-maintenance, open-pipe discharge design; low risk of pluggage

Beware of multi-jet lance designs. They are prone to pluggage. Particles tend to bias toward lower jets.

Hg Control Demonstration Program
Cornell University

Case Study

Cornell University Utilities Boiler #8

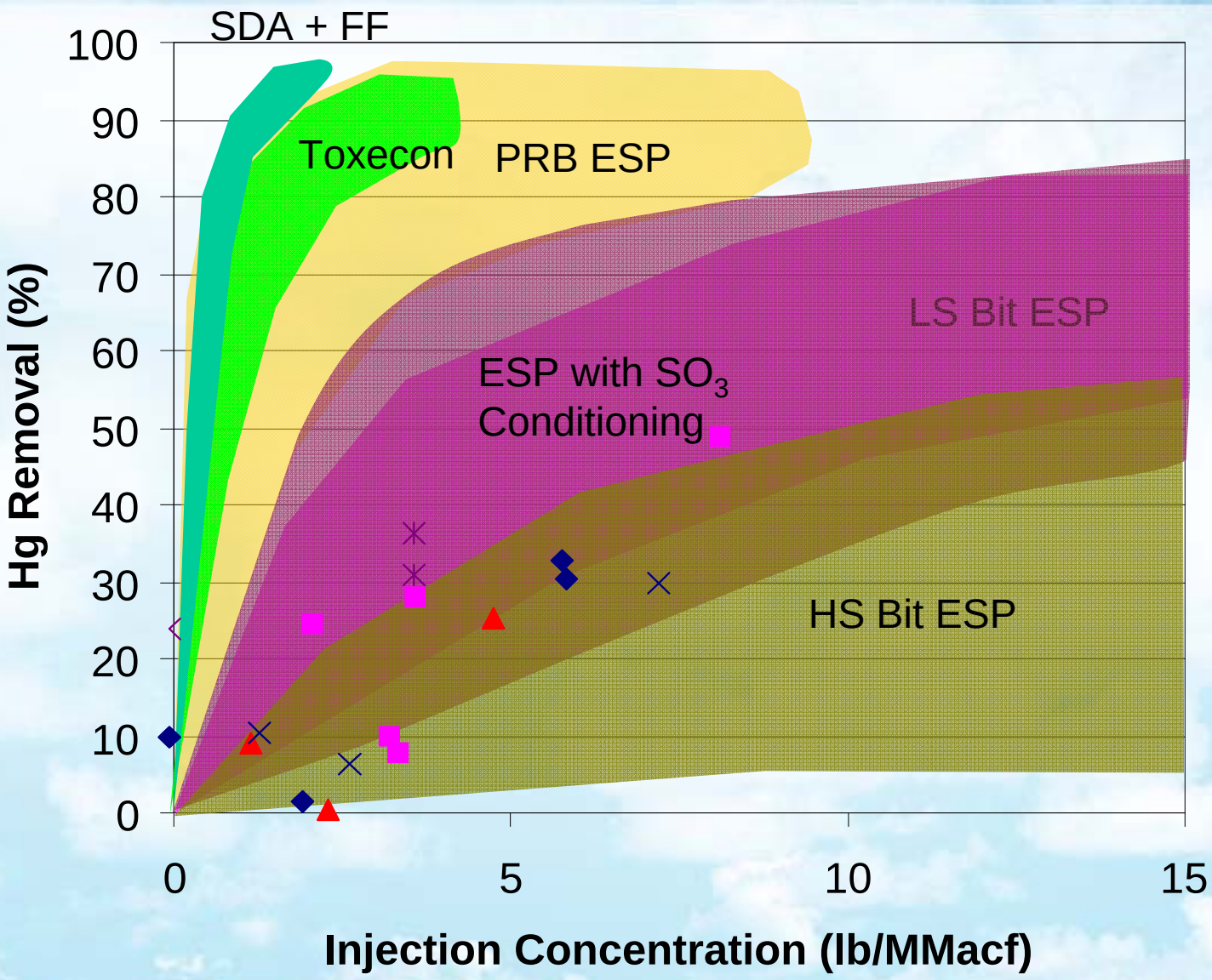


- Mass Overfeed Stoker
- Riley 1949
- 175,000 pph steam
- Pulse jet fabric filter installed 1998
- Flue gas 375°F
- Bags: woven fiberglass with 10% Teflon® B finish
- Historically operated October to May

Background

- Plant fires low sulfur bituminous coal
- Mercury (3 year avg) 5.9 lb/tBTU (range 3.6 to 9.5)
- High (> ~10 ppm) SO_3 in flue gas
  - Coal sulfur < 1%, but boiler design and operation resulted in high conversion to SO_3
- Unburned carbon in ash > 20%
- Results from 2007 test show
  - low native mercury removal and
  - low mercury removal with ACI
- New York State Energy Research and Development Authority (NYSERDA) awarded grant for mercury control project in 2008

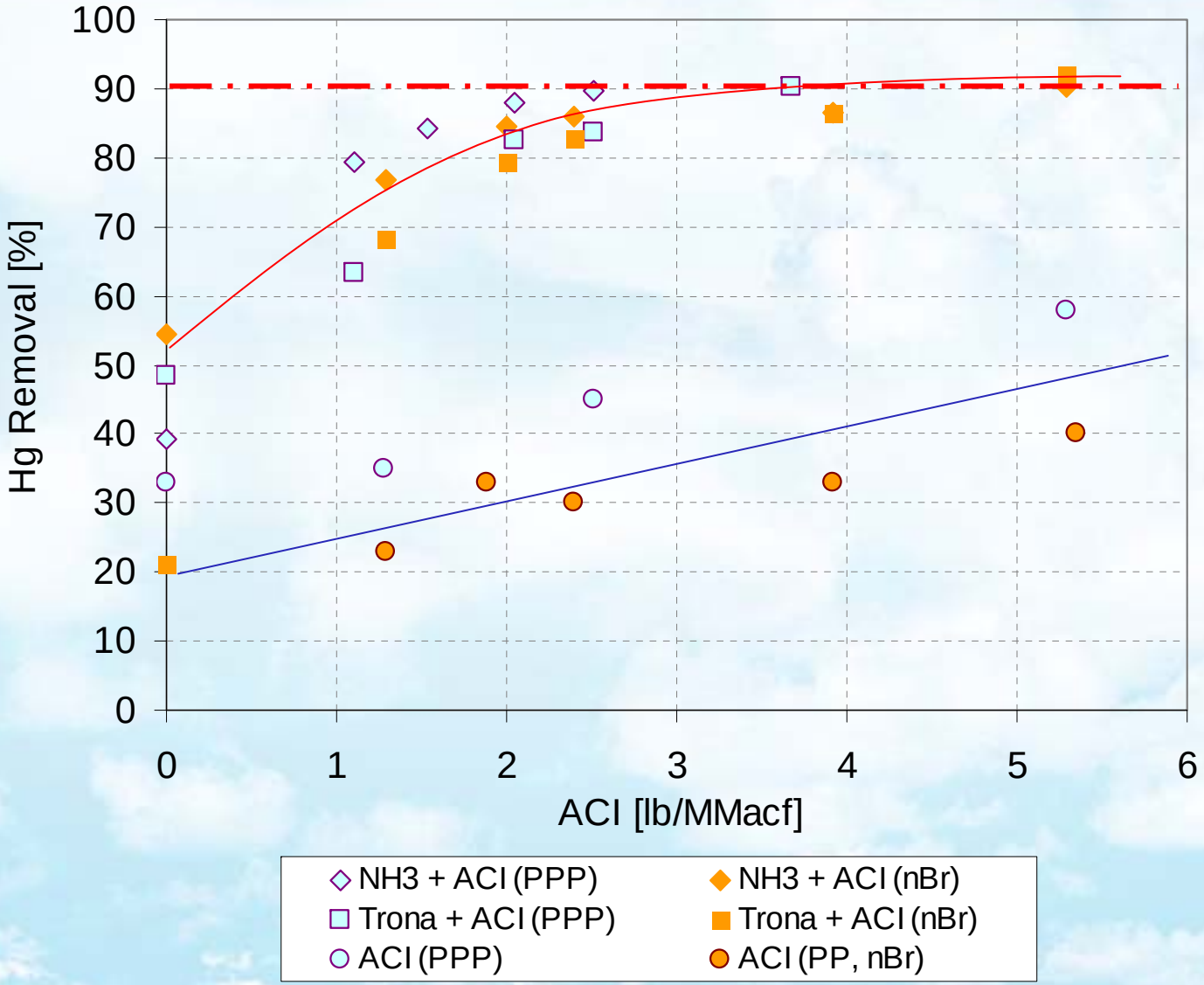
Summary of 2007 Results



2009 Test Matrix
Cornell Boiler #8

- Baseline Removal
- Characterize effectiveness of PAC, no SO_3 mitigation
  - Standard PAC
  - PAC treated with bromine
- Characterize effectiveness of PAC, with SO_3 mitigation
  - Trona (sodium sesquicarbonate) injection
    - Goal: capture SO_3
  - Ammonia injection
    - Goal: form ammonium sulfate

2009 Parametric Test Results
Cornell Boiler #8



Additional testing and optimization is required to assess balance-of plant impacts and assure long-term mercury capture

Summary

- Many lessons learned from the power sector can be applied to industrial boilers
- Industrial boilers have unique concerns
  - Full-scale demonstration testing is recommended to better characterize performance
  - Consortiums can be formed to gain representative test data for industrial boiler owners
- Commercial equipment and activated carbon is available
- Carbon can be delivered to process via many types of systems, including:
  - Portable (1,000 lb. Super Sacs) injection systems
  - Shop welded and assembled steel silos

PAC Injection

- Bulk (1000 lb) bags
- Metering screw
- Blower
- Injected into venturi section of duct

Mercury CEMS