Industrial Boiler MACT Rule

Impact and Control Options for Mercury and Dioxins/Furans

Hot Topic Hour
November 19, 2010

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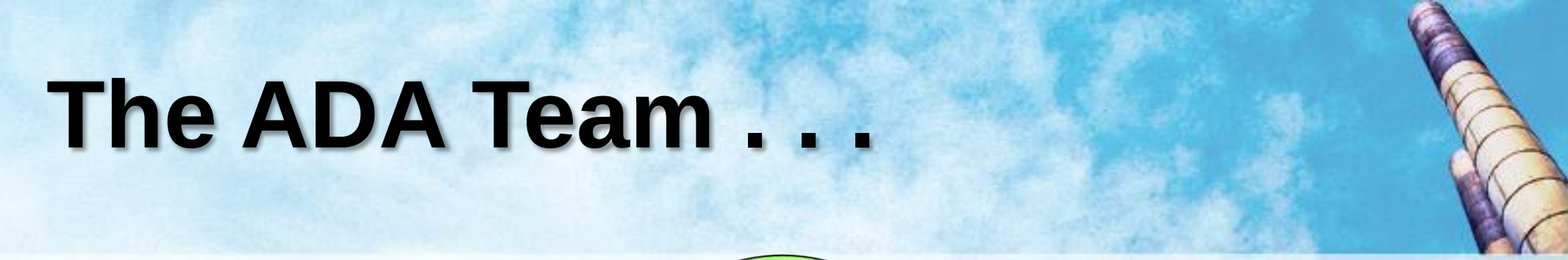
The ADA Team . . .



Emission Control Systems

Mercury Control (ACI)
SO_3 Management
Flue Gas Conditioning

Technology Development And Services

Mercury Measurement
Mercury Control
Full-Scale Demonstrations
Flue Gas Conditioning
Beneficial use of Ash
Clean Coal Additives
CO_2 Capture

Activated Carbon

ADA CARBON SOLUTIONS

Interim Processing
Production Facilities
Logistics

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

(NASDAQ: ADES)

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ACI for Mercury and D/F Reductions

- Draw on experiences from other industries
  - Municipal solid waste
  - Coal generation
  - Other?
- Activated Carbon injection has been proven to be effective for mercury and D/F control in the past on various applications
- Determine control capabilities of AC for coal-fired industrial boilers, as well as biomass fired units

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Potential Issues to Address for Mercury & D/F Control

- Fuel types/properties being fired in boilers
- Type of boilers: Stokers, FBC, PC
- Flue gas operating temperatures
- SO_3 levels in the flue gas exiting boilers and entering particulate control systems
- Existing APC configuration (SCR/SNCR's, ESP, FF, Scrubbers & even Cyclones)

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Potential Issues to Address for Mercury & D/F Control

- Lack of performance data on P&P/Biomass fired boilers
- Lack of measurement capabilities and reliability for low levels of D/F and Hg
- Uncertainty on need to retrofit with a baghouse to meet PM/HAPs regulations
- ***NEED TEST DATA!!***

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Proposed Emission Limits For Major Sources in ICI Boilers and Process Heaters

Subcategory	PM lb/10^6Btu	HCl lb/10^6Btu	Hg lb/10^{12}Btu	CO ppm, 3% O_2	D/F, total TEQ ng/dscm
Existing Units					
Coal Stoker	0.02	0.02	3	50	0.003
Coal FBC boiler	0.02	0.02	3	30	0.002
Coal PC boiler	0.02	0.02	3	90	0.004
Biomass Stoker	0.02	0.006	0.9	560	0.004
Biomass FBC	0.02	0.006	0.9	250	0.02
Biomass Suspension Buner/Dutch Oven	0.02	0.006	0.9	1010	0.03
Biomass Fuel Cell	0.02	0.006	0.9	270	0.02
Liquid	0.004	0.0009	4	1	0.002
Gas (Other Process Gases)	0.005	0.000003	0.2	1	0.009
New Units					
Coal Stoker	0.001	0.00006	2	7	0.003
Coal FBC boiler	0.001	0.00006	2	30	0.00003
Coal PC boiler	0.001	0.00006	2	90	0.002
Biomass Stoker	0.008	0.004	0.2	560	0.00005
Biomass FBC	0.008	0.004	0.2	40	0.007
Biomass Suspension Buner/Dutch Oven	0.008	0.004	0.2	1010	0.03
Biomass Fuel Cell	0.008	0.004	0.2	270	0.0005
Liquid	0.002	0.0004	0.3	1	0.002
Gas (Other Process Gases)	0.003	0.000003	0.2	1	0.009

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Biomass and Coal-Fired Boilers in CIBO Database Requiring Control for D/F Emissions

	Dutch Oven Biomass	FB Biomass	Fuel Cell Biomass	Stoker Biomass	*All Biomass*	FB Coal	PC Coal	Stoker Coal	*All Coal*
Mean emission, TEQ ng/dscm, 7%O_2	0.1573	0.0084	0.2753	0.0118	*0.0790*	0.0087	0.0235	0.3416	*0.1515*
MACT limit*, TEQ ng/dscm	0.0300	0.0200	0.0200	0.0040	---	0.0020	0.0040	0.0030	---
% requiring control	55.6%	28.6%	57.9%	50.0%	*47.3%*	66.7%	73.3%	62.2%	*66.7%*
Avg. level, if control needed	75.2%	59.3%	64.1%	58.9%	*62.1%*	65.6%	58.4%	64.2%	*62.8%*

*Existing boilers

About half the biomass and 2/3rds the coal-fired boilers identified in the CIBO data base would require controls under the current proposed rules based upon the reported emission levels. As noted above, the average % reduction levels would be around 62%.

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Anticipated Industrial Boiler ACI System MACT Compliance Timeline

Testing & Evaluation
1/2010 – 12/2011

Compliance Strategy, Eng, & Specifications by Customers
12/2010 – 12/2011

Place ACI Equipment Orders
6/2011 – 6/2012

Install ACI Equipment
2/2012 -2/2013

Start-up, Test and Optimize
1/2013 – 6/2013

Don't Wait!!!

Final MACT Rule
1/14/2011

5/01/10 | **6/01/10** | **12/01/10** | **6/2011** | **12/2011** | **6/2012** | **12/2012** | **6/2013** | **12/2013** | **1/14/2014**
MACT Compliance

Draft MACT Rule
5/2010

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ACI and Sorbent Injection Systems

- ACI systems available for a variety of injection and operating requirements
- Depending upon expected coal type and operating conditions, dual injection of both PAC and other alkaline dry sorbents may be required to ensure effective Hg capture
- Same alkaline sorbents (Trona/Hydrated Lime) may also be used for meeting HCl reduction limits as an option to scrubbers
- PAC feed rates are typically tied to “feed forward” signals from boiler/steam flow rates, boiler load and/or flue gas volumes as injection rates are tied to lb/MMacf

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ACI Performance Guarantees

- Mercury reduction guarantees are currently being provided to coal-fired utility market
- Guarantees typically tied to measurements from EPA Mtd. 30b or certified Hg CEMS
- Current Hg emission targets for new biomass fired boilers very low at 0.2 lb/Tbtu which is both difficult to measure and guarantee
- Reduction guarantees for dioxins and furans may also be difficult due to reduction levels required and lack of performance data on both coal and biomass fired boilers.

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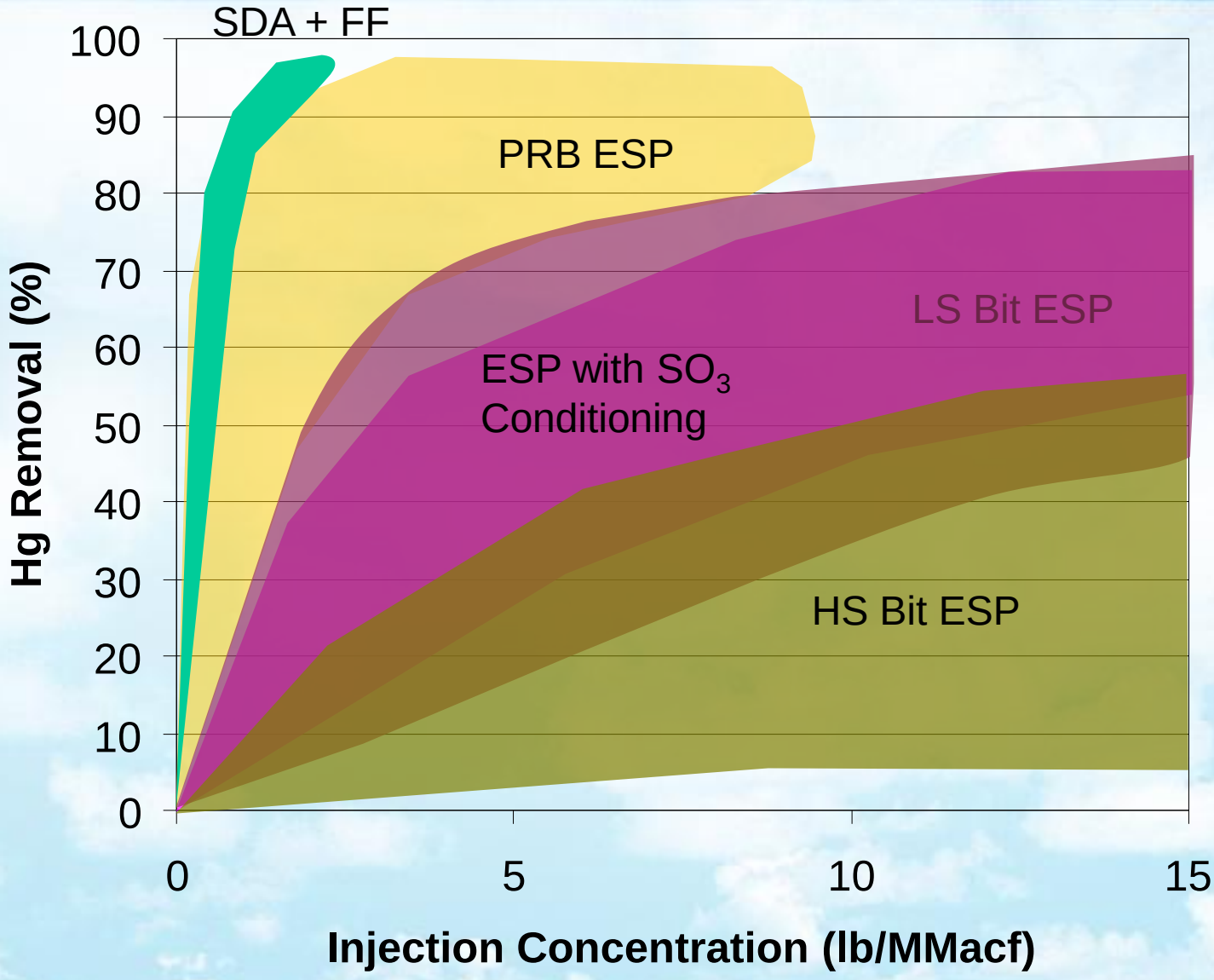
Activated Carbon Injection – Summary of Results (Source: Utility Coal-Fired Boilers)



Will Industrial coal-fired boilers produce the same results??

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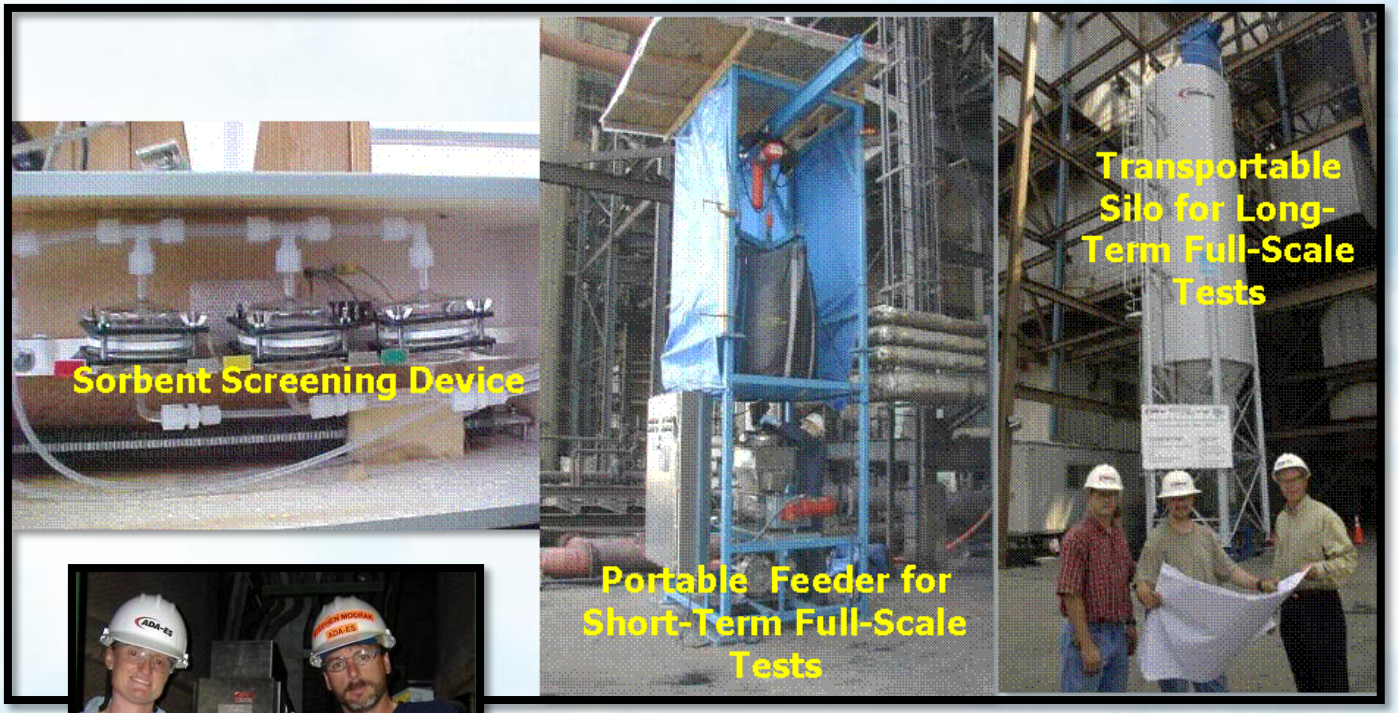
Tools for Evaluating ACI Performance

ADA Currently Owns Fleet of Certified Hg CEMS



Portable Hg CEMS and Mtd 30a IR Calibration Units

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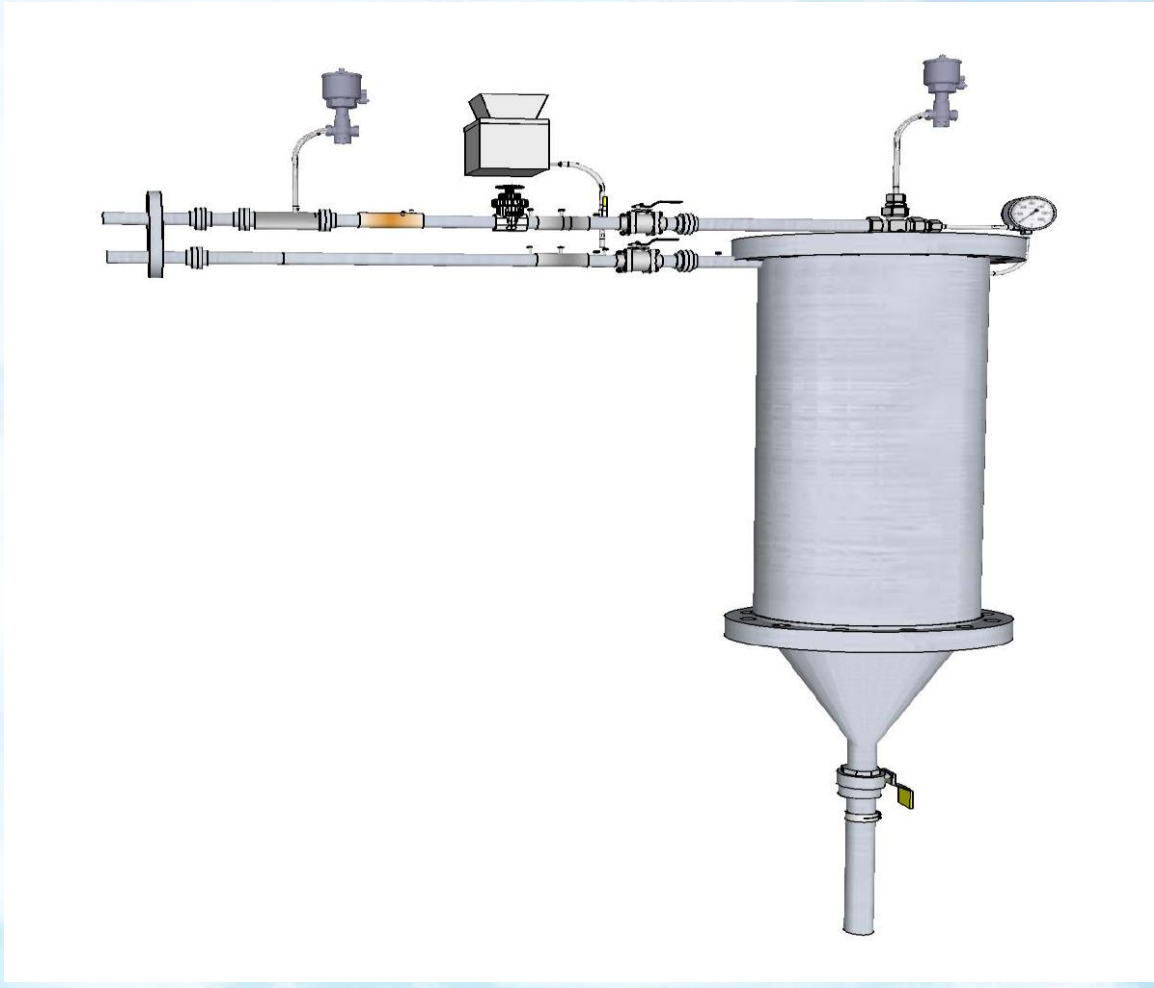
Fabric Filter Screening Device

- Mercury Control
- Dioxin/Furan Control
- THC control
- Particulate Control



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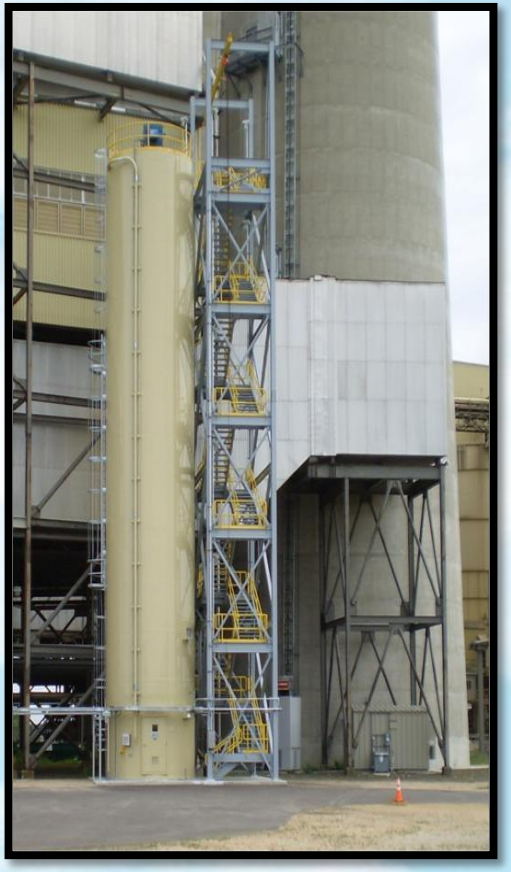
Typical Commercial ACI Systems for Both EGU's and Industrial Boilers



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ADA ACI System Experience

- Currently ~150 commercial electric utility ACI systems sold to date as reported by ICAC members
  - Of these ADA has sold ~47 commercial ACI systems
  - ~30 now in operation
  - Balance starting up over the next year
- This is in addition to another 50+ demonstration programs that have utilized industrial size systems including:
  - Bulk bag systems
  - Small portable silos
  - Hybrid systems (Small silo attached to bulk trailer for PAC supply)

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Industrial Boiler ACI System Cost Expectations:

- Typically lower flow rates in comparison to larger EGU's
- Bulk Bag type injection systems likely used by majority of smaller boilers due to low relative feed rates & cost
- Smaller steel ACI system silos will likely be utilized by balance of larger boilers or combined boiler systems
- Capital cost expectations: (Pricing includes required lances and manifolds)
  - Bulk Bag Systems (<$150K/unit)
  - Smaller Steel Silos (<$350-450K/unit)
  - Larger Utility Size Systems (<$1mm/unit)
    - Could serve multiple boilers from single silo

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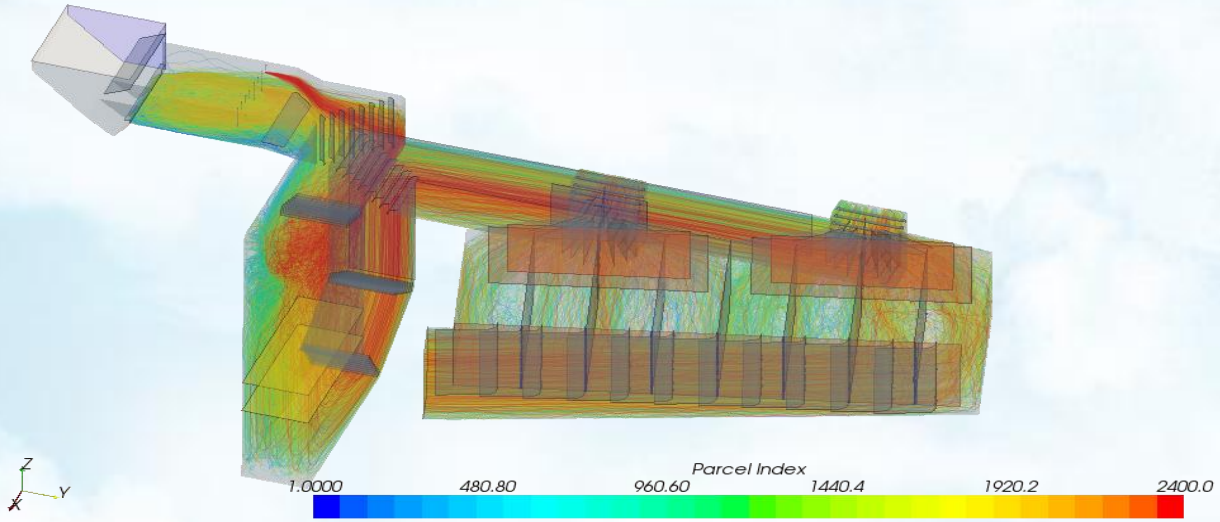
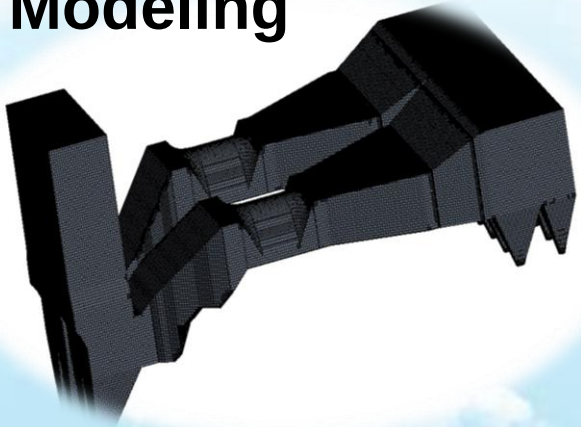
PAC Distribution is Key to Enhanced Performance



Shown below is Larger EGU PAC Distribution Manifold Design

ADA In-House CFD Modeling



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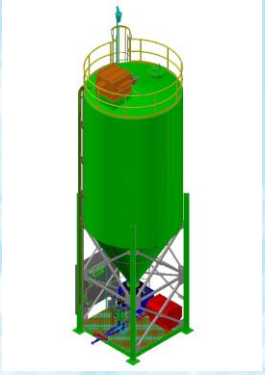
Summary

- Many lessons learned from the utility power sector can be applied to industrial boilers
- Industrial boilers have unique concerns
  - Full-scale demonstration testing is being recommended to reduce uncertainties in data
  - Additional data is needed for D/F emission reductions
- Commercial equipment and activated carbon is currently available but Utility MACT rule coming up fast……
- Activated carbon can be delivered to flue gas via many types of commercial injection systems, including:
  - Portable (~1,000 lb. Super Sacs) injection systems
  - Shop welded and assembled steel silos
  - Hybrid, lower cost designs



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Thank You

Questions?

ADA-CS Red River Parish, Activated Carbon Production Facility

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