



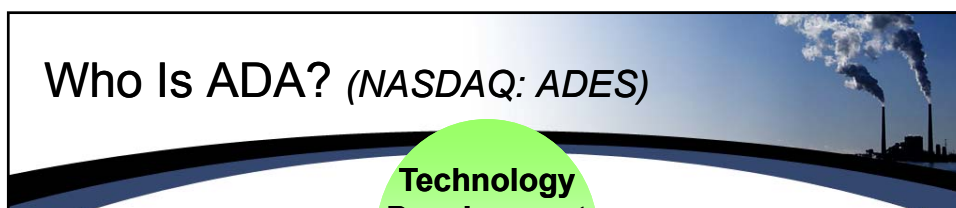
# The Next Challenge for Measurement: Mercury Control

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NASDAQ:ADES

*A Leader in Clean Coal Technology*



## Who Is ADA? (NASDAQ: ADES)

### Emission Control Systems

- Mercury Control (ACI)
- Flue Gas Conditioning


### Technology Development And Services

- Mercury Measurement
- Mercury Control
- Flue Gas Conditioning
- Beneficial use of Ash
- Clean Coal Additives
- CO<sub>2</sub> Capture

### Activated Carbon

- Interim Processing
- Production Facilities
- Logistics

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



## Mercury Measurement Experience

- A lead developer and user of the sorbent trap method since the early 1990s
  - Lead contractor in development of EPRI Quick SEM™, now Draft EPA Method 324 / 40 CFR Part 75 App K and Method 30B
- Partnership with ThermoFisher to advance mercury CEM
  - Currently owns or operates 11 systems. Provides monitoring support to power generators for additional systems
- Successfully implemented EPA Method 30A
- Full-scale sorbent injection tests for mercury control
  - Over 40 units tested - sponsored by DOE, EPRI, and power generators
  - Testing with various coals and unit configurations, including ESP, SD/BH, WPS, TOXECON™ and TOXECON II™



## Perspective

- Hg CEMS quality assurance metrics are more appropriate for systems without mercury control

Criteria to Pass:

RATA:  $\pm 1 \mu\text{g}/\text{m}^3$  for  $< 5 \mu\text{g}/\text{m}^3$

*If CEM = 0.5 and OH = 1.49  $\mu\text{g}/\text{m}^3$ , RATA passes, but OH shows only 70% removal and CEM shows 90% removal*

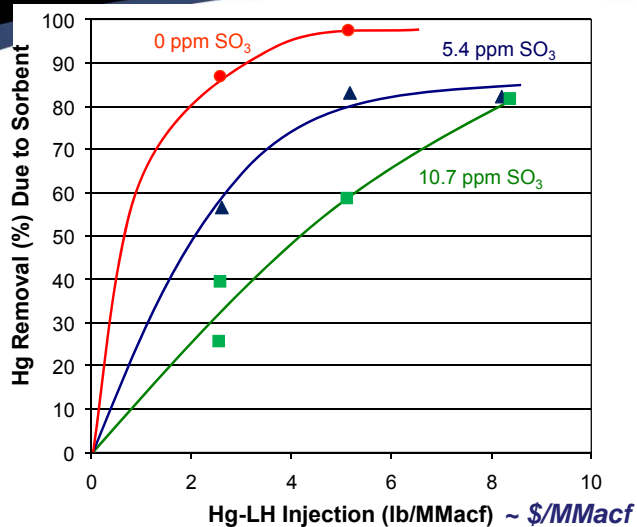
Daily Span Calibration Error:  $\pm 1 \mu\text{g}/\text{m}^3$  for  $< 5 \mu\text{g}/\text{m}^3$



**Most systems with mercury control will be at or below  $1 \mu\text{g}/\text{m}^3$**



## Sorbent Injection and Hg Removal



Labadie Data: DOE Cooperative Agreement DE-FC26-03NT41986 and EPRI

## Tools to Assure Proper Operation

- RATA
- Daily zero/span
- System Integrity Check with Oxidized Mercury
- Linearity Checks
- Diagnostic Capabilities of System

## GAP: “But it passed the RATA”

- What has changed since RATA ?
  - Outage
  - Maintenance performed
  - Developed leak
  - Others
- RATA requirements for “Passing” may not be tight enough to verify permit levels



## GAP: “But it’s Passing Daily Cals”

### Common Issues

- Cold Spots and Contamination
  - Sample line – results in low bias
  - Calibration line – results in high bias
- Slow Response
  - May need longer span period
  - Often needs cleaning or new converter core
  - Humidifier Empty
- Dilution Pressure
  - If dilution pressure changes between calibration and sample periods, the calibration will not be accurate



## Poor Response to Oxidized Hg

Most common issue: **COLD SPOTS**

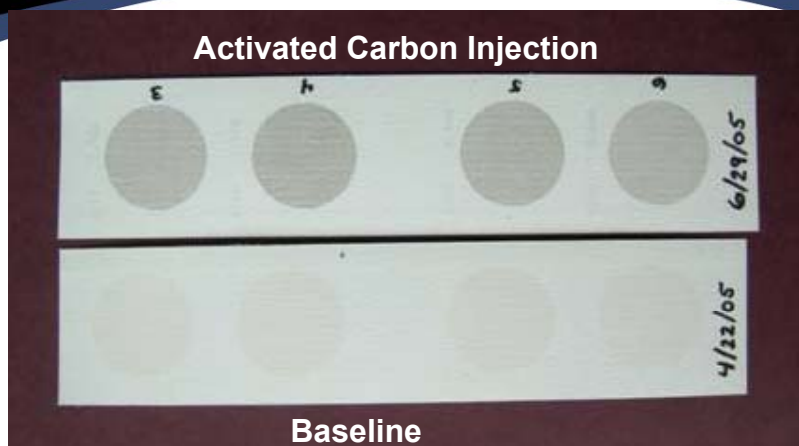


## Other “Common” Issues

- Temperature setpoints incorrect (**Cold Spots**)
- Insufficient insulation or probe box open (**Cold Spots**)
- Not allowing sufficient time for conditioning of new components
  - Lamp
  - Converter core
- Activated carbon on outlet filter or stinger possible (frequent blow-back recommended)



## Activated Carbon at Outlet of ESP

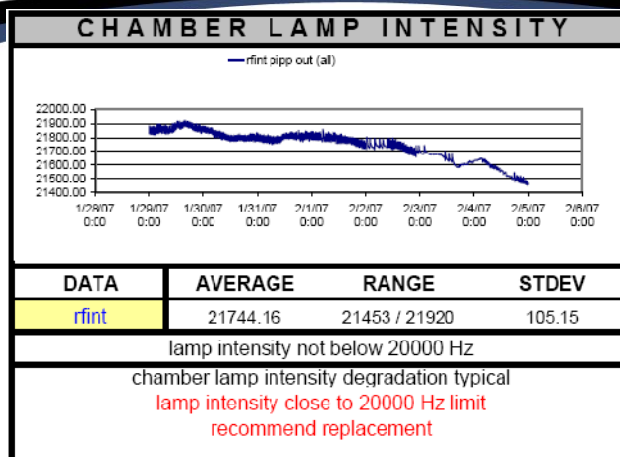


*No measurable differences in particulate emissions for two periods shown*

## Linearity Checks

- Valuable tool to indicate degradation of calibrator

## Diagnostic Data



17 Operating Parameters Monitored by ADA

## Diagnostic Tools: Example

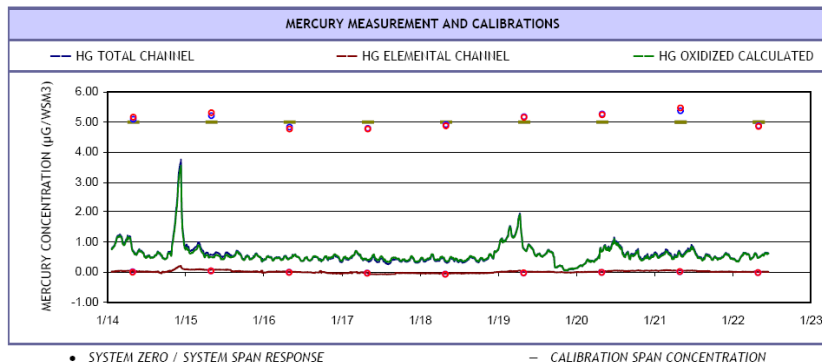
### ADA-ES CEMS DAILY OPERATION REPORT

SYS ID # 90

DATE: 01/22/2008

LOCATION: WE PRESQUE ISLE OUTLET

DOCUMENT REVISION: 0712-03



# Diagnostic Tools: Outlet CEM

MERCURY CONCENTRATIONS				
DATA	AVG	MIN	MAX	STD
HG TOT	0.59	0.05	3.76	0.35
HG ELEM	0.01	-0.08	0.21	0.04
HG OX	0.58	0.05	3.56	0.32

MERCURY CONCENTRATIONS - FILTERED				
DATA	AVG	MIN	MAX	STD
HG TOT	0.52	0.09	0.97	0.16
HG ELEM	0.01	-0.08	0.12	0.04
HG OX	0.51	0.16	0.88	0.12

CALIBRATION FACTORS				
DATA	START	END	DIFF	AVG
E BKG	1.70	1.56	-0.14	1.67
T BKG	1.52	1.44	-0.08	1.51
E COEF	1.08	0.98	-0.10	1.05
T COEF	0.90	0.93	0.03	0.91
DIL FACT	23.10	23.10	0.00	23.10

CALIBRATION MULTIPLIERS				
DATA	START	END	DIFF	AVG
RAW E BKG	0.07	0.07	0.00	0.07
RAW T BKG	0.07	0.07	0.01	0.07
E MULT	24.95	22.64	2.31	24.26
T MULT	20.79	21.48	-0.69	21.02

SYS ID # 90
LOCATION: WE PRESQUE ISLE OUTLET
DATE: 01/22/2008

### MERCURY MEASUREMENT AND CALIBRATIONS

LAST SYSTEM CHECK CALIBRATION RESPONSE										
DATE	TIME	ELEM ZERO		ELEM SPAN		TOTAL ZERO		TOTAL SPAN	RESULT	
1/22/2008	7:37	-0.02	-0.16%	4.85	-1.51%	-0.02	-0.20%	4.87	-1.29%	PASS

CALIBRATION QUALITY ASSURANCE										
SPAN	MPC	EZ 90%	ES 90%	TZ 90%	TS 90%	INST CAL DRIFT	SYS CAL DRIFT			
5.00	10.00	..	..	..	..	0.01	0 h	..	0.00	96.5 h

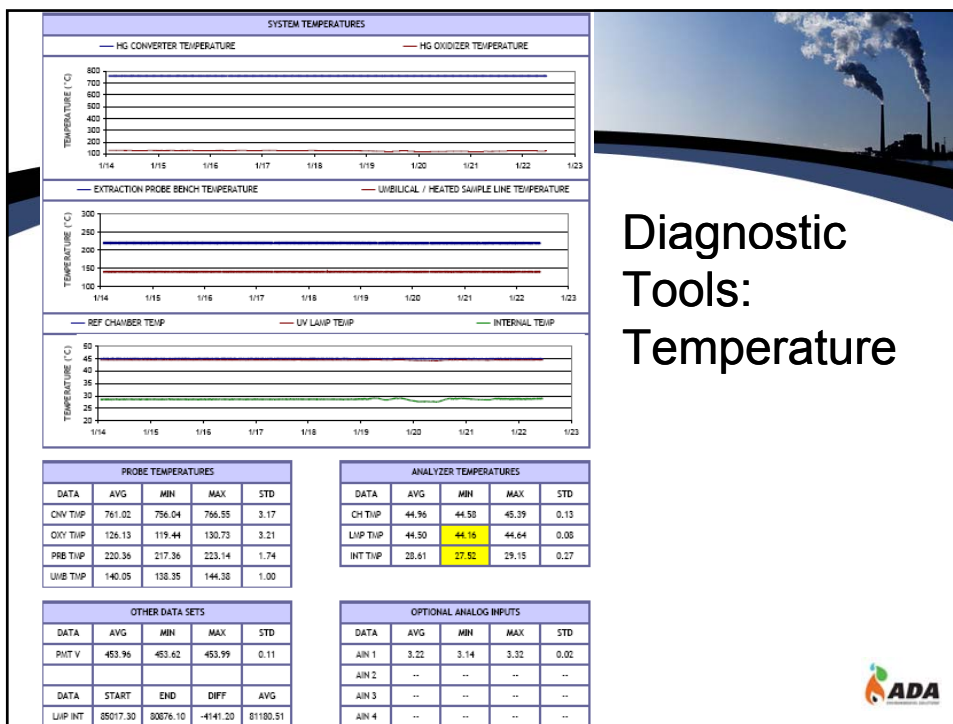
GAS MODE BREAKDOWN										
MODE	AU 10	SAMPLE	A ZERO	A SPAN	T ZERO	T SPAN	S ZERO	S SPAN	Q17 CAL	REC %
PCT REC	100.0%	94.4%	0.0%	0.0%	0.0%	0.0%	0.7%	0.7%	0.0%	3.6%

COMPONENT POWER AND COMPENSATION SETTINGS										
SET	SERV	PRB	UMB 1	UMB 2	CHV	EDU	STNG	L CMP	T CMP	P CMP
PCT ON	0.0%	100.0%	100.0%	0.0%	100.0%	100.0%	100.0%	100.0%	0.0%	0.0%

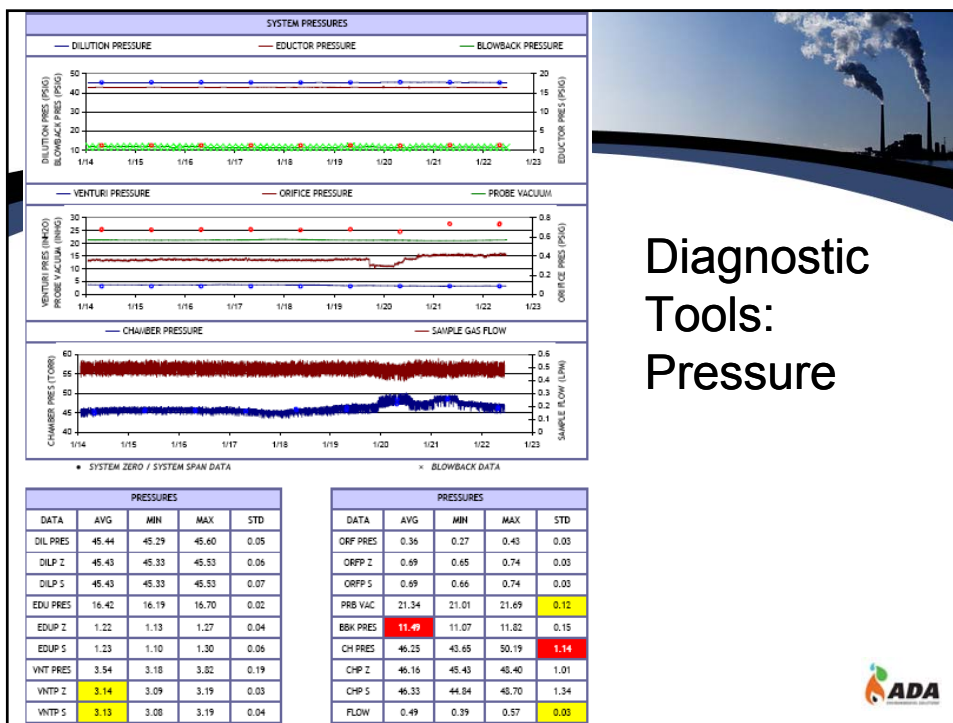
ALARM ACTIVATION						
ALARM	HGO	HG2	HGT	PRES	FLOW	LMP INT
PCT LOW	54.4%	0.9%	0.6%	0.0%	0.0%	0.0%
PCT HIGH	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

ADDITIONAL ALARMS		
ALARM	PROBE	TEMPS
PCT ANY	50.4%	0.0%
FAILSAFE TEMP		160

## Diagnostic Tools: Cal Data



## Diagnostic Tools: Temperature



## Diagnostic Tools: Pressure



## Comments from ADA CEMS Team

### Operators are not using diagnostic data

- “CEMS Operators are very capable of working on the systems, taking things apart and putting them back together, but they do not focus on the details to make sure the system is working”
- “.... futility and potential for damage by just opening up the box and turning wrenches”
- “...use the data files to troubleshoot. I have started to use this tool and been able to diagnose problems quicker and more efficiently than before”



## Recommendations

- For CEMS Vendors
  - Improve temperature management
- For Integrators
  - Offer diagnostics packages that highlight potential operational issues
- For Operators
  - Monitor the operational information to assure system is working properly
  - Conduct regular RA checks with sorbent traps
  - Make sure system stays hot
  - Implement tighter QA standards
  - Provide sufficient training and support



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**Thank You**

Questions?

