



Panel Discussion - Sorbents for Mercury Control



**A Commercial Update on
B-PAC™, C-PAC™, H-PAC™, F-PAC™**



Can Fully Supply Your Hg Sorbent Needs Today



- >15,000,000 annual pounds of existing bromination capacity
- 4 day-to-day customers currently for B-PAC™
- in contract negotiations for 5 additional boilers, including C-PAC™ & H-PAC™
- plus numerous plants are testing truckload quantities



Also Sorbent Injection Systems



8 Systems Sold Already

- 4 systems delivered
- 4 for 2008 delivery
- 2 of a revolutionary design
- silo partner: 30 MSW trains

- New X-a-Lances™ reduce sorbent consumption
- operating on 2 ESPs
- Also: miniature M-PACT™ system





Begun planning a 40 Million lb/yr site next

Row	Capacity	Region	Company	Technology	Permit Status
50	800	Midwest	Wheelabrator	E. Bit	New Construction Permit
51	350	Midwest	ADA-ES	PRB	Retrofit Construction Permit
52	568	Southwest	Alstom/ADA-ES	PRB	SCR/FF/WF GD New Construction Permit
53	248	Midwest	Sorbent Tech	E- Bitum	ESP/WFGD Retrofit Consent Decree
54	590	Midwest			
55	608	Midwest			
56	110	Midwest			
57	272	Midwest			
58	375	Midwest			
59	100 ea. 200 Total	Northeast			
60	200 ea. 400 Total	Northeast			
61	200 ea. 400 Total	Northeast			
62	300	Midwest			

Row	Capacity	Region	Company	Technology	Permit Status
14	650	Midwest	Alstom (ADA-ES)	PRB	SDA/FF ACI New Plant New Construction Permit
15	156 MW ea. 315 Total	Midwest	Powerspan	Bituminous	Multi-pollutant ESP/WFGD/WESP ECO Retrofit Construction Permit
16	750	Midwest	Wheelabrator	High Sul. Bit	SDA/FF ACI New Plant Construction Permit
17	680	South			
18	107	East			
19	860	South			
20	860	South			
21	220	West			
22	575	Southwest			
23	575	Southwest			
24	335	Northeast			
25	880	Midwest			
26	350	Midwest			
27	650	Southwest			
28	628	Southwest			
29	855	Southwest			
30	670	Midwest			

Plant	Plant Size (MW)	Location	Prime OEM Contractor	Coal	APC Configuration	Hg Control	New Plant or Retrofit	Regulatory Driver
1	90 MW ea. 270 Total	Midwest	Wheelabrator (Norit/ADA-ES)	PRB	TOXECON	ACI	Retrofit	Consent Decree
2	250	East	Wheelabrator	Bituminous	SDA/FF	ACI	Retrofit	State Regulatory
3	250	East	Wheelabrator	Bituminous	SDA/FF	ACI	Retrofit	State Regulatory
4	650	East	Wheelabrator	Bituminous	ESP	ACI	Retrofit	State Regulatory
5	740	Midwest	B&W (ADA-ES)	PRB	SDA/FF	ACI	New Plant	New Construction Permit
6	550	Midwest	B&W (ADA-ES)	PRB	SDA/FF	ACI	New Plant	New Construction Permit
7	350	West	B&W (ADA-ES)	PRB	SDA/FF	ACI	Retrofit	Consent Decree
8	350	West	B&W (ADA-ES)	PRB	SDA/FF	ACI	Retrofit	Consent Decree
9	800	West	B&W (ADA-ES)	PRB	SDA/FF	ACI	New Plant	New Construction Permit
10	350	East	ADA-ES	Bituminous	ESP	ACI	Retrofit	Consent Decree
11	350	East	ADA-ES	Bituminous	ESP	ACI	Retrofit	Consent Decree
12	204	Midwest	Dustex	PRB	TOXECON	ACI	Retrofit	Consent Decree
13	375	East	Wheelabrator	Bituminous		ACI	Retrofit	Consent Decree

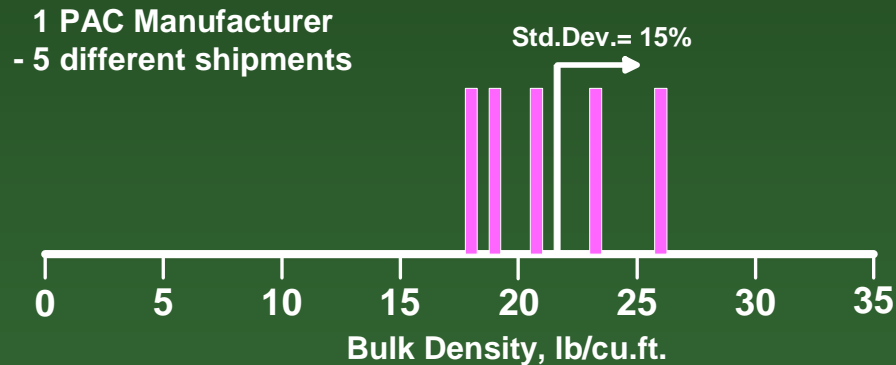


- We expect to have the raw PAC supply as well
- Only a 1-year lead-time: by mid 2009



High-Quality Chinese Base Carbons

- Calgon is, by far, the biggest importer of Chinese AC
- Very consistent qualities from our supply partners
- Previous U.S. domestic PACs were highly variable:

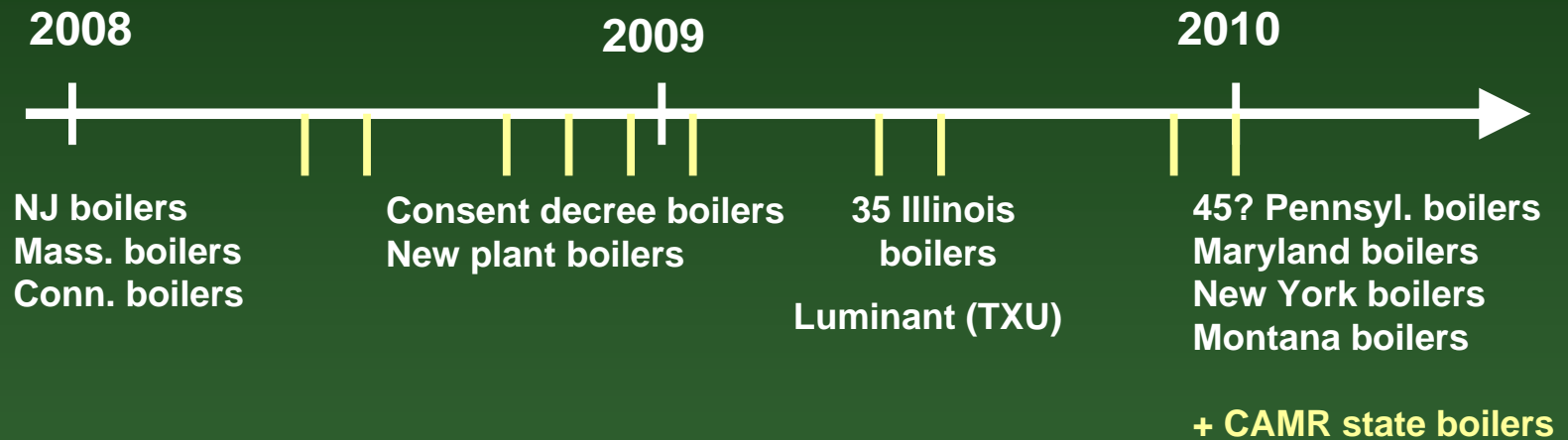


- Then patented **gas-phase** bromination, not salt-phase
(all brominated carbons are **not** the same)



Demand Projections

Forecast: Big Crunch Jan.1, 2010 (or Nov. 2009)



- 10% of U.S. capacity *already* has ACI systems ordered and likely 20% by next year
- These plants need compliance *before* any new U.S. plant
- Sorbent availability 1Q 2010 & earlier may be an issue



Pricing

- **Varies with the length of the contract**
- **Dedicated production capacity means take-or-pay**
- **Currently north of \$1.00/lb FOB for gas-phase B-PAC™**
- **Modest premium for C-PAC™ or H-PAC™**
- **AC prices jumped 70% courtesy of Norit & Calgon**
- **Don't be surprised if \$2.00/lb or more come 2010**

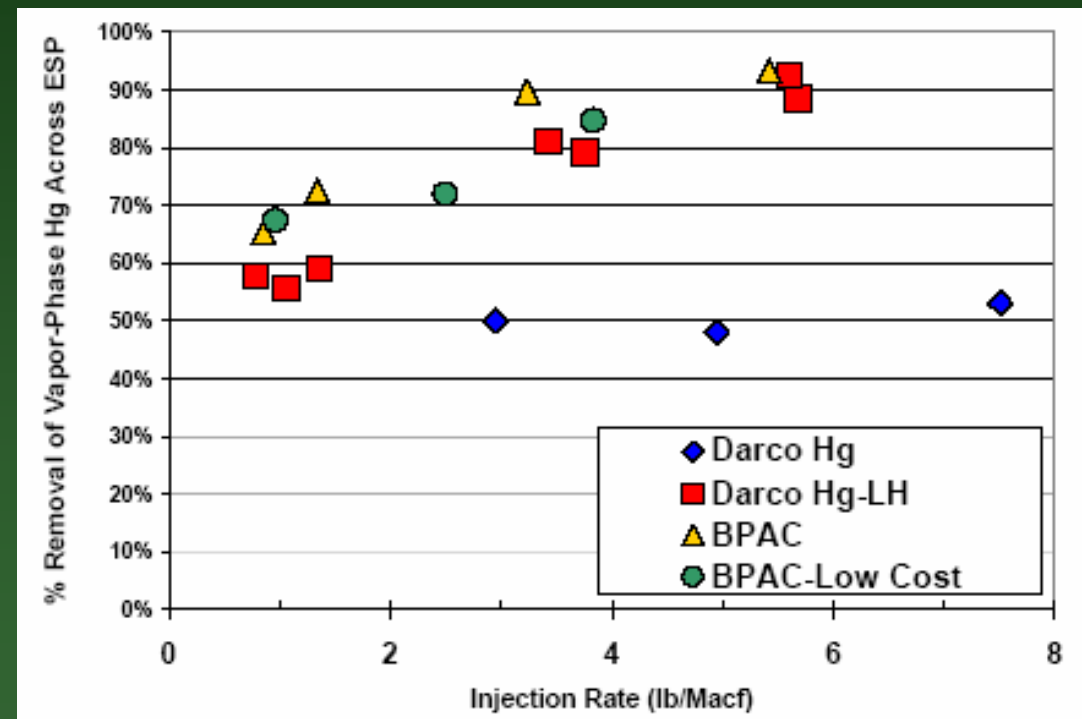




Pricing: Need to Discern 0.1 lb/MMacf Differences

- Once the ACI system is installed, you are free to test & determine which sorbent is the most cost-effective & there can be big differences
- Deceptive: a sorbent can cost 20% more \$/lb & still save you 40%
- So spot purchases while testing? Multiple suppliers rather than sole-sourcing? And constant performance monitoring for supplier QC

Subbituminous Coal & Cold-Side ESP at Great River Energy's Stanton Station Unit 1



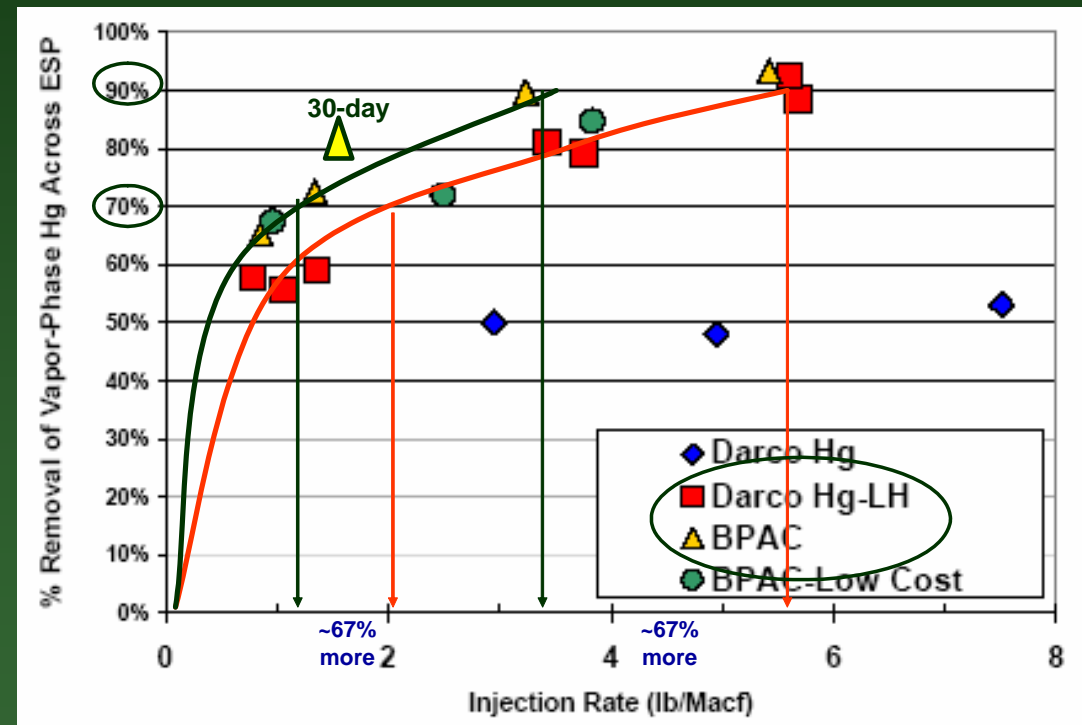
Dombrowski, K., URS Corp., "Full-Scale Activated Carbon Injection for Mercury Control in Flue Gases Derived from North Dakota Lignite and PRB Coal," Air Quality V, Arlington VA, Sept. 2005.



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Specifying Mercury Sorbents: e.g. C-PAC™

- Carbon: 100% Virgin
- Particle size: > 90% < 325 mesh
- Moisture: < 6 wt%
- Bromine: > 4 wt%
- Hg performance: ~~surface area or pore volume?~~
~~melasses number?~~
~~iodine number? benzene number?~~
proprietary metric
pilot plant performance
continuous CMM monitoring
- Concrete: Foam index





Emerging Issues

1. Guarantees

- Performance varies too much with operations, coals, etc.
- Now plants have CMMs for own trials

2. Injection Systems

- Pre- or post-air-preheater injection
- Sorbent distributions can be critical at some plants
- If poorly designed, sorbent can't help much

3. Increased Particulate Emissions

- Plant Yates was not unique, but plant & coal specific
- Triggers New Source Review
- Hopefully gas-phase brominated PACs can help



Emerging Issues

4. SO₃

- May need 2 systems: trona or lime + PAC

5. Intellectual Property

- Patents or patents pending (B-PAC™, C-PAC™, etc.)
- Indemnification



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- Validity of EPRI's U.S. 6,712,878 (2004)
 - looks like it covers *all sorbent injection into ESPs*:

"A method for removing a vapor-phase contaminant from a gas stream, comprising:

- coating a non-porous sorbent structure [ESP plate] positioned in a gas duct with a sorbent;
- passing a gas stream comprising a vapor-phase contaminant [Hg] through the gas duct;
- contacting the vapor-phase contaminant with the sorbent, thereby adsorbing the vapor-phase contaminant onto the sorbent [PAC];
- removing the sorbent having the adsorbed vapor-phase contaminant from the gas duct; and
- recoating the non-porous sorbent structure with fresh sorbent."



Sorbent Technologies Corp.

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