TOXECON™ Retrofit for Mercury and Multi-Pollutant Control

NETL Mercury Control Technology

December 13, 2006
Pittsburgh, PA

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TOXECON™ – 270 MW Demonstration

- **Presque Isle Power Plant, Marquette MI**
  - **Units 7-9**
  - **PRB Coal from Antelope and Spring Creek Mines**
- **$53.3M**
  - **$24.9M DOE**
  - **$28.5M We Energies**
- **90% Hg Control**
- **70% SO_2 Control***
- **30% NO_X Control***

*** Potential**

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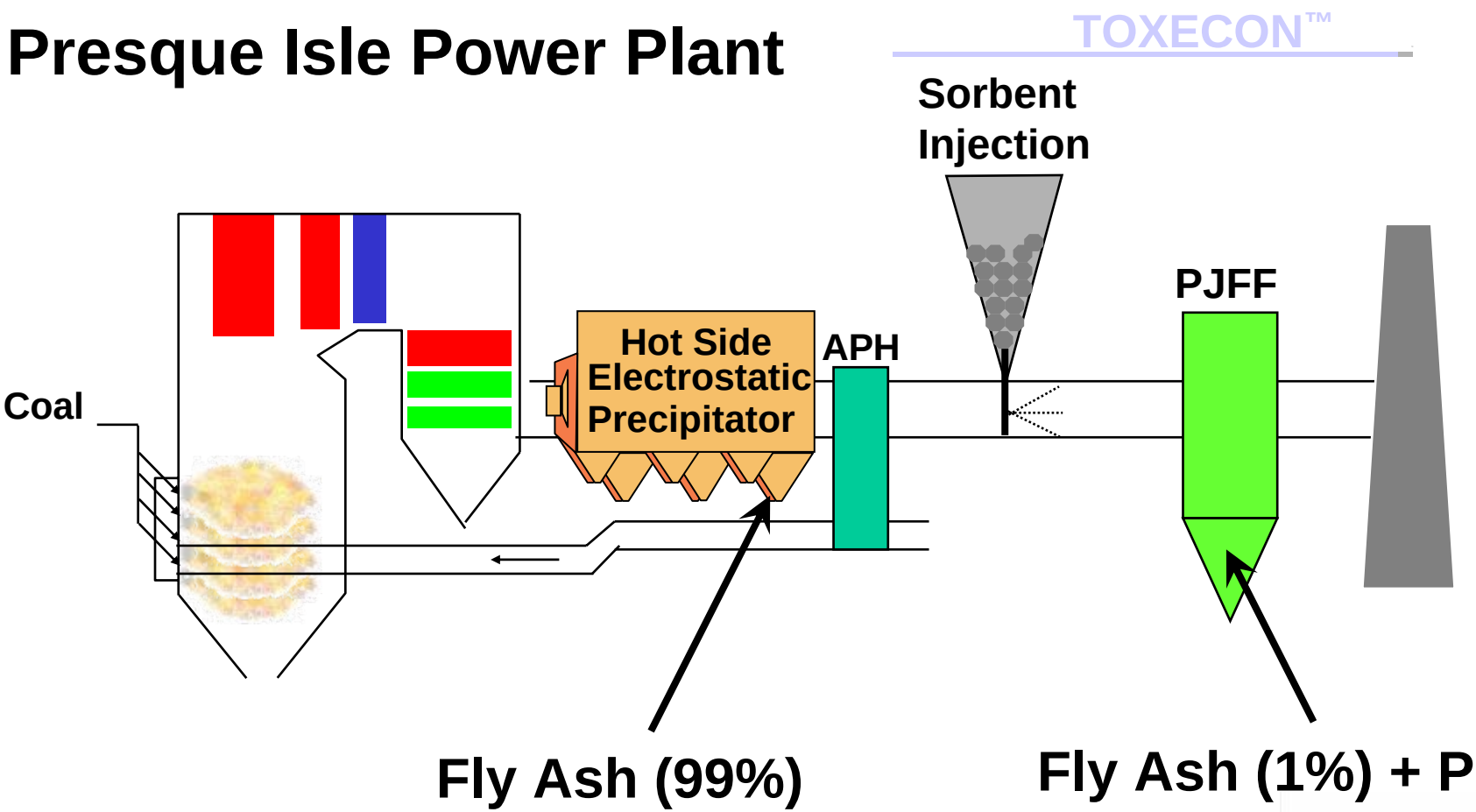
TOXECON™ Configuration

Presque Isle Power Plant



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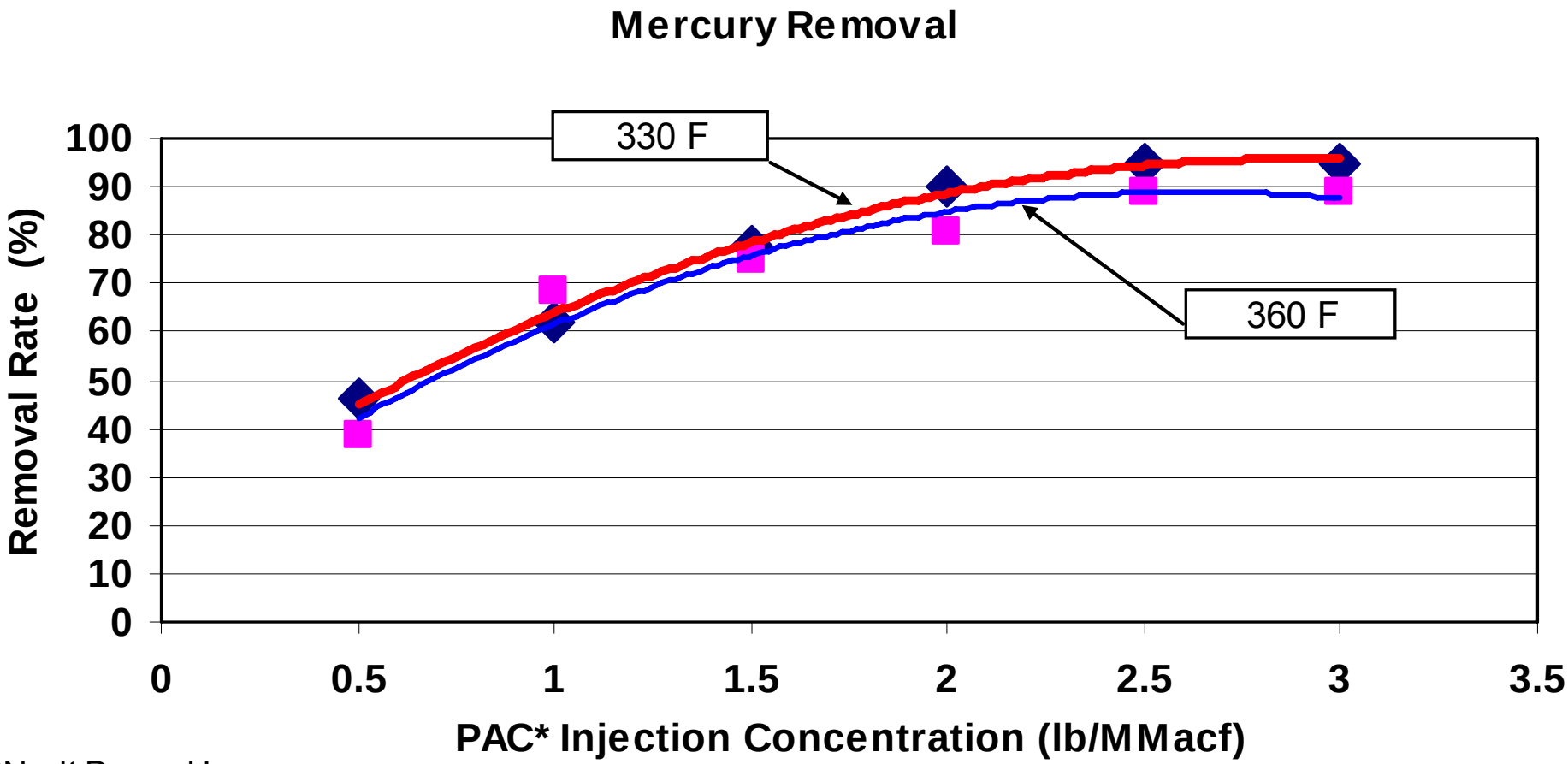
PIPP Baghouse Design

- Pulse-Jet Fabric Filter
  - Supplied by Wheelabrator
  - On-line cleaning
  - Ability for off-line cleaning
- Air-To-Cloth Ratio
  - 5.5 ft/min (gross)
  - 1,080,000 acfm
- 10 Compartments
  - 648 bags/compartment
  - PPS fabric

Schedule – Baseline and Parametric

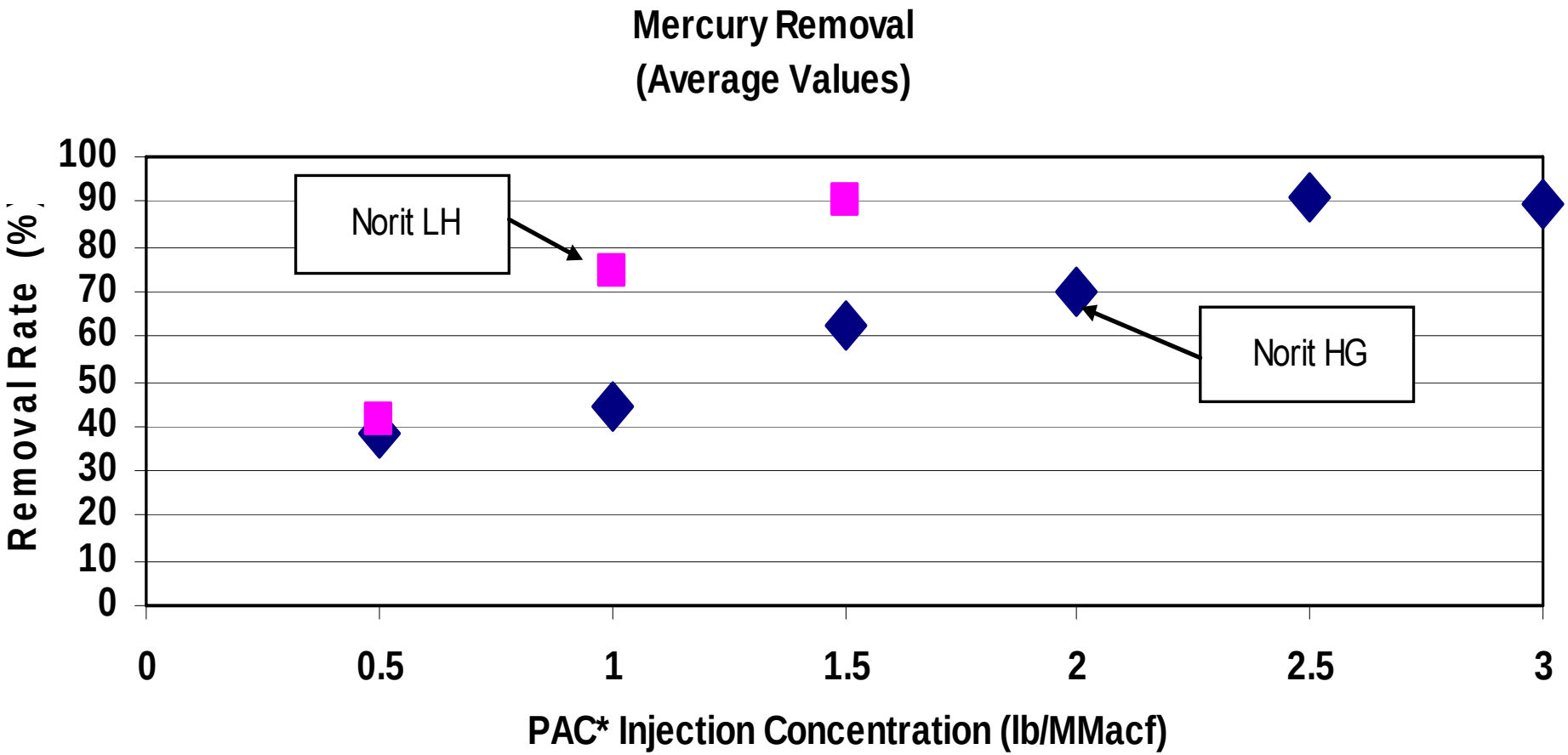
Date	Activity
2/13/06 – 2/17/06	Baseline Testing • Two CEMs sampling from inlet and outlet of baghouse • Stack sampling (Ontario Hydro Method, Method 17 for particulate, Appendix K Sorbent Trap Method, Method 26A for halogens) • Ash and coal sampling
2/20/06 – 3/2/06	Round 1 Parametric Testing • Injection concentrations • CEMs sampling from inlet and outlet of baghouse • Baghouse ash and coal sampling
8/20/06 – 11/7/06	Round 2 Parametric Testing • Injection concentrations • Sorbents • CEMs sampling from inlet and outlet of baghouse • Baghouse ash and coal sampling

Preliminary Mercury Removal Results

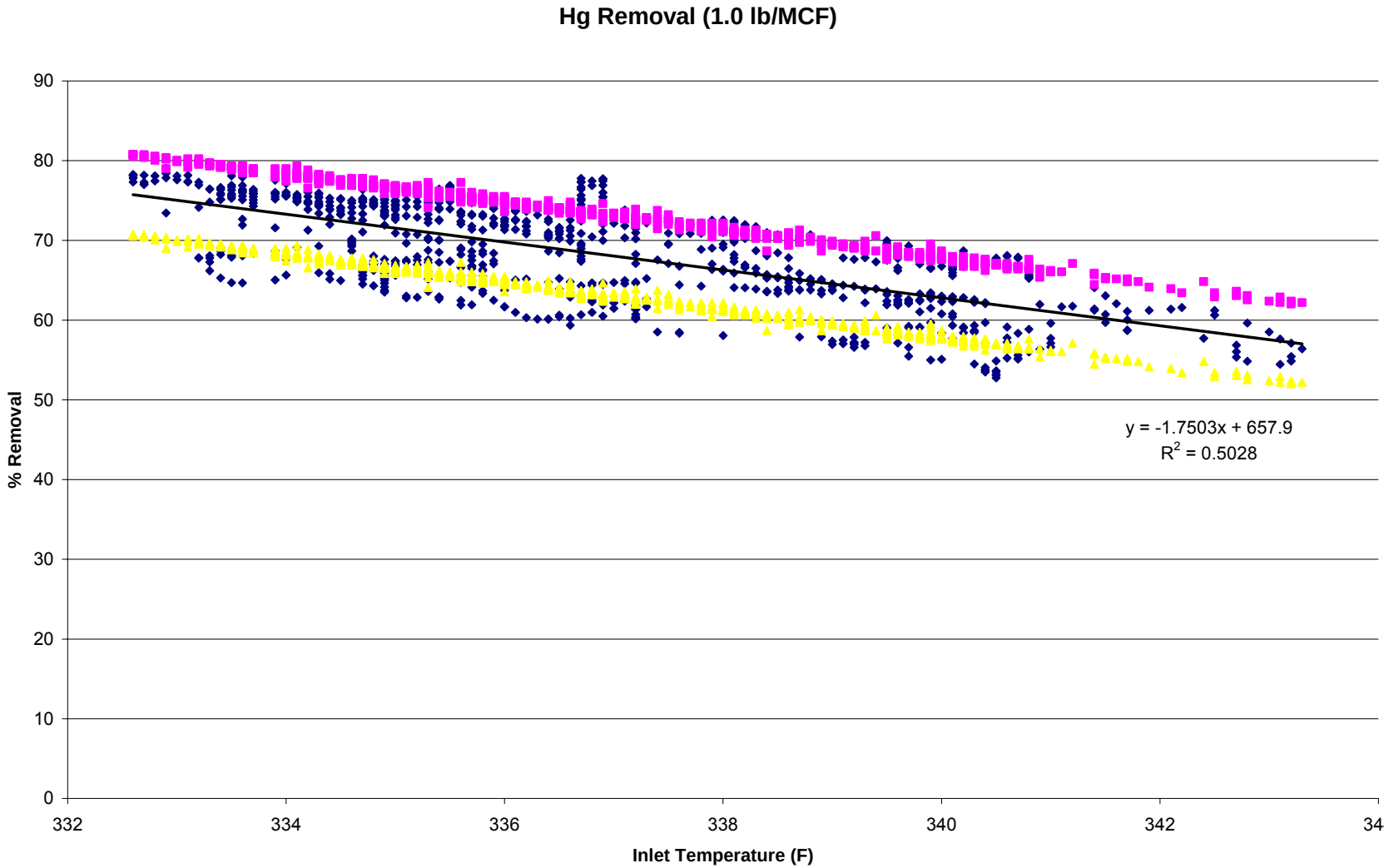


*Norit Darco Hg

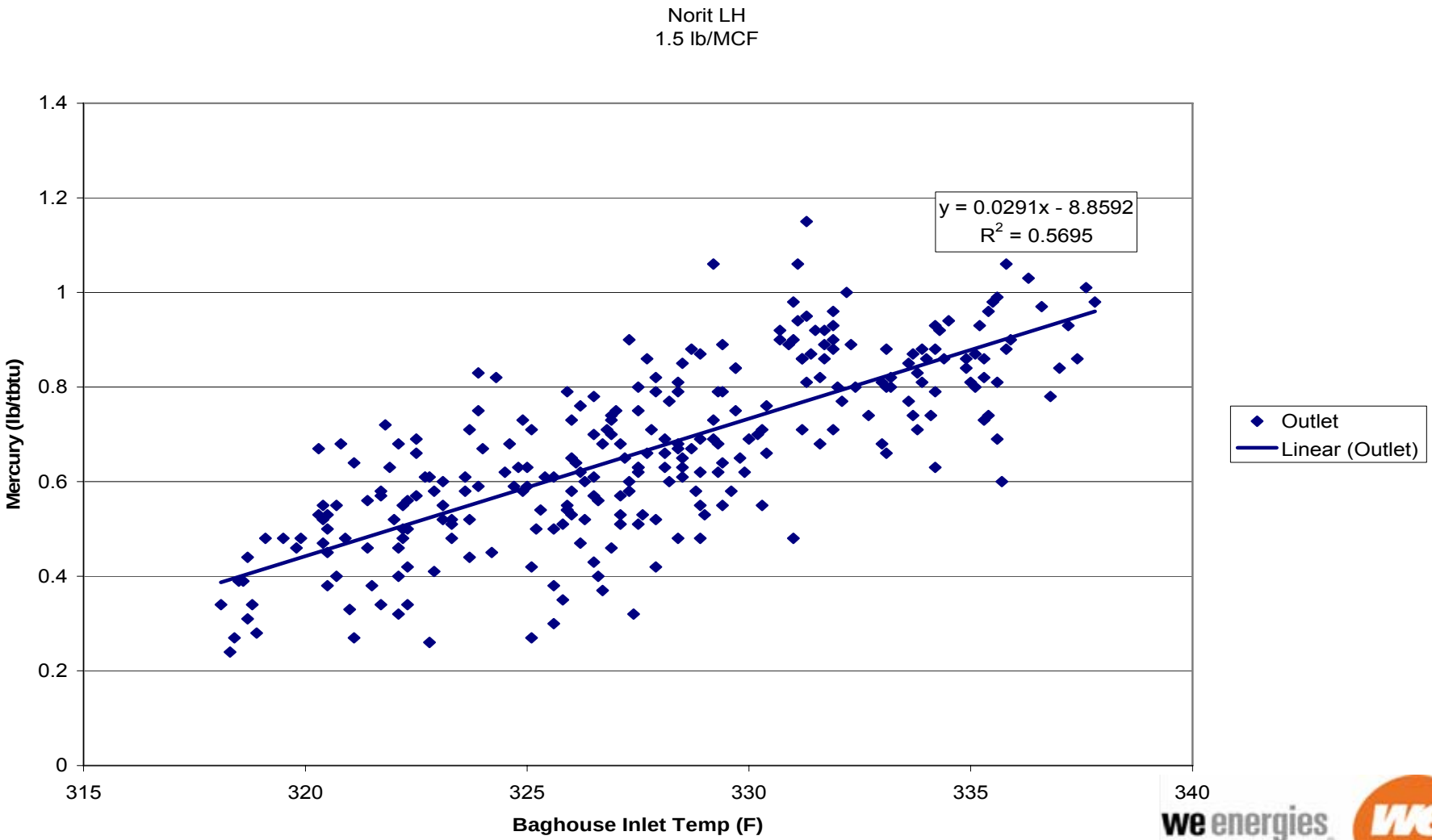
Preliminary Mercury Removal Results



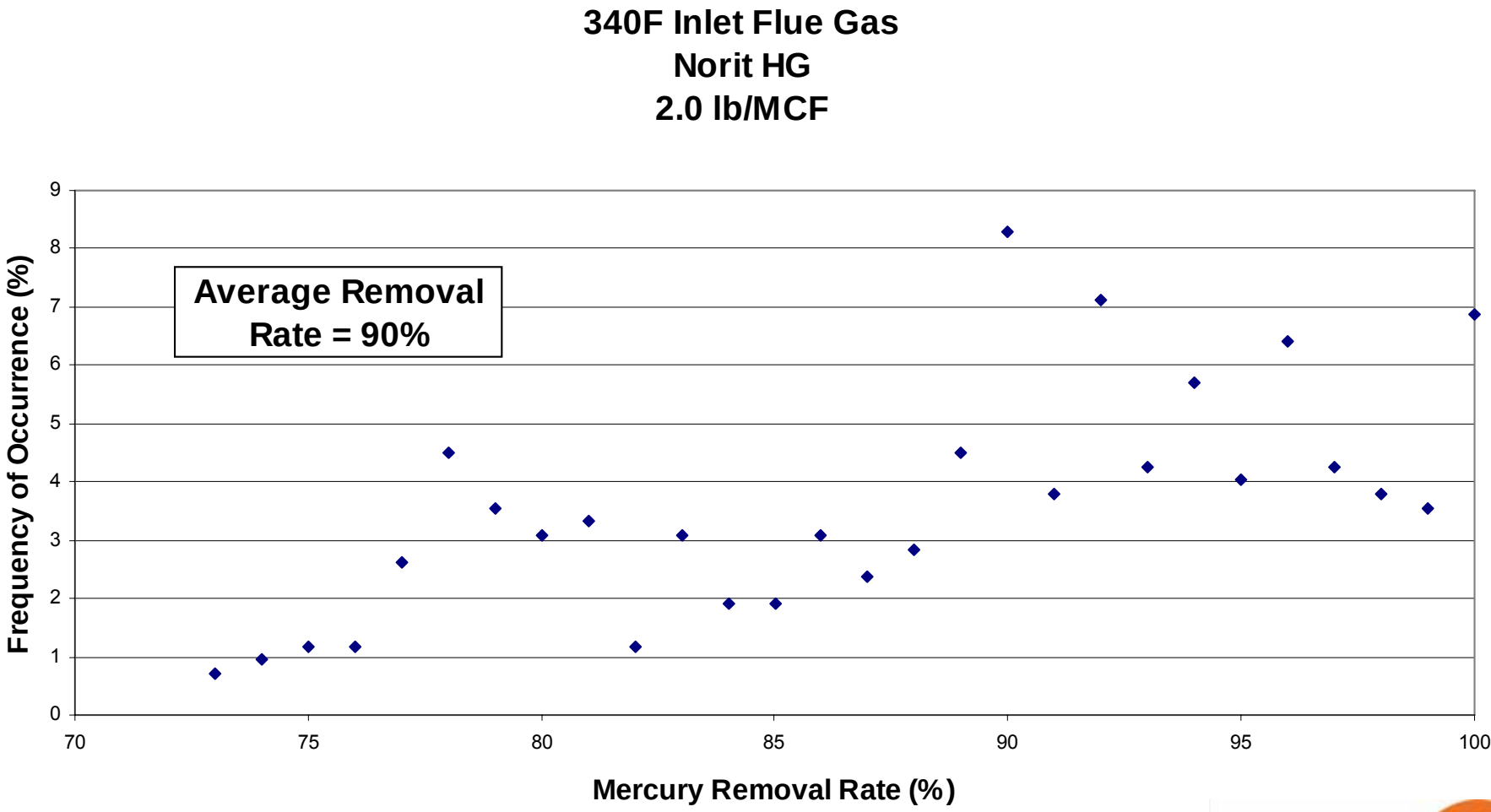
Effects of Flue Gas Temperature



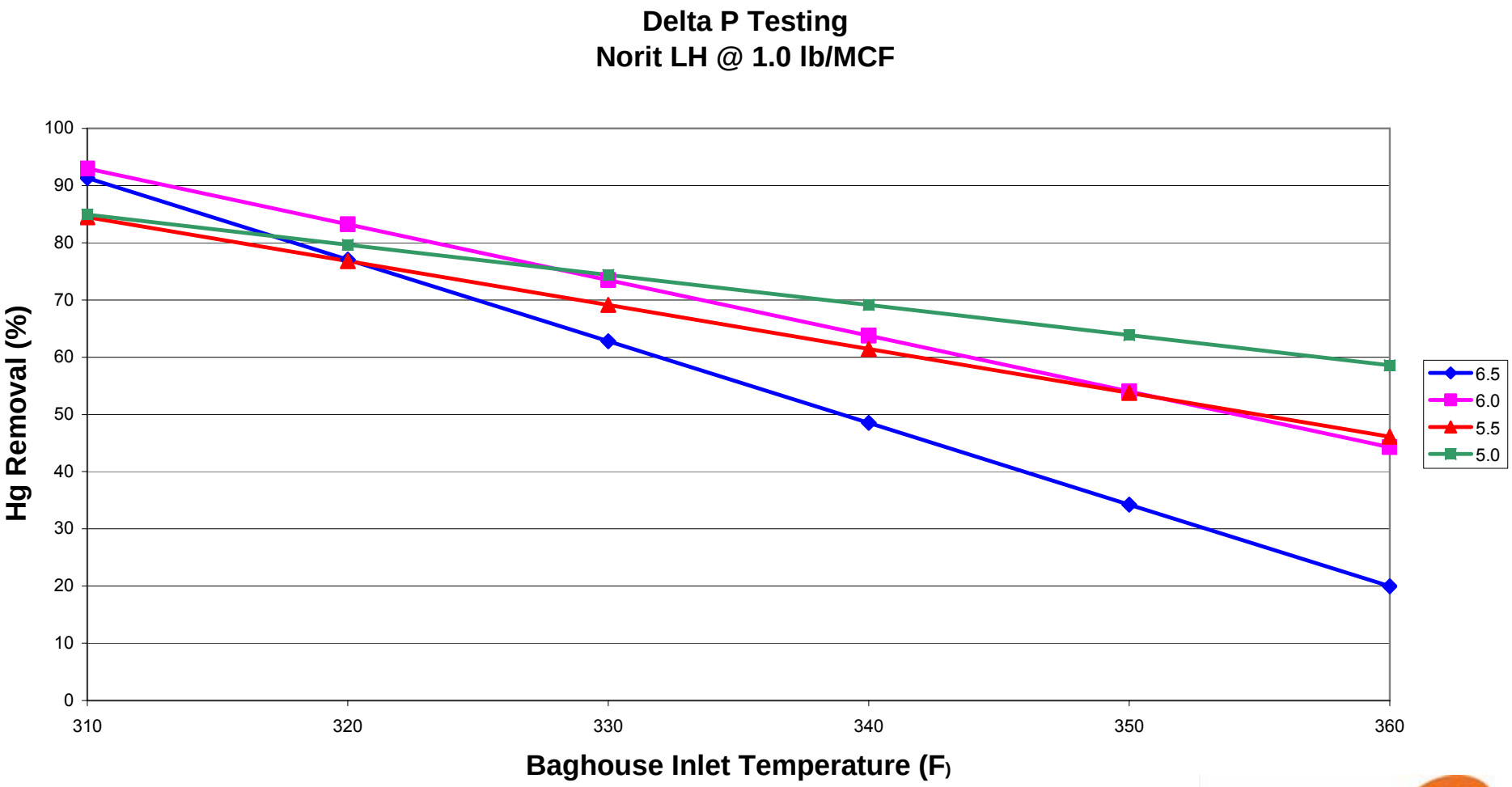
Preliminary Mercury Removal Results



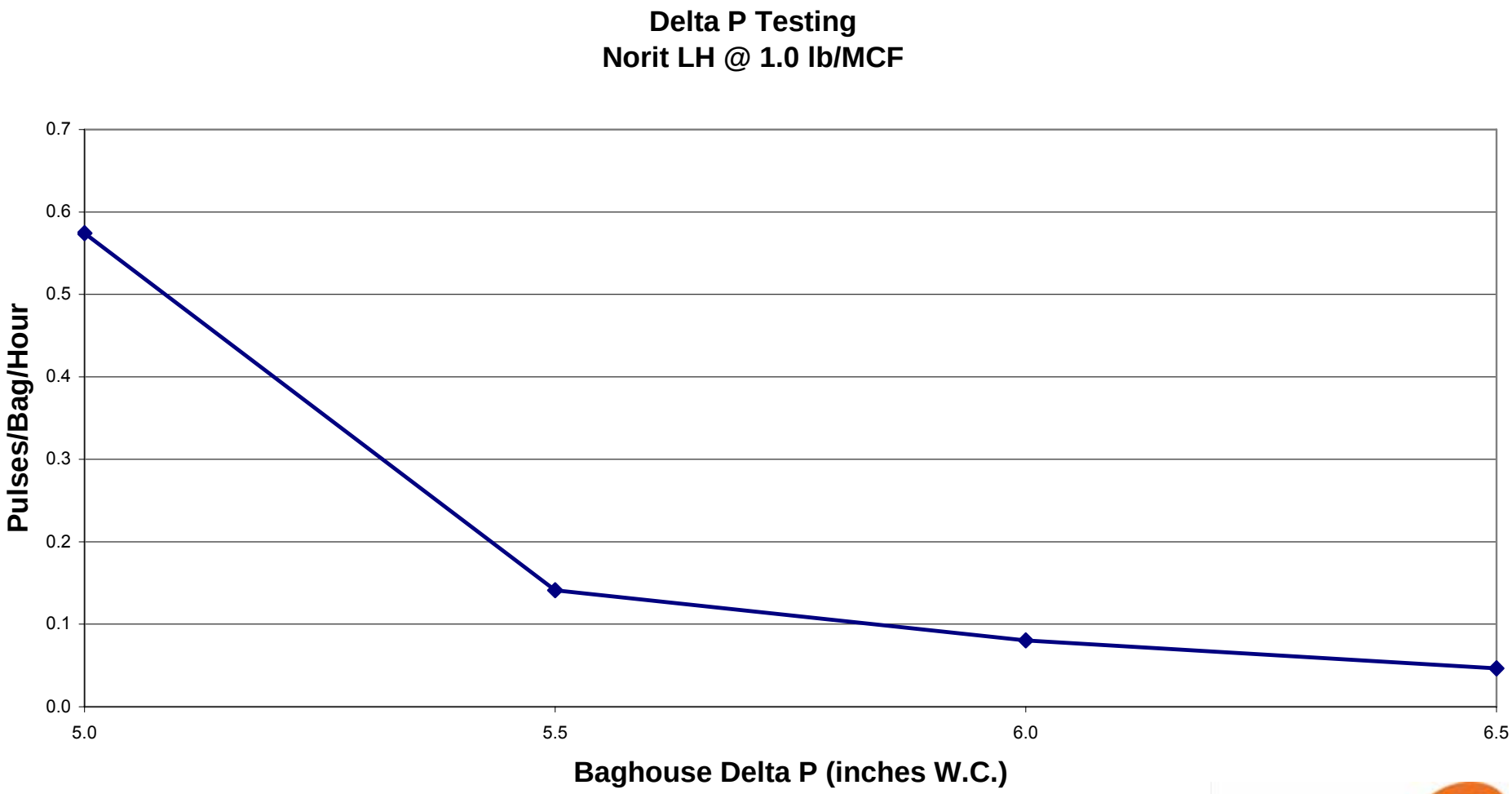
Mercury Removal Uncertainty



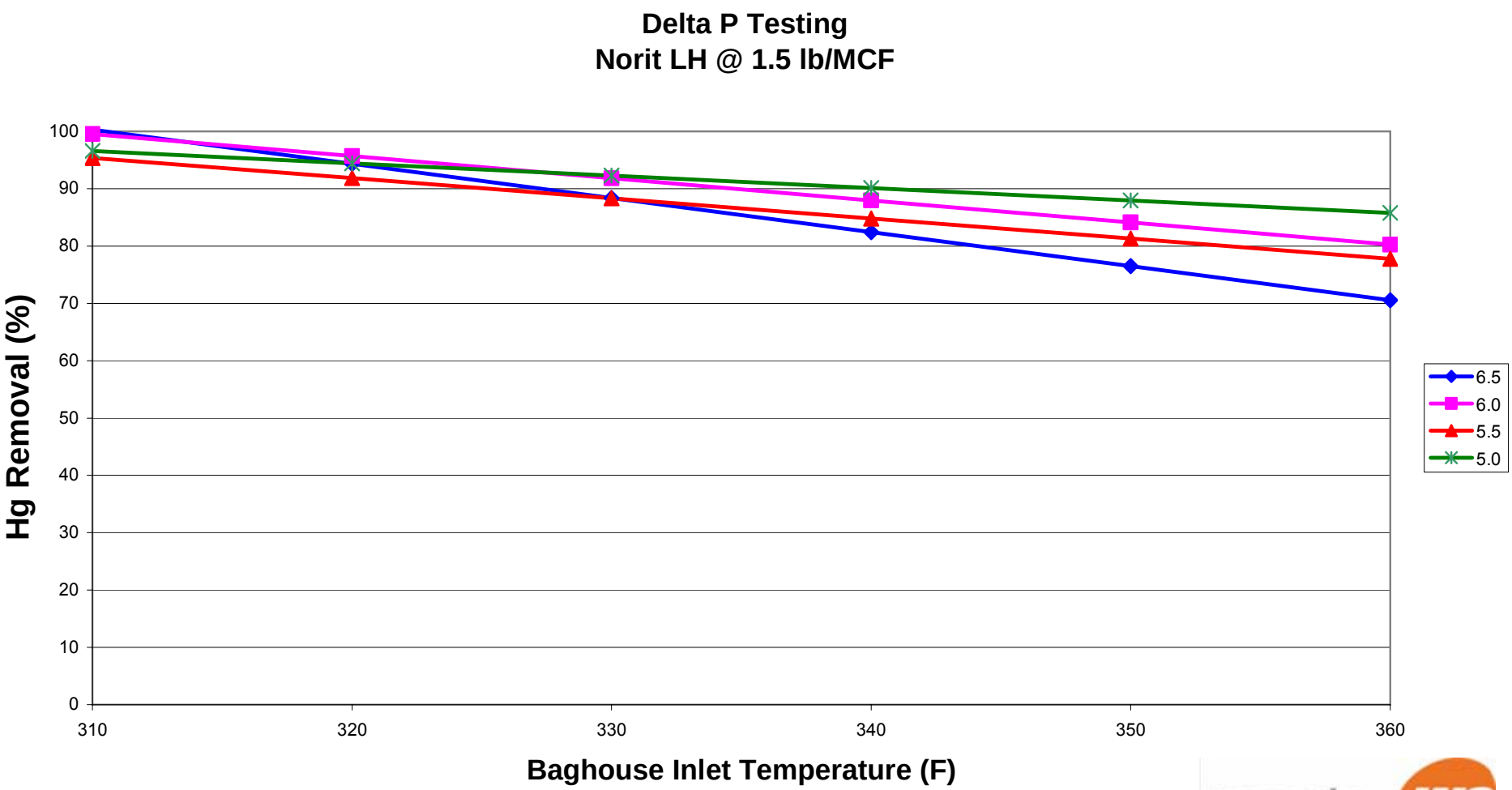
Effect of Baghouse ΔP



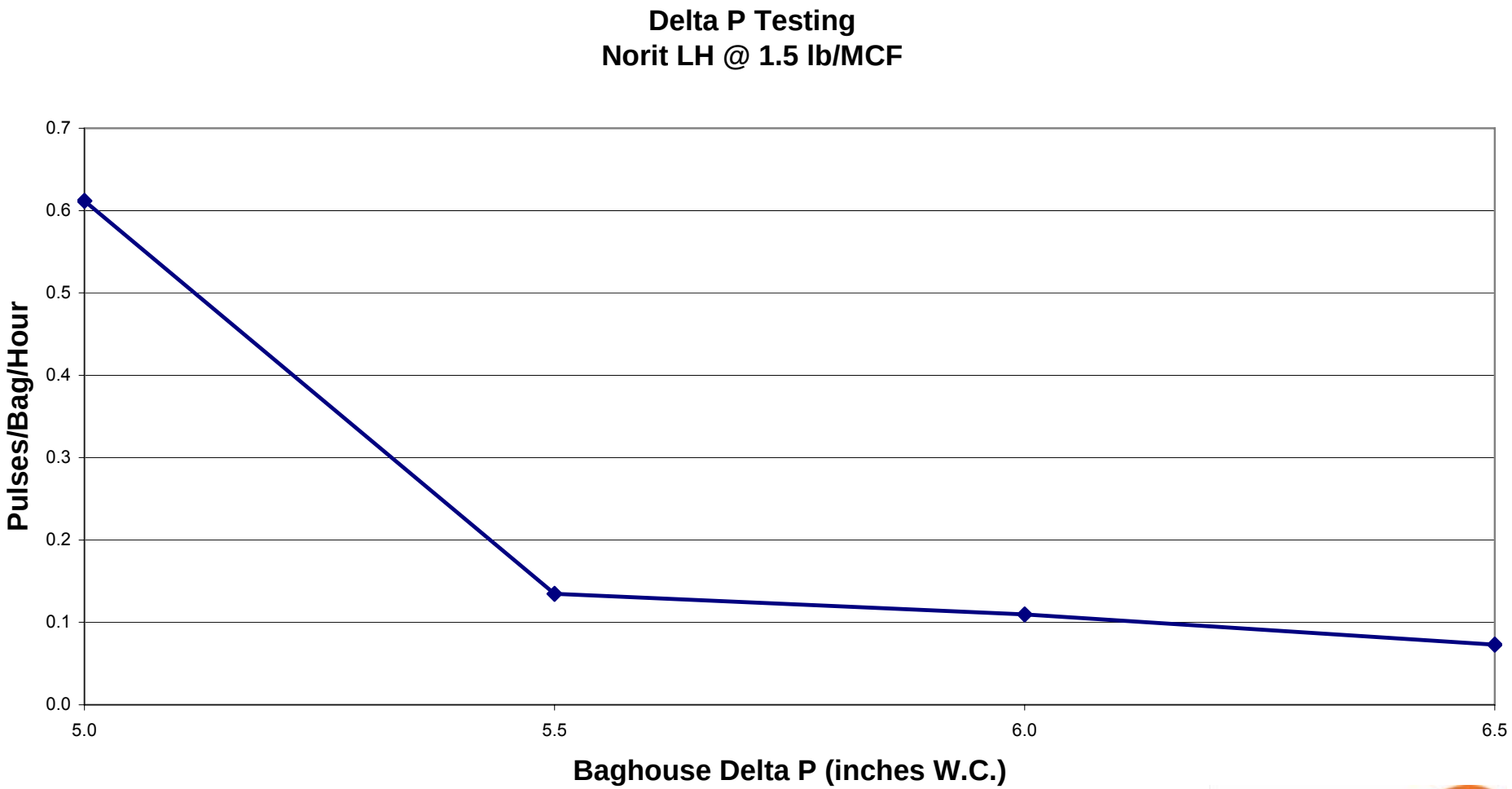
Effect of Baghouse ΔP



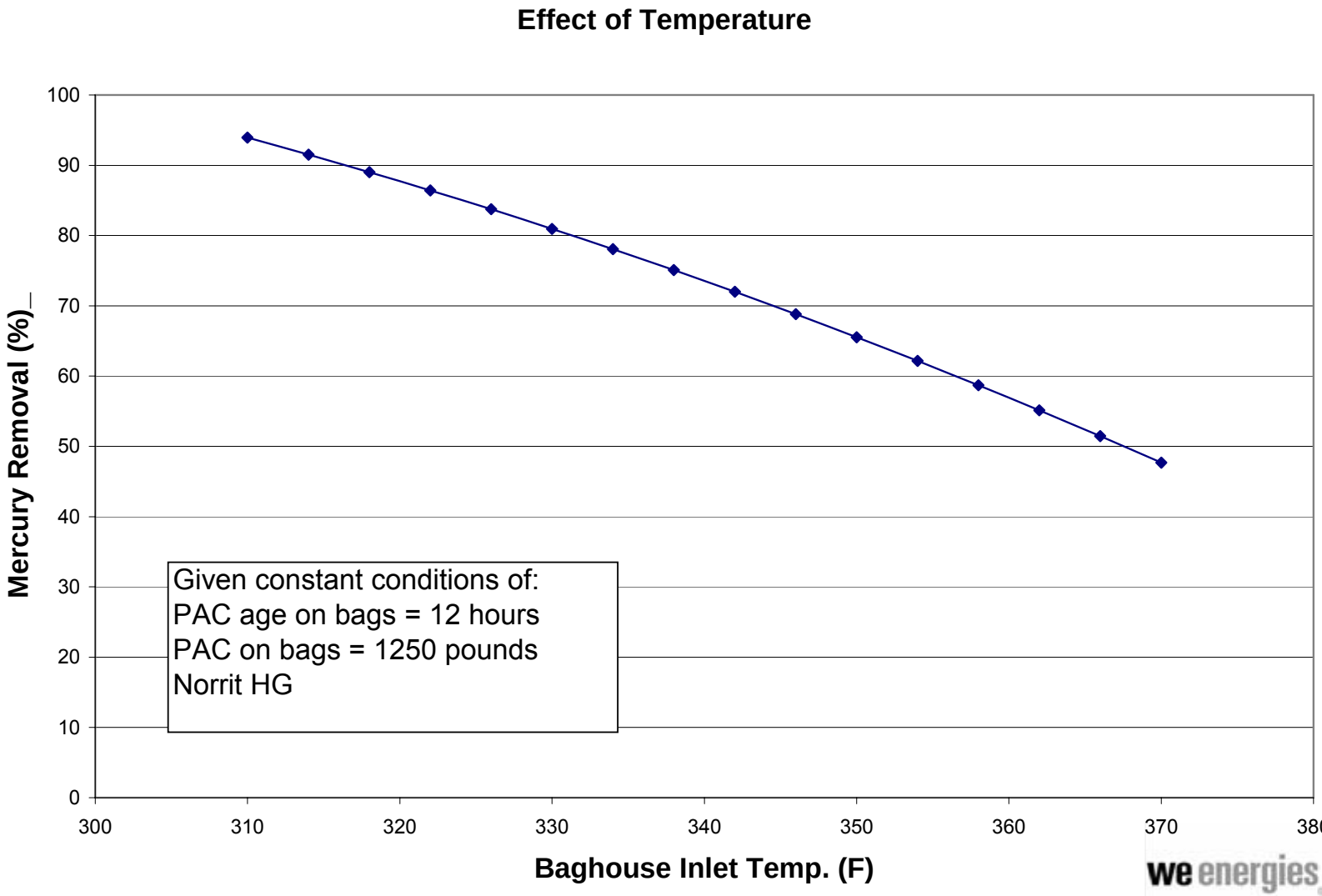
Effect of Baghouse ΔP



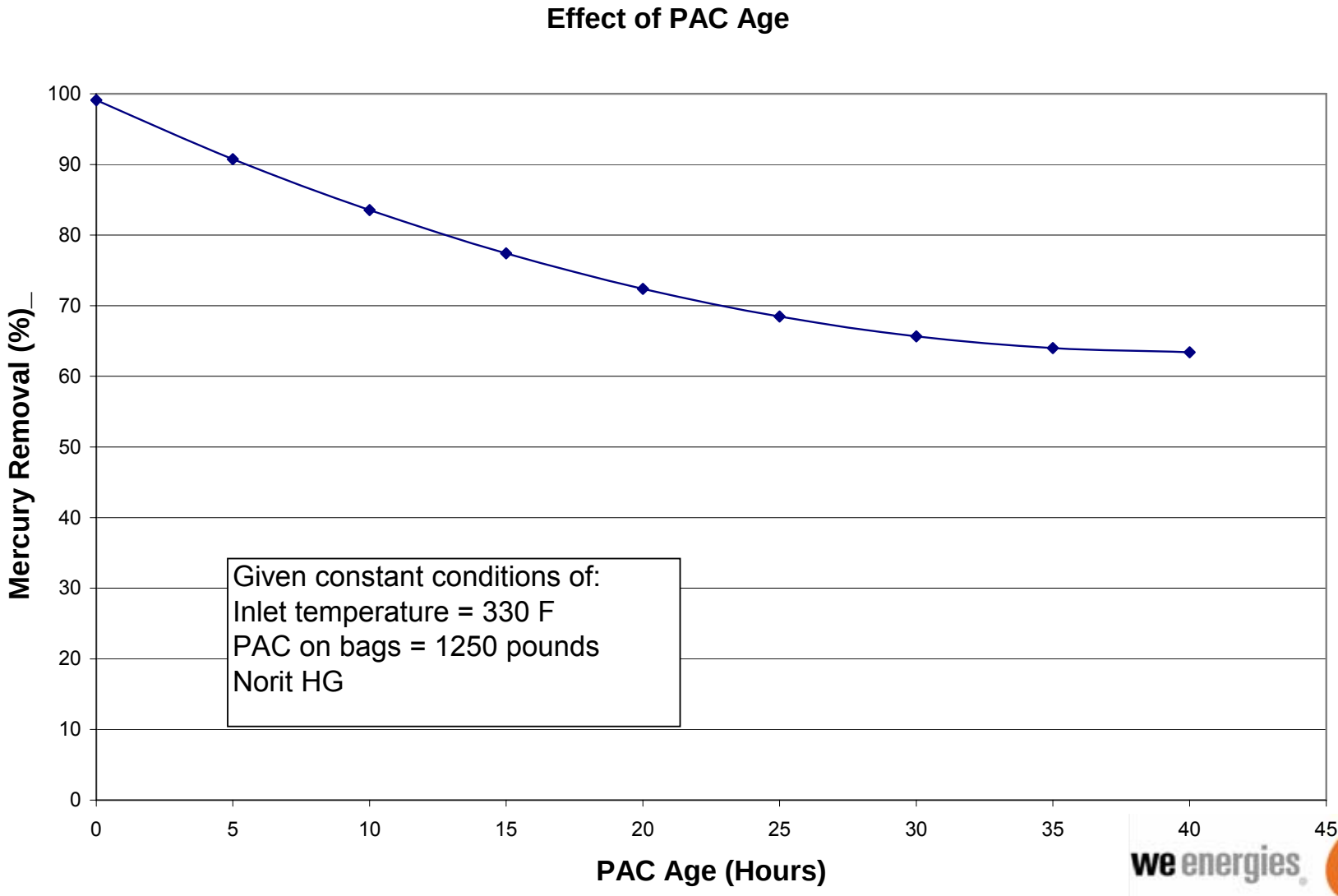
Effect of Baghouse ΔP



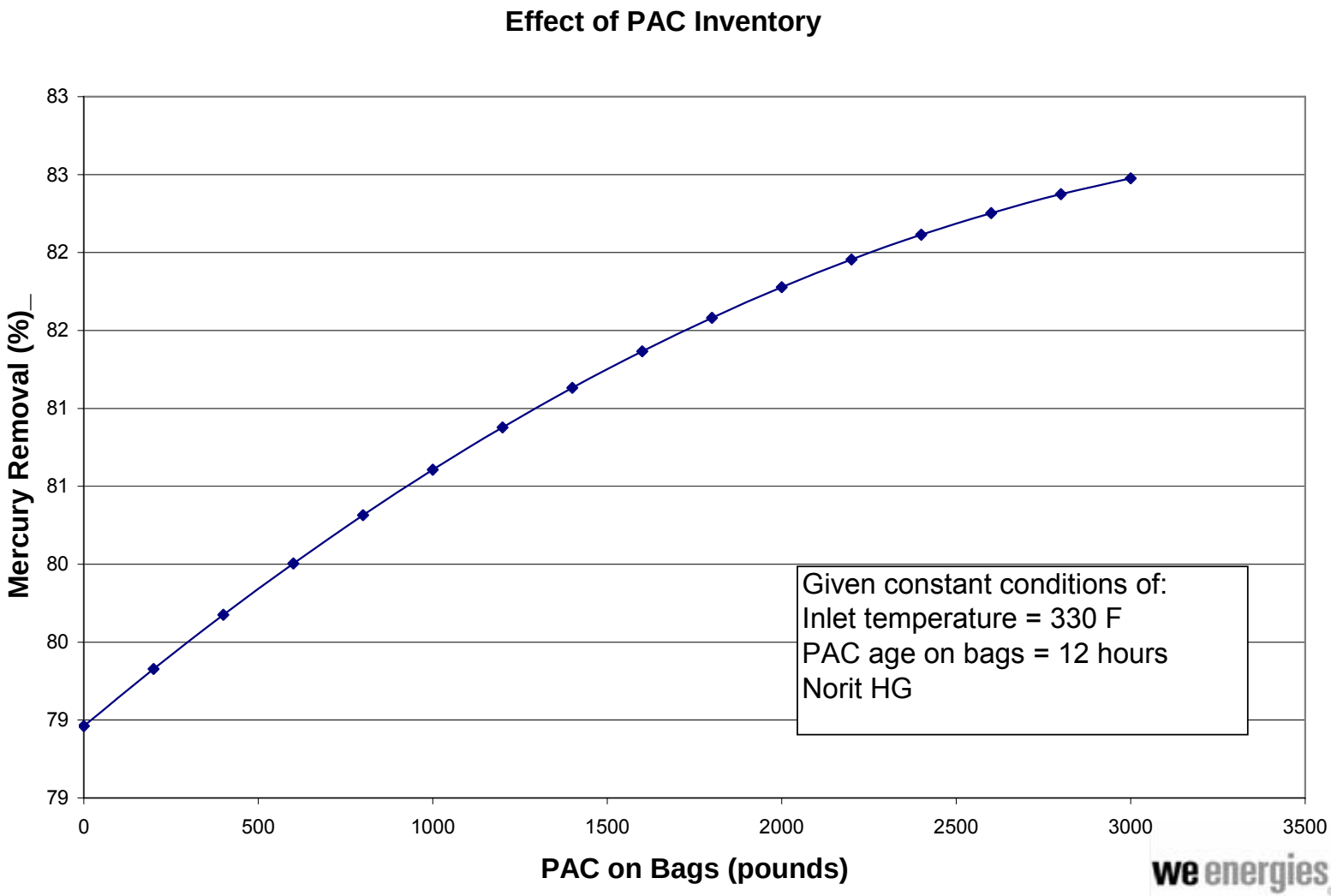
Effect of Temperature



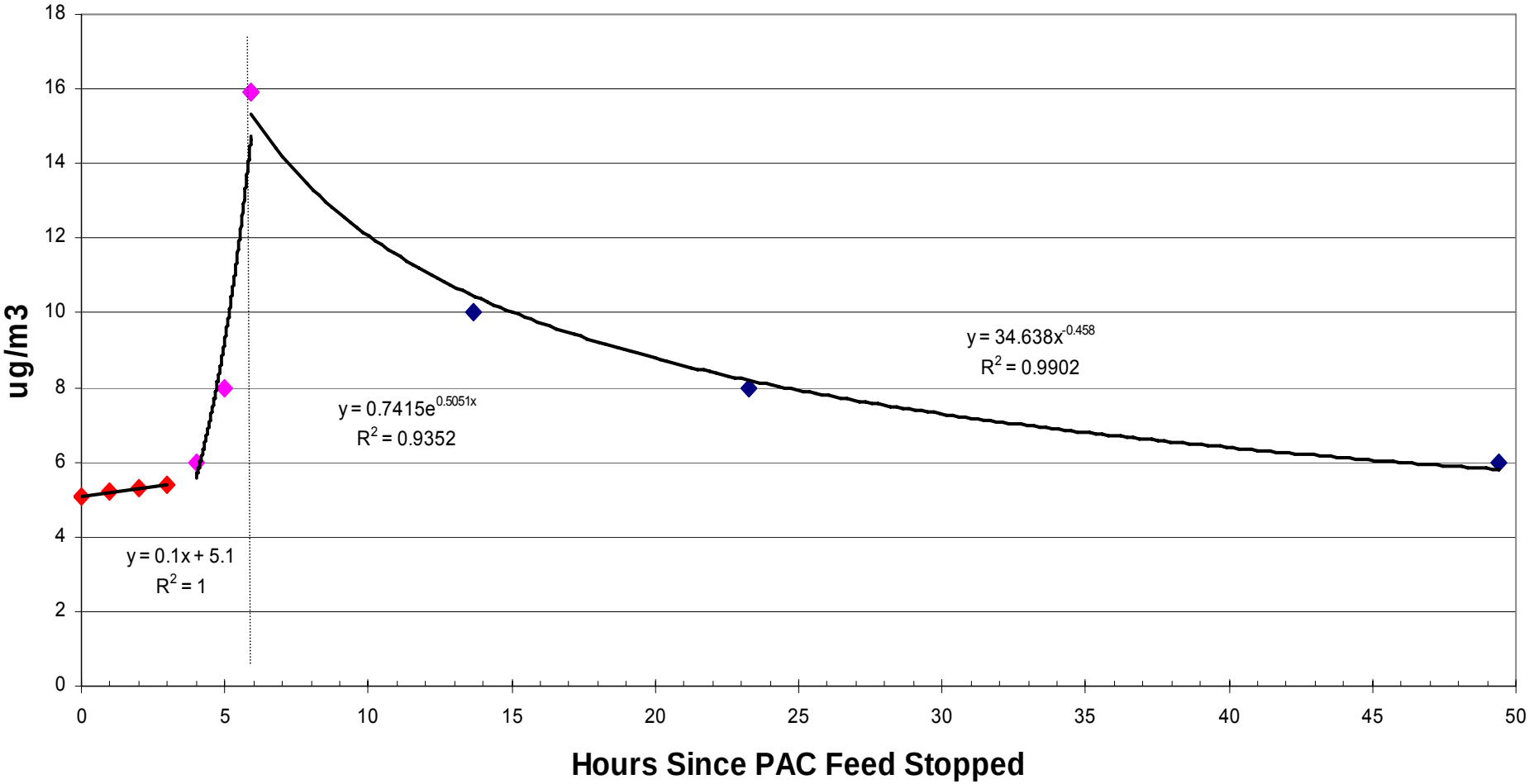
Effect of PAC Age



Effect of PAC Inventory



Mercury Outlet Without PAC Feed
9/22/06 to 9/24/06



Economics

	$/MWH	
PAC	0.33	
Fan Power	0.27	
Bag Replacement	0.09	
Ash/PAC Disposal	0.03	
Annual Scheduled Maintenance	0.02	
Miscellaneous	0.07	
TOTAL	**0.81**	
Annual mercury removed	82	pounds
Average cost (variable only)	16,000	$/lb

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Economics

- Capital Costs
  - $34.4 million, 270 MW
  - $128/kw
- O&M Costs
  - $0.81/MWH
- Hg Removal (variable only)
  - $16,000/lb

Balance of Plant Issues

- Smoldering PAC/ash in hoppers
- Bag cage separation
- Condensation at startup
- Ash silo unloading
- Cold air on pulse header valves
- Air heater soot blowing

What We Learned So Far

- Carbon injection effectively removes mercury
- Standard activated carbon is sensitive to temperature at low injection concentrations
- Bag cleaning based on ΔP and time reduces temperature sensitivity
- PAC/ash mixture can ignite with sufficient time and quantities at temperatures above 400 °F
- PAC/ash mixture is “sticky” and hoppers tend to “rat-hole”
- Normal ash unloading equipment is not effective when handling PAC/ash mixtures

Design Recommendations

- Minimize PAC/ash storage in baghouse hoppers
  - Evacuate hoppers often
  - Prevent material build-up
- Control hopper temperatures
  - Eliminate or minimize use of hopper heaters
  - Controls should provide narrow band
- Install additional thermocouples or CO monitor for early detection of fires

Conclusions

- CCPI demonstrations provide key support for the commercialization of new technologies
- Preliminary full-scale testing essential for establishing design basis and reducing risk
- First commercial mercury control system is now operational
  - Still some significant issues to resolve
  - The industry is closely watching this project

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