



***ADVANCED
CARBON PRODUCTS***

McIlvaine Company | Hot Topic Hour | March 5, 2015

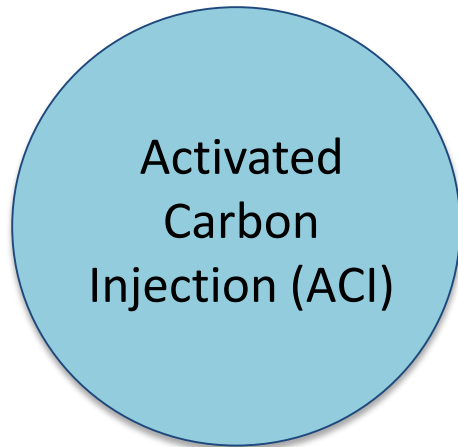
Mercury Measure and Capture: PAC Injection in the WFGD

Michelle Brown, PE & Dr. Christine Valcarce
McIlvaine Company | Hot Topic Hour | March 5, 2015

Regulation Compliance

Mercury and Air Toxics Standards (MATS)	Effluent Limitation Guidelines (ELGs)
Air Phase	Water Phase
April 2015/2016	July 2017 (projected)
<u>Mercury</u> , Particulate Matter, HCl/SO ₂ , HF	<u>Mercury</u> , Arsenic, Selenium, Nitrate/Nitrite

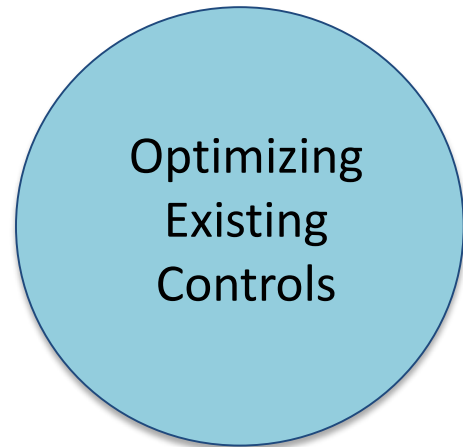
MATS Compliance Strategies



With or without halogen addition



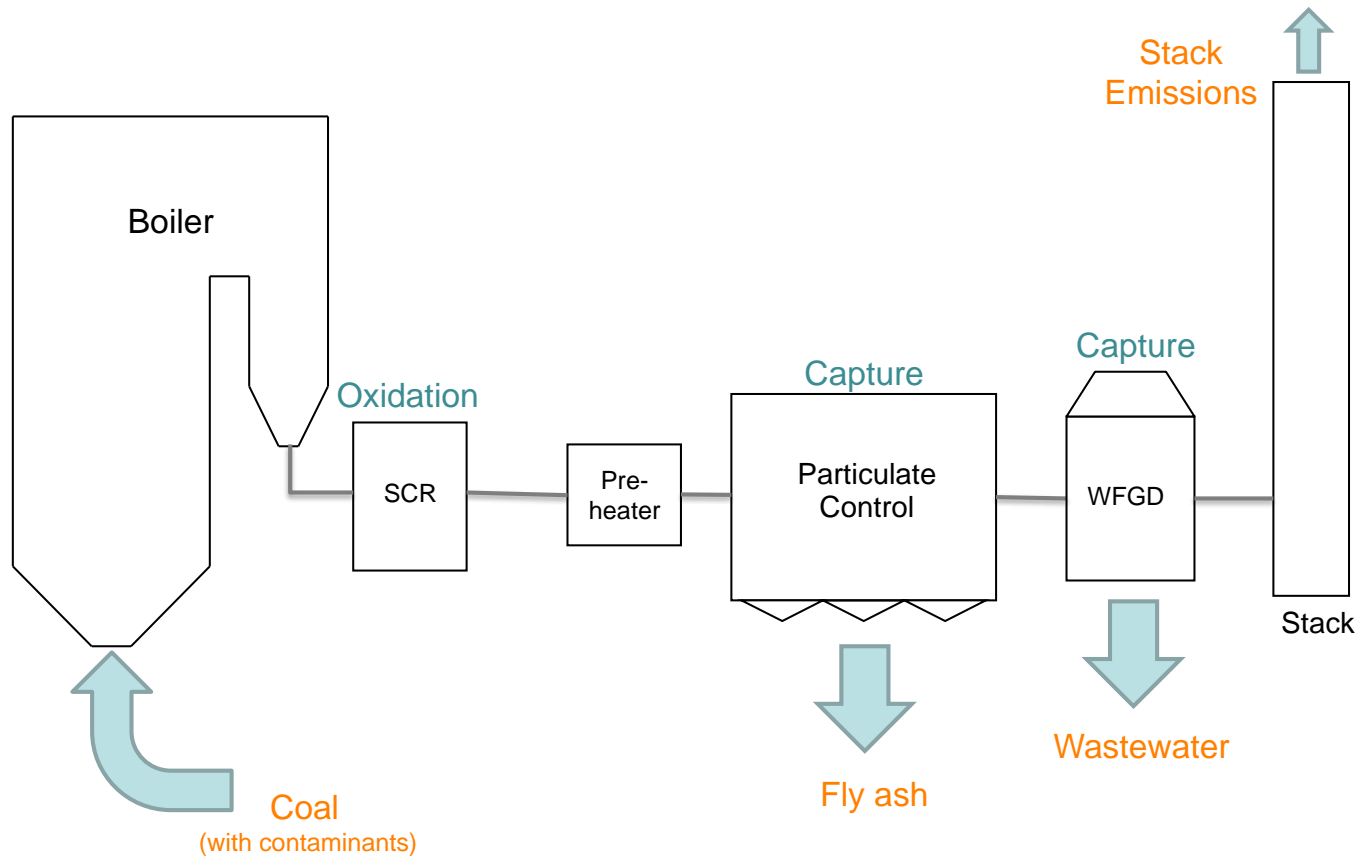
Oxidized Hg captured by ACI, fly ash or WFGD



e.g. SCR with targeted catalyst and WFGD

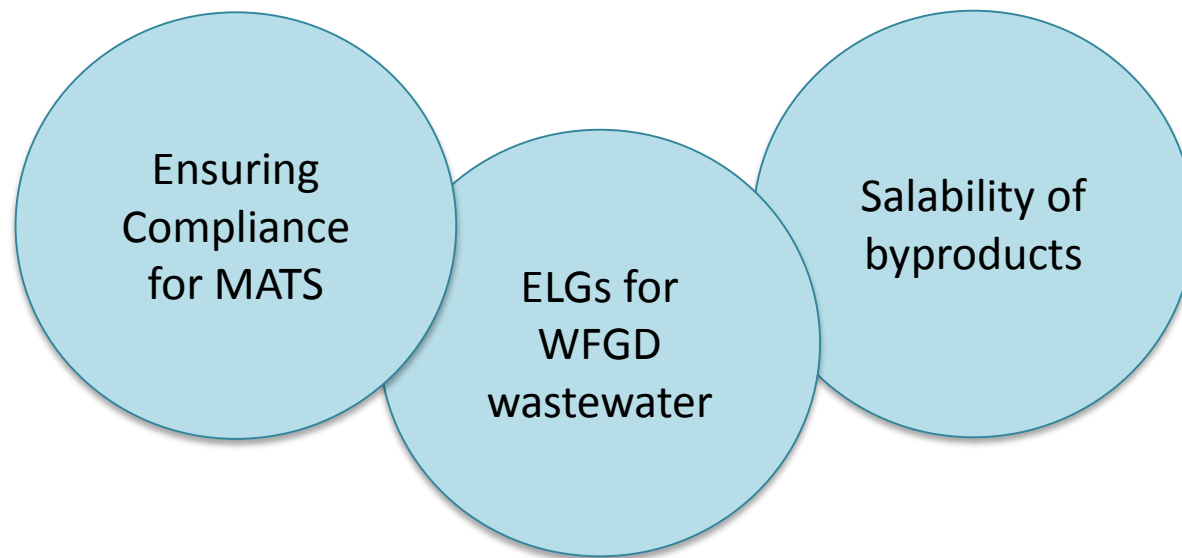
Fate of Contaminants

Contaminants from coal will transition into the flue gas during combustion then accumulate in particulate matter and liquids



Hg Capture in WFGD

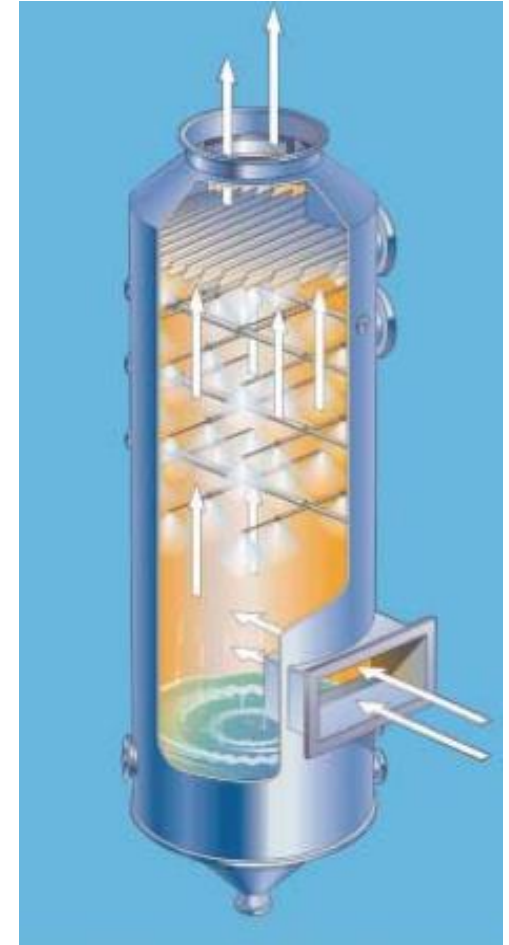
Several balance of plant issues must be considered with this strategy:



Powdered Activated Carbon (PAC) addition to the WFGD effectively addresses these concerns.

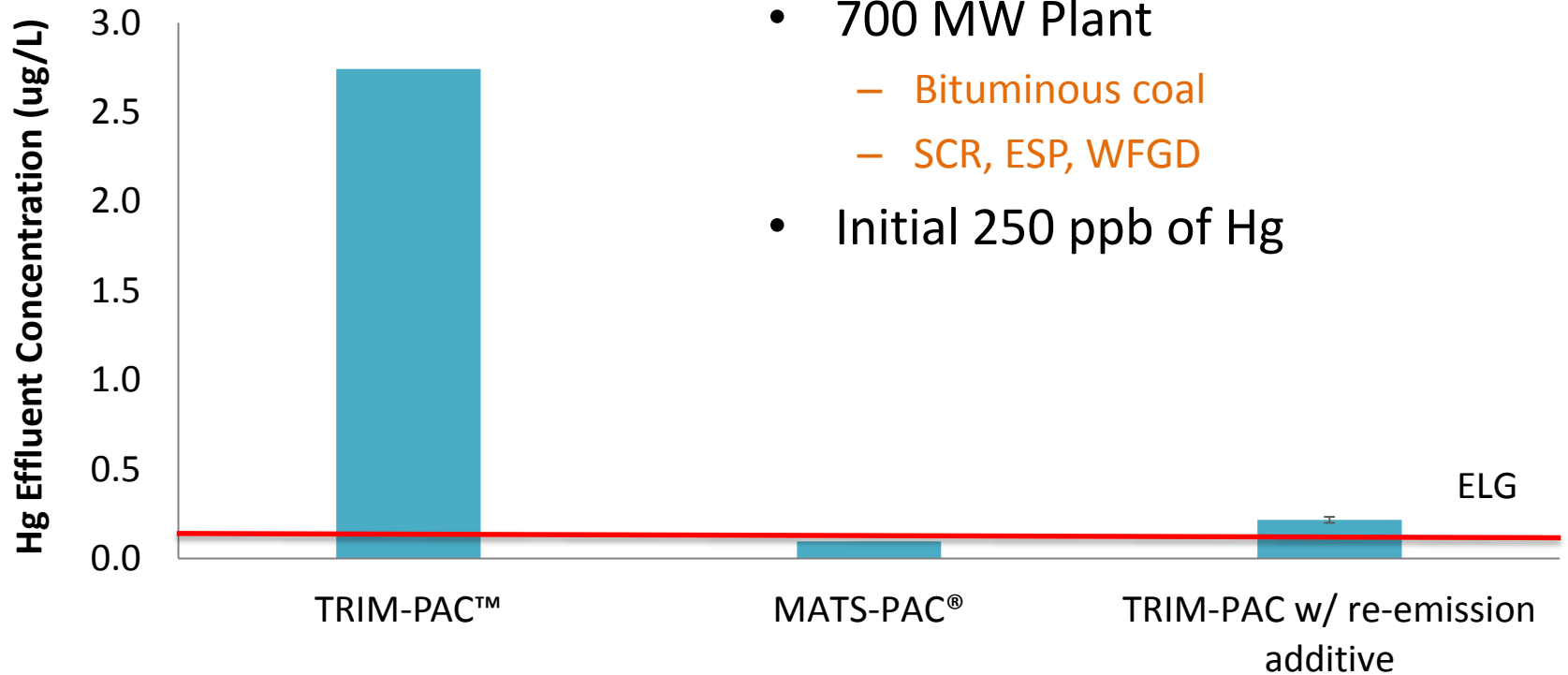
Ensuring Compliance

- WFGD efficiently captures Hg^{2+}
- WFGD chemistry may cause Hg re-emission:
 - Putting MATS compliance at risk
- PAC added to the WFGD adsorbs Hg^{2+}
 - Prevents re-emission
 - Decreases Hg in the wastewater effluent for compliance with proposed ELGs



Wastewater ELGs

- Bench-scale testing
- 700 MW Plant
 - Bituminous coal
 - SCR, ESP, WFGD
- Initial 250 ppb of Hg



By-Product Salability

- PAC adsorbs Hg^{2+}
 - Decreases Hg loading to gypsum products thereby increasing value
- PAC can be separated from by-products using a hydrocyclone
 - Preserves gypsum salability



Operational Benefits

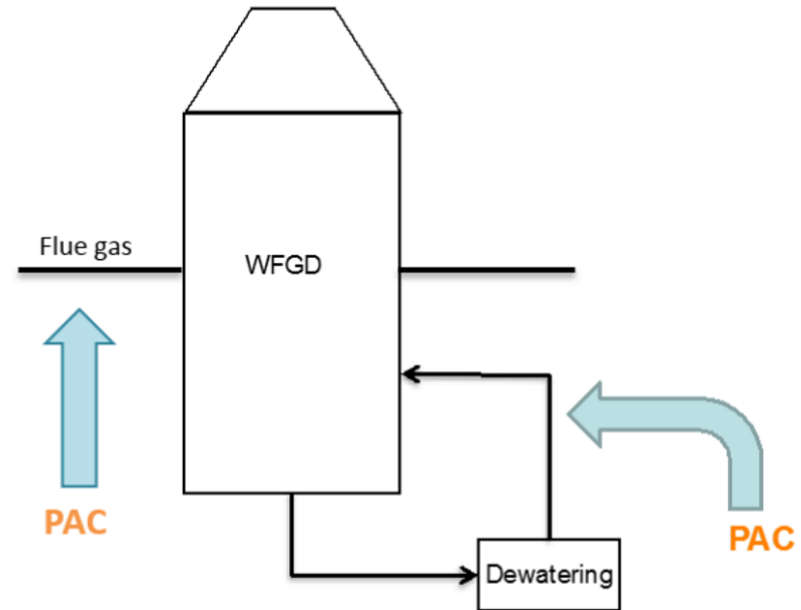
- PAC will likely not change WFGD chemistry
 - No change to operating ranges
- Bromine concerns
 - Selenium oxidation
 - Potential corrosion
 - Impacts for downstream drinking water supplies

Bromine Concerns

- Arambasick, Katie, Katherine Dombrowski and Nanda Srinivasan.** "2014 Update on EPRI's Balance on Plant Effects Study of Bromine Based Mercury Controls." Mega Symposium. Baltimore, 2014.
- Bisson, Teresa and Zhenghe Xu.** "Potential Hazards of Brominated Carbon Sorbents for Mercury Emissions Control." Environmental Science and Technology (2015).
- Blythe, Gary, et al.** "Assessing FGD Corrosion Risk for Bromine-Based Hg Control Tech." EUEC. Phoenix, 2014.
- Guffre, John.** "Mercury Oxidation Across the Air Heater." World Pollution Control Association. 2012.
- Miller, Jon, et al.** "Impact of PAC Injection Upstream of the APH on Baskets Corrosion and Mitigation Strategies." EUEC. 2014. Phoenix.
- Zhuang, Ye, et al.** "Investigation on Bromine Corrosion Associated with Mercury Control Technologies in Coal Flue Gas ." Fuel 88 (2008): 1692-1697.

PAC Addition Strategy

- PAC injection point options
 - Dilute pneumatic injection into the flue gas as with traditional ACI but upstream of the WFGD
 - Wet sluiced into WFGD slurry

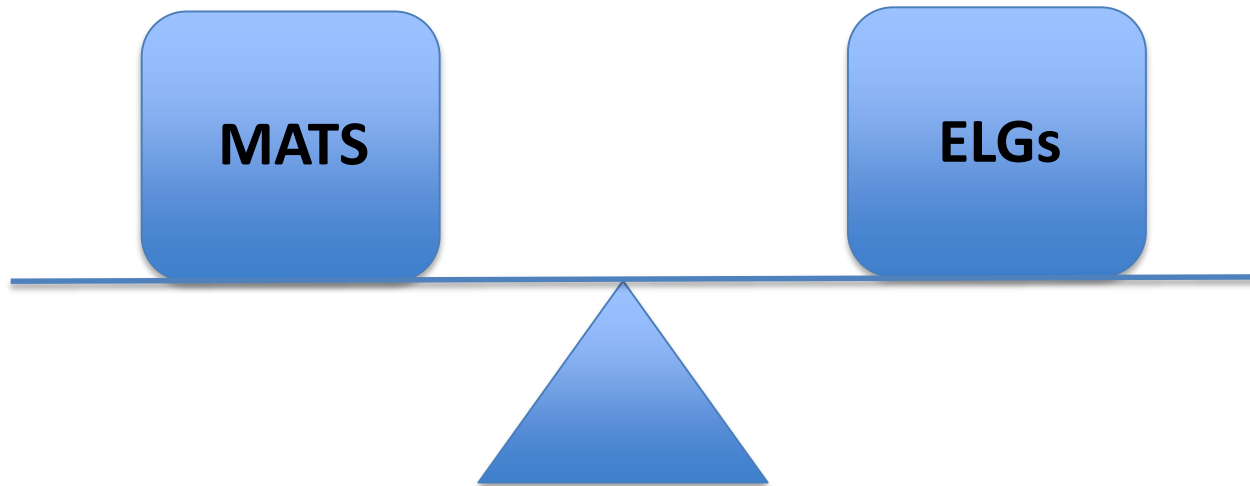


PAC Addition Strategy

- Several companies offer injection strategies
 - Steag Energy Services, LLC
 - Claims patented processes for an enhanced system
 - U.S. Patent 7,727,307
 - U.S. Patent 6,090,355
 - U.S. Patent 5,811,066
 - U.S. Patent 5,405,812
 - URS Corporation (now AECOM)
 - Geosyntec

The Balancing Act

Environmental regulation compliance is an ongoing dynamic challenge. It is essential to understand how MATS compliance options may affect ELG compliance down the road.



Innovative Non-halogenated Powdered Activated Carbons

Gas and Liquid Phase Mercury Capture

Contract Flexibility and Partnership Philosophy

Industry-leading R&D

Reduce Costs for MATS Compliance

Thank You!

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