COMMENTS ON SELECTED EPA ASSUMPTIONS REGARDING MERCURY CONTROL COSTS

Submitted by the Utility Air Regulatory Group

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KEY ISSUES

• Feasibility of spray cooling
• Carbon injection/ESPc: feasibility, applicability
• Co-benefits of SNCR, SCR
SPRAY COOLING

• Critical for least-cost Hg reduction, per EPA
• Lower flue gas temperature by 50-100° F improves
  – ESP opacity
  – Carbon use/Hg removal
• Used for non-utility applications w/low sulfur and ash content (steel mills)
• Evaluated but not commercially deployed at:
  – SWEPCo/Harrington (1995)
• Pacificorp/Jim Bridger (1996) status not confirmed
SPRAY DRYING, COOLING: NOT THE SAME

**Spray Drying**
- Atomizer: 80,000 rpm
- $V_{\text{gas}} = 5-8 \text{ fps, 3-5 sec residence time}$
- Gas in
- Gas out
- Capital: $75-100/kW$

**Spray Cooling**
- Atomizer: dual fluid
- $V_{\text{gas}} = 40 \text{ fps}$
- Res time to ESP
  - Usually $<1 \text{ sec}$
- Gas in
- Capital: $2-3/kW$

Spray Cooling is fundamentally different from Spray Drying. While both processes involve atomization and gas flow, the conditions and equipment used are distinct. In Spray Drying, the gas velocity is lower, typically 5-8 fps, with a residence time of 3-5 seconds. The atomizer operates at a high speed of 80,000 rpm. In contrast, Spray Cooling uses a much higher gas velocity of 40 fps, and the residence time is usually less than 1 second. The atomizer in Spray Cooling is dual fluid, as indicated. Capital costs also differ, with Spray Drying being more expensive ($75-100/kW$) compared to Spray Cooling ($2-3/kW$).
SPRAY COOLING AT PP4 DEMO
(SOLE COMMERCIAL EXPERIENCE)

• Deposits noted via cameras within 1 hr operation
• Key areas of concern (flow vanes, baffles, ESP inlet, etc.) inaccessible to video monitor
• Deposits removable, but after injection terminated
• Significant finding: 50° F temperature drop did not benefit Hg removal, carbon utilization
KEY TO THE ESP: CARBON (LOI), SCA (RELATIVE SIZE)

53% ESP Population

LOI: Opacity-inducing boiler upset, or 12 lbs/MACF ACI

Range of LOI, SCA for many existing units

LOI

5

30

20

10

Specific Collecting Area, SCA

150 300 450 600

Salem Harbor

Brayton Point

PP4
CARBON INJECTION/ESPc FEASIBILITY

• PP4: one of the most ACI-tolerant ESPs
  – large SCA (465)
  – LOI < 1% (volatile PRB fuel)

• 53% of US ESP inventory
  – SCA <300
  – 5-10% LOI---->10-15 with 12 lbs/MACF

• Units <300 SCA will probably require ESP upgrade to tolerate ACI
  – capital $17-24/kW, not $2-4 /kW per EPA
  – total 2-3 mills/kWh, not <1/kWh per EPA
Hg/NOx “CO-BENEFIT”: FACTORS AFFECTING Hg OXIDATION

SNCR: 3 field sites
- No clear mechanism
- No evidence from 3 field tests with SNCR, NH3-conditioning

SCR: 2 of 4 sites positive, but “typical”?
- High S coal (2.9, 3.8%)
- Chlorides “not low” (380-1100 ppm)
- Group 2 boilers (cyclone, cell)
- Low “inherent’ Hg oxidation (<50%)
- “Excess” catalyst volume (by >50%) than usually deployed for NOx
SCR CO-BENEFITS, EVEN IF REAL, ARE NOT FREE

- Two units “testing positive” featured 50% greater catalyst volume (res time) than typical SCR design
- Catalyst aging may be important

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\begin{align*}
\text{Hg SCR Capital,} \\
\text{Operating Premium} \\
$20-40/kW \\
0.25 \text{ mills/kWh}
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