MACT/MATS Compliance

- Limit of 0.03 lb/Mbtu for filterable particulate
  - EPA excluded condensable fraction
- ESP performance at these low emissions levels dependent on a number of factors
  - ESP Optimization must approach ideal conditions more closely than for previous requirements
  - Upstream equipment dictate inlet conditions
  - Injected sorbents can have a significant effect
Observed ESP Performance

• Most Effective ESP Upgrades
  – Installing high frequency power supplies
  – Increasing the degree of electrical sectionalization
  – Optimizing the gas flow distribution for an ESP

• ESP performance insensitive to plate spacing
  – 9 inch rebuilds are producing very low emissions
  – 16 inch rebuilds are producing very low emission

• The “size” of an ESP needed to meet the new limit keeps getting smaller
SO$_3$/Sorbent Related Issues

- Upstream equipment impacts ash layer resistivity
  - SO$_3$ concentration a major factor controlling resistivity
  - Allowable SO$_3$ “window” dictated by:
    - SCR catalyst’s SO$_2$ oxidation can produce high SO$_3$ levels
    - Hg sorbent (ACI) efficiency begins to drop at about 3 ppm of SO$_3$
    - Depending on moisture, ash type, temperature, 3 ppm of SO$_3$ is close to the minimum required for ash conditioning
    - Accurate SO$_3$ control, probably by sorbents, is imperative
  - Sorbents incident on ESP a secondary issue
    - Sorbent particle size generally large, easy to capture
    - ACI injection rates minimal, generally don’t impact ash resistivity, re-entrainment from hoppers can be an issue however
    - Sodium based sorbents appear to enhance ash conductivity
    - Calcium sorbents only an issue if SO$_3$ drops too low
Sectionalization

• Good sectionalization is a common characteristic of all small, highly efficient ESPs
  – For any given SCA, increased efficiency is realized by increasing sectionalization
  – This correlation holds for both 60Hz and HF power supplies

• Sectionalizing with respect to gas flow preferred
  – Allows energization to more closely follow grain loading
  – Electrically extends the effective length of the ESP
  – Minimizes rapping losses
Gas Flow Optimization

• Non-ideal ESP factors previously tolerated must be optimized
  – Sneakage above and below collecting electrodes, hopper re-entrainment
  – Non-uniform velocity profiles across ICAC plane, should be within 10% RMS
  – Temperature & particulate stratification (mixing)

• ESP performance at low emission rates is inherently limited by the worst actor of the above factors
Summary

• ESPs significantly smaller than 300 SCA on a 9” center basis have been demonstrating sub-MATS emissions

• Keeping ash resistivity in the $10^9$ ohm-cm range common to most small, high performers

• Intermittent energization with HF power supplies is beginning to show promise with higher resistivity ash

• PCT is uniquely positioned to evaluate all these factors and predict performance and available improvement potential for your ESP