MATS Compliance Choices for Particulate Control

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Mercury and Air Toxics Rule (MATS)

• The MATS ("Utility MACT") Rule was finalized by the US EPA in December, 2011.
• Requires reductions of PM, metals, HCL and Hg from new and existing boilers.
• PM level at 0.03 lb/MMBtu (filterable) for existing units.
MATS Compliance Options

• Unit compliance strategy depends on a number of factors, including:
  – Age and size of unit
  – Fuel options
  – Fleet generation options
  – Existing compliance equipment
  – Cost to comply
MATS Compliance Technologies

- **PM, Metals**
  - *Electrostatic Precipitators*
  - *Fabric Filters*
- **Acid Gases (HCl, SO₂)**
  - Dry Sorbent Injection
  - Dry Scrubbers
  - Wet FGD
- **Hg**
  - Activated Carbon Injection
  - Other sorbents
  - Additives
Evaluating Existing PM Control Equipment for MATS Compliance

- What was it originally designed for?
  - Emission limits
  - Fuel, flow rate, etc.

- How is it operating now?
  - Fuel switch?
  - Change in operating conditions?
  - O&M history?

- Where does it need to be?
  - Adding DSI, Hg control also?
  - Changing fuel?
• ESPs are very efficient particulate collectors
  – Existing units are achieving 0.01 lb/MMBtu
• But, ESPs are very application specific
  – Not as forgiving as fabric filters
• Changing the operating parameters affects performance
  – Fuel and ash characteristics may change over time
  – Flow rate can change
  – Upstream DSI can impact ESP performance
Design Parameters for Electrostatic Precipitators

- Gas flow rate
- Inlet Particulate Loading
- Required Outlet Loading
  - Desired Removal Efficiency
- Inlet Particulate Size
- Inlet Particulate Chemistry
  - Particle resistivity
- Gas Temperature
- Gas Moisture
Effect of Sorbent Injection

• Inlet dust loading increases
• Particle size distribution may change
  – Impact on Collection Efficiency?
  – Impact on ash removal system?
• Particulate resistivity can be altered
  – Sodium compounds reduce resistivity
    • Easier to collect
  – Calcium compounds increase resistivity
    • More difficult to collect
  – Activated carbon is very conductive, very fine
ESP Upgrade Options

- Improve gas distribution
- Change Internals – collectors, electrodes
- Improve Rapping
- Modern control systems
- Increased power: more T/R sets
- High Frequency T/R sets
- Raise the roof
- Additional inlet/outlet fields
- New parallel ESPs
- Conversion to baghouse
Many existing power stations use ESPs for particulate collection.

A properly designed ESP can achieve the required MATS limit for PM.

Existing ESPs designed for previous limits may not need to be replaced.

A variety of upgrade options can be employed, many in parallel, to improve performance.

There is no single solution.
Pulse Jet Filters

- Tube sheet at top
- Circular bags arranged in arrays
- Bags supported by internal cages
- Longer bag lengths: 7-10 meters
- Online or off-line cleaning
- Bags cleaned by pulse of clean, dry air (40-50 psig)
Recent Trends in Fabric Filters

- Low pressure pulse, long bag design
- Online cleaning
- No bypass on start-up
- Filter as reactor (primary or secondary)
- Increasingly lower emission rates
- Use of PTFE membranes
Factors Affecting Filter Performance

- Inlet gas conditions
- Filtering Velocity ("Air-to-Cloth Ratio")
- "Can Velocity"
- Gas Distribution
- Nature of Incoming Particulate
  - Amount, size, chemistry
- Particulate Distribution
- Bag Material
- Bag Cleaning Mechanism
Filter Configuration

- Filtering Velocity
- Number of Modules or Compartments
- Module/compartment Configuration
- Bag Configuration
- Filter Inlet Design
- Cleaning System Design
- Tubesheet Design
Bag Material Considerations

- Operating temperature
- Moisture
- Chemistry
- Abrasion resistance
- Filtering Mechanism
  - Depth vs. Surface Filtration
Thank you for your attention!

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