MATS Compliance Choices for Particulate Control

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Mercury and Air Toxics Rule (MATS)

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- The MATS ("Utility MACT") Rule was finalized by the US EPA in December, 2011.
- Compliance timeframe: 2015 - 2017.
- 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

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- 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

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- ***PM, Metals***
  - ***Electrostatic Precipitators***
  - ***Fabric Filters***
- Acid Gases (HCl, SO_2)
  - Dry Sorbent Injection
  - Dry Scrubbers
  - Wet FGD
- Hg
  - Activated Carbon Injection
  - Other sorbents
  - Additives

Evaluating Existing PM Control Equipment for MATS Compliance

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- 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?

ESP Design and Operation

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- 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

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- 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

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- 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

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- 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

ESPs for MATS Compliance

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- 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

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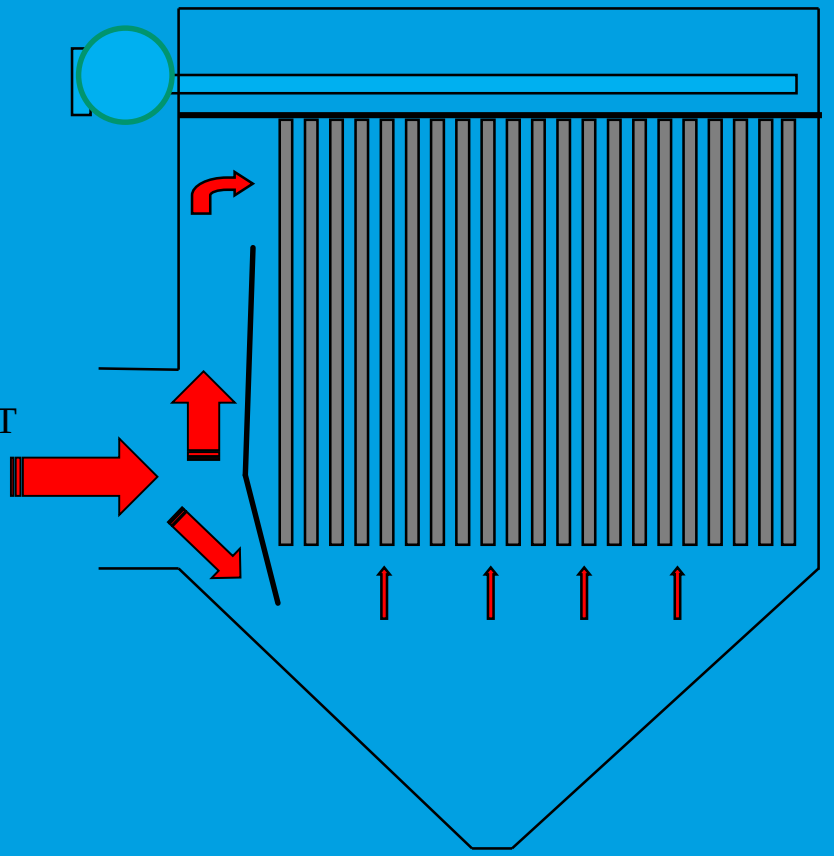
- Tube sheet at top
- Circular bags arranged in arrays
- Bags supported by internal cages
- Longer bag lengths:7-10 meters
- Online or off-line cleaning
- Bags cleaned by pulse of clean, dry air (40-50 psig)



Recent Trends in Fabric Filters

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- 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

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- 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

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

Bag Material Considerations

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- Operating temperature
- Moisture
- Chemistry
- Abrasion resistance
- Filtering Mechanism
  - Depth vs. Surface Filtration

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Thank you for your attention !

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