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Wet ESPs for Advanced Particulate Collection

Presented to McIlvaine Hot Topics Hour

August 1, 2013

Steven A. Jaasund, P.E.

E-Tube® system at FM Global in Rhode Island

- High efficiency PM removal, including sub-micron
- Proven solution on many applications
- No impediment to gas flow, low pressure drop
- Ideal for clean-up after wet scrubber
- High uptime, low maintenance
- Simple solution, add-on capability

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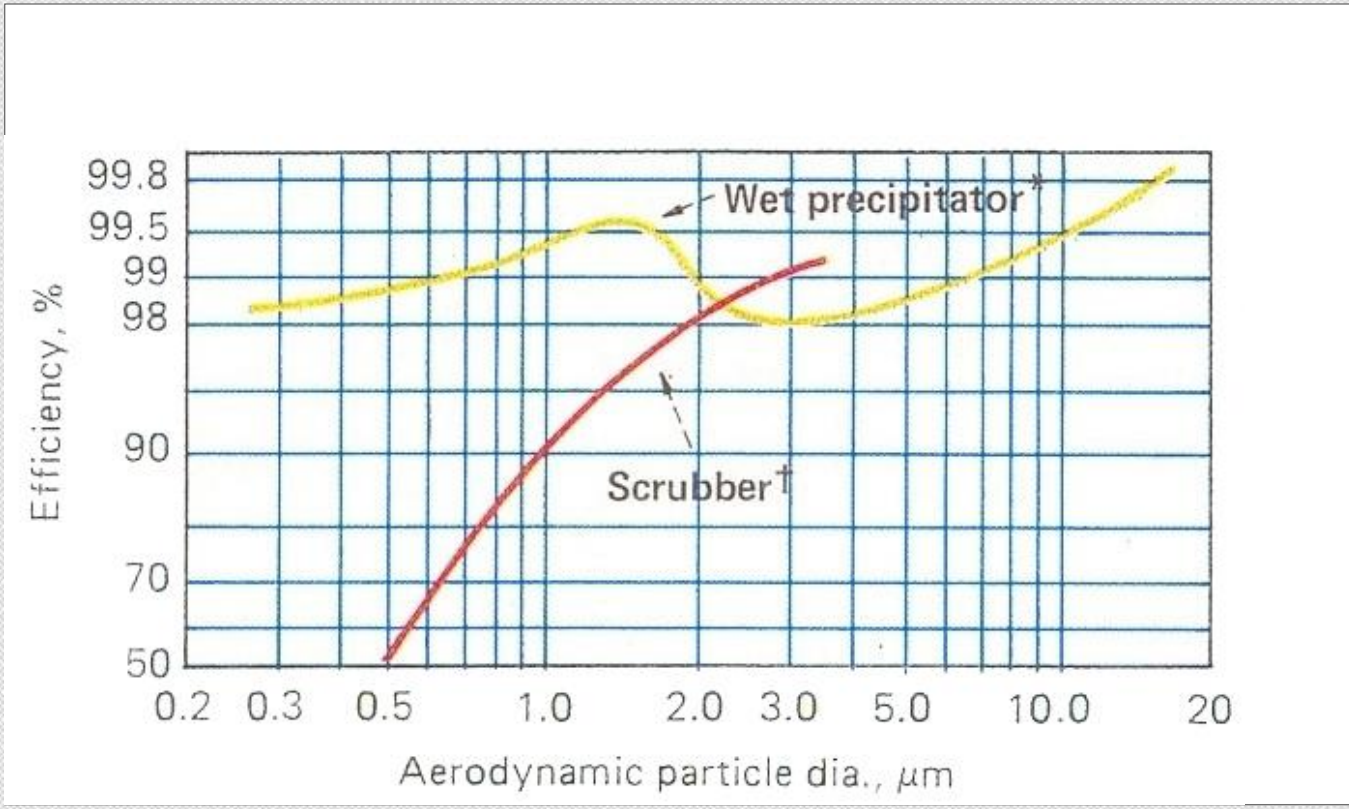
Wet ESP Technology

A Proven Solution for Particulate Control

- Size has a strong influence on the performance of a wet precipitator in collecting fine particles
- Wet electrostatic precipitators capture fine particles more efficiently than the highest-energy wet scrubbers



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Wet ESP vs. Scrubber

Wet ESP Performance Test Results
Northwest P&P Mill

- Biomass stoker boiler also burning mill sludge, OCC and TDF
- Tests conducted from 2009 through 2011
- 46 total tests; 23 on each wet ESP unit
- Average outlet emission
  - 0.0032 lb/MM BTU
  - 0.0033 grains/scfd @ 7% O_2

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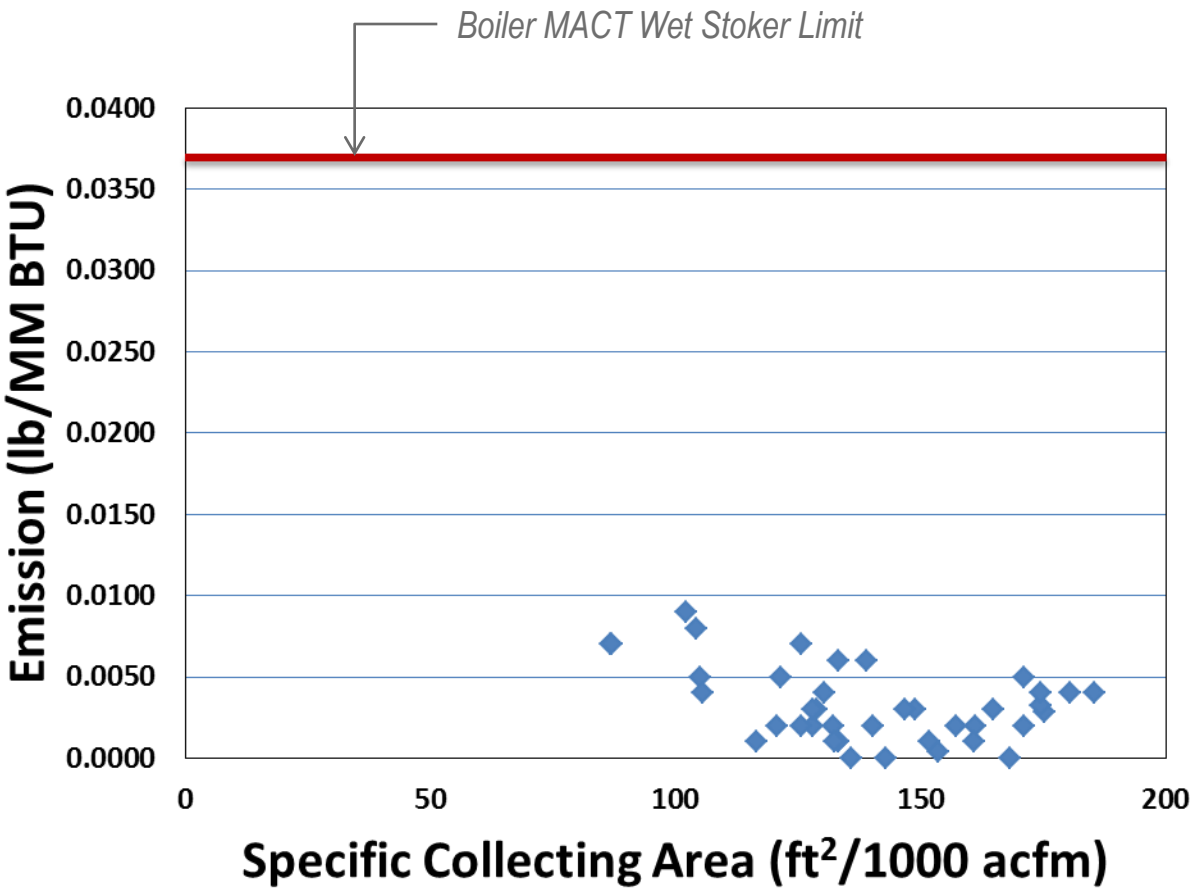
Biomass Fired Boiler

- *First Boiler MACT compliant installation*
- *Biomass stoker boiler also burning mill sludge, waste oil and OCC*

- *46 total tests; 23 on each wet ESP unit*
- *Avg. 0.0032 lb/MM BTU (0.037 limit)*



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Boiler Wet ESP Performance Data

Winter 2012 Pilot Test Program

- **Test Site – London, England**
- **Application - Municipal waste-to-energy boiler**
- **Test Set-up**
  - ~1200 scfm (wet) raw gas from upstream of dry ESP
  - Pilot Equipment
    - » Multiclone
    - » Wet scrubber; ΔP ~ 15 inches w.c.
    - » Wet ESP; SCA ~ 100 to150 ft^2/1000 acf
- **Inlet Gas Stream Profile**
  - >2000 mg/Nm3 total particulate
  - ~100 ppm HCl
  - ~75 ppm SO_2

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MSW Demonstration

Pilot Test Program Results

- **Particulate Results (11 tests)**
  - Solid particulate 0 to 3.0 mg/Nm3; average 1.5 mg/Nm3
  - Condensable particulate 0 to 3 mg/Nm3; average 1.5
- **Group II and III Heavy Metals >99% removal**
- **Mercury >90% Removal**
- **Acid Gases**
  - HCl < 1.5 ppm
  - SO_2 < 1.0 ppm

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MSW Results

Steel Mill Pilot Test Program

- **Test Site – Seattle, WA**
- **Application – Slag Pile Cooling Shed**
- **Test Conditions**
  - 5800 acfm (wet) raw gas from slag pile
  - 100°F
  - Wet ESP SCA = 32 ft^2/1000 acf
- **Test Results**
  - Inlet – 3.4 mg/Nm3 solid particulate
  - Outlet - < 0.2 mg/Nm3 solid particulate

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Steel Mill Demonstration

E-Tube® system at RockTenn

- **Materials of construction**
  - -Austenitic stainless is minimum
  - -Duplex alloys are economical upgrade
  - -High nickel required for most difficult applications
- **Waste water treatment**
- **Wet plume**

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Wet ESP Challenges

E-Tube® Power Off

E-Tube® Power On

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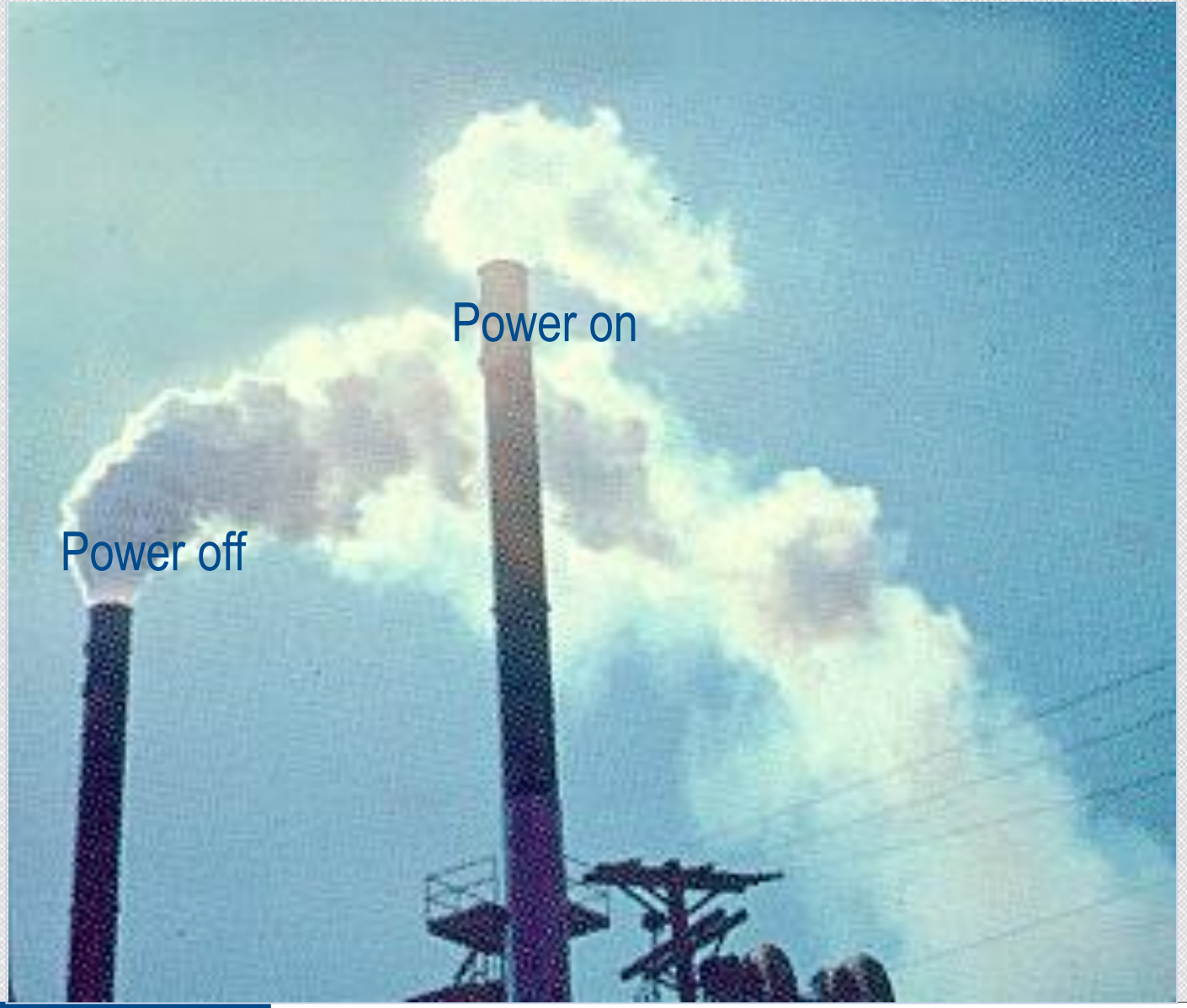
Power On/Off



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Side-by-Side

Questions

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