Wet ESPs for Advanced Particulate Collection

Presented to McIlvaine Hot Topics Hour
August 1, 2013
Steven A. Jaasund, P.E.
• 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
• 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.
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$_2$
• 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)

Boiler MACT Wet Stoker Limit

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 to 150 ft²/1000 acf

▪ Inlet Gas Stream Profile
  - >2000 mg/Nm³ total particulate
  - ~100 ppm HCl
  - ~75 ppm SO₂
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
  - SO₂ < 1.0 ppm
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 ft²/1000 acf
- Test Results
  - Inlet – 3.4 mg/Nm³ solid particulate
  - Outlet - < 0.2 mg/Nm³ solid particulate
- **Materials of construction**
  - Austenitic stainless is minimum
  - Duplex alloys are economical upgrade
  - High nickel required for most difficult applications

- **Waste water treatment**

- **Wet plume**
Questions
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Steven A. Jaasund, P.E.
steve.jaasund@lundberg-us.com

May 29, 2013