Dry Scrubber NID Humidity Measurement and Control

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Objective of Presentation

- Plant Description
- Data Analysis
- Sensor Technology
- Questions / Discussion
GE Power / Alstom NID

- Cleaned Flue Gas
- Fabric Filter
- Fluidizing Trough
- Recycled Fly Ash and Lime
- Byproduct Disposal
- Fresh Hydrated Lime + Recycled Fly Ash & Lime
- Recycle Rotary Feeder
GE Power / Alstom NID

NID Process

NID DFGD Design

- Large gas flow range
- Unitized compartment design
- Compact footprint
- Gas cooling by thin film evaporation
- Very high solids recirculation
- Fluid bed / dust recirculated continuously
- No external hydrator
- No external dust recycle
- No slurry handling
- Free flowing dry end product
GE Power / Alstom NID

Modular Design

Modularization Offers Design and Layout Flexibility
Process Description

- Boiler - 2 Hot Sided Precipitators – Split Gas
- Air Heaters A & B - Activated Carbon
- NID Inlet Plenum (ducts recombine from AC before inlet)
  - SO$_2$ inlet monitor
- 4x4 Module System - 8 NID Reactors / 8 PJFF
  - 7 modules in service / 1 standby at full load
  - 4 modules at base load
- NID Outlet
  - Outlet temperature measured after each module damper
  - All eight modules recombine and feed outlet duct
- Outlet Duct
- ID Fan / Stack2 H2O sensors installed (January 2016) across duct
Process Description

Control

• Hydrated lime, air flow, recycled FF solids and moisture
• Inlet / outlet SO2 CEM controls quicklime to hydrators
• Mixer water addition controls ADP
• Higher humidity increases scrubbing efficiency
• Accurate humidity control optimizes lime usage
• Protects baghouse from blinding and corrosion
• 40 degree approach to dew point
  • Average of the two sensors is the control point
  • Adiabatic saturation temperature can also be calculated
• No maintenance since installation on either unit
Installation Picture – Inside Duct
Installation Picture – Inside Duct
Moisture Variables at Probes

• Ambient Humidity
  • Jan 1, 2017 – 0.8% volume
  • July 1, 2017 – 2.25% volume
  • Relates to a 4 degree dew point difference at scrubber inlet

• Load Condition
• Soot Blows
• Coal Moisture
• Tube Leak
• Scrubber Approach to Dewpoint
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ADP (blue) vs SO2 Removal Rate (red)
Scrubber Metrics

• Dew point varied by 15 degrees over the course of 2017
• $672,000 in 2017 lime costs
• Every 5 degrees – 5% savings
• If assuming a safe dew point / the savings is $100,800
• Initially started at 65 degree approach to dew point due to learning the system
• Now at 40 degree approach to dew point
• Tube leak detection at scrubber inlet
• No corrosion seen during outages
# Tube Leak Occurrence

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**Note:** The table above provides data on various parameters such as NID, NID Outlet, MST A, MST B, SO2 Inlet Rate, SO2 Outlet Rate, NID Inlet Temp Avg °F, NID Outlet Temp Avg °F, NID M8 Dew Point Temp Avg °F, FC, Gross MW, Ambient °F, Approach to dewpoint °F, SO2 removal, Nid M8 Lime Lb/Hr, Outlet temp Cnty, abs humidity, vapo pressure, sRH, and Delta T of Scrubber.
H2O Technology

• Absolute Humidity Sensor
  • Direct measurement of the water molecule
  • Dipole moment measuring effect
  • In-situ measurement

• Advantages
  • High temperature operation – 1000 F
  • High particulate operation
  • Minimal maintenance
  • Corrosive and condensing environments are not an issue
  • Accurate
  • Robust (sensor life is 10 years minimum)
Installation Requirements

• Probe sizes – 490 mm or 1,470 mm lengths
• Flange - 4 inch, 150 lb. ANSI
• Power – 110V, 5 Amps
• Output Signal – 4..20 mA isolated
• Measurement unit – g/m3 corrected to 0C at process pressure
• Other Units – Equations are provided (i.e., dew point, RH, humidity ratio)
Questions / Discussion