Field Test Programs to Evaluate EGU MACT Compliance Strategies

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The Quote of 2012 will be…

“Hmmm, I’ve never seen it act like that before.”

May not need to test every unit, but some testing is strongly encouraged.
Designing an AC/DS Test Program

- Design a test program that fits the source
- Design a Program that will yield results applicable to other units
  - May have some restrictions that will limit the applicability of some or all test results
  - May still need to test other units.
Designing the Test Program

◆ Must Consider:
  - Types of units
  - Size of units
  - Types of fuel(s) combusted
  - Possible injection locations
  - Existing and planned control devices
  - Types of dry sorbents (DS), activated carbon (AC) and fuel additive materials
AC and Fuel Additives

- Calcium Bromide - (CaBr$_2$)
  - ~50% Solution fuel additive
- Powdered Activated Carbon - (PAC)
- Brominated PAC - (BPAC)
  - Milled BPAC - (MBPAC)
DS Additives

- **Hydrated Lime** – \([\text{Ca(OH)}_2]\)
- **Sodium Bicarbonate** \([\text{NaHCO}_3]\)
  - Always milled – otherwise it’s too granular
- **Trona** – \([\text{Na}_3(\text{CO}_3)(\text{HCO}_3)\cdot2\text{H}_2\text{O}]\)
  - Milled and unmilled
- **Typically takes 30 – 50% more unmilled trona to match the performance of milled trona.**
Factors Impacting Results

- Unit Configuration
  - Residence Time
  - Mixing
  - Control Devices

- AC/DS Materials
  - Type of Sorbent
  - Size (milled or unmilled)
  - Injection Rates
  - Use of a Fuel Additive
Factors Impacting Results

- Fuel/Exhaust Gas Compositions
  - Acid Gas Concentrations
  - Metals Content
  - LOI (Carbon Content)
Fuel Additives are not for everybody
  - Not very promising for bituminous coals
  - If LOI in fly ash is very low

For some Subbituminous sources (with low SO$_3$), fuel additives with PAC may be effective -- injected upstream of a scrubber and maybe upstream of DS.
Prevailing Thoughts and Observations

- Head-to-head, sodium bicarbonate should perform better than trona; however, …
  - Sodium bicarbonate decomposes at higher temperatures – cannot be used upstream of the air preheater.
  - With good mixing and longer residence times using trona – SO$_2$ removals ~95%
  - With limited mixing and shorter residence times using sodium bicarbonate - SO$_2$ removals ~80%.
Prevailing Thoughts and Observations

- Inject DS first
- Then, inject AC – especially for bituminous coal
- Should have a 1 second (minimum) residence time between injection locations
- DS appears to affect AC performance
- Have not found any Hg in DS materials
  - Had heard from others that this might be an issue
Prevailing Thoughts and Observations

- Try to limit projects to “best” options
- If possible test fewer options for longer periods of time.
- It takes awhile for the process and emissions to settle after changing the test conditions.
- Long-term effects on ESP performance and ID fan O&M are really unknown at this point
- Trona and hydrated lime are “softer” and will cause less wear on fan blades
Emissions Test Planning

- Hg CEMS data are often not very good at low concentrations (e.g., <1.0 µg/scm)
- Still – Hg CEMS serve as a good, real-time indicator
- Must pay attention to the details
  - Zero and span drift – Periodic Hands-off cals
  - Hg^{2+} calibrations
  - NIST traceable standards
  - Air/N_2 Quality, pressure and temperature stability
Emissions Test Planning

- RM 30B testing at high temperatures (> 400 °F, or so) and/or high particulate matter (PM) concentrations will not yield useful results.
  - Even with an air cooled probe.
  - The analyzer is temperature sensitive

- Recommend running RM 30B tests at the stack in conjunction with the Hg CEMS

- Speciated and total gaseous Hg traps will work well at the stack
Emissions Test Planning

- Confirm PM and Metals emissions
- PSD considerations for PM
  - Depending on control device performance
  - With DS, may increase PM inlet loadings by 50 – 100% or more.
- Extended metals tests are required (typically 4 to 6 hours is needed)
- Comprehensive fuel and ash sample collection
Other Considerations

- Could a plant use DS in conjunction with a "marginal" scrubber
- Give yourself time to optimize the AC/DS system following permanent installation
- Must consider the impact on ash quality
  - Sellability
  - Disposal
Ash Leaching Issues

◆ Sodium in the ash may increase metals leaching by 10 – 20%
  • Probably not an issue with subbituminous
  • For bituminous coals, if the leaching is already close to being an issue, you may have a problem – especially with As and Se