Field Test Programs to Evaluate EGU MACT Compliance Strategies

By Russell S. Berry

EUEC Energy & Environment Conference

Phoenix, Arizona

January 30 – February 1, 2012

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 – [$Ca(OH)_2$]
- Sodium Bicarbonate [$NaHCO_3$]
  - Always milled – otherwise it's too granular
- Trona – [$Na_3(CO_3)(HCO_3)\cdot 2H_2O$]
  - 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)

Prevailing Thoughts and Observations

- 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