O&M Issues DSI Systems
Startup, Shutdown & Cycling Loads

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EPA Requested Comments on Proposed New Rules Startup-Shutdown-Maintenance (SSM)

- Request published on 6/25/13 based on rules proposed 12/30/12
- Reopened comment period limited to 3 questions
- Institute of Clean Air Companies (ICAC) submitted comments on 8/26/13 addressing
  - SCRs & SNCR
  - ESPs
  - Baghouses
  - Wet and Dry FGD
  - DSI & carbon injection

O&M Issues Coal Fired Plants

- Startup – Shutdown Rules
- Start averaging time using a default electrical production
  - 25% of nameplate capacity plus 3 hrs. or
  - the start of electricity generation plus 6 hrs., whichever comes first;
- Other Industry Challenges Cycling Loads
- "Green" Energy and gas price: coal plant cycling
  - Shutdowns: hours to a few days
- Low load operations
- Improved heat rate for CO_2 Rule

DSI Challenges

- How soon can we turn or turn off on DSI & carbon systems.
- Prevent deposits forming in ductwork.
- Sorbent contact with acid gases/Hg at low flow conditions -**mass transfer**
- Does the chemistry work at lower temperatures seen during startup/shutdown?
- Contact time
- Impacts on balance of plant

What Can We Do?

- Modeling - most modeling for flow distribution and deposition done at full load conditions.
- Need to model at low flow conditions
- Inspections of ductwork after cycling operations
- Use CEMS when possible to optimize sorbent injection.
- Other
  - Better distribution
  - More frequent tuning
  - Frequent cleaning of catalyst & airheater
  - DSI injection ahead of airheater

Benefits of DSI Injection During Start/Shutdown and Cycling Operations

- With increased cycling operations we expect to see increased corrosion along the flue gas path. Lime injection could mitigate corrosion that will develop with these operating conditions
- Allow SCRs to startup earlier (lower operating temp.)
  - Startup - Shutdown Conditions
  - Turn on ammonia ≈ 600 °F
    - Actual depends on fuel primarily sulfur
  - SCRs are temperature driven – no relationship to MW generation

Typical SCR Startup & Shutdown

- Startup - Shutdown Conditions
  - Temperature limited by ABS formation that fouls airheater
  - ABS needs SO_3 and NH_3
  - Take SO_3 out and you can start injecting NH_3 sooner which will result in reducing NOx and being in compliance sooner limit to less than 5 ppm
  - Inject before catalyst or airheater
    - May be able to lower startup temperature from 600 $\longrightarrow$ 540 °F

Benefits of Pre-APH Removal of SO_3

Improve Heat Rate/Reduce CO_2 Emissions

- Reduce SO_3 Dew Point prior to APH
- Reduce operating temperature of APH

40°F reduction → 1% heat rate improvement → 1% savings on fuel budget

- Reduction in CO_2 emissions
  - 1 lb coal → 2.5 lb CO_2

DSI Challenges

- Emissions Control
- Operate over wide range of load conditions
- Can it play a role in heat rate improvement
- "Net" low cost sorbents that do not impact other APC equipment performance and ash management

DSI Design

- Periods of operation, especially for boiler startup, characterized by rapid transient changes in flue gas composition, quantity, temperature, and moisture conditions.
- The problems are aggravated with installation of multiple APC equipment and processes, especially those required to achieve MATs compliance.
- Minimize Sorbent usage
  - Cost
  - Ash
  - Other APC equipment

Key To DSI Design

- Distribution of sorbent
- Get the sorbent to the pollutant in the flue gas
- Adjustable feed rate – don't overfeed or underfeed
- Modeling
- Mixing
- Maintain Ca/air ratio in transport pipe and injectors
  - Plugging at low flow
  - Mat need to overfeed

DSI System – for SO_3 Control

- Target feed rates established during stack test period
  - Complete load profile, not all at full load
  - Coal sulfur content ranges

- In line monitoring of emissions
  - SO_3 : Breen, SICK, Stack visual
  - SO_2 : CEMS
  - Hg : CEMS (indirect method)

Injection Pre-SCR

- Benefits
  - Earlier control of SO_3
  - Longer contact time
  - Enhanced mixing

  Concerns
  - Fouling of catalyst
  - No signs of deactivation on test conducted to date

Questions & Answers

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