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

Tony Licata – Licata Energy

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 CO₂ 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 SO₃ and NH₃
 - Take SO₃ out and you can start injecting NH₃ 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 → 540 °F

Benefits of Pre-APH Removal of SO₃

Improve Heat Rate/Reduce CO₂ Emissions

- Reduce SO₃ Dew Point prior to APH
- Reduce operating temperature of APH



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

- Reduction in CO₂ emissions
 - 1 lb coal \rightarrow 2.5 lb CO₂

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

July 2014

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 SO₃ 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
 - SO₃: Breen, SICK, Stack visual
 - SO₂ : CEMS
 - Hg: CEMS (indirect method)

Injection Pre-SCR

- Benefits
 - Earlier control of SO₃
 - Longer contact time
 - Enhanced mixing

Concerns

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

Questions & Answers

Tony Licata
Licata Energy & Environmental Consultants, Inc.
345 Concord Road
Yonkers, NY 10710
Phone 914-779-3451

Email <u>TonyLicataLEEC@aol.com</u>