Precipitator Efficiency Improvement
August 25, 2011
ESP Performance Improvement

ESP Performance Improvements can be done via two paths, or a combination of both:

- Modifications or Enhancements to Existing ESP
- Structural/Physical Changes to ESP Size

Improvements presented are based on estimated reduction in emissions
Enhancements to Existing ESP

Good Maintenance!

- Are the internals aligned?
- Are all rappers working?
- Are T/R controllers working and optimized?
- Are T/R signals calibrated and working at controller?
- Are all meters working?
- Is ash removal system working?
- Are all insulators clean?
- Have any leaks been eliminated?

Improvements 5-10% dependent upon work done
ESP Performance Improvement

Enhancements to Existing ESP (cont.)

- Power supplies
  - Conventional T/R’s and controls – upgrade to newer controls
    - IE
    - Pulsing
  - Higher frequency power supplies
    - Mid frequency
    - High frequency

Improvements 10-30% dependent upon increase in power
Enhancements to Existing ESP (cont.)

- Discharge electrode design
  - Rigid electrode
  - High versus low emission electrode
  - Location in ESP

VI-Curve for 5 Electrode Configurations

Improvements 5-10% based upon degree of change-out
Enhancements to Existing ESP (cont.)

- Electrical field sectionalization

Improvements 5-20% based upon degree of sectionalization
Optimized rapping program

Opacity charts to evaluate rapping
- Rapping spikes
- Localized rapping issues
- Excessive rapping

Power Levels to ensure good and consistent voltage-current relationship
- Increase in current/drop in voltage
- Increase in voltage/drop in current

Improvements 5-10% based upon starting point of optimization
ESP Performance Improvement

Enhancements to Existing ESP (cont.)

- Review Gas Distribution
  - ICAC guidelines
  - Skewed gas flow
- Minimize Sneakage

Improvements 5-10% based on degree of maldistribution
Skewed gas flow:

- Bias flow into upper regions of ESP
  - Higher gas flow at top of ESP
  - Majority of dust in bottom region of ESP
    - Hopper re-entrainment
Sneakage: Prevent Flue gas from by-passing treatment zone

- Vertical baffles

ESP Plan View

Collecting Plates (typ.)

Casing Wall (typ.)

Baffle (typ.)

Gas Flow

ESP Performance Improvement
ESP Performance Improvement

- Upper and lower girder extensions
ESP Performance Improvement

Enhancements to Existing ESP (cont.)

Summary:

- Good Maintenance
- Power Supplies
- Discharge Electrode Design
- Sectionalization
- Optimize Rapping
- Review Gas Distribution
- Minimize Sneakage

Note: Improvements are not completely additive – there is a practical limit to how much improvement one can achieve out of an ESP
Structural/Physical Changes to ESP Size

- Increase plate height
  - Increase collecting area
  - Lower gas velocity and increase residence time in treatment area (if no change in volume)
  - Requires change in discharge electrodes to match new height
  - Need to evaluate structurally the casing/support steel
  - May need to increase T/R sizes
Structural/Physical Changes to ESP Size (cont.)

- Add field at inlet or outlet
  - Increase collecting area
  - Increase sectionalization by adding fields
  - Increase residence time in treatment area (if no change in volume)

- Additional chamber
  - Size dependent upon level of performance improvement desired
  - Space constraints
  - Ductwork issues
Thank you!