Dry Sorbent Injection and Material Handling for APC

Delta DSI Static Mixers

for

McIlvaine Hot Topic Hour

June 20, 2013
LIMB (Limestone Injection Multistage Burner) program 1984 to 1987

- The chemistry works, different sorbents work in different temperature zones and are predictable
- “Proper mixing and dispersion of the injected sorbent into the temperature window required for maximum removal are **more important** than finding the optimum injection level or temperature”

**Mixing is critical to Dry Sorbent Injection**
Why Use Static Mixing?

• Mixing is important for emissions performance and sorbent usage
  ➢ Reduce emissions and/or
  ➢ Reduce sorbent usage
  ➢ lowers loading on particulate removal equipment and lower disposal costs from sorbents

• Simplicity of DSI System Design
  ➢ Minimize injection points
  ➢ Reduce system maintenance

• Reliable
  ➢ Proven Delta Wing® technology in use at many operating plants

• Operability
  ➢ Better mixing equals better control over varying loads
How Do We Do It - Delta Wing® Technology

- Proven Delta Wing® Mixing System -- the Art and Science of Mixing
- Proven Application of Mixing to Emissions Control System
  - Can be added as a retrofit

“A BETTER IDEA”

THE DELTA WING
WHAT IS IT?
HOW DOES IT WORK?
OBSERVATION OF STRONG STABLE VORTICES AT LEADING WING EDGE

WIND TUNNEL WORK ON DELTA WING FIGHTER JETS

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Delta Wing® Technology

The principle of DELTA WING®

Leading-edge vortices at a delta-shaped plate (DELTA WING)

TRIANGLE OR DELTA SHAPE RESULTS IN NARROW FIELD OF VORTICES

Leading-edge vortices at a circular shaped plate

ROUND OR ELLIPTICAL SHAPE RESULTS IN WIDER FIELD TO SPREAD VORTICES TO ACCOMMODATE DUCTWORK GEOMETRY
Delta Wing® In Duct Mixer

- Able to mix gases, temperature, velocity, concentration before injectors
- Use after injectors to mix entire duct cross section
• Scope includes detailed flow and dust models
• Measurement of velocity and mixing at multiple plane locations
• Sorbent injection model based on extensive dust model experience
Modeling (con’t)

- Similarity Conditions for Sorbent/Dust Model the Barth Number
- Ratio of Particle Drag to Particle inertia forces
- Similarity of Velocity with Reynolds Number
BPEI Approach To DSI
Delta Wings® Installed at Shawnee Station
• Mixing and Dispersion Critical to DSI Process

• Delta Wing® Mixers assure good Mixing and Dispersion

• In Duct Mixing reduces number of injectors thereby reducing or eliminating several current DSI O&M issues

• Delta Wing® Mixers and Model Studies Successfully Applied to other Emissions Control Technologies

• Delta Wing® Mixers are operating successfully in DSI applications