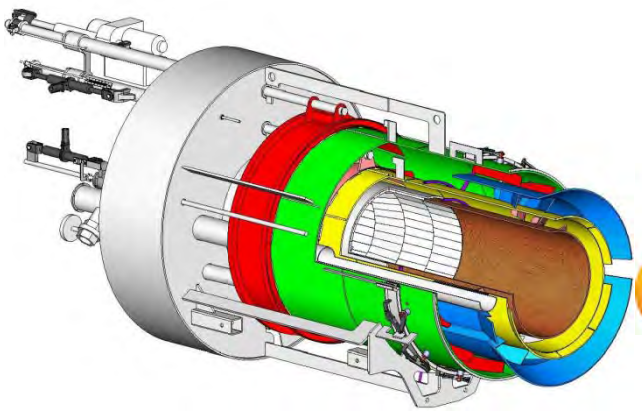
REINHOLD ENVIRONMENTAL Ltd.

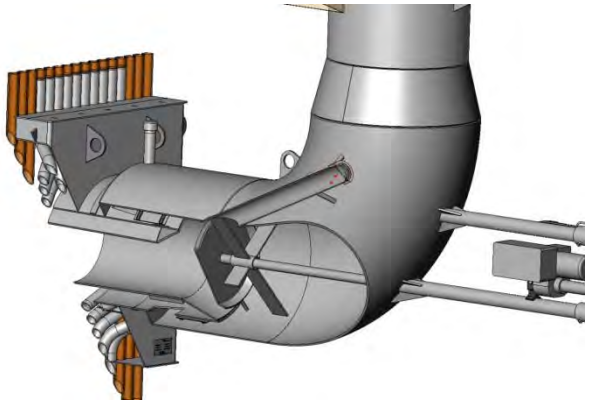
2014 NOx-Combustion Round Table & Expo Presentations

February 10 & 11, 2014, in Charlotte, NC / Hosted by Duke Energy

NOx Reductions Via Overfire Air Modifications

2014 NOx-Combustion-PCUG Conference

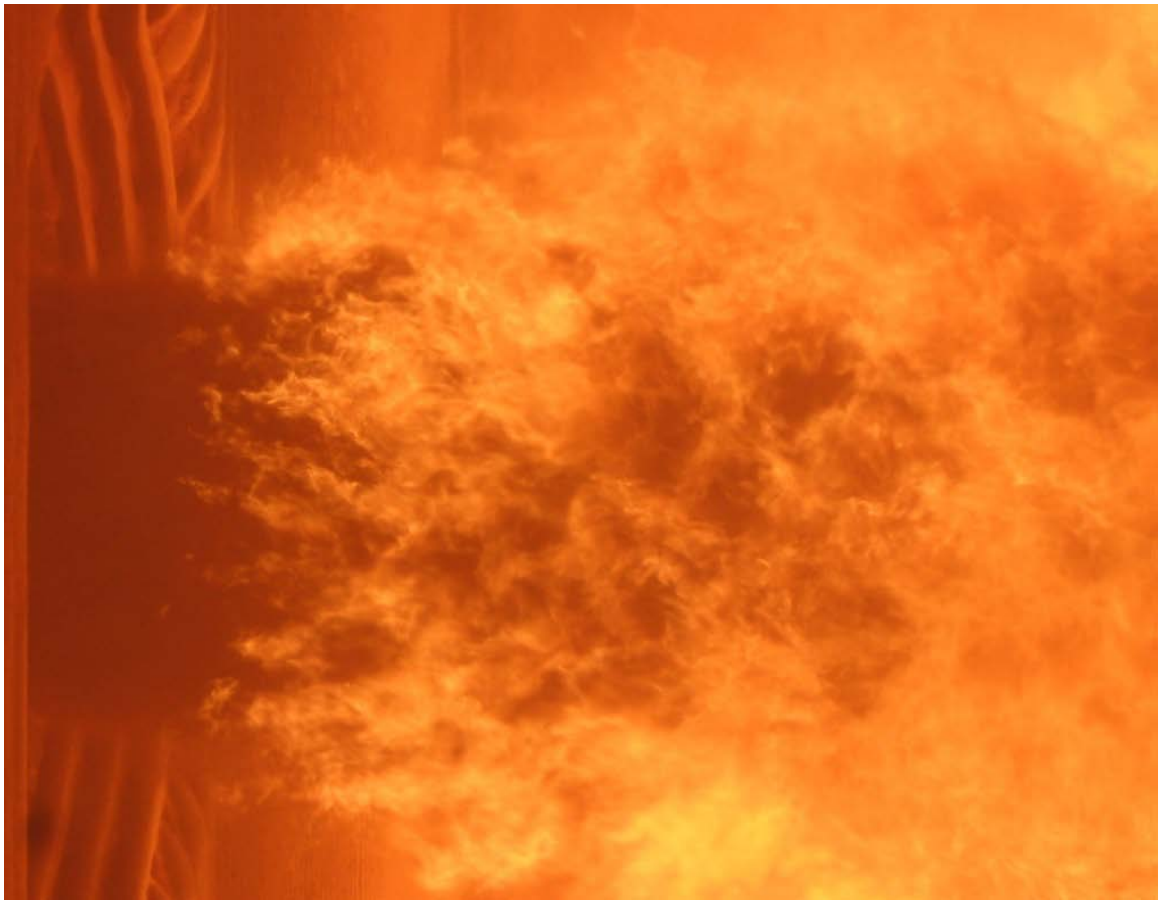




Joseph G. Eutizi, Engineering Manager
San Miguel Electric Cooperative, Inc.
&
Brian M. King P.E., Project Manager
Power & Industrial Services Corporation

Agenda

- Background
- OFA Design
- Project Description
- Results
- Conclusion

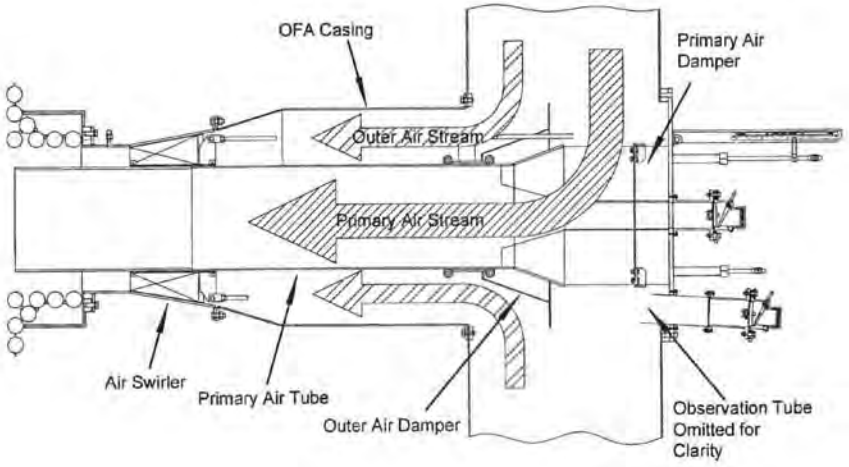


Background

- San Miguel Generating Station
- 440 MWg
- Opposed - Wall Fired
- Texas Lignite ~ 5,300 Btu/lb
- Windbox Compartments
- Multi Phased Approach
- Phase 1 OFA, Phase 2 Burners
- Retrofit OFA

Background…….cont.

- Phase 1
  - Dual elevation OFA system
  - 2 OFA ports above each column of burners
  - Front and Rear – 24 total ports

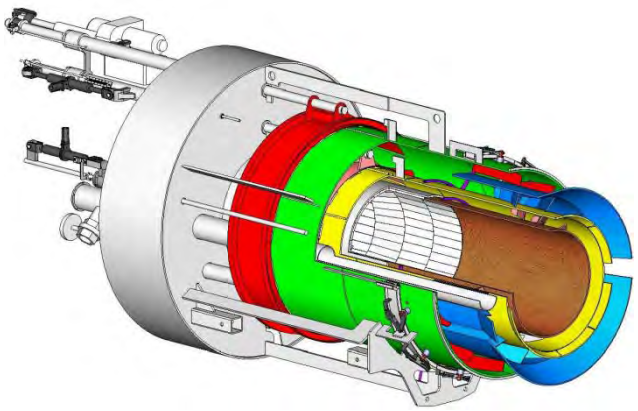


Background…….cont.

- Phase 2
  - 42 new low NOx burners
  - Seven pulverizers total
  - 3 rows on front
  - 4 rows on rear

Background…….cont.

- Combustion Tuning
  - Measure pipe to pipe air and fuel flow
  - Set burner air registers
  - Swap mills and analyze economizer sampling grid data
  - Adjust OFA to minimize changes
  - Lower O_2
  - CO spikes require higher O_2, thus higher NOx

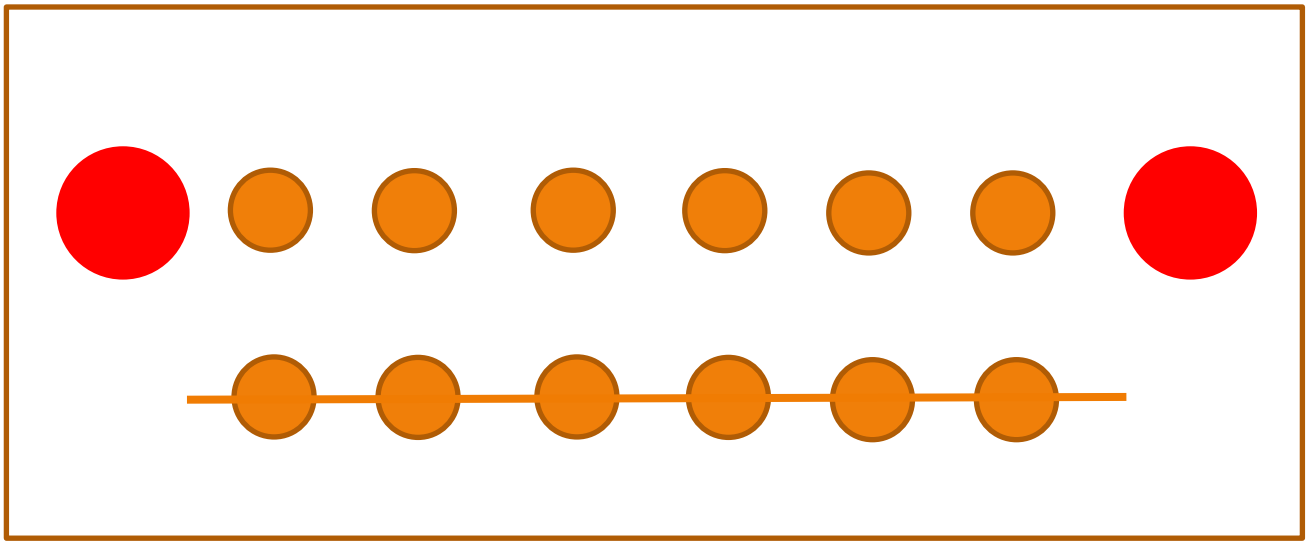


OFA Design

- Overfire Air – How Much Air?
- Burner Stoichiometry ~ 0.8 to 1.05
- Average Upward Flue Gas Velocity
- OFA Design Velocity ~ 75 to 250 ft/sec
- Residence Time to Furnace Exit
- NOx reformation

Project Description

- Computational Fluid Dynamic Modeling
  - Reaction Engineering International (REI)
  - Baseline and six case studies
  - Project Objective: **Combustion Improvements**



Project Description

- Computational Fluid Dynamic Modeling
  - Results predicted a 10% reduction in NOx

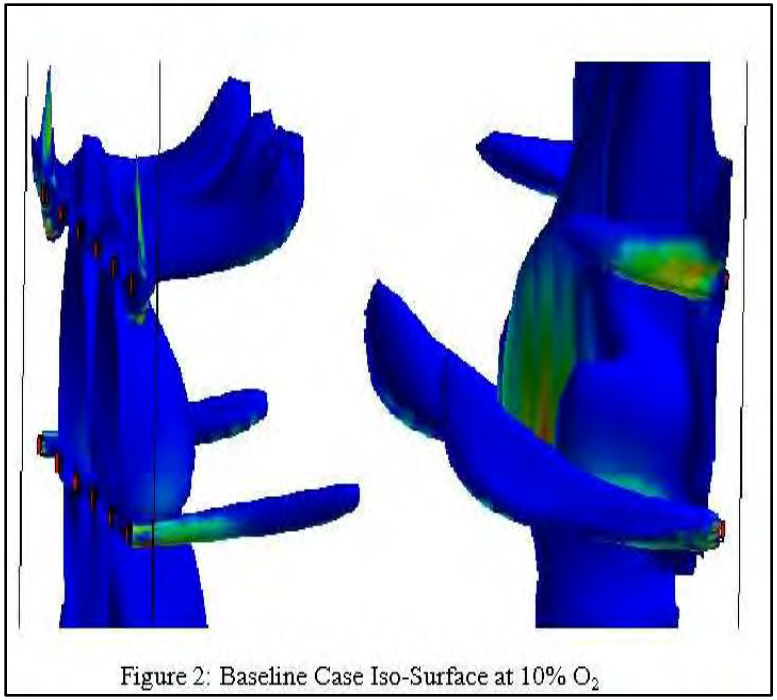
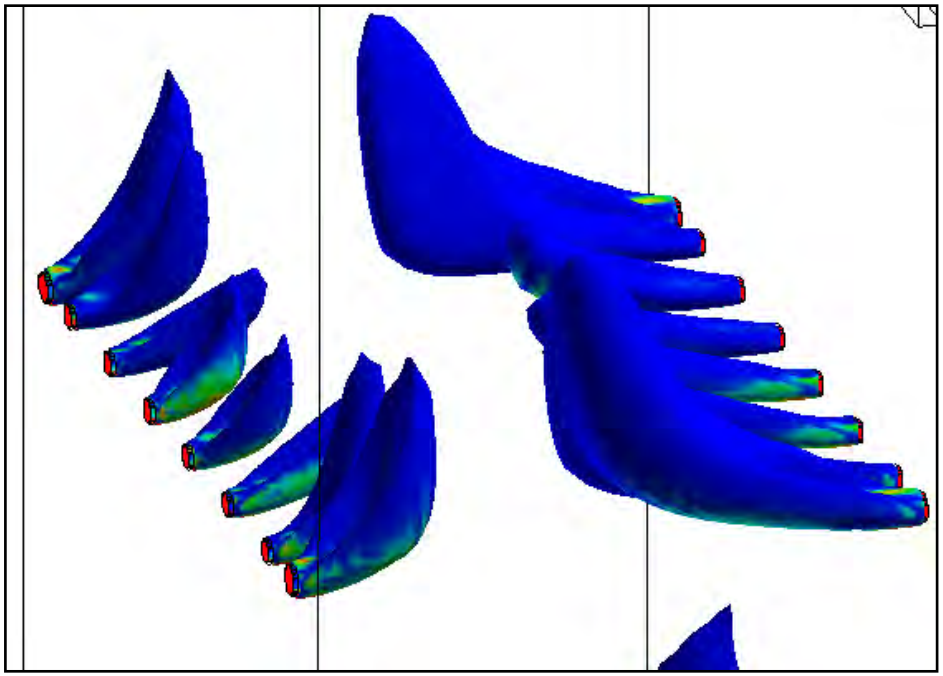


Figure 2: Baseline Case Iso-Surface at 10% O_2

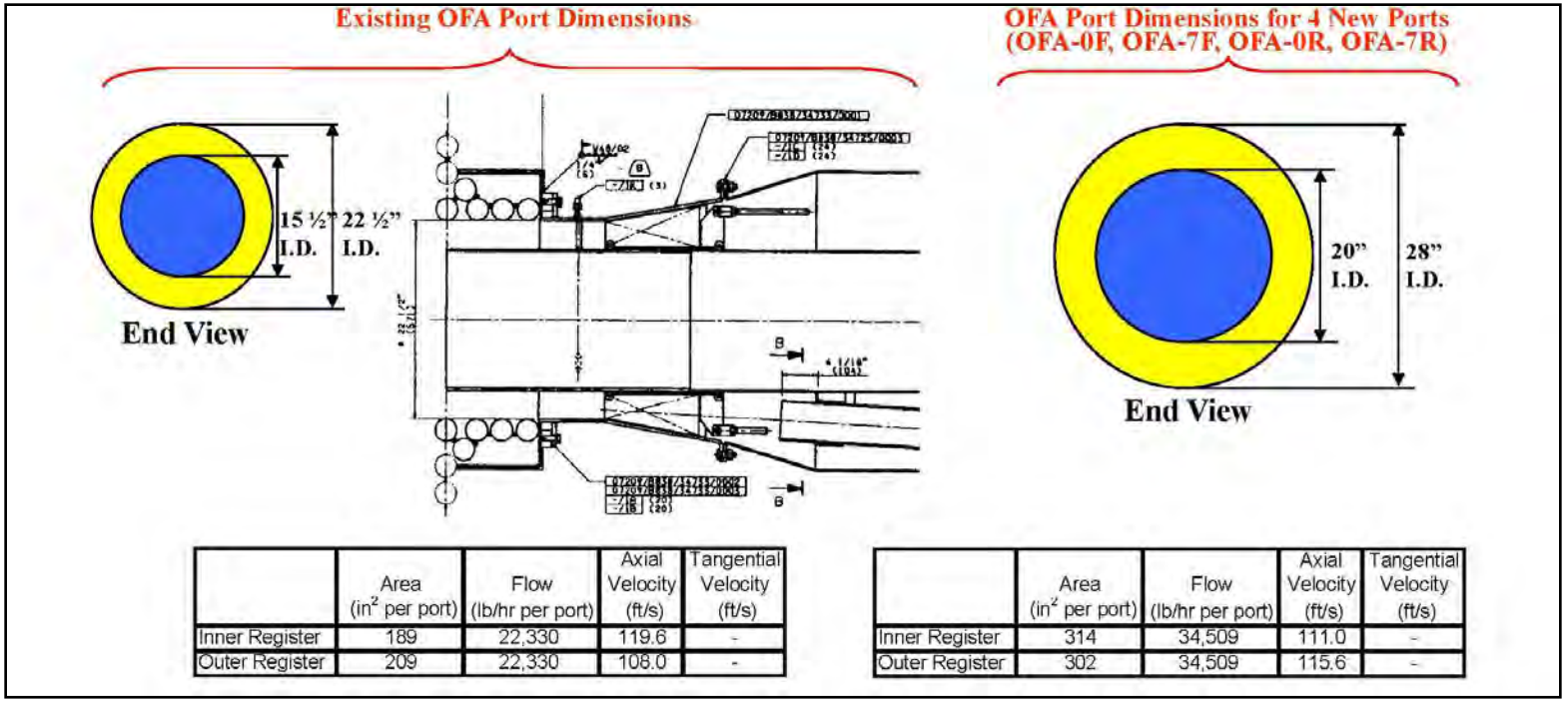
Baseline



OFA Upgrade

Project Description

- Reduce NOx Reformation
  - Dual Register OFA Ports
  - Less air in the core air
  - More air in the outer air

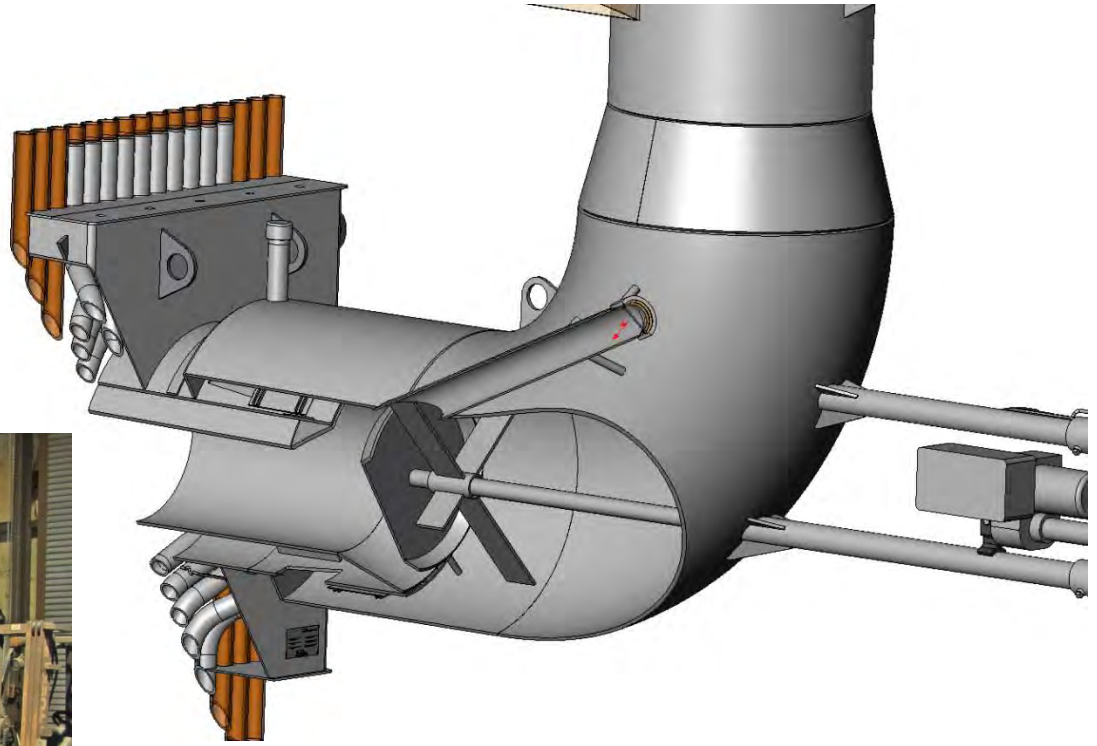


	Area (in^2 per port)	Flow (lb/hr per port)	Axial Velocity (ft/s)	Tangential Velocity (ft/s)
Inner Register	189	22,330	119.6	-
Outer Register	209	22,330	108.0	-

	Area (in^2 per port)	Flow (lb/hr per port)	Axial Velocity (ft/s)	Tangential Velocity (ft/s)
Inner Register	314	34,509	111.0	-
Outer Register	302	34,509	115.6	-

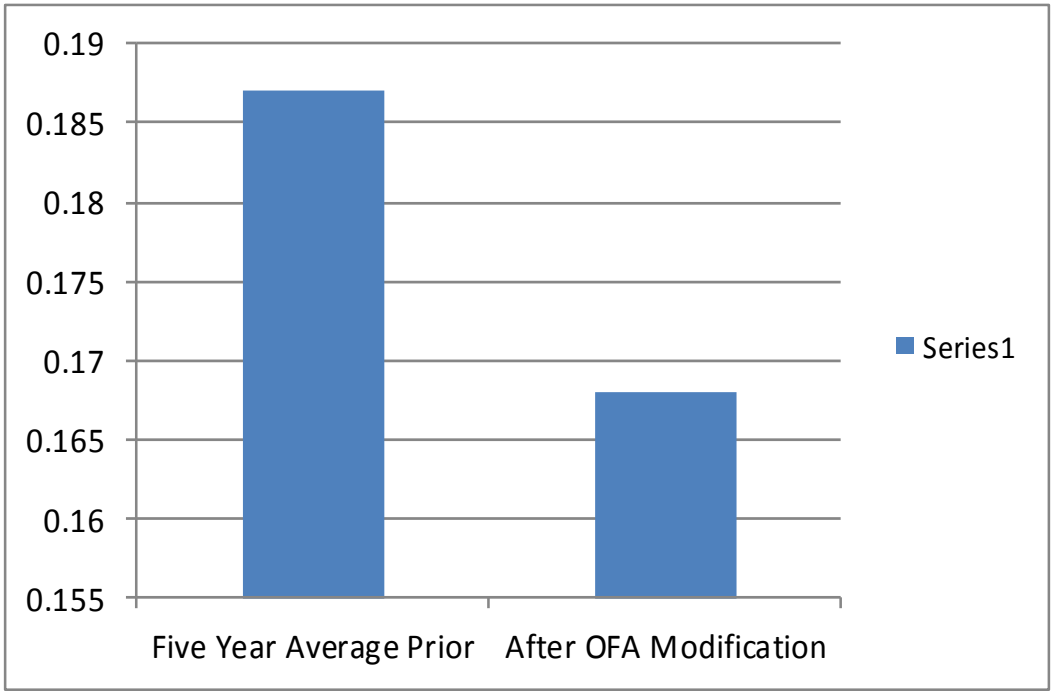
New OFA Ports

- Tie-in to existing take-off duct



Results

- ~10% reduction in NOx emissions



Date	Configuration	O_2 (%)	CO ppm	NO_x ppm	NO_x lb/mmBtu
	Average	2.26	140	127	0.168

Conclusion

- Lowered O_2 to lowest permissible set point
- Found OFA settings that work for all mill combinations
- Changed the primary objective of the neural network from CO to NOx

Thank You!

Questions

&

Discussion