Reinhold Environmental Ltd.

2008 NOx-Combustion Round Table & Expo Presentation

February 4-5, 2008 in Richmond, VA

GE Multi-Objective Combustion Optimization

imagination at work

Multi-Objective Challenges

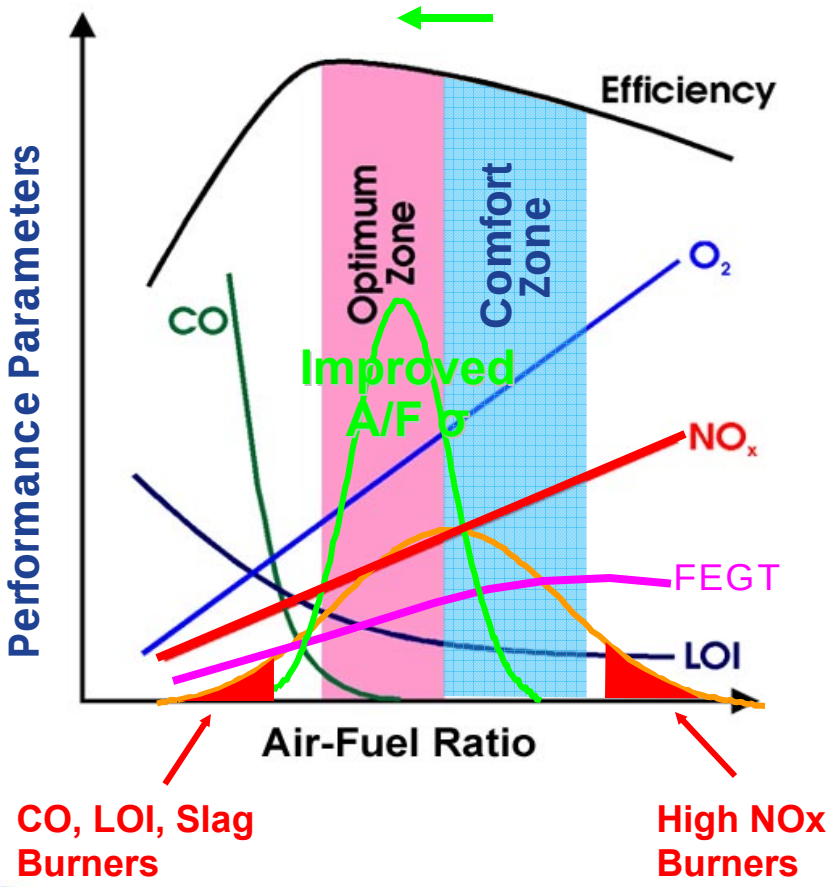
Optimize Reduction of NOx, CO and Mercury

(after Low NOx mods)

Minimize LOI – Fly Ash Sales

Mitigate Impact on Slagging/Fouling

Zonal Focus = Multi-Objective



Lower excess air (O2) operation enables:

- Lower NOx
- Lower FEGT
- Lower Heat Rate

Improved zonal combustion reduces local "hot spots"

- Mitigates Slagging/Fouling
- Addresses CO and LOI "hot spots" (Chimneys)

CO Precedents

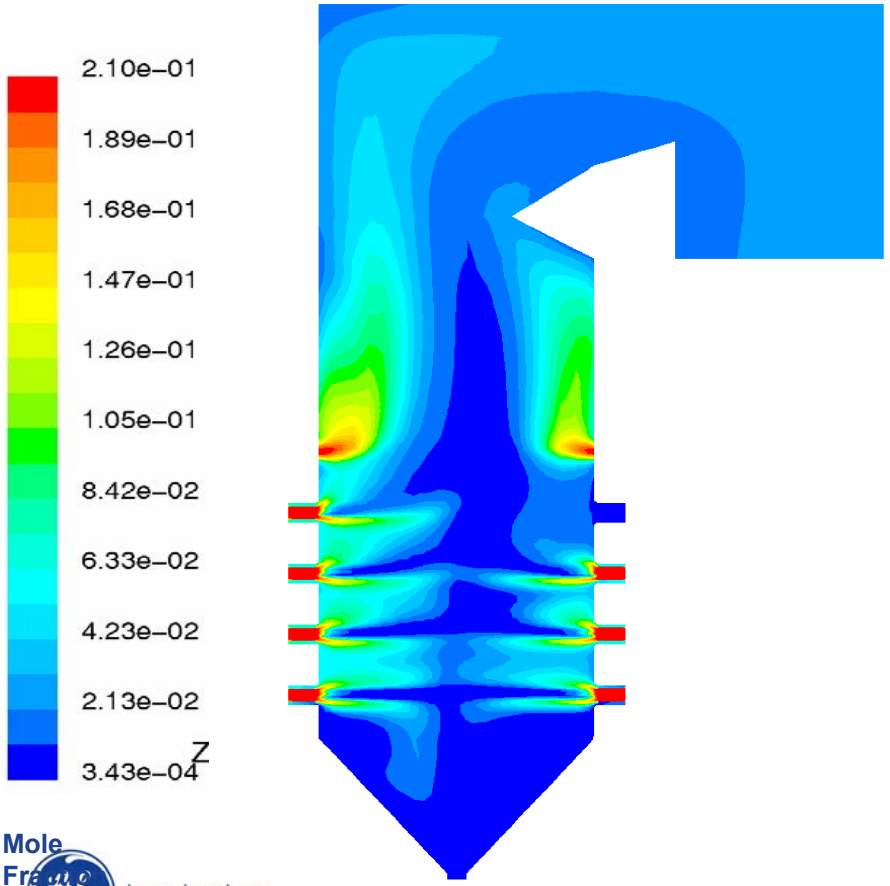
Boilers are often operated at “high average O2 in order to avoid local regions of poor combustion”.

CO has been used as a trim to lower O2, but in most cases only by observing the average CO at or downstream of the normal O2 sensor locations.

The problem is that small average CO increases usually are driven by large local CO increases. These local increases lead to serious localized slagging/fouling and are primary sources of significant LOI increases.

Reducing Atmosphere Chimneys

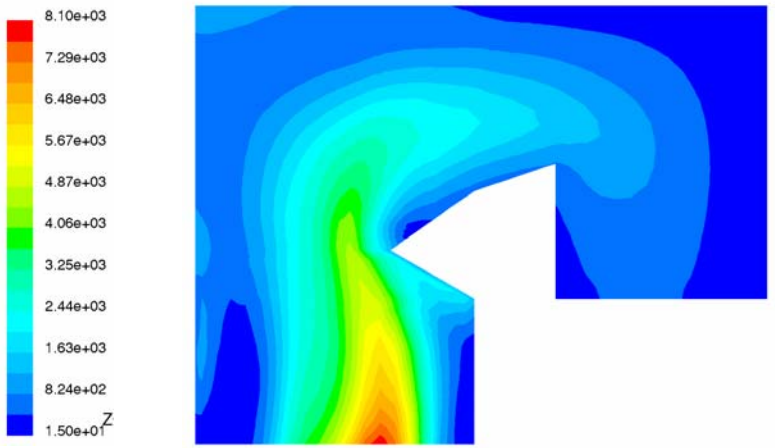
Predicted Oxygen Profile



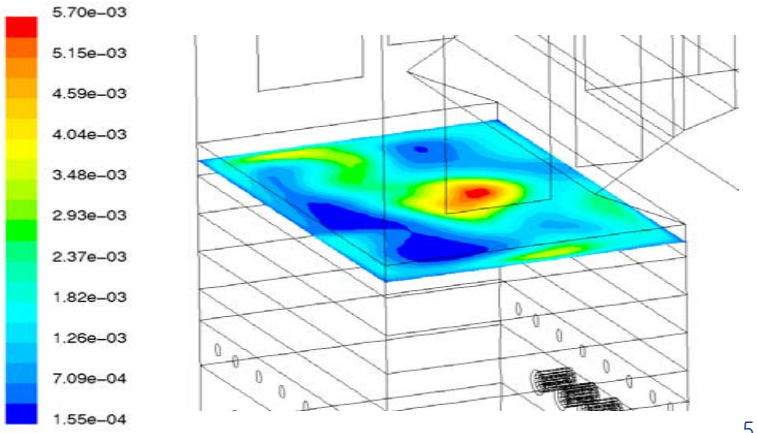
Mole Fra

imagination at work

Predicted CO Profiles

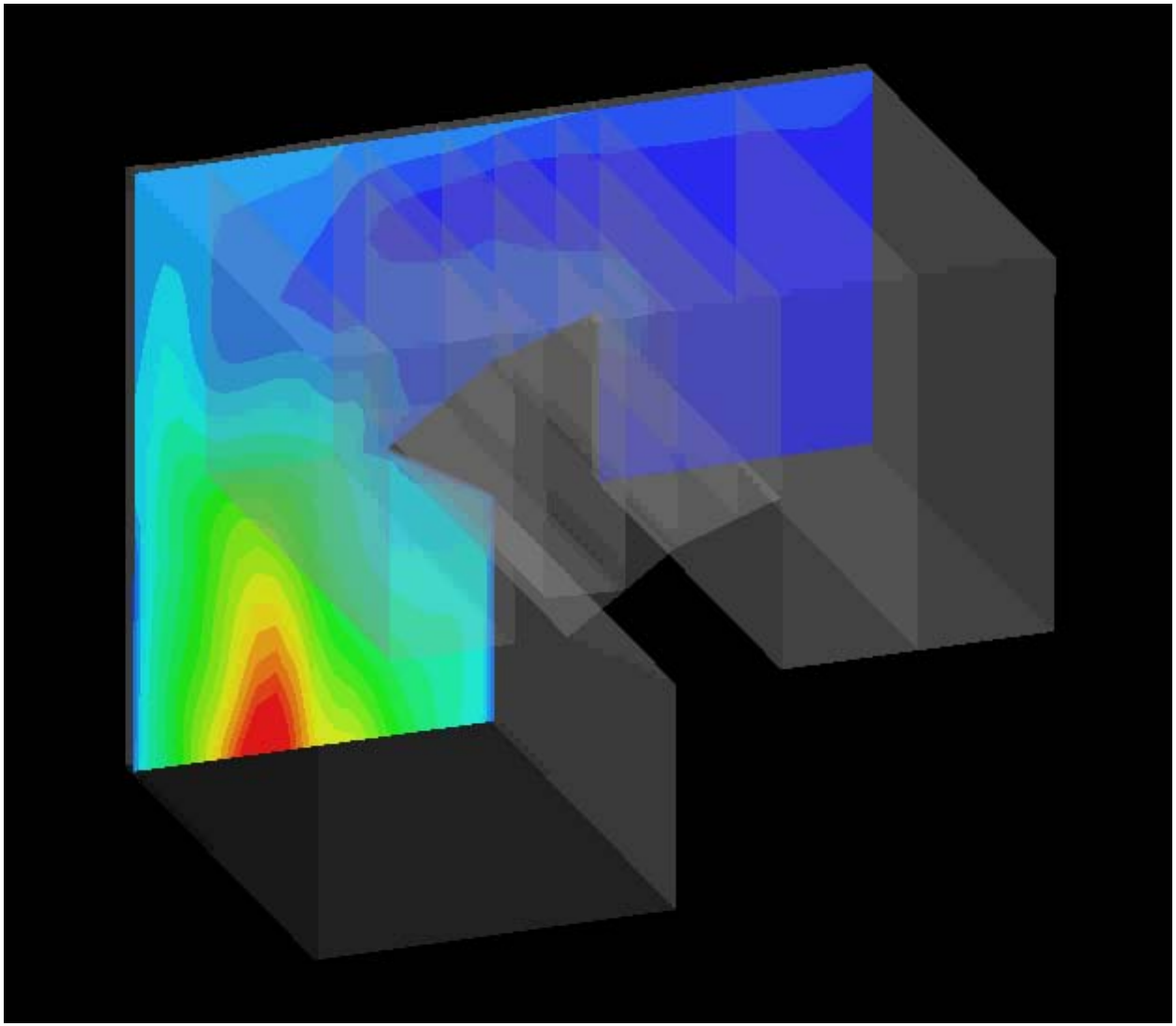


ppm

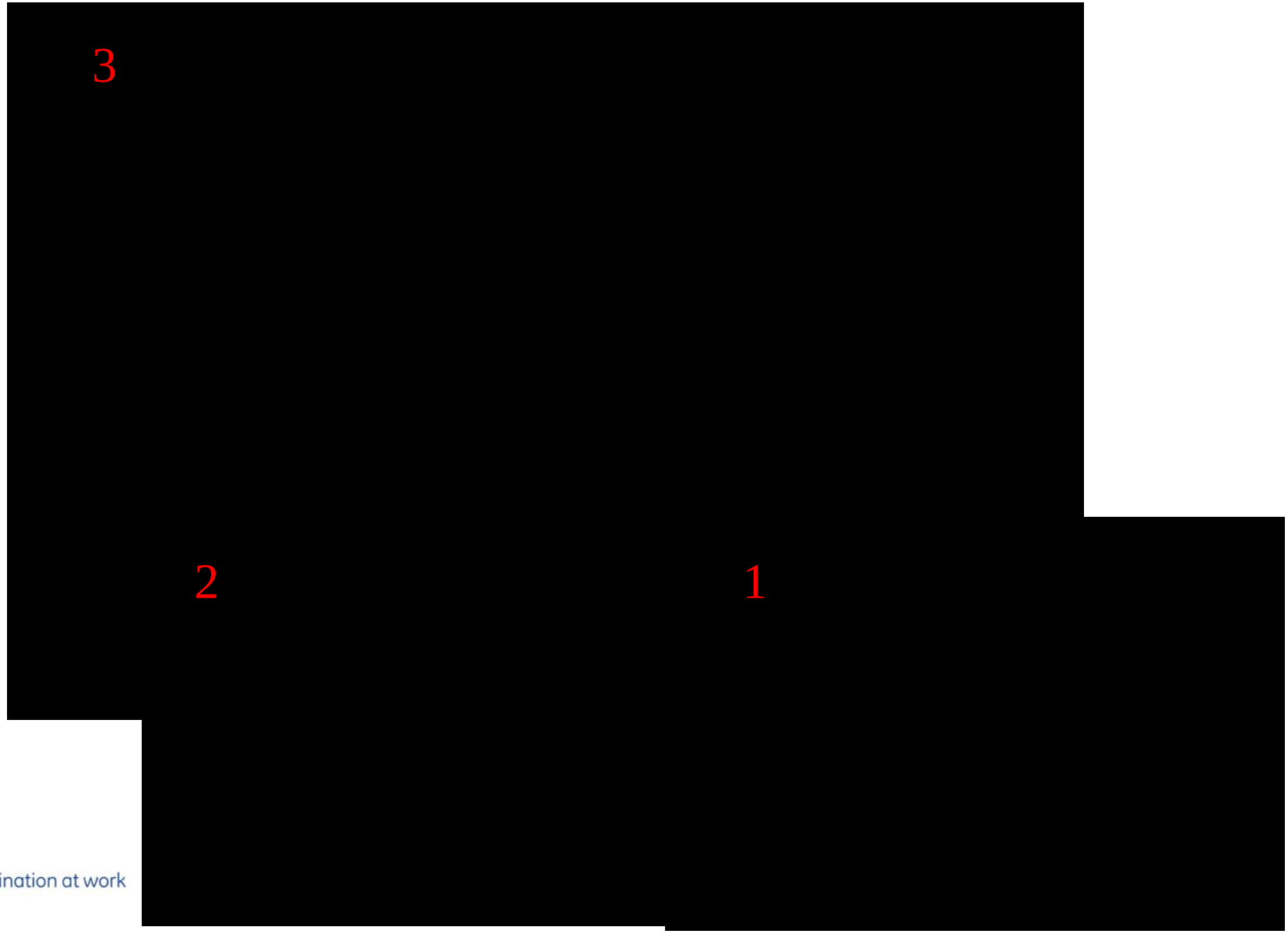


Mole Fraction

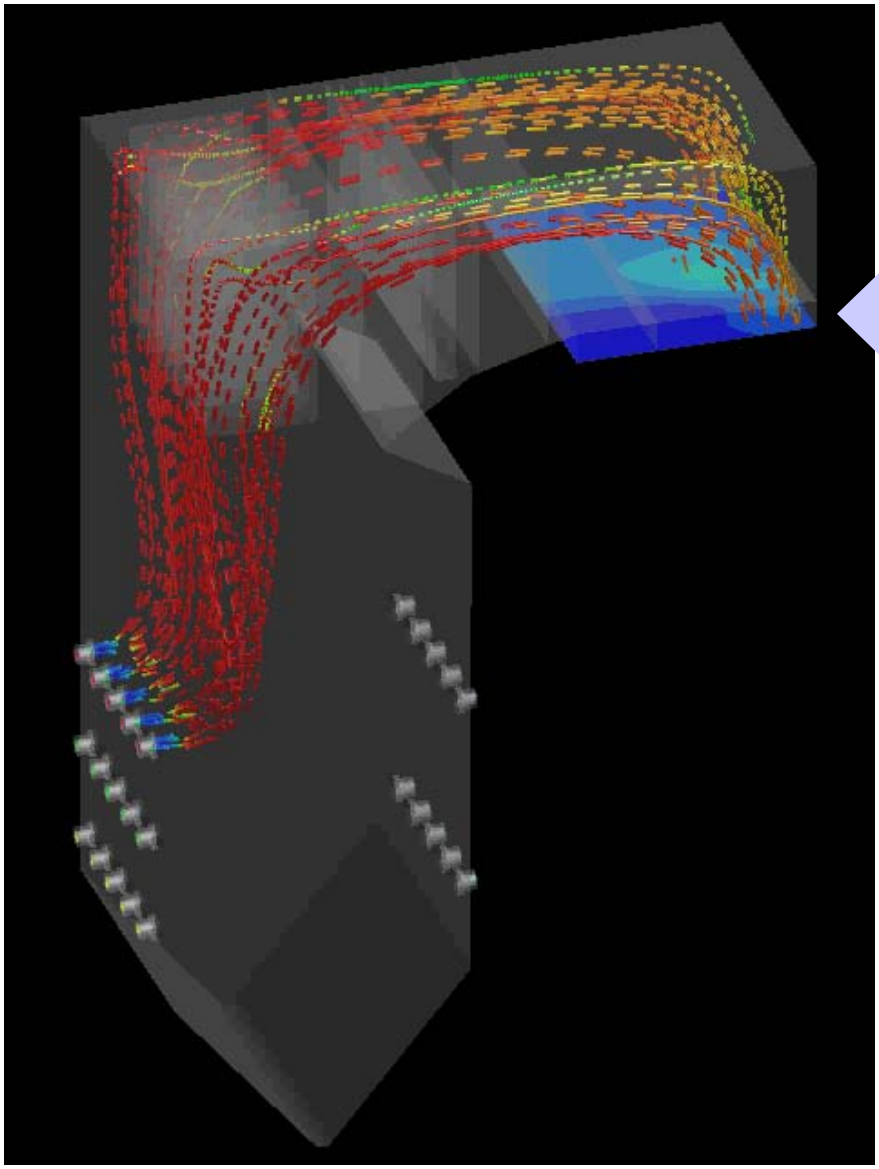
Zonal CO Vertical



Zonal Slagging – Cause/Effect

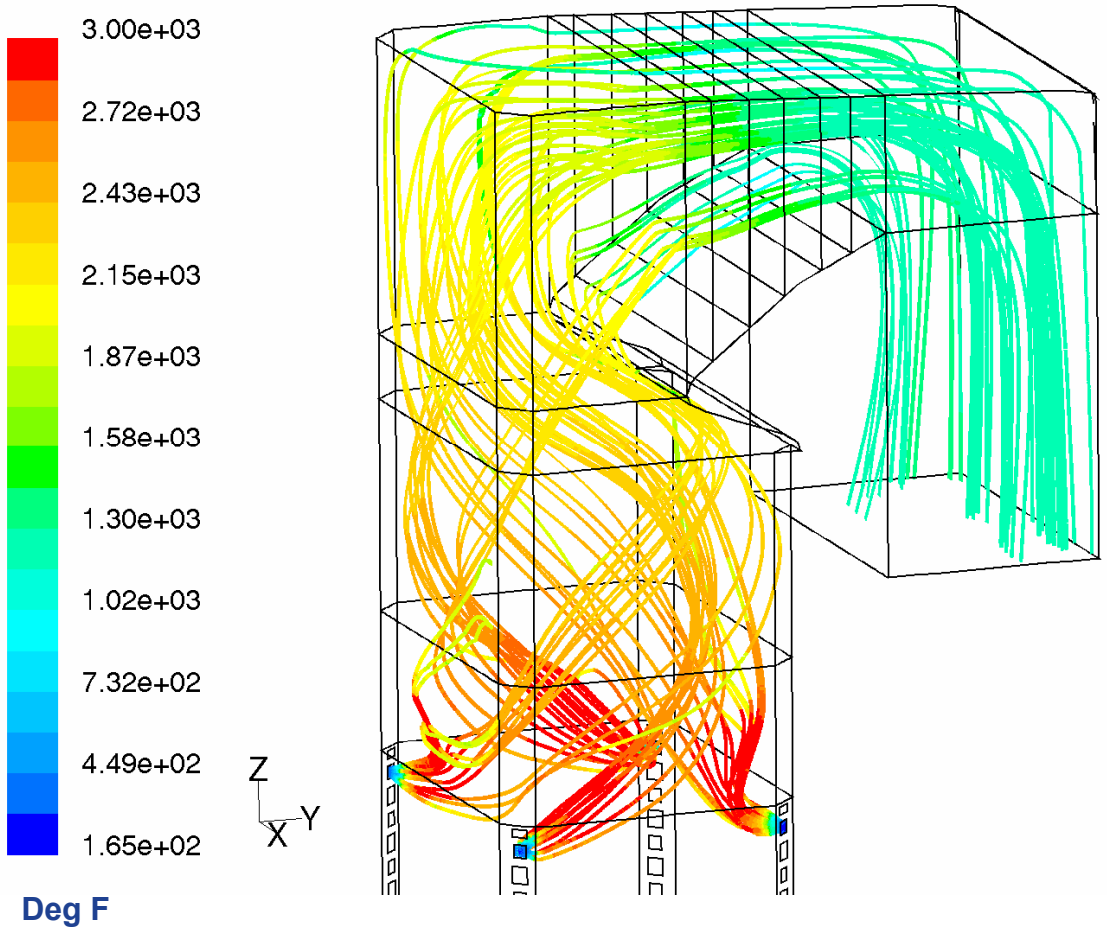


Zonal Pathlines

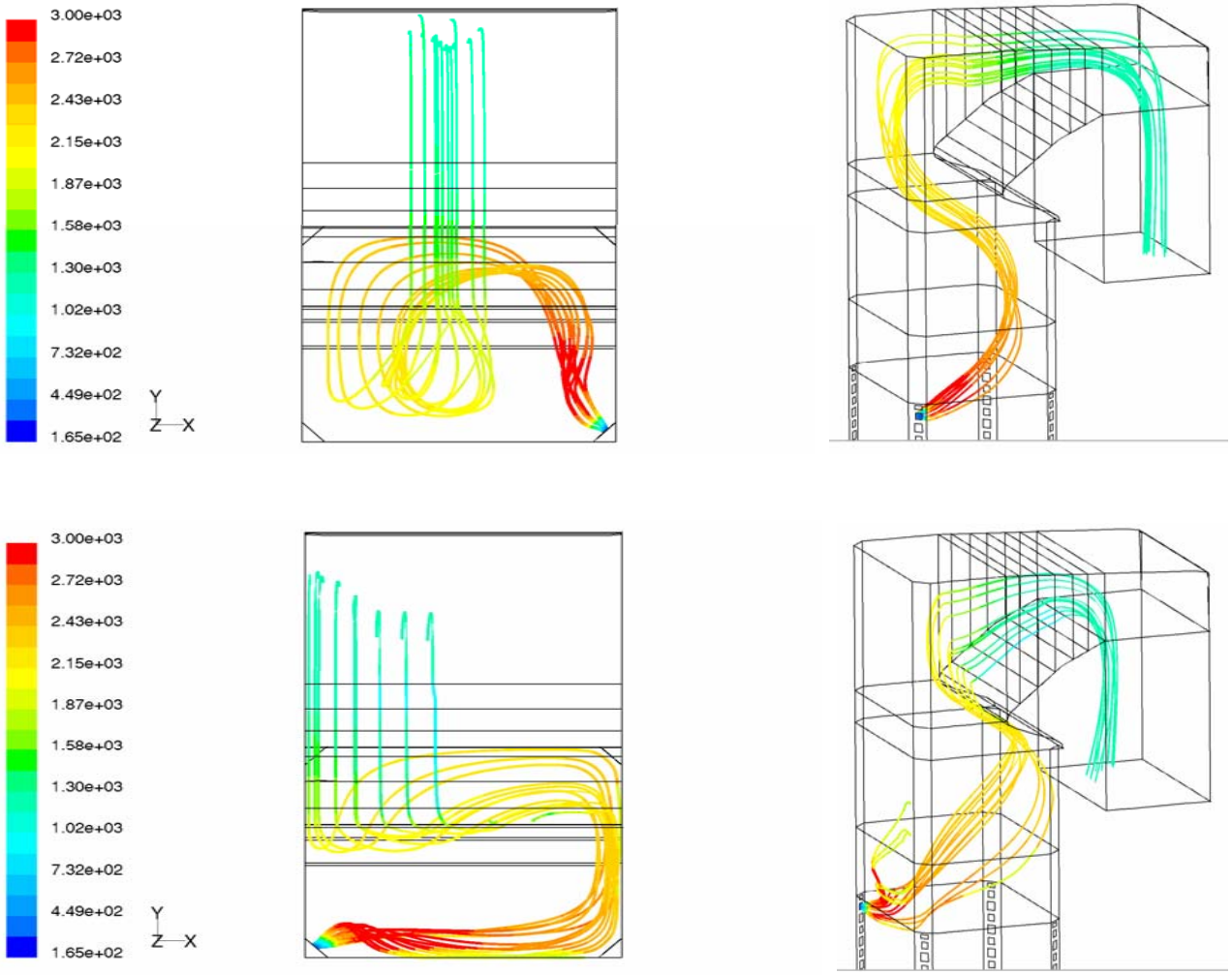


imagination at work

T-Fired Pathlines



Zonal T-Fired Pathlines



T-fired Grid

(Right) Normal Excess O2 Operation 3.6%,

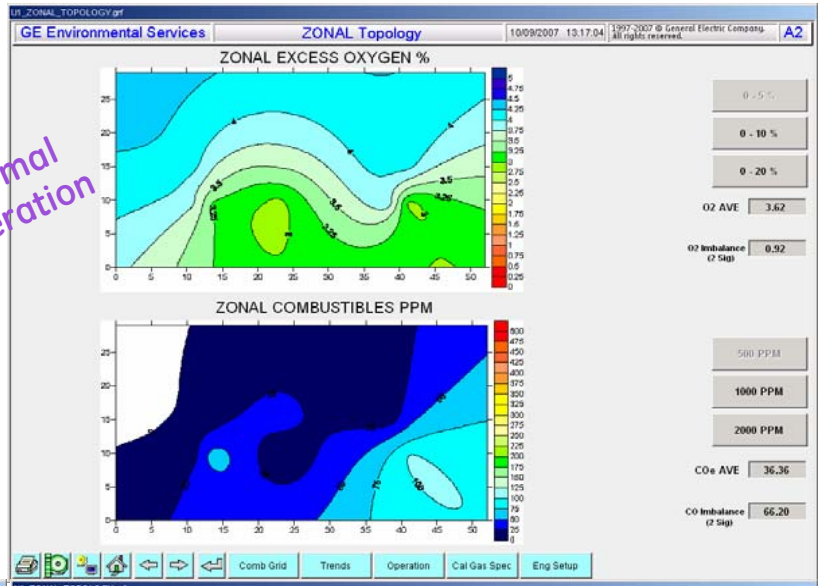
- High NOx & FEGT, low efficiency
- O2 imbalance about 1%; CO Avg. 36 ppm

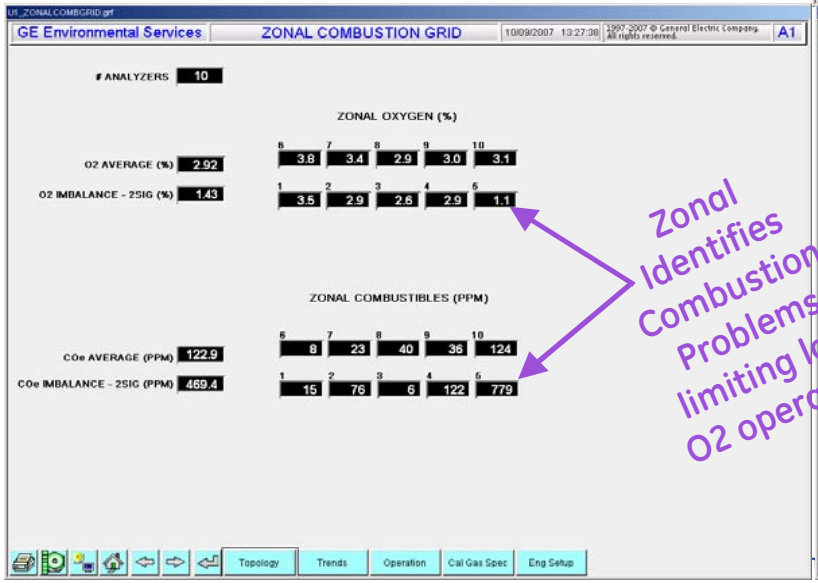
(Bottom) Reduced Excess O2 to 2.8%

- Average CO still low – difficult to detect with single stack measurement.
- CO Avg. 154 ppm; Locus Hi of 779 ppm
- Need to address CO/O2 loci to avoid slagging.

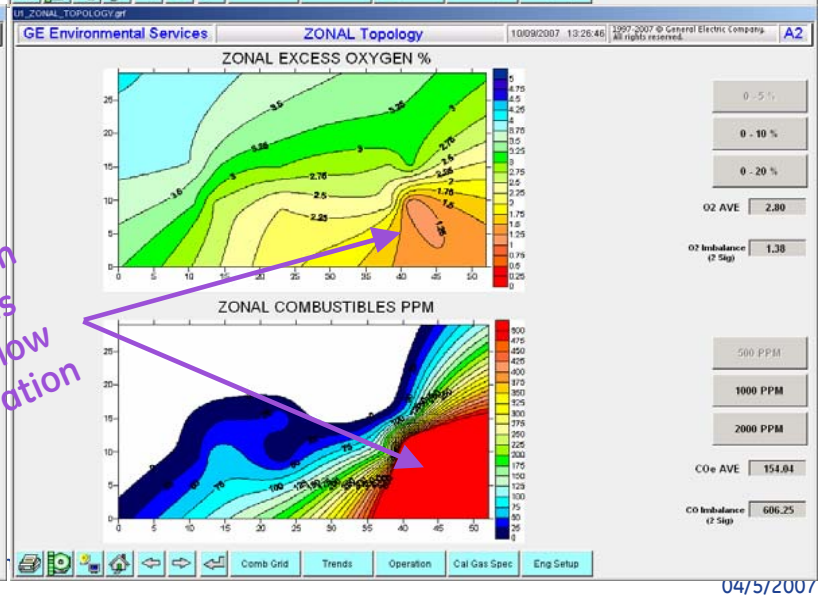
Normal Operation

2





Zonal Identifies Combustion Problems limiting low O2 operation



04/5/2007

Live Zonal CO Correction

350 MW Wall-Fired – 25 Burners

imagination at work

Recent Success

(Low NOx LNB & OFA Mods)

12 Months Before:

Coal Switch

8 Slag Outages

NOx .46 Average

Excess Sootblowing

O2 Set-point 3.2%

9 Months Project:

Bad Coal

No Slag Outages

NOx .4 Stable Average

½ Sootblowing Frequency

O2 Set-point 2.9%

Zonal Conclusions

CO mapping will allow the lowest, safe/stable O2 operation.

Control of CO for regulatory purposes is best achieved by zonal CO correction.

CO mapping has been used as a precursor of slagging events.

The lowest concurrent levels of NOx, CO, LOI and Hg will be achieved through CO mapping and smoothing methodology.