Reinhold Environmental Ltd.

2007 NOx Round Table & Expo Presentation

February 5-6, 2007 in Cincinnati, OH

NOx Round Table Conference
Panel III
Effects of Fuel & Combustion Practices on SCR/SNCR Operation

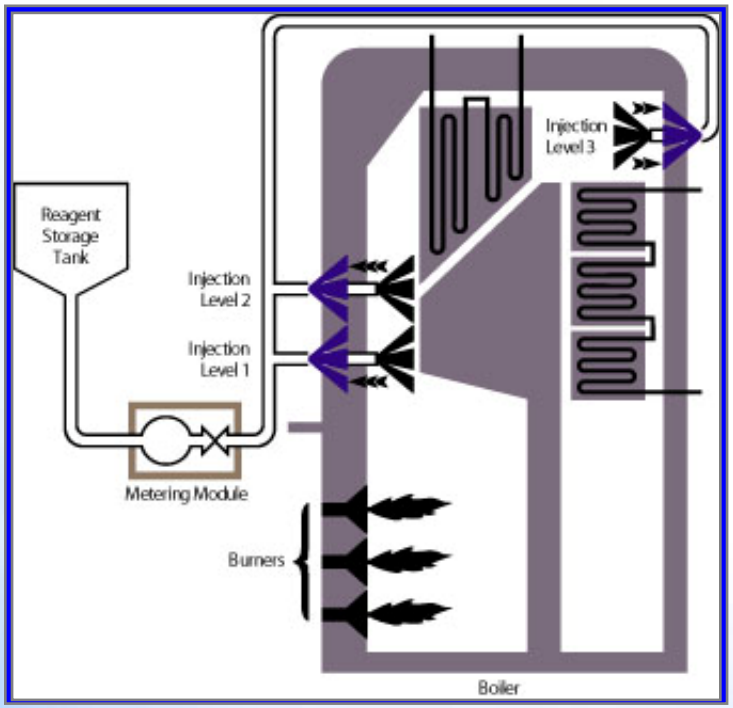
February 3-4, 2007
Cincinnati, Ohio

Kevin Dougherty – VP Marketing

FUEL TECH®
Technologies to enable clean efficient energy™

Technology Overview: NOxOUT® SNCR

Selective Non-Catalytic Reduction



- Over 400 Systems Installed Worldwide
- Injection of Urea Reagent in Upper Furnace:
  - Low Energy, High Momentum Droplets
  - Controlled Distribution through Wall-mounted Injectors or In Furnace Lances
  - In-furnace Gas Phase Reactions between NH_3 & NOx
- Process Reaction Temperature Range: 1600°F to 2200°F
- NOx Reduction: Utility 20-35%
- NOx Reduction: Industrial 30-70%

Boiler and Fuel Experience

Utility Boilers

- T-fired
- Wet Bottom
- Wall Fired
- Cyclone
- Tower

Industrial

- Circulating Fluidized Bed
- Bubbling Fluidized Bed
- Stoker, Grate Fired
- Incinerators
- Industrial

Coal

- Bituminous
- Sub-bituminous
- Lignite

Other Fuels

- Oil – #2 and #6
- Natural Gas
- Refinery Gases (High CO)
- Municipal Solid Waste
- Tire Derived Fuel
- Biomass (Wood, Bagasse, Waste)
- Sludge

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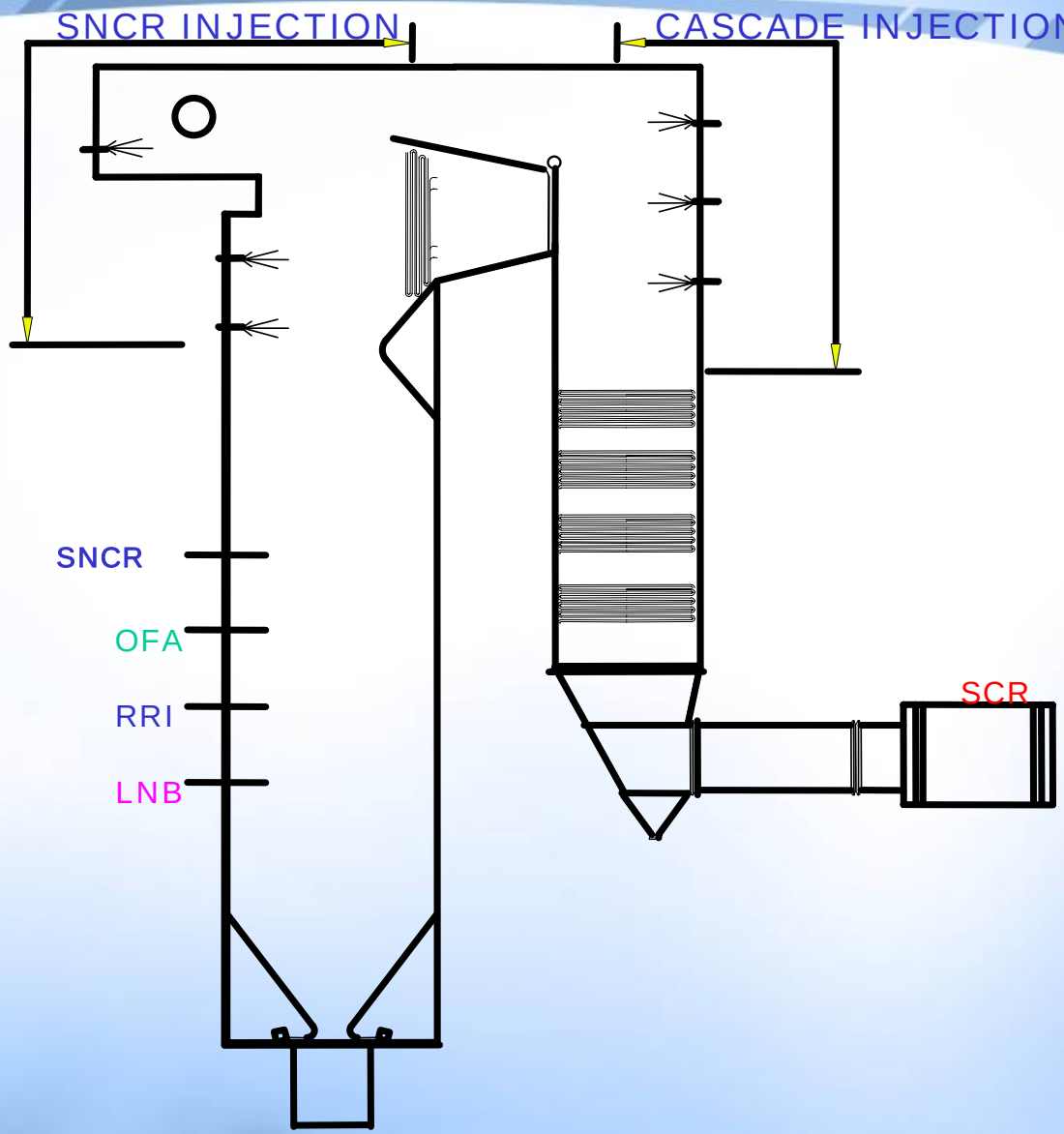
Combining NO_x Reduction Technologies



NOxOUT® SNCR Performance

- Combustion Performance has Direct Impact
  - Non-Optimized Combustion
    - Reduced SNCR Performance – Effect of CO
    - Increase Reagent Operating Costs
  - NOx Reduction Guarantees with SNCR
    - Combustion Re-Optimization
    - Burner De-Tuning
    - SNCR becomes more critical with Combustion Staging
    - Variations in Combustion Process may require conservative SNCR approach to control ammonia slip
    - Modeling and Experience are key to performance

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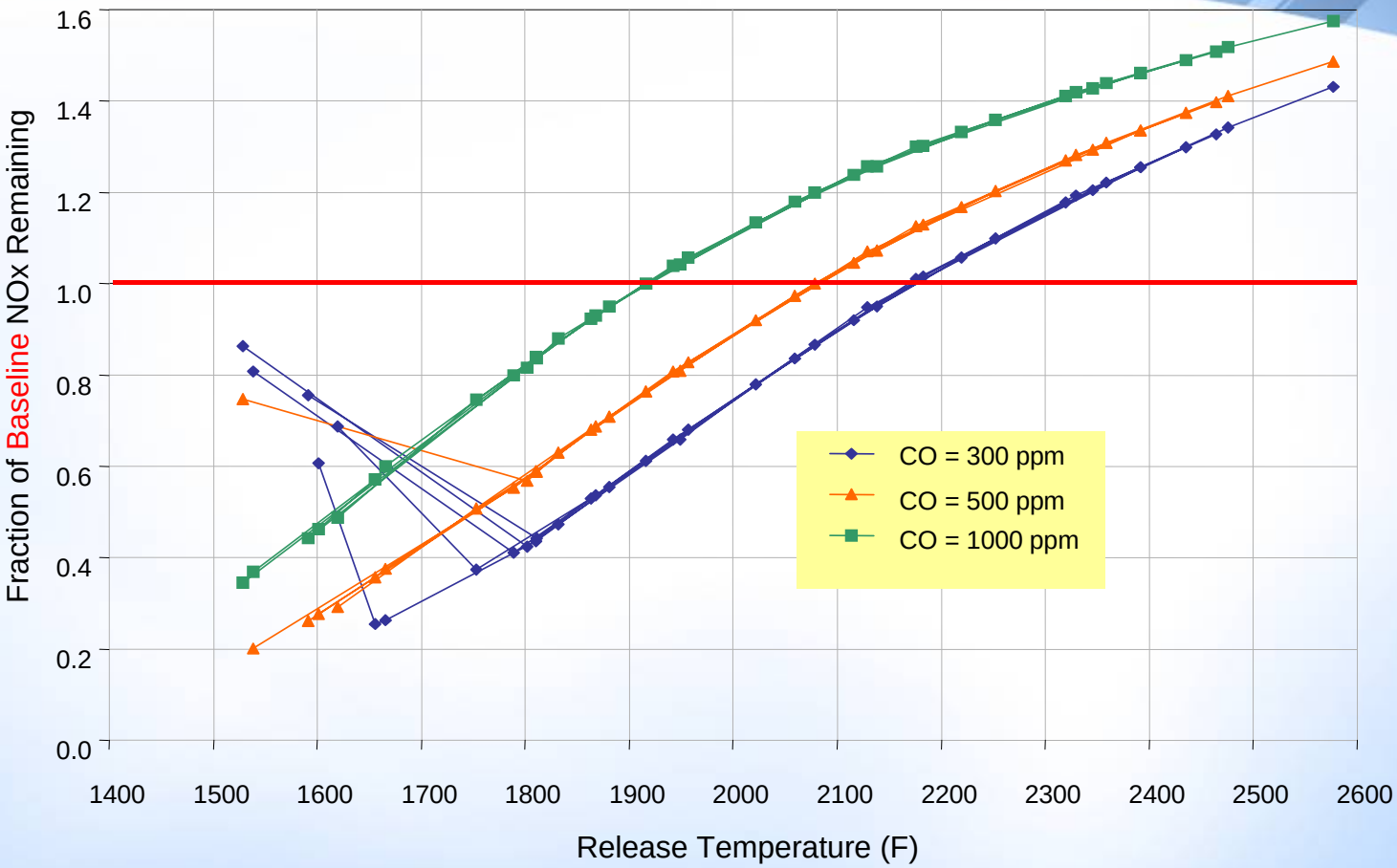
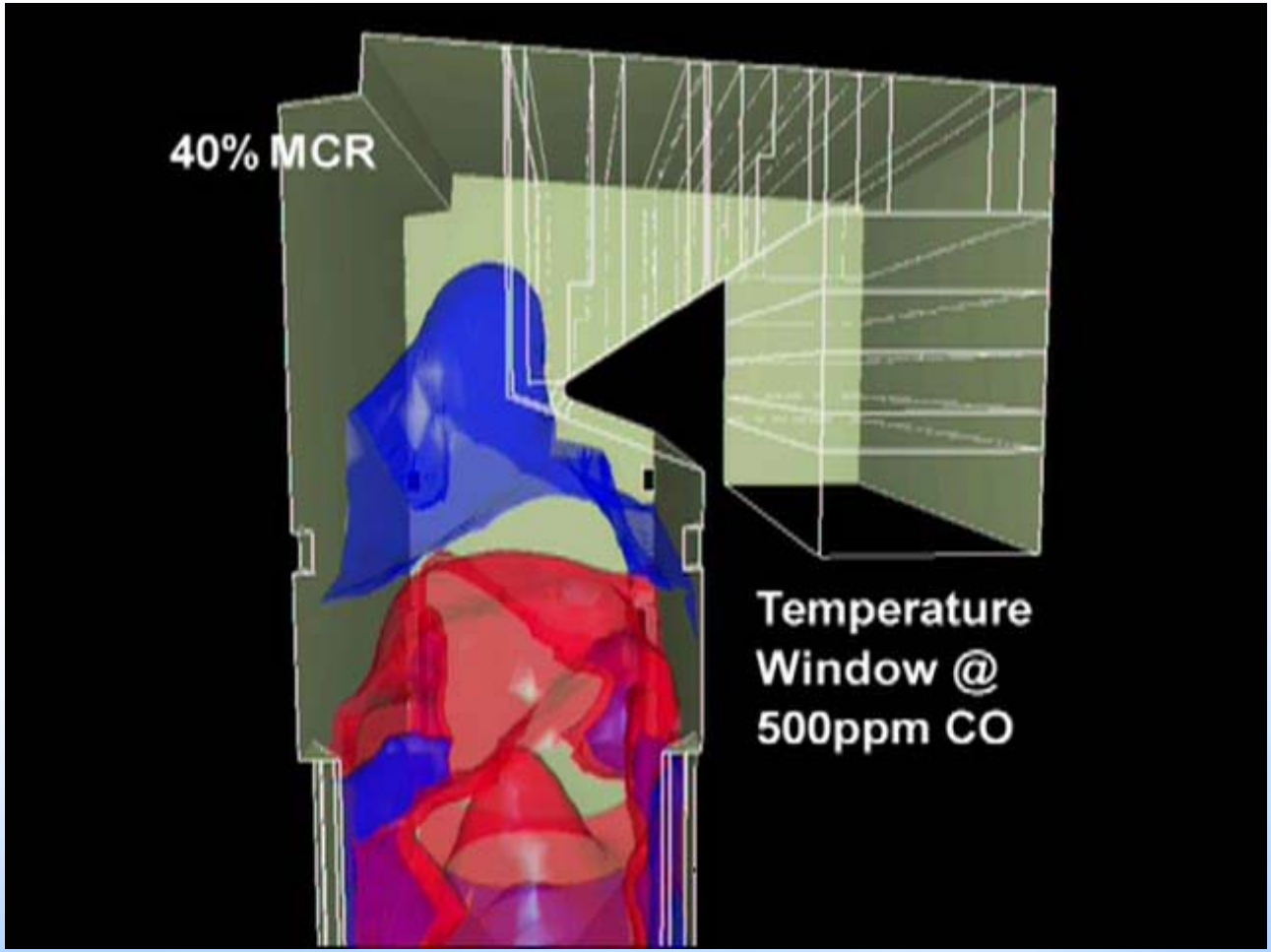
Effect of CO Concentration

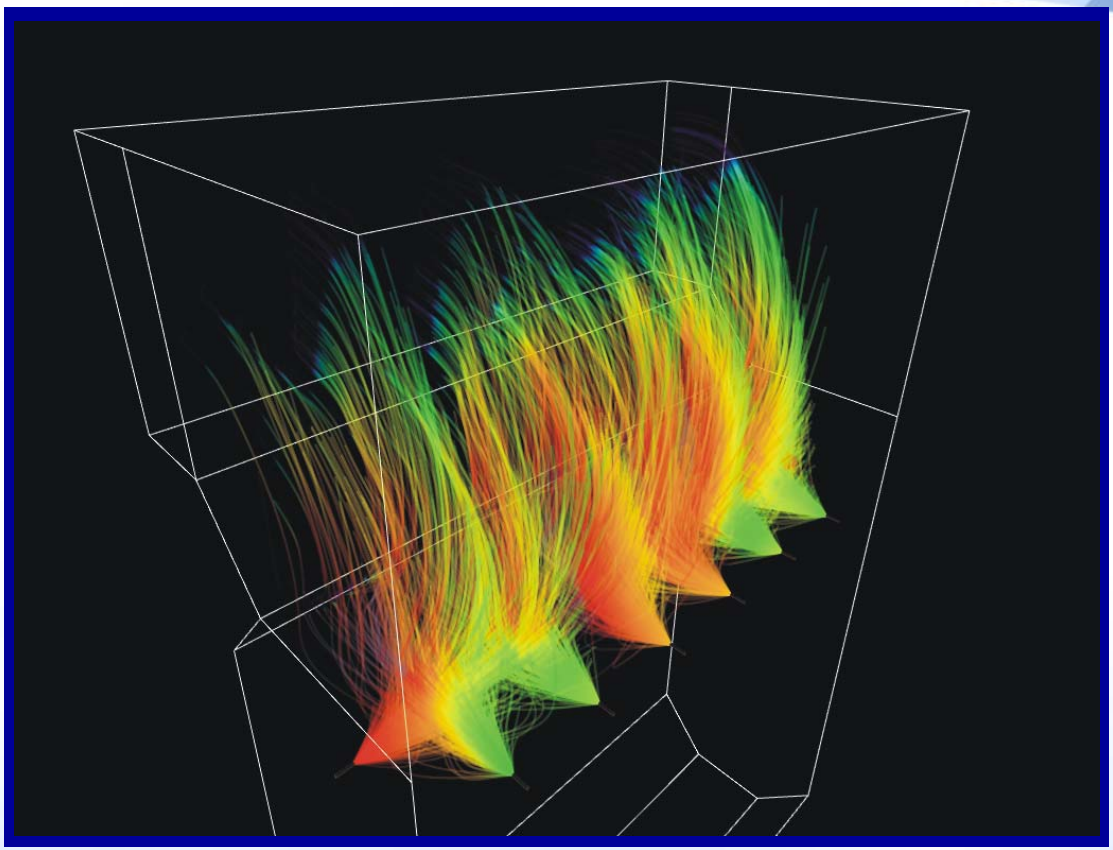


Note: Higher CO Levels Increase the Rates of NH2 Formation and NH3 Oxidation to NO; Effective NOx Reduction Window for Process is Shifted to a Lower Temperature

Effect of CO Concentration

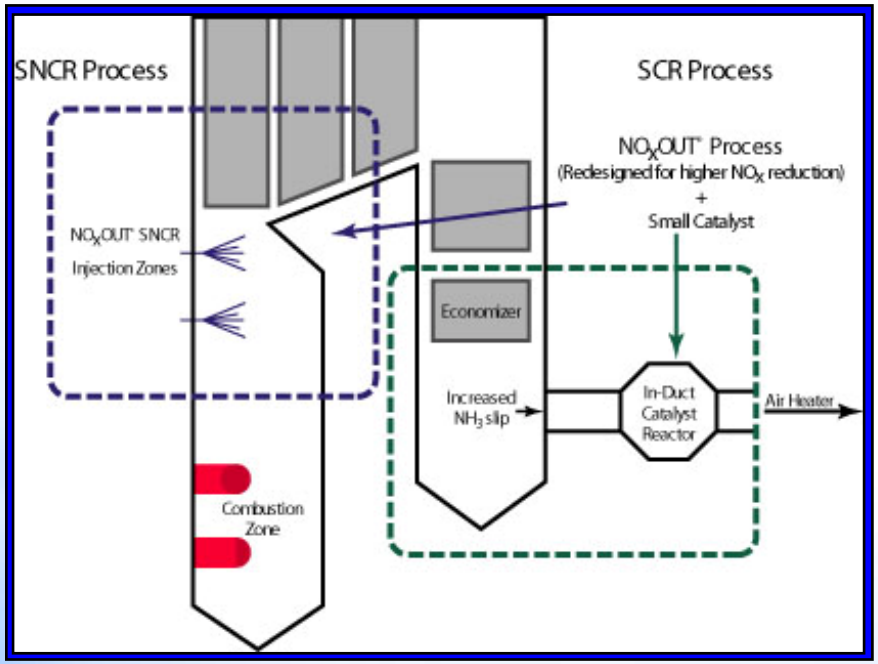


3D VISUALIZATION – Urea Distribution



NOxOUT CASCADE® Technology Overview

Hybrid SCR Technology



- Patented Process
- Reduced Volume (less treatment length)
- Improved SNCR Chemical Utilization and Reduction Efficiency with Higher, Controlled Level of Ammonia Slip
- Ammonia Slip from SNCR Provides Reagent for Catalytic Reactions – No Ammonia Added at SCR Inlet
- Reductions in 50-70 Percent Range Typical, Capable of 80% Reduction

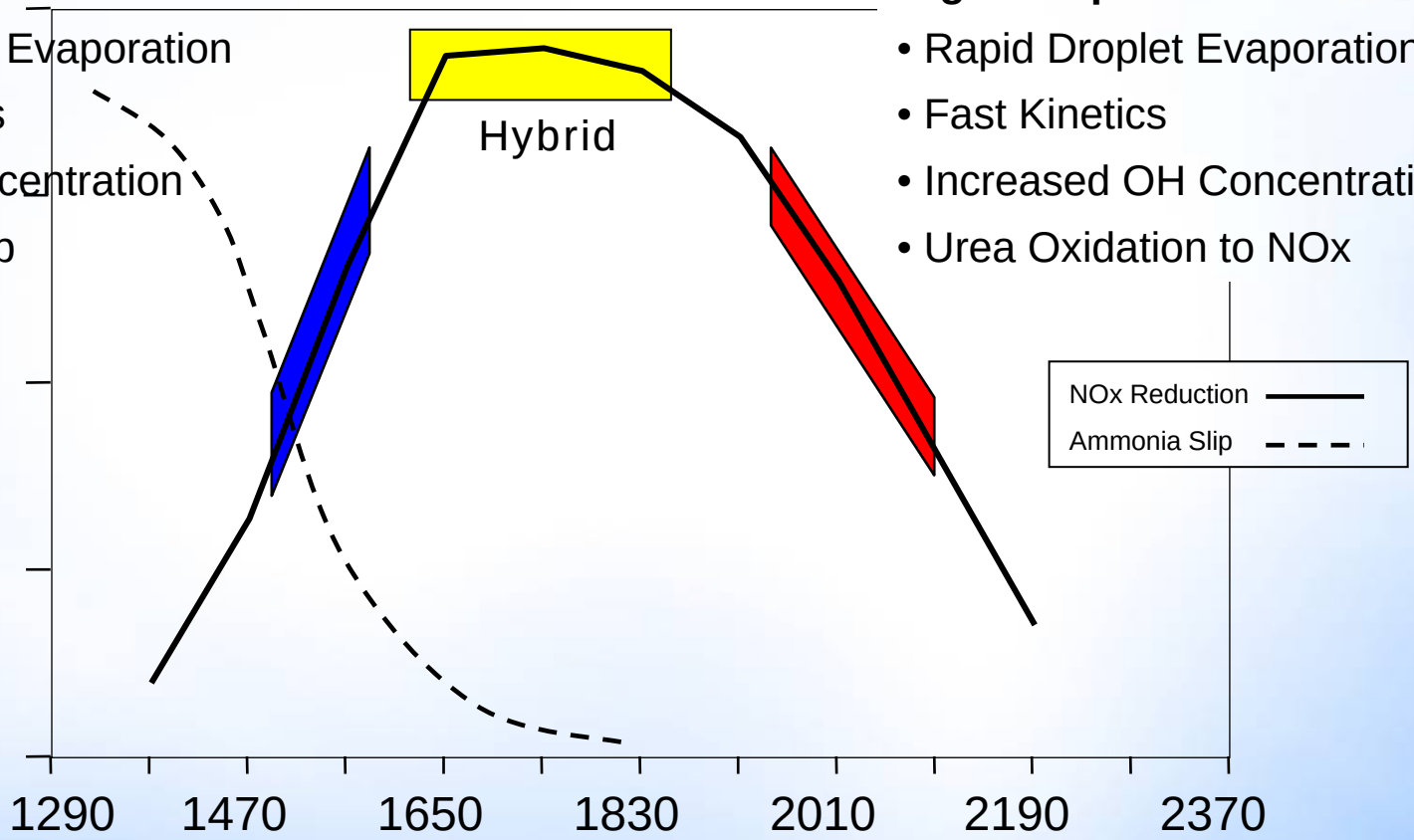
"Right Side of the Slope" Injection

Low Temperatures

- Slow Droplet Evaporation
- Slow Kinetics
- Low OH Concentration
- Ammonia Slip

High Temperatures

- Rapid Droplet Evaporation
- Fast Kinetics
- Increased OH Concentration
- Urea Oxidation to NOx



SNCR/SCR Results @100% MCR (320MW Unit)

Fuel	NOx Control System	NSR	SNCR Reduction	SNCR Utilization	SCR Reduction	Total Reduction	Overall Utilization
Coal	Standard SNCR	1.19	37.0%	31.1%	-	37.0%	31.1%
Coal	Hybrid	0.79	41.1%	59.2%	16.3%	50.7%	64.2%
Coal	Hybrid	1.15	36.9%	45.7%	54.2%	71.1%	61.8%
Gas	Hybrid	1.44	36.1%	38.6%	78.9%	86.5%	60.1%
Gas	Hybrid	1.56	39.0%	37.1%	83.6%	90.0%	57.7%

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NOx Reduction Strategies

- Cost Effective NOx Reduction
  - Work From the Inside Out - Starts with Combustion
  - Capitalize on Synergies of Combining Technologies
  - Get Guaranteed Performance on each Technology
  - Ounce of NOx Prevention worth a Pound of NOx Cure
- SNCR/Compact SCR vs. Full Scale SCR
  - Hybrid System can Approach SCR levels of NOx Reduction
  - Reduced Capital Cost
  - Reduced SO_3 Levels
  - Compact SCR catalyst will provide Hg Oxidation
  - Reduced On-going Catalyst Costs
  - NOx Reduction at Low Boiler Load and Low SCR Temperature

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