

# Low NOx Technology Seminar

Sponsored by  
**The Gas Company**

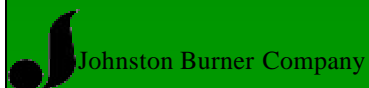
April 30<sup>th</sup>, 2003  
Downey, CA

David Thornock



## Presentation Overview

- Who is Johnston Burner Company
- Overview of the FIR Burner
  - Burner design
  - Demonstrations and Installations
- Summary



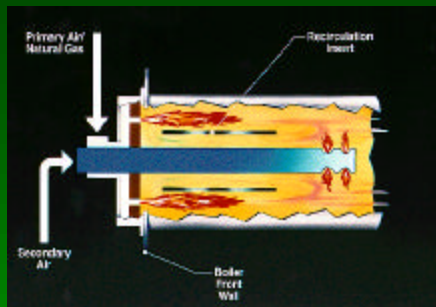
## Johnston Burner Products

- “AR” Burner
  - Low NO<sub>x</sub> – 30-25 PPM NO<sub>x</sub> on NG
  - Standard – 60-80 PPM NO<sub>x</sub> on NG
- “A” Burner
  - Low NO<sub>x</sub> – 30 PPM NO<sub>x</sub> on NG
  - Standard – 90-110 PPM NO<sub>x</sub> on NG
- “S” Burner
  - Low NO<sub>x</sub> – 30 PPM NO<sub>x</sub> on NG
  - Standard – 90-110 PPM NO<sub>x</sub> on NG
- “J” Burner
  - Standard – 60-80 PPM NO<sub>x</sub> on NG
- “FIR” Burner
  - Low NO<sub>x</sub> – Under 9 PPM NO<sub>x</sub> on NG (Gas only burner)



Johnston Burner Company

## FIR BURNER



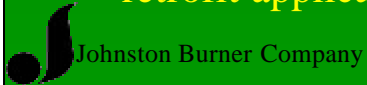
- Burner was developed at the Gas Technology Institute
- Licensed Technology to Johnston Boiler Co. for Firetube Market
- Funded by SMP, GRI, SoCalGas, and DOE
- Retrofit or new
- Premixed staged combustion
- Forced internal recirculation
- No efficiency loss
- Lowest cost premium



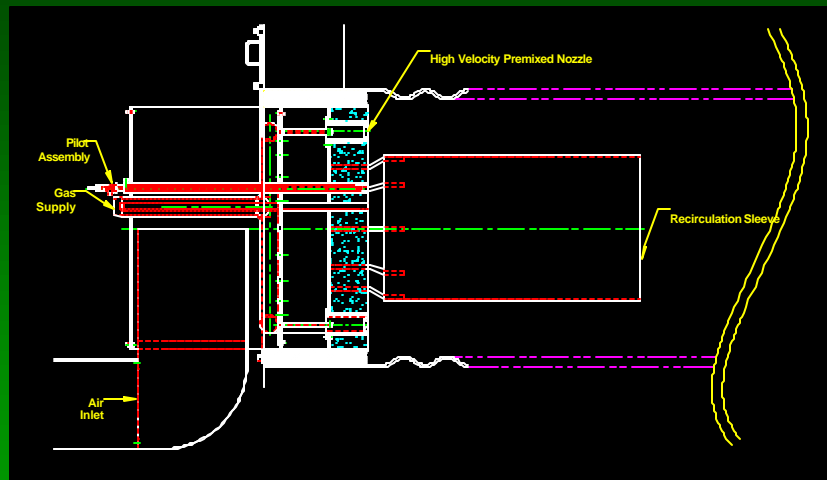
Johnston Burner Company

## Johnston's FIR Burner

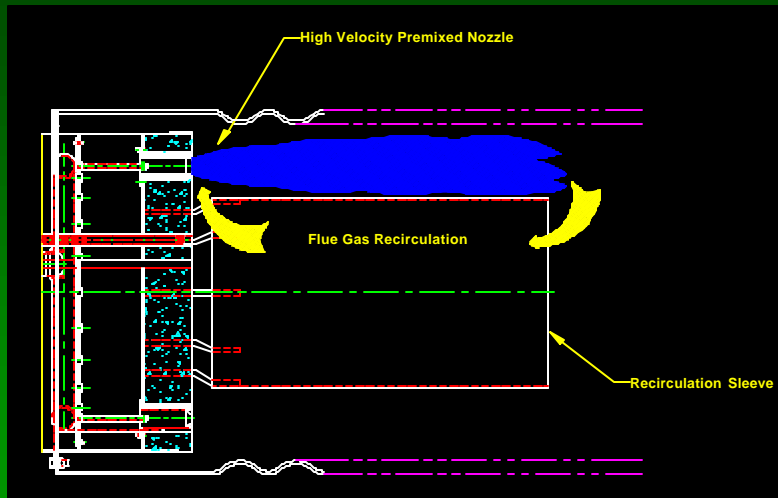
- The FIR Burner was chosen to address the Under 20 PPM to Under 9 PPM NO<sub>x</sub> requirement
- Gas only applications
- Targeted towards the non-attainment areas like California, Texas, and isolated areas on the east coast
- We are using the FIR burner for new and retrofit applications



## FIR Burner Cross Section

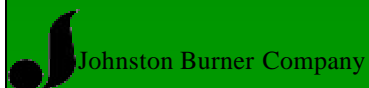


## FIR Burner Mechanics



## FIR Burner Installations

- The FIR Burner has been installed and tested on 3 different Firetube Boilers
  - Vandenberg AFB 50 hp Kewanee
  - GTI's Laboratory 250 hp Johnston 2-pass Ohio Special
  - Fullerton College (2) 250 hp Johnston 4-pass boilers
- An 800 hp FIR burner has been tested at Johnston and we are now in the process of building and testing a 900 hp



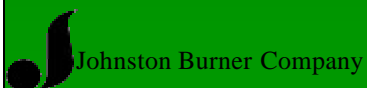
# VANDENBERG AFB DEMO

Firetube Boiler  
20 vppm NO<sub>x</sub>



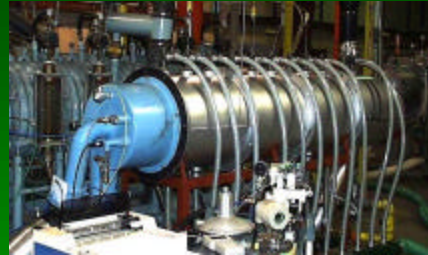
## FIRETUBE BOILER DEMONSTRATION

- SITE: Vandenberg AFB in Santa Barbara County, California
- Pilot site for ENVVEST program (EPA/DoD partnership to achieve regulatory compliance via pollution prevention)
- 45 firebox and firetube boilers located at site



# FIR Firetube Boiler Demonstration

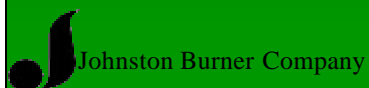
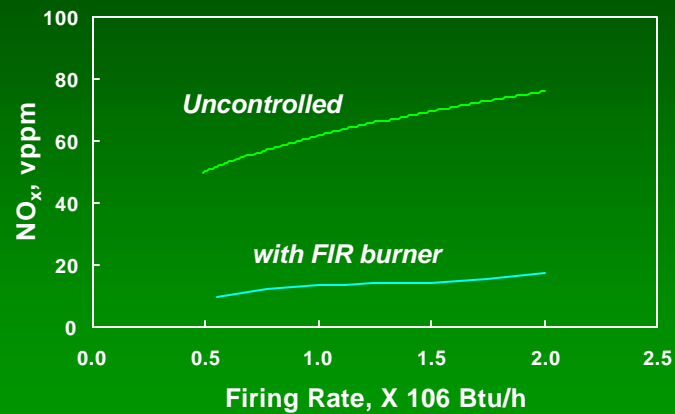
- BOILER:  $2.5 \times 10^6$  Btu/h  
Kewanee firetube
- Burner fabricated by  
Detroit Stoker Company



- >1800 hours unattended operation  
for >2300 cycles
- Meets all emissions targets
- Continue to monitor and address  
long-term reliability



## Firetube Boiler: $\text{NO}_x$ BEFORE AND AFTER



## FIR BURNER



## The FIR Burner on Johnston's 2-Pass Ohio Special

- Challenging application because of the Boiler design
  - A 70 hp boiler that is fired at 250 hp
  - Typically a smaller furnace
  - Typically a larger pressure drop



Installed at GTI's Lab running at 250 hp 4.2% O<sub>2</sub> and 11 PPM NO<sub>x</sub>



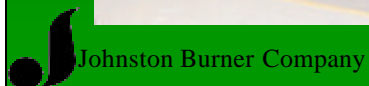
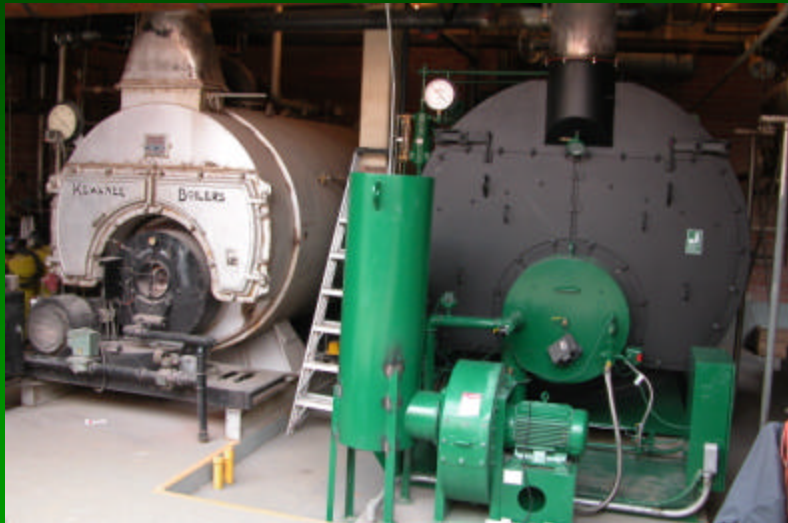
 Johnston Burner Company

## Fullerton College

- (2) 250 hp boilers used for heating
- 15# steam design
- Gas firing only
- Requires under 12 ppm NO<sub>x</sub>



## Fullerton College




## Fullerton College



 Johnston Burner Company

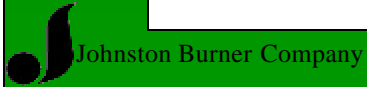
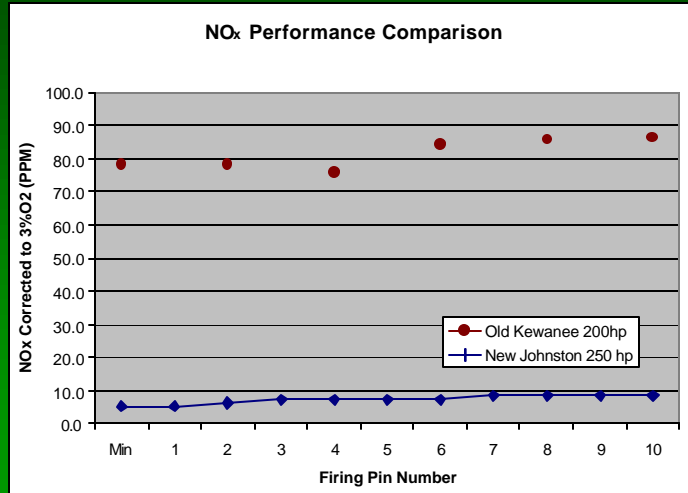
## Fullerton College

- **Load Requirements**
  - Seasonal heating load with winter the highest and summer non-existent
  - Early morning largest day load
  - Load tapers off in the afternoon and evening

 Johnston Burner Company

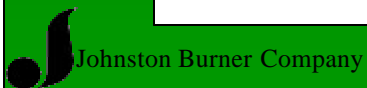
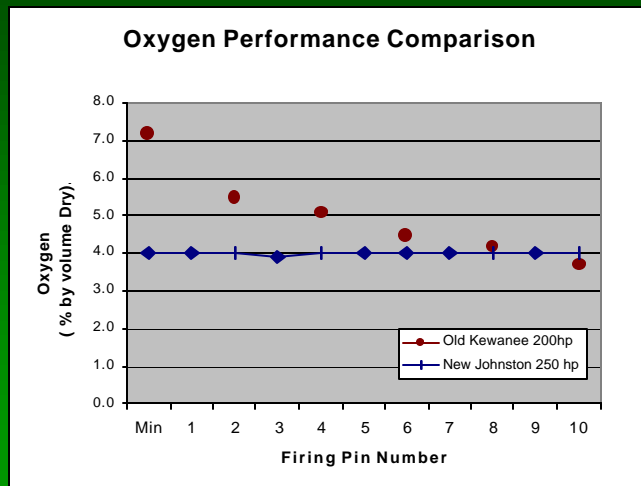
# Fullerton College

## Operating Results



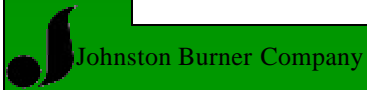
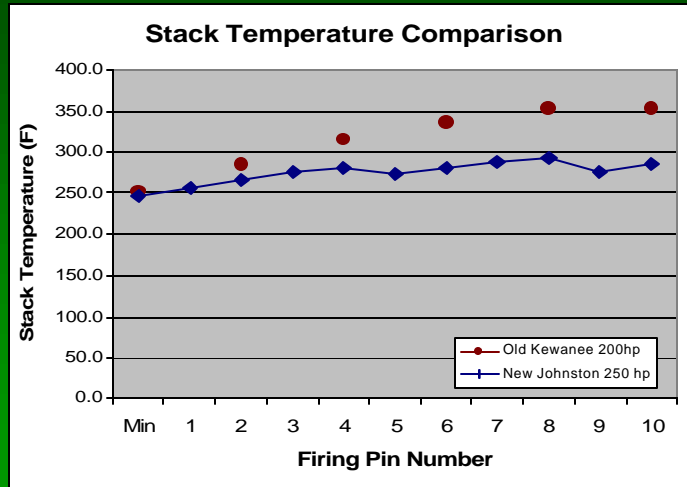
# Fullerton College

## Operating Results



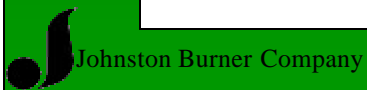
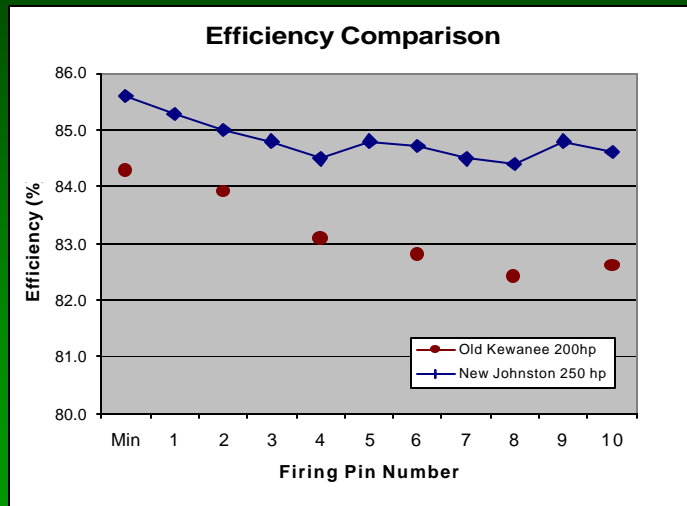
# Fullerton College

## Operating Results

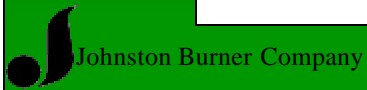
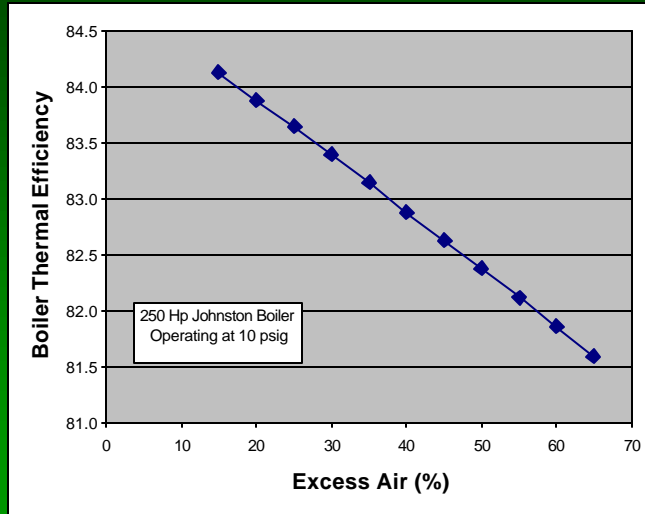


# Fullerton College

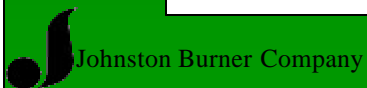
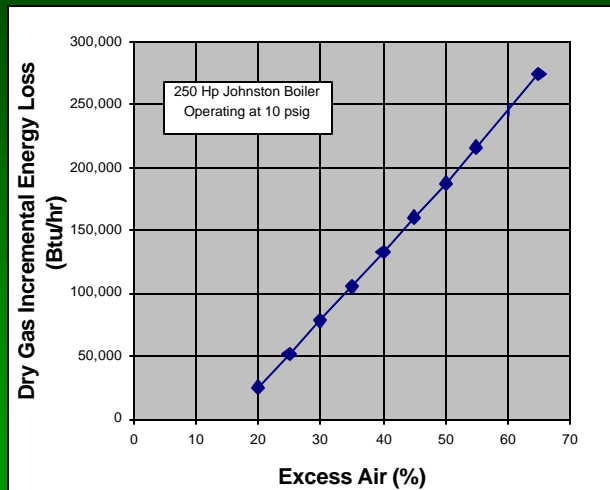
## Operating Results



## Thermal Efficiency and Excess Air



## Dry Gas Loss and Excess Air



## Summary

- The FIR Burner is an Efficient solution for Firetube Boiler Low NO<sub>x</sub> applications (under 10 ppm)
  - Burner operation at 4% O<sub>2</sub> through travel
  - Simple controls
  - Standard boiler packages
- The FIR burner optimizes energy use:
  - No external FGR
  - No need for large hp fans to push extra FGR or Excess Air



Johnston Burner Company

## Summary

- The FIR burner has now been demonstrated for small firetube boiler applications 50 – 250 hp
- Will be extended to 1000 hp this summer and installed in Houston
- GTI and Johnston Burner company are committed to move the FIR Burner and all of its benefits into the firetube market place



Johnston Burner Company