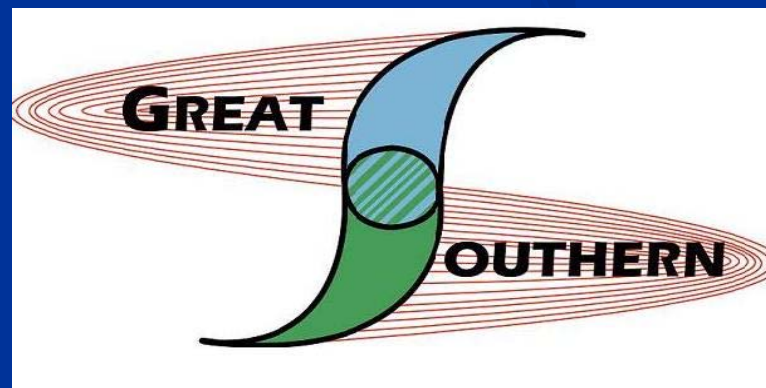


AFRC 2013 Industrial Combustion Symposium

Kauai, HI

September 23-25, 2013

*Oxy-Flameless Combustion Heaters for  
Refinery Process*



Great Southern Flameless, LLC

# INTRODUCING OXY-FLAMELESS COMBUSTION HEATERS

GSF'S New Design Concept  
for Flameless Combustion

# GSF OXY-FLAMELESS COMBUSTION HEATER

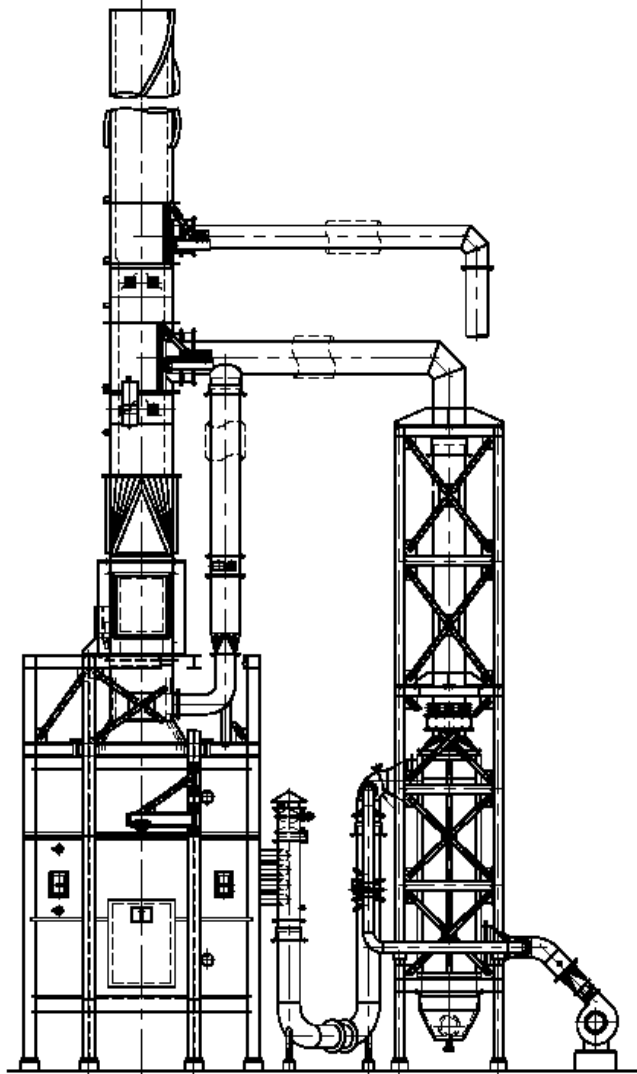
- Current Flameless Heater design can be easily retrofit and converted to an Oxy-Flameless Heater
- 0-1 ppm Nox
- Increased heater efficiency
- Reduced flue gas volume for potential post-combustion CO<sub>2</sub> capture requirements

- Maintain advantages of flameless heater performance
  - Even radiant section flux rates
  - Lower tube metal temperatures

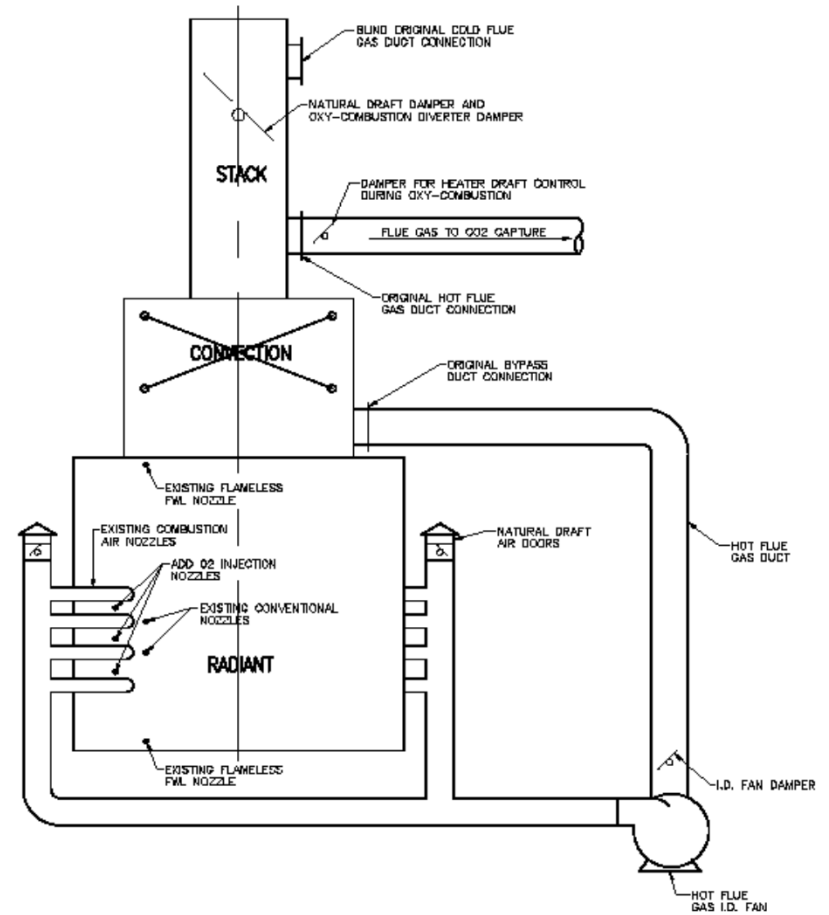
# CONVERT AN EXISTING FLAMELESS HEATER TO AN OXY-FLAMELESS COMBUSTION HEATER

- Add oxygen injection nozzles to each flameless nozzle group (FNG)
- Convert the hot flue gas duct into a transfer line to the CO<sub>2</sub> capture system
- Remove APH and fans
- Add hot ID fan and modify ductwork to recirculate hot flue gas back to the heater.

# CONVERTING THE HEATER



U.S. PATENT No. 8128268  
ADDITIONAL PATENTS PENDING



# OPERATION

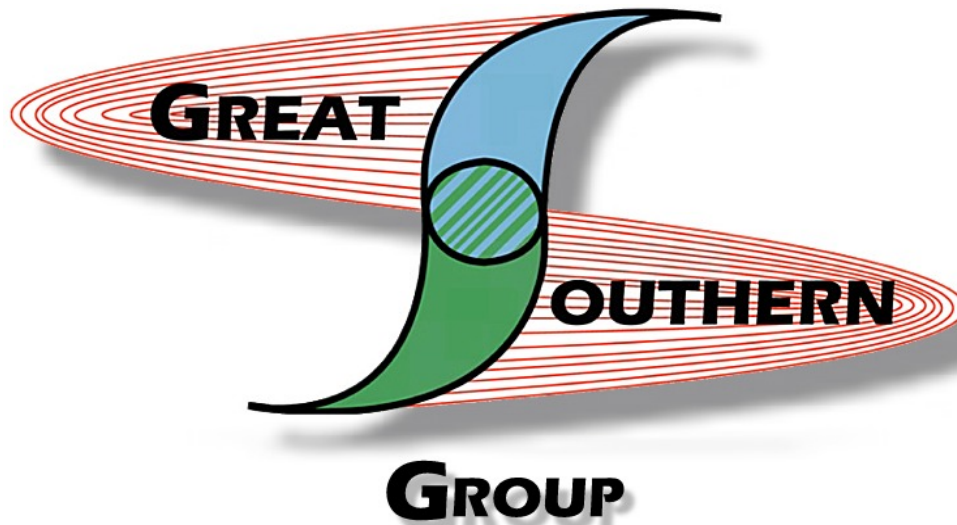
- Start up on natural draft, conventional firing mode.
- Gradually bring on oxygen injection
- Bring on flue gas recirculation
- When temperature permissives are met, transition to staged and then flameless firing modes.

# CONSIDERATIONS

- Upcoming CO<sub>2</sub> regulations?
- Continued reduction of NO<sub>x</sub> emissions required? SCR?
- Efficiency will be more important than ever before.
- BACT for the future?



# QUESTIONS AND ANSWERS



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*Significantly different companies.*