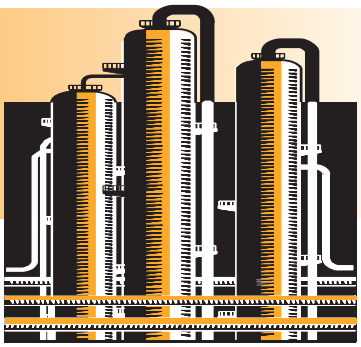
PETROLEUM

Project Fact Sheet



VERY LOW EMISSIONS: RADIATION STABILIZED BURNER

BENEFITS

- Elimination of "post-combustion" pollution control devices to reduce the cost of NO_x compliance
- Uniform heating of sensitive fluids and more compact boiler designs due to the uniformly distributed heat flux from the RSB surface
- Simultaneous achievement of low NO_x emissions, low CO, and unburned hydrocarbon emissions due to the fully premixed burner design
- Stable operation over a broad range of emissions levels, from sub-7.5 ppm NO_x to sub-30 ppm NO_x, with one burner design

APPLICATION

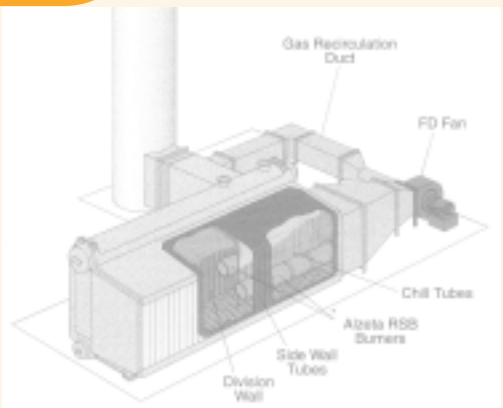
Industrial boilers and low- to intermediate-temperature fluid heaters are used in industries such as refineries, pulp and paper plants, and chemical manufacturing. They represent a major component of industrial fuel consumption. The first RSB targeted application is industrial package boilers of which there are approximately 12,000 units in the U.S. ranging in size from 25 million (mm) British thermal units per hour (Btu) to 250 mm Btu per hour.

NEW INDUSTRIAL BURNER WILL DELIVER HIGH EFFICIENCY AND LOW EMISSIONS IN INDUSTRIAL BOILERS AND PROCESS HEATERS

The Radiation Stabilized Burner (RSB) is a fully premixed, semi-radiant, surface-stabilized burner developed to provide high thermal efficiency and very low emissions of nitrogen oxides (NO_x) and carbon monoxide (CO) in industrial boilers and process heaters. Characteristics of the RSB that improve performance relative to conventional burners include: full premixing of fuel and air, surface stabilization through the use of radiant zones and high flux zones on the burner surface, and controlled flame shape above the burner surface. The current goal of the RSB is to provide sub-9 parts per million (ppm) NO_x and sub-50 ppm CO emissions without sacrificing thermal efficiency or boiler reliability.

Premixing of the fuel and air prior to combustion provides a simple method of combusting all fuel at the desired fuel-air ratio, and has been demonstrated to be an effective method of providing simultaneous low NO_x and low CO emissions. The semi-radiant design of the burner surface balances excellent flame stability with high burner surface flux. Excellent flame stability is needed to achieve low emissions levels over the broad range in which industrial boilers operate. High surface heat flux is critical to achieving compact designs required in most industrial applications. The controlled flame shape above the burner surface allows for more compact boiler designs, and for more rapid cooling of the flame to further reduce NO_x emissions.

INTEGRATED BOILER BURNER



Controlled flame shape of the RSB leads to compact integrated boiler burner designs and more rapid cooling of combustion products.

Project Description

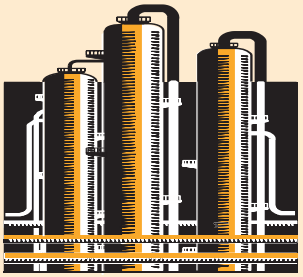
Goal: Demonstrate a commercially viable very low emissions industrial burner capable of achieving sub-9 ppm NO_x and sub-50 ppm CO emissions with no loss in thermal efficiency relative to current 30 ppm burner designs.

The RSB achieves its NO_x reduction by diluting the fuel-air mixture with flue gas to reduce the temperature of the flame. The surface stabilized burner design has been demonstrated to provide excellent flame stability at the very high dilution levels that are necessary to achieve very low emissions of NO_x and CO. During the first phase of this project, tests were conducted to determine the limits of burner operation, and the goal of sub-9 ppm NO_x was demonstrated to be achievable.

Subsequent development work has focused on demonstrating improved materials of construction, more effective methods of fabrication, and cost effective methods of burner control. In addition, new boiler designs have been developed that will take further advantage of the unique characteristics of the distributed flux burner.

Progress and Milestones

- Prototype burner tests in a Chevron steam generator demonstrated the project goals of sub-9 ppm NO_x and sub-50 ppm CO at 15 percent excess air with Flue Gas Recirculation (FGR).
- Design modifications and the qualification of new materials have reduced burner cost and improved burner performance and reliability.
- Conceptual boiler designs have been completed that will reduce emissions levels and improve thermal performance beyond what can be achieved with a burner replacement only.
- The RSB is now commercially available to meet sub-20 ppm NO_x emissions levels for boilers with capacity less than 16.7 mm Btu per hour.
- A final field demonstration in an industrial package boiler will be conducted to demonstrate performance under representative industrial boiler conditions.



Project Partners

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