

# Process Heating

FOR MANUFACTURING ENGINEERS WHO USE HEAT PROCESSING EQUIPMENT AND SUPPLIES.

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## Managing NO<sub>x</sub>

From burners to boilers, combustion systems need effective emissions control. Find low NO<sub>x</sub> burners using our Equipment Overview.

- Steam Team Know-How
- Reduce Utility Costs by Improving Power Factor
- 4 Ways to Improve Chiller Operation



# Managing Emissions

**As emission limits continue to decrease, boiler operators seek products that provide efficient, safe and economical operation.**

**E**missions from combustion systems have been regulated by local and federal governments since the early 1960s. During the 1990s, industrial boilers were heavily targeted, due in part by the Clean Air Act, and end users addressed regulatory air emission reductions specifically associated with nitrogen oxides (NO<sub>x</sub>),

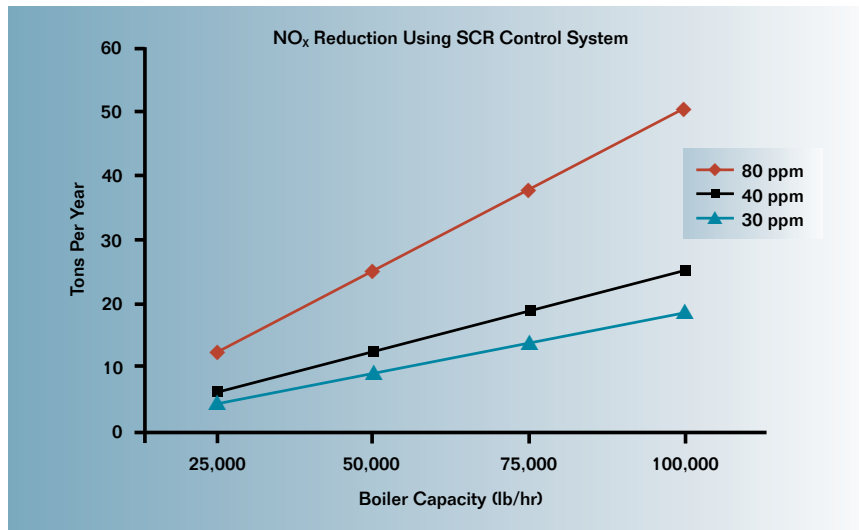
lowers flame temperature, thus reducing thermal NO<sub>x</sub> production. External flue gas recirculation utilizes an external fan; by contrast, induced flue gas recirculation utilizes the combustion air fan to recirculate air back into the flame. Although flue gas recirculation effectively reduces thermal NO<sub>x</sub> emissions, there are limita-

achieve single-digit NO<sub>x</sub>. The SCR system, known as CataStack from Nationwide Boiler, Fremont, Calif., provides benefits to users through improved operating efficiency and lower emissions. According to the company, the system exceeds emission limits beyond what is typically required. To demonstrate its effectiveness, the company used the SCR system to augment its rental fleet of boilers.

“We were not satisfied with the 9 ppm burner options available, so we looked at back-end equipment options. We wanted to develop an add-on 9 ppm option that was easy to install, did not require any fan or control changes, and did not affect the operation of the boiler,” said Larry Day, Nationwide Boiler’s vice president of sales. “Our rental units utilized a proven burner design with dependable controls, which always started up quickly and had high turndown and fast response to load swings. We did not want to jeopardize those important ‘must-have’ characteristics, and those were the parameters for which CataStack was developed and had to meet.”

The company then began selling new units to users from various industries. Ingomar Packing Co. as well as a prominent industrial food manufacturer, both located in California, experienced firsthand the benefits of the SCR system. Nationwide Boiler offered these manufacturers guaranteed performance of at least 9 ppm NO<sub>x</sub>, with improved operational efficiencies. The SCR system met and exceeded these requirements and yielded results of less than 5 ppm.

The system is relatively compact and designed for vertical or horizontal field retrofit on most package boilers up to 250,000 lb/hr. It performs efficiently across a flue-gas temperature range of 325 to 650°F (163 to 343°C). The ammonia supply skid holds three 150-lb anhydrous ammonia gas cylinders, an ammonia header, and associated instrumentation and controls. This skid design minimizes the need for HAZMAT and a risk man-



The performance of the SCR system, based on reducing NO<sub>x</sub> to less than 6 ppm, is shown.

carbon monoxide (CO), particulate matter (PM) and sulfur dioxide (SO<sub>2</sub>). Industry quickly responded and energy conversion system designs were focused heavily on providing high efficiency and low emissions performance.

Advancements in “front-end” burner technology such as the use of low NO<sub>x</sub> burners for natural gas-fired units have been designed to reduce NO<sub>x</sub> emissions by more than 50 percent or more, mainly through flue gas recirculation. Flue gas recirculation recirculates a portion of exhaust gases back into the combustion flame in order to reduce O<sub>2</sub>, which

includes handling load swings and maintaining flame stability, which place demands for precise controls and fuel/air ratio monitoring systems.

Low NO<sub>x</sub> equipment manufacturers realized that burners alone would not be able to meet evolving requirements faced by industrial users in areas such as California, where emission limits were approaching 9 ppm or less. Alternative “back-end” solutions, which complemented low NO<sub>x</sub> burners, appeared to be the answer.

One potential solution is a post-combustion, selective catalytic reduction (SCR) system that has been shown to



## Boilers

The system for package boilers consists of a low temperature SCR catalyst, a complete ammonia injection skid, ammonia injection grid, and a thermocouple for monitoring stack temperature. A three-bottle system is shown.

a Condimax condensing heat exchanger. Once installed and started up, it was certified to operate at better than 95 percent fuel-to-steam efficiency with less than 1.0 ppm NO<sub>x</sub> emissions.

As emission limits continue to decrease, boiler operators will continue to seek products that provide efficient, safe, practical and economically viable solutions. Low NO<sub>x</sub> manufacturers are continually developing new technology and new systems that are designed to look past what is required today, and look forward at what will be required as far as over ten years from now. **PH**

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agement plan, often times needed when more than 500 lb of hazardous material is stored at a facility. The only required routine maintenance is the changing of ammonia cylinders.

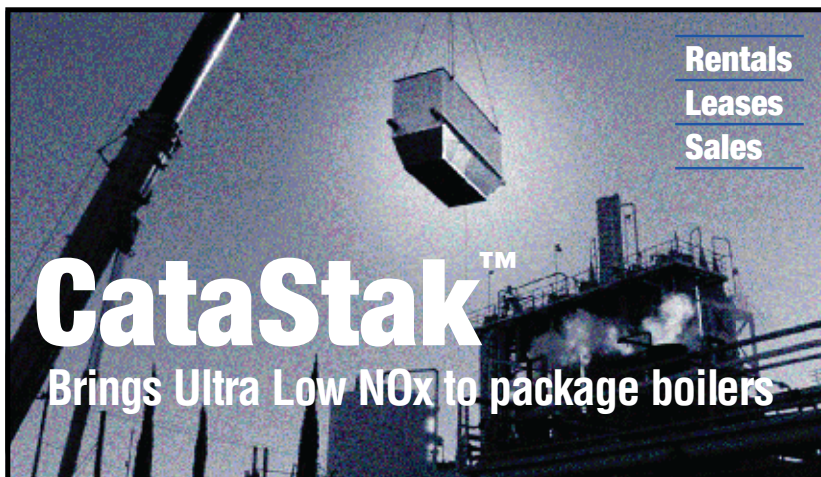
### Put into Action

Before installing the CataStak, Ingomar Packing averaged 27 ppm NO<sub>x</sub> with a low NO<sub>x</sub> burner installed on its 75,000 lb/hr boiler (originally installed in 1983). Once equipped with the SCR system, emissions were reduced to 5 ppm NO<sub>x</sub> — nearly 80 percent below the 9 ppm NO<sub>x</sub> San Joaquin Valley Air Pollution Control District requirements, as certified by a third-party compliance testing company.

According to Ingomar Packing's director of operations, the two-week installation and one-day startup of the system was seamless, and it has operated effectively for more than two years. It has consistently reduced the facility's NO<sub>x</sub> emission well below the required level, and continues to have minimal operating costs.

In another instance, the SCR system reduced NO<sub>x</sub> emissions to less than 1 ppm NO<sub>x</sub> and resulted in an energy efficiency rebate of almost \$300,000 for the food manufacturing facility. The company was supplied a new Babcock and Wilcox 50,000 lb/hr, 275 psi boiler, equipped with a

standard 30 ppm low NO<sub>x</sub> burner, a CataStak SCR system by Nationwide Boiler, a Kentube fuel economizer, and



- **<6ppm NO<sub>x</sub>**
  - With CRI Catalyst/Shell DeNO<sub>x</sub> components
- **Field Installation**
  - On package boilers to 250,000 lb/hr
- **Simple Operation**
  - No special facilities, permits, controls or modifications required
- **Low Pressure Drop**
  - 2" WC means no fan changes



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