COMBUSTION & EMISSION CONTROL SOLUTIONS

CCA
COMBUSTION SYSTEMS

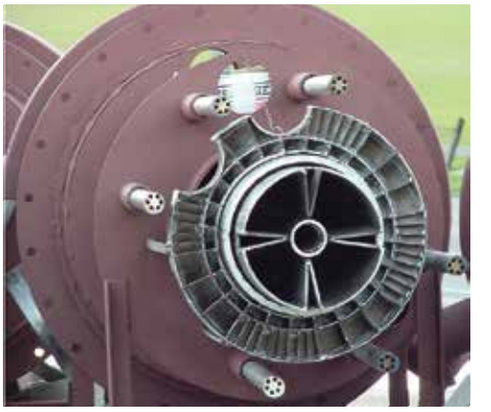
A Division of PEERLESS Mfg. Co.

About CCA

CCA Combustion Systems, a division of Peerless Mfg. Co., is a global provider of combustion control technologies to reduce NOx, particulate matter (PM), unburned carbon and CO emissions at various types of combustion facilities including utility power plants, paper & pulp mills, chemical plants, oil refineries, ethanol plants and marine vessels. CCA maintains a strong intellectual property portfolio with 35 patents owned or under license.

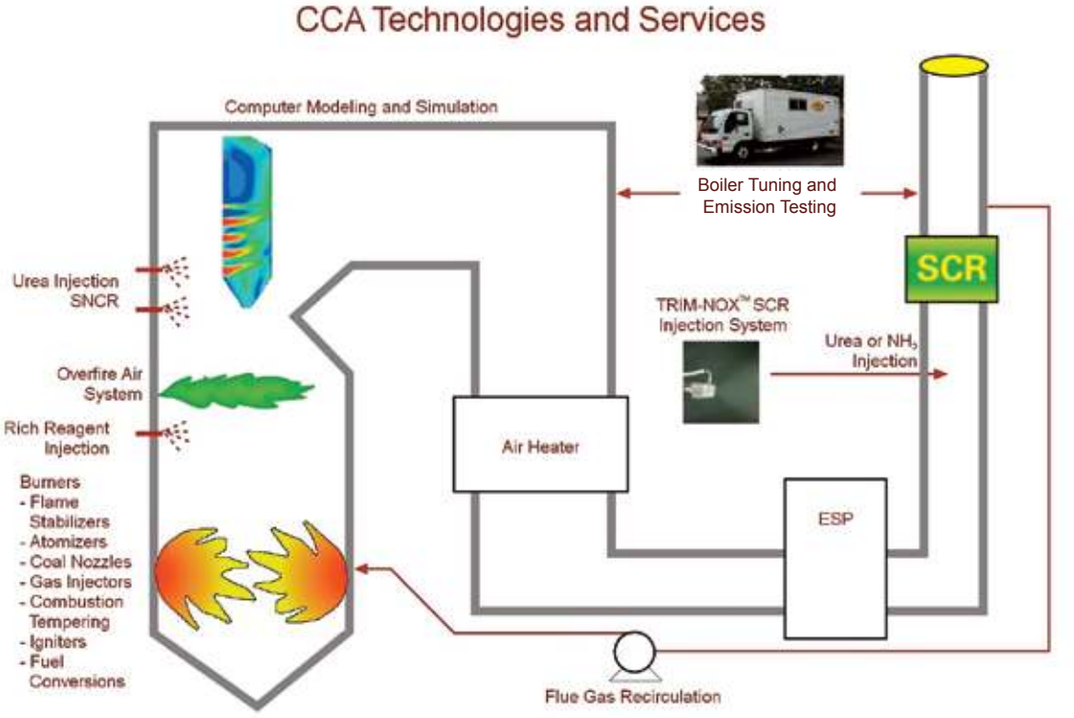
CCA specializes in supplying in-furnace and post combustion emission control technologies. CCA's technologies have been installed in over 250 steam generators worldwide ranging in size from 10 MW to 800 MW (50,000 to 5,500,000 lb/hr steam flow) on coal, natural gas, fuel oil, refinery gas, and biofuel fired units. CCA technologies also have been installed on thermal oxidizers and dryers.

CCA's in-furnace combustion control technologies (burner assemblies, upgrade of existing burners, RRI, and overfire air) achieve up to 70% reduction in NOx emissions through patented and proprietary technologies on wall-fired, tangential-fired, cyclone fired, circulating fluid bed (CFB), package, and stoker-fired boilers, in addition to heaters and dryers. NOx reductions up to 95% can be achieved with the addition of post combustion systems such as SNCR and SCR. The combination of in-furnace with post combustion technologies provides the most cost effective approach to minimize NOx emissions.



CCA's core expertise is emissions technologies for gaseous, liquids, and solid fuels, including combustion and post combustion NOx controls. CCA offers burners and burner upgrades for coal, oil, and gas-fired systems, new burners, overfire air (OFA), flue gas recirculation (FGR), targeted water tempering, SNCR, and SCR. Technologies can be implemented alone or in combination to achieve high levels of NOx control.

Combustion Products & Services



Low-NOx Burners (LNB)

CCA offers patented technologies that can be applied to new or existing coal, oil, and gas fired boilers. CCA is able to achieve, through upgrades to existing burner assemblies NOx emissions comparable to new low-NOx burners at a fraction of the cost. CCA has supplied new burners or performed upgrades to existing burners on over 3,000 burners on wall-fired and tangential-fired boilers, package boilers, heaters, and dryers.

Low-NOx Burner Assembly

The basis of CCA's NOx reduction technology is fuel and air staging. Fuel staging is accomplished using fuel injectors that produce fuel rich and fuel lean zones immediately downstream of the burner. Similarly, the combustion air is staged into air lean and air rich zones by a multi-zone flame stabilizer. The end result is fuel rich and fuel lean zones that can reduce NOx emissions by up to 50% with extremely stable flames.

CCA can furnish complete burner systems including the windbox, fuel trains, burner management, forced draft fan, and combustion controls.

Low-NOx Burners
for Multi-Burner Boiler

Burner/Windbox Assembly
for Package Boiler

Selective Catalytic Reduction (SCR)

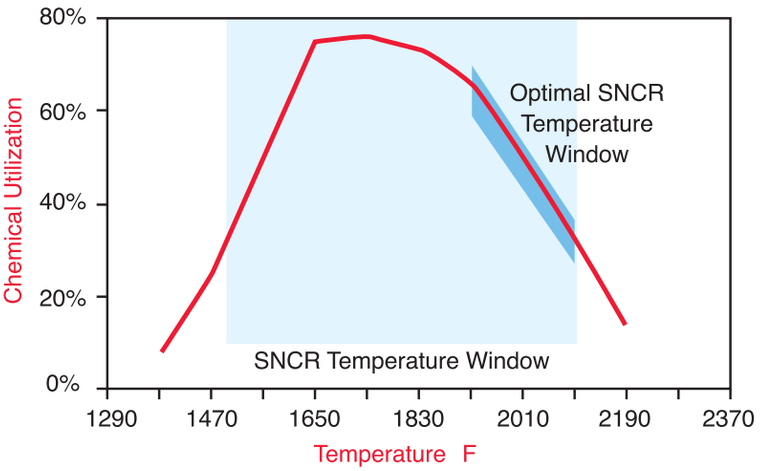
CCA supplies Selective Catalytic Reduction (SCR) systems which convert NOx into nitrogen and water with the aid of a catalyst and an injected reagent such as ammonia or urea. The reagent is injected prior to the catalyst chamber and mixes with the flue gas. NOx reduction takes place as flue gas passes through the catalyst chamber. SCR systems can provide any level of NOx reduction required depending on the size of the catalyst chamber and the type of catalyst used.

CCA supplies complete SCR systems using aqueous urea, aqueous NH3, or the urea-to-NH3 process to suit customer and regulatory requirements. Our system includes the reagent storage tank, pumping and flow control, reagent injection system, boiler control interface, and the SCR catalyst chamber. Our patented TRIM-NOX® SCR injection system can be supplied with mechanical or air atomization depending upon the application. CCA has pioneered the direct injection of aqueous reagents into the exhaust duct of package boilers thereby eliminating the need for heater, vaporizers and fans.

The SCR catalyst chamber is designed as a complete unit to provide for proper flow patterns through the catalyst and easy access for maintenance. CCA utilizes a unique means of on line catalyst cleaning that prolongs catalyst life for dirty applications. Experienced CCA field engineers provide technical support in the start-up and operation of the CCA SCR system.

Selective Non-Catalytic Reduction (SNCR)

CCA's SNCR system provides a low cost technique to reduce NOx emissions by 30%-60% for both boilers and lime kilns. The SNCR process involves injecting a reagent (urea or ammonia) into the flue gas in the appropriate temperature window. The reagent reacts with NOx to form harmless nitrogen and water. The optimum temperature window for efficient SNCR operation typically occurs between 1,620°F and 2,010°F (900°-1,100°C) and is usually located in the upper furnace and convective areas. The design, arrangement, and location of the reagent injectors is critical to the performance of the SNCR system. CCA's advanced SNCR technology utilizes variable droplet size control and automatic tilting based upon furnace temperature to enhance the NOx reduction performance.



CCA uses CFD modeling to optimally locate the injectors on the boiler to provide for complete mixing of the reagent with the flue gas across the injection plane. Depending on the application, multiple levels of injectors, along with other proprietary techniques, are used to ensure that the reagent is injected in the optimal temperature window across the operating range of the boiler. The modeling results also provide design information related to reagent flow requirements and design aspects to minimize ammonia slip.

CCA SNCR Tilting Injector

CCA's SNCR systems include reagent storage tanks, pumping and flow control, reagent injection systems, and a boiler control interface. CCA also provides experienced field engineers for optimizing the SNCR in conjunction with the combustion system and overall operations.

Overfire Air (OFA)

CCA's Overfire Air (OFA) system typically diverts 20-30% of the combustion air from the burners to the upper furnace to stage the combustion process beyond what can be achieved with low-NOx burners. CCA's OFA technology has been applied to wall, cyclone, tangential, and stoker-fired boilers burning oil, gas, coal, and biofuels. CCA's unique OFA port design ensures good air/fuel mixing and carbon burnout at all boiler loads.

The unique ports are designed to inject air at the proper velocity and direction to complete combustion prior to the furnace exit at all boiler loads. If required to improve burnout, tilting (vertical) and yawing (horizontal) port designs are available. CCA uses CFD modeling to locate the OFA ports on the furnace walls and to design the geometry of the OFA port. NOx reductions achieved with a CCA OFA system range from 25-40% depending on the fuel and initial NOx level.

CCA's Overfire Air Ports

Flue Gas Recirculation (FGR)

Flue Gas Recirculation (FGR) is a powerful NOx control technique where flue gases from the boiler exhaust duct are mixed with the combustion air stream and enter the furnace through the windbox and burners. FGR reduces peak flame temperature and therefore reduces thermal NOx formation. Consequently, FGR is most effective on gaseous fuels where NOx emissions are almost always 100% thermal NOx. FGR is less effective on liquid fuels because a portion of the NOx emissions can be generated from fuel bound nitrogen compounds.

Two approaches are commonly used to inject the FGR into the combustion air. Forced FGR uses a separate fan (FGR fan) to inject the flue gas into the combustion air downstream of the FD fan. The second approach uses the suction of the FD fan to induce flue gas from the exhaust duct, through the FD fan, and into the windbox (induced FGR). Induced FGR is lower in cost, but has the disadvantage of reduced effectiveness at high load as FD fan suction diminishes. CCA offers both forced and induced FGR, which are compatible with CCA's other NOx control technologies.

Combustion Tempering (CT)

Combustion tempering is a patented NOx reduction process by which micronized water, steam, or flue gas is target injected into the flame. Typically water is used because of low capital cost. The water is injected just upstream of the flame which reduces the temperature at the point of initial combustion. CFD modeling is used to determine the injection droplet size, velocity, spray pattern and direction to insure that the water is injected into the most effective NOx reduction zone. Research has shown that NOx production decreases about 50% for every 190°F reduction in flame temperature in the NOx production zone of a flame. CFD modeling effectively identifies the optimum zone to minimize the water and maximize the NOx reduction when compared to conventional bulk water injection. Laser doppler spray testing is used to confirm that the water spray is consistent with the design requirements. CCA also provides skid mounted pumps and control skids to control the water usage and to integrate our systems with the boiler controls.

Rich Reagent Injection (RRI)

CCA is a licensed implementer of the Rich Reagent Injection (RRI) technology. RRI was jointly developed by Reaction Engineering International (REI) in collaboration with EPRI and DOE.

RRI is similar to SNCR in that a reducing reagent is injected into the furnace to chemically reduce NOx formed by the combustion process. RRI, however, is injected into a fuel rich zone of the combustion process to react with NOx. Overfire air is used to complete combustion above the RRI zone. RRI is useful in many applications, since it generates very little ammonia slip.

**CCA's Patented TRIM-NOX®
SCR Injection System**

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