

Low NO_x Burners & OFA System

Grand River Dam Authority – Coal Fired Complex

Customer

Grand River Dam Authority
Coal Fired Complex Units 1 & 2

Completion Dates

Fall 2012 – Unit 2
Spring 2013 – Unit 1

Services Provided

- EPC Services
- Burner Design
- OFA design
- CFD modeling
- Procurement
- Installation
- Startup, commissioning
- Overall project management
- Construction management
- Combustion tuning

Pre-Installation

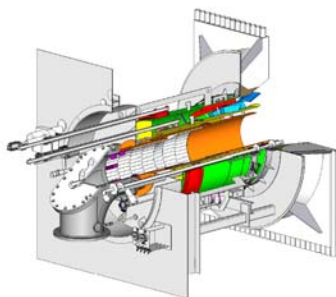
Boiler Performance

Burner Heat Input = 240 mmBtu/hr
NO_x = 0.35 – 0.53 lb/mmBtu
CO ~ 100 ppm

Post-Installation

Boiler Performance Test

NO_x = 0.168 lb/mmBtu
CO < 50-200 ppm



Project Summary

Power & Industrial Services provided complete turn-key services to Grand River Dam Authority to improve NO_x and combustion with the design, fabrication, installation, start-up and combustion tuning of new low NO_x burners and a new overfire air system at the Coal Fired Complex Units 1 & 2 located near Chouteau, Oklahoma.

Project Features

- Computational Fluid Dynamic Modeling
- Low NO_x Burners, designed and manufactured by Power & Industrial Services, including new igniters and scanners
- Overfire Air Ports & Bent Tube Panels, designed and manufactured by Power & Industrial Service
- New Burner Management System
- Full Balance of Plant Engineering including Mechanical, Electrical, and Control System Design
- Complete Installation Services including Construction Management and Scheduling
- Combustion Optimization and Performance Testing

Project Description

Grand River Dam Authority retained the services of Power & Industrial Services to engineer, design, manufacture, and install a combustion system upgrade project that included the replacement of 24 low NO_x burners and a new 12 port overfire air system on both units. Both units are opposed wall fired 500 + MWg FW boilers firing low sulfur PRB coal.

The main goal of the project was to improve combustion and operation of the boiler while lowering NO_x and CO and keeping unburned carbon to a minimum.

One of the challenges facing GRDA with the existing burners was very high NO_x levels at reduced boiler loads. Power & Industrial provided a new burner/OFA design solution that reduced low load NO_x levels by 60 to 75%.

Low NO_x Burners & OFA System

Henderson Municipal Power & Light – Station 2 – Unit 1

Customer

HMP&L
Big Rivers Electric Corporation
Robards, KY

Completion Date

Summer 2012

Services Provided

- Burner Design
- CFD modeling
- Installation Support
- Startup, commissioning

Pre-Installation

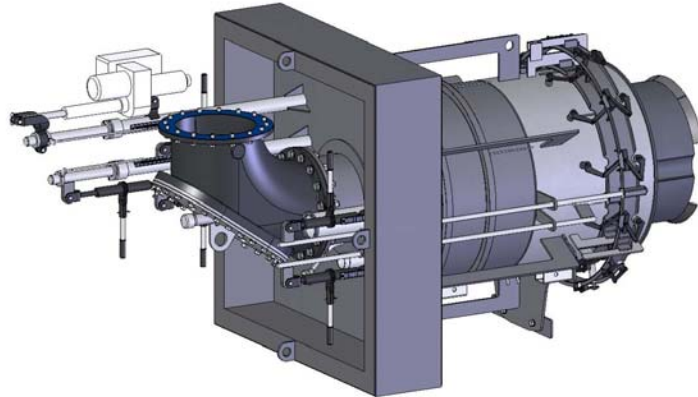
Boiler Performance

NO_x = 0.50 lb/mmBtu
CO ~ 100-600 ppm

Post-Installation

Boiler Performance

NO_x = 0.38-0.42 lb/mmBtu
CO < 20-30 ppm



Project Summary

Power & Industrial Services provided new Low NO_x Burners to HMP&L and BREC in order to improve NO_x and combustion. Power & Industrial designed, fabricated and delivered the burners.

Project Features

- Computational Fluid Dynamic Modeling
- Low NO_x Burners, designed and manufactured by Power & Industrial Services
- New Coal Elbows with P&I Ropebreaker Flatback Technology

Project Description

BREC retained the services of Power & Industrial Services to engineer, design, manufacture, and deliver a combustion system upgrade project that included the replacement of 8 low NO_x burners on their Station 2 Unit 1 boiler. Unit 1 is a single wall fired 165 MWg Riley boiler firing 12,200 Btu/lb eastern bituminous coal. The main goal of the project was to improve combustion and operation of the boiler while lowering NO_x and CO and keeping unburned carbon to a minimum. The original windbox is very small and subsequent burner length was very limited. Power & Industrial utilized SolidWorks modeling to help overcome the limitations.

The results of this project included near elimination of the boiler backpass slugging. The new burner design also reduced waterwall flame impingement. The resulting CO emissions were very low. Additionally, the new burner design will significantly reduce long term maintenance costs.

Low NO_x Burners & OFA System

Nebraska Public Power District – GGS Unit 1

Customer

Nebraska Public Power District
Gerald Gentlemen Station Unit 1

Completion Date

April 2006

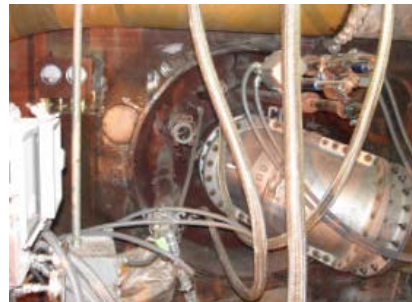
Services Provided

- CFD Modeling
- Overfire Air System Design & Manufacturing
- Low NO_x Burner Design & Manufacturing
- Procurement
- Fabrication
- Technical Field Support

Pre-Installation

Boiler Performance

NO_x = 0.46 lb/mmBtu; CO > 200 ppm; O₂ = 3.2 %



Post-Installation

Boiler Performance Test

NO_x = 0.20 lb/mmBtu; CO = 100 ppm; O₂ = 2.65 %



Project Summary

Power & Industrial Services designed and supplied new burners and an overfire air system to NPPD in an effort to improve NO_x and combustion with the replacement of existing burners and a new overfire air system at Nebraska Public Power District's Gerald Gentleman Station Unit 1, located in Sutherland, Nebraska.

Project Features

- Computational Fluid Dynamic Modeling
- Low NO_x Burners, designed and manufactured by Power & Industrial Services Overfire Air Ports & Bent Tube Panels, designed and manufactured by Power & Industrial Services
- Combustion Optimization

Project Description

NPPD retained the services of Power & Industrial Services to engineer, design and manufacture, and deliver a combustion system upgrade project that included replacement low NO_x burners and a new overfire air system on their Gerald Gentlemen's Unit 1. Gerald Gentleman's Unit 1 is a wall fired 665 MW FW boiler firing low sulfur PRB coal. The unit includes sixteen burners on the front and rear walls arranged in four rows of four and 12 overfire air ports were added 6 on the front and 6 on the rear wall of the boiler. The original equipment was FW Scroll Burners installed in 1979. The main goal of the project was to improve the combustion environment of the boiler while lowering NO_x and keeping CO and unburned carbon to a minimum.

Low NO_x Burners & OFA System

Northern Indiana Public Service Company – RMSGS Unit 15

Customer

Northern Indiana Public Service Company
R.M. Schahfer Generating Station Unit 15

Completion Date

February 2009

Services Provided

- CFD Modeling
- Overfire Air System Design & Manufacturing
- Low NO_x Burner Design & Manufacturing
- Procurement
- Fabrication
- Technical Field Support

Pre-Installation

Boiler Performance

NO_x = 0.27 lb/mmBtu; CO > 200 ppm; O₂ = 3.0 %



Post-Installation

Boiler Performance

NO_x = 0.15 – 0.18 lb/mmBtu; CO < 200 ppm; O₂ = 2.75 %



Project Summary

Power & Industrial Services worked with Northern Indiana Public Service Company in an effort to improve NO_x and combustion with the design and supply of new low NO_x burners and a new overfire air system at the RM Schahfer Generating Station Unit 15 located near Wheatfield, Indiana. This unit had previously been retrofitted with low NO_x burners in 1995.

Project Features

- Computational Fluid Dynamic Modeling
- Low NO_x Burners, designed and manufactured by Power & Industrial Services
- Overfire Air Ports & Bent Tube Panels, designed and manufactured by Power & Industrial Service
- Combustion Optimization
- Integration of existing scanners and igniters into the new Low NO_x Burners

Project Description

Northern Indiana Public Service Company retained the services of Power & Industrial Services to engineer, design, manufacture, and deliver a combustion system upgrade project that included replacement of 24 low NO_x burners and a new overfire air system on their RM Schahfer Station Unit 15. Unit 15 is an opposed wall fired 510 MWg FW boiler firing low sulfur PRB coal. The main goal of the project was to improve combustion and operation of the boiler while lowering NO_x and keeping CO and unburned carbon to a minimum.

Low NO_x Burners & OFA System

Kansas City Power & Light – Iatan Unit 1

Customer

Kansas City Power & Light
Iatan Station – Unit 1

Completion Date

January 2009

Services Provided

- EPC Services
- Burner Design
- OFA design
- CFD modeling
- Procurement
- Installation
- Startup, commissioning
- Overall project management
- Construction management
- Combustion tuning

Pre-Installation

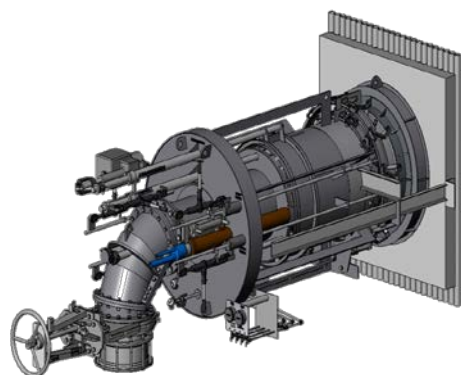
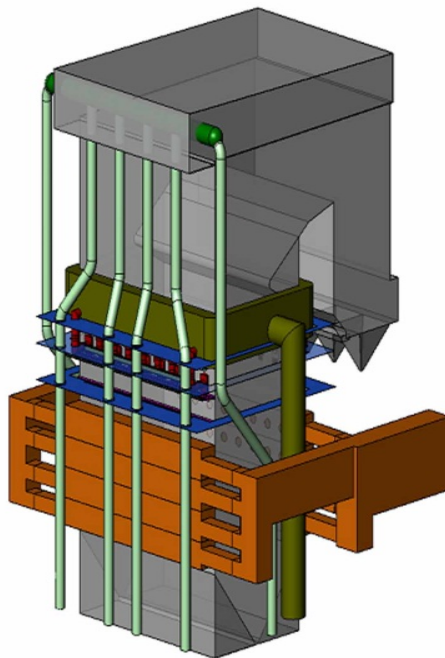
Boiler Performance

Burner Heat Input = 130 mmBtu/hr
NO_x = 0.38 lb/mmBtu
CO > 1000 ppm

Post-Installation

Boiler Performance Test

Burner Heat Input = 143 mmBtu/hr
NO_x = 0.18 lb/mmBtu
CO < 50-150 ppm



Project Summary

Power & Industrial Services provided complete turn-key services to Kansas City Power & Light to improve NO_x and combustion with the design, fabrication, installation, start-up and combustion tuning of new low NO_x burners and a new overfire air system at the Iatan Plant Unit 1.

Project Features

- Computational Fluid Dynamic Modeling
- Low NO_x Burners, designed and manufactured by Power & Industrial Services, including new igniters and scanners
- Overfire Air Ports & Bent Tube Panels, designed and manufactured by Power & Industrial Service
- Extensive Overfire Air system ductwork design, supply and installation
- Combustion Optimization

Project Description

Kansas City Power & Light retained the services of Power & Industrial Services to engineer, design, manufacture, and install a combustion system upgrade project that included the replacement of 56 low NO_x burners and a new 18 port overfire air system on their Iatan Plant Unit 1. Unit 1 is an opposed wall fired 710 MWg B&W boiler firing low sulfur PRB coal. The main goal of the project was to improve combustion and operation of the boiler while lowering NO_x and CO and keeping unburned carbon to a minimum.

Low NO_x Burners & OFA System

San Miguel Electric Cooperative – San Miguel Plant

Customer

San Miguel Generating Plant
Unit 1

Completion Date

May 2004

Services Provided

- Overfire Air System Design & Manufacturing
- Low NO_x Burner Design & Manufacturing
- Procurement
- Fabrication
- Technical Field Support



Pre-Installation

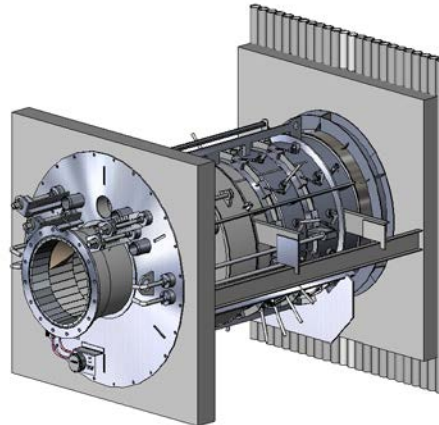
Boiler Performance

NO_x = 0.40 lb/mmBtu
CO = 200 ppm

Post-Installation

Boiler Performance

NO_x = 0.17 lb/mmBtu
CO = 100 ppm



Project Summary

Power & Industrial Services provided new Low NO_x Burners to San Miguel Electric Cooperative to improve NO_x and combustion. Power & Industrial designed, fabricated, delivered replacement burners within 20 weeks after receipt of order.

Project Features

- Low NO_x Burners, designed and manufactured by Power & Industrial Services
- A delivery schedule that no other manufacturer could meet

Project Description

San Miguel Electric Cooperative retained the services of Power & Industrial Services to design, manufacture and deliver 42 replacement low NO_x burners at the San Miguel Plant. The Unit is an opposed wall fired 440 MWg B&W boiler firing lignite. The customer had a very short lead time for the project and Power & Industrial was able to make delivery within 20 weeks.

Low NO_x Burners & OFA System

Tri-State Generation & Transmission Association

Customer

Tri-State Generation & Transmission Association – Craig Station Unit 3

Completion Date

May 2009

Services Provided

- CFD Modeling
- Overfire Air System Design & Manufacturing
- Low NO_x Burner Design & Manufacturing
- Procurement
- Fabrication
- Technical Field Support

Pre-Installation

Boiler Performance

NO_x = 0.50 lb/mmBtu
CO > 500 ppm; O₂ = 3.5 %

Post-Installation

Boiler Performance

NO_x = 0.275 lb/mmBtu
CO < 100 ppm; O₂ = 2.75 %



Project Summary

Power & Industrial provided design and manufacturing services for the retrofit of new Low NO_x Burners and overfire air system at Craig Station Unit 3 located near Craig, Colorado.

Project Features

- Computational Fluid Dynamic Modeling
- Low NO_x Burners, designed and manufactured by Power & Industrial Services
- Overfire Air Ports & Bent Tube Panels, designed and manufactured by Power & Industrial Service
- Combustion Optimization
- Integration of existing scanners and igniters into the new Low NO_x Burners

Project Description

Tri-State Generation and Transmission Cooperative's plant improvement project included environmental system upgrades on Unit 3 at the Craig Station. As part of the overall project, Power & Industrial provided design and manufacturing services for the retrofit of new Low NO_x Burners and overfire air system. Unit 3 is a 475 MW B&W wall fired boiler. The boiler has 40 burners and 12 overfire air ports located on the front and rear walls of the boiler.

