University of Chicago
System Expansion and Renewal

Presented by:
Sumit Ray – University of Chicago
Kevin Voss and Jacob Price – PRVN Consultants, Inc.
AGENDA

• Introduction
• South Steam Plant Modifications
• Condensate Polisher Project
• Q&A
GOALS OF SOUTH STEAM PLANT PROJECT

• Meet federal, state, and local regulations for emissions
• Increase overall efficiency of plant
• Maximize available incentives from the utility companies
• Have minimal impact on turnover from old to new system
SOUTH STEAM PLANT OVERVIEW

• Four (4) natural gas boilers: 600,000 lb/hr
  • Installed in 1970
  • Replacement for coal-fired boilers
  • All boilers have been retubed within the last 15 years
EMISSIONS

• Pre-project emissions:
  • NOx: 0.20 lb/MMBtu
  • CO: 200 ppm

• Emissions requirement:
  • NOx: .08 lb/MMBtu
  • CO: 50 ppm
BURNER UPGRADE

• Modified burner throat
• New gas pokers and swirlers
EXISTING BURNER FRONT VIEW

BURNER
SCANNER ASSEMBLY
SCANNER ASSEMBLY
INFLATE PLATE

EXISTING BURNER CROSS SECTION

GAS RESERVOIR INLET
6" 150# N.P. FLANGE

PRIMARY/SECONDARY AIR INLET

EXISTING WINDBOX INSULATION

EXISTING BOILER FRONT ROLL

REFRATORY THRESHOLD

TO FACE OF FLANGE

15° REF.
15° REF.

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INDUCED FLUE GAS RECIRCULATION

- Recirculate flue gas:
  - Reduces peak flame temperature
  - Lowers average oxygen content of the combustion air
NEW ECONOMIZERS

- Replaces air preheaters
  - Smaller size
  - Lowers NOx emissions
BREECHING

• Modified breeching transition in location of demolished air preheater
STACK DAMPER

• Modified Boiler 3 and 4 breeching to common stack to includedivider plate and stack dampers
CONTROLS SYSTEM UPGRADE

• New predictive emissions monitoring system:
  • Compliance to regulations
  • Will work during loss of power and loss of communications

• New combustion control system
  • Controls boilers to obtain optimum combustion to limit emissions
GOALS OF CONDENSATE POLISHER PROJECT

• Install duplex condensate polishers in West Campus Combined Utility Plant and South Steam Plant

• Modify condensate piping system to address localized bottlenecks

• Replace South Steam Plant reservoir pumps

• Install new condensate bypass in South Steam Plant
Design Conditions

- Flow rate
  - Design: 600 GPM
  - Peak: 900 GPM

- Pressure Drop
  - Design: 5 PSI
  - Peak: 10 PSI

- Operating Temperature Range: 40 – 200°F
- Operating Pressure Range: 30 – 100 PSI
- Daily Water Usage: 865,000 GPD
- Effluent Water Quality: < 0.3PPM total hardness as CaCO$_3$
WEST CAMPUS COMBINED UTILITY PLANT OVERVIEW

• Two (2) natural gas boilers: 450,000 lb/hr
• Two (2) 2,000-ton chillers
COMMISSIONING

- Get CX Agent involved early and develop checklists early
- Project wiring diagrams
- Operating/control system description with equipment-vendor-supplied data and review
- Control system FAT with Control Service Technician and equipment vendor in attendance
- Loop checkout utilizing vendor representatives
- Set up historian (PI, etc.) prior to startup
- Startup and testing procedures prior to startup efforts
Best Practices & Lessons Learned

- Boiler tuning is critical when two boilers utilize a common stack
- Scheduling
- Coordinate plant outages
- Care when operating equipment until plant is fully commissioned
Questions