2017 Plant Simulation Conference
San Diego

ReACT Simulator: Emissions Control Technology for WPS Weston U3 Plant
Overview

• Background
• ReACT Technology Overview
• Implementation into Simulator
• Challenges
• Questions
Background

- Wisconsin Public Service (WPS) Unit 3
- 370MW Coal Plant
- ABB Symphony DCS/HMI
- U3 Simulator Delivered July 2014
Background
**ReACT Technology Overview**

- **Regenerative Activated Coke Technology**
- Licensed from J-Power in Japan
- First installation in USA
- SOx, NOx, and Hg Removal from Flue Gas
- 3 Stages:
  - Adsorption Stage
  - Regeneration Stage
  - By-Product Recovery Stage
ReACT Technology Overview
ReACT Technology Overview: Adsorption Stage

- Flue Gas exits ID fans and enters ReACT Adsorber structure
- SO2, SO3, Hg, NOx, interact with a moving bed of activated coke pellets:
ReACT Technology Overview: Regeneration Stage

- Activated coke pellets conveyed into Regenerator
- Activated coke undergoes thermal desorption – Sulfur removed from coke pellets… coke is regenerated – sent back to Adsorption stage
ReACT Technology Overview: By-Product Recovery Stage

- Acid Plant
- SO2 rich gas from Regenerator converted into H2SO4 Sulfuric Acid -> Product Acid
Simulating ReACT: Adsorber

• **Major Components:**
  - Moving Solids – Activated Coke Pellets
  - Solid storage/inventory management – Conveyors/Silos

• **Considerations:**
  - Thermal loading characteristics of activated coke (specific heat, thermal conductivity, density)
  - Plugging/blockages
  - Cycling Time ~ 40+ hours
  - SOx loading
Simulating ReACT: Adsorber
Simulating ReACT: Regenerator

• **Major Components**
  - Activated coke lock hoppers and roll feeders
  - Regenerator furnace
  - Cooling, Combustion and Purge Air fans

• **Considerations**
  - Heat exchange with Regenerator furnace gases (heat loop)
  - SO2 gas generation amount
Simulating ReACT: Acid Plant

• Major Components:
  ▪ Scrubber
  ▪ Drying Tower
  ▪ Absorbing Tower
  ▪ Main Gas Blower
  ▪ Converter

• Considerations:
  ▪ CHEMISTRY!!
Simulating ReACT: Acid Plant
Simulating ReACT: Effect on Boiler Air

• Major Components:
  - New ID fans!
  - Polishing Fabric Filters
  - Flue Gas Attemperation

• Considerations:
  - Adding ReACT adsorber to flue gas discharge required more powerful fans. WPS purchased new ID fans to accommodate. New fan curves, new motors.
  - More powerful ID fans add more heat to ID fan exhaust – Flue Gas attemperation added
Challenges

• ReACT Controls were still under development

• Uncertainties with performance – process flow diagrams and theoretical calculations for everything
  - Only running plant with ReACT in Japan

• Technology so new… hard to dream up malfunctions/abnormal operations

• Uncertainties with operating procedures – still in development

• Working with moving solids… that are not coal!
Thank You!

- Questions?