



2017 Plant Simulation Conference San Diego



ReACT Simulator: Emissions Control Technology for WPS Weston U3 Plant



Wisconsin Public Service





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



Instructor Station - ABB Weston.proj (Reset:9038, Snap): <FREEZE>

Project Drawing Edit View Execution IC Presentation Object Instructor Window Help

Simulation Time	Scenarios	Events	MFs	CMFs	RFs	Load	Drum Pressure	Drum Level
00:00:00	0	0	0:0	0:0	0	365.8 MW	2728.0 psi	0.08 in
Clock Time	Current IC:	Snap ped IC:	Clear All MFs		Clear RFs	Main Steam Press	Main Steam Temp	ADS Demand
01:29:57	9038	0				2464.1 psi	1007.0 deg F	0.0 MW

KEYSOFTWARE®

WPS

cursorselect

ScrollBars Wheel To Zoom

Weston Unit 3 Fossil Power Plant Simulator

Event Triggers

Scenario

Report

TPR

Create Trend

Trends

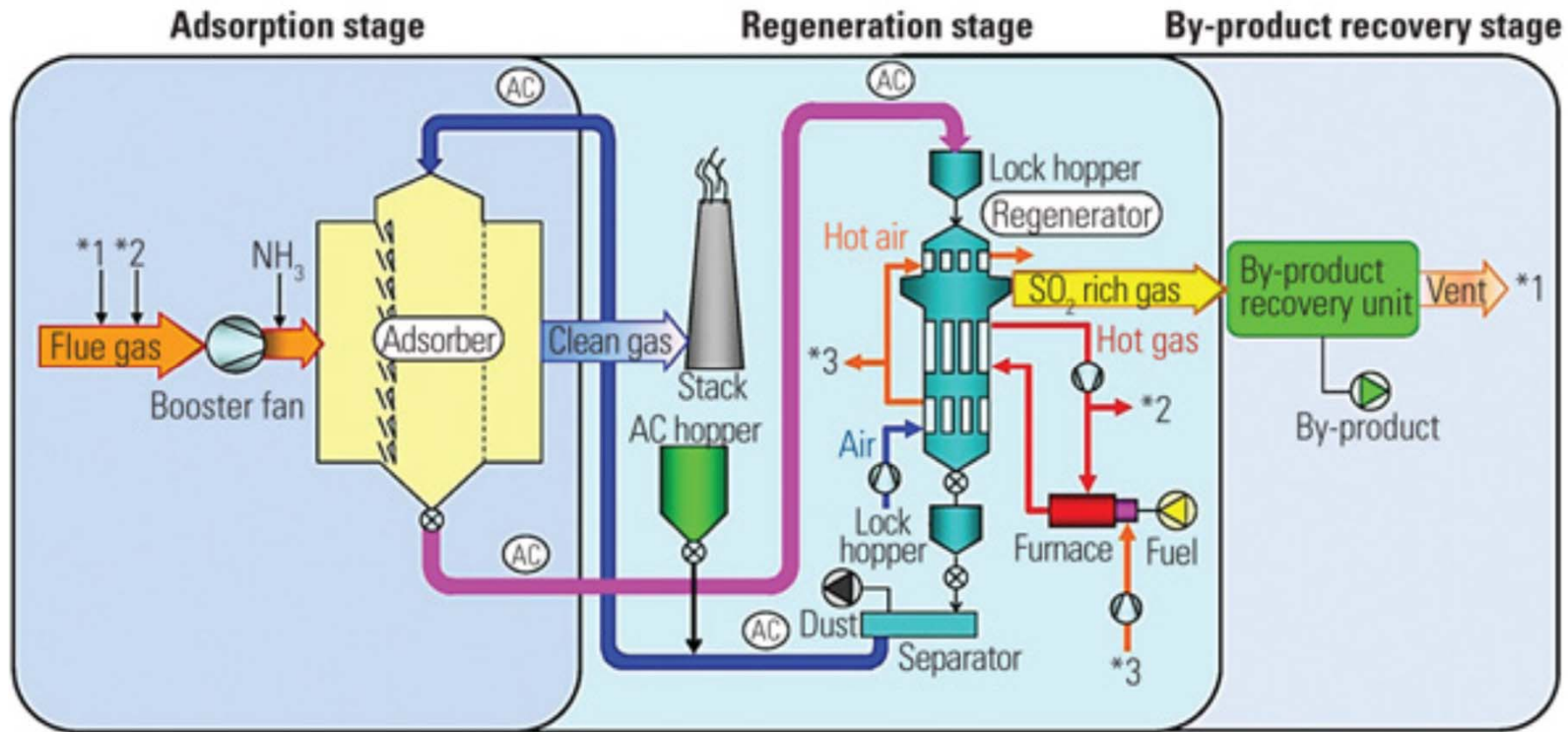




ReACT Technology Overview

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





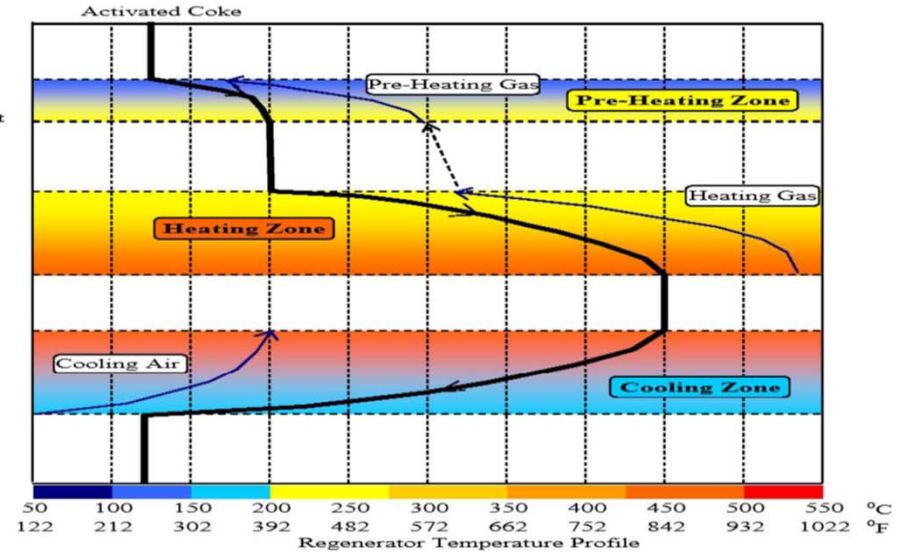
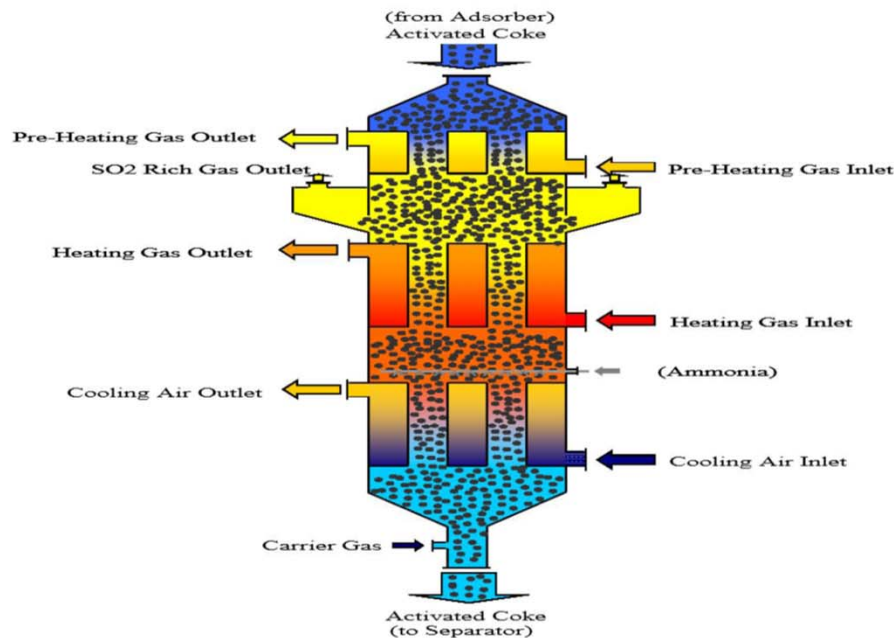
- Flue Gas exits ID fans and enters ReACT Adsorber structure
- SO₂, SO₃, Hg, NO_x, interact with a moving bed of activated coke pellets:





ReACT Technology Overview: Regeneration Stage

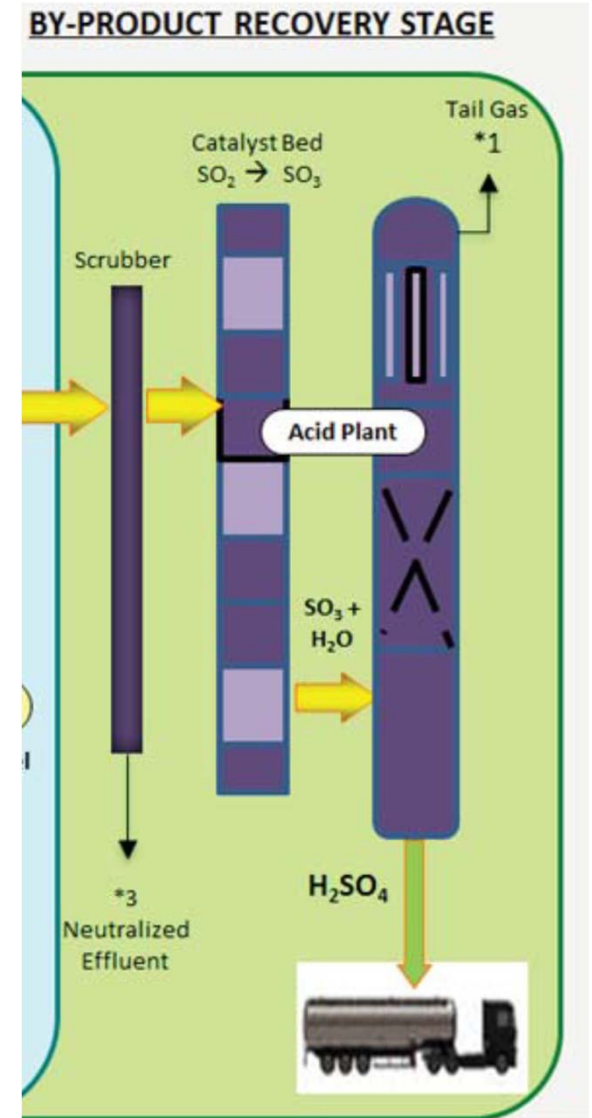
- Activated coke pellets conveyed into Regenerator
- Activated coke undergoes thermal desorption – Sulfur removed from coke pellets... coke is regenerated – sent back to Adsorption stage





ReACT Technology Overview: By-Product Recovery Stage

- Acid Plant
- SO₂ rich gas from Regenerator converted into H₂SO₄ Sulfuric Acid -> Product Acid



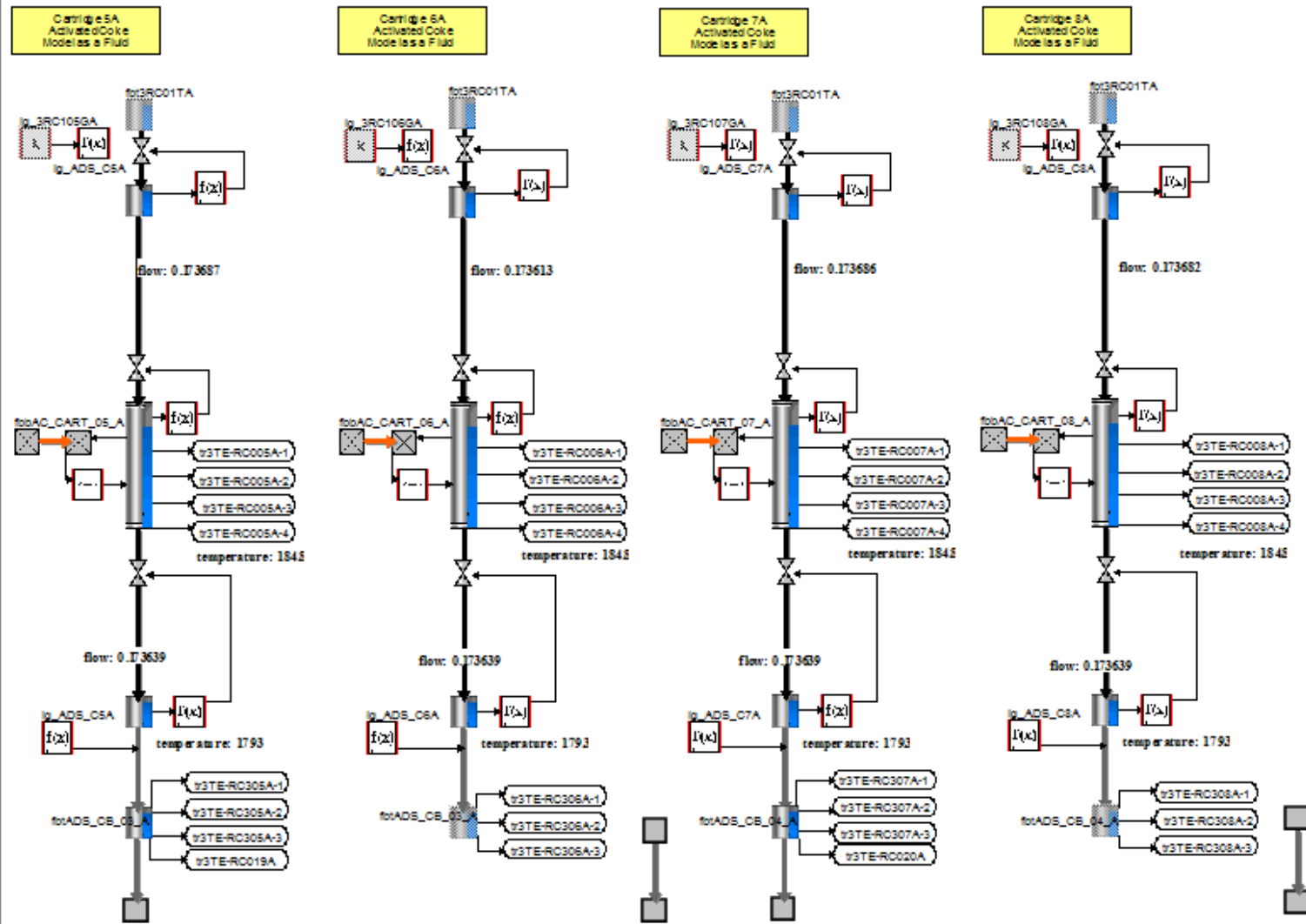
- Major Components:
 - Moving Solids – Activated Coke Pellets
 - Solid storage/inventory management – Conveyors/Silos

- Considerations:
 - Thermal loading characteristics of activated coke (specific heat, thermal conductivity, density)
 - Plugging/blockages
 - Cycling Time ~ 40+ hours
 - SO_x loading



Simulating ReACT: Adsorber

Project Explorer





Simulating ReACT: Regenerator

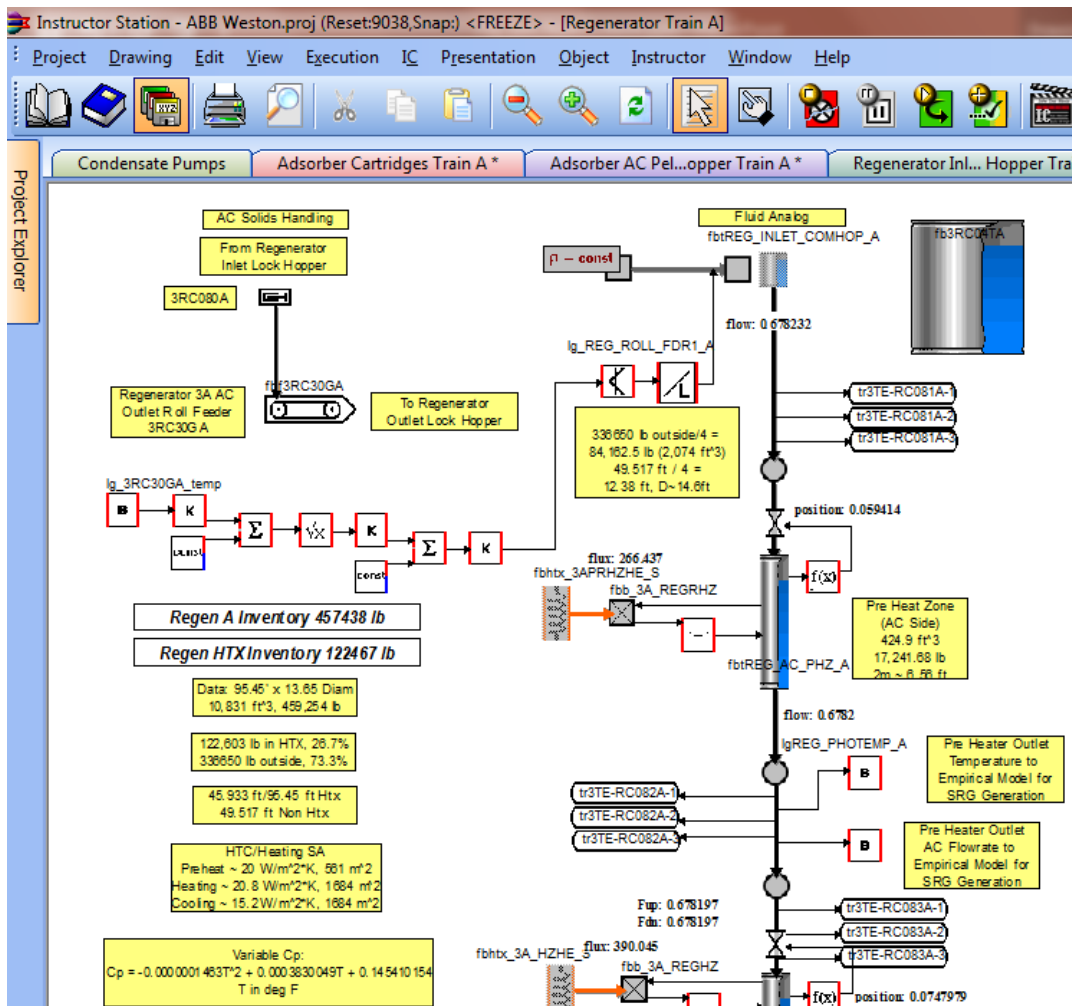
- Major Components
 - Activated coke lock hoppers and roll feeders
 - Regenerator furnace
 - Cooling, Combustion and Purge Air fans

- Considerations
 - Heat exchange with Regenerator furnace gases (heat loop)
 - SO₂ gas generation amount





Simulating ReACT: Regenerator

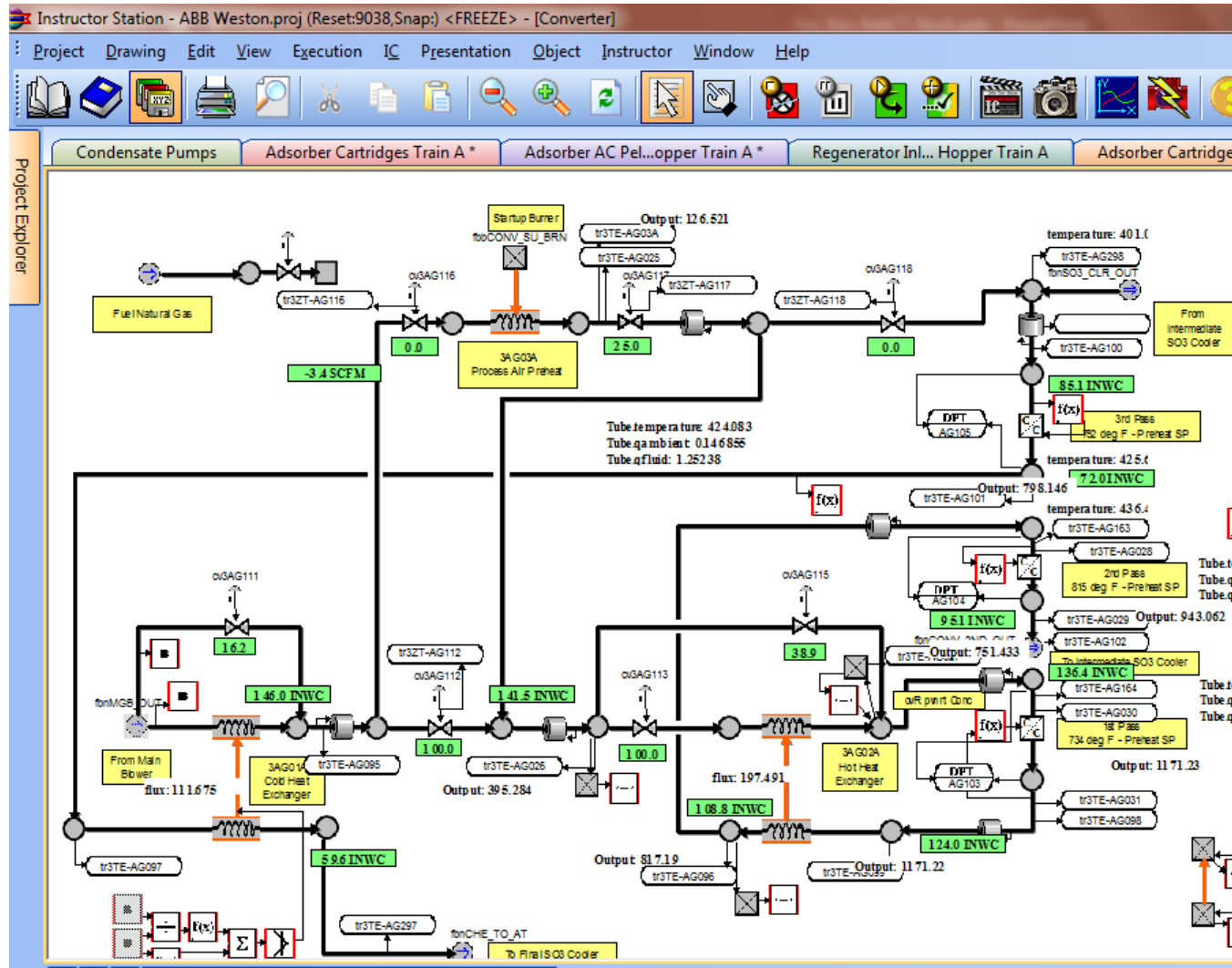


- Major Components:
 - Scrubber
 - Drying Tower
 - Absorbing Tower
 - Main Gas Blower
 - Converter

- Considerations:
 - **CHEMISTRY!!**



Simulating ReACT: Acid Plant



- 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



- 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?

