

THE CONSOL/ALLEGHENY PILOT PLANT STUDY OF LOW-TEMPERATURE MERCURY CAPTURE WITH AN ELECTROSTATIC PRECIPITATOR

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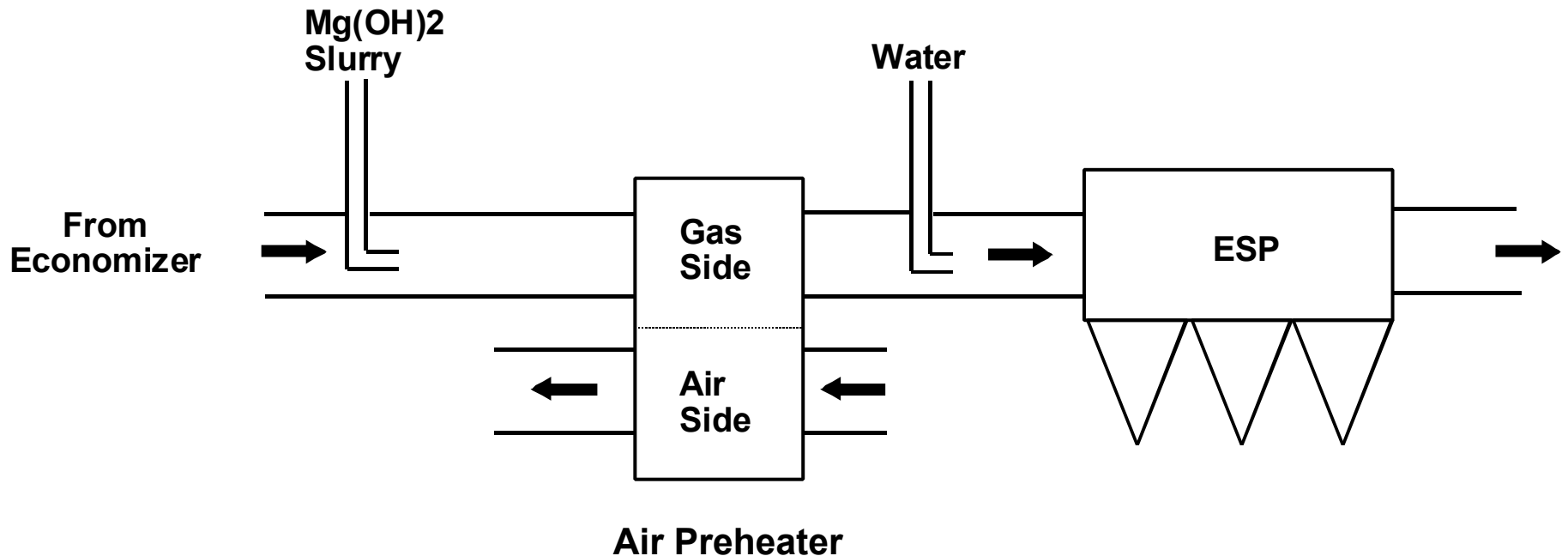
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Concept

- Absorb Hg on particulate by cooling flue gas to 220-240 °F with air preheater or water spray
- Collect particulate with ESP to remove Hg
- Protect against acid corrosion by introducing $\text{Mg}(\text{OH})_2$ into flue gas upstream of preheater

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Prior Development Work

- CONSOL pilot-scale combustor
 - ▶ 90% Hg removal from Illinois coal, depending on gas temperature and ash carbon content
- CONSOL bench-scale work
 - ▶ FGD by-product $\text{Mg}(\text{OH})_2$ slurry is an active sorbent for SO_3 at economizer outlet temperatures

POTENTIAL BENEFITS OF TECHNOLOGY

- 80-90% Hg removal expected
- Projected cost order of magnitude lower (\$/lb Hg) than carbon injection
- Suitable for retrofit or new plants
- Potential applicability to full range of coal types
- Effective SO₃ reduction
 - ▶ Visible plume mitigation, TRI reduction
 - ▶ SCR/SNCR benefits
 - ▶ Secondary fine particulate reduction
- Potential to improve heat rate by 2%
 - ▶ 2% reduction in NO_x, SO₂, CO, particulate and CO₂
 - ▶ ~ \$600,000/y fuel cost savings for 600 MW plant

HOST PLANT SITE

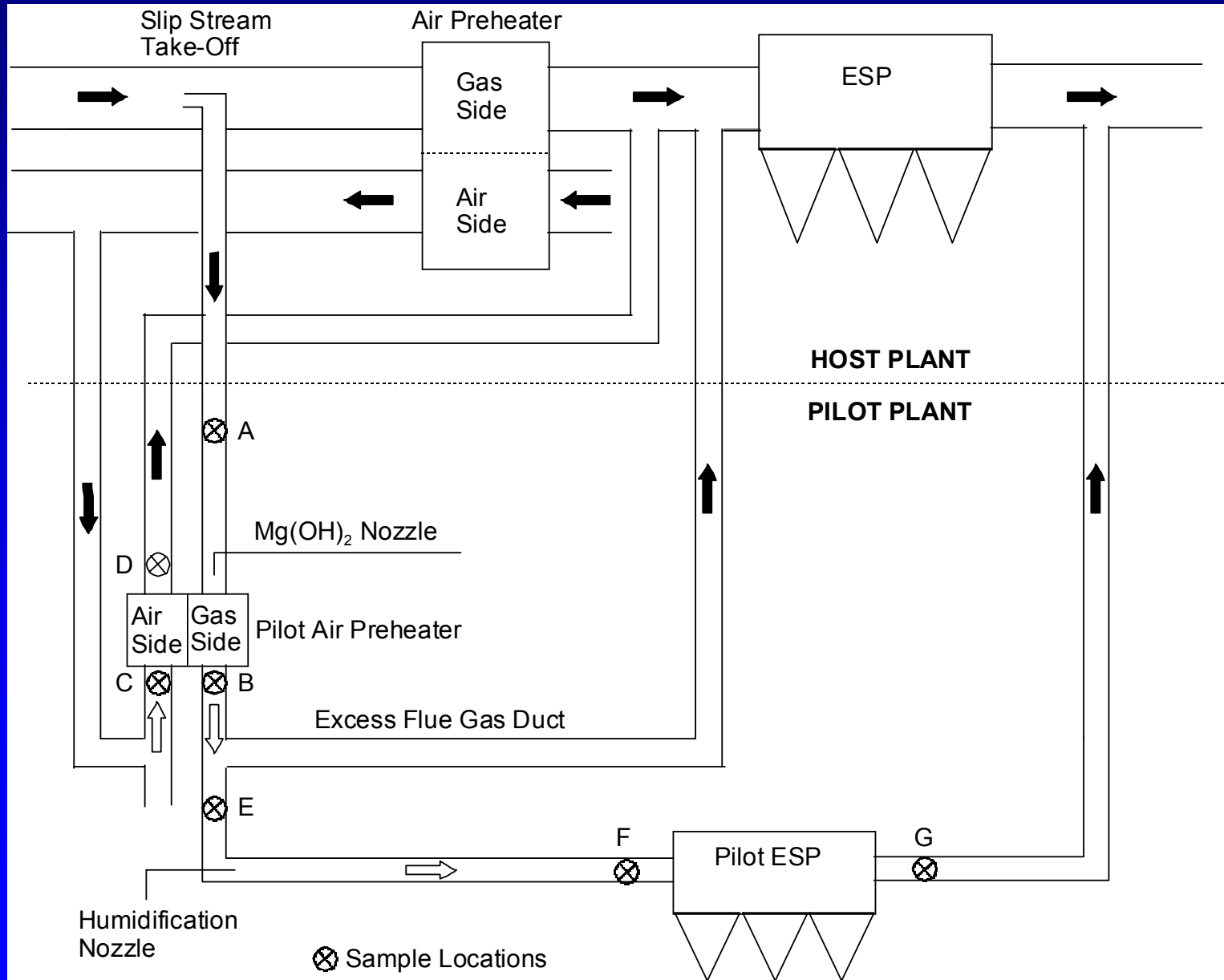
Allegheny Energy Mitchell Station

- Courtney, PA
- 288 MW Unit 3
- In service 1963
- Thiosorbic Lime wet FGD, ESP, no SCR
- Fired with eastern bituminous coal
 - ▶ 3.5% S and 0.1% Cl typical

ALLEGHENY MITCHELL STATION



PILOT PLANT PROCESS SCHEMATIC









CAUTION
THIS ROOM IS PROTECTED
BY HALON FIRE SUPPRESSION
SYSTEM LEAVE IMMEDIATELY
UPON WARNING OF DISCHARGE.
DO NOT RE-ENTER UNTIL
FRESH AIR IS RESTORED.





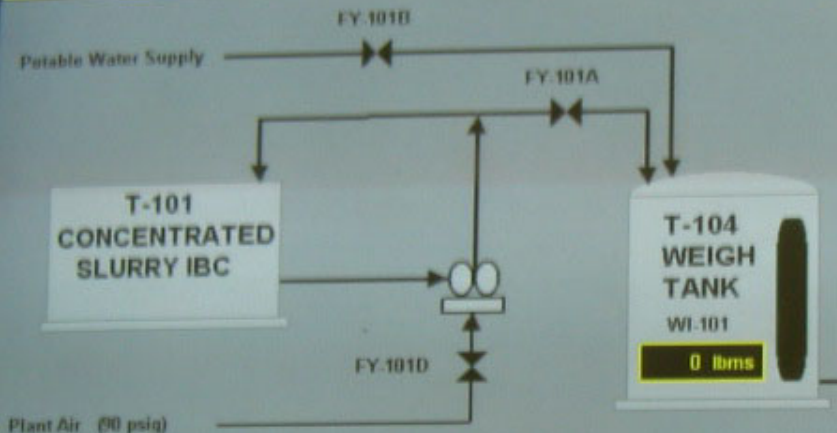












FY-101B Water	FY-101A Slurry	FY-101D Pump	FY-101C Drain
Manual	Manual	Manual	Manual
Open	Open	Open	Open
Close	Close	Close	Close

SLURRY AREA ALARM ON
 FAH107
 FAL107
 ALARM RESET

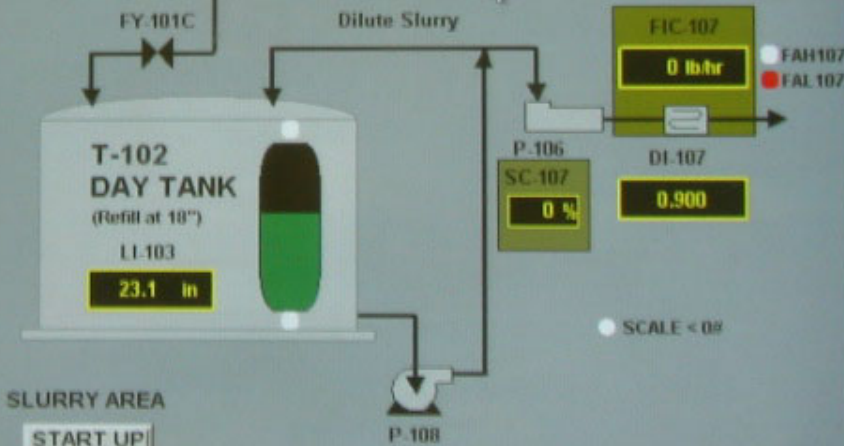
WEIGH TANK T-104 CONTENTS

Mode Selection:

BATCH PREPARATION:

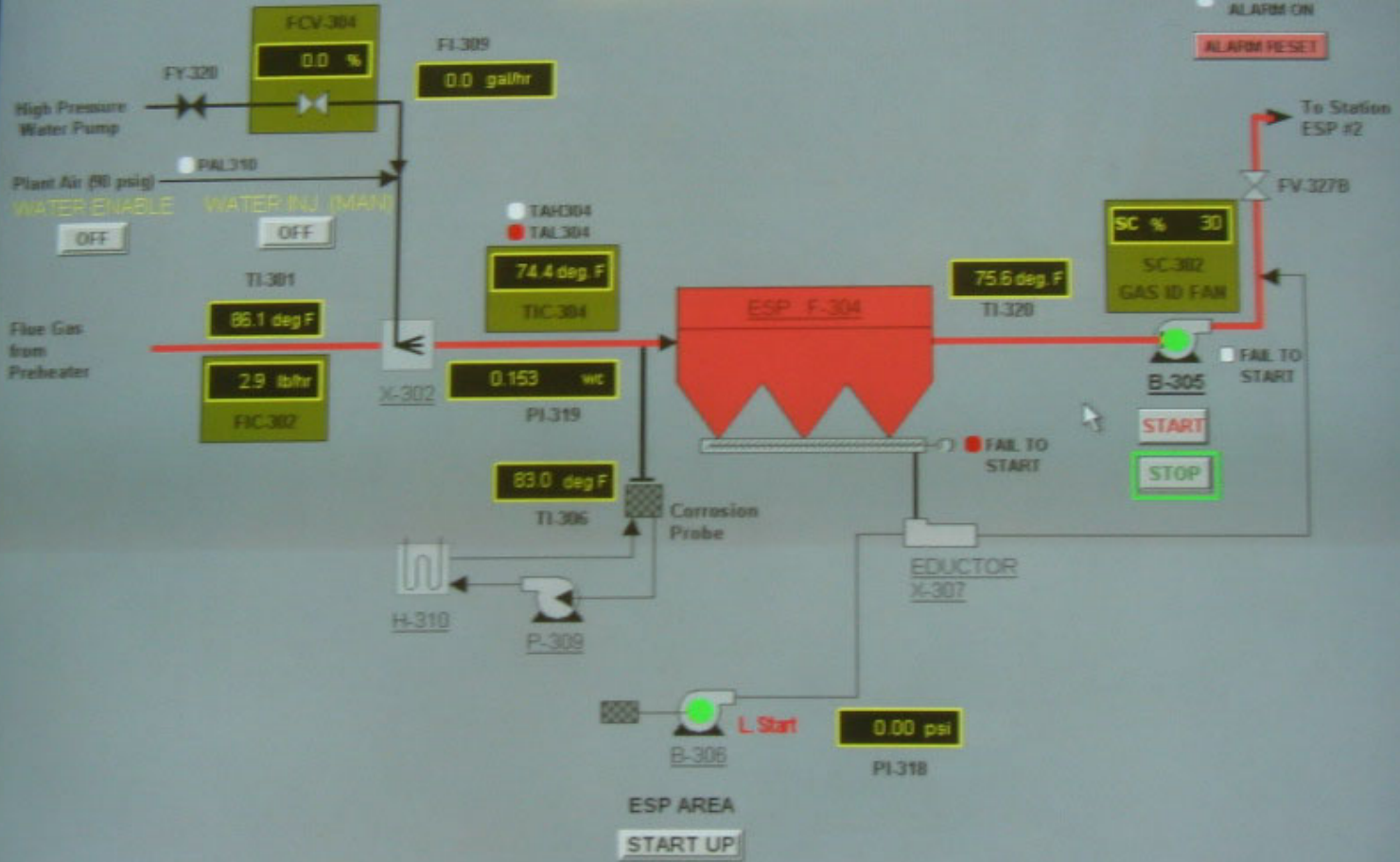
Total Tank Weight (450 Batch): **0.2 lbsms**

	Required	Actual
Weight of Water	400. lbsms	400. lbsms
Weight of Slurry	45.0 lbsms	45.1 lbsms



SLURRY AREA

Clear Clear All



EXPERIMENTAL PLAN

- Flue gas flowrate: 16,500 lb/h (1.7 MW)
- Mg/SO₃ molar ratio: 2/1 - 5/1
- Gas temperature at ESP inlet: 225 - 315 °F
- Water spray cooling: on/off
- Gas sampling for Hg, particulate, SO₂, SO₃
- Speciate Hg at inlet/outlet of air preheater and ESP
- Evaluate air preheater and ESP performance and corrosion
- Evaluate stability of captured Hg

PILOT PLANT PROGRAM GOALS

- Demonstrate 80-90% Hg removal
- Evaluate Hg removal by species
- Determine optimum operating conditions for cost-effective Hg control
- Determine sorbent rate for cost-effective SO₃ control
- Determine impact of reduced cold-end temperature and SO₃ control on air heater and ESP performance and corrosion
- Demonstrate long-term operability
- Determine stability (leachability, volatility) of captured Hg
- Disseminate information

STATUS OF PROJECT AS OF JULY 31, 2003

- **Design and construction completed**
- **Pilot plant start-up 8/03**
- **Project completion 3/05**

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