

Mitigating PCD System Operation Issues

Xiaofeng Guan

NCCC/PSDF

Southern Company Services, Inc.

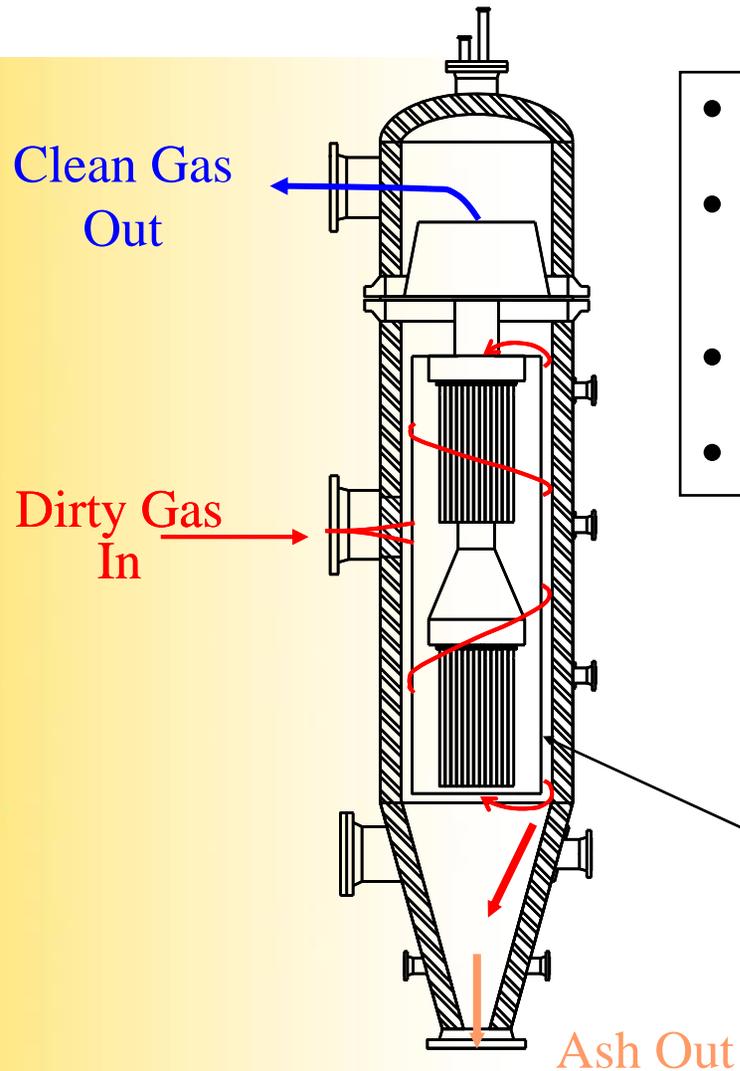
March 19, 2015

Particulate Control Device (PCD)

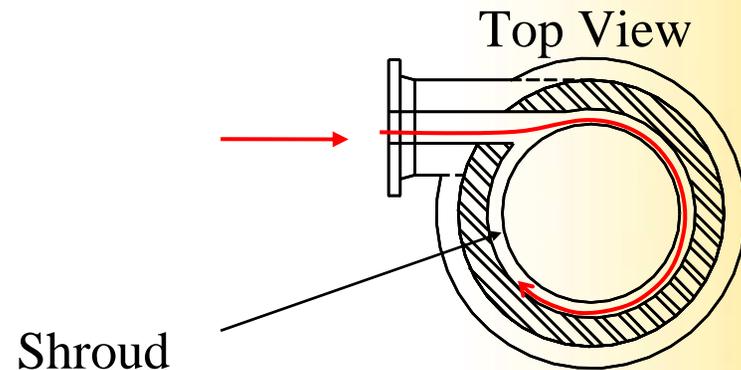


- Siemens (Westinghouse) design
- Install up to 91 filter elements
- More than 35 types of filter elements tested
- Metal and ceramic filter elements
- Individual failsafe for each filter element
- Gasification char: 10-15 micron MMD
- Particulate loading: 10,000-20,000 ppmw
- Outlet emission: less than 0.1 ppmw
- 150-240 psig pressure, 750°F temperature

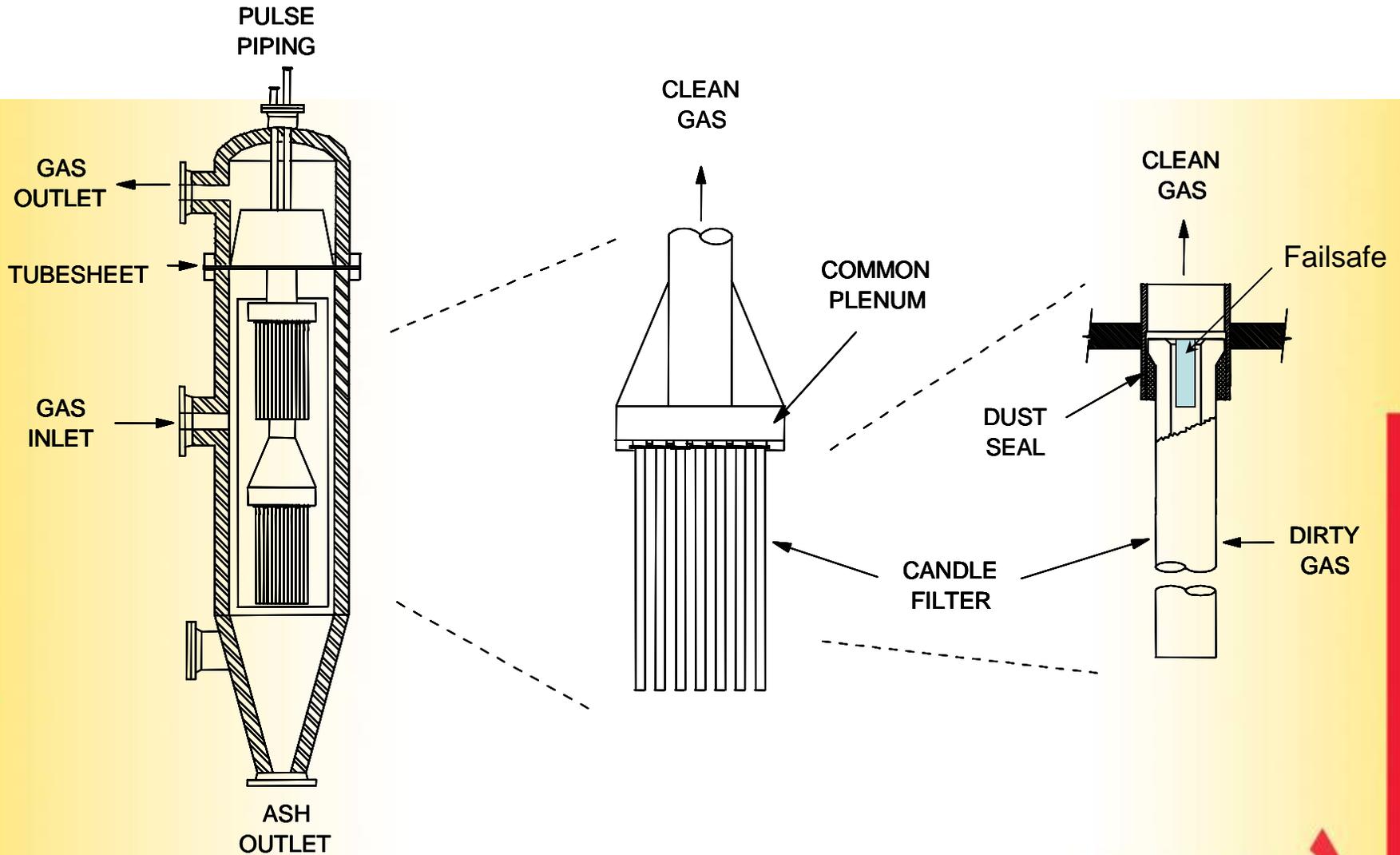
Siemens-Westinghouse PCD FL0301



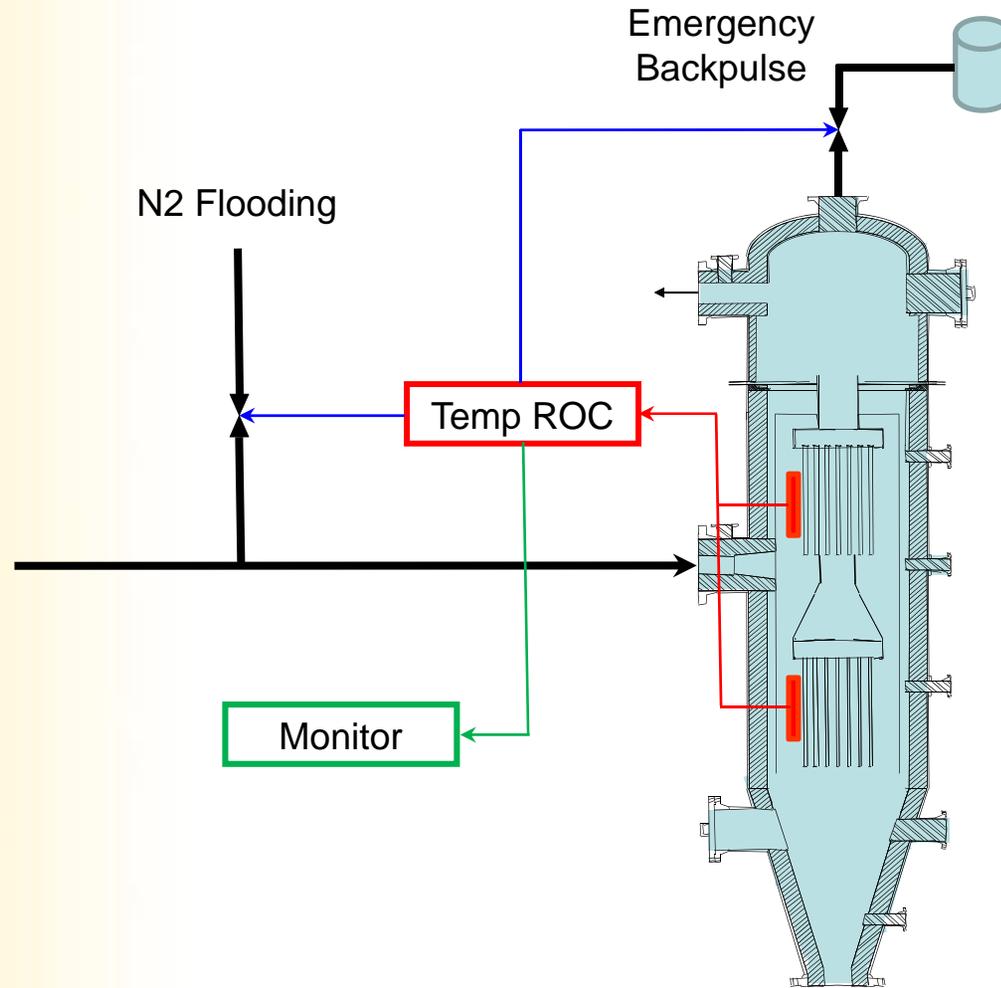
- 91 filter elements on two plenums
- Top and bottom plenums back-pulsed separately
- Tangential inlet
- Cylindrical shroud



Particulate Control Device (PCD)



PCD Emergency Handling

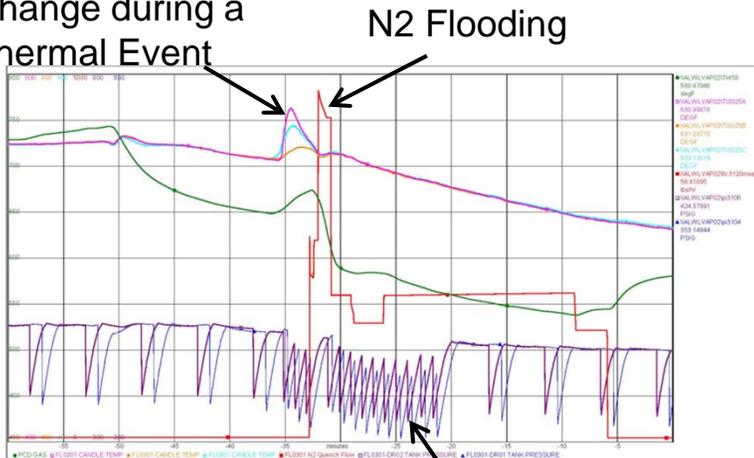


Rate of Change (ROC)

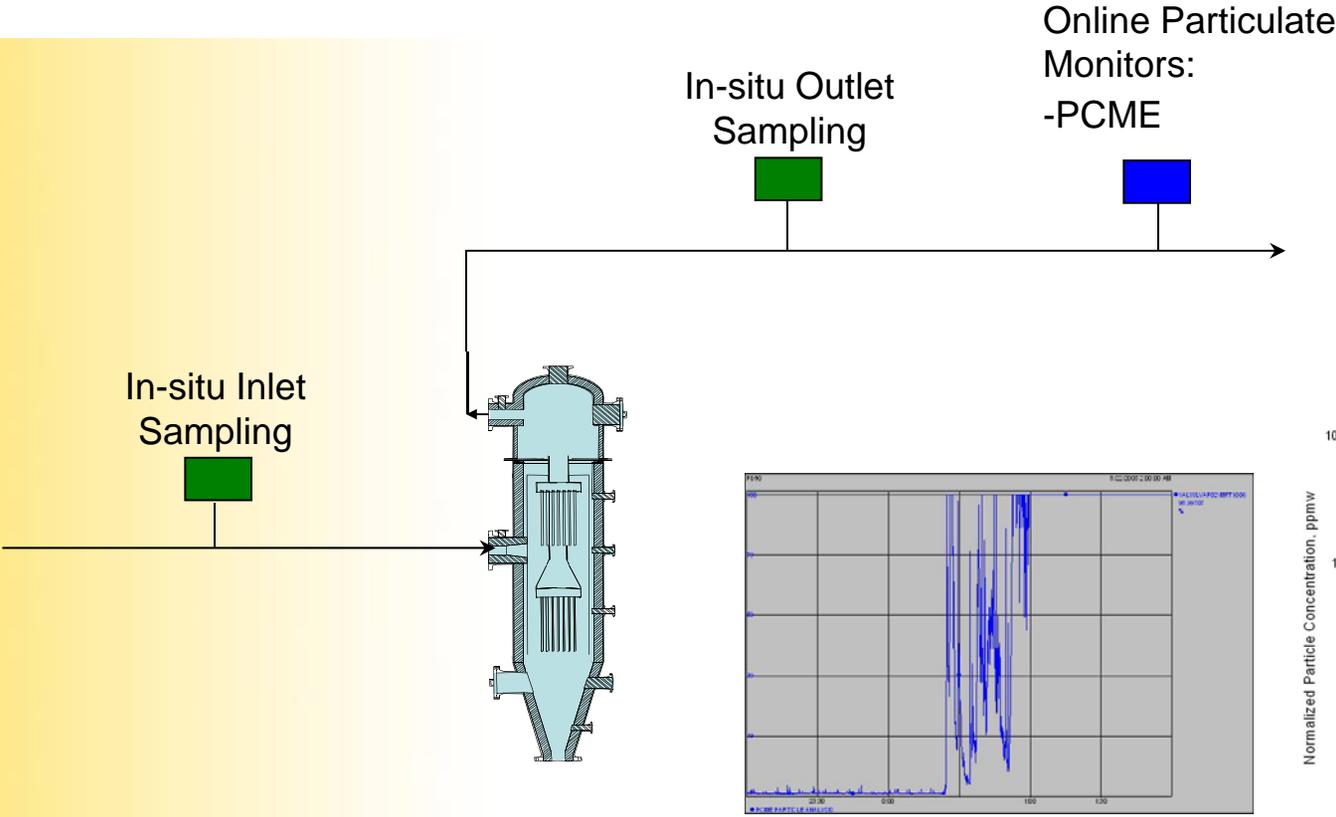


- Rate of change in temperature of filter element surface (thermocouples)
- Indicative of char combustion caused by O₂ breakthrough
- Emergency handling actions triggered by the ROC

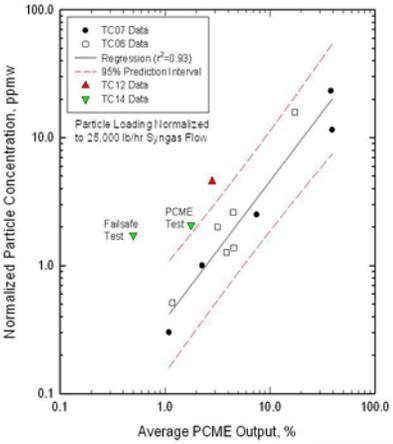
Temperature
Change during a
Thermal Event



Online Particulate Monitor (PCME) at PCD Outlet

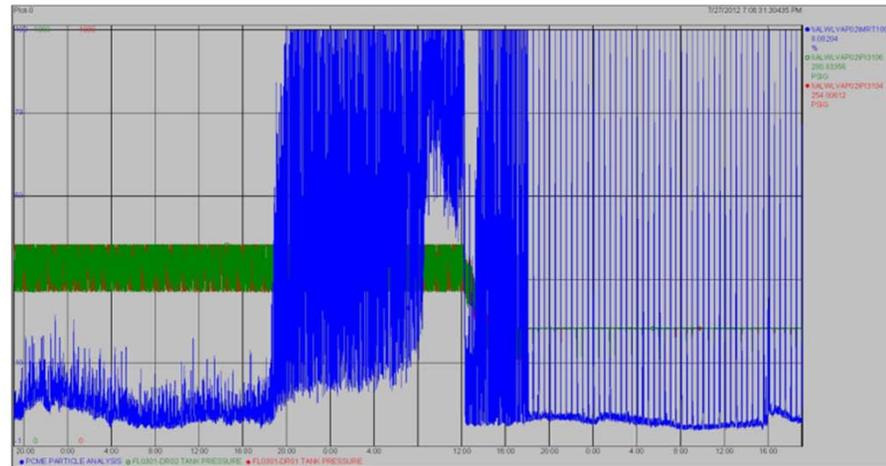
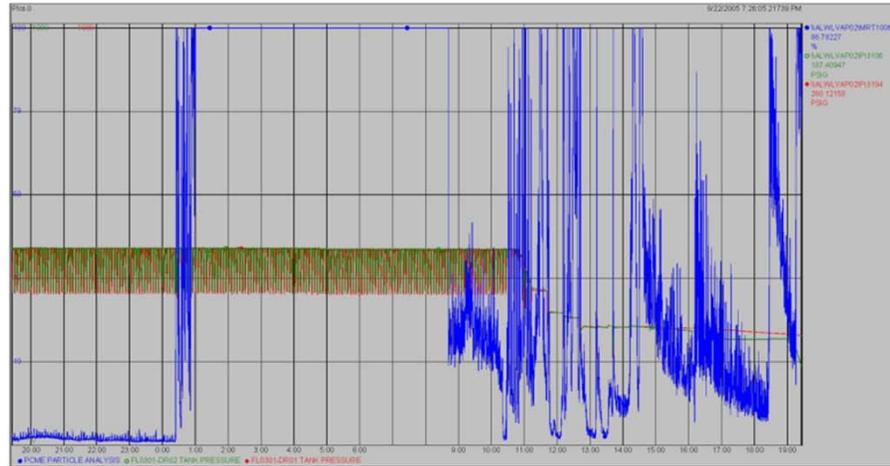


PCD Leaking Detected



PCME Calibration Curve

PCME Response to Particulate Leak



Particulate Sampling

Sampling System



In-situ Inlet Sampling

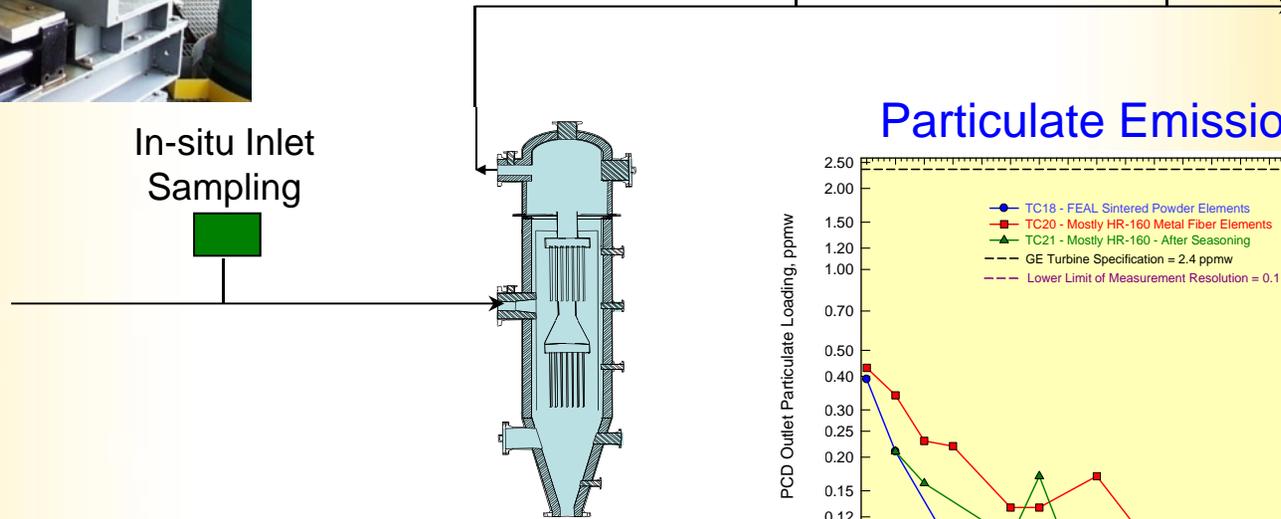


In-situ Outlet Sampling

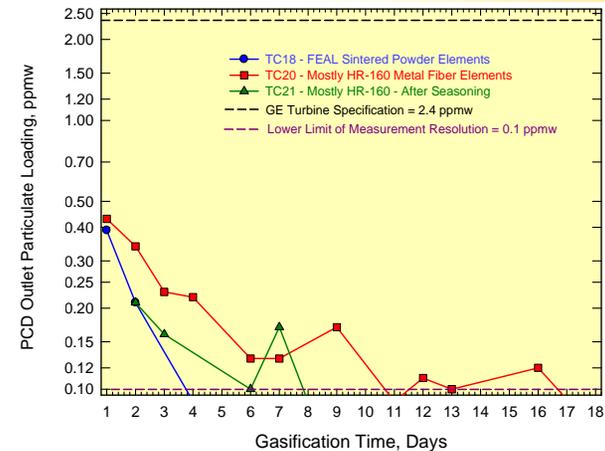


Online Particulate Monitors:

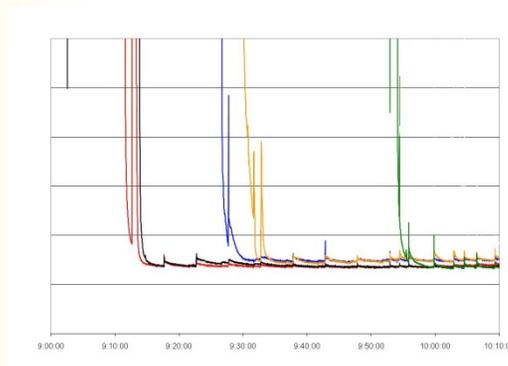
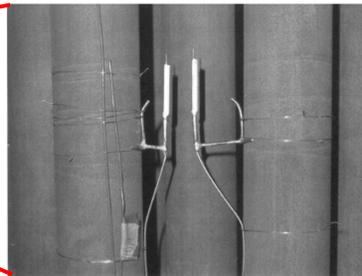
- Jonas Acoustic
- PCME
- PPC (Laser)



Particulate Emission



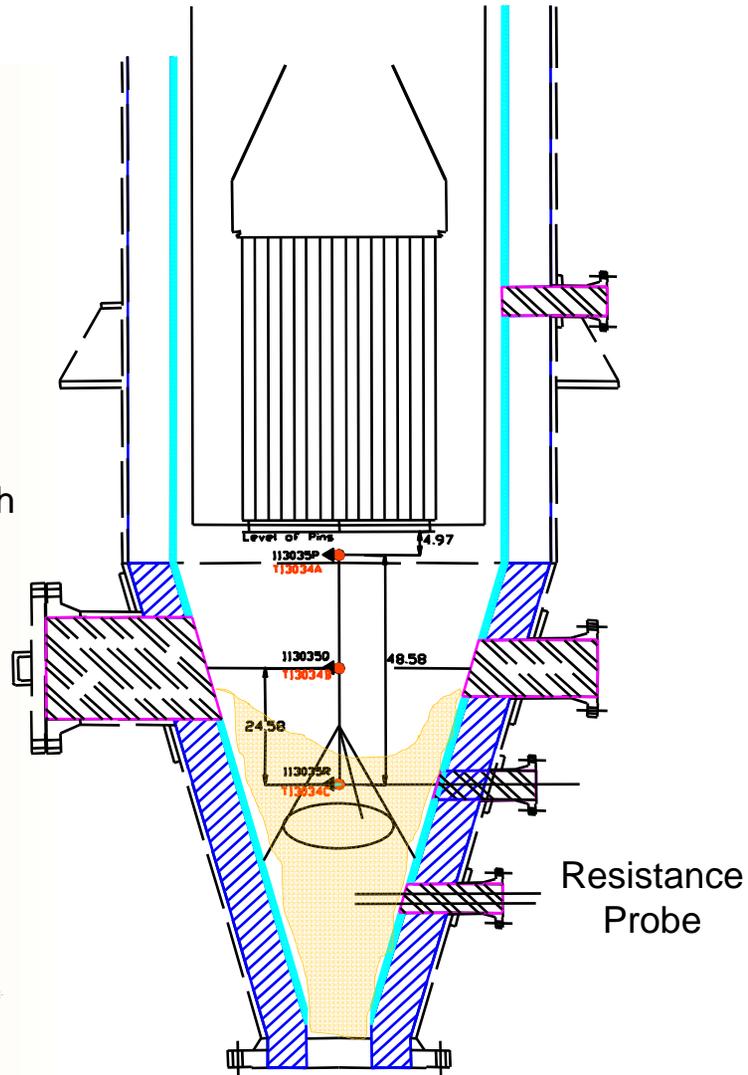
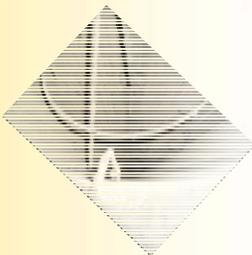
Char Bridging and Resistance Probes



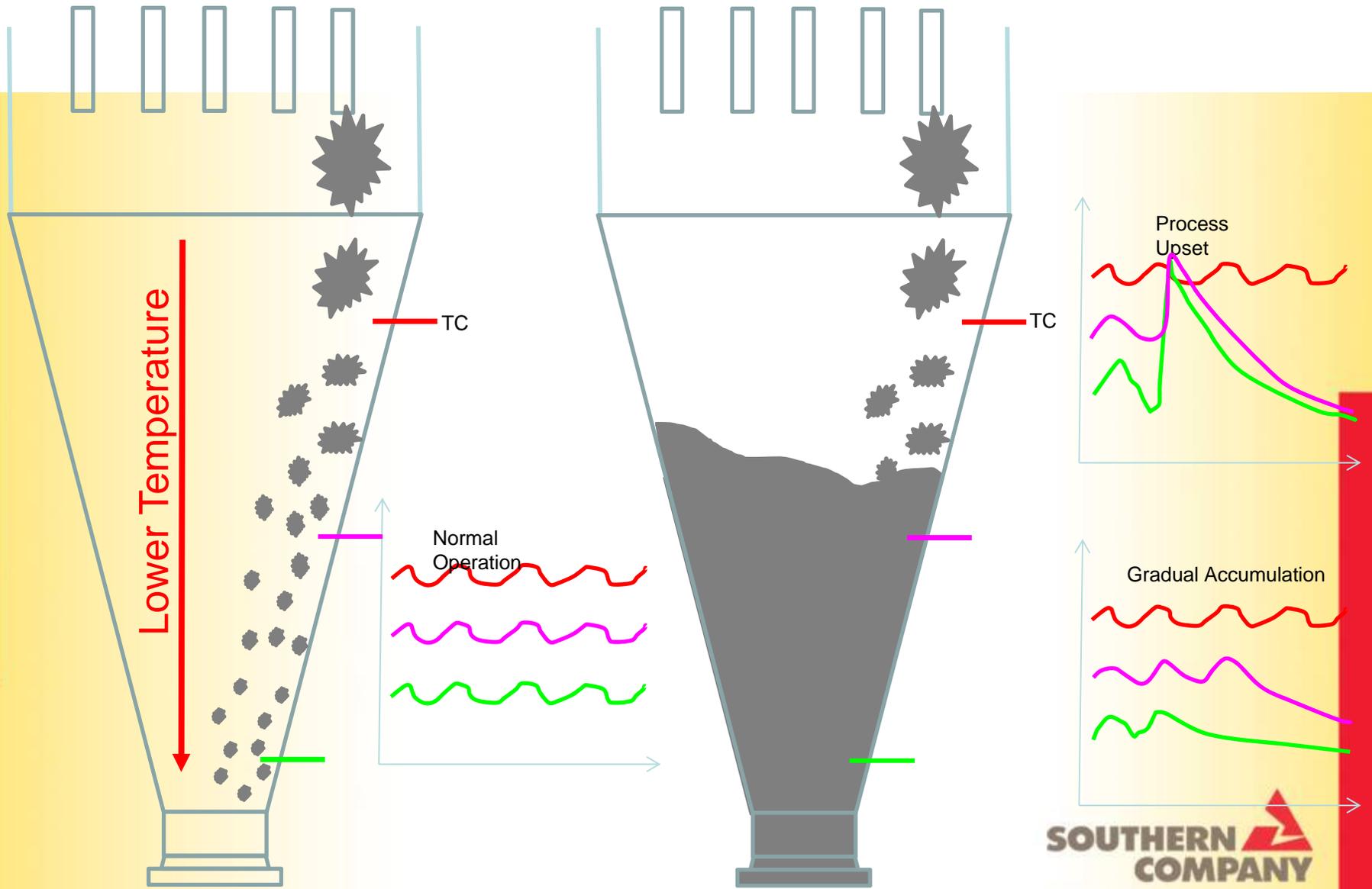
- Developed resistance probe to monitor char bridging between filter elements
- Detect char bridging from resistance probe, thermocouple, and pressure drop trends

PCD Cone Solids Accumulation

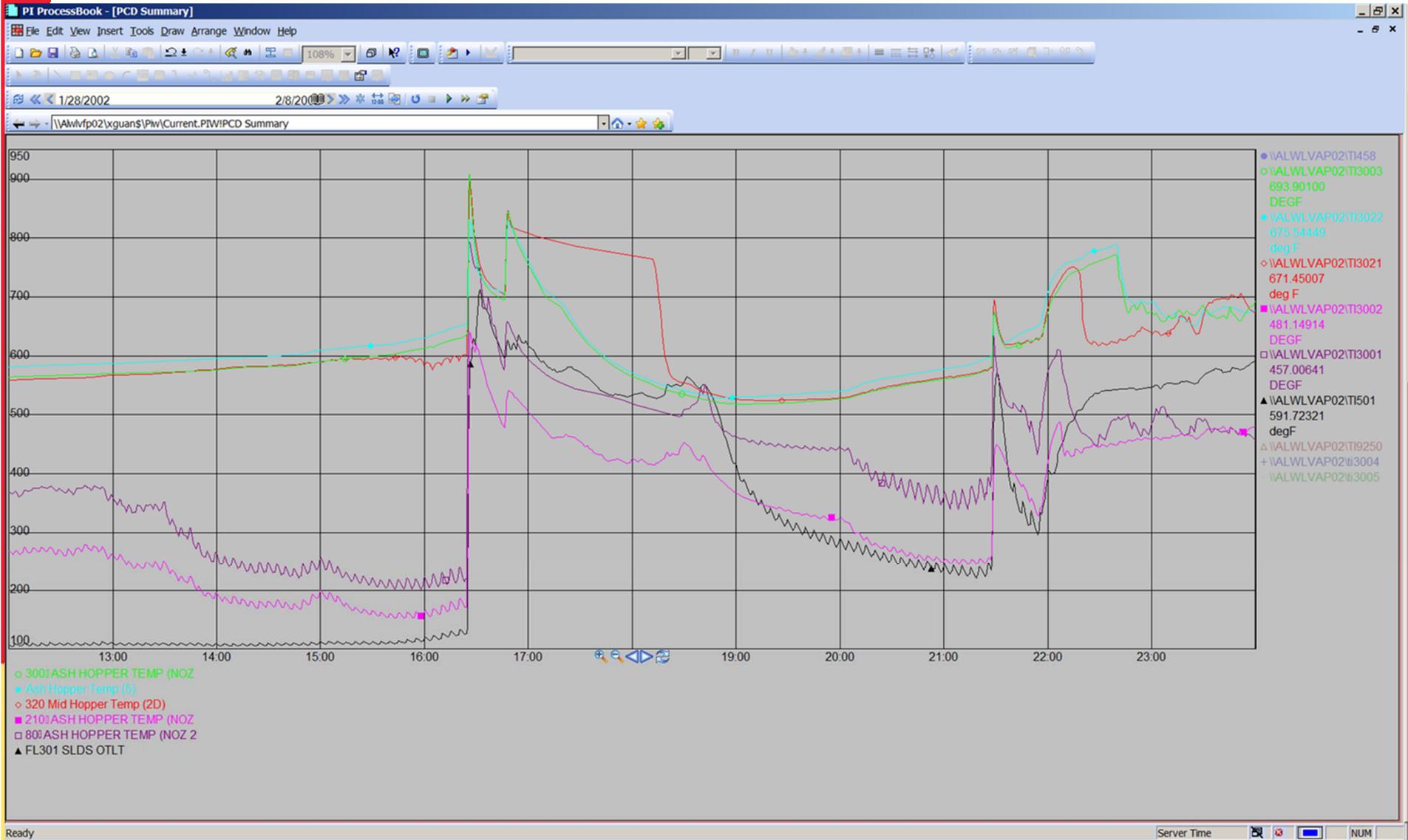
Christmas Tree with Thermocouples



PCD Cone Thermocouple Response to Solids Buildup



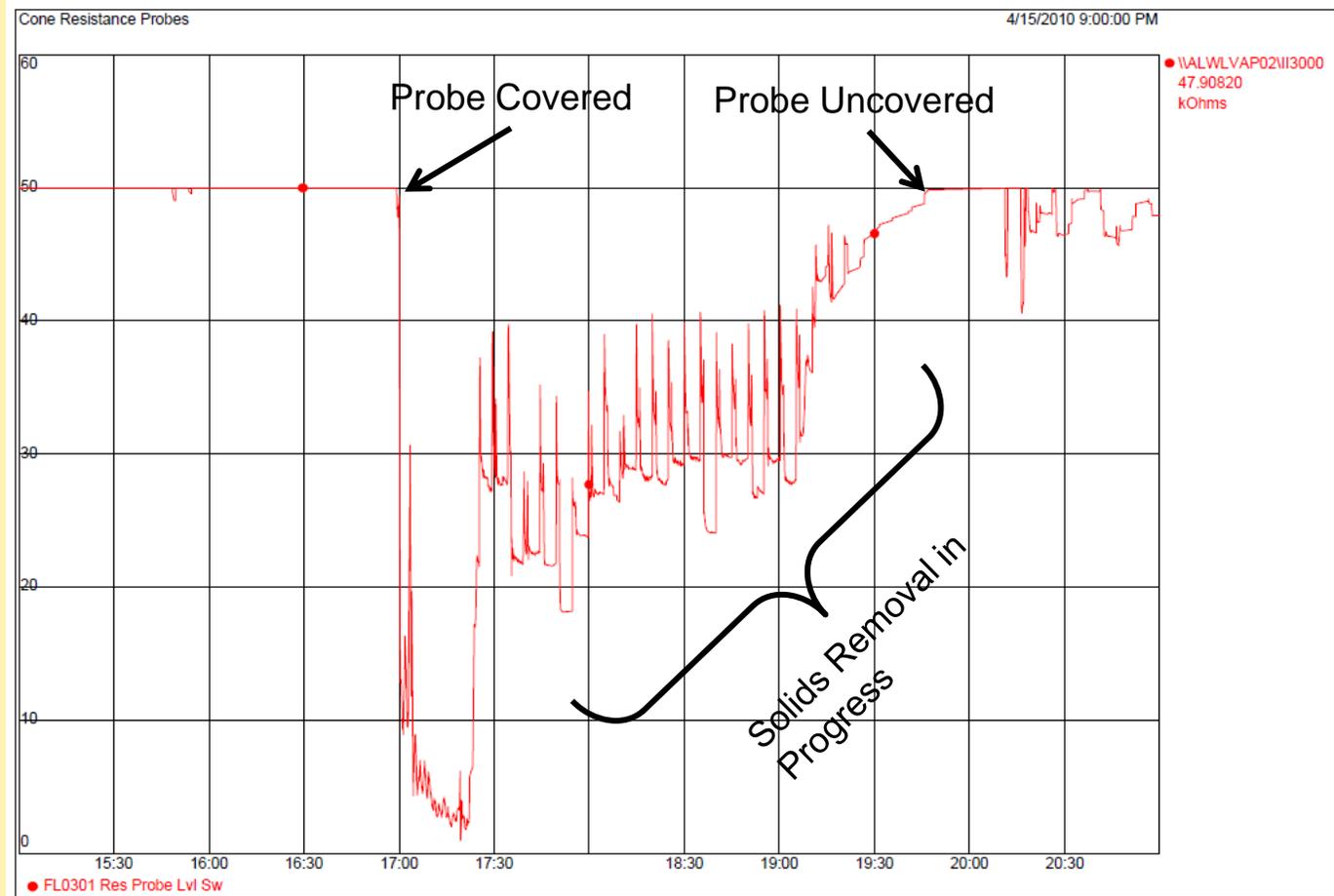
Thermocouple Response to Solids Accumulation in PCD Cone



Resistance Probe in PCD Cone for Level Detection



Resistance Probe's Response to Solids Buildup in PCD Cone



Other Operation Issues

- Pre-heat PCD during startup
- Monitor and control tubesheet pressure drop
- Optimize back-pulse pressure
- Purge PCD with N2 or dry air during shutdown

Questions?