Analytical Instrumentation & Maintenance Systems (AIMS)

SRU Stack Gas Emissions

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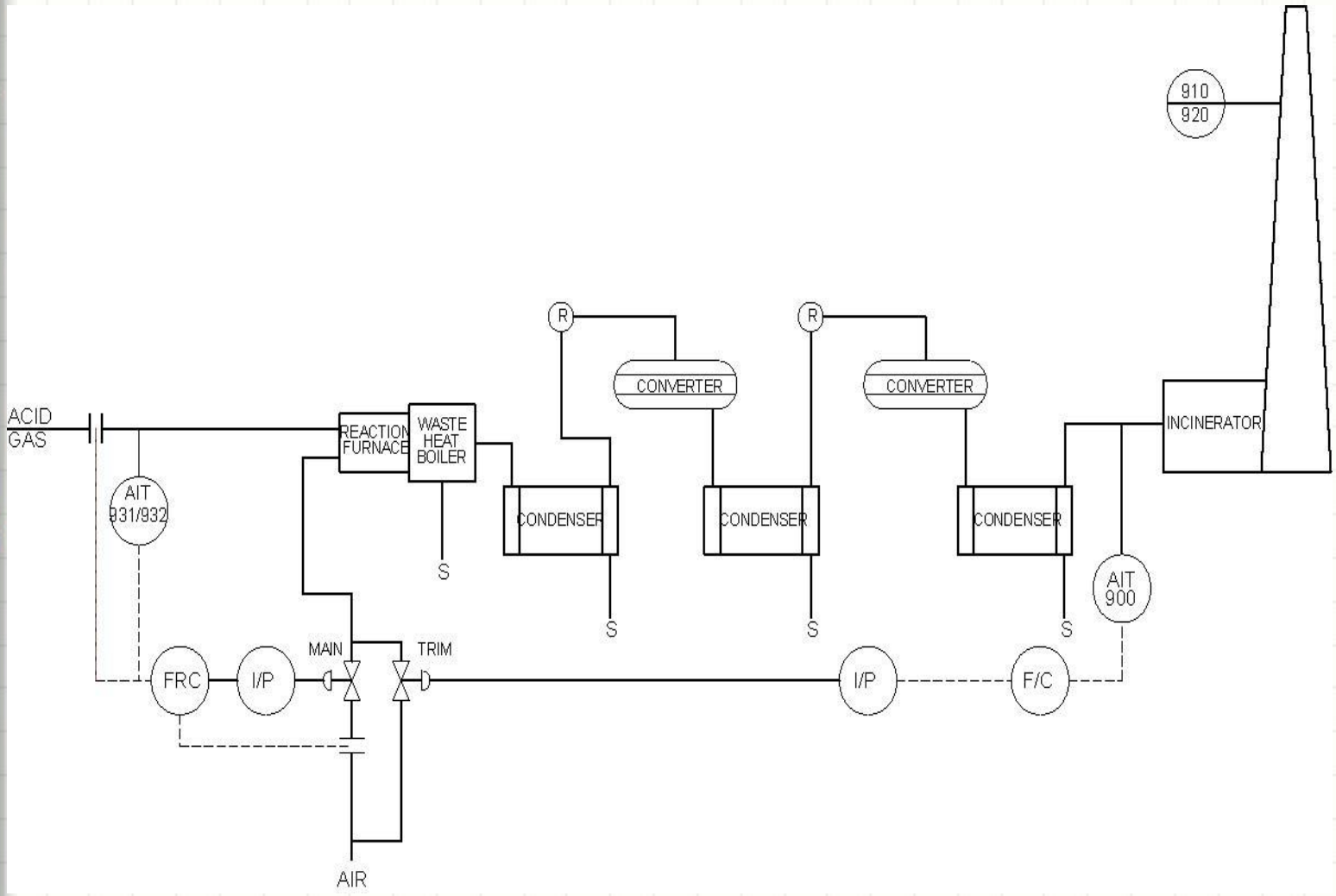
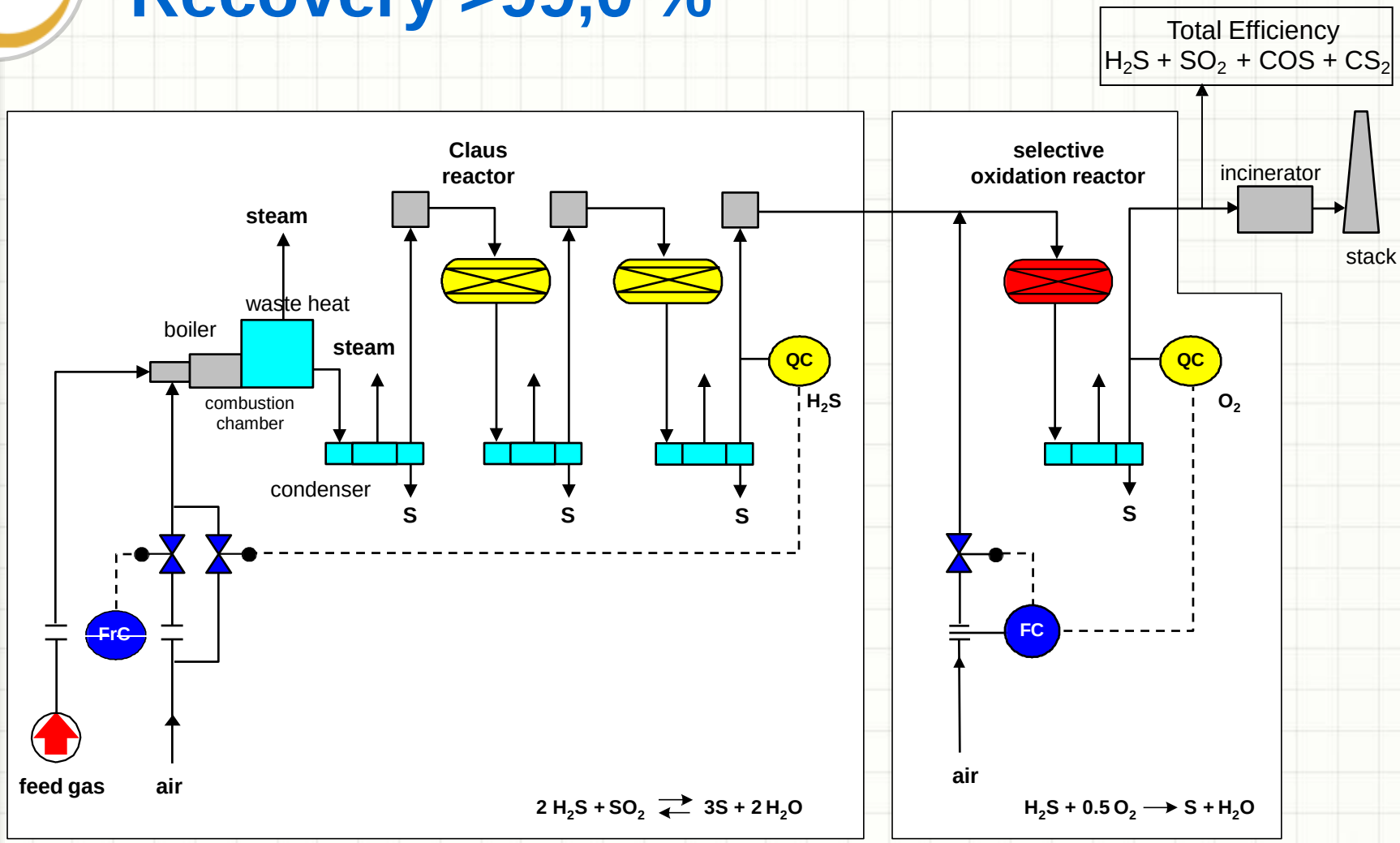
Analytical Instrumentation & Maintenance Systems(AIMS)

Safety is Important for all and so is Environment

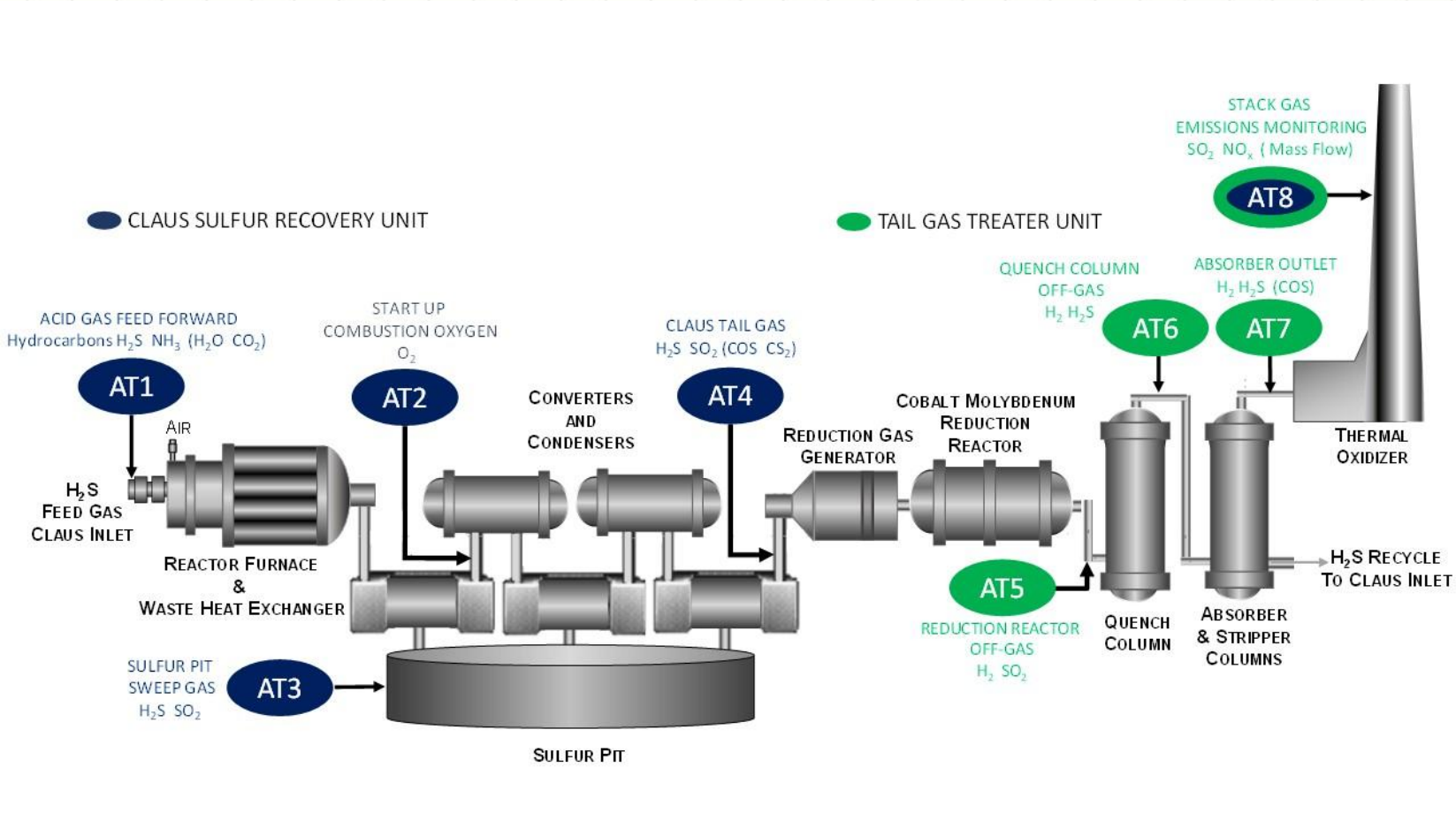
Claus Reaction



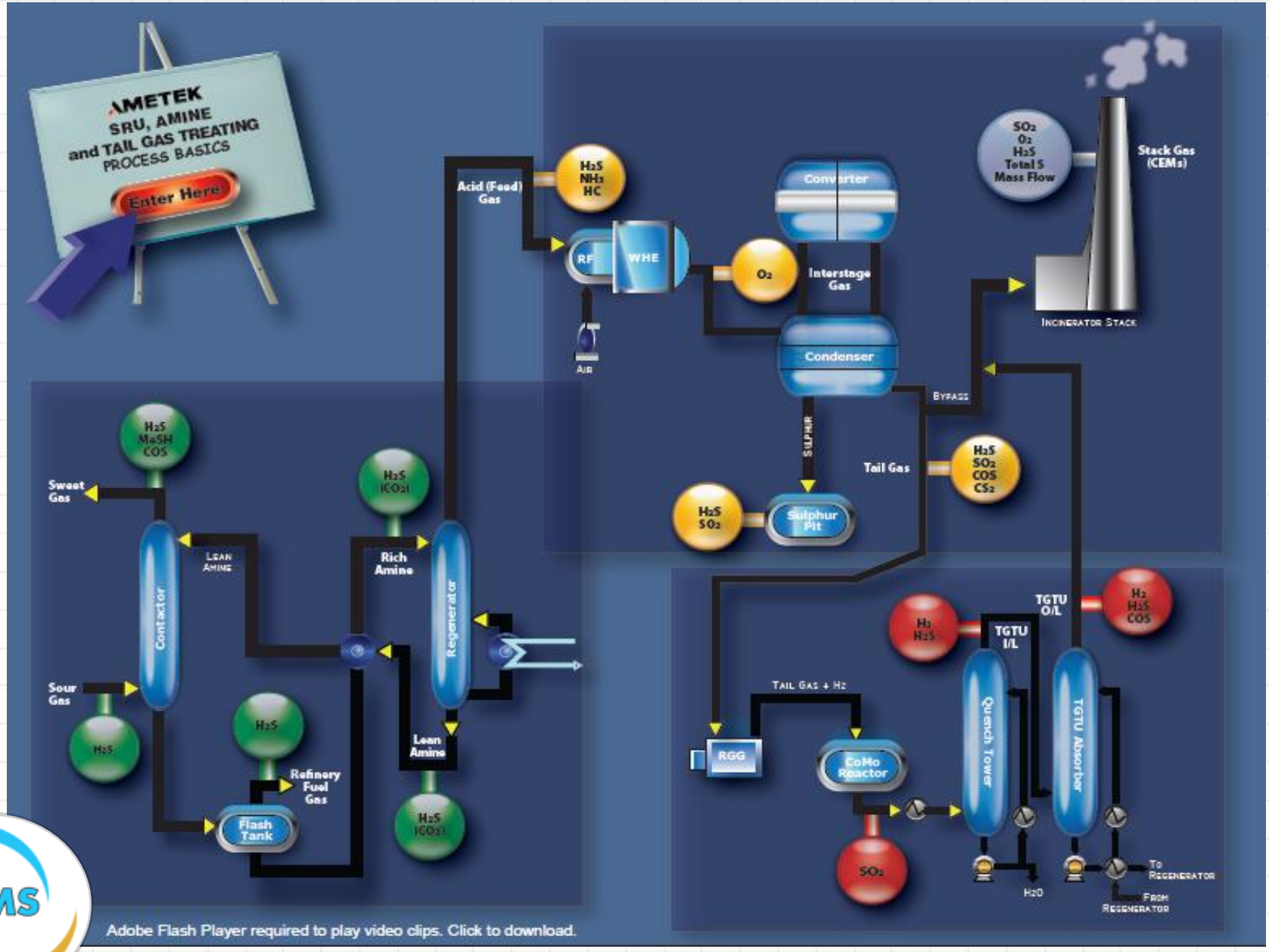
Jacobs Engineering Superclaus® S – Recovery >99,0 %



SRU-TGT Analyzer Tags



Analytical Instrumentation & Maintenance Systems (AIMS)

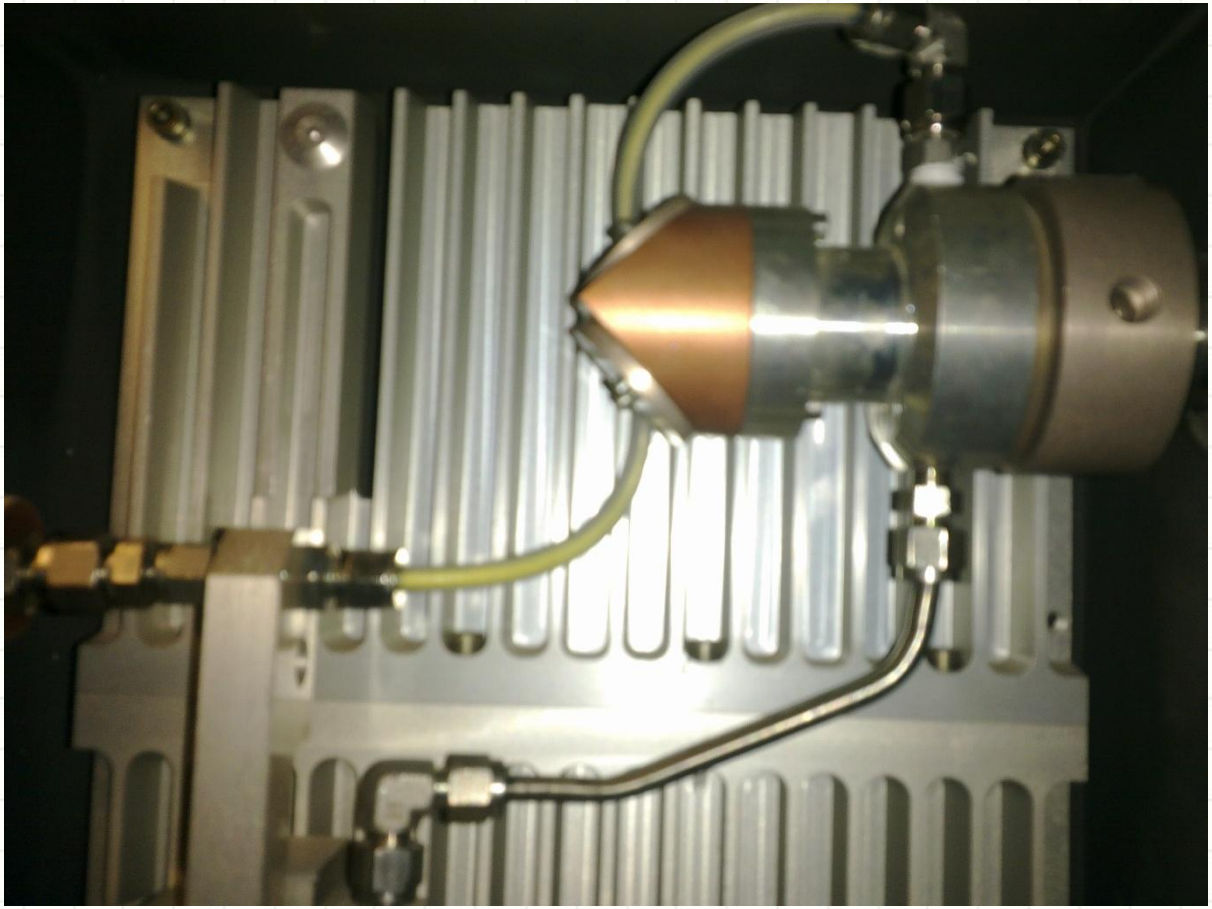


PROBE MAINTENANCE MISTAKES

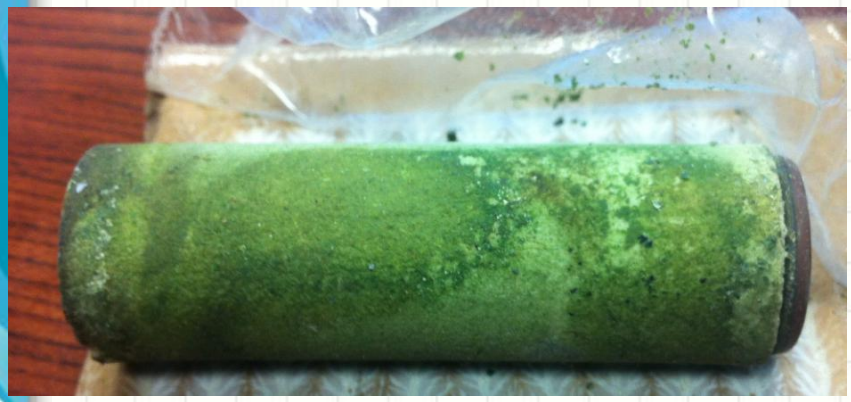
Where iam when sampling

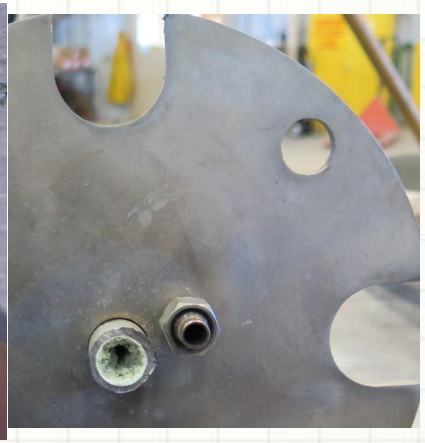
PROBE MAINTENANCE MISTAKES

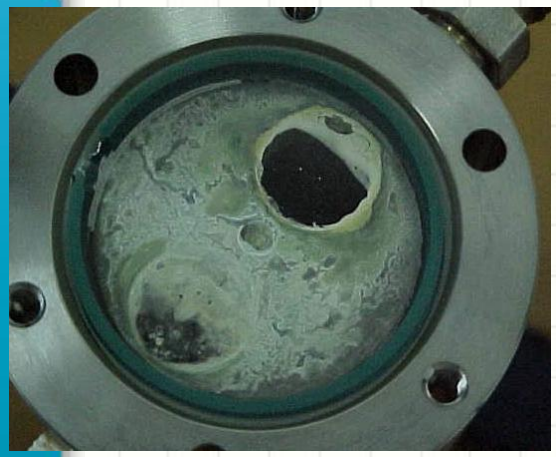
What can happen



Acid Mists, Salts and Corrosion







SRU Stack Gas: Continuous Emission Monitor

- A SRU is a “Chemical Pant” (more than it is a “Combustion Source”)
  Like a chemical plant it does not operate at the same efficiency at varying loads
- A SRU must measure **MASS Emission** (SO_2 x stack gas flow rate)
- MASS Emission SO_2 is used for material balance / optimization purposes
- Combine with **H_2S acid gas** analyzer to **calculate recovery efficiency**
- Requires “**hot-wet**” measurement
- Velocity measured with pitot tube, sighted 5-8 dia above incinerator
- Design sample system for possible SO_3 formation

Other Parameters

SO2

- Dual range (TGTU bypass)

H_2S CHECK REQUIRE D OR NOT

- Measurement of residual value after incineration (~10 ppm)
- "Account" for the H_2S by oxidizing the residual H_2S to SO_2

O_2

- Stand alone analyzer or on board with SO_2 analyzer

NOx

- NOx values are low, not normally required
- Can be measured with same analyzer along with SO_2

Emission Analyzers

- Accounting for un-combusted reduced sulfur compounds
  - The part of EPA sub-part J(a) that was not promulgated
- Dual Range of SO_2 if TGTU can be bypassed
- "The Color of Plumes"
  - White: Steam plume caused by water condensation (cold, Canada)
  - Bluish white: SO_3 plume usually caused by high SO_2 emissions
  - (….Confirmed by "Green Slime" in the CEMS sample system)
  - Orange: NO_x plume
  - Brown: Unburned hydrocarbon / soot plume
  - Green: Burning H_2S plume

AMETEK Process Instruments
WR Series Hot/Wet Analyzers

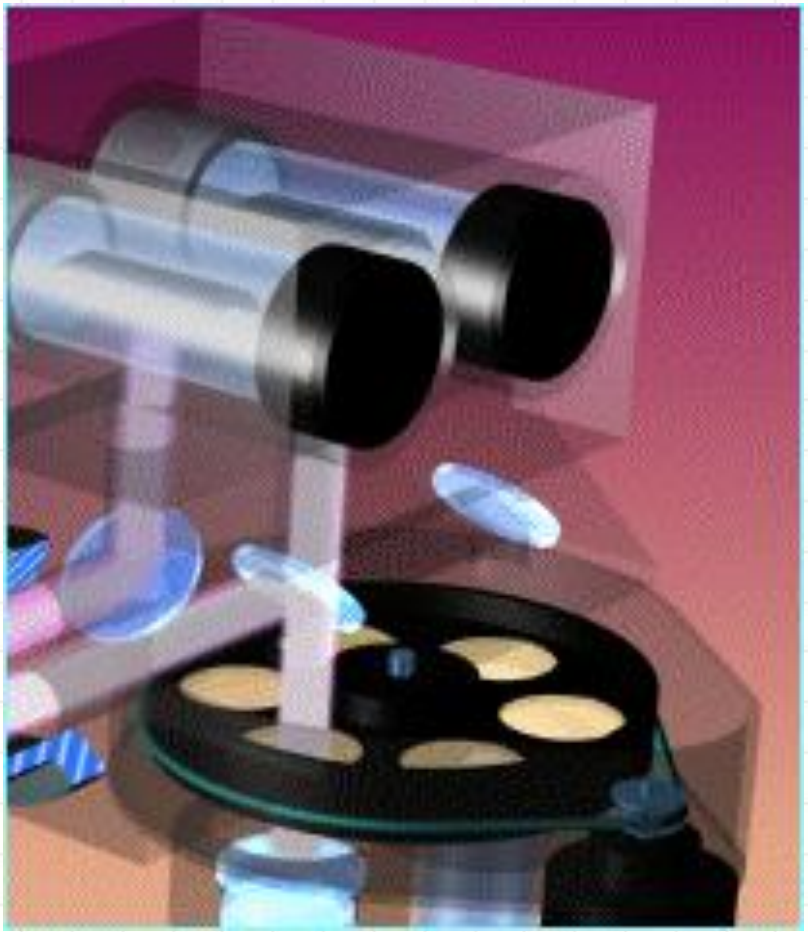
Hot/Wet Extractive UV Photometric Analyzers

- Single component analyzer systems
  - Models 909 and 919
    - Common components measured: SO_2, NO, NO_2 ,H_2S, COS, CL_2, NH_3
- Multi-component analyzer systems
  - Models 910 and 920
    - Simultaneous determination of SO_2, NO, NO_2 (as NOx)
- No interferences from other flue gas components (water, CO2)
- Used in CEM and process control monitoring applications

AMETEK Series Hot/Wet CEM Analyzers – Why Extractive Systems?

Extractive Sample System Design

- accurate temperature control of sample
  - ensures sample is kept above the highest dew point
- Sample (pre-) conditioning
  - critical for high particulate/high acid dew point applications
- Easy to calibrate (using certified EPA approved cal gases)
- Easy to maintain
- Easy access (in shelter)
  - 'safer' (and more comfortable) working environment
- extractive CEMs live longer!
- Easy integration of additional equipment
  - Additional analyzers or instruments
  - Data acquisition systems (DAS)
  - Other hardware (control) requirements



Photomultipliers, Filter Wheel & Chopper Motor

AMETEK
PROCESS INSTRUMENTS

AMETEK Stack Analyzers
Common Features and Benefits

- UV Measurement
- High Resolution
  - Hollow cathode lamps define resolution - typically 0.02 nm
- Superior Geometry
  - Dual beam design
  - "Neutral Drift" reference
- Serial communications
  - Modbus protocol

➔ No Interference from H_2O and CO_2

➔ Linearity better than 1% over 4 to 5 orders of magnitude

➔ Superior wavelength stability

➔ Excellent baseline stability

➔ Minimal span drift

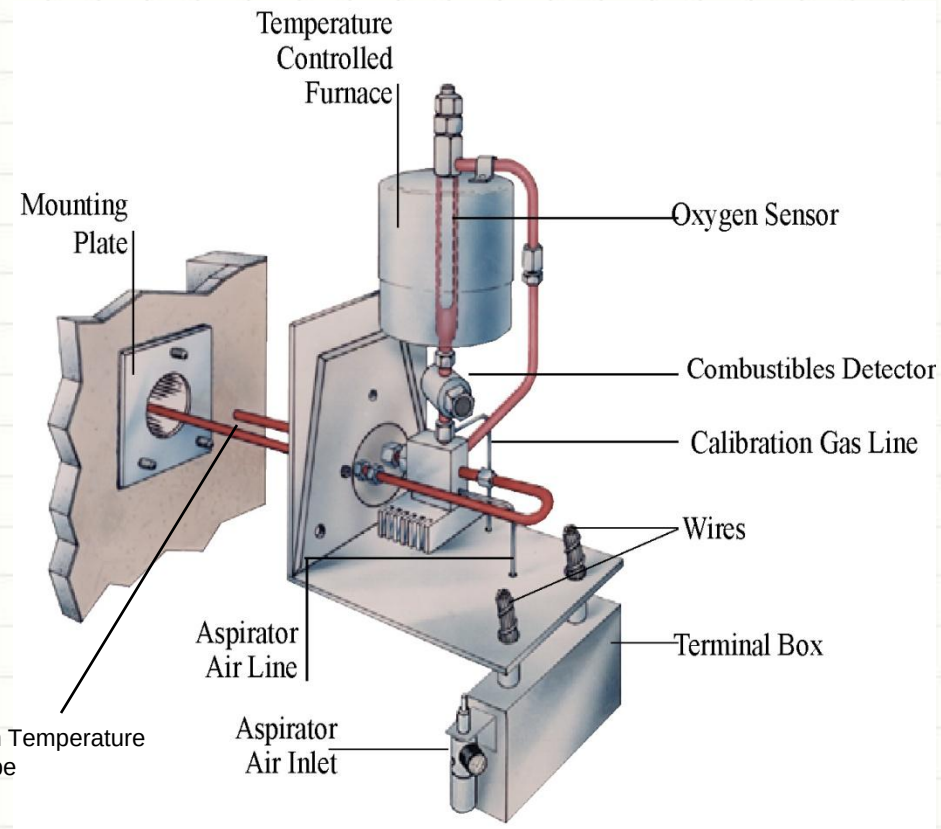
➔ Direct interface with DCS

➔ Remote diagnostics

WDG-IVC – Theory of Operation

Close-coupled extractive

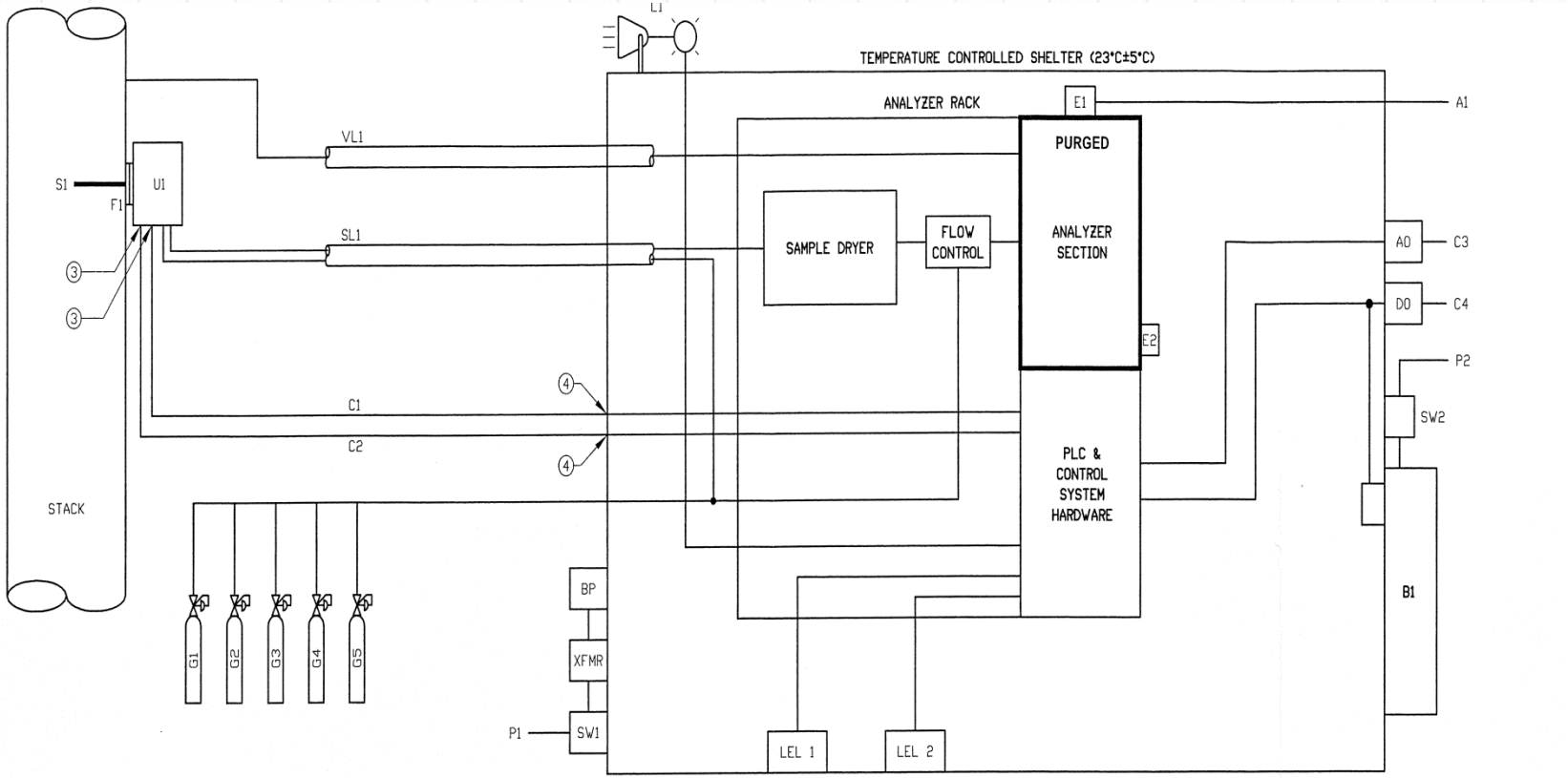
- **Close-coupled extractive is direct mounted to flange (hot-wet sampling)**
- **Uses an aspirator for true fast response (2-5 LPM primary loop flow)**
- **Cells located in the convection loop (approx 250 cc/min flow controlled by delta temperature between cell furnace at 695ºC and enclosure at 230ºC)**
- **90% Response time - < 6 secs O2 WDG-IV; < 12 secs O2, < 20 secs Combustibles/CH4 WDG-IVCM GP**
- **Designed for high temp process (Hexoloy® Probes – 1650ºC)**
- **Easy to service on flange**



Continuous Emissions Monitoring Systems Key Components (Cold/Dry)

- Every CEM consists of:
  - Analytical equipment (analyzers) – 19” rack mounted
    - One or more analyzers
  - Sample system
    - Sample probe (typically includes stack pre-conditioning)
    - Sample lines and controllers (panel mounted)
    - Sample conditioning (panel or rack mounted)
      - cold/dry systems require cooler/extraction, pump
  - Sample flow and control (rack or panel mounted)
    - Hardware (plumbing, flow distribution, solenoids etc)
  - customer termination and signal control panel
    - Typically consists of PLC for sample system flow control, auto or manual calibrations, temperature zone control for SCU & sample line digital alarm signaling, analog outputs (raw or compensated for drift) ,track and hold function
  - Data acquisition system (DAS)
  - Enclosure/Shelter

Cold/Dry System Block Diagram



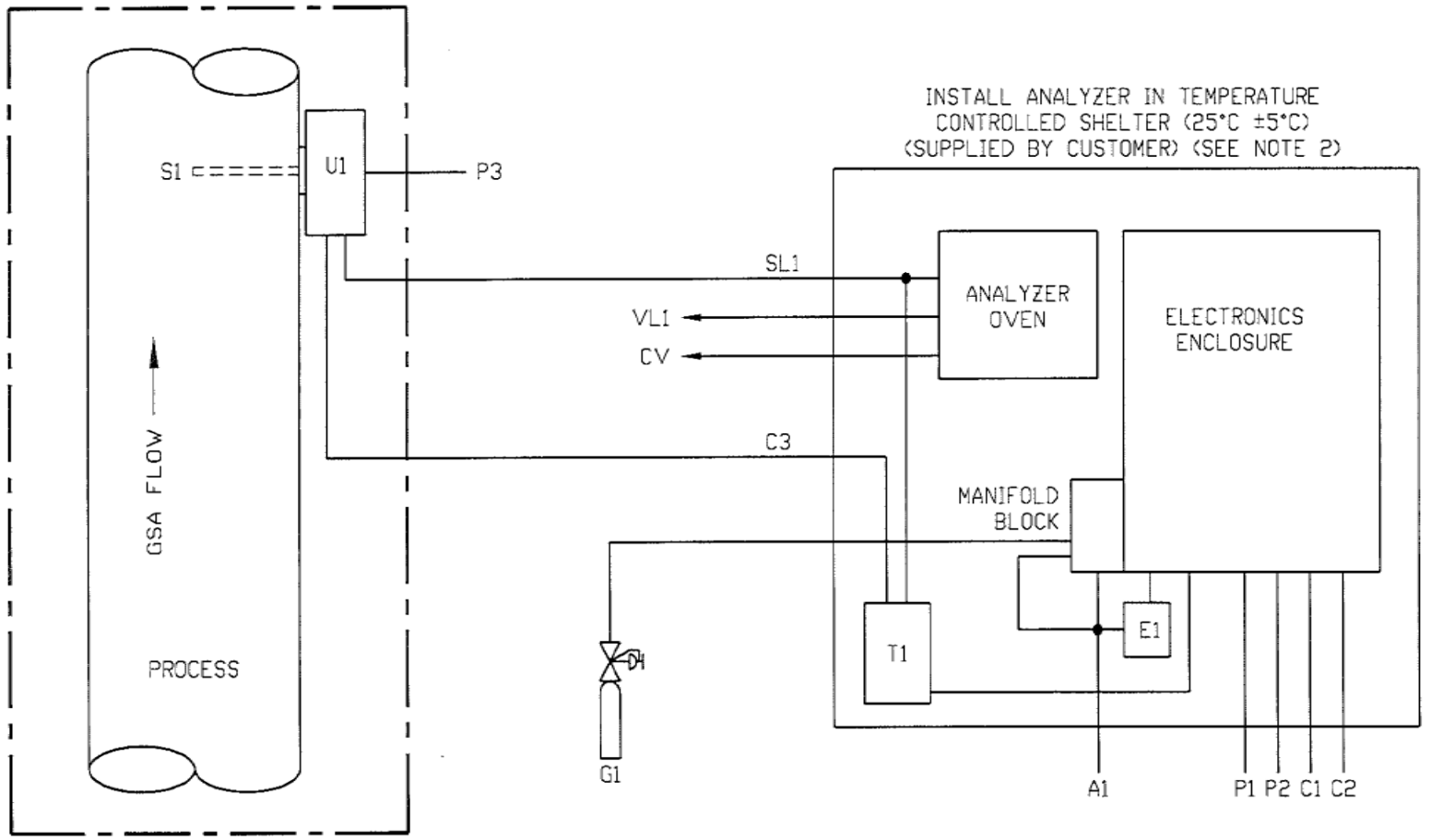
Model 920 SO2/NO/NO2/O2 Analyzer Sample System Features

- Fully integrated system
  - Temperature control
    - model 9xx series allow for independent PID temperature control, including probe, heated sample lines and analyzer oven
    - Flexible probe designs based on severity of service (application), includes probe tip calibration
  - Flow control
    - Aspirated sample system (no pump)
    - Field unit gas manifold for cal (span), zero and sample gas provided
    - Basic timing sequence for cal incorporated in series 9xx analyzers

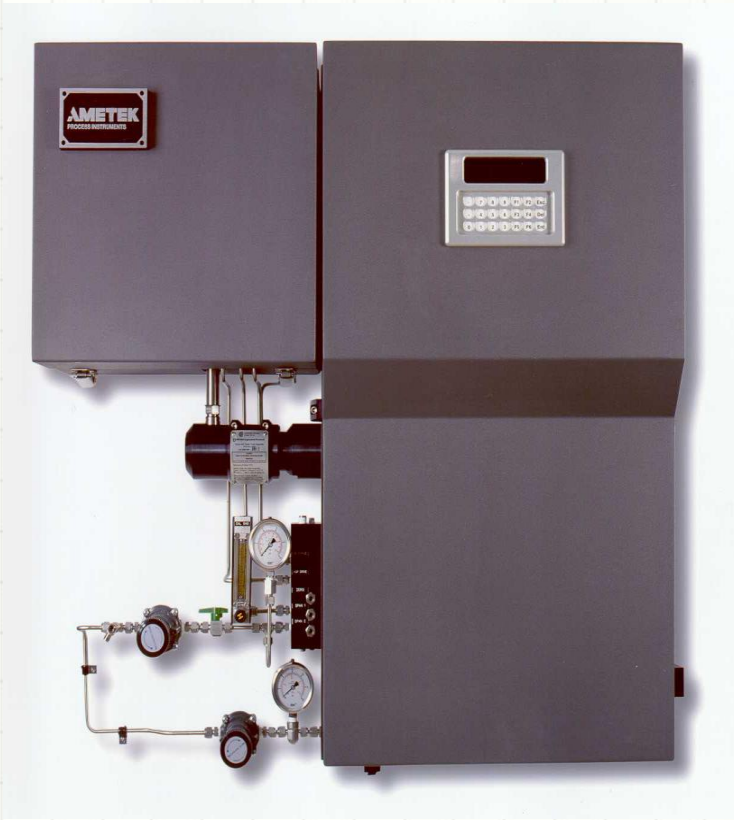
M920/910 (919 and 909) CEM - Benefits

- Multi-range SO2
  - Auto-ranging from 250 ppm FS to 2.0% FS (for 910 and 920)
  - No operator intervention required
  - No need for multiple analyzers
- Operational
  - No additional calibration gas handling system - built in
  - No additional probe and sample line temp control needed - built-in
  - Serial communications (Modbus protocol) allows direct interfacing with DACS
  - Remote diagnostics

Model 910 System Block Diagram (Basic System)



Hot/Wet Analyzer System Components



Model 910 Analyzer in Shelters

Additional Equipment for CEMs Data Acquisition

- Data Acquisition and Control
  - Typically required to meet environmental reporting and data logging requirements
  - AMETEK uses packaged DAS systems from established vendors; NEXUS, ACS, VIM, Vivicom, Honeywell, ESC etc
  - DAS is configured to meet the client's reporting requirements as per the operating permit.
    - Emission limit alarms
    - System non-operational alarms
    - Out of control calibration alarms
    - Daily, weekly, monthly reports
    - Real time data screens

AMETEK Stack Analyzers
Installed Base – Key Applications

- SRU Emissions Monitoring
  - Models 909/910 Continuous Mass Emissions Monitor (CMEM)
    - Built-in S-type pitot tube, DP cell for stack velocity, thermocouple for mass emission calculation
    - 150+ units installed globally
- General Emissions Monitoring
  - Models 919 single component, no-moving parts CEM
    - Most commonly measured component: SO_2
    - 100+ units installed globally since introduced in 2002, approx 75% as CEM analyzers (balance process monitoring applications)
  - Model 920 multi-component CEM
    - Common component combinations: multi-range SO_2, SO_2, $NO/NO_2/NOX$, H_2S
    - 300+ units installed globally

AMETEK Western Research HOT/WET System Integration

- Adding Additional Analyzer Technologies
  - Flow (pitot tubes, optical, ultrasonic)
  - Opacity
  - CO/CO2 (IR)
  - Oxygen (various technologies, e.g. zirc oxide, TDLAS etc)
- Adding Data Acquisition Systems and PLC Control
  - Various experienced suppliers (Honeywell, Vims, WTC, Vivicom etc)
  - PLC (Allen Bradley, Schneider, Siemens etc), when applicable
- Adding Utilities
  - Compressors, HVAC, gas detection, cal manifolds, user interfaces etc

AMETEK Western Research Model 910 SO2/NO/NO2 Analyzer

- **Manufactured:**
  - Usually in a carbon steel, fiberglass cabinet or walk in shelter
  - Various probe configurations
  - Heated Sample Line
- **Certifications:**
  - General Purpose; NEC/CEC Class I, Div 2, Group C/D and ATEX II 2G (EEx p d)
- **Target Industries:**
  - Sulfur Recovery Units
  - Sulfuric Acid Plants
  - Power Generation Plants
  - Cement Kilns
  - Smelters
  - Pulp and Paper Manufacturing
  - Fluid Catalytic Cracker Stacks