

MERCURY MONITORING

ROLAND ZEPECK

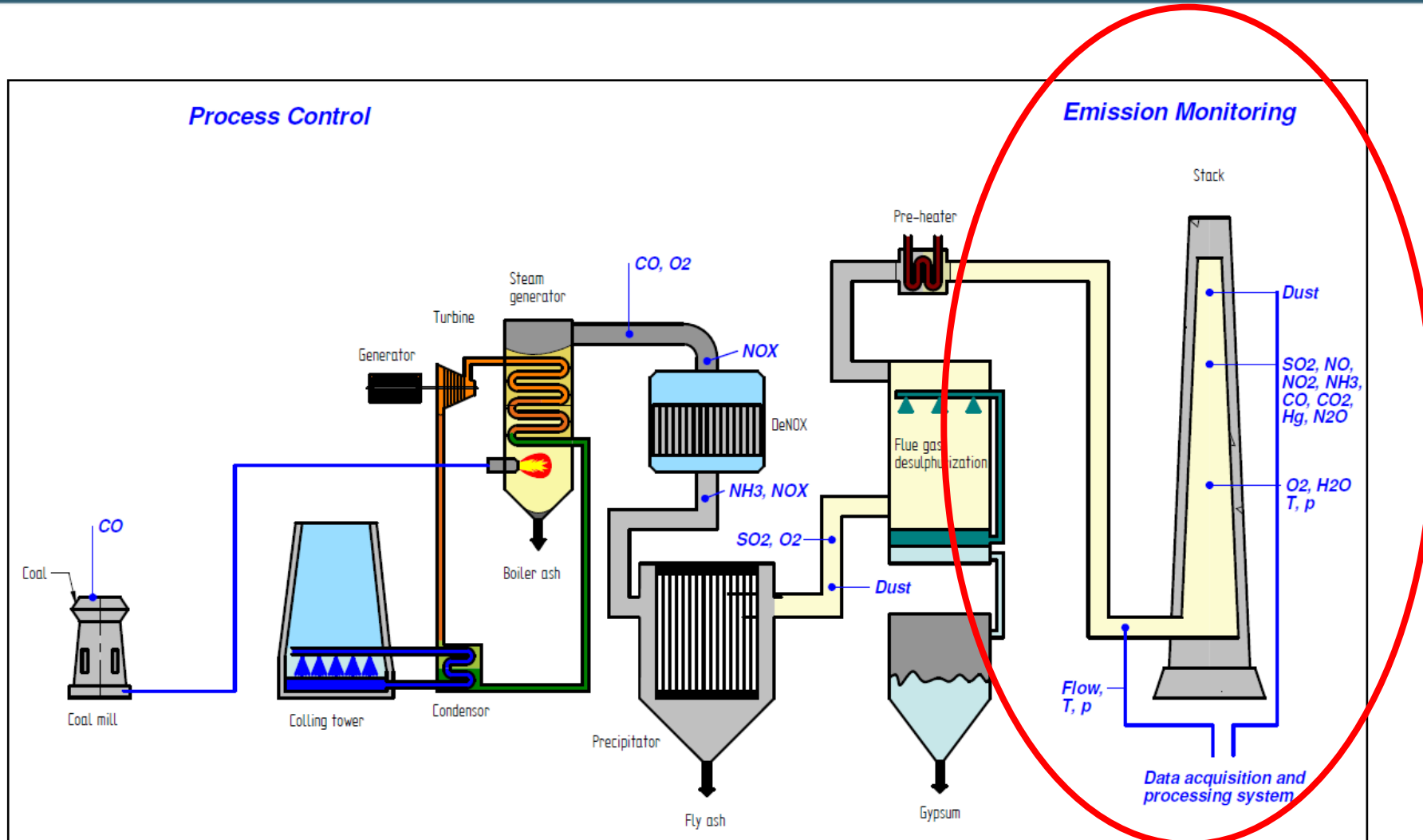
BHUBANESWAR, JULY 11TH – 13TH, 2022



INTERNATIONAL CENTRE FOR
SUSTAINABLE CARBON



WHERE DO WE NEED TO MEASURE ?



LEGISLATIVE MONITORING



BASICS-1

MERCURY is a special element with special compounds – *the only metal being liquid at room temperature.*

Hg^{±0}

Atomic Number: 80

Atomic Weight: 200.6

Melting Point: -38.84 °C

Boiling Point: 356.58 °C

Specific Weight @ 0 °C: 13.595

Saturation Concentration @ 0 °C: 15 mg/m³

Not water soluble

Compounds: Hg⁺¹, Hg⁺² - all are water soluble

Health effects: Hg and all compounds are very toxic; the human body is bio-accumulative to Hg and its compounds



BASICS-2

What is **Total Mercury (THg)**?

Sum of $\text{Hg}^{\pm 0}$ plus all its Hg^{+1} and Hg^{+2} compounds

Which are the sources of THg in emissions?

Waste: batteries, paint pigments, light bulbs, thermometers, seed dressing, preservative agents, and many more

Waste Water / Waste Water Sludge: dental fillings, wash-off of paint

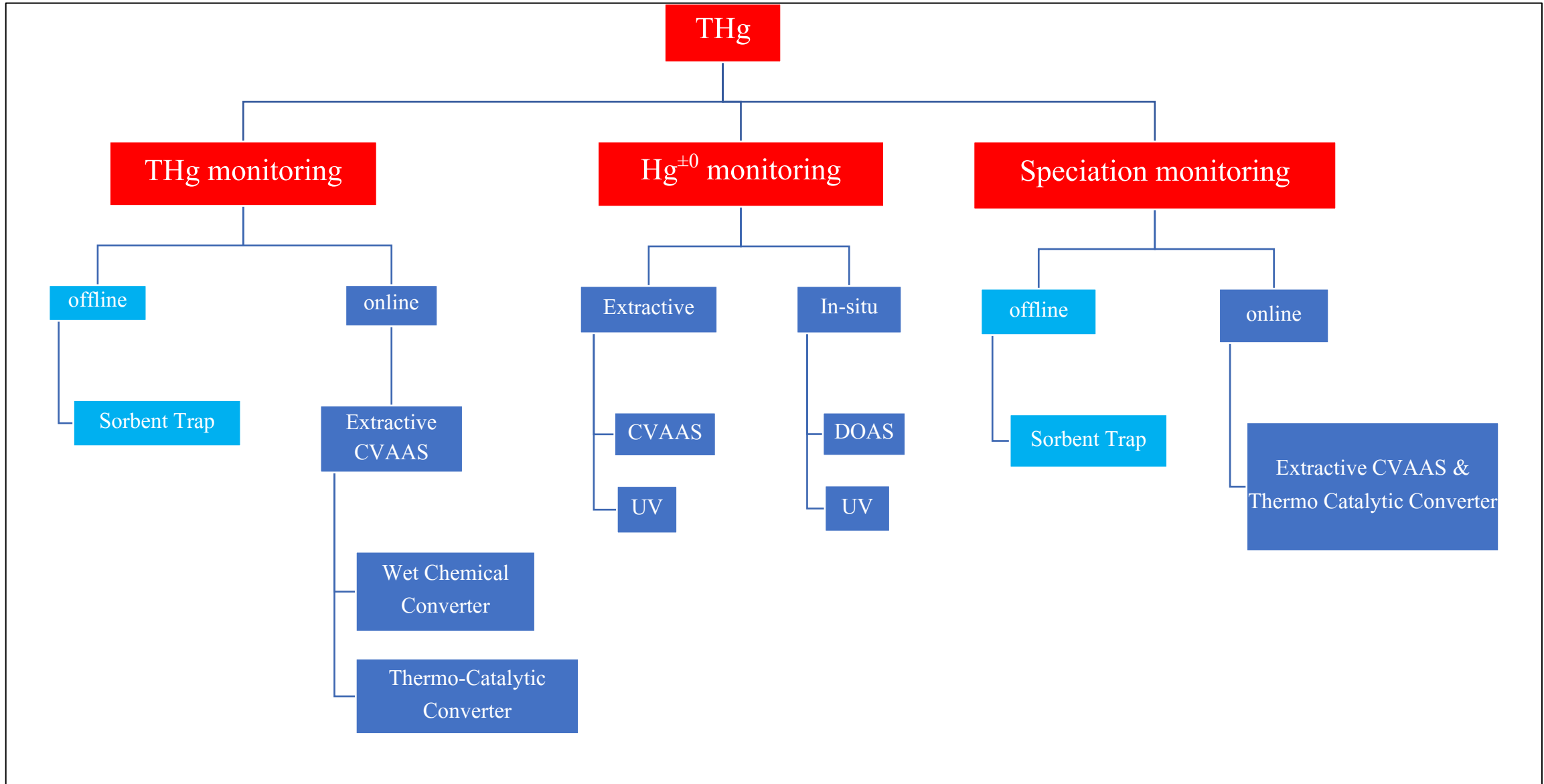
Power Plants: Natural Gas, Heavy Oil, Coal (as part of the “Salt Coal”)

What is so special about the monitoring of Total Mercury?

- ✓ It is the combined measurement of a multitude of compounds
- ✓ The concentration to be measured is *four to five orders of magnitude lower* than of any other pollutant



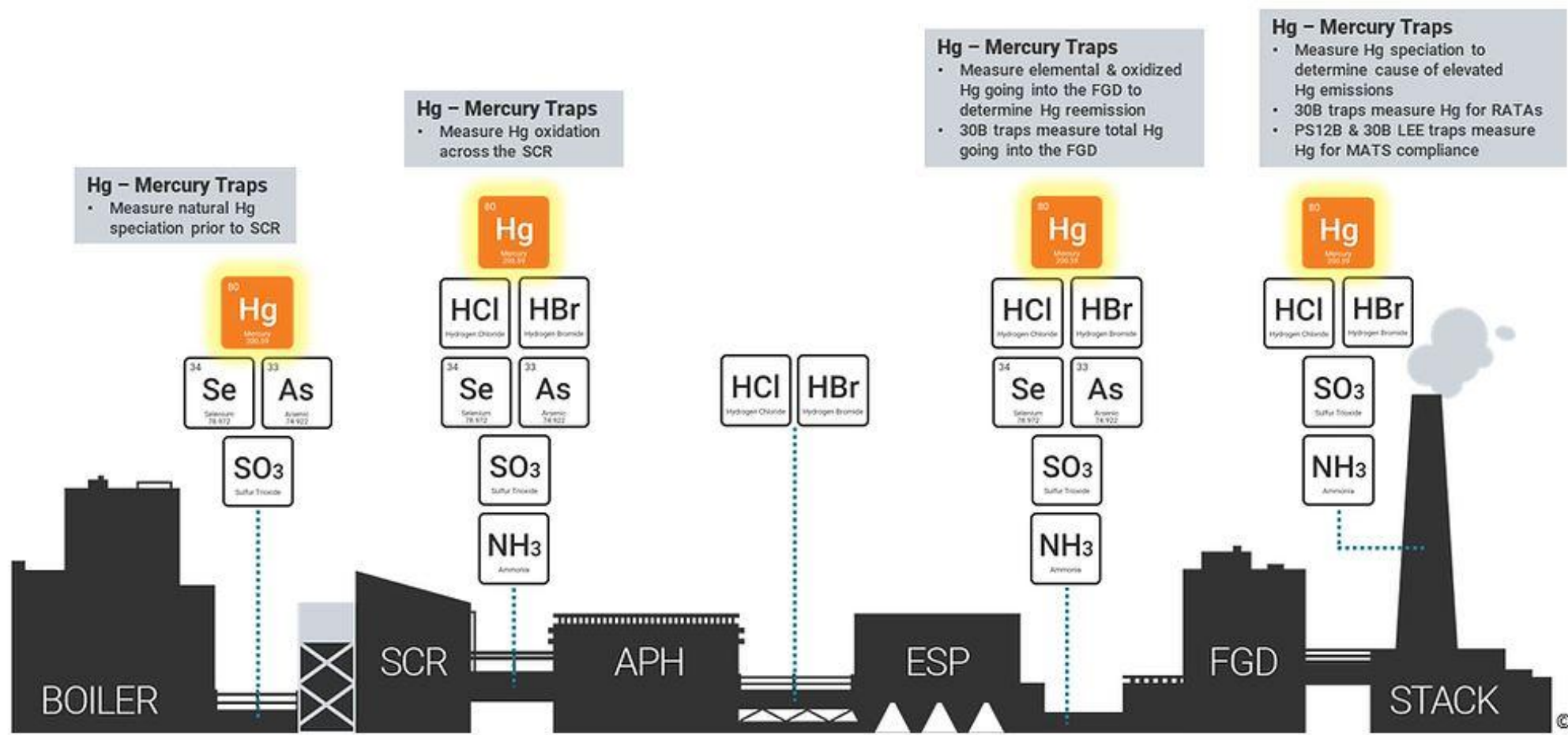
HOW TO MEASURE MERCURY?





ONLINE SAMPLING / OFFLINE ANALYSIS

Mercury Sorbent Trap Application Diagram





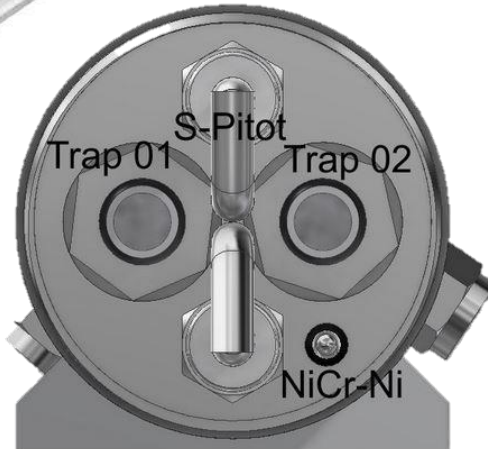
EXAMPLES



Hg Probe with S-Pitot acc. PS 12B/30B with two traps in heated section



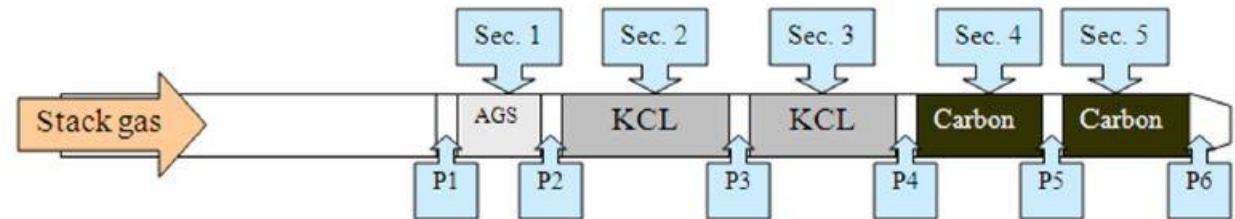
Hg traps



Method 30B Total Mercury



Hg Speciation Sorbent Trap



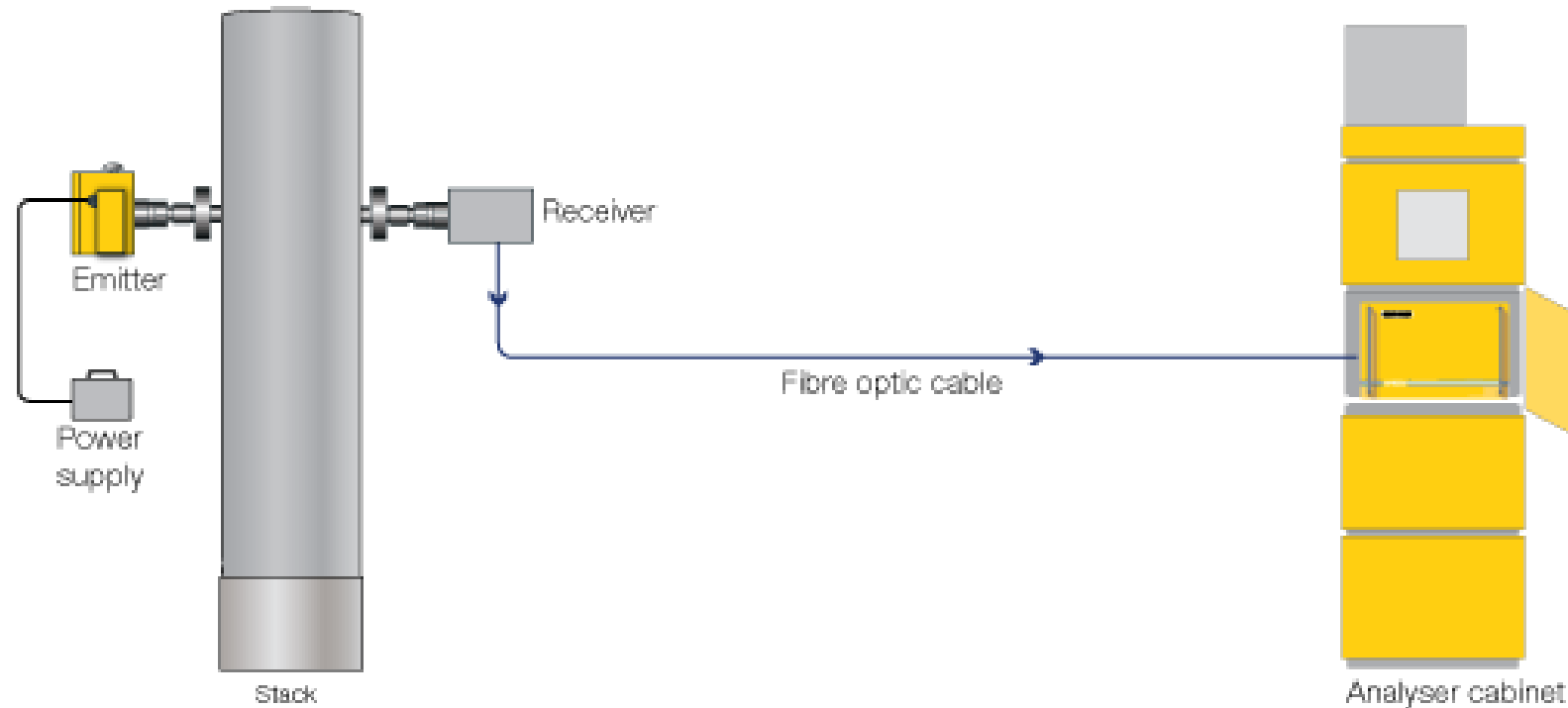
- | | |
|--------------------------------------|---------------------------------------|
| 1. Acid Gas Scrubber (AGS) | 4. Elemental Mercury Analytical Bed |
| 2. Oxidized Mercury Analytical Bed | 5. Elemental Mercury Breakthrough Bed |
| 3. Oxidized Mercury Breakthrough Bed | 6. P1-P6 (plugs in order) |



ONLINE MONITORING – IN-SITU

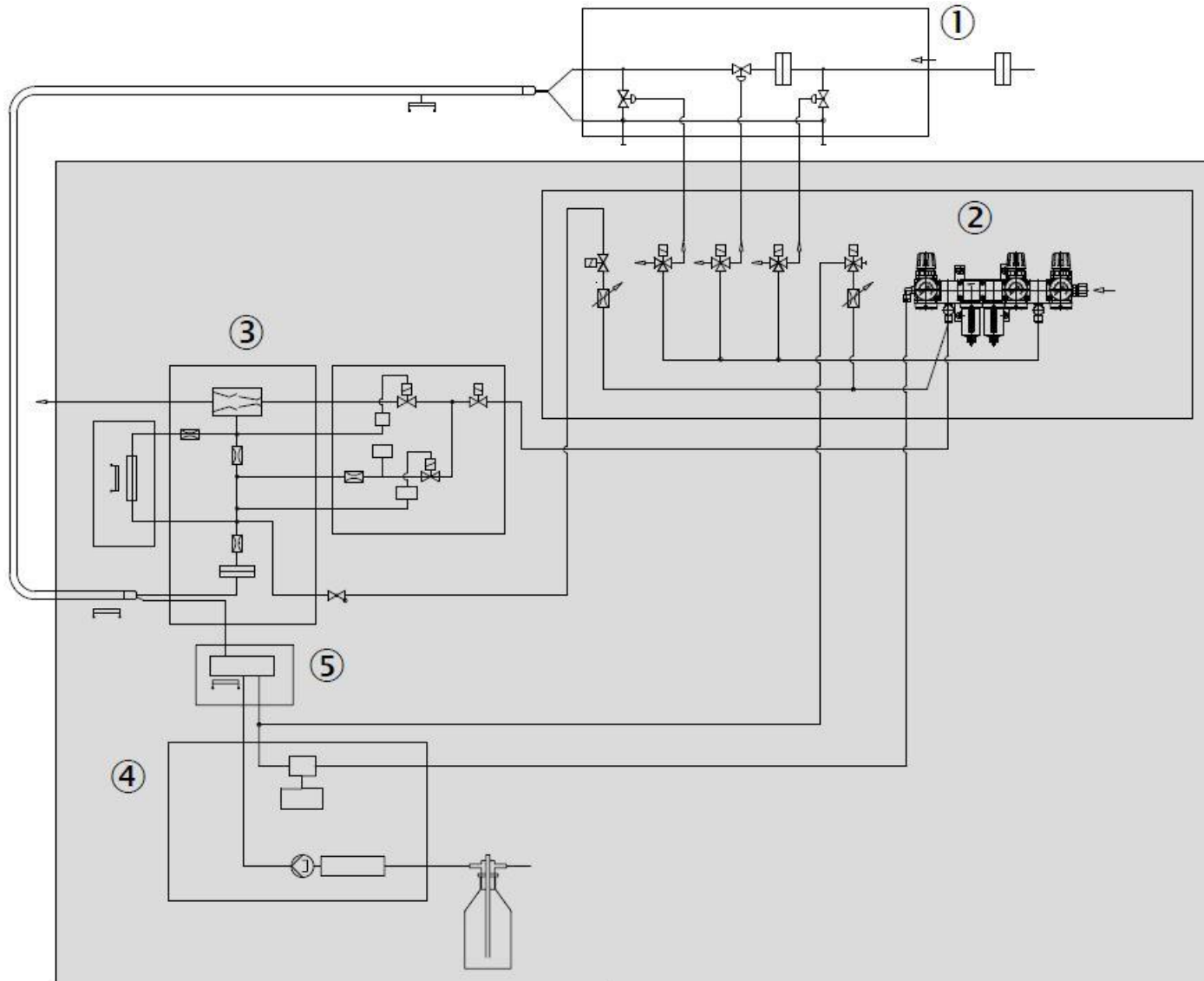
CEM systems measure multiple emissions or process gases in real time in situ. Using the UV / FTIR DOAS (Differential Optical Absorption Spectroscopy) technique, the system is non-contact, with fast response.

A basic system includes an analyser spectrometer, an emitter/receiver set, and an optical fibre cable & calibration gas cylinders.





ONLINE MONITORING – EXTRACTIVE

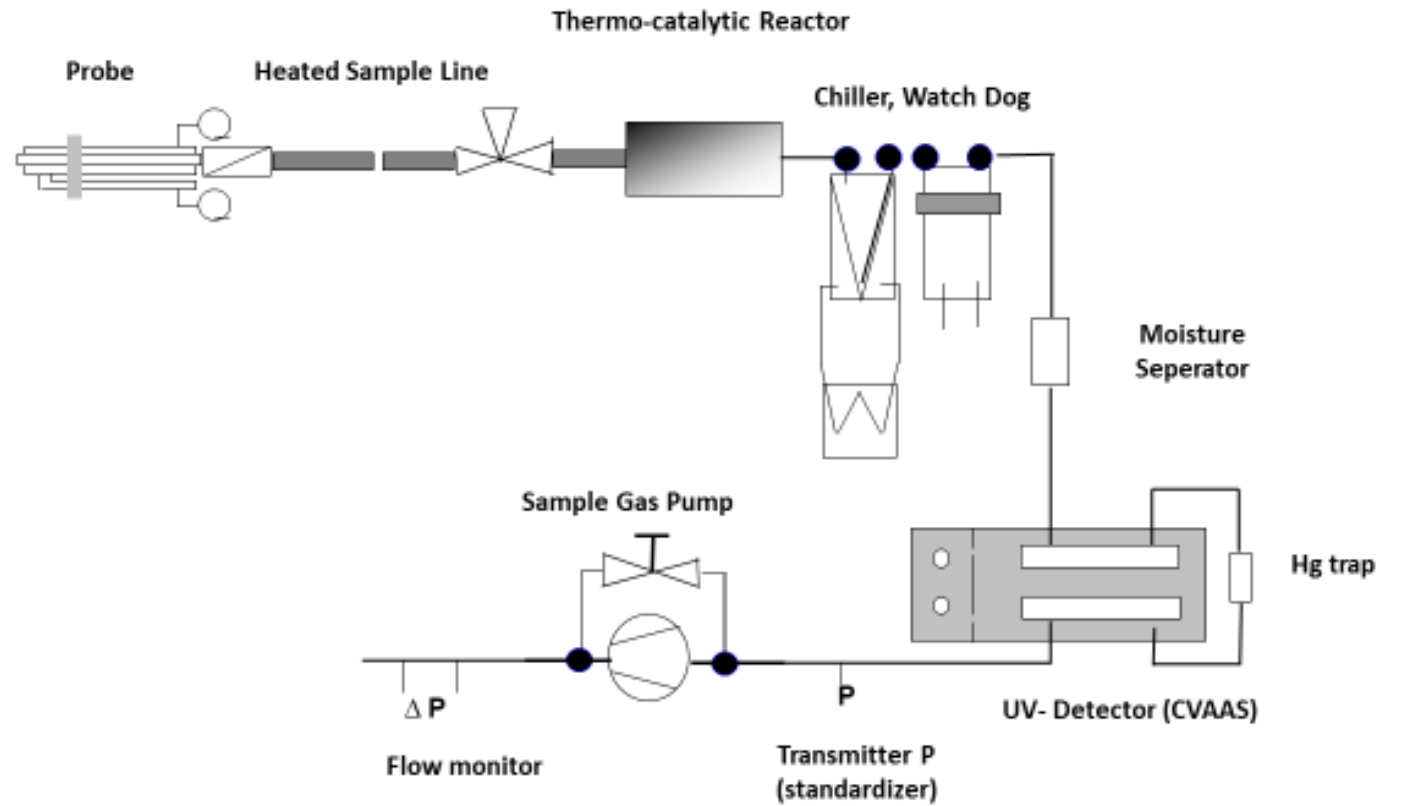


- 1 Gas sampling system
- 2 Instrument air conditioning
- 3 Thermal converter and cell
- 4 Test gas generator
- 5 Vaporizer (of test gas generator)



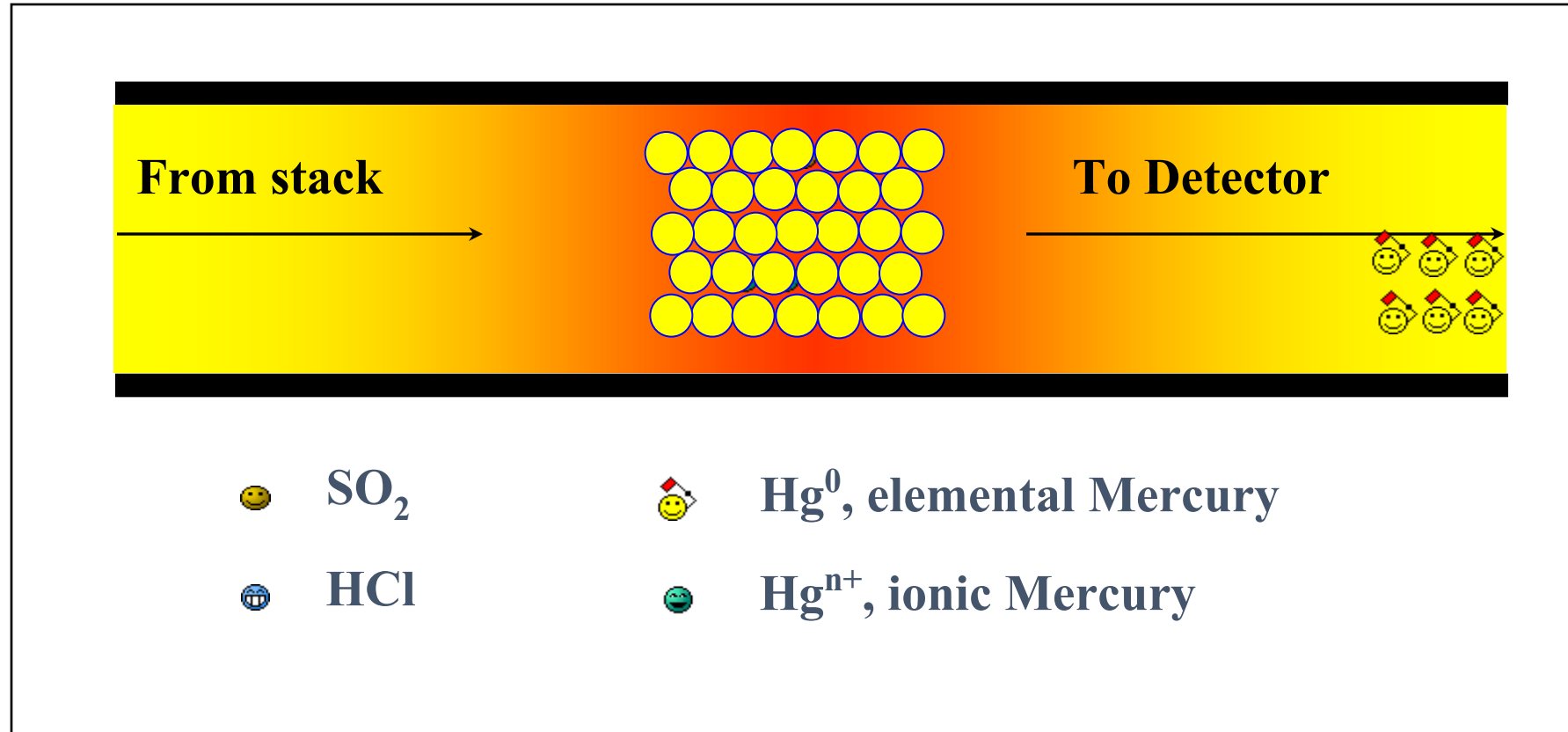


SCHEMATIC, PRINCIPAL OF OPERATION





THERMOCATALYTIC CONVERTER



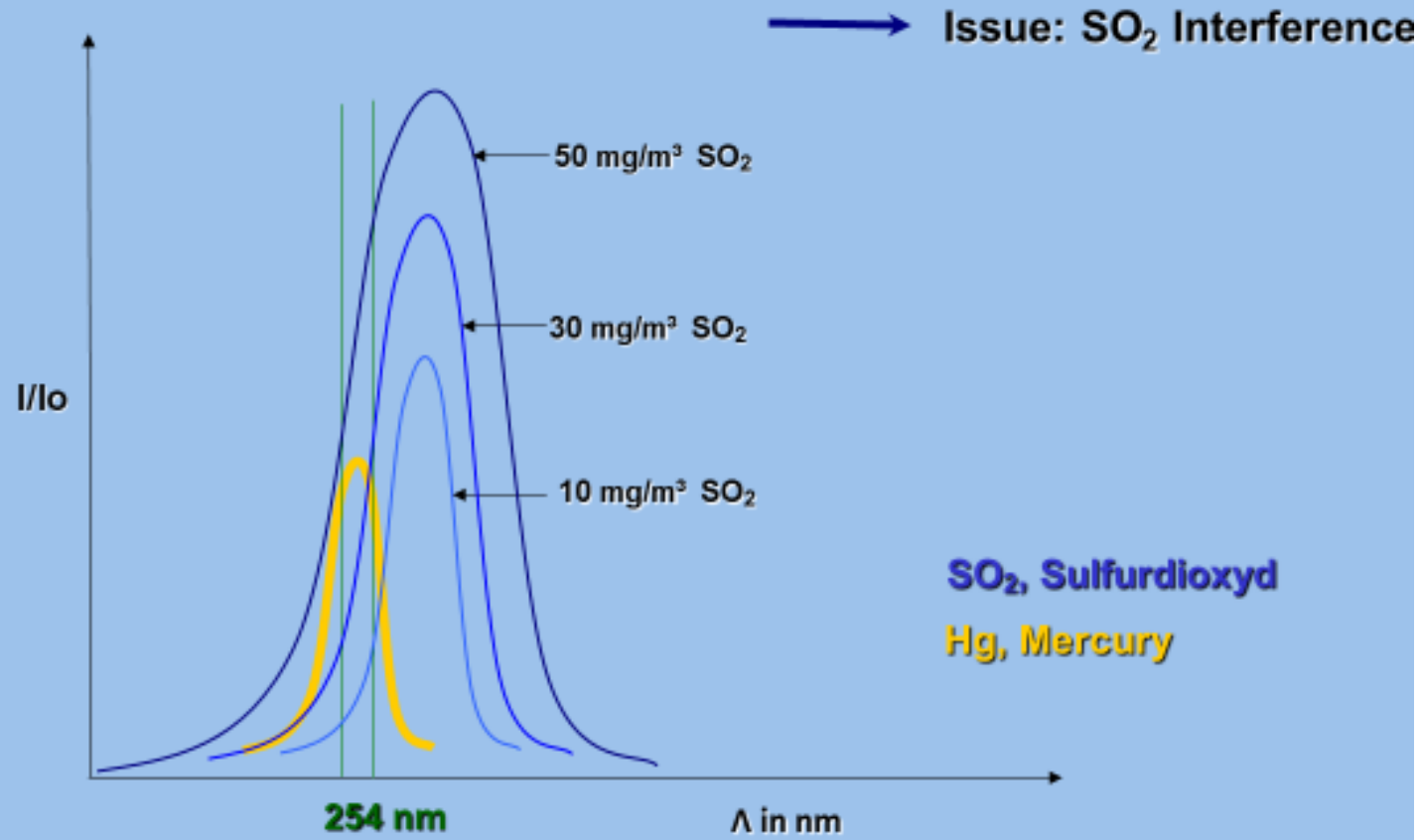


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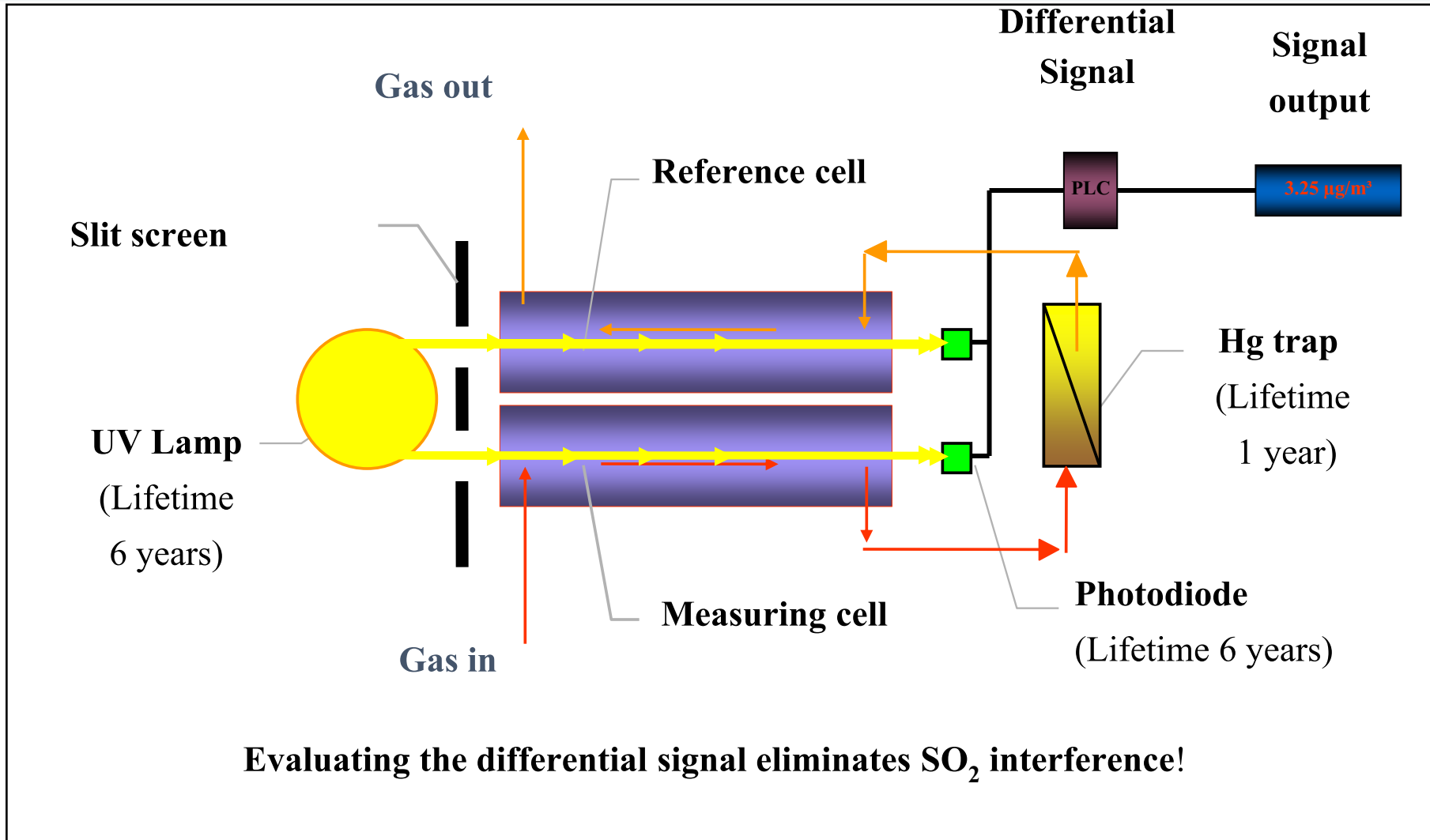
SO₂ INTERFERENCE

UV Detector





UV DETECTOR



Evaluating the differential signal eliminates SO_2 interference!



CALIBRATORS FOR SPAN CHECK, ELEMENTAL MERCURY

Peristaltic pump Cal gas out

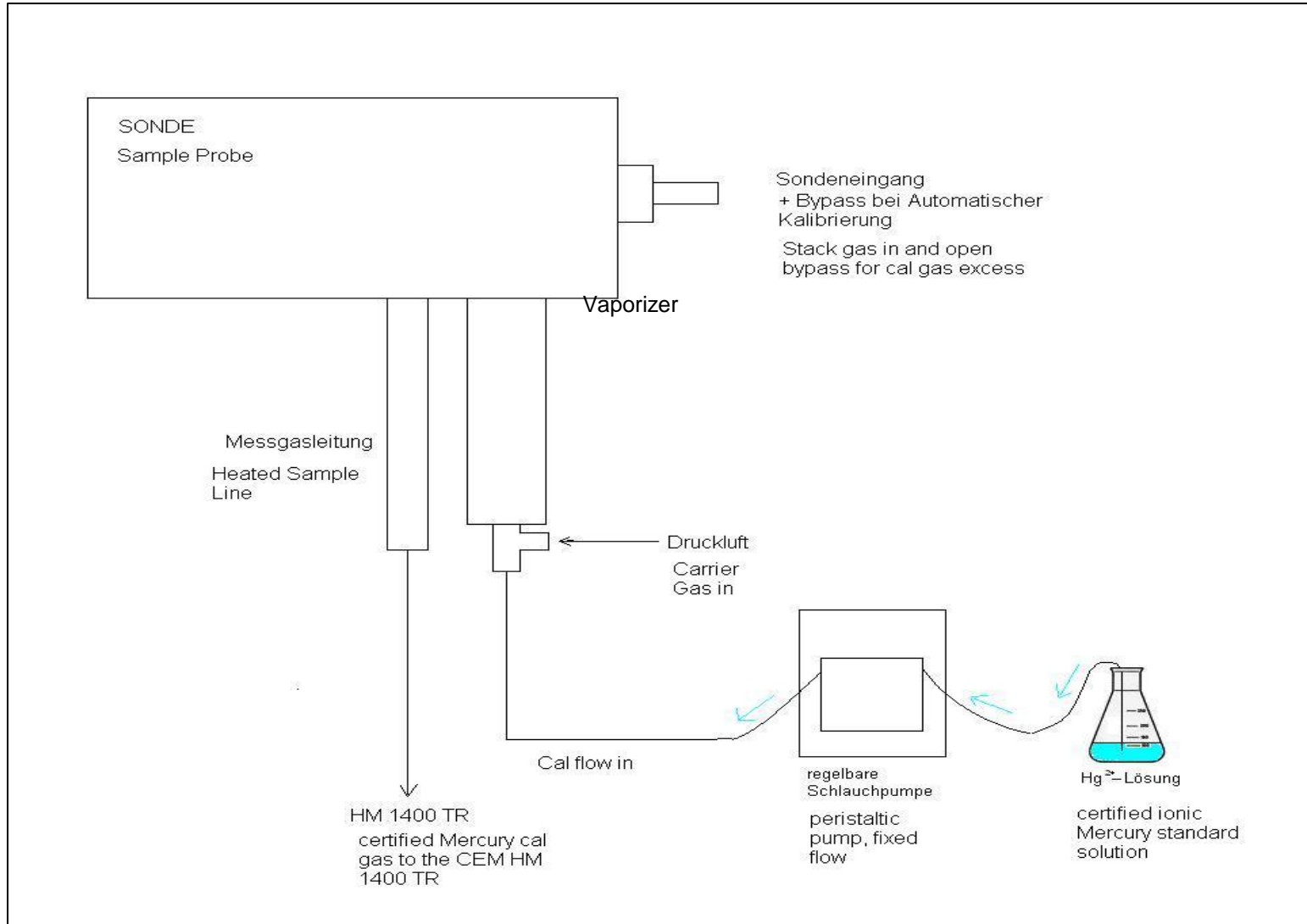
Ambient air in

Chemical reactions

Stannous
chloride
solved in
HCl



CALIBRATORS FOR SPAN CHECK, TOTAL MERCURY





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THANK YOU FOR LISTENING

ANY QUESTIONS?