WELCOME!

Introduction to Continuous Monitoring Systems

NACT 221

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Instructors

- John Doe
  - Title

- Jane Doe
  - Title

Course Introduction

Logistical Information

- Location of the restrooms, coffee, refreshments
- Emergency evacuation information

01 Name
02 Job Title
03 Expectation

INTRODUCTIONS

Course Goal

Upon completing this course, you will gain a basic understanding of Continuous Monitoring Systems (CMS). You will be able to use the knowledge gained on the following topics to assess the accuracy of CMS data and the ongoing compliance of sources monitored by CMS:

- Types and purposes of CMS
- Review of regulatory basis for CMS
- Overview of enforcement aspects for CMS

These topics are covered through three separate modules.

Course Learning Objectives

At the end of this course, learners will be able to:

- Understand the purpose of CMS and different types and uses of CMS
- Identify the regulations that contain CMS requirements
- Recognize enforcement aspects of CMS

Course Materials

You should have the following course materials:

- Participant Guide
- Handouts
    - Master glossary
    - General provisions
    - Properties of light
    - Commonly used technologies
    - General categories of CMS
    - Pre and post self-assessment

Course Schedule

Scheduled Time	Module	Duration
8:30 am – 9:00 am	Introductions	30 minutes
9:00 am – 10:45 am	Module 1	105 minutes
10:45 am – 11:00 am	Break	15 minutes
11:00 am – 11:30 am	Module 2	30 minutes
11:30 am – 12:00 pm	Module 3	30 minutes
12 pm – 1:00 pm	Lunch	60 minutes
1:00pm-1:30pm	Module 3, continued	30 minutes
1:30pm-4:00 pm	Site visit	150 minutes
4:00pm-5:00pm	Post-Training Assessment and Exam	60 minutes
	Total:	510 minutes (8.5 hours)

Module 1: Purpose and Types of CMS

Module 1 Outline

- What are CMS and why are they important
- Basis for CMS programs
- Types and uses of CMS
- Considerations for choosing a CEMS location

Module 1 Learning Objectives

- Describe different types and uses of CMS
- Define opacity and describe how continuous opacity monitoring systems (COMS) are used
- Recognize the pollutant parameters measured by continuous monitoring systems (CMS)
- Describe the components of continuous emission monitoring systems (CEMS)
- Distinguish between extractive and in-situ systems
- Describe how predictive emission monitoring systems (PEMS) are used
- Describe how continuous emission rate monitoring systems (CERMS) function
- Describe CEMS location and siting considerations

What are CMS?

Continuous monitoring systems (CMS) **means "the total equipment, required under the emission monitoring sections in applicable subparts, used to sample and condition (if applicable), to analyze, and to provide a permanent record of emissions..."*****40 CFR Part 60***

Why CMS?

CMS are required under some of the EPA regulations for either continual compliance determinations or determination of exceedances of the emissions standards.

The individual subparts of the EPA rules specify the reference methods that are used to substantiate the accuracy and precision of the CMS.

Basis for CMS Programs

- As a result of the Clean Air Act (CAA), many pollution control devices such as baghouses, scrubbers, and electrostatic precipitators have been installed.
- After the equipment is installed and operating, an air pollution control agency needs to know if the equipment is actually reducing emissions and if the facility is meeting its emissions standards.
- CMS programs are one of the methods used to measure emissions from stationary sources.

Basis for CMS Programs (Cont'd)

EPA established two methods to measure concentrations of pollutants from regulated sources:

1. EPA Reference Methods
2. CMS

Reference Methods

Reference methods are beneficial, but may have disadvantages when compared to using a CMS:

- Performed infrequently and for a relatively short period of time (hours)
- Often conducted when the source is operating under optimal conditions, which may not result in producing normal, day-to-day emission values

CMS

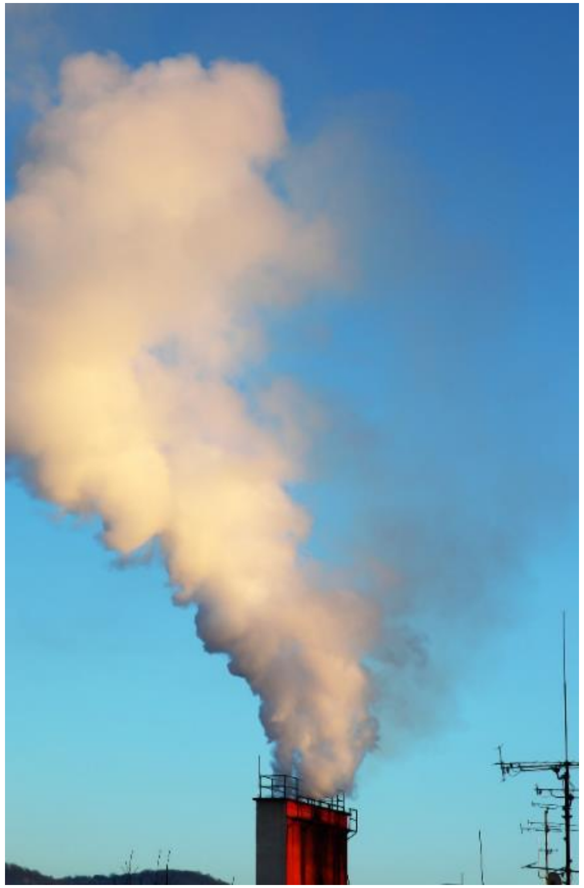
CMS have become an important part of a facility's compliance demonstration. The advantages of CMS are:

- DATA IS CONTINUOUSLY COLLECTED, IN MOSTLY REAL-TIME
- DATA IS AVAILABLE FOR ALL OPERATING CONDITIONS
- ALLOW REGULATORY AGENCIES TO DETERMINE CONTINUOUS COMPLIANCE

CMS Are Used To…

- Demonstrate compliance with regulations
- Generate data that can be used to develop regulations
- Improve emission databases
- Monitor control equipment operation
- Monitor process operating parameters
- Identify periods of excess emissions
- Assess control equipment efficiency
- Validate emission credits
- Provide public assurance

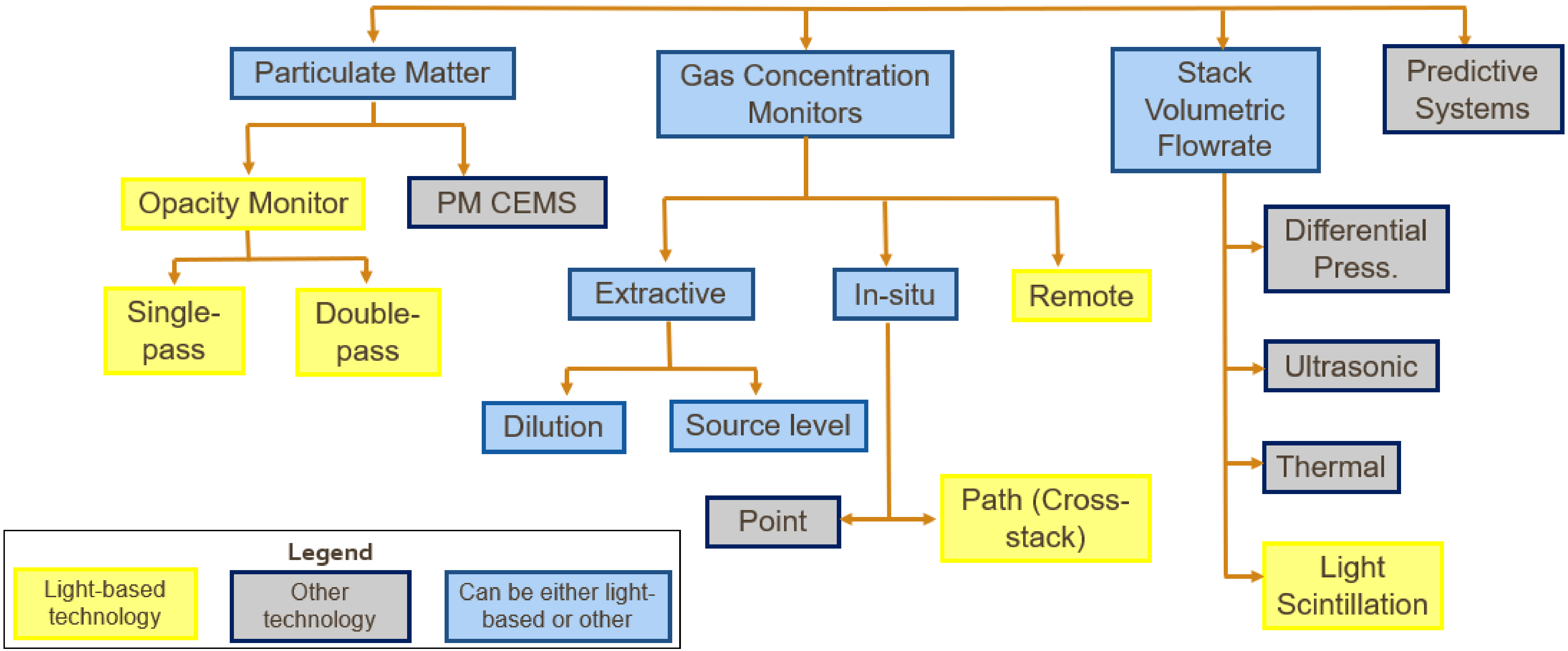
Pollutant Parameters



Continuous Monitoring Systems (CMS) may be used to measure the following:

- Opacity
- Sulfur Dioxide
- Nitrogen Oxides
- Carbon Dioxide
- Oxygen
- Carbon Monoxide
- Total Reduced Sulfur
- Stack Flow Rate
- Hydrogen Sulfide
- Volatile Organic Compounds
- Particulate matter
- Ammonia
- Mercury
- Hydrogen Chloride
- (And other pollutants or parameters)

General Categories of CMS



Types of CMS

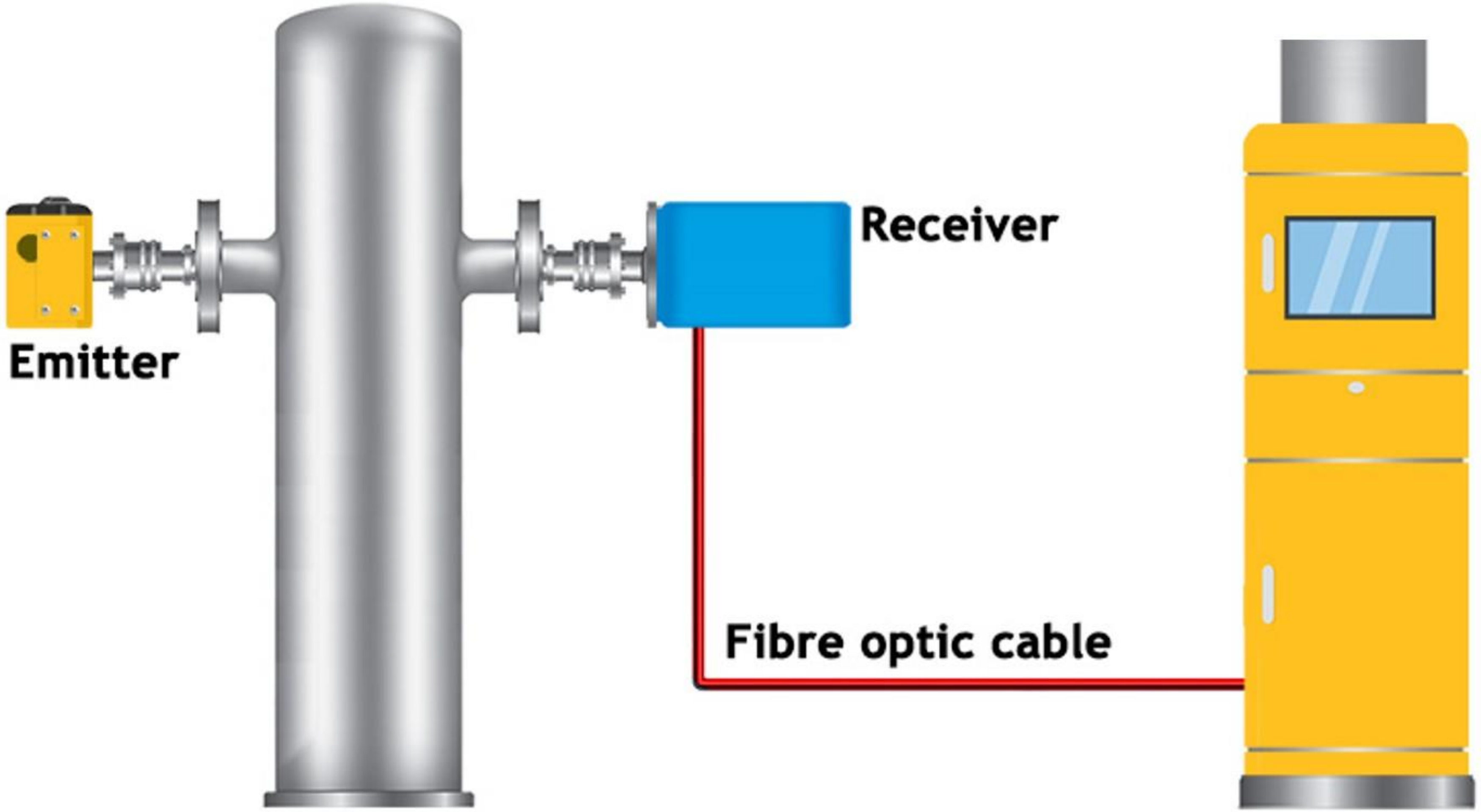
- The four types of CMS:
  - Continuous Opacity Monitoring Systems (COMS)
  - Continuous Emission Monitoring Systems (CEMS)
  - Predictive Emission Monitoring Systems (PEMS)
  - Continuous Emission Rate Monitoring Systems (CERMS)

Continuous Opacity Monitoring Systems (COMS)

COMS

- COMS consist of the **total equipment** used to sample, analyze, and provide a permanent record of opacity.
- COMS use light to determine opacity levels.
- Due to absorption and scattering of light by dust, smoke, and/or particulate present in the gas stream, there will be an attenuation of the transmitted light and a decrease in the light intensity that is measured.
- COMS can be “single pass” or “double pass”.

COMS: Illustrative Example



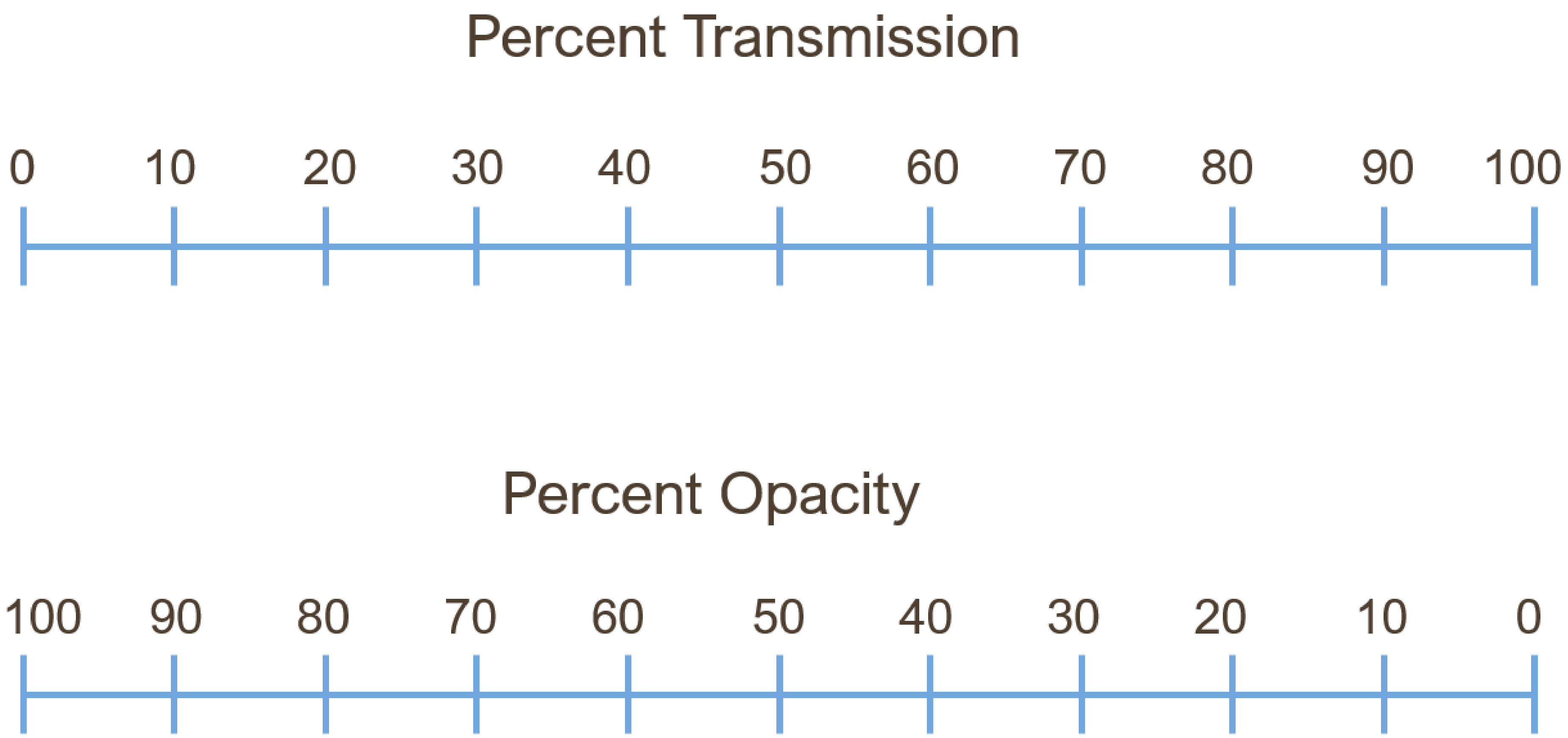
Opacity – Setting the Stage

- **OPACITY (Op)** → The percentage of light that is attenuated by an optical medium – in our case, the effluent gas stream.

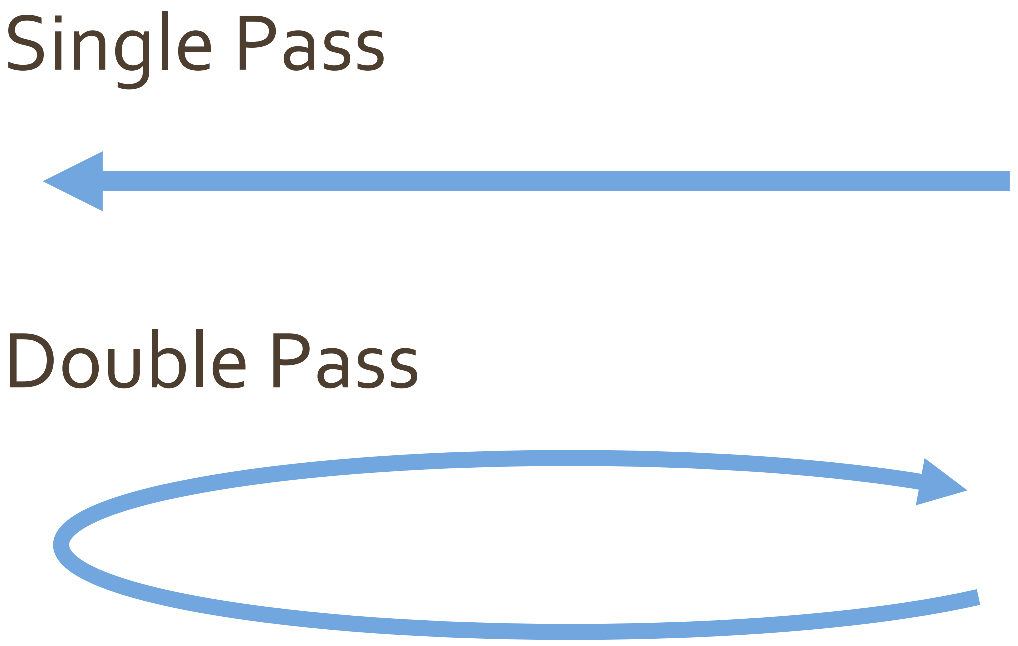
- **TRANSMITTANCE (Tr)**→ The percentage of light that is transmitted through an optical medium.

  Therefore, Op = 100 - Tr

Transmittance vs. Opacity



Single Pass and Double Pass COMS



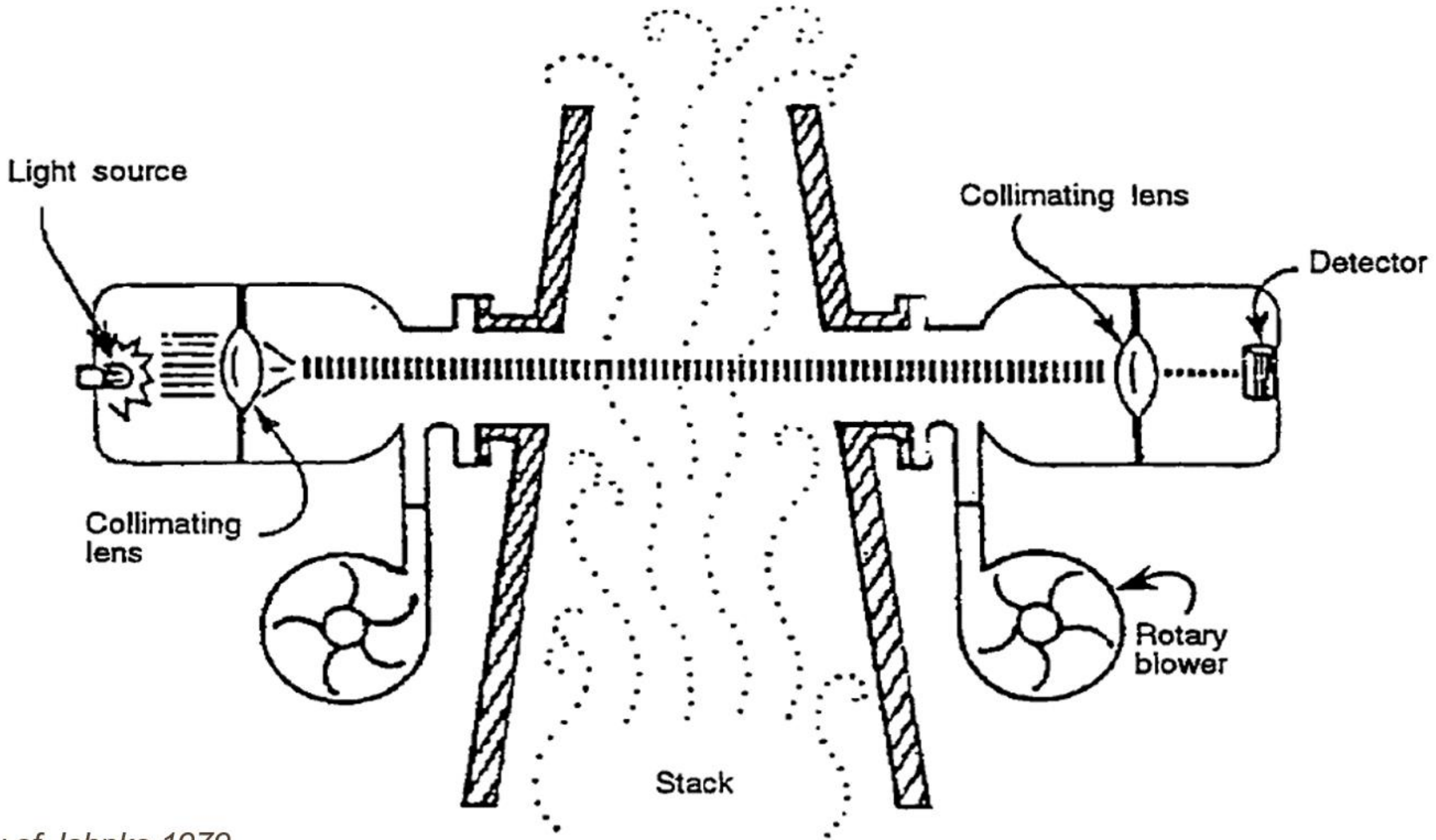
- Can be single pass or double pass design (double pass transmissometer).
- Most COMS used for compliance determinations are double pass, which use a light path that is twice the stack diameter.
- Require a means to calibrate and periodically (usually quarterly) audit the COMS.
- Most have a remote display and control panel in the facility control room or CEMS shelter.
- Must have a means to capture, average, and store data measured by the COMS.
- Must have means (most use air blowers) to keep stack gas from impinging on and potentially damaging the lenses of the COMS.

Transmissometry

Transmissometry

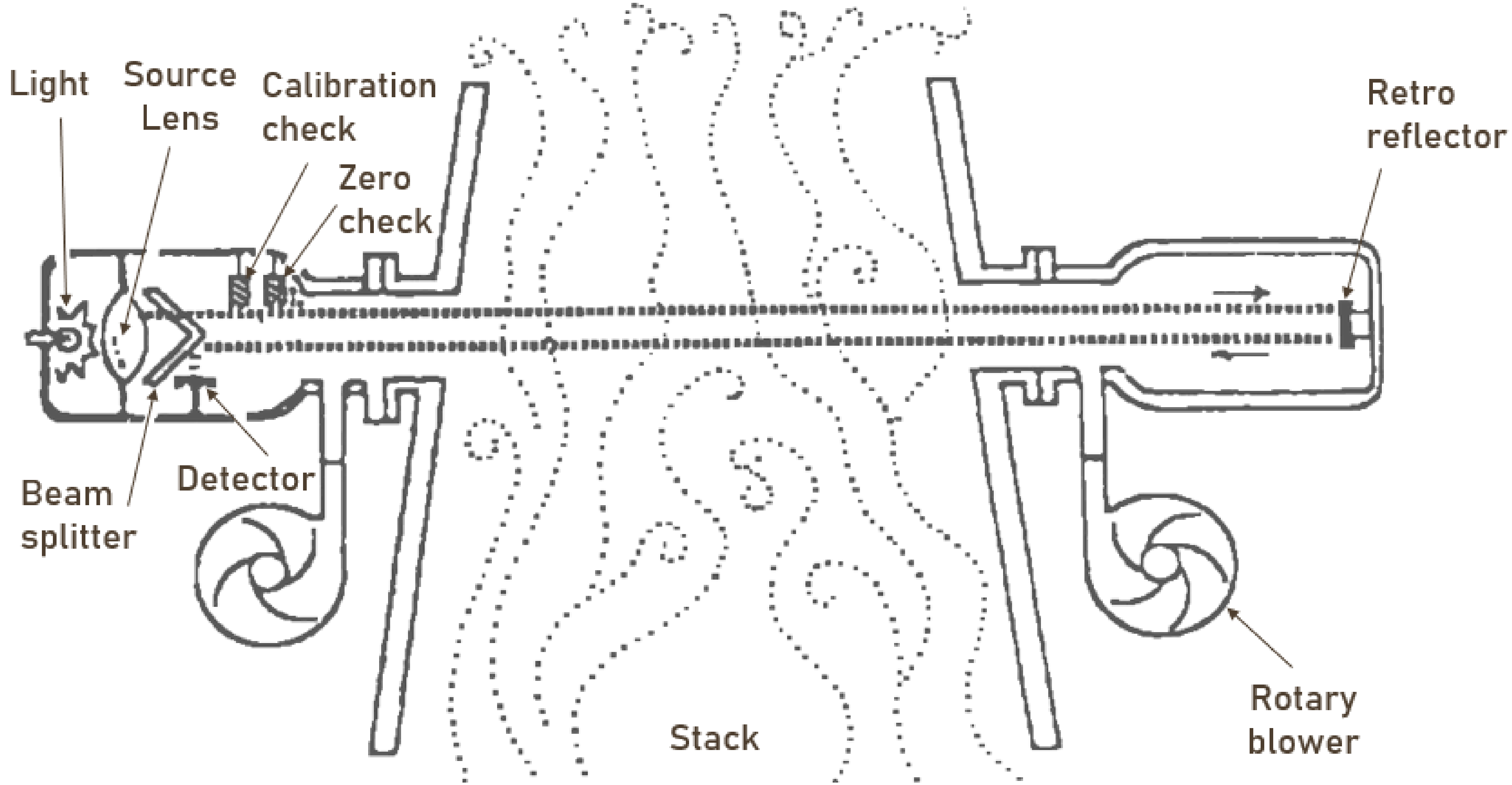
- The measurement of the amount of light that can be transmitted through a stack exhaust.
  - The intensity of the light is attenuated by scattering and absorption by PM in the stack exhaust.
  - The amount of attenuation is measured as percent opacity, and is a function of the amount, type, and distribution of PM in the stack gas.

Single Pass Transmissometer



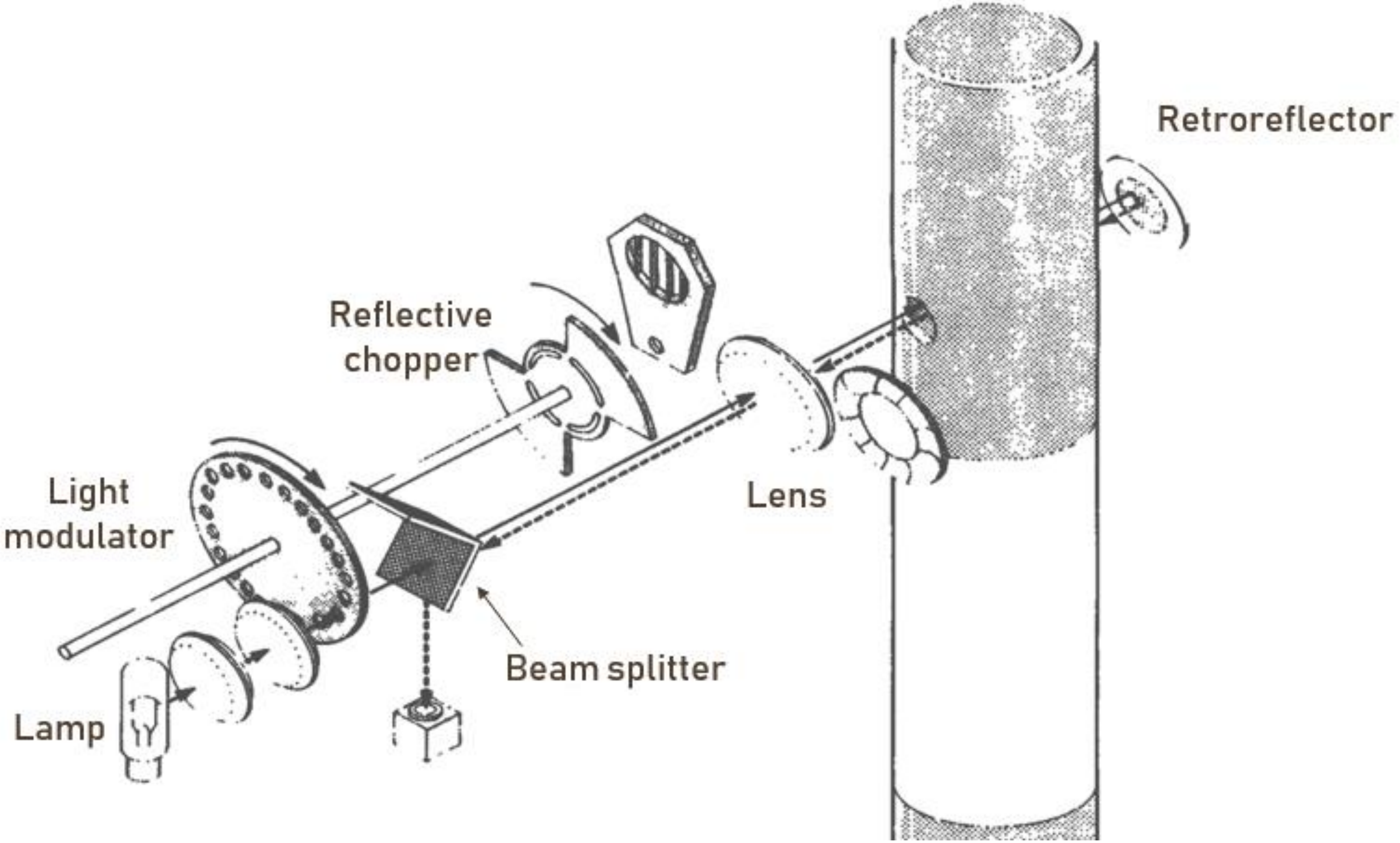
Courtesy of Jahnke 1979

Double Pass Transmissometer



Courtesy of Jahnke 1979

Double Pass Transmissometer (Cont'd)



Courtesy of Jahnke 1984

Typical Sources with COMS Requirements

- COMS are typically used by facilities that rely on waste materials, oil, coal, wood, or other fossils fuels for combustion.

- Examples of sources are:
    - Utilities
    - Boilers
    - Flares

Continuous Emission Monitoring Systems (CEMS)

CEMS Definition

CEMS consists of the **total equipment** necessary to determine a gas or particulate matter emission concentration.

Image courtesy of Thermo Fisher Scientific™

CEMS

CEMS:

- Continuously measures actual emissions from stationary sources by extracting a sample of gas from the emission source:
  - Sample gas may be extracted, filtered, transported, conditioned, or diluted before being presented to the analysis system.
  - Gas concentrations are measured, recorded, and stored as data.
- May also include components for measuring particulate matter, and stack gas flowrate

Basics of CEMS Design

CEMS can be divided into two general categories based on the means by which the sample gas is acquired (captured) and delivered to the analyzer:

1. Extractive systems

- Withdraw flue gas from the stack and transport the gas to analyzers.
- An extractive system may be either source-level or dilution.

2. In-situ systems

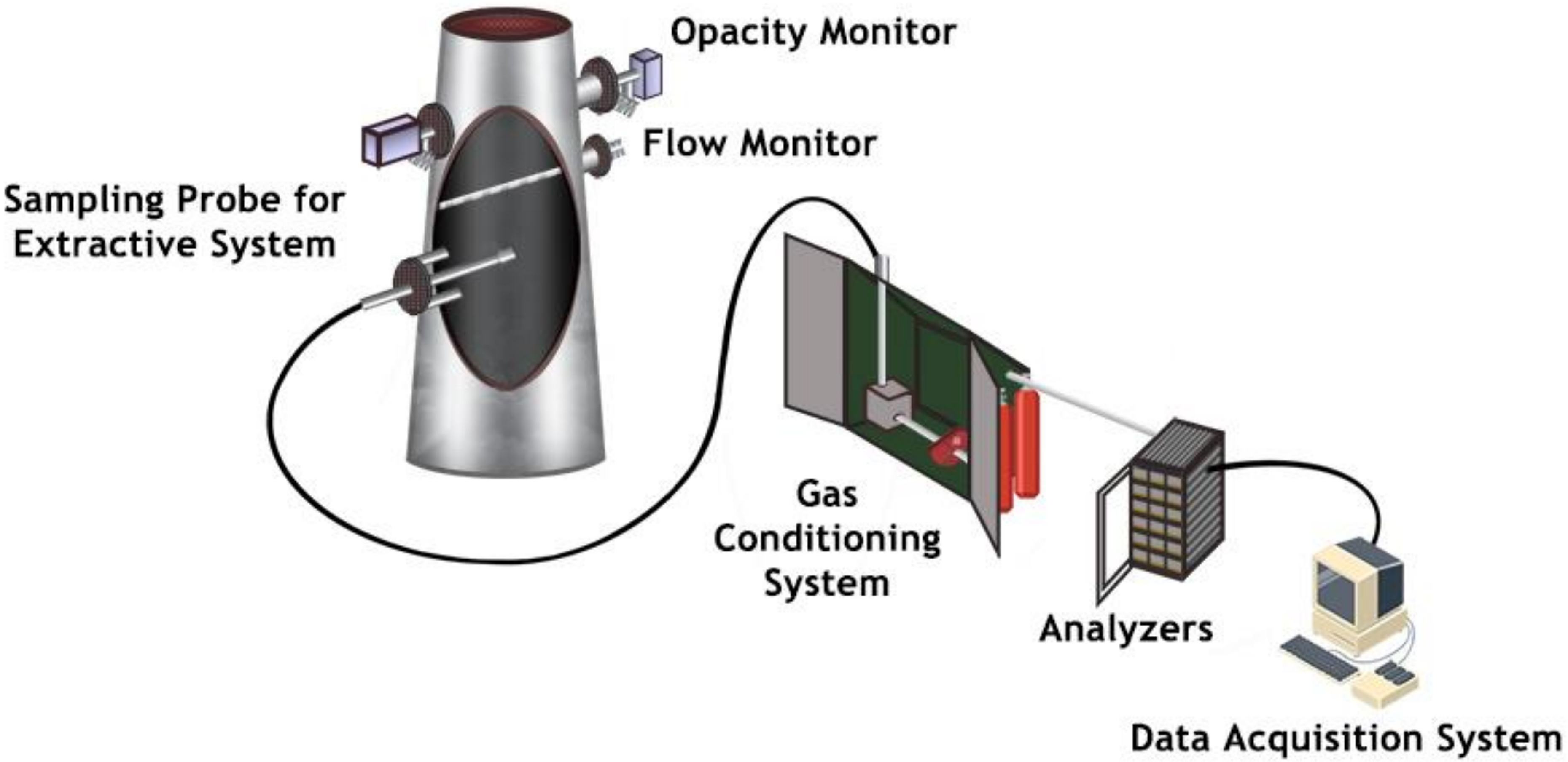
- Have at least some part of their analysis subsystem mounted in the stack in direct contact with the flue gas.

General Extractive System – Conditioning Cabinet

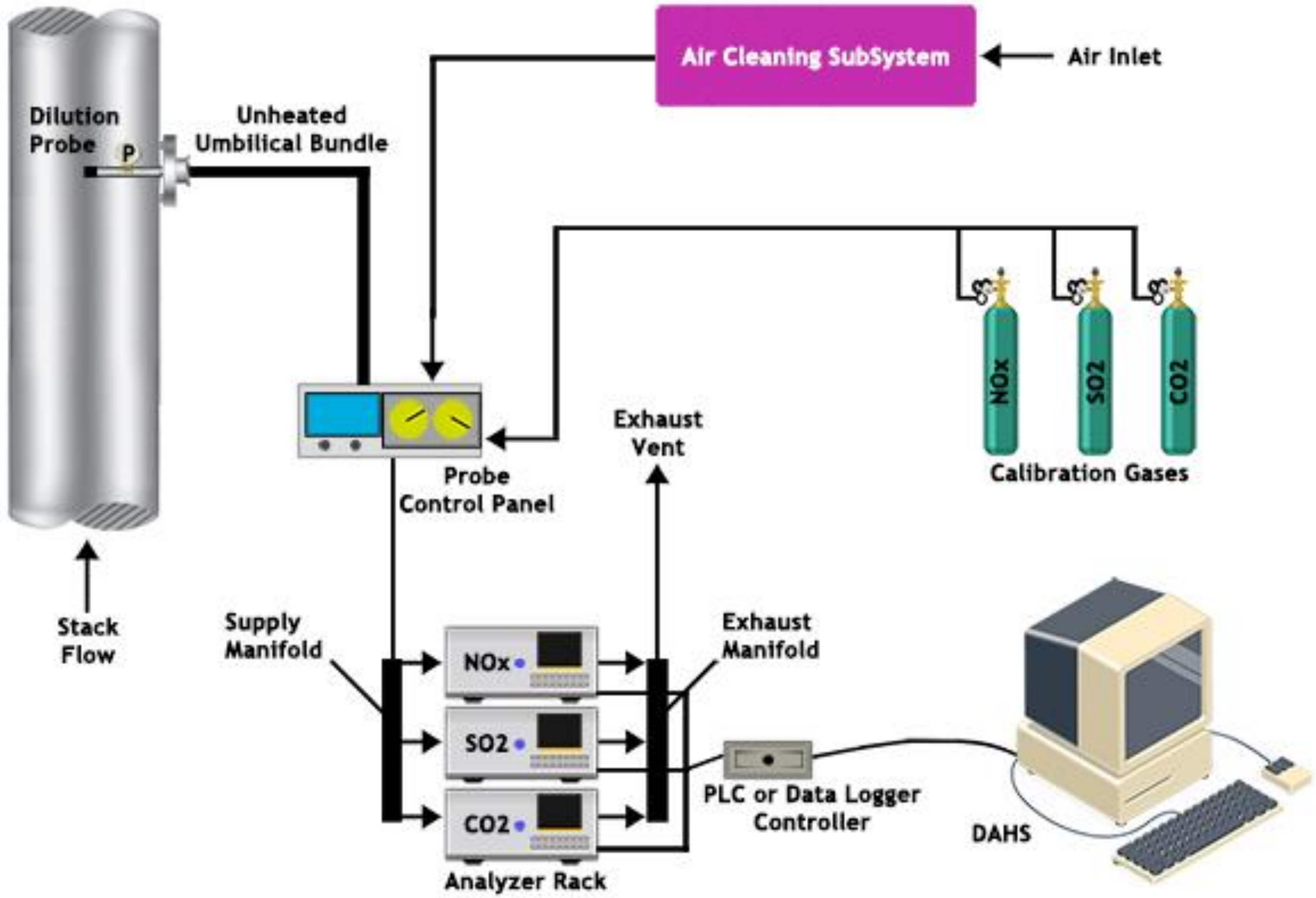
General Extractive System Components

- Probe
- Particulate Filter
- Sample Conditioning or Dilution
- Sample Line
- Pump
- Controller
- Analyzer
- Data Calculation and Storage

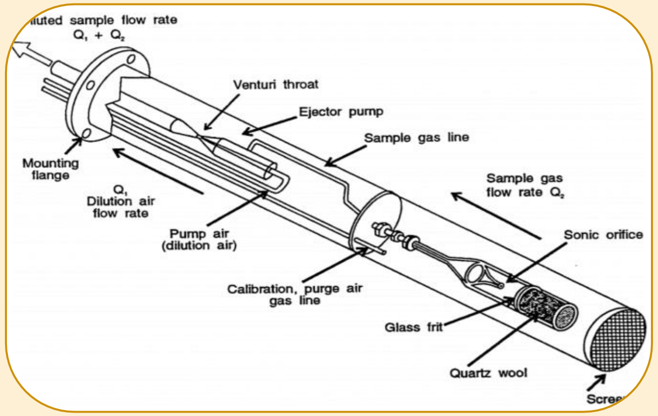
Source-Level Extractive System



Dilution Extractive Systems



Dilution Extractive Systems (Cont'd)



The sample gas is diluted with dry, contamination-free air to a level below the dew point of the diluted sample gas to eliminate condensation in the sample line.

- The diluted sample is measured by pollutant and CO_2 monitors operating at or near ambient concentration ranges to provide concentration measurements on a wet basis.

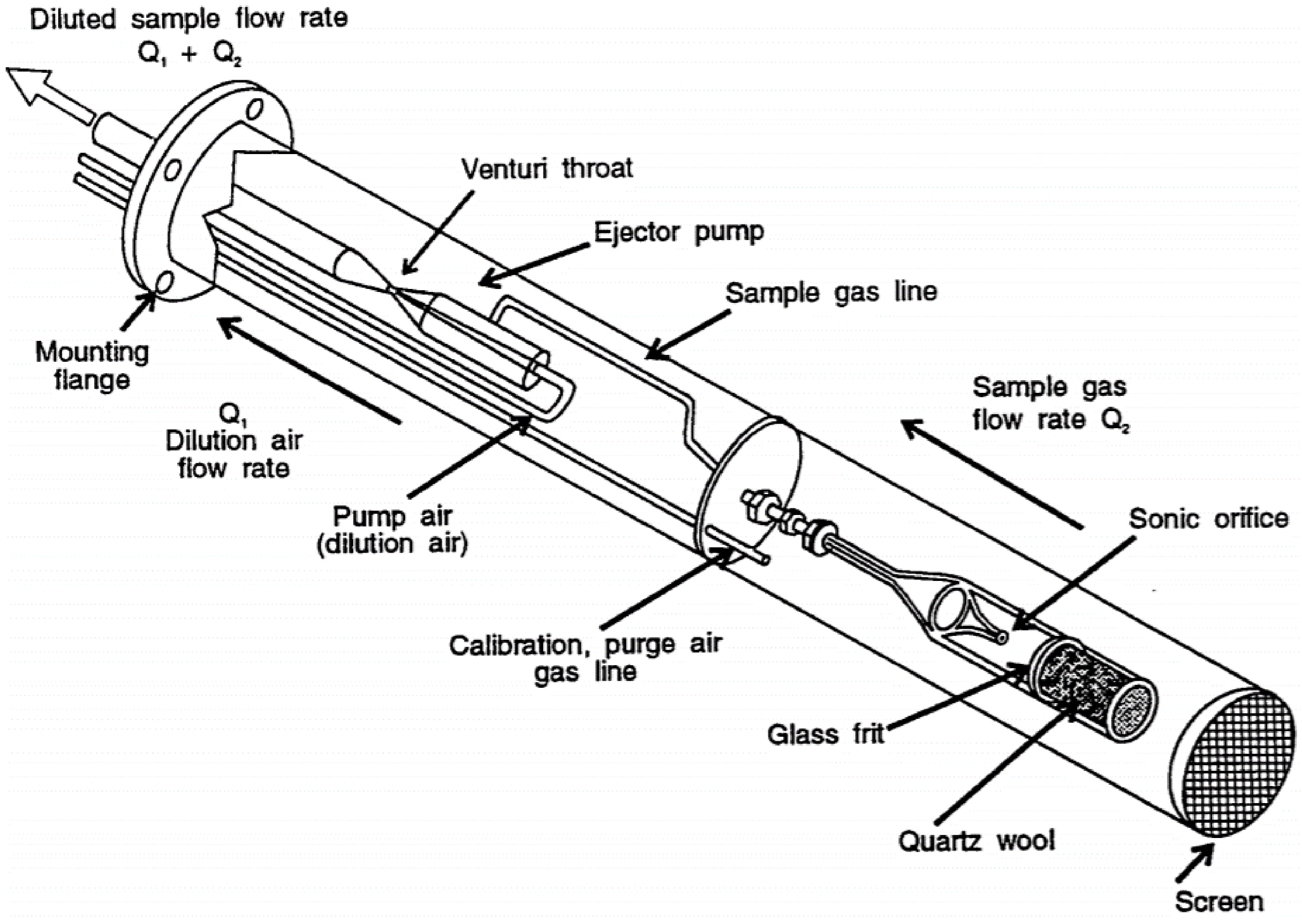
The concentrations are measured on a wet-basis. With a wet stack volume flowrate measurement, the pollutant mass emission rate can be calculated without a separate stack gas moisture measurement or assumption needed.

The most unique component of a dilution-extractive system is the dilution sampling probe.

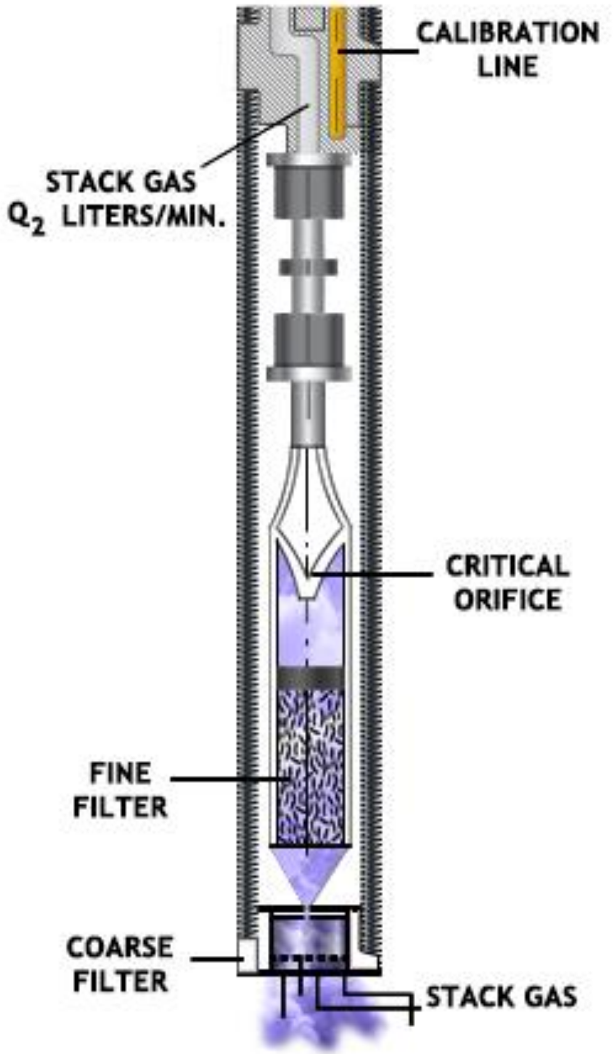
There are two types, depending on where the dilution occurs:

- In-stack
- Out of stack

Dilution Probe



Dilution Probe Orifice



In-Situ Systems

- Perform analysis at the stack
  - Lack of conditioning and transport sub-systems, hence, generally less equipment required than extractive systems

- EPA distinguishes between point and path monitors by the amount of gas stream that the probe is blocking.
  - Usually "very small" segment (point), or 1 or 2 diameters (path).

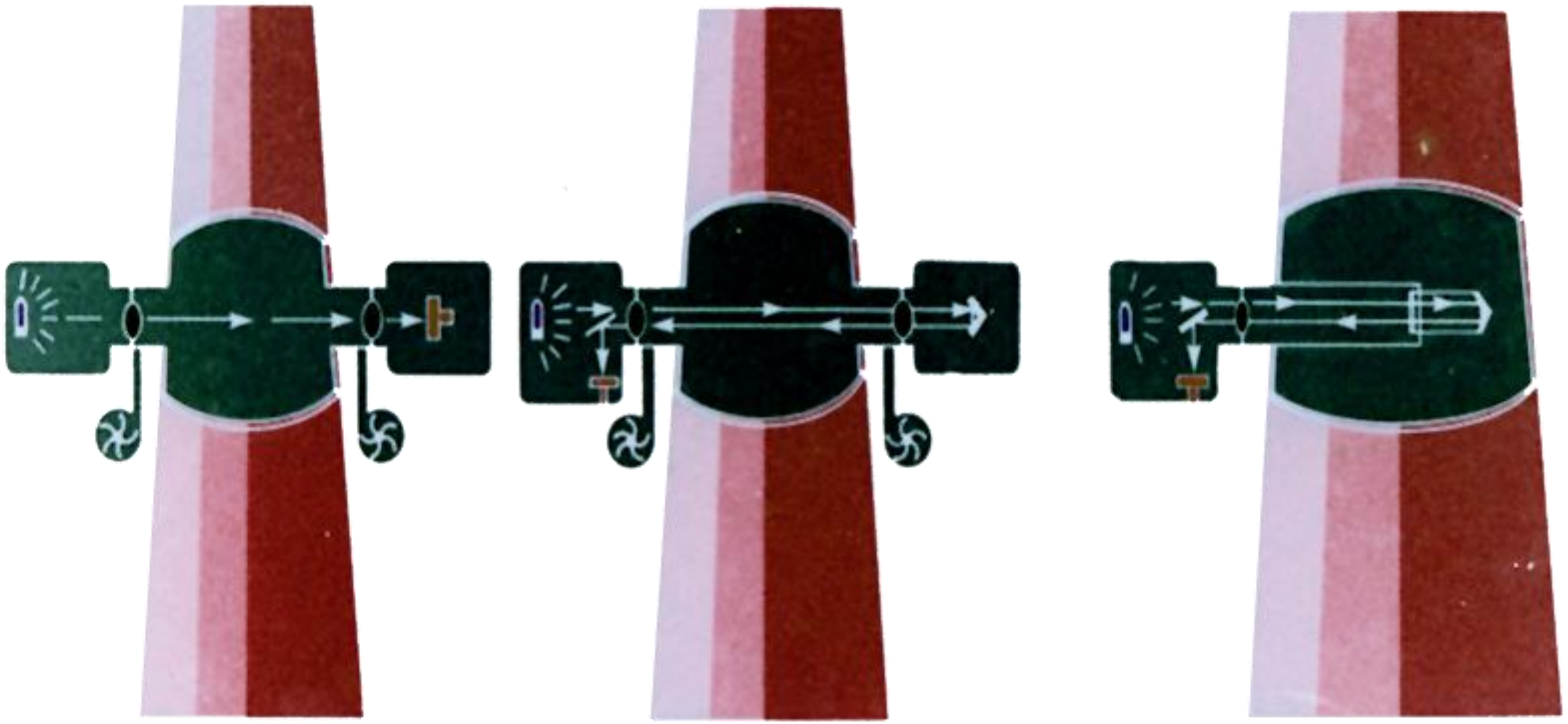
There are two types of in-situ systems:

- **Point systems** – monitor at a single point or along a very short path within the stack.
- **Path systems** (also called "cross stack") – monitor across a certain path of stack gas.

In-Situ Monitors

Cross-Stack (path)

In-Stack (point)



Single Pass

Double Pass

Advantages of Extractive Systems

- ✓ Analyzers can be installed in an accessible, clean environment
- ✓ Ease of maintenance
- ✓ Time sharing capability
- ✓ Allows widest selection of analyzer technologies
- ✓ Can combine more than one analyzer
- ✓ Can remove interfering substances before measurement
- ✓ Gas is measured on a dry or wet basis depending on design

Disadvantages of Extractive Systems

- Expensive to install and operate. It has high power requirements and potential for plugged lines, leaks and condensation (water and acid).
- Sample gas conditioning or dilution is required
- May alter sample, may inadvertently remove substances of interest from sample gas
- Response time of the sampling system may be slow
- Has lots of components and a complicated design
- Analyzer may have time-lag with high concentrations

Advantages of In-Situ Systems

Advantages

Fast response time
No sample transport or conditioning
Simple, less expensive installation
Less equipment to buy and maintain
Has few components

Disadvantages

Vibration sensitive
Access for service and maintenance can be difficult
Limits choice of analyzer
Does not allow for expansion
Operates in a potentially harsh environment
Path type may not be able to be located downstream of sorbent injection or spray dryer systems

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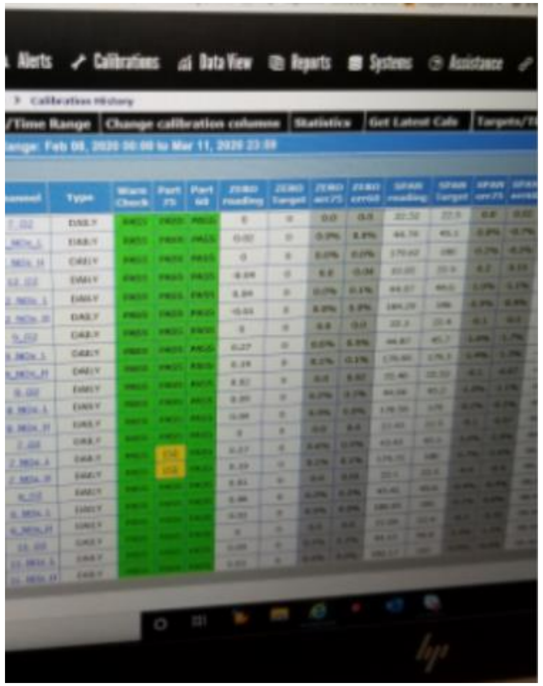
Major Components of CEMS

- Sample Probe
- Filter
- Sample Line (umbilical)
- Gas Conditioning System
- Calibration Gas System
- Gas Analyzers (may include more than one)
- Data Acquisition Systems (DAS)

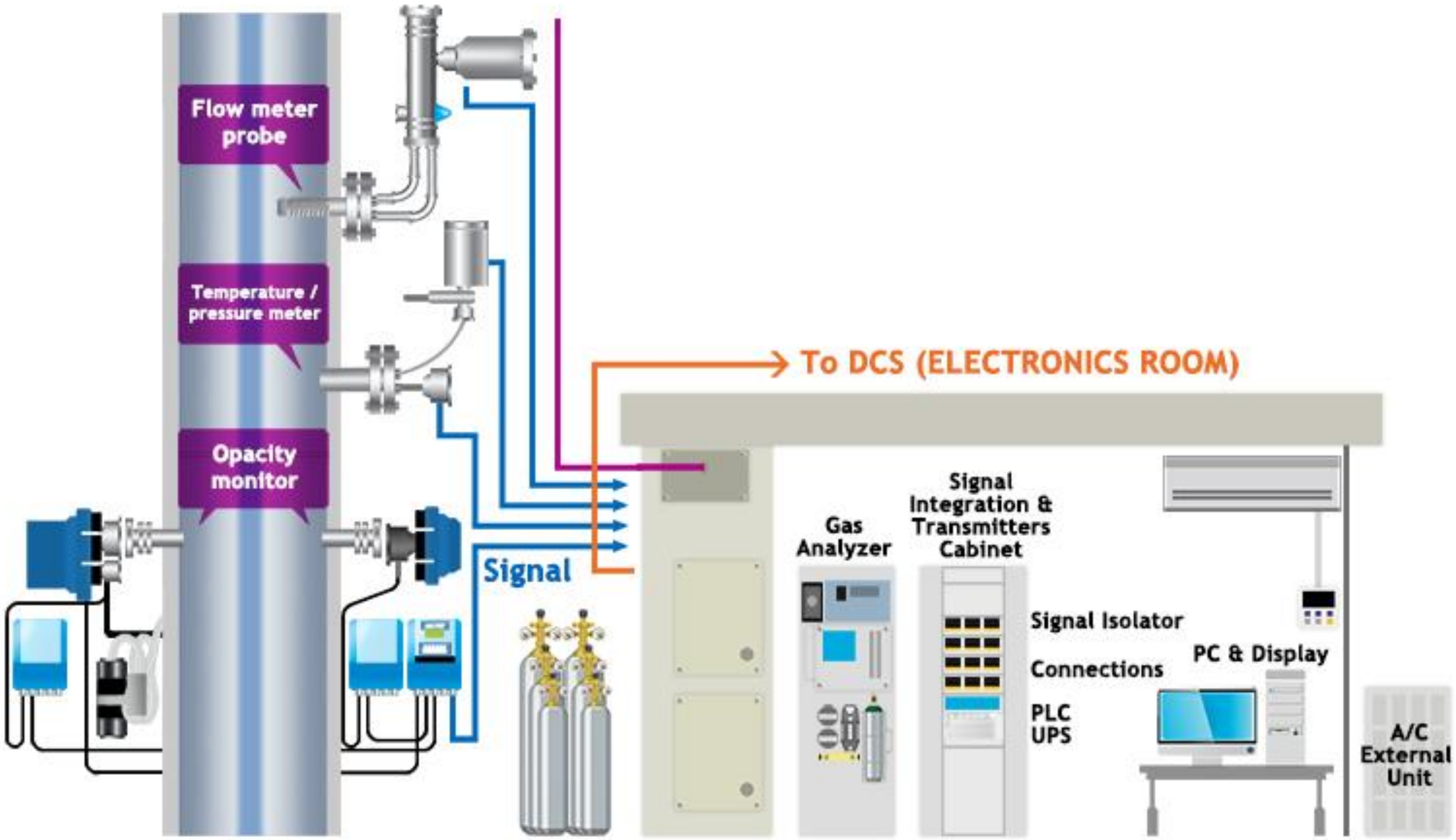


Data Acquisition System

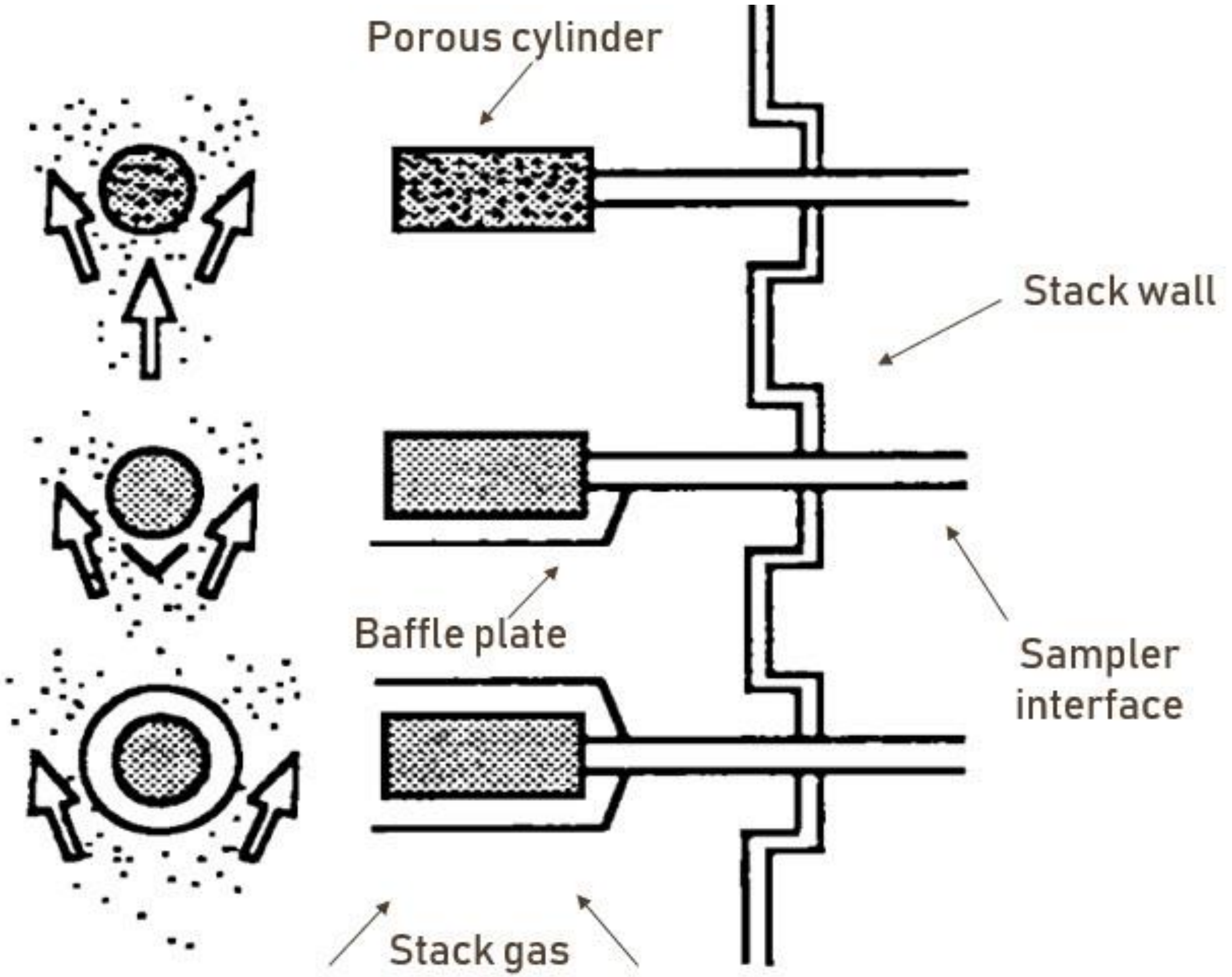
Extractive Conditioning System

Gas Analyzers

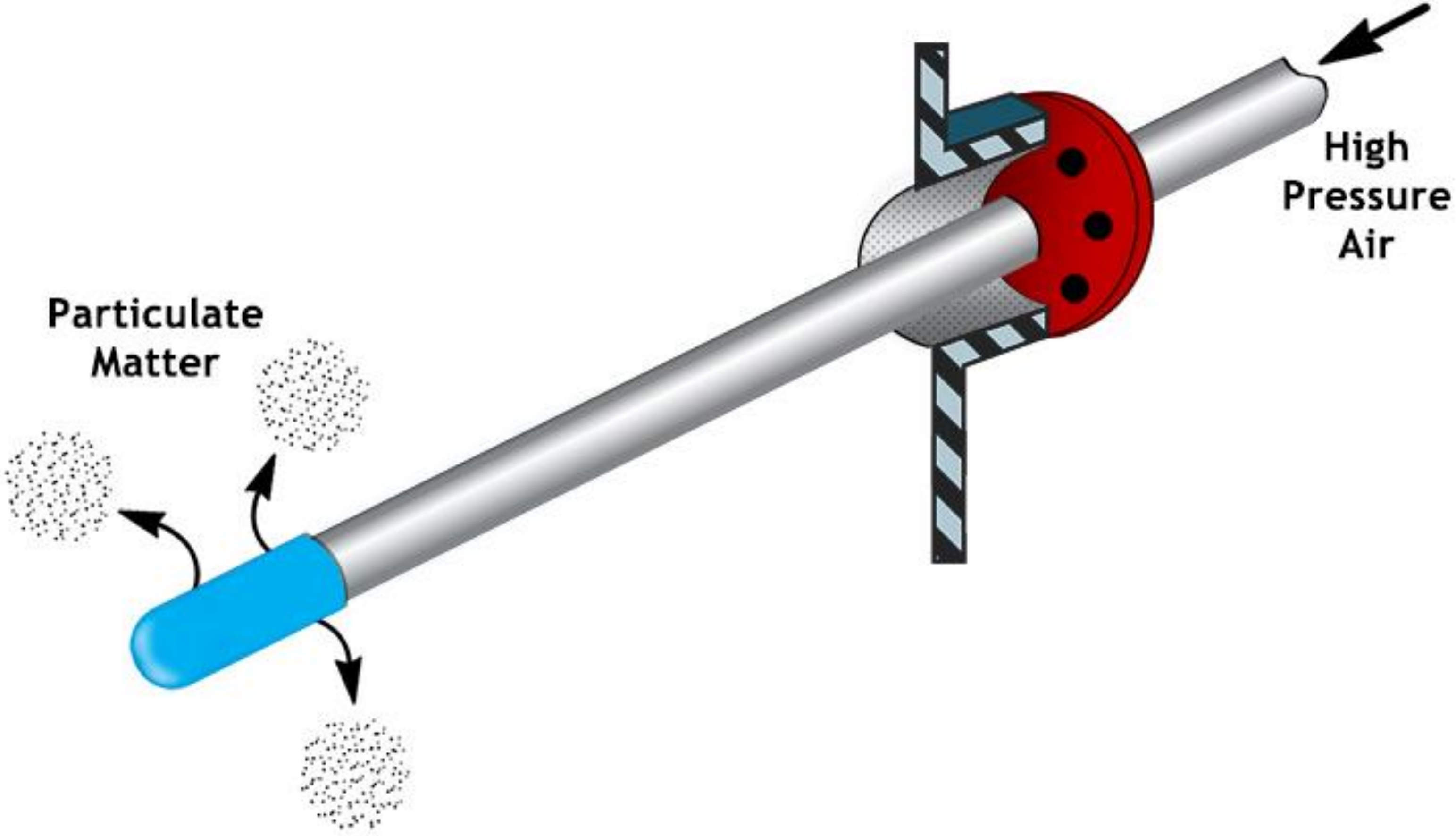
CEMS: Illustrative Example



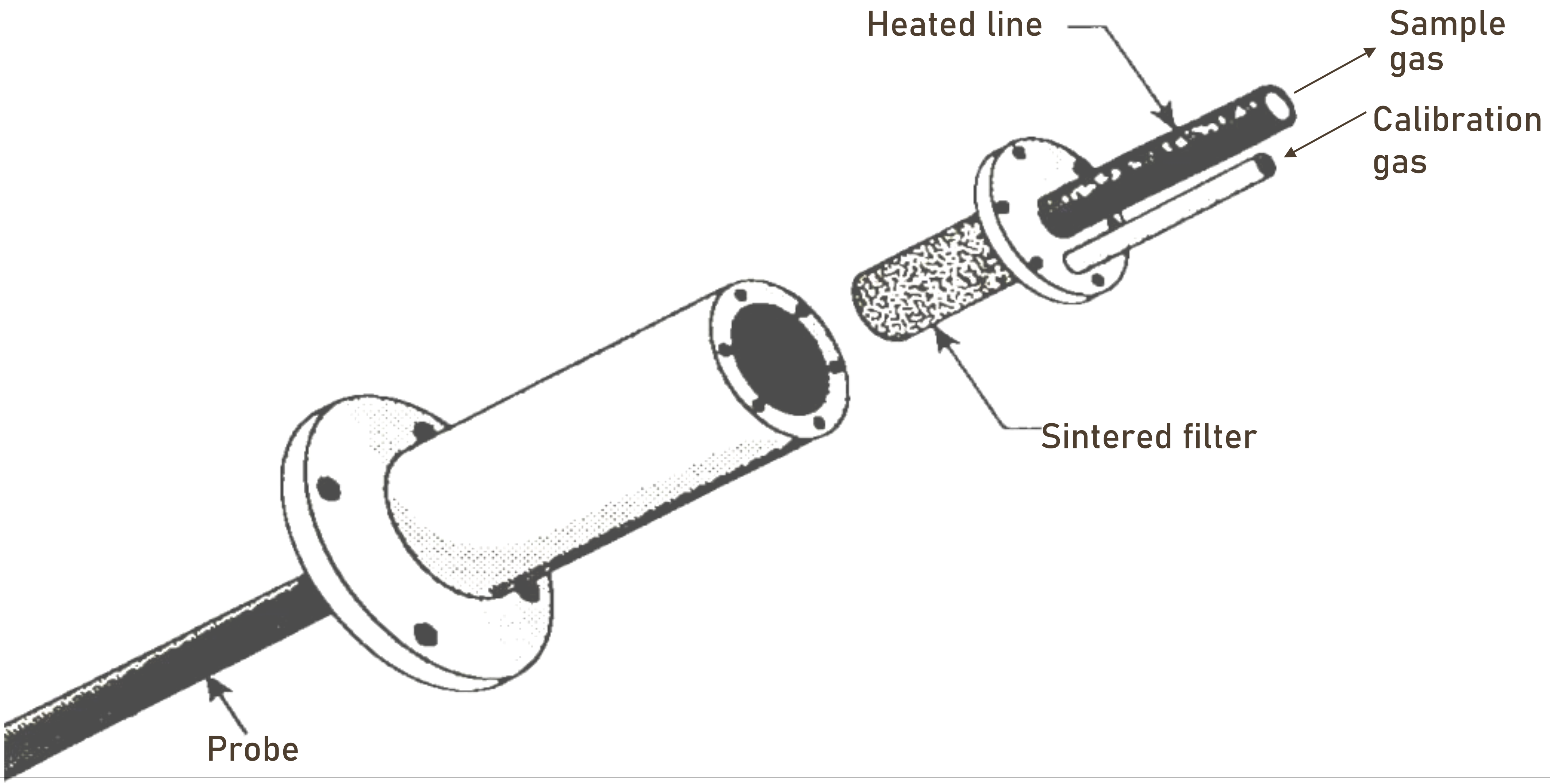
External Probe Filters



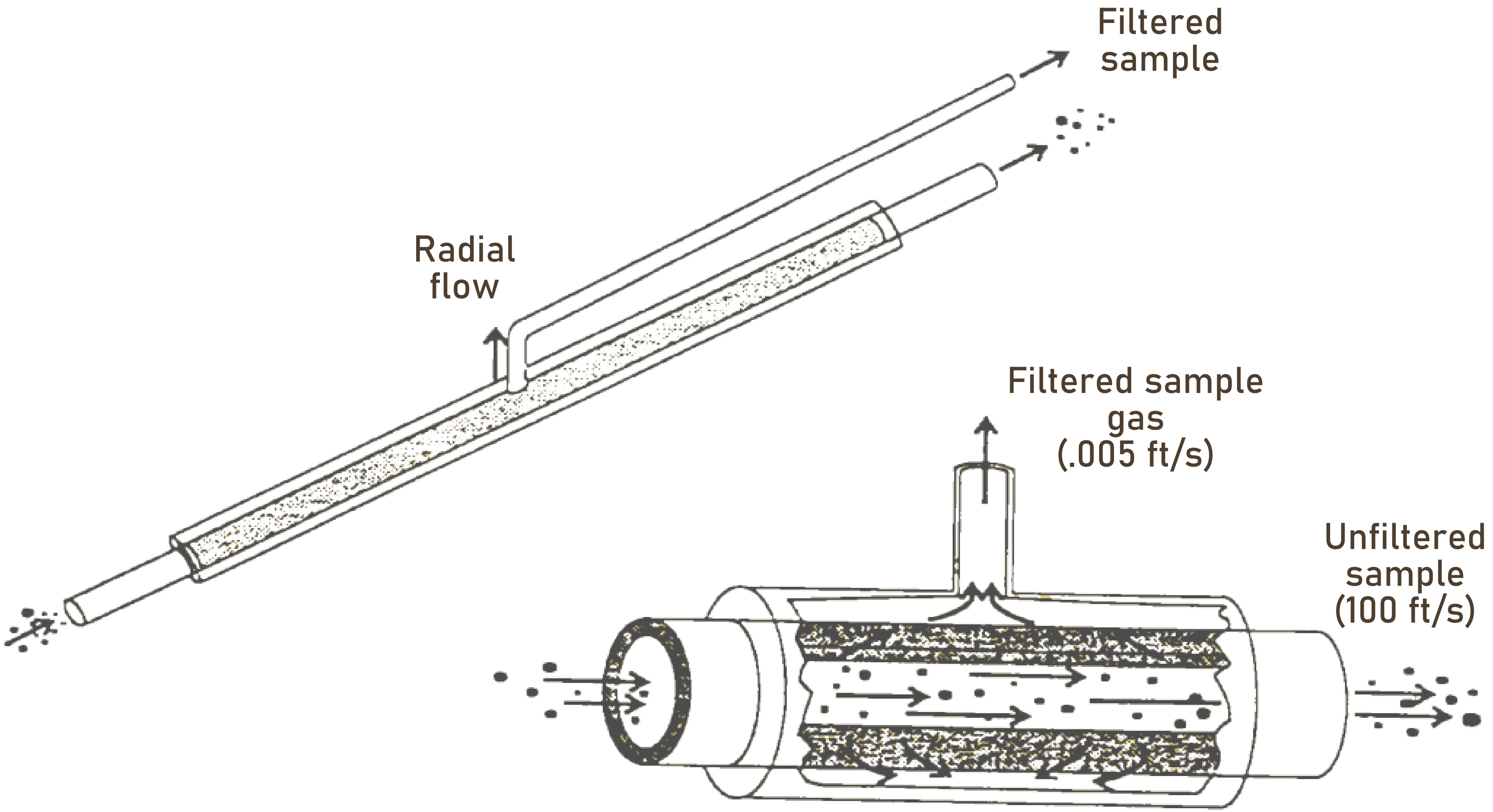
Filter Blow Back



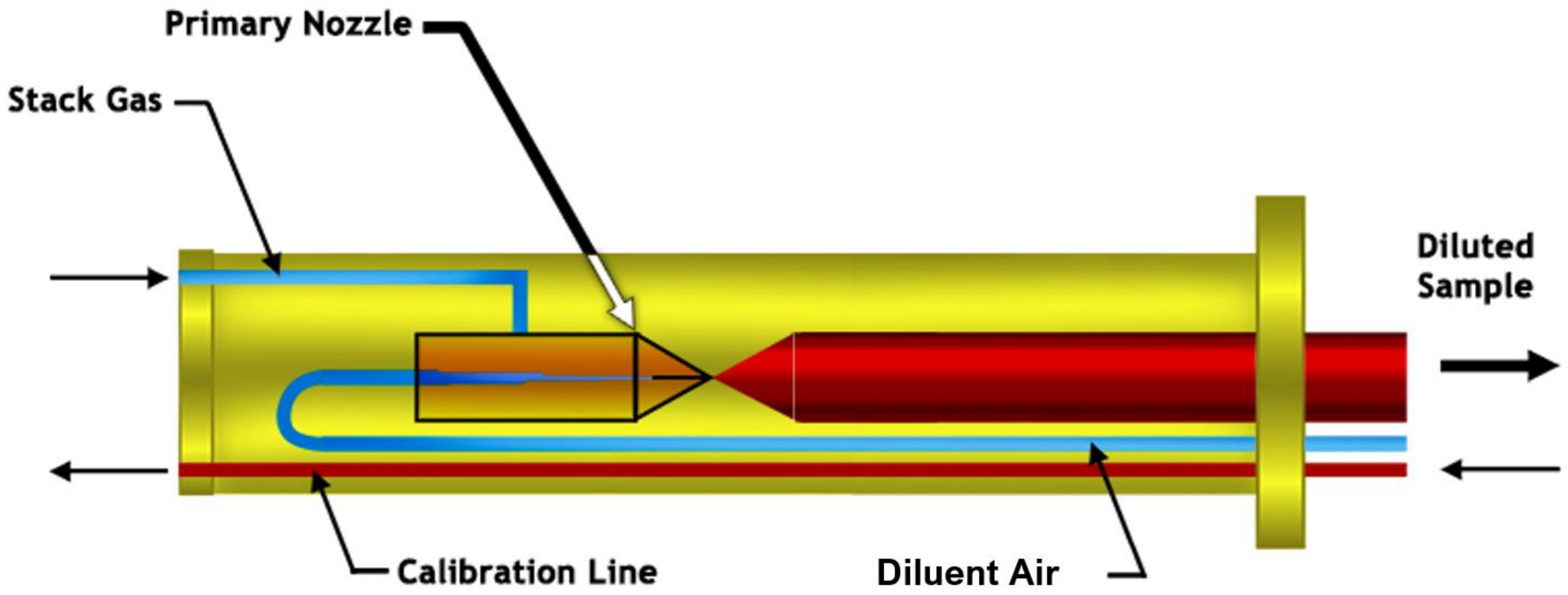
Internal Coarse Filter



Inertial Filter

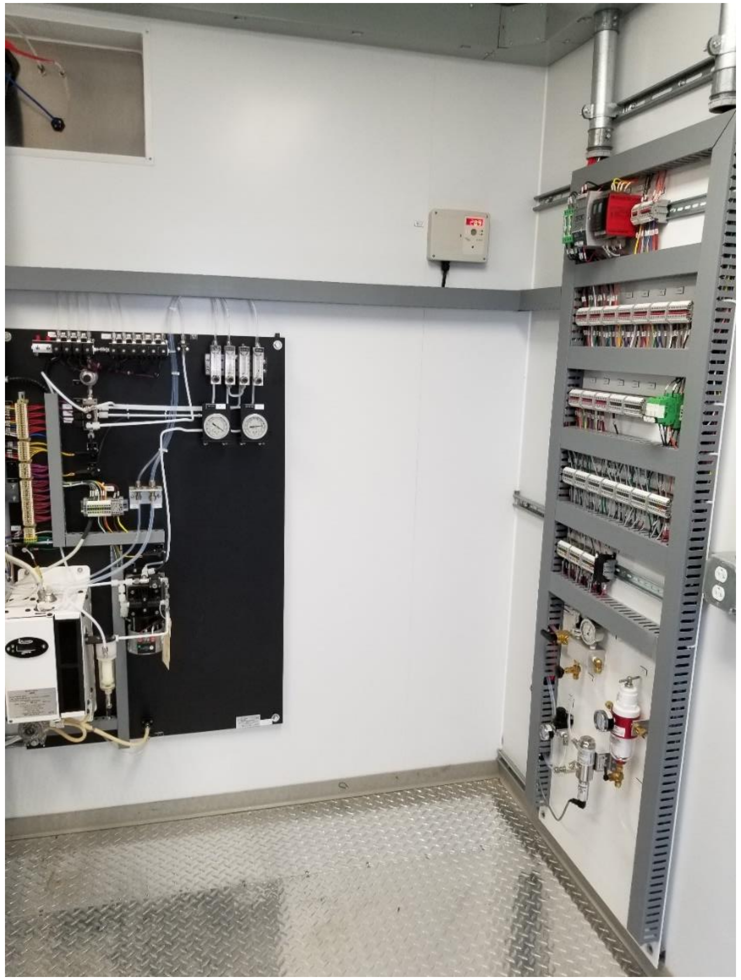


Example of How a Dilution Probe Works



Cylinders of EPA Certified Gases and CEMS Cabinet

Cylinders of EPA Certified Gases



Inside a CEMS Shelter

Outside a CEMS Shelter

CEMS Unit Shelter

Commonly Used Technologies for SO_2 and NO_x

Pulsed Fluorescence

- Uses the property of SO_2 molecules to absorb ultraviolet (UV) light and become excited at one wavelength, then decay to a lower energy state emitting UV light at a different wavelength, the measured emitted light corresponding to the concentration of SO_2 in the sample gas.
- The pulsing of the UV source lamp allows the analyzer to use both the light and dark phases of the pulsed light to continuously detect and correct for electronic noise, and to measure lower pollutant concentrations.

Chemiluminescence

- Uses the light-emitting chemical reaction of NO and analyzer-generated ozone to measure the concentration of the NO in a gas sample. A successive measurement of the NO, plus NO converted from the NO_2 in the sample, gives a total NOx measurement; the difference between the two measurements is equal to the NO_2 concentration in the sample.

SO_2 Analyzer

- Microprocessor control
- SO_2 specific
- Reflective UV filtering
- Hermetically sealed UV lamp
- No consumables

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Chemiluminescence NOx Analyzer

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Commonly Used Technologies for O_2 and CO_2

Paramagnetic O_2 Analyzer

- In a paramagnetic O_2 analyzer, a sample gas containing O_2 is drawn into two parallel sample paths, one passing through a magnetic field and one not. The O_2 is attracted into the magnetic field path, with the rest of the sample being split between the two paths, and the difference between the two measured gas flow rates is proportional to the O_2 content of the sample.

Non-Dispersive Infrared

- Non-dispersive infrared (NDIR) is a type of infrared (IR) absorption spectroscopy using parallel sample and reference (non-absorbing) cells.
- It is one of the most commonly used IR methods.
- The IR light is filtered for a specific wavelength that is absorbed by CO_2, and the difference in intensity of that specific IR wavelength after passing through each of the two cells is proportional to the CO_2 concentration in the sample gas.

O_2 & CO_2 Analyzer

Photo reprinted with permission from Alabama Department of Environmental Management

Commonly Used Technologies for PM

- A light scattering PM CEMS measures the light scattered by the entrained particulate in the stack exhaust, the amount of scattering being proportional to the particulate concentration, and affected by particle size, shape, and color.

- A beta gauge PM CEMS uses a beta radiation source and an adhesive filter tape material which collects the PM material at predetermined intervals. The collected PM on the filter tape attenuates the beta radiation, the amount of attenuation being proportional to the mass of collected PM, and independent of particle characteristics.

NOTE: Both PM CEMS require site-specific correlation against manual gravimetric RM measurements.

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Typical Sources with CEMS Requirements

CEMS are generally required on larger emitting stationary sources. Below are a few examples:

- Utilities
- Cement Plants
- Municipal Waste Combustors
- Nitric and Sulfuric Acid Plants
- Petroleum Refineries
- Copper, Zinc, and Lead Smelters
- Steel and Ferroalloy Plants
- Kraft Pulp Mills
- Glass Manufacturing Plants
- Magnetic Tape Production
- Phosphate Plants

Considerations When Choosing a Location for CEMS

Representative Emissions (well-mixed, laminar flow, and downstream of control equipment)

Accessibility for routine maintenance and repairs and performance of calibration audits and checks

Sufficient distance from flow disturbances, such as bends, changes in stack/duct diameter, and control equipment

Protection from weather and vibration

For opacity monitoring systems: no condensation inside stack near monitor and no ambient light

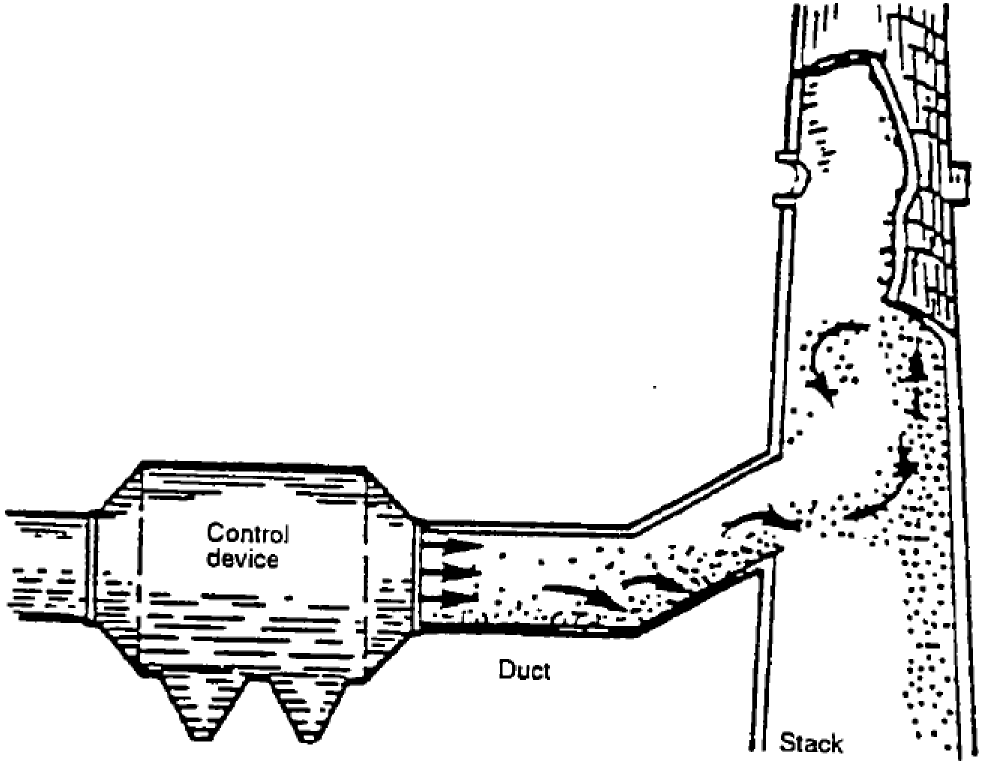
For specific requirements, see applicable performance specification.

Determining if Stratification Exists

- Calculate the mean value of all the sample points

- Find the difference between the mean value and each individual sample value

- If the mean pollutant concentration is more than 10% different from any single sample point, then stratification exists



Access for Reference Method Testing

Predictive Emission Monitoring Systems (PEMS)

What is a PEMS?

- PEMS refers to all the equipment that is required to predict an emission concentration or emission rate.
- Unlike a CEMS which uses sampling and analytical equipment to directly measure specific pollutant concentrations, a PEMS uses the continuous measurement of selected plant parameters and plant operating conditions with a software-based system of mathematical models to determine the pollutant emissions.

PEMS (Cont'd)

- **Software-based system** which uses process values as input variables to provide a real-time estimation of emissions by means of derived mathematical or statistical algorithm.
- PEMS are an acceptable regulatory alternative to CEMS for source emission compliance in some regulations.

Example Input Variables

- Feed Type
- Firing Rate
- Fuel Gas Density
- Furnace Air Preheat Temperature
- Percent Excess Oxygen
- Stack Temperature
- Inlet Air Humidity
- Inlet Air Temperature

Continuous Emission Rate Monitoring Systems (CERMS)

CERMS

- Is the **total equipment required** for determining and recording the pollutant mass emission rate (in terms of mass per unit of time)

- Includes the use of a flow rate monitor to measure the volumetric flow rate of the emission stream and generate an output proportional to that flow rate

CERMS (Cont.)

CERMS are:

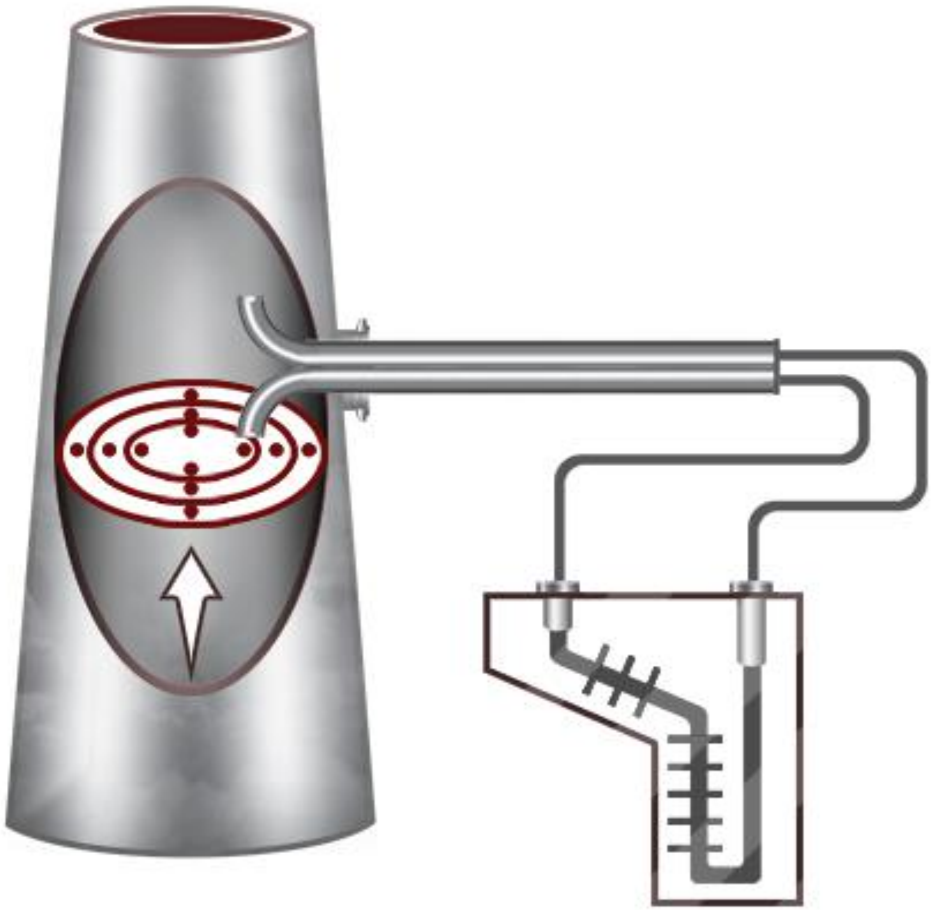
- Used in conjunction with gas concentration measurements, to calculate mass emission rates.
- Required for most sources subject to 40 CFR Part 75.

Pollutant Mass Emission Rate (PMER) = $C_S A_S V_S$

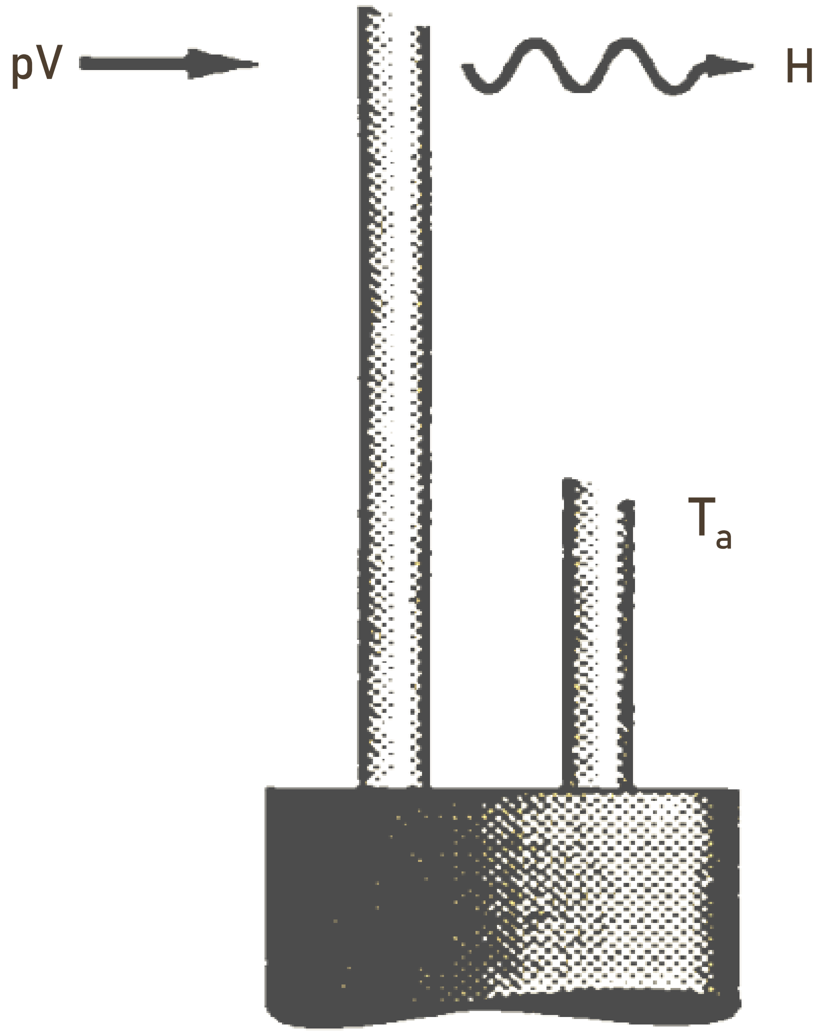
C_S = Concentration
A_S = Stack Area
V_S = Stack Gas Velocity

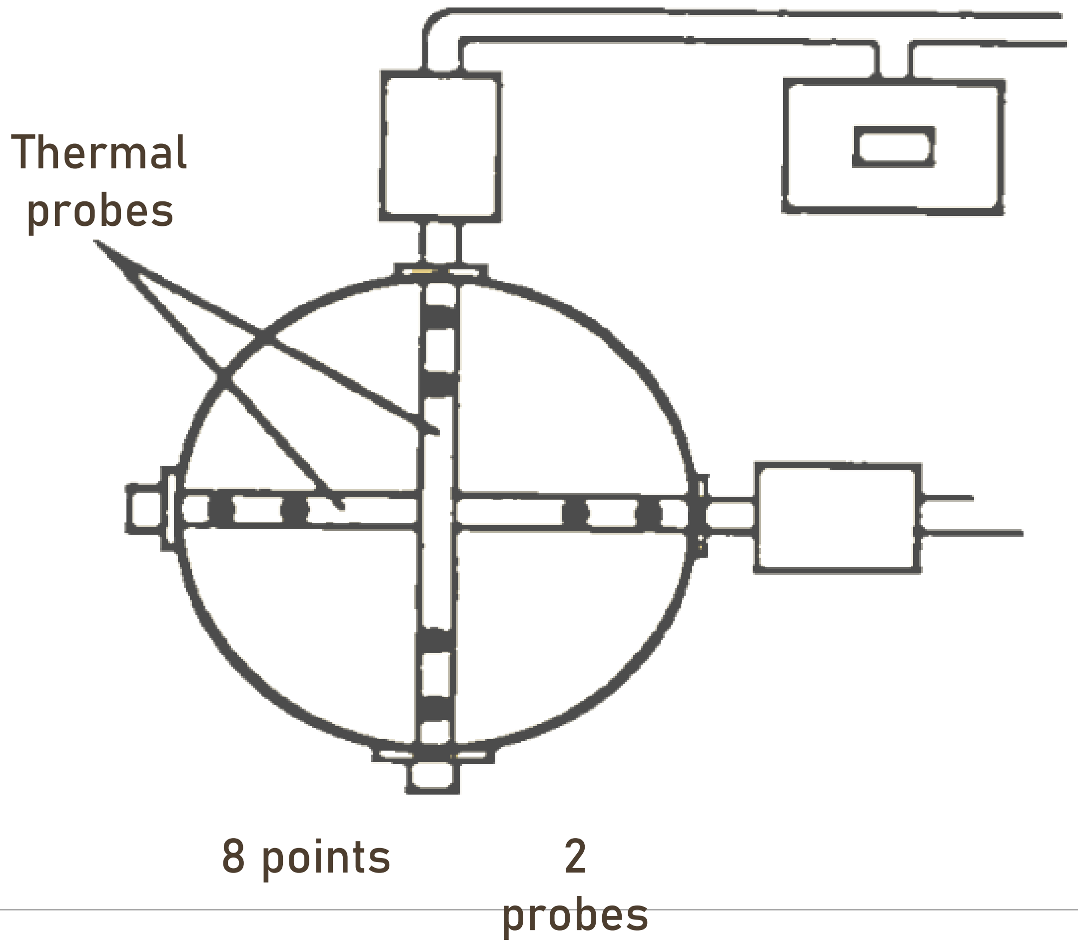
$$\text{lbs/hr} = (\text{lb/ft}^3)\ (\text{ft}^2)\ (\text{ft/hr})$$

Differential Pressure Measuring



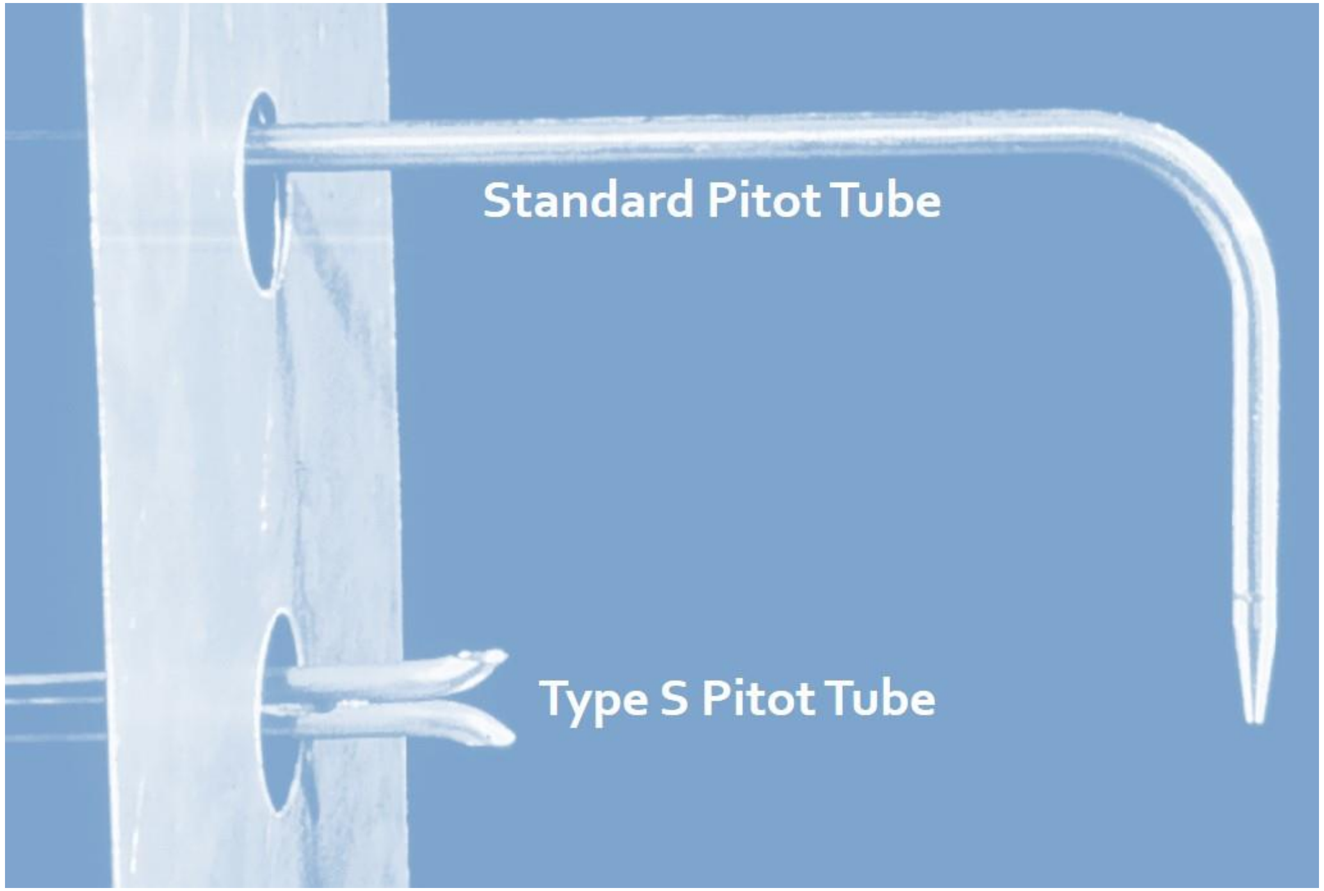
Thermal Flow Sensor





Pitot Tubes

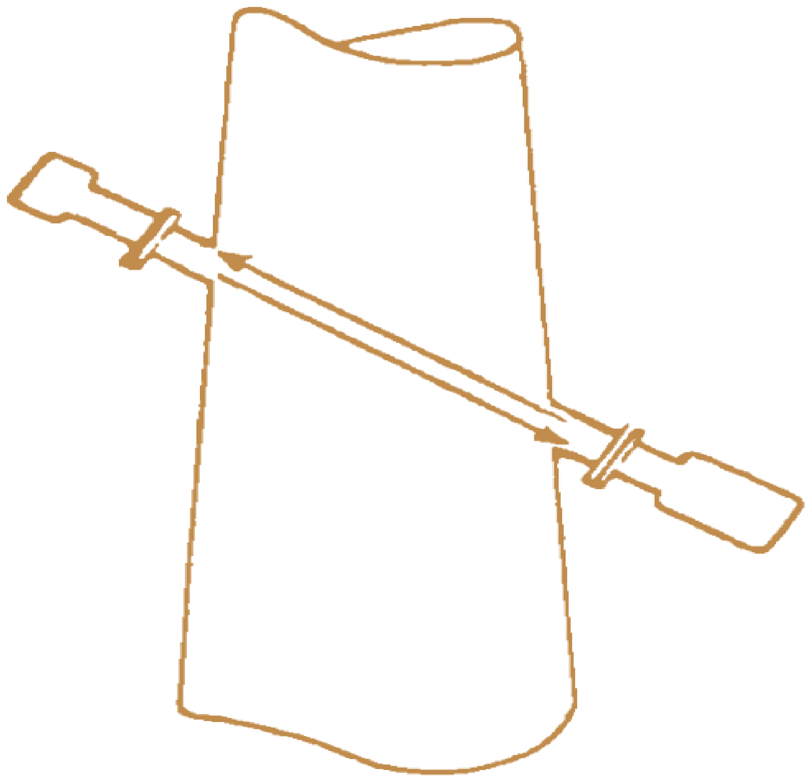
Pitot tubes use the differential pressure between the measurements of total pressure and the static pressure at a point in the stack to calculate the stack gas velocity and volumetric flowrate.



Ultrasonic Flowmeter

An *ultrasonic flowmeter* uses a pair of transmitter/receivers mounted on opposite sides of the stack, with one upstream from the other. The signal is alternated between them, sending it in the direction of stack gas flow, where it is speeded up, and then against the direction of flow, where it is slowed down. The difference in the time between the two signals is proportional to the stack gas velocity.

Acoustic Velocity

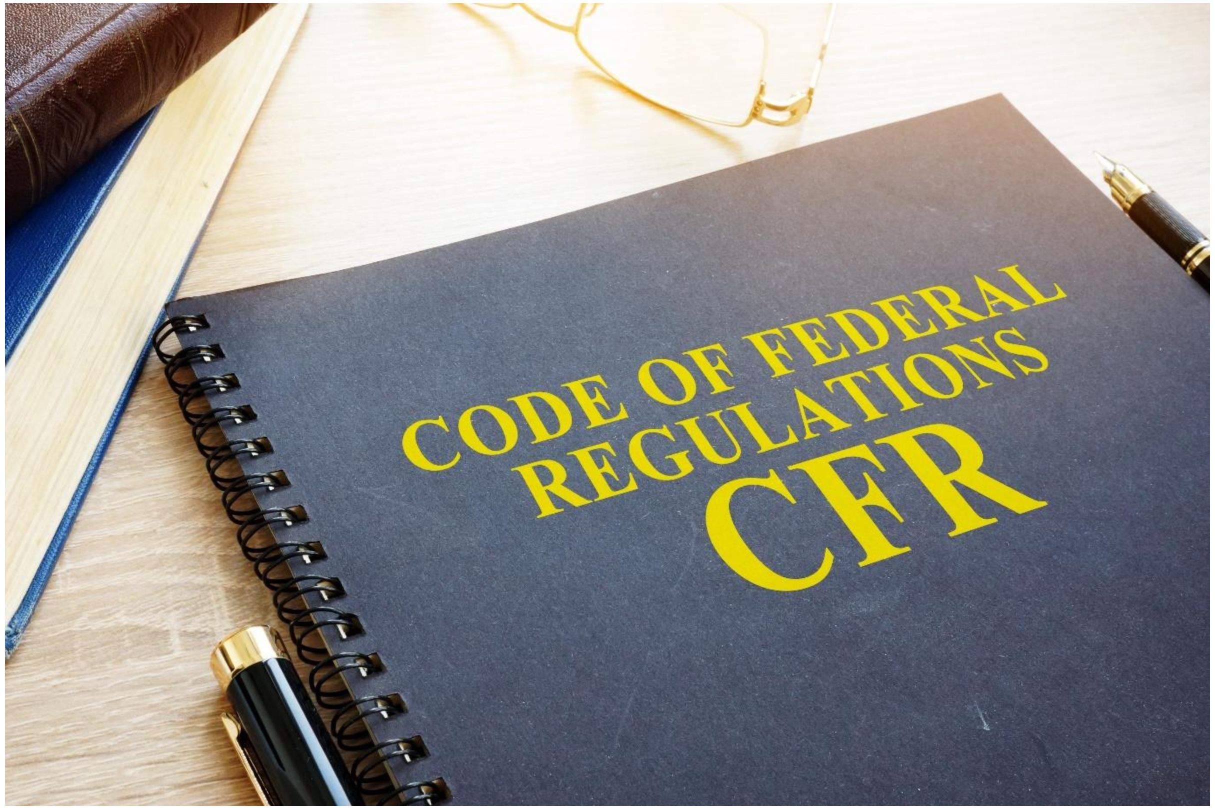


Module 1 Summary

Now that you have completed module 1, you should be able to:

- Describe different types and uses of CMS
- Define opacity and describe how continuous opacity monitoring systems (COMS) are used
- Recognize the pollutant parameters measured by continuous monitoring systems (CMS)
- Describe the components of continuous emission monitoring systems (CEMS)
- Distinguish between extractive and in-situ systems
- Describe how predictive emission monitoring systems (PEMS) are used
- Describe how continuous emission rate monitoring systems (CERMS) function
- Describe CEMS location and siting considerations

Module 2: CMS in Federal Regulations



Module 2 Outline

- Overview of relevant CFR Parts pertaining to CMS
- Introduction to performance specifications and quality assurance

Module 2 Learning Objectives

- Identify the regulations that contain CMS requirements

- Recognize, in general, what performance specifications and quality assurance are

40 CFR, Part 60 - New Source Performance Standards (NSPS)

- CAA, Section 111 establishes mechanisms for controlling emissions of air pollutants from stationary sources:
  - Section 111(b) provides authority for EPA to promulgate new source performance standards (NSPS) which apply only to new and modified sources.
  - Section 111(d) requires regulation of existing sources.
- These standards limit the amount of air emissions (SO_2, NOx, etc.) that may be emitted from stack sources.
- The performance specifications and quality assurance procedures for CMS are found in Appendix B and F of 40 CFR, Part 60.

40 CFR Part 61 - National Emission Standards For Hazardous Air Pollutants (NESHAP)

- Established under Section 112 of the CAA
- Promulgated prior to November 15, 1990, the date of enactment of the CAA amendments of 1990
- National emission standards for hazardous air pollutants (NESHAP) contained in this part remain in effect until they are amended, and if appropriate, added to Part 63.

40 CFR, Part 63 - National Emission Standards for Hazardous Air Pollutants (NESHAP) for Source Categories

- Established under Section 112 of the 1990 amendments to the CAA
- These standards regulate specific categories of stationary sources that emit (or have the potential to emit) one or more hazardous air pollutants listed in this part.
- The standards in this part are independent of the NESHAP contained in 40 CFR Part 61.

40 CFR, Part 75 – Acid Rain Program

- Established under Title IV of the CAA of 1990
- First national cap and trade program in the country
- Requires major emission reductions of SO_2 and NO_X from the power generation sector
- SO_2 and NO_X are the primary precursors for acid rain
- Part 75 monitoring requirements are not the focus of this training

Performance Specifications and Quality Assurance

Performance Specifications are used for evaluating the acceptability of the CMS at the time of, or soon after installation, or whenever specified in the regulations.

Quality Assurance (QA) procedures are used to evaluate the effectiveness of quality control (QC) and the quality of data produced by any CMS that is used for determining compliance with the emission standards as specified in the applicable regulation.

Performance specifications and QA procedures can be found in 40 CFR, Part 60 Appendices B and F, respectively.

Performance Specifications and QA Procedures

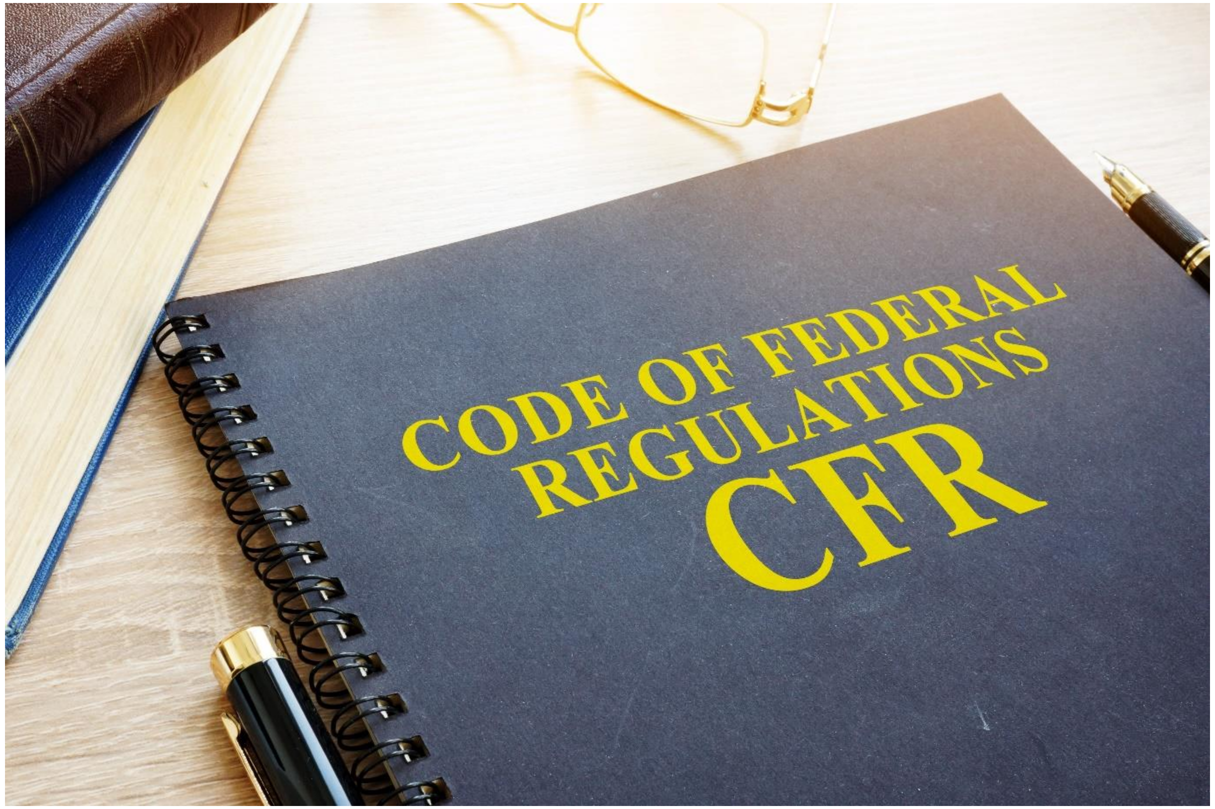
PS	Pollutants Covered	QA Procedure
PS-1	Opacity – Continuous Opacity Monitoring Systems (COMS)	Procedure 3
PS-2	Sulfur Dioxide (SO_2) and Oxides of Nitrogen (NO_X)	Procedure 1
PS-3	Oxygen (O_2) and Carbon Dioxide (CO_2)	Procedure 1
PS-4, 4A, and 4B	Carbon Monoxide (CO) for PS 4 and PS-4A; and CO and O_2 for PS-4B	Procedure 1
PS-5	Total Reduced Sulfur (TRS)	
PS-6	Flow Rate – Continuous Emission Rate Monitoring Systems (CERMS)	
PS-7	Hydrogen Sulfide (H_2S)	
PS-8	Volatile Organic Carbon (VOC)	
PS-8A	Total Hydrocarbons (THC)	
PS-9	Gas Chromatography (GC)	
PS-11	Particulate Matter (PM)	Procedure 2
PS-12A and 12B	Mercury (Hg)	Procedure 5
PS-15	Fourier Transform Infrared (FTIR)	
PS-16	PEMS	
PS-18	Hydrogen Chloride (HCl)	Procedure 6

Module 2 Summary

Now that you have completed module 2, you should be able to:

- Identify the regulations that contain CMS requirements
- Recognize, in general, what performance specifications and quality assurance are

Module 3: Audits/ Inspections and Enforcement



Module 3 Outline

- Performance and system audits overview
- Quality assurance procedure audits
- Inspector’s role in system/field audits
- Enforcement applications of CMS

Module 3 Learning Objectives

- Distinguish the difference between performance audits and systems/field audits
- Explain the utility of performance audits and systems/field audits
- Describe the inspector’s role during an audit
- Distinguish between CMS as compliance method and CMS data as credible evidence

Performance and System Audits

EPA relies on a combination of **performance** and **system/field auditing** to verify overall data integrity.

Performance Audit Procedures

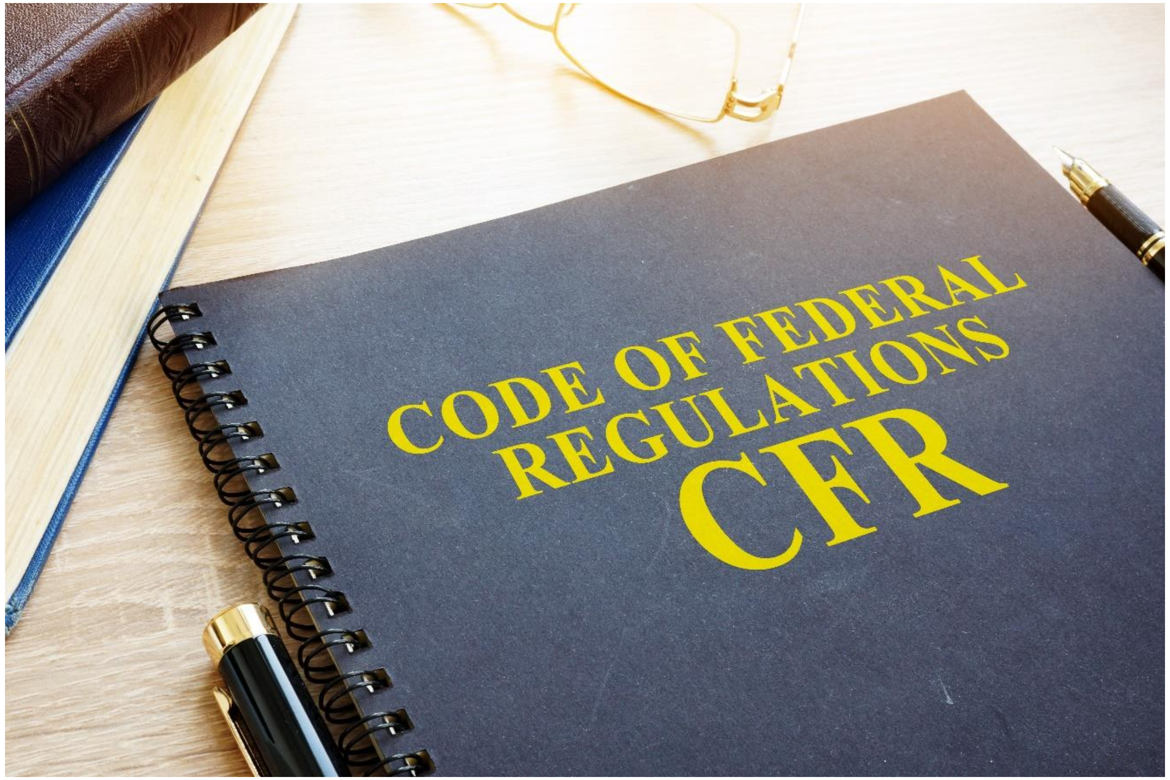
- Performance audit procedures are critical for verifying proper performance of the monitoring systems and identifying problems which may lead to inaccurate emissions accounting.

System or Field Audits

- System or field audits are an opportunity to provide information to the source on the regulatory requirements, and for the inspector to observe monitoring practices that may lead to regulatory problems.

Performance Audits

- Required by 40 CFR Part 60
- Found in performance specifications and QA procedures
- Include the daily, quarterly, and annual audit procedures
- Audit results usually submitted to agency for review



Introduction to Quality Control and Quality Assurance

1. Quality Control

- Quality control (QC) is the procedures, policies, and corrective actions necessary to ensure product quality.

2. Quality Assurance

- Quality assurance (QA) procedures are used to evaluate the effectiveness of QC and the quality of data produced by any CMS that are used for determining compliance with the emission standards on a continuous basis as specified in the applicable regulation.
- These procedures are pollutant-specific and published in Appendix F of 40 CFR 60.

Quality Assurance Procedure Audits

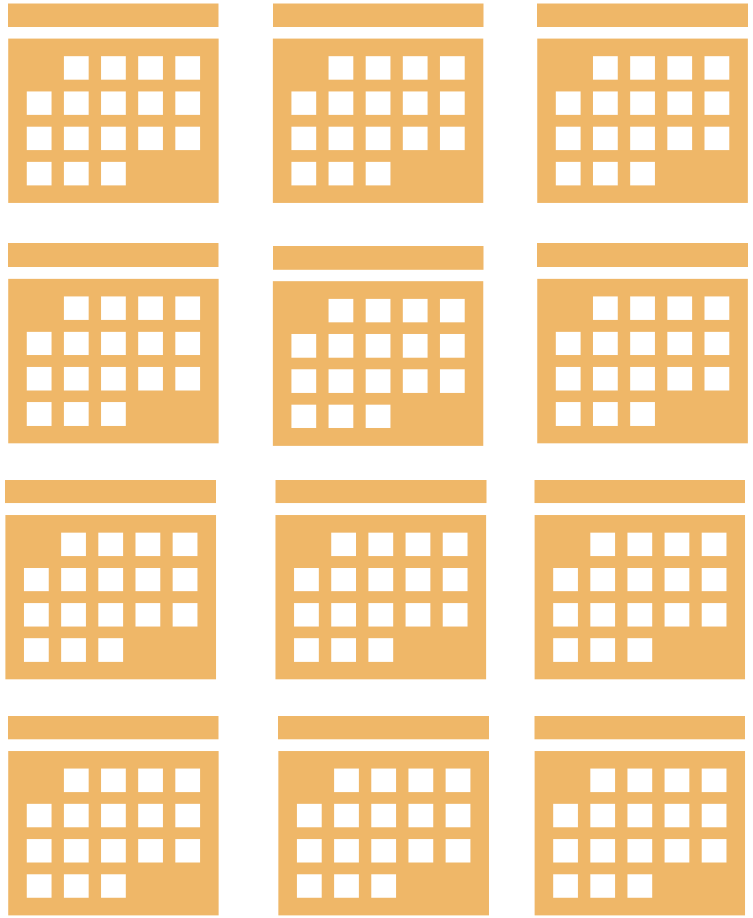
Audit procedures are critical for verifying proper performance of the monitoring systems and identifying problems which may lead to inaccurate emissions accounting.

There are four main types of audits discussed in QA procedures:

- Relative Accuracy Test Audit (RATA)
- Cylinder Gas Audit (CGA)
- Calibration Drift Assessment
- Relative Accuracy Audit (RAA)

What is a Relative Accuracy Test Audit?

- The **ANNUAL** comparative evaluation of the CEMS performance using a Reference Method (RM)
- Consists of:
  - 9 or more RM test runs
  - Usually 21 minutes in duration



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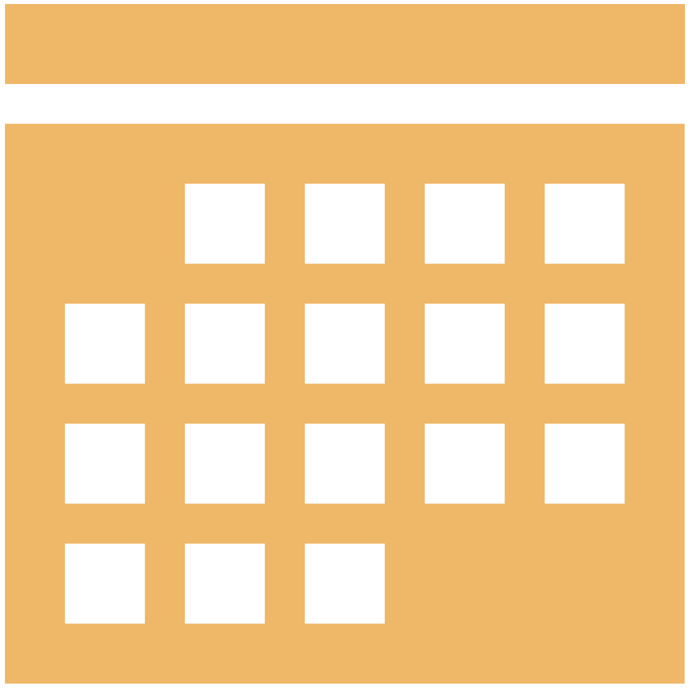
What is a Cylinder Gas Audit?

- Usually performed **QUARTERLY** – in three of four quarters, annually
  - With RATA conducted in the fourth quarter
- Gases needed and methodology used are found in applicable QA procedure
- Audit gases must be certified by or traceable to National Institute of Standards and Technology (NIST)

What is a Calibration Drift Assessment?

- The **DAILY** check of the difference in the CEMS readings from a known value, usually a calibration gas
- Performed to demonstrate the stability of the CEMS calibration – how does it fluctuate over time?
- Initial certification usually requires a 7-day drift test
- Daily drift test required for ongoing operation



What is a Relative Accuracy Audit?

- An alternative **QUARTERLY** audit procedure which correlates the CEMS data to simultaneously collected RM data
- Performed like a RATA, but only requires three RM test runs
- Not used very often, but is an option

System/Field Audit or Inspection

- May be conducted in conjunction with a performance audit such as a RATA or separately as part of a Full Compliance Evaluation
- Allows the observer to…
  - Physically inspect the CEMS,
  - Review the data collected, and
  - Review maintenance logs, etc.

Note: The audit procedures for Part 75 can be found here: https://www.epa.gov/airmarkets/clean-air-markets-field-audit-manual

Inspector’s Role in System/Field Audits

Every inspector should check with their agency to see exactly what their policies and procedures are before conducting an audit.

Typically, the inspector’s role is not to provide technical advice or consulting on the operation of the monitoring equipment.

Usually a "hands off" approach is used when conducting the audit so that the inspector does not have any physical contact with the monitoring system hardware.

Inspections: Before Going Onsite

Preparing for an inspection:

- ✓ Review any monitoring plans or test protocols, quality assurance/quality control (QA/QC) manuals, RATA records, quarterly audit records, and quarterly emission report submittals.
- ✓ Check data availability, amount and causes of downtime, significant maintenance and any reports of replacement of key components.
- ✓ Make note of multiple failed QA tests, missing data, unusual data trends (inconsistent over time, or inconsistent with other, similar facilities), and calculation errors.

Inspections: Before Observing a Performance Audit

Preparing to observe any performance audit that will be conducted during the site visit:

- ✓ Review the results of the last audits, noting any issues
- ✓ Review the necessary performance specifications and QA procedures

The Road to Continuous Compliance: Operation of CEMS

- Conduct Calibration Drift (CD) at least once per operating day: Zero and Span - New Source Performance Standards (NSPS)
- Must be in continuous operation. Except for system breakdowns, repairs, calibration checks, and zero and span adjustments. A "continuous operation" means a minimum of one cycle of operation (sampling, analyzing, and data recording) is completed or each successive 15-minute period.
- Maintain and operate the CEMS in a manner consistent with good air pollution control practices and manufacturer's written specifications.
- Ensure the visual display or indication of operation is readily available on-site

Inspections Process – At the Facility

Verify:
- Calibration and audit gas used, and
- General appearance of analyzers and sampling system

Check:
- Check if any alarms or warnings are indicated on DAS screen or system panels

Review:
- Additionally, review maintenance logs and verify regular maintenance (daily, weekly, monthly) activities.
  - Compare with description of these activities in QA/QC manual
  - Note any frequent or reoccurring problems

Visual Inspection of the CEMS

If possible, do a visual inspection of the CEMS from the sample probe location on the stack or duct, following the sample line to the CEMS shelter, and continuing inside the shelter through the gas conditioning system (if source-level extractive) to the analyzers.

- ✓ Does the system look to be well maintained?
- ✓ Are there low spots in the sample line where moisture might collect and scrub out pollutants? If the facility experiences cold winters, are all parts of the sampling system heated?
- ✓ Is the physical location of the CEMS probe reasonable to access for maintenance?

Visual Inspection of the CEMS (Cont'd)

Inside the CEMS shelter, check the condition of the sample gas conditioning system for any condensed liquid in Teflon lines.

- ✓ Where does the liquid drain?
- ✓ Could it get blocked or freeze?
- ✓ Are there signs of corrosion of valves and fittings?

Enforcement Applications of CMS

- CMS can provide accurate data regarding a source's compliance with the emissions limits and standards.
  - CMS data can be more representative of a source's ongoing compliance status when compared to infrequent performance testing, and
  - CMS data typically can cover a greater percentage of a source's time in operation.

Enforcement Applications of CMS (Cont.)

CMS data is important to enforcement, irrespective of whether the legal requirement being enforced specifies CMS as the compliance method.

- The CAA authorizes EPA to bring an administrative, civil, or criminal enforcement action “on the basis of any information available to the administrator.”

- The 1997 “Credible Evidence” revisions to 40 CFR Parts 51, 52, 60, and 61 clarified that non-reference test data, including CMS, can be used for establishing whether or not the source has violated or is in violation of any standard of that part.

CMS is the Compliance Method

Required by some NSPS, National Emission Standards for Hazardous Air Pollutants (NESHAPS) and State Implementation Plans (SIPs)

Includes data validation requirements

Requires monitoring against emission limits with long averaging time

Data documents compliance against the emissions standard

CMS is not the Compliance Method

CMS data is “Credible Evidence:”

Data is used for initiating and supporting enforcement cases alleging emissions violations.

CMS data may provide a basis to issue a Section 114 request for compliance method data.

CMS data may be used to enforce operation and maintenance, monitoring and recordkeeping and reporting requirements, when the regulation does not specify a compliance method or an emissions standard (e.g. General Duty Clause).

Module 3 Summary

Now that you have completed module 3, you should be able to:

- Distinguish the difference between performance audits and systems/field audits
- Explain the utility of performance audits and systems/field audits
- Describe the inspector’s role during an audit
- Distinguish between CMS as compliance method and CMS data as credible evidence

End of Course Review

Now that you have completed this course, you should be able to:

- Recognize the purpose of CMS and different types and uses of CMS
- Identify the regulations that contain CMS requirements
- Recognize enforcement aspects of CMS

Next, you will measure how much you learned through:

- The end of course self-assessment
- The final exam

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