Measuring Particulates Continuously

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Types of Particulate Matter (PM) CEMS

- Light Scattering
- Beta Attenuation
- Probe Electrification
- Light Extinction (Opacity Monitors)
- Light Scintillation

- Note – all measure filterable particulate matter only.

Advantages/Disadvantages of CEM Types

- Light Scattering Advantages
  - Lower cost, easier to install and maintain
  - Sensitive to low PM concentrations

- Light Scattering Disadvantages
  - Sensitive to particle size, density and shape
  - Measures entrained water droplets as PM

Advantages/Disadvantages of CEM Types (Cont.)

- Beta Attenuation Advantages
  - Measures PM concentration directly
  - Most similar to EPA Method 5 sample collection
  - Not affected by particle size, density, shape
  - Can measure PM in wet stacks

- Beta Attenuation Disadvantages
  - More expensive and difficult to install
  - Higher cost to maintain
  - Sample transport issues

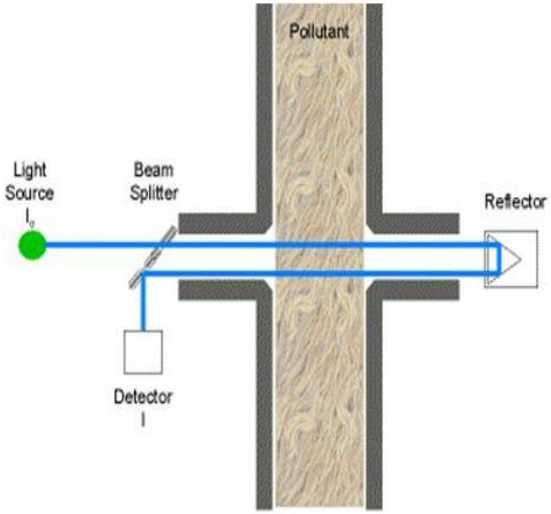
Advantages/Disadvantages of CEM Types (Cont.)

- Probe Electrification Advantages
  - Inexpensive and easy to install/maintain
  - Sensitive at low PM concentrations
  - Typically used as a broken bag detector

- Probe Electrification Disadvantages
  - Affected significantly by particle charge & size
  - Affected significantly by velocity changes
  - Measures water droplets as PM

Advantages/Disadvantages of CEM Types (Cont.)

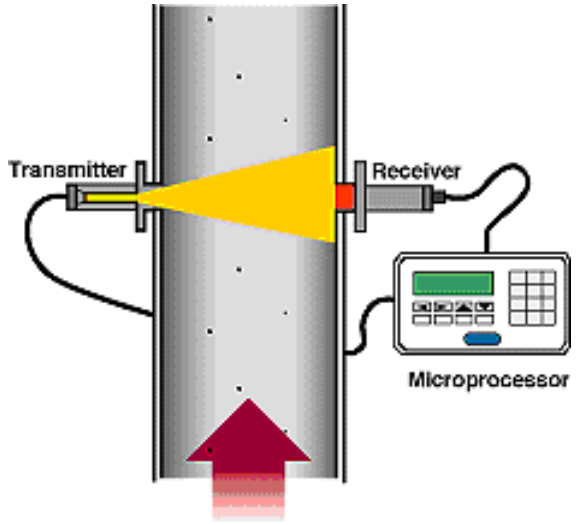
- Light Extinction (Opacity) Advantages
  - Installed at many facilities already
  - Easy to maintain



- Light Extinction (Opacity) Disadvantages
  - Poor PS11 correlation
  - Not sensitive at low PM concentrations
  - Measures water droplets as PM
  - Affected by particle size, shape, density changes

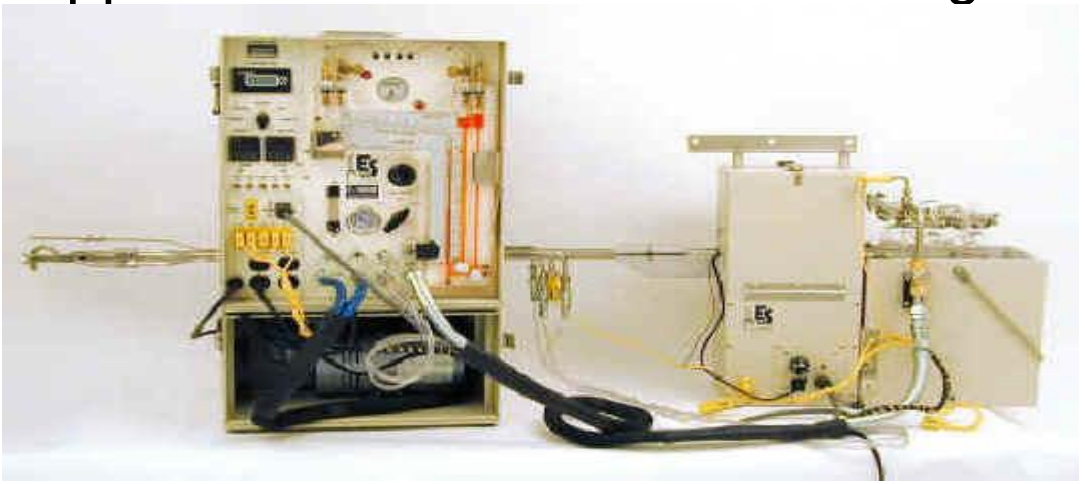
Advantages/Disadvantages of CEM Types (Cont.)

- Light Scintillation Advantages
  - Low cost, easy to install and maintain
- Light Scintillation Disadvantages
  - Not sensitive at low PM concentrations
  - Affected by particle density changes
  - Measures water droplets as PM



PM CEMS Correlation

- All instruments must be correlated to a manual gravimetric method (EPA Method 5 or 5i) to develop a correlation factor
- Correlation must be conducted per EPA PS11
- PS11 determines where PM CEMS should be located, and details specific approaches for correlation testing



PS11 Correlation Issues

- PS11 requires correlations to be performed at three distinct particulate concentration levels. This is a problem for facilities who may have to alter operations or pollution control devices to obtain three distinct PM concentration levels.
- PS11 requires that EPA Method 5 or 5i be used which requires paired sampling trains. Strict precision results between paired trains is required to obtain valid test runs (typically leading to additional testing). Five valid runs per particulate concentration level is required.
- Typically onsite weight analyses are performed to obtain real time results for assessment of the number of valid run pairs that been achieved and to assess correlation.
- Experience has indicated that in some cases it is difficult to obtain similar correlation factors between the three PM concentration levels.

Upcoming Utility MACT Challenges

- After the initial compliance demonstration for all MACT limits, the proposed rule gives the option to use PM CEMS for continuous compliance for PM and as surrogate of compliance for non-mercury metals.
- If not PM CEMs then stack tests must be conducted every 2 months for total or individual non-mercury HAPs (1/month if no PM controls).
- Expensive (6 tests/yr @ 15K-20K each) for 5yrs

Upcoming MACT Challenges (Cont.)

- Filterable PM levels on FGD saturated stacks are very low (1-5 mg/dscm@7%O_2)
- These levels create challenges for paired sampling trains meeting PS11 criteria
- These levels are at the lower end of measurement ranges of PM CEMs

PM CEMs Viability

- PM CEMs are currently being used at power plants, hazardous waste combustors, MSW plants under consent orders and lately to assist with de-rating of power plants
- Viability requires choosing the right monitor for the application
- Close attention to monitor maintenance and other QA/QC activities is required to obtain accurate results
- Oversight of PM testing activities is required to obtain reliable test results (proper method, QA/QC, onsite analyses during correlation work).

Thank You

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