

Summary Information

- **Principles of reference method**
- **Calculation of mass concentration**
- **Sampler design illustration**
- **Field QA/QC checks**
- **Laboratory QA/QC checks**
- **Sampling procedures**

Principles of PM_{2.5} Reference Method

- **Sample is drawn at a flow rate of 16.67 L/min through specially designed inlet.**
- **Particles greater than 10 µm in diameter are removed.**
- **Remaining particles are sent to next stage.**
- **Particles less than 10 µm but greater than 2.5 µm are removed.**
- **Particles \leq 2.5 µm are collected on PTFE filter.**

Sample Volume

$$V_a = \frac{Q_{avg} \times t}{10^3}$$

Where:

V_a = total sample volume, actual m³

Q_{avg} = average sample flow rate over the
sample collection period, L/min

t = total elapsed sample collection time, min

10^3 = units conversion

Net PM_{2.5} Mass Calculation

$$M_{2.5} = (M_f - M_i) \times 10^3$$

Where:

- M_{2.5}** = total mass of PM_{2.5} collected during the sampling period, μg
- M_f** = final mass of the equilibrated filter after sample collection, mg
- M_i** = initial (tare) mass of the equilibrated filter before sample collection, mg
- 10³** = units of conversion, ($\mu\text{g}/\text{mg}$)

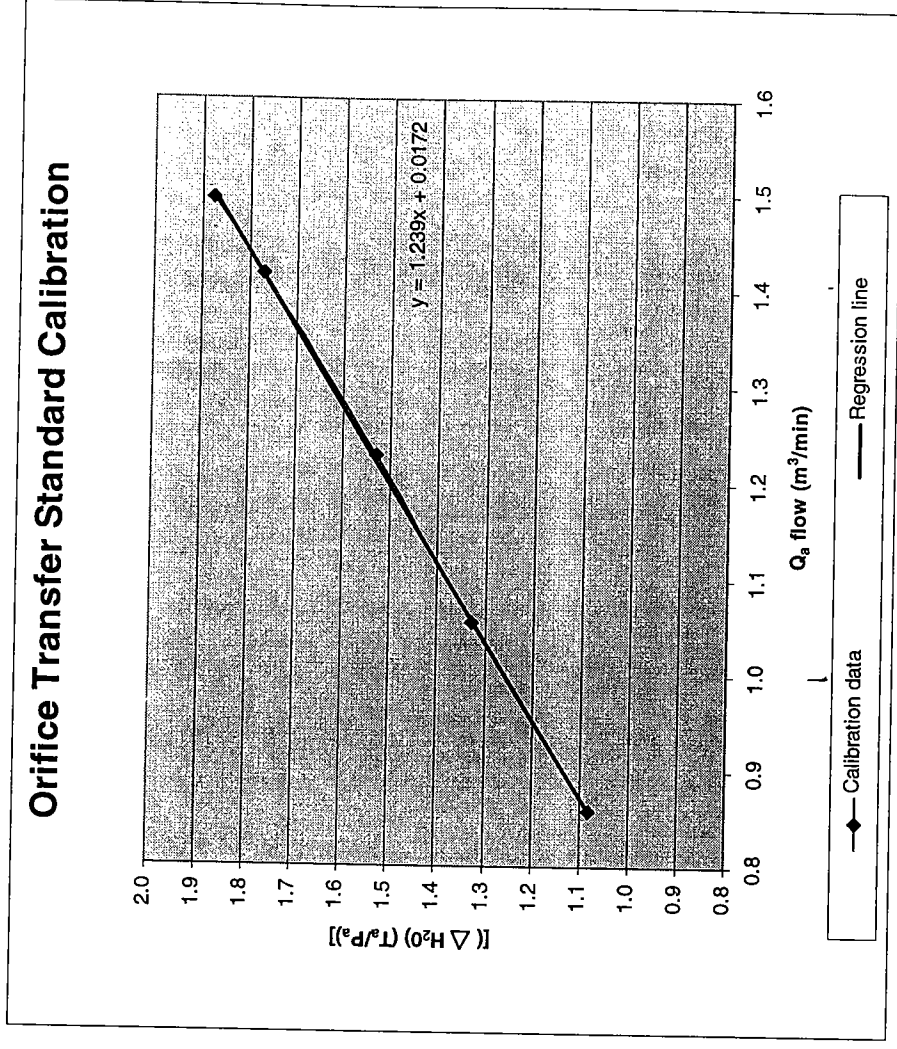
Orifice Calibration Procedure

(continued)

- Repeat for at least four additional flow rates.
- Compute $[(\Delta H_2O) (T_a/P_a)]^{1/2}$ for each flow rate.
- Draw orifice transfer standard calibration curve.
- Calculate the slope (m), intercept (b), and correlation coefficient (r) of the linear least-squares regression.

Orifice Calibration Procedure (continued)

- Plot regression line on same graph as calibration data
- Readable to 0.02 m³/min
- Within 2% of line



Orifice Calibration Procedure

(continued)

- For future use of the orifice standard, calculate Q_a .

$$Q_a \text{ (orifice)} = \{ (\Delta H_{2O}) (T_a / P_a)^{1/2} - b \} \{1/m\}$$

Orifice Calibration Procedure

(continued)

Where:

Q_a (orifice) = actual volumetric flow rate as indicated by the orifice transfer standard, m³/min

ΔH_2O = pressure drop across the orifice, mm (or in.) H₂O

T_a = ambient temperature during use, K ($K = ^\circ C + 273$)

P_a = ambient barometric pressure during use, mm Hg
(or kPa)

b = intercept of the orifice calibration relationship

m = slope of the orifice calibration relationship

Orifice Transfer Standard Calibration Frequency

- **Upon receipt**
- **At least annually**
- **When nicks or dents are visible**

Basic Calibration Procedure for MFC Sampler

- **Overview**
- **Calibration Equipment**
- **Multipoint Flow Rate Calibration Procedure**
- **Calibration Calculations**

Overview

- **Flow rates are determined by an orifice transfer standard.**
- **Recommended exit orifice plenum pressure is measured with a 25 cm water or oil manometer.**
- **Each sampler should have its own dedicated manometer.**

Calibration Equipment

- **Orifice transfer standard traceable to NIST**
- **An oil or water manometer with a 0 to 400 mm (0 to 16 in) range, scale division of 2 mm (0.1 in)**
- **A sampler oil and water manometer with a 0 to 200 mm (0 to 8 in) range, scale division of 2 mm (0.1 in) for measurement of sampler exit orifice plenum pressure**

Calibration Equipment

(continued)

- **Thermometer range of 0 to 50°C to the nearest 0.1°C traceable to NIST**
- **Portable aneroid barometer range of 500 to 800 mm Hg, sensitivity to nearest 1 mm Hg, referenced within 5 mm Hg of a barometer of known accuracy annually**
- **Miscellaneous handtools, calibration data sheets, and duct tape**

Multipoint Flow Rate Calibration Procedure

- **Set up calibration system.**
- **Disconnect motor from flow controller.**
- **Install orifice transfer standard.**
- **Check all gaskets and replace as needed.**
- **Select first calibration flow rate, install appropriate resistance plate or adjust the variable orifice valve.**
- **Conduct leak test.**

Multipoint Flow Rate Calibration

Procedure

(continued)

- **Eliminate any leaks before proceeding.**
- **Inspect connecting tubing.**
- **Adjust manometer's sliding scales.**
- **Connect orifice transfer standard manometer to the orifice transfer standard.**
- **Connect sampler's exit orifice manometer to the exit orifice plenum port.**