Fine PM Source Test Method

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Project Goals

- Quantify Course & Fine PM
  - Use Dilution Sampling to Mimic Atmospheric Physics
  - Operationally Simple
  - Minimal Sample Location Limitations

- Speciation of Particulate

- Minimize Pseudo Particulate Formation
Description

- In Stack Particle Sizing
  - Large Cyclone Separates PM >10µM
  - Smaller Cyclone Separates PM >2.5µM

- Air Dilution Condenses Vaporous PM
  - Air is Filtered & Dehumidified
  - Sample is Diluted up to 30 to 1

- PM2.5 is collected on multiple filters
Competing Methodologies

- U.S. EPA Test Methods
  - Preliminary Method 004 (M201A +2.5)
  - Method 202
- State Test Methods
  - More Than Four Variants
  - Similar to Method 202
- Research Methods
  - More Than Six Variants
  - All Based on Dilution Sampling
EPA Reference Methods

- EPA Pre Method 4 & Method 202

**Strengths**
- Compact
- Uses Existing Sampling Systems
- Applicable to Almost All Sources

**Weaknesses**
- Optional Procedures Allowed
- Potential Biases
Existing Dilution Methods

- More than Six Variants
  - With/Without Stack Particle Sizing
  - Different Residence Times
  - Dilution Ratios

- Strengths
  - Condense Particulate by Dilution

- Weaknesses
  - Heavy, Bulky, Complex
Typical Research Test Method

Dilution Air Inlet
HEPA Filter

Activated Charcoal Filter w/ Glass Wool Back-up

0 - 5 in H₂O Magnheletic Gage
Heated Venturi w/ Temp Sensor

Heated Sample Line w/ Temp Sensor
¼ in x 2 M Long SS

Temperature Sensor
Sample Inlet and
Stack

20 - 30 LPM

Turbulent Dilution Tunnel
Residence Time 2.4 Sec @
1200 LPM
Dilution Ratio 25X - 50X
6 in dia x 9 ft Long

Hi-Vol Pump & Flow Sensor
18 in Dia x 6 ft H
Residence Chamber
80 sec Res Time @ 226 LPM

Temp Controller

S Type Pilot Tube

2.5 μM Cyclones

To Sampler (113 LPM)

To Sampler (113 LPM)
Typical Research Test Method
Existing Sampler
In Stack Particle Sizers

PM$_{2.5}$ Cyclone  Nozzle

PM$_{10}$ Cyclone
Heated Sample Venturi
Dehumidifier / HEPA Filter
Mixing Chamber

- Sample Gas Inlet
- Mixing Zone
- Dilution Air Inlet
Dilution Air Mixer

Static Mixer
Major Components

- Heated Sample Venturi Box
- Dilution Air Venturi
- Dilution Chamber
- Mixing Area
- Extraction Port for Speciation Samples
- Filter Holder
Speciation Filter Module

- Aliquot of diluted sample extracted for speciation analysis
- Denuders used to remove potentially reactive gases
Expected Need in FY 2004
Current Status

- Completing Hardware Development
  - Hardware Operates as Expected
    - Sample Rate Maintained
    - Isokinetics Maintained
    - Dilution Ratios Maintained
    - Temperatures Maintained
  - Have Partial Preliminary Results from 2nd Hardware Shakedown Test

- Planning Comparison Tests
  - Pre M4 & Method 202
  - Modified URG Dilution Sampler
Preliminary Results of Second Test

Dilution Sampling System (7ppm SO3)

Method 17/202
9ppm SO3

Method 17/202
15 – 18 ppm SO3

Concentration (gr/dscf)

DST
PM <2.5
PM >2.5
M17/202
Ps PM
ICPM
OCPM
FPM

PM >2.5
Operating OAQPS Sample Train