

# PM<sub>fine</sub> Quantification

## Condensable PM Issues



Ron Myers  
OAQPS/SPPD/MPG  
6/14/2006

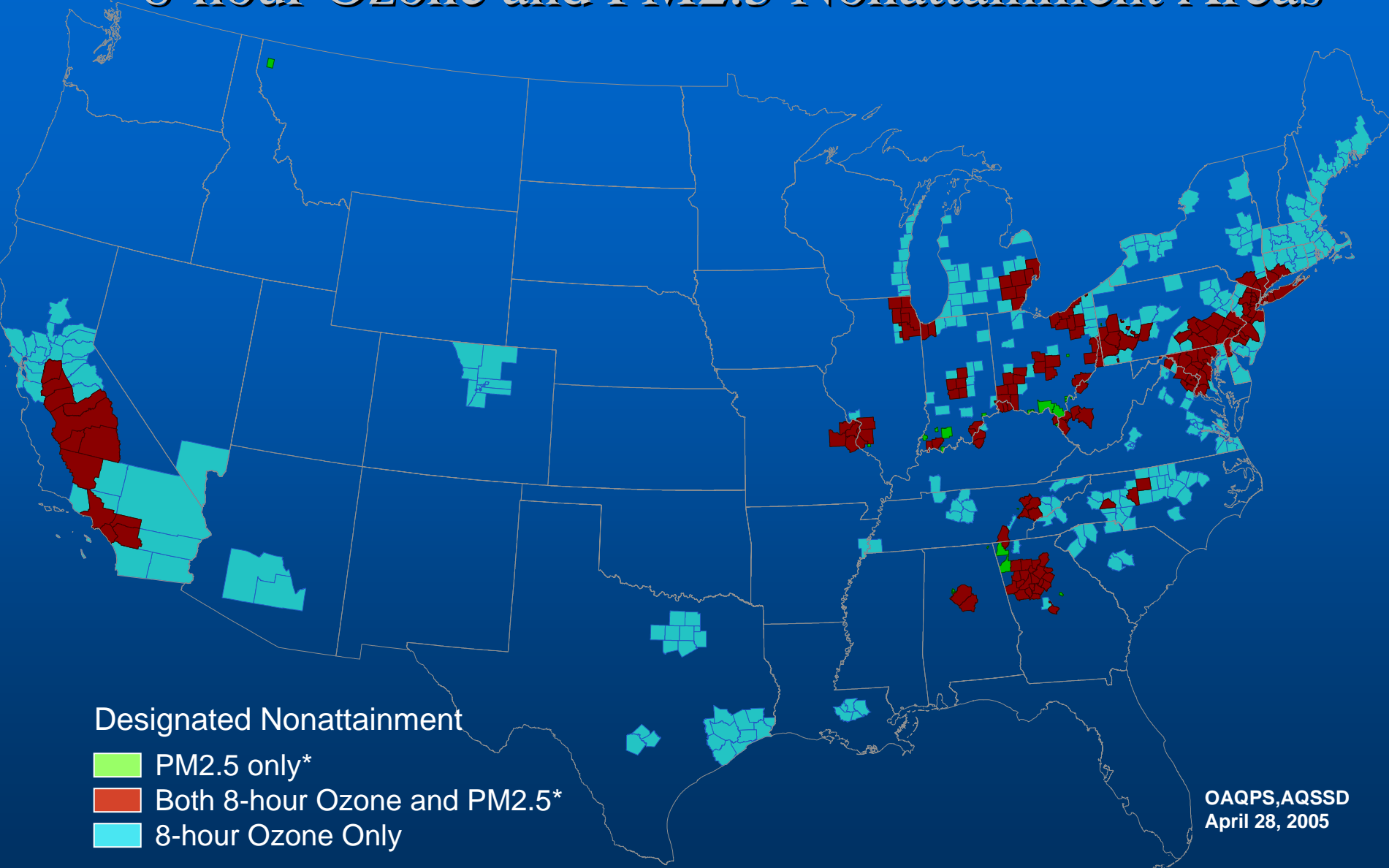


# Presentation Topics

- **PM<sub>fine</sub> Problem**
- **Test Method Archaeology**
- **Source Test Method Philosophy**
- **Recent History**
- **Current Activities**
- **Future**



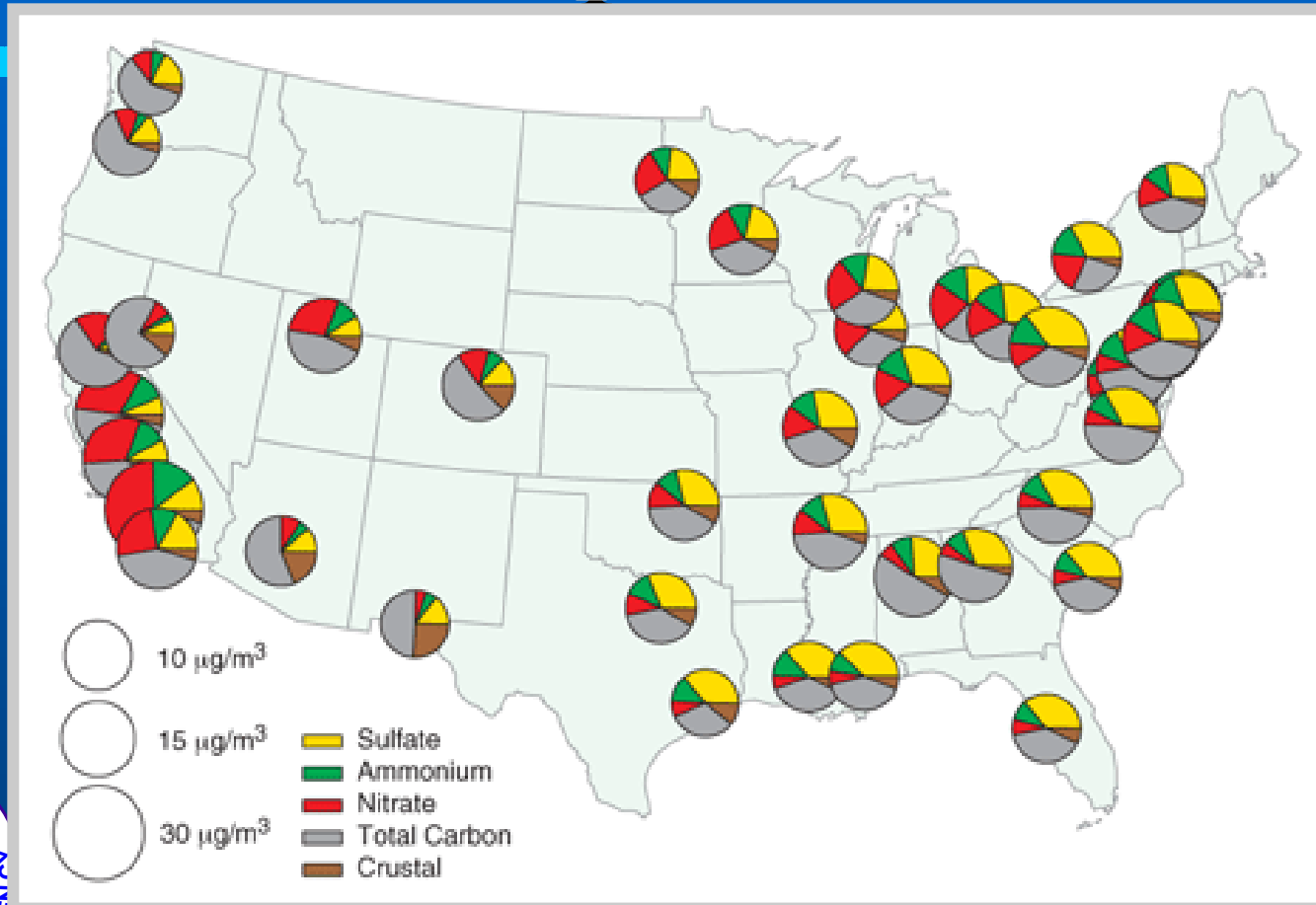
# 8-hour Ozone and PM2.5 Nonattainment Areas



OAQPS,AQSSD  
April 28, 2005

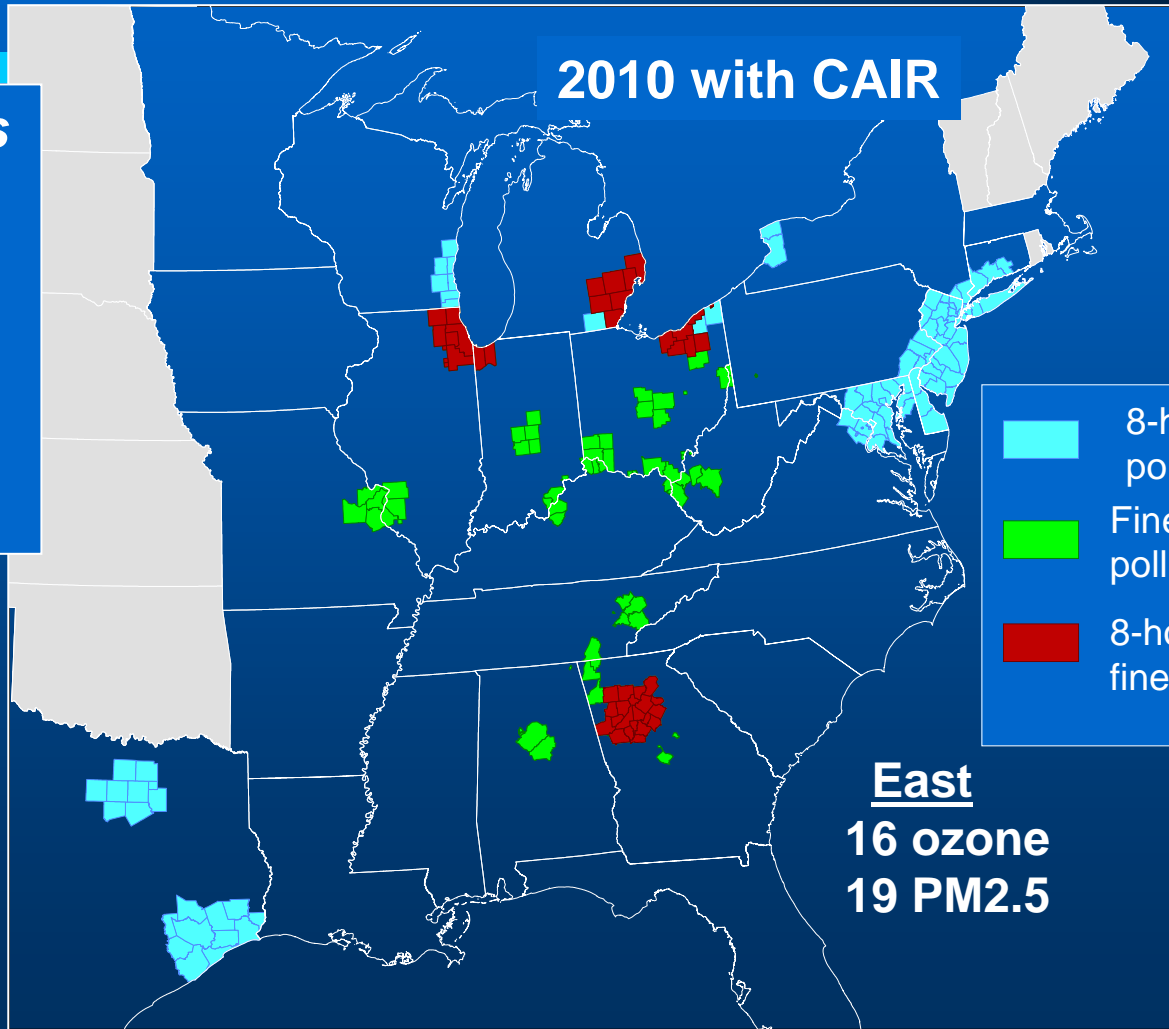
\* For PM2.5, the designated partial county areas are shown as actual boundaries designated.

# Particle Composition Varies



# Non Attainment Areas w/ CAIR

*Projected NAs  
in 2010 after  
reductions  
from  
CAIR and  
existing CAA  
programs*



- 8-hour ozone pollution only
- Fine particle pollution only
- 8-hour ozone and fine particle pollution



# 22 PM2.5 Areas Projected to Not Attain by 2010

- Atlanta, GA
- Birmingham, AL
- Canton, OH
- Charleston, WV
- Chattanooga, TN-GA-AL
- Chicago, IL
- Cincinnati, OH-KY-IN
- Cleveland, OH
- Columbus, OH
- Detroit, MI
- Huntington-Ashland, WV-OH-KY
- Indianapolis, IN
- Knoxville, TN
- Libby, MT
- Los Angeles (South Coast), CA
- Louisville, KY-IN
- Macon, GA
- Pittsburgh (Liberty-Clairton), PA
- Rome, GA
- San Joaquin, CA
- St. Louis, MO-IL
- Steubenville-Weirton, OH-WV

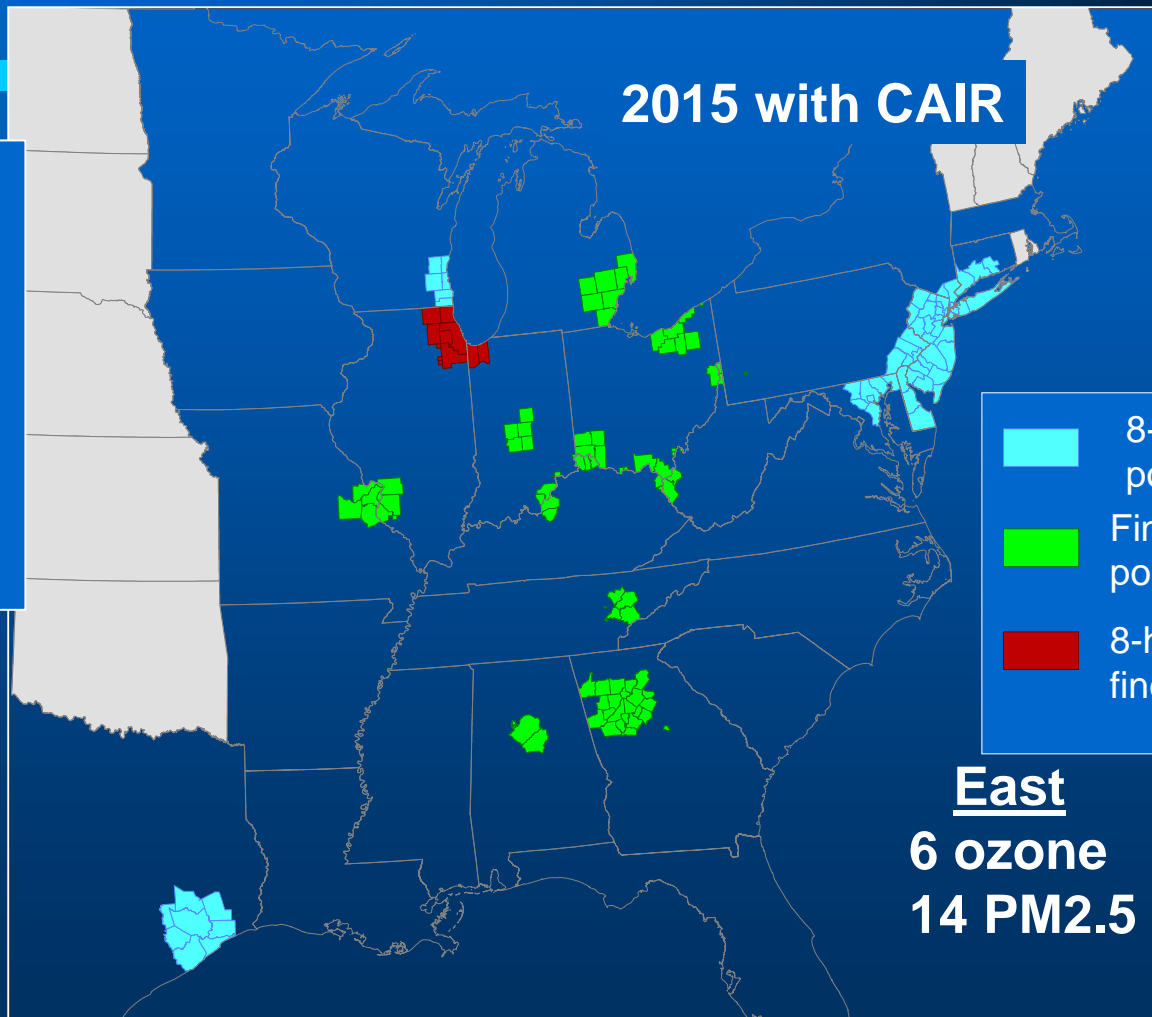





Total: 122 counties, 51 million population



# Non Attainment Areas w/ CAIR

**Projected NAs  
in 2015 after  
Reductions  
from  
CAIR and  
Existing CAA  
programs**



-  8-hour ozone pollution only
-  Fine particle pollution only
-  8-hour ozone and fine particle pollution



# PM fine Implementation Proposal

- **Announced on Sept 9, 2005**
  - **Source Emissions Testing**
    - PM sizing at 2.5  $\mu\text{M}$
    - PM condensable
  - **Source Emissions Monitoring**
    - Filterable & condensable PM
    - Precursor compounds
- **Comment Period Closed**
  - 19 commenters on testing & monitoring





# PM fine Implementation Proposal

- **Source Testing Methods**
  - When local controls required – include condensable particulate matter
- **Source Emissions Monitoring**
  - Sought comments on
    - Assertion
    - Feasibility of co-pollutant control
  - Asked for
    - Examples of improved monitoring
    - Methods of determining reductions



# Proposed NAAQS Revision

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- Affirms existing PM<sub>2.5</sub> annual average
- Proposes PM<sub>2.5</sub> 24 hr average standard
- Proposes coarse PM 24 hr average standard
- Any 24 hr average will increase need for local controls



# CPM Measurement Archaeology

- **August 1971**
  - **First NSPS Proposal**
    - EGU's, Portland Cement Plants, Incinerators, Sulfuric Acid Plants & Nitric Acid Plants
    - Back half PM emissions included
  - **Promulgated Standards & Method**
    - PM test method excluded back half
    - Emissions limitation reduced by half for EGU's & 20% for Incinerators



# Archeology (cont)

- NSPS approach for PM emissions
  - NSPS PM limits governed by “Best” control devices available
    - ESP’s
    - Fabric Filters
  - Several NSPS recognized that emissions measured for compliance purposes do **NOT** quantify total PM emissions



# PM Measurement Philosophy

- **PM emissions limitations reflect capabilities of available controls**
  - Measure only controllable component
  - “Best” controls were ESP’s & FF
  - Scrubbers were “Best” for a few sources
- **Recognized that unmeasured portion was important in ambient air**



# Recent History

- **PM-10 NAAQS**

- Recognized condensable PM impact
  - Crustal PM was cause of most non-attainment areas
  - Condensable PM was a small consideration
- Condensable PM method proposed in 1990
  - Was a “Consensus Method” addressing several State specific compliance test methods
  - Incorporates several analytical options



# EPA Method 202

- **Collects PM in impinger water**
  - **Similar to 1971 back half PM method**
    - Nitrogen purge added
    - Added stabilization of Sulfuric Acid
  - **Reflected several State/local methods**
    - **Allowed several options**
      - Air purge
      - No purge
      - Analysis of some components



# Method 202 (cont)

- Intent is to replicate ambient air emissions (see Philosophy Quote 1)
  - PM is defined by the conditions
    - Temperature
    - Pressure
  - All M202 options generate different emissions values
  - No simple Referee Method available in 1990





# Current Activities – Method 202

- Conducted Laboratory Study
- 36 samples
- SO<sub>2</sub> bubbled through impingers
  - 300 ppm for 1 & 3 hours
  - 50 ppm for 6 hours
  - Nitrogen purge and no purge
  - Hold times from 1 to 20 hrs for initial analysis



# Method 202 Artifacts

| SO <sub>2</sub><br>ppm | Test<br>duration | H <sub>2</sub> O<br>volume | Artifact Mass (mg) |          |
|------------------------|------------------|----------------------------|--------------------|----------|
|                        |                  |                            | No Purge           | Purge    |
| 300                    | 1 Hr             | 400 ml                     | 180 ± 6            | 10 ± 0.5 |
| 300                    | 3 Hr             | 800 ml                     | 400 ± 25           | 20 ± 5   |
| 50                     | 6 Hr             | 1400 ml                    | 200 ± 10           | 20 ± ??  |



# Artifact Implications (Coal Fired Boiler)

- FPM & CPM of 0.03 #/MMBtu

- SO<sub>2</sub> of 1.3 #/MMBtu (150 ppm)

|          | Purged    | Un-purged     |
|----------|-----------|---------------|
| FPM      | 50 mg     | 50 mg         |
| CPM      | 50 mg     | 50 mg         |
| Artifact | 3 to 6 mg | 100 to 200 mg |



# Current Activities

- **Dilution Sampling for PM**
  - OAQPS developed Method
  - Industry developed Method
  - ASTM consensus standard
  - Development of Fine PM CEM's
- **Improve Method 202**



# OAQPS Dilution Sampling System

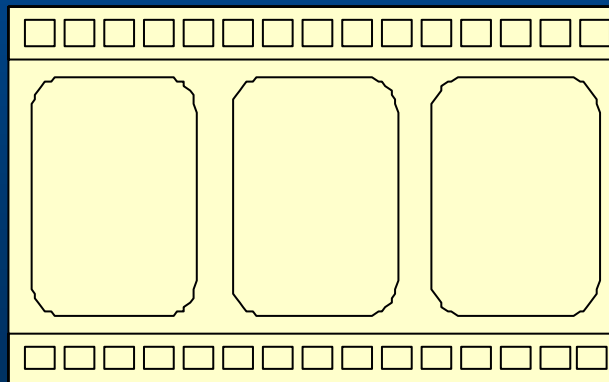


# Video Tour of the OAQPS DST

To run the video, just click on the film image and if you have the Windows Media Player (or software that will run a windows video media file) it should play.

Otherwise it is available below CTM-039 on the Conditional Test Method page of the Emissions Measurement Centers web site (<http://www.epa.gov/ttn/emc/ctm.html> ).

The specific location of the video is at [http://www.epa.gov/ttn/emc/ctm/dst\\_tour.wmv](http://www.epa.gov/ttn/emc/ctm/dst_tour.wmv) )



# ASTM PM Test Method

- **ASTM D22 Committee**
  - Developing a dilution base standard for sampling and analysis of PM<sub>2.5</sub>
    - Glenn England – Chairperson
    - EPA is active participant
    - State/local agencies are represented
    - Industry is represented



# CTM 039 vs. Method 202

| Time Period               | Concentration, mg/dscm |                | Percent Difference |
|---------------------------|------------------------|----------------|--------------------|
|                           | CTM-039                | CTM-040/ M-202 |                    |
| 1 & 2                     | 49.4                   | 36.8           | 34                 |
| 3 & 4                     |                        | 26.9*          |                    |
| 4                         | 48.9                   | 46.2           | 6                  |
| 5 & 6                     |                        | 57.7**         |                    |
| (excluding 202-4A)        | 26.9                   | 23.5           | 14                 |
| 7                         | 28.4                   | 26.0           | 9                  |
| Average Fine PM Emissions | 38.4                   | 38.7           | 16                 |

- \*= runs 202-2A,B done at different control device setting
- \*\*= error in condensable data for run 202-4A





# Method 202 Improvement

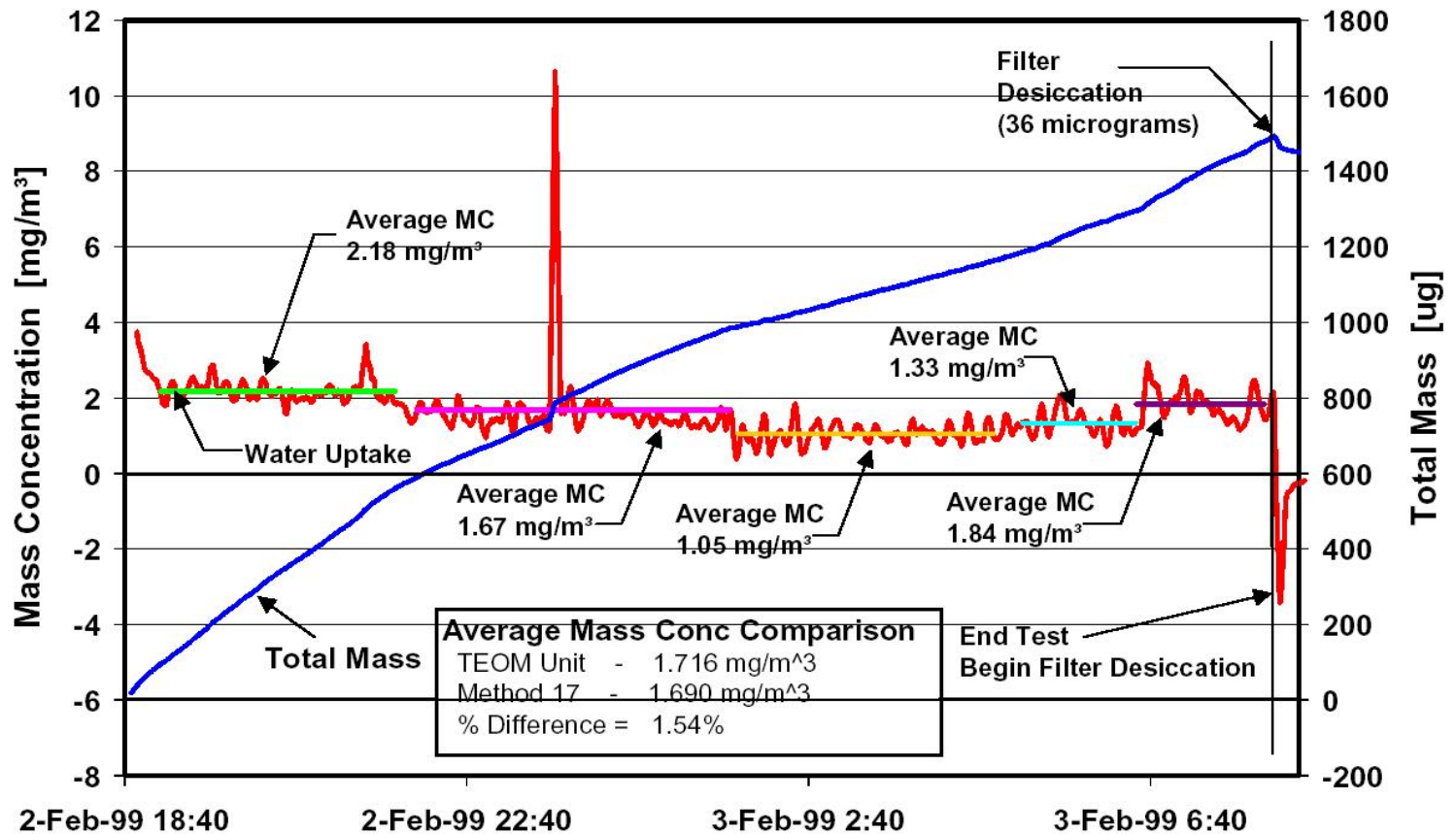


- **Expand Lab Study**
  - Purge Only
  - Expand SO<sub>2</sub> conc
  - Modify glassware
  - Collaborate with stakeholders



# Fine PM CEM's Development

Figure 8. Low Contration Emission Test Using Dilution with Comparison to Manual In-Stack Method



# Open Discussion

- QUESTIONS?



# Archeology Quote

- *Supplemental Statement in Connection with Final Promulgation: (3/21/1972)*
  - *"It is the opinion of EPA engineers that particulate standards based either on the front half or the full EPA sampling train will require the same degree of control if appropriate limits are applied. Analyses by EPA show that the material collected in the impingers of the sampling train is usually although not in every case a consistent fraction of the total particulate loading."*



# Philosophy Quote

- *Preamble to the Promulgated Changes of the NSPS Subparts (10/6/1975)*
  - *The method should measure pollutant emissions indicative of the performance of the best systems of emission reduction. A method meeting this criterion will not necessarily measure emissions as they would exist after dilution and cooling to ambient temperature and pressure, as would occur upon release to the atmosphere. As such, an emission factor obtained through the use of such a method would, for example, not necessarily be of use in an ambient dispersion model.*



# Philosophy Quote (cont)

- *Preamble to the Promulgation of Kraft Pulp Mills NSPS (Subpart BB - 2/23/1978)*
  - *State Implementation Plans (SIP's) approved or promulgated under section 110 of the Act, on the other hand, must provide for the attainment and maintenance of national ambient air quality standards (NAAQS) designed to protect public health and welfare. For that purpose, SIP's must in some cases require greater emission reductions than those required by standards of performance for new sources."*



# Philosophy Quote (cont)

- *Preamble to Promulgated Standards of Performance for Glass Manufacturing Plants (Subpart CC 10/7/1980)*
  - *When particulate matter is filtered at about 120 C, a significant amount of sulfuric acid, if present, can condense on the filter. The measurement of this sulfuric acid by Method 5 does not constitute an error in the method because sulfuric acid is normally considered to be particulate matter. However, the variability of the sulfuric acid content in the stack gas was not considered in developing the standards. As a result, the decision was made not to include sulfuric acid as part of these standards. Therefore the method was modified to allow operation of the filter and the probe at up; to 177 C, which is above the acid dew point and would prevent sulfuric acid mist from being collected by the filter.*



# Philosophy Quote (cont)

- *Preamble for the Promulgated NSPS for Wool Fiberglass Insulation Manufacturing (Subpart PPP 2/25/1985)*
  - *Determining baseline emissions from wool fiberglass insulation manufacturing plants directly from the State regulations is inappropriate because a different test method was used in developing the standard than was used to determine allowable SIP emission limits. This modified test method is the reference method for determining compliance with the standard of performance for wool fiberglass insulation manufacturing plants. Most state regulations are based on a "front-half catch" test method and the standard is based on a test method that measures total catch. The total catch test method was developed and proposed along with the standard to account for certain factors that are peculiar to the wool fiberglass insulation manufacturing industry.*





# Future

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- **PM condensables are increasingly important**
- **Several methods are available to accurately quantify condensable PM**
- **Continuous Monitoring Systems are on the Horizon**
- **Several CPM control technologies available**

