PM_{fine} Quantification

Perceptions about Ammonia Slip, Acid Gases, Condensable Particulate Matter and Applicable Test Methods

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Presentation Topics

- **Archaeology**
- **Philosophy**
- **Recent History**
- **Current Activities**
- **Future**

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**

1990 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 was to replicate ambient air emissions (see Quotes from NSPS)**
  - **PM is defined by the conditions**
    - **Temperature**
    - **Concentration**
    - **Pressure**
  - **All 1990 M202 options generated different emissions values**
  - **No Referee Method available in 1990**

Measurement/Monitoring Drivers

- **PM fines NAAQS**
- **Permits Program**
- **Enhanced Monitoring**
- **Consolodated Emissions Reporting Rule**
- **Significant emissions increase w/ CPM addition**
- **Industry “artifacts” concern**

Assessment of 1990 Method 202

- **Conducted Laboratory Study**
- **SO_2 bubbled through impingers**
  - **300 ppm for 1 & 3 hours**
  - **50 ppm for 6 hours**
  - **Nitrogen purge and no purge**
- **No ammonia**

Method 202 Artifacts

SO_2 ppm	Test duration	H_2O 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 ± ??

Recent Activities

- **Revised Method 201A & 202**
  - **Eliminated options**
  - **Reduced initial impinger water**
  - **Required purge**
  - **Required back up impinger**
- **Dilution Sampling for PM**
  - **Research Methods**
  - **OAQPS developed Method**

Method 202 Improvement

- **Expand Lab Study**
  - **Purge Only**
  - **Expand SO2 conc**
  - **Modify glassware**
  - **Collaborate with stakeholders**

Dry Impinger Method Performance

Run	Organic (mg)	Inorganic (mg)	Filter (mg)	Total
1	0.11	2.23	-0.34	2.34
2	0.15	2.88	-0.06	3.03
3	0.09	1.37	0.00	1.46
4	0.30	1.91	0.00	2.22
5	0.16	1.54	0.07	1.77
6	0.33	2.19	-0.17	2.52
7	0.08	1.18	0.30	1.56
8	0.02	1.87	0.17	2.06
Blank	-0.02	0.21	0.00	0.68
Average	0.16	1.90	0.00	2.12
Std Dev	0.1	0.51	0.17	0.45
MDL	0.31	1.54	0.49	1.36

Important $PM_{2.5}$ Method Dates

- **Final PM Implementation Rule**
  - **April 25, 2007**
  - **FR Vol 72, No 79, pg 20586**
- **Proposed Test Methods**
  - **March 25, 2009**
  - **FR Vol 74, No 56, pg 12970**
- **Final Test Methods**
  - **December 21, 2010**
  - **FR Vol 75, No 244, pg 80118**

Residual PM Testing Concerns

- **Method 202 > SO_3**
- **Ammonia reactions**
- **CPM still dominates $PM_{2.5}$ emissions**
- **Permit limits exceeded**

Example Measurement Issue

- **Coal fired utility boiler**
  - **Catalytic Reduction for NO_X**
  - **Permit limit for NO_X & PM_{10}**
- **Failed annual PM compliance test**
  - **PM_{10} was 5x limit**
  - **CPM was 95% $(NH_4)SO_4$**
  - **NH_3 slip measured at 57 ppm**
  - **SO_3 measured at 0.4 ppm**
- **Stack test consultant concluded PM was primarily "*artifact*"**

Resolution of Measurement Issue

- **Retested with several test method changes**
  - **Increased sample rate**
  - **Increased condenser temperature …**
  - **Same results**
- **Replaced catalyst bed 2 years early**
- **Reduced NH_3 slip to 1 ppm**
- **CPM emissions reduced by 90%**
- **New Plant Manager hired**
- **New Test Contractor hired**

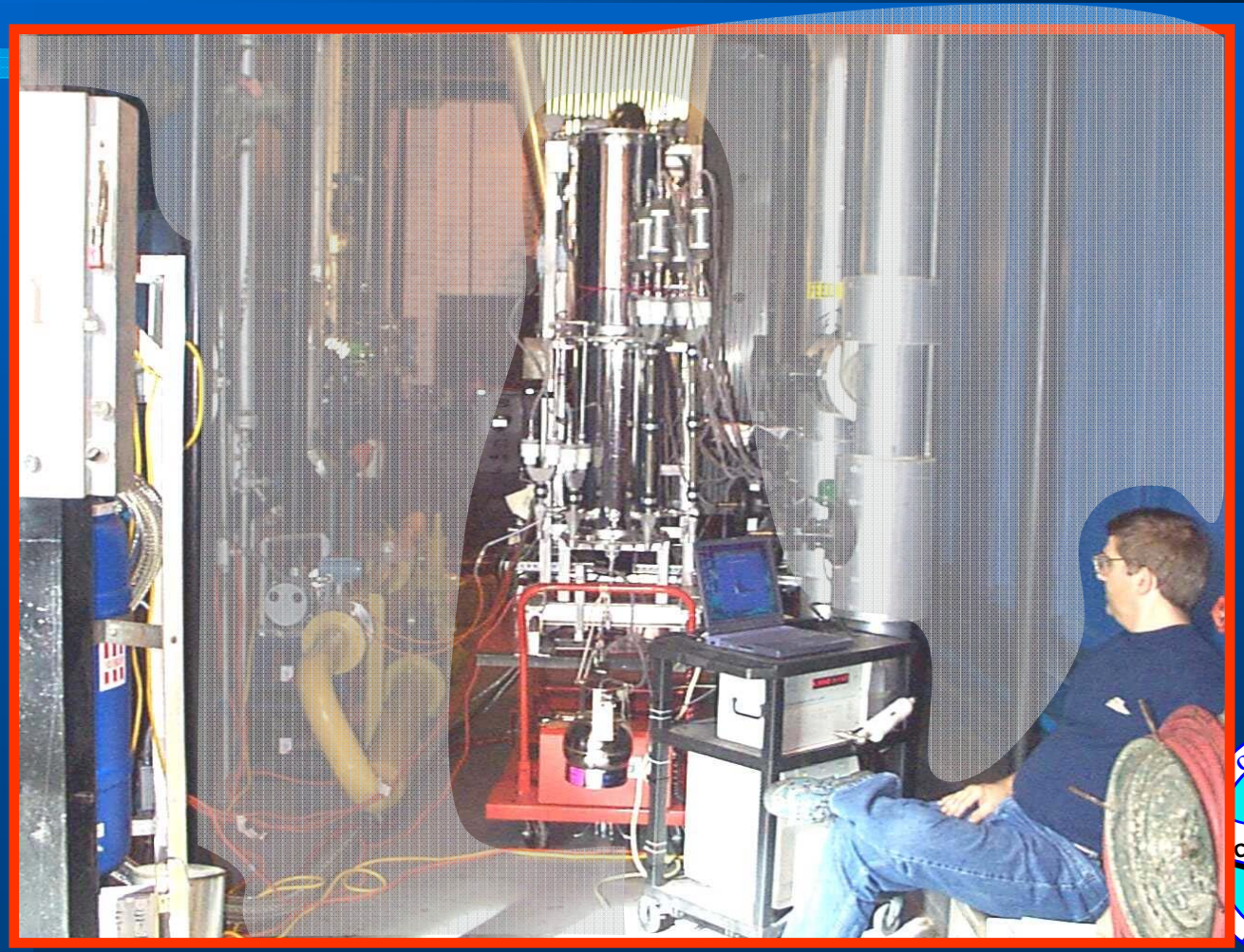
Next Example Measurement Issue

- **Biomass Boiler**
  - **Noncatalytic reduction during O_3 season**
  - **FF for PM control**
- **PM (M5 & 202) test results**
  - **w/o NH_3 injection - 0.004 #/mmBtu**
  - **w/ NH_3 injection - 0.02 – 0.04 #/mmBtu**
- **CTM 039 results – 0.007 #.mmBtu**
  - **Sampling issues**
    - **Water**
    - **Filter**

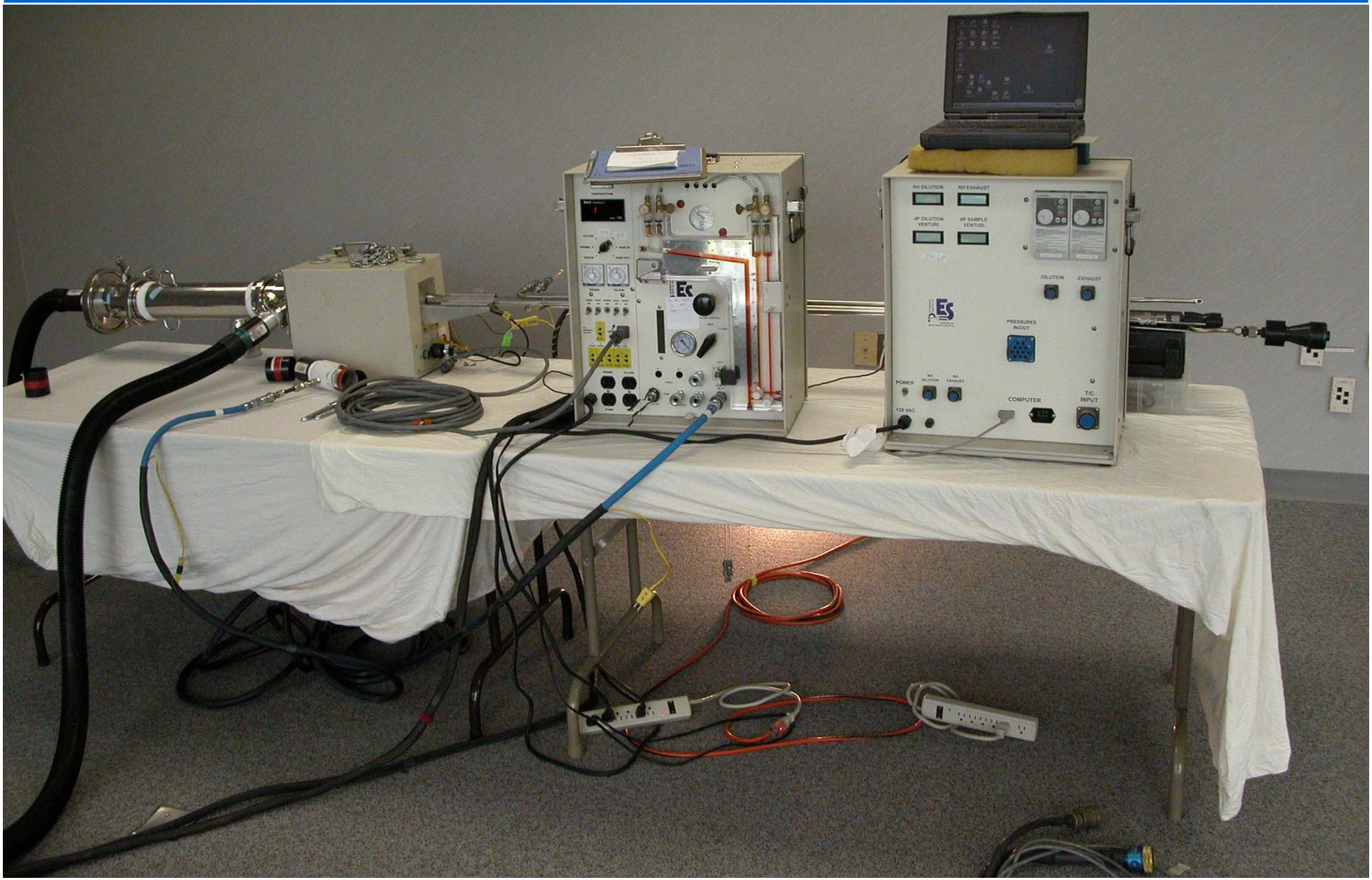
Interest in CTM 039 Increasing

- **National Academy encouraged use of dilution sampling**
- **EPA developed system**
  - **Potential benchmark for "artifact" elimination**
  - **Potential for use with extended sampling times**
  - **Development of speciation profiles**
- **EPA continues to encourage further development**

Typical Research Test Method



OAQPS Dilution Sampling System



OAQPS Dilution Sampling System

Video of OAQPS DST

This link will take you to the 2 min video of the OAQPS Dilution Sampling System.
You need to have Windows Media Player to view this slide of the presentation.

Future

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

Open Discussion

- **QUESTIONS?**