EMISSIONS AND AIR QUALITY MANAGEMENT

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EMEP--October 25, 2005

AT THE AIR QUALITY POLICY-SCIENCE INTERFACE

--Emissions estimates are a mainstay of air quality management appraisals

--View of the state-of-the-art

- o A North American perspective
- o New York State issues
- o Measurements and uncertainties

--NYSERDA's role

- o The NARSTO partnership
- o Working with DEC to add confidence
- o Defining key emissions through measurement

The NARSTO ASSESSMENT

- What's NARSTO?
- Recognizing air quality progress and problems in the North American context.
- Emission inventories
  - Their historical use
  - Contemporary drivers (links with models)
- Limitations and fixes
- Role of innovative methods
- Future efforts

The NARSTO Assessment

- Identifies national and sub-national inventories and their access
- Describes methods to generate inventories
- Uncertainties and methods to determine them
- Ways to improve inventories, characterize uncertainties and improve delivery

The NARSTO Assessment

- Target resources by priority to improve limited source category knowledge; address uncertainties for most effective control options
- Improve speciation and special estimates
  - Especially carbon (VOC, SVOC, OC, BC)
  - Non-traditional components like NH3
  - HAPs
  - Transportation
  - Attention to small sources

- Improve and develop emission inventory tools
- Quantify and report uncertainty
- Increase inventory compatibility and comparability
- Improve timeliness
- Assess and improve projections

The NARSTO Assessment

- Current knowledge—subjective in AP-42, etc.
- Dealing with uncertainty
  - Measurements and their representativeness and specifying standard error
- Thinking in in probability language
  - In probabilistic terms, are the data accessible the most probably value for a source category?
  - Given very small samples, how can one estimate the range of estimation for emission factors and process activity in terms of probability distributions?

The NARSTO Assessment

- Adopting innovative approaches
  - Remote sensing from satellites to roadway observations
  - Real world vehicle fleets (chase vehicles, portable measurements systems, dilution tunnels, …
  - Advanced aircraft plume measurements
  - Direct flux determination
  - Receptor modeling
  - Inverse modeling
  - New ways to manage data

New York State Applications

- Current context of SIP development
- Seeking practical answers for estimating emissions
- The weak spots
- Reference data for contemporary sources
- Accounting for limitations and errors in the NEI

New York State Applications

- Context –Concerns for certain local and regional pollutants relating to modeling, particularly SIP development for PM2.5 (2005-2006 frame)
  - Receptor model applications and use of CMAQ
- Non-attainment focuses largely on the New York metro area
  - Particular concern with sulfate and nitrate (ammonium salts) and carbon components

New York Application

- Needs for specific information beyond NEI
  - Tracing estimates to measurements
  - BART Rule
  - Distinguishing PMx in NEI and PM2.5
  - Ammonia inventory, especially agricultural emissions perhaps in Pennsylvania
  - Carbon emissions including speciation of OC
    - Example—Upstate NY and NYC woodstove anomaly
  - HAPs—metals in PM2.5, differentiating crustal and anthropogenic material
    - E.g. Si at Lye Brook—anomaly associated with a fiber glass plant

New York Application

- The Transportation Sector
  - Emissions models using SMOKE and MOVES vs. MOBILE 6
  - Unclear if national model has reliable application to New York metro conditions
  - Future projections are problematic for New York
  - Specifics on carbon emissions and distinction between OC and BC; VOCs and PM production

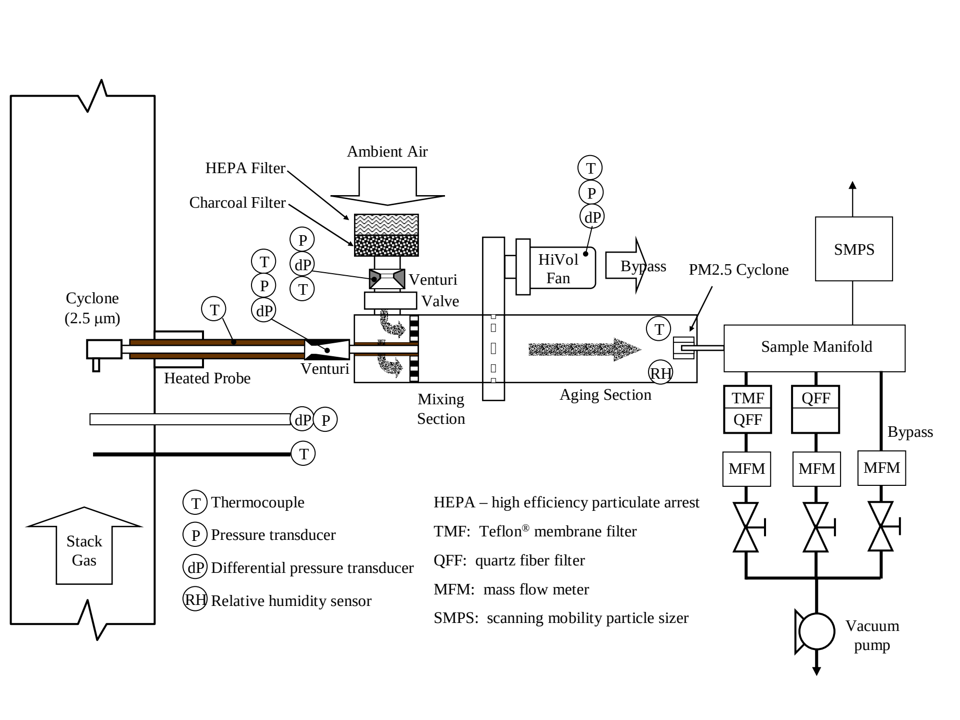
NYSERDA and Defining a PM2.5 Reference Method

- Reference method for PM2.5 stationary source emissions measurement a chronic concern
  - Need for a "real world" simulation of effluent entry into the atmosphere, for PMx noting that cooling of effluent produces condensable material
  - Technical solution has focused on dilution sampling
  - Also concern for achieving low detection limits for stationary combustion sources, especially gas fueled
  - NYSERDA partnership with API, DOE, CEC and GE to develop and apply a portable dilution sampler
  - A major investment in developing dilution sampling as a reference method, and acquisition of portfolio of PM2.5 related emissions

Dilution Sampling

- Portable dilution sampler developed and extensively evaluated in the NYSERDA et al program
  - Sampler designed and built at GE-Energy
  - Evaluated sampling emissions from a pilot combustor using gas, oil and coal fuels
  - Evaluation through comparison with a reference dilution sampler of Hildemann et al design, and with established PMx reference methods, including Method 5 and Method 202.
  - Evaluation of sampler performance established operating parameters for stack sampling.
  - Found major differences between dilution sampling results and standard reference methods, mostly identified with condensable fraction defined in terms of impinger collection.
  - Recommended new reference method using dilution sampler considered by ASTM

GE Dilution Sampler



Illustrative Dilution Sampler Results

- Characterized PM2.5 mass, PM2.5 composition and related trace gas emissions from a number of gas fired combustors, a dual and oil fired unit, and compared with data in the literature
- Found gas fired units have very low PM2.5 emissions relative other fuel combustion
  - Results were complicated by approaching detection limits and by highly filtered dilution air quality
  - Carbon sampling complicated by as much SVOC as condensable OC

Dilution sampling-comparative results (%)

Component	NGCC	Diesel Generator	Coal	Biomass
OC	**68**(66)	22(10)	1-5.2 (27.2)	62
EC	2.5	**78**	4.1-4.9	16-33
SO4=	13	0.3	5-15	0.18-3.2
Si	1.8	ND	6.8-10	0.066-0.30
K	0.3	ND	0.08-0.52	**0.35-5.7**
V	0.01	ND	0.0072-0.076	0-0.0088
Se	ND	ND	**0.041-0.35**	0-0.0002

Summary and Conclusions

- National emissions measurements and inventories need improvement in many key areas, including PM2.5, carbon components and HAPs.
  - Uncertainty is likely to be a significant issue
- In the short term, NYS like other entities have problems extracting and applying emissions data or models to air quality management analyses.
  - Reliability of NH_3, Carbon, small sources and transportation estimates are particularly important.
- NYSERDA has worked closely with DEC and others to foster emissions estimation improvement.
  - One example the development of a dilution sampler for stationary source measurement, perhaps leading to a new reference method.
- More work to be done for improvement!