Emissions Inventory:
Lessons Learned and Future Plans for PM$_{2.5}$, Haze, and Ozone

VI STAS-SESARM
MARAMA meeting
February 10, 2009
Lessons Learned in the Regional Haze Program

- Class I areas in the Southeast are not remote, located near PM$_{2.5}$ and ozone non-attainment areas
  - Urban and Class I areas have common regional pollutant contributions (SO$_4$, carbon)
  - Urban areas have additional local increment (NO$_3$, OC, EC, metals)
  - Emissions controls to address PM$_{2.5}$ nonattainment areas will also reduce PM$_{2.5}$ and improve visibility in Class I areas
  - Integrated air quality management approach needed for ozone, PM$_{2.5}$, and haze
PM2.5 constituents are similar at urban and nearby Class I Areas

2002 3rd Quarter Fine Particle Mass – Southern Appalachian Sites

- Unidentified
- Fine Soil
- EC
- Organic Carbon
- NO3
- NH4
- SO4

PM2.5 constituents are similar at urban and nearby Class I Areas.
Lessons Learned in the Regional Haze Program

- $\text{SO}_2$ most important contributor to $\text{PM}_{2.5}$ and haze in the Southeast
  - Fortunately, high confidence in $\text{SO}_2$ inventory
  - In VISTAS states, point sources are 96% of total $\text{SO}_2$ inventory
  - Even assuming EGU controls under CAIR, in 2018 EGU are still largest contributors to $\text{SO}_4$
  - Second largest source category is coal-fired industrial boilers
Lessons Learned in the Regional Haze Program

- Organic carbon is major contributor to PM$_{2.5}$ and haze in the Southeast
  - Higher OC at urban monitors than Class I areas
  - Primary PM$_{2.5}$ from biomass or fossil fuels
  - Secondary organic aerosol, mostly biogenic

- Elemental carbon is important in PM$_{2.5}$ non-attainment areas, less so at Class I areas
  - Primary PM$_{2.5}$ from incomplete combustion of biomass or fossil fuels
Lessons Learned in the Regional Haze Program

- Carbon inventory needs improvement!
  - Improved profiles for mobile, nonroad, point, and area sources
    - LADCO-NREL project to improve mobile profiles
    - Speciation of PM$_{2.5}$ from point sources
  - Fire activity and emissions
    - Significant impacts to ozone, daily PM$_{2.5}$, haze
  - Biogenic emissions
CMB-C14 Apportionment of Total Carbon

Largest contributions from biomass burning, mobile, and unidentified modern carbon attributed to biogenic emissions

Cape Romain, SC

Raleigh, NC

(ng/m³)

Winter Spring Summer Fall

Winter Spring Summer Fall

Veg Burn - Hardwood  Veg Burn - Softwood
Meat Cooking  Diesel
Gasoline  Vegetative Detritus
Unidentified modern (Biogenic)
Lessons Learned in the Regional Haze Program

- **NO$_3$** small contributor to PM$_{2.5}$ in Southeast
  - NO$_x$ and NH$_3$ contribute to NH$_4$NO$_3$
  - NH$_4$NO$_3$ may be elevated on some winter days
  - NO$_x$ fairly good inventory
    - incomplete combustion of fossil fuels, biomass, livestock, biogenic
  - NO$_x$ emissions important for ozone

- **NH$_3$** inventory needs improvement!
  - Primarily from livestock and fertilizers, also human waste management systems
  - Large uncertainty in current assumptions
Lessons Learned in the Regional Haze Program

- “Soil” or “Crustal” minor contributor to PM$_{2.5}$ in Southeast except in local nonattainment areas
  - Need better PM$_{2.5}$ profiles
  - Industrial PM profiles include metals in “soil” category with crustals, leads model to over predict “soil”

- Fugitive dust is issue for West, not populated east
Lessons Learned in the Regional Haze Program

- Emissions Inventories need to support Air Quality Modeling
  - Speciation of primary PM$_{2.5}$
  - Temporal allocation: how much simplification is too much?
    - Utility daily and annual profiles
    - Mobile profiles
    - NH$_3$
  - Improve spatial resolution of inventory data for modeling
    - E.g. fire, agricultural emissions, rail yards as point source emissions
Lessons Learned in the Regional Haze Program

- **Process and Policy**
  - RPOs shared methods and inventories, but schedules didn’t align across RPOs
  - Eastern RPOs used different utility projections
    - Range of 2018 forecasts reflects future uncertainties; we won’t know which is most accurate until 2018
    - GA and NC have state rules for EGU controls
    - Consent decrees and federal court order require additional controls in AL, FL, KY, SC, TN, VA, WV
  - Eastern RPOs need to coordinate inventories better for next SIPs
Annual 2018 EGU Emission Totals

Regional Planning Organization

- VISTAS Total
- MRPO Total
- MANE-VU Total
- CENRAP Total
- WRAP Total

Annual SO2 Emissions (Thousand Tons)
Planning for Next SIPs

- One-atmosphere modeling for ozone, \( \text{PM}_{2.5} \), and haze SIPs
  - One emissions inventory supporting all SIPs
  - VI STAS is currently reviewing bids in response to request for proposals re emissions inventory development
    - Contractor to support state inventory staff
    - Expect contractor selection by end of Feb 2009
  - Working with ERTAC to define improvements for base year inventory and projection methods
    - Expect to follow ERTAC recommendations unless issues
Planning for Next SIPs

- No one modeling base year will be representative for all Southeastern states
  - 2005 hurricanes in Gulf, more typical for NC, VA
  - 2007 record drought, large fires in GA and FL
  - 2008 still drought, large fire in eastern NC affected VA
- Assume that 2008 is focus for emissions development
  - 2008 inventory will not be available until 2010
  - Expect to do preliminary modeling with an initial 2005 inventory
  - Evaluate 2005 LADCO and NEI inventories for initial modeling
  - May use meteorology from more than one base year for modeling demonstrations, still to be evaluated
June 2008 fires in eastern NC
Planning for Next SIPs

- VISTAS Inventory priorities
  - EGU projections: what requirements, what controls, where, when
  - Fire: how much can we afford to do?
  - NH$_3$ emissions from agricultural sources
  - Mobile emissions improvements
  - Rail improvements per ERTAC
  - ERTAC recommendations re area source methods
  - Better international emissions
    - Cuban emissions added?
  - Work with EPA to benefits from their improvements
Planning for Next SIPs

- Mobile emissions plans
  - EPA recommends MOVES model but model is not yet available
  - MOVES will project inventory but will not be integrated with emissions models (why?)
  - Intend to continue to use MOBILE 6 for emissions modeling

- Biogenic emissions: still evaluating options
  - MEGAN has additional secondary organic aerosol formation
  - EPA updated SOA formation in CMAQ v4.7

- CONCEPT emissions model
  - Open source model
  - Conceptually more transparent than SMOKE model
  - But...need better documentation for other users
  - VISTAS states will continue to use SMOKE
Planning for Next SIPs

- Coordination with other regions
  - Need to do better than regional haze experience
  - Already cooperating to improve and standardize methods through ERTAC ad-hoc group
    - $\text{NH}_3$, EGU projections methods in 2009
  - Already cooperating through State Collaborative effort on common modeling platform
  - Build success through existing technical efforts