VISTAS Emissions Inventory Development

Presented to Emissions Inventory Conference
May 1, 2003

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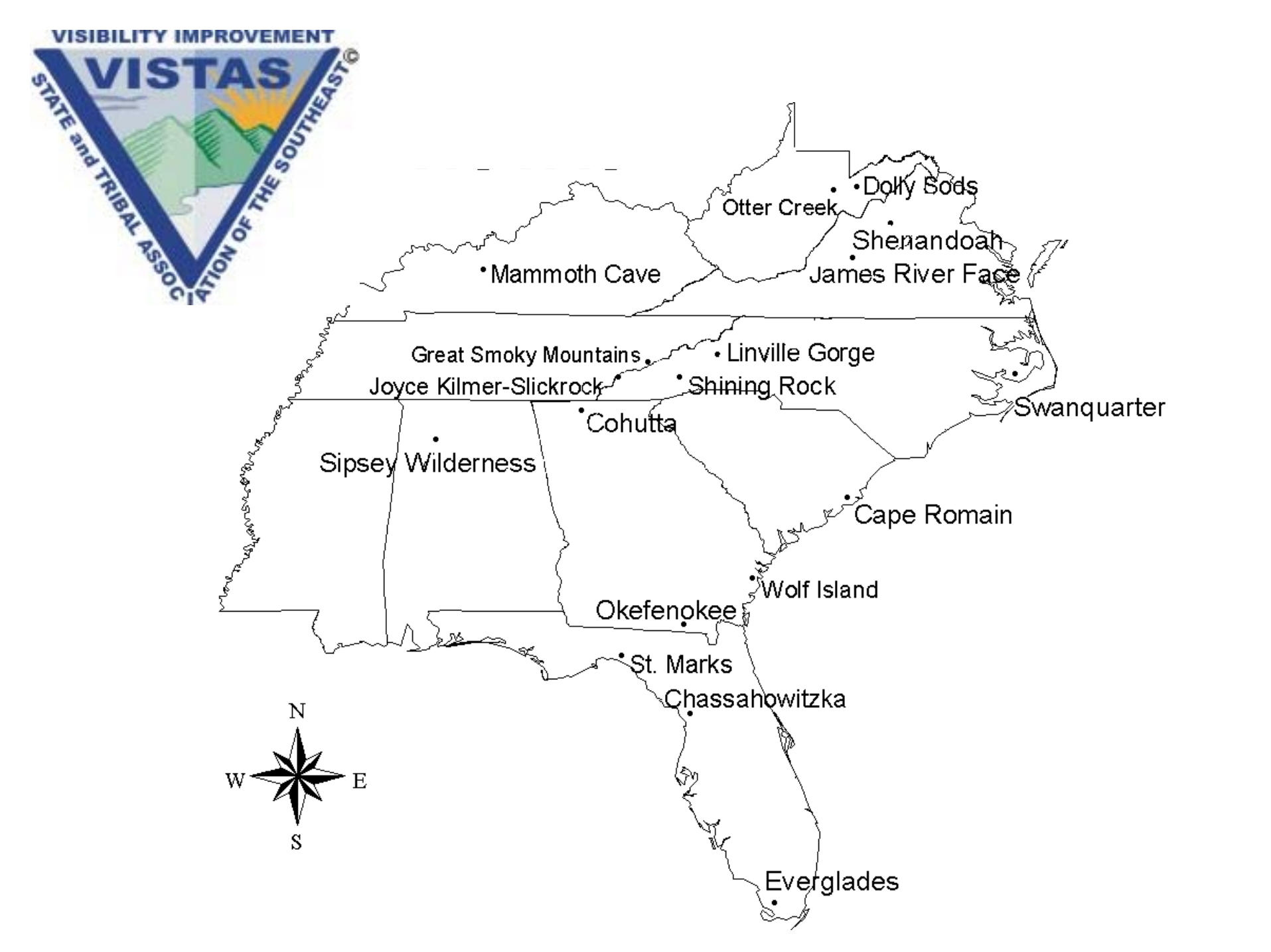

VISIBILITY IMPROVEMENT
VISTAS
STATE and TRIBAL ASSOCIATION OF THE SOUTHEAST©
Dolly Sods
Otter Creek
Shenandoah
James River Face
Mammoth Cave
Great Smoky Mountains
Linville Gorge
Joyce Kilmer-Slickrock
Shining Rock
Swanquarter
Cohutta
Sipsey Wilderness
Cape Romain
Wolf Island
Okefenokee
St. Marks
Chassahowitzka
N
W
E
S
Everglades

VISTAS Emissions Inventory Objectives

- Provide inventory data to support photochemical modeling for speciated $PM_{2.5}$ and regional haze
- Work with state and local agencies to develop 2002 inventory
- Improve inventories, especially where affect model performance or visibility calculations
  - NH_3
  - Primary $PM_{2.5}$: OC, EC
  - Fire

VISTAS 2002 Inventory Responsibilities

- MACTEC, Inc.:
  - point and area sources
- E. H. Pechan & Assoc., Inc.:
  - mobile onroad and non-road engines
- State and local agencies:
  - provide latest existing inventory (99, 00, 01, or 02)
  - provide input for inventory improvements
  - review products
- VISTAS Participants: review methods, products

VISTAS 2002 Inventory Approach

- Review existing inventories and identify gaps
- Update NEI 1999 with state and local data
  - fill missing data (e.g. area & non-road NH_3, $PM_{2.5}$)
- Grow inventories to 2002:
  - state/local data
  - Bureau of Census
  - Economic Growth Analysis System

VISTAS 2002 Inventory Approach, cont.

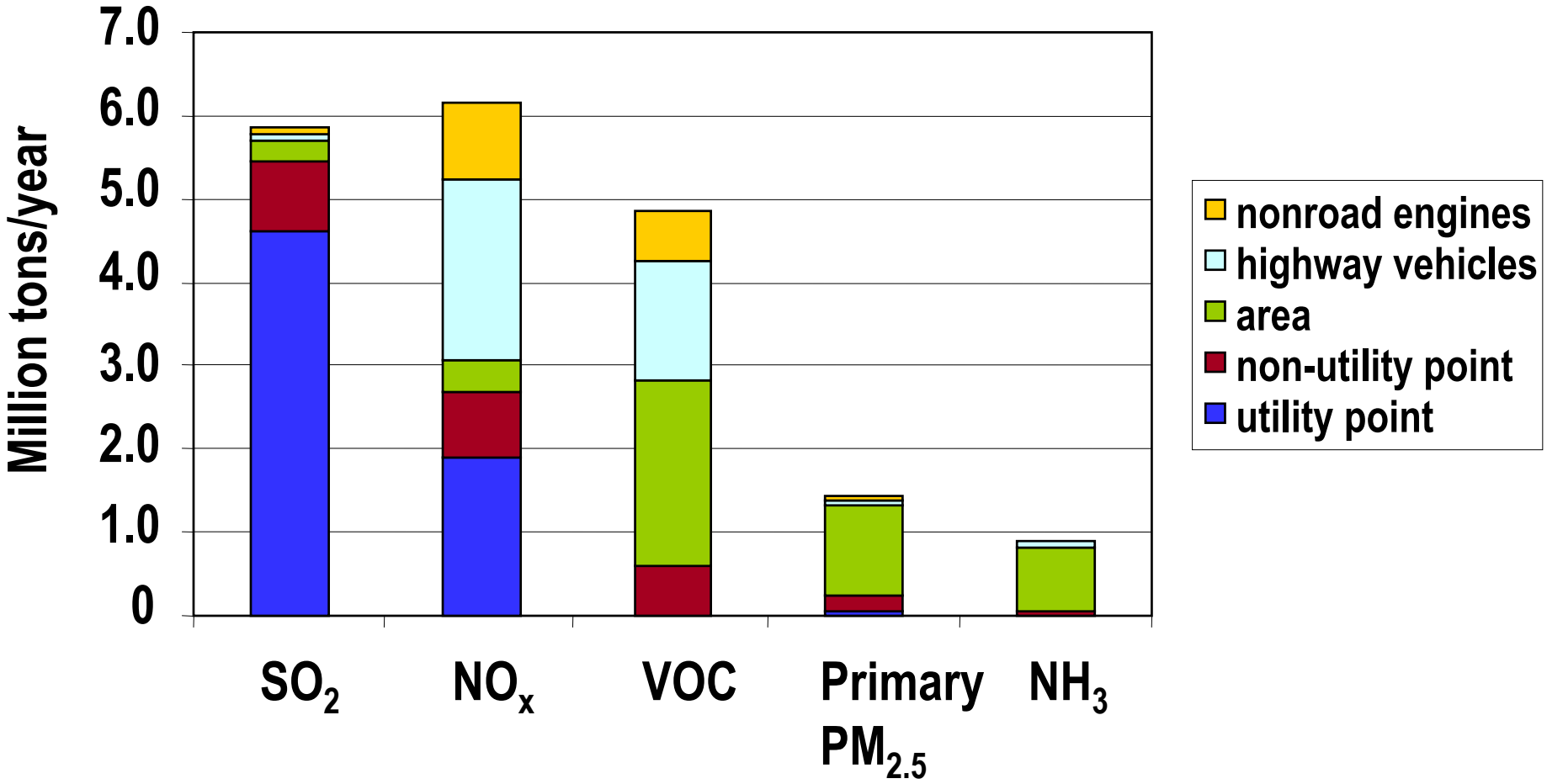
- QA/QC throughout the project, format as
  - Comprehensive Emissions Reporting Requirements
  - Data Exchange Protocol
- Apply speciation factors for primary $PM_{2.5}$
- Allocate emissions temporally and spatially
- Enhance inventories for selected sectors

First draft 2002 inventory due June 2003

Prioritizing Inventory Improvements

- Inventory contribution

1999 Emissions in 10-state VISTAS Region



Based on 1999 National Emissions Inventory, version 2

Prioritizing Inventory Improvements

- Inventory contribution
- **Inventory uncertainty**

Qualitative Confidence in
1999 National Emissions Inventory

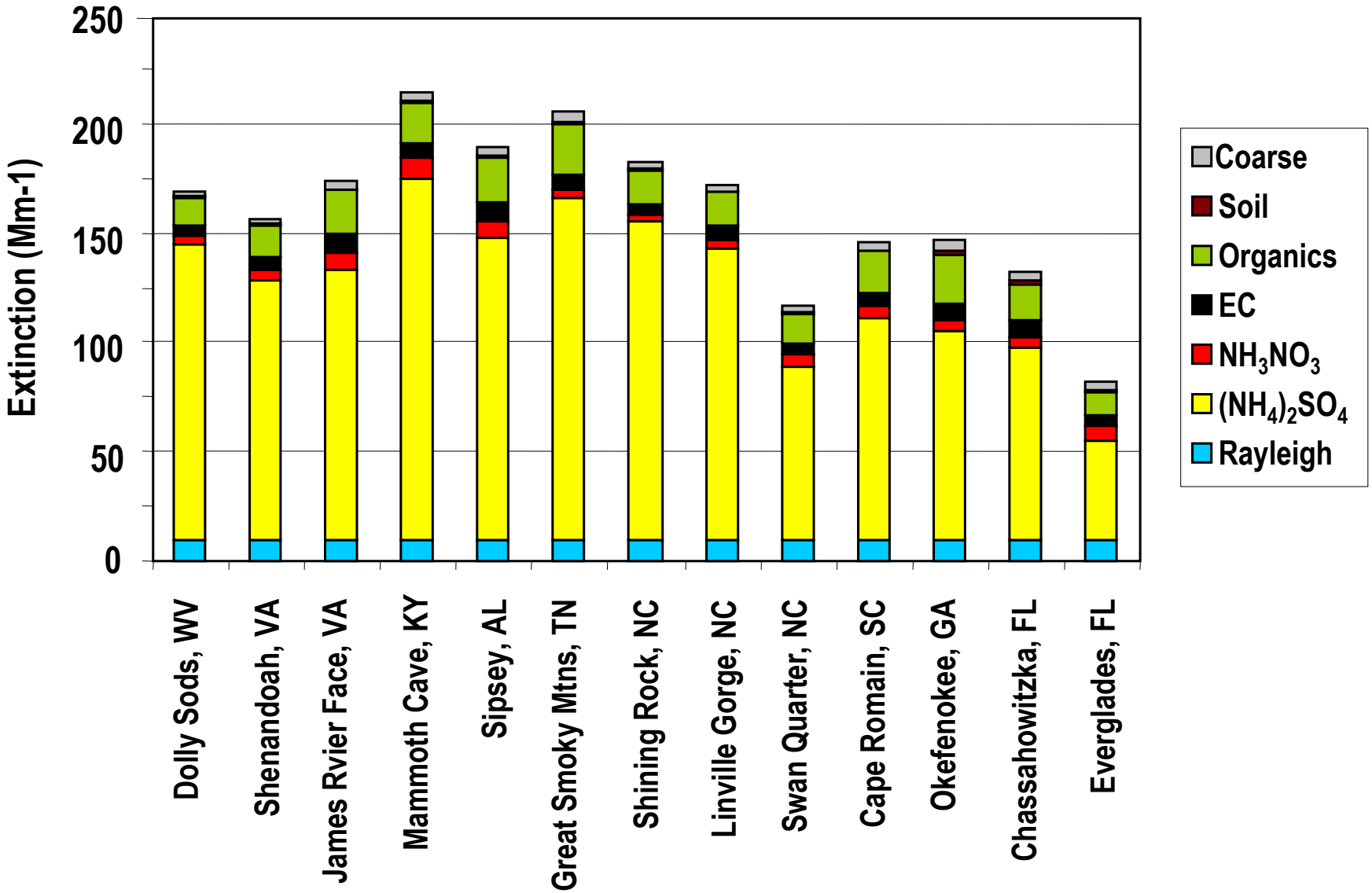
	Utility	Industry	Highway Vehicles	Nonroad Engines	Area
SO2	3	2	2	2	1
NOx	3	2	2	2	1
VOC	2	2	2	2	1
NH3	2	2	1	1	1
PM2.5	2	1	1	1	1

Greatest Confidence = 3; Least Confidence = 1

Prioritizing Inventory Improvements

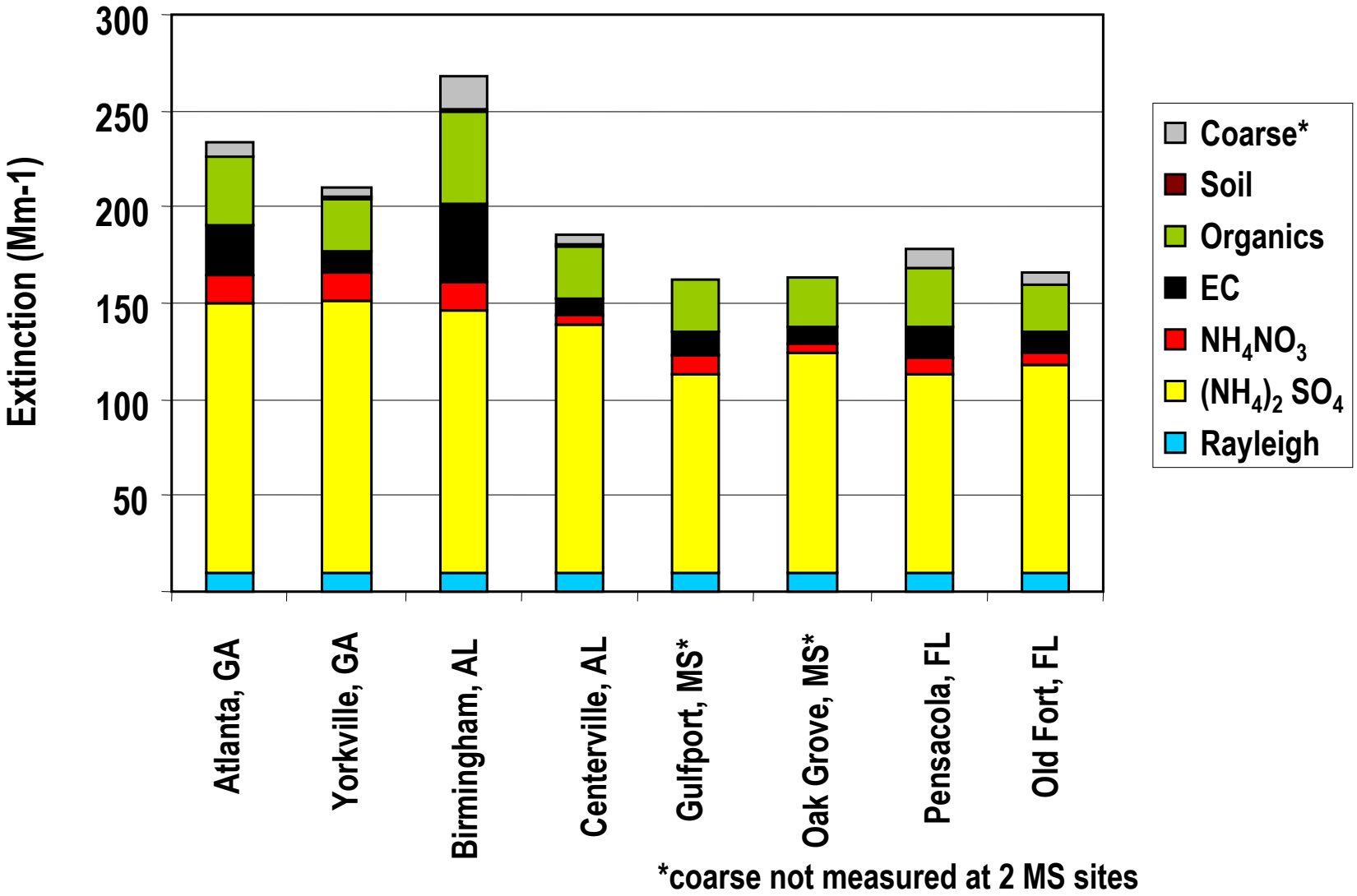
- Inventory contribution
- Inventory uncertainty
- **Ambient monitoring data: largest contributors to PM2.5 and haze**

Light Extinction on Days with 20% Poorest Visibility - IMPROVE 1998 - 2001



Light Extinction on Days with 20% Poorest Visibility

SEARCH 1999 - 2001

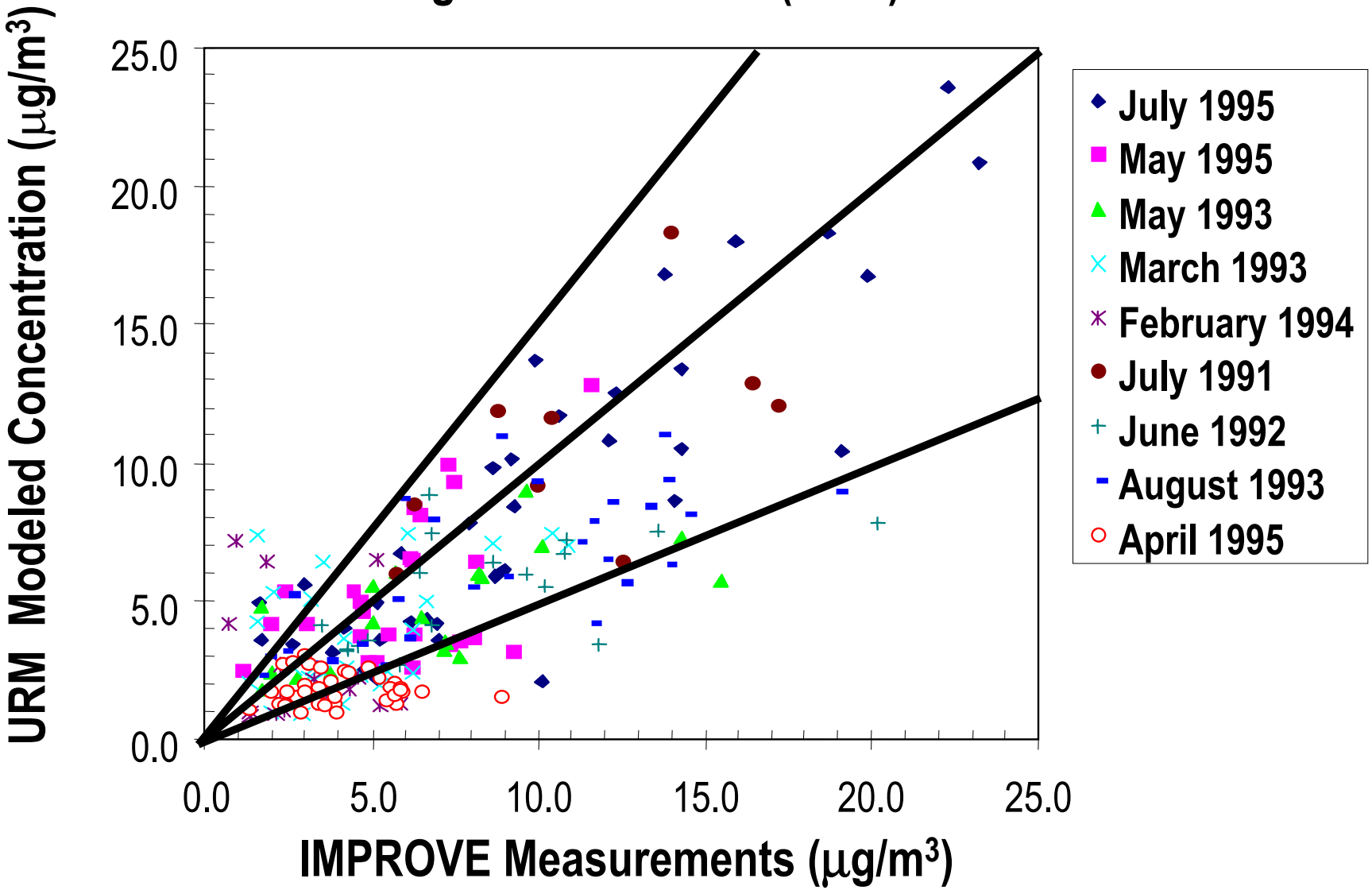


Prioritizing Inventory Improvements

- Inventory contribution
- Inventory uncertainty
- Ambient monitoring data: largest contributors to PM2.5 and haze
- **Atmospheric model performance**

Model Performance: Sulfate Fine Particle Mass

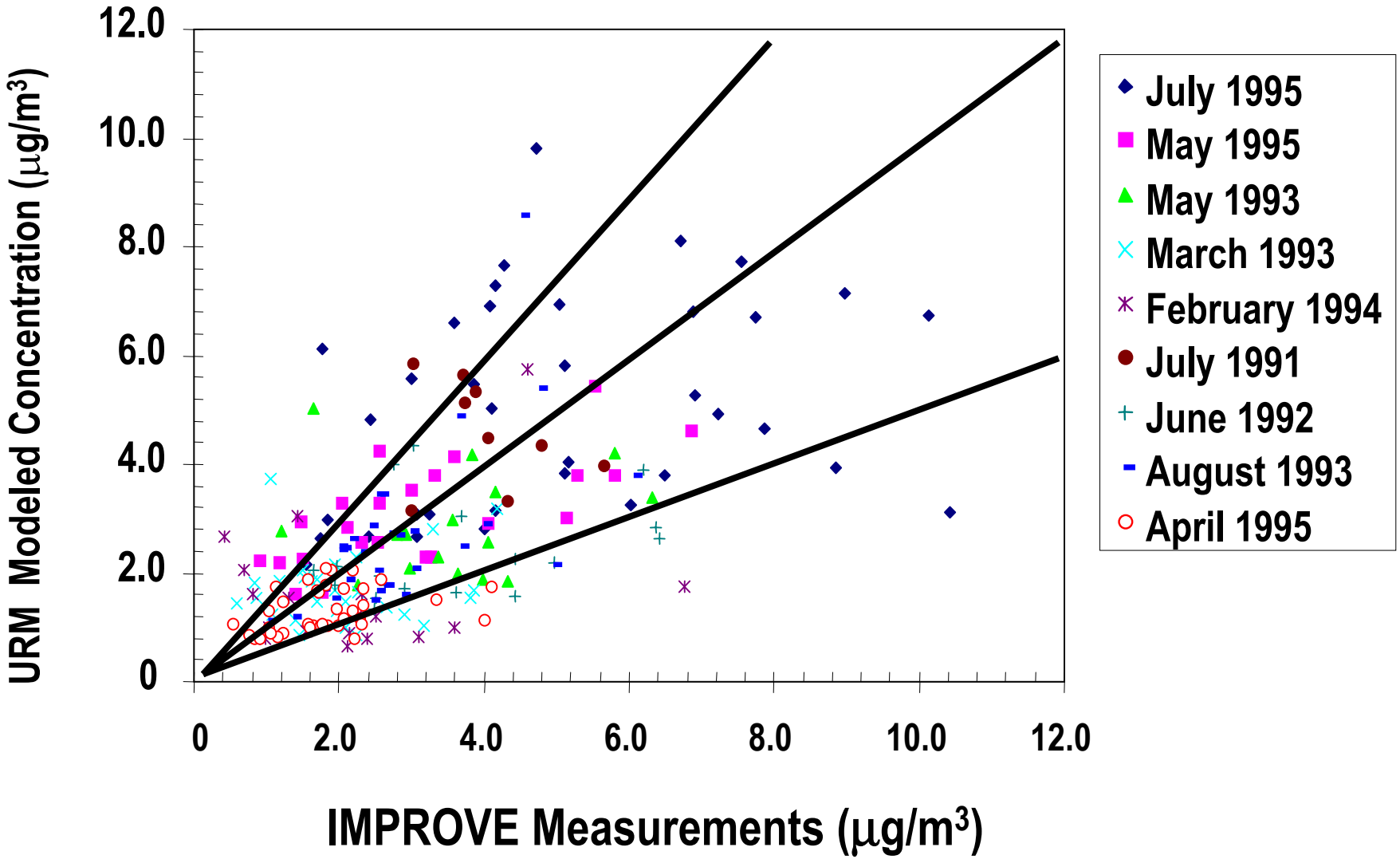
Urban Regional Multiscale (URM) Model



Odman, et.al, 2002

Model Performance: Organic Carbon $PM_{2.5}$

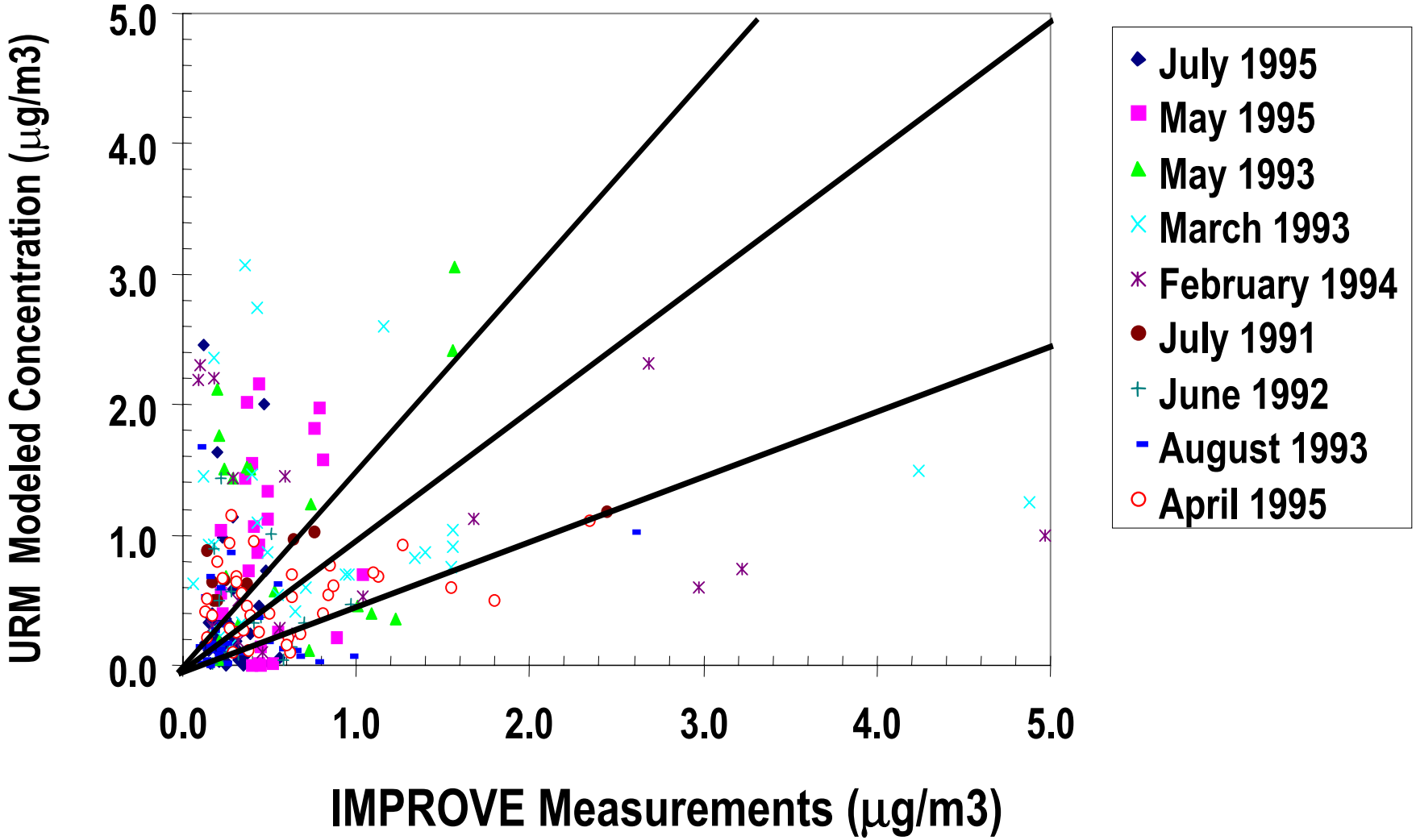
Urban Regional Multiscale (URM) Model



Odman, et.al, 2002

Model Performance: Nitrate Fine Particle Mass

Urban Regional Multiscale (URM) Model

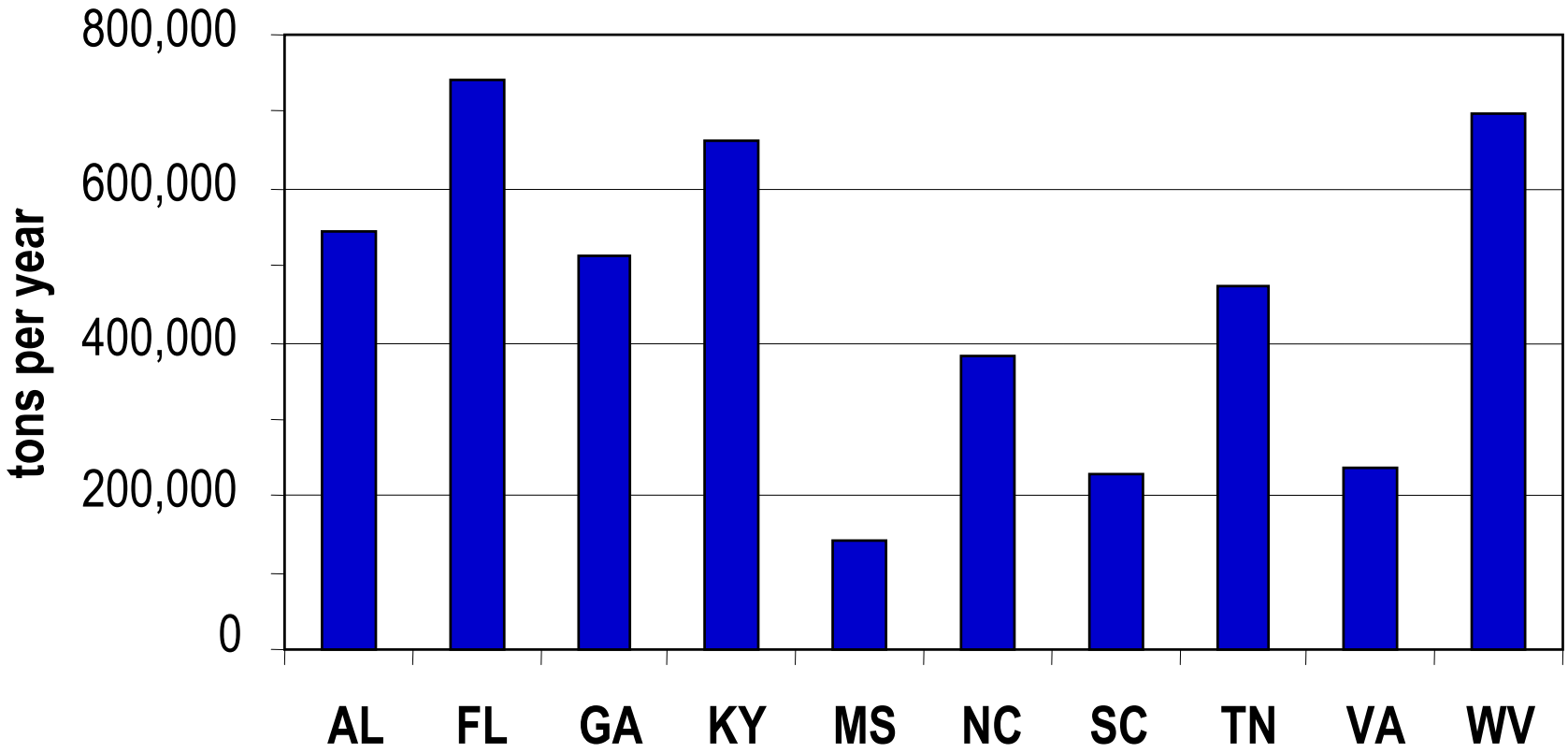


Odman, et.al, 2002

Inventory Improvement Priorities

- SO2: daily, seasonal emissions from point sources
- OC and EC : primary vs secondary, anthropogenic vs biogenic
- Fire: activity factors, emissions
- NH3: activity factors, seasonal variation

1999 Utility SO2 Emissions in VISTAS region



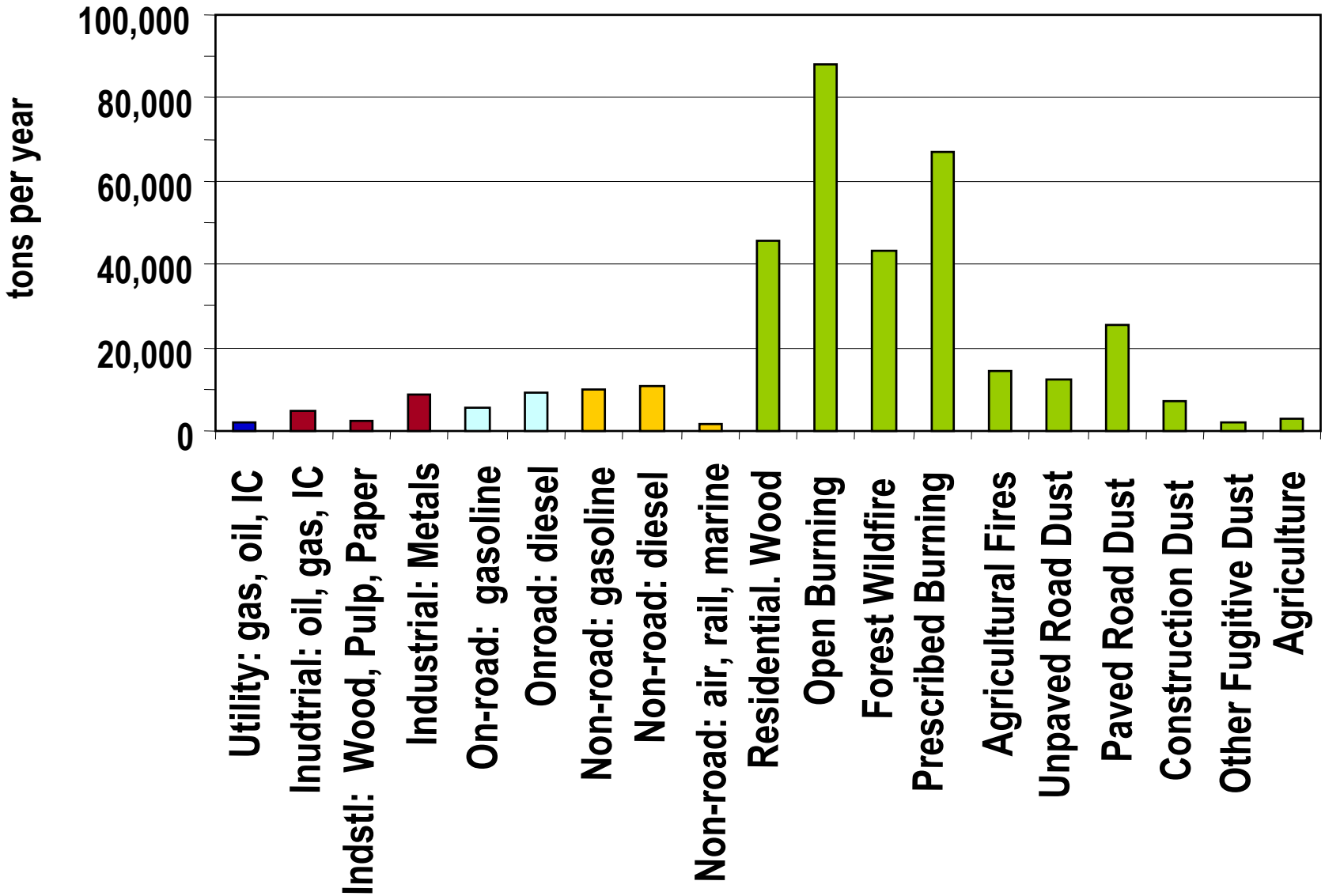
Based on 1999 National Emissions Inventory, version 2

Inventory Improvement: OC and EC

- OC 2nd largest contribution to $PM_{2.5}$ and haze
- EC: generally higher urban than rural
- Initial SPECIATE application to 99 NEIv2:
  - define largest source categories for OC, EC
  - compare to primary OC sources identified by Chemical Mass Balance Analyses

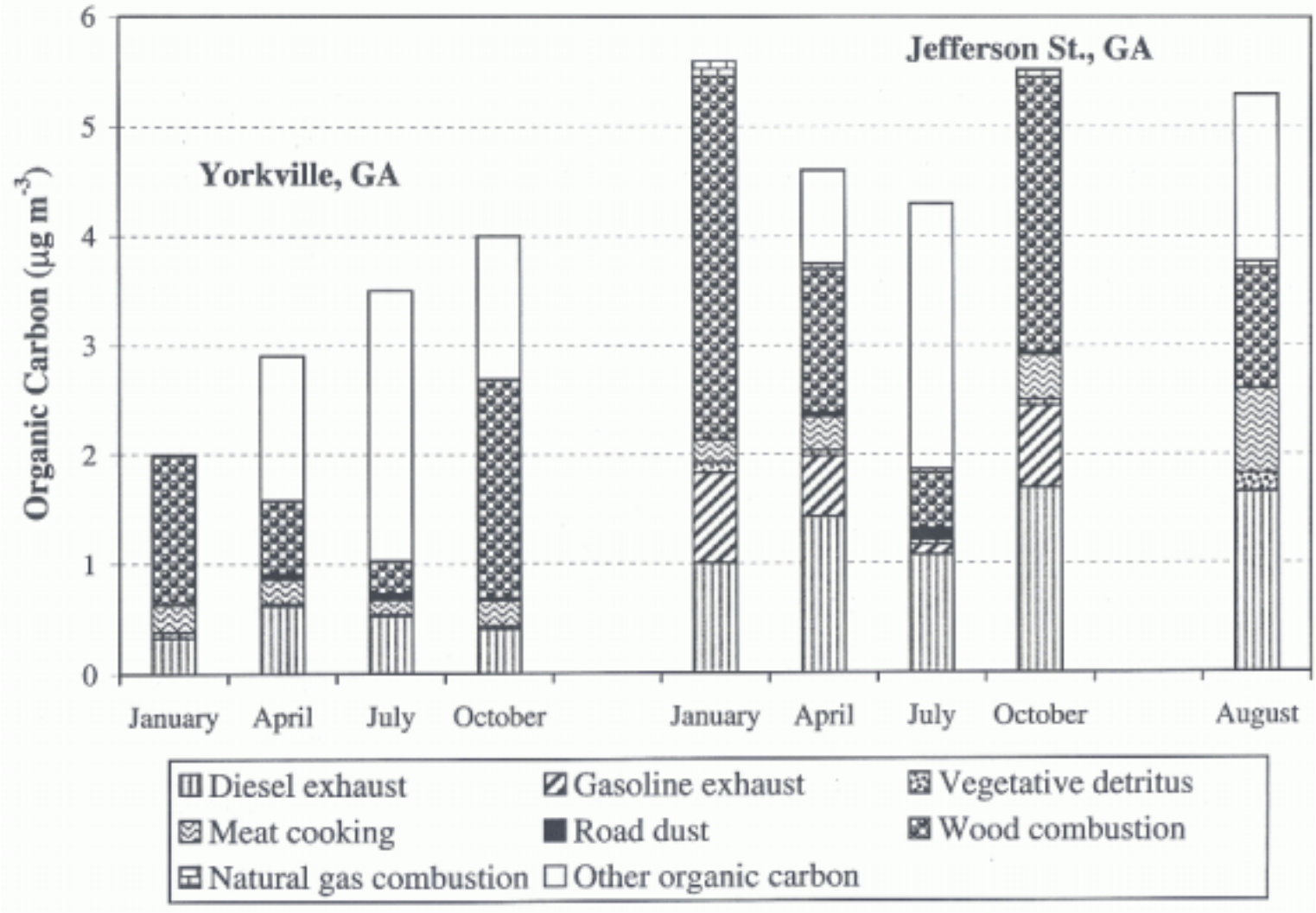
Annual Primary PM2.5 Organic Carbon - VISTAS Region

SPECIATE with 1999 NEIv2



Sources of Fine Particle Organic Carbon

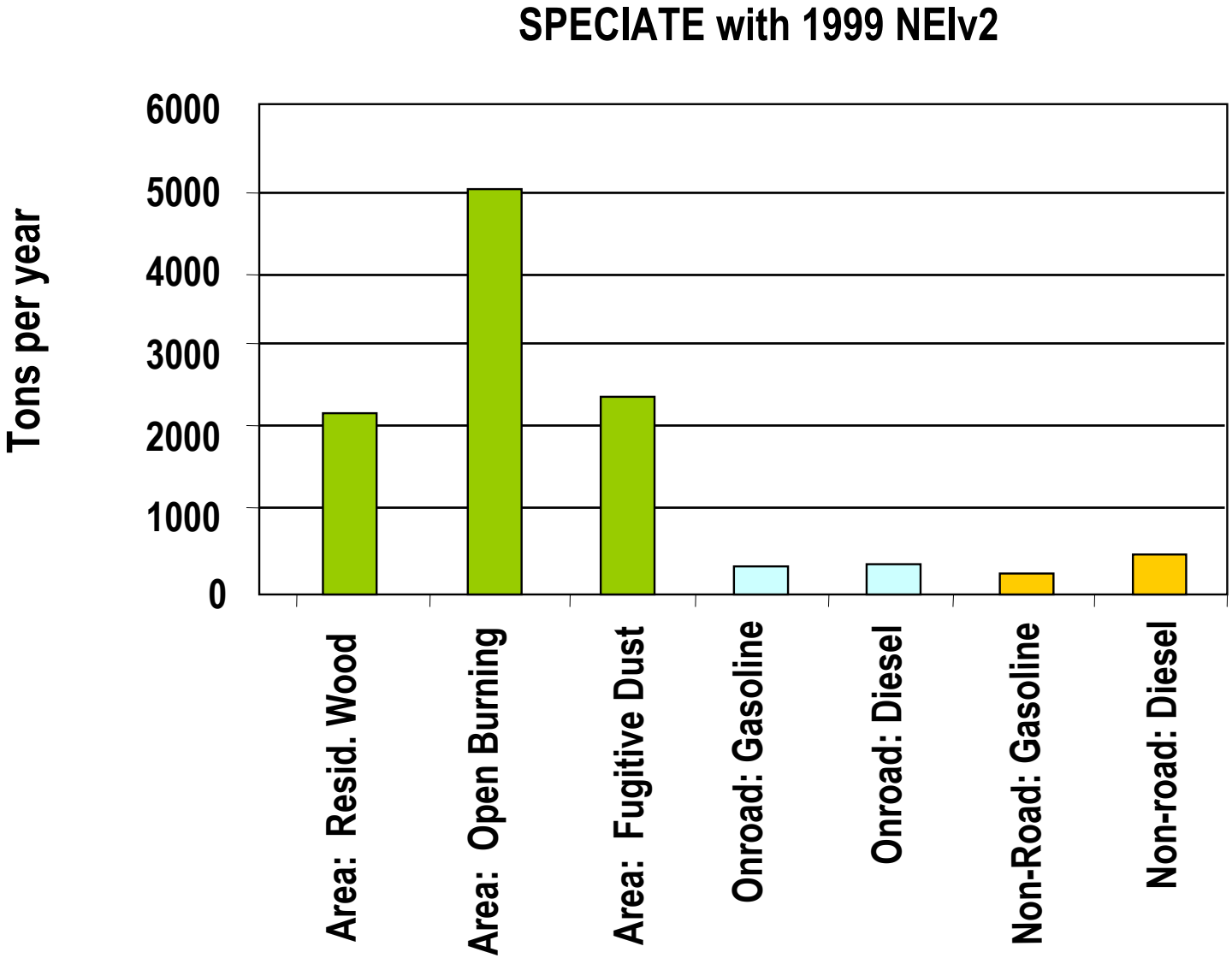
Chemical Mass Balance Analyses at SEARCH sites



SEARCH

Zheng, Cass, Schauer, Edgerton, 2002, Environmental Science & Technology

Annual Primary PM2.5: Organic Carbon - Atlanta*, GA



*6 counties: Fulton, Cobb, DeKalb, Gwinett, Cherokee, Forsyth

Inventory Improvement: Fire

- Fire contributes to $PM_{2.5}$ and haze
  - Elevated OC, EC, non-soil P, and OC/EC ratios are indicators of fire events
- Request fire data from state forestry agencies
  - date, location (lat/long or county), acres, fuel type, fuel load
  - wildfire, prescribed burning, open burning permits
  - July-Aug 99, July 01, all 2002
  - in future, using 1999-2003 data, estimate fires in “typical” year and “future” year for air quality modeling

Inventory Improvement: Fire

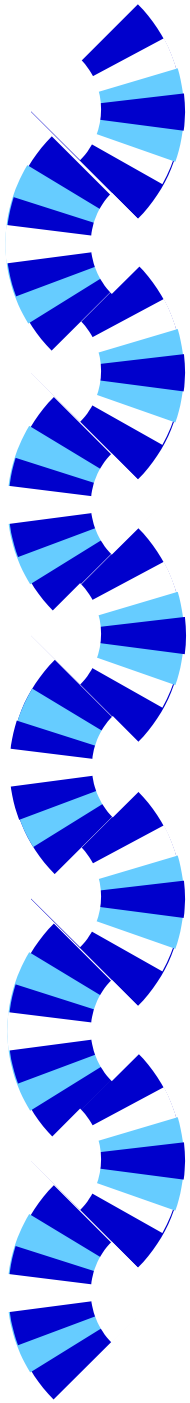
- VISTAS held Fire Workshop in Oct 2002
  - experiences of states, USFS, EPA, other regions
- Opportunities to cooperate with other regions
  - WRAP Fire Forum
  - MARAMA: opening burning and residential wood burning
  - Midwest survey: state forestry records
  - future joint RPO project?

Inventory Improvement: Ammonia

- NH_3 emissions affect levels of NH_4NO_3 and H_2SO_4/ NH_4SO_4/ $(NH_4)_2SO_4$
  - Atmosphere is NH_3 limited in Southeast
- VISTAS will apply Carnagie Mellon University (CMU) NH_3 model
  - updated 2003 by Sonoma Tech. for Midwest RPO
- Update input data for CMU model
  - activity data: e.g. state livestock populations
  - define specific lat/long location for large farms
  - temporal emissions factors??

Next Steps: VISTAS Emissions Inventory

- VISTAS interested in opportunities to collaborate with EPA, other RPOs on inventory improvements
- targeted surveys within states to improve activity factors



appendix

Point Source Inventory

- Incorporate state/local data to 1999 NEIv2
  - Check for new or retired facilities
  - Compare NH_3 to Toxics Release Inventory
  - QA/QC lat/long, age, emissions, stacks, temporal
  - Conduct targeted survey of large sources
  - Incorporate 2002 CEM data as available
  - Format day-specific emissions for emissions model
  - Apply speciation factors

Area Source Inventory

- Incorporate state/local activity data
- Improve activity and growth data:
  - large emission source categories (top 80 %)
  - difficult to estimate growth factors (e.g. fires)
  - alternative growth factors (e.g. livestock)
- Fill missing pollutants
  - apply emissions factors to define NH_3, PM
  - apply SPECIATE for primary PM (e.g. SO_4, NO_3, OC, EC, crustals)

Onroad Mobile Inventory

- Incorporate state/local data (99, 00, 01, or 02)
  - VMT, fleet, speed, fuel, control programs
- Project 2002 VMT
  - extrapolate state/local data or use NEI defaults
- Create MOBILE6 input files
- Calculate annual emissions
- Develop temporal and speciation factors

Nonroad Mobile Inventory

- Apply NONROAD model
  - Farm and construction machinery, lawn and garden, recreational vehicles, many others
- Apply NEI assumptions for aircraft, locomotives, commercial marine vessels
- Update NEI defaults with state/local activity, fuel data
  - estimate NH_3 or $PM_{2.5}$ from emissions factors
  - apply speciation factors