Status of PM Emission Inventories

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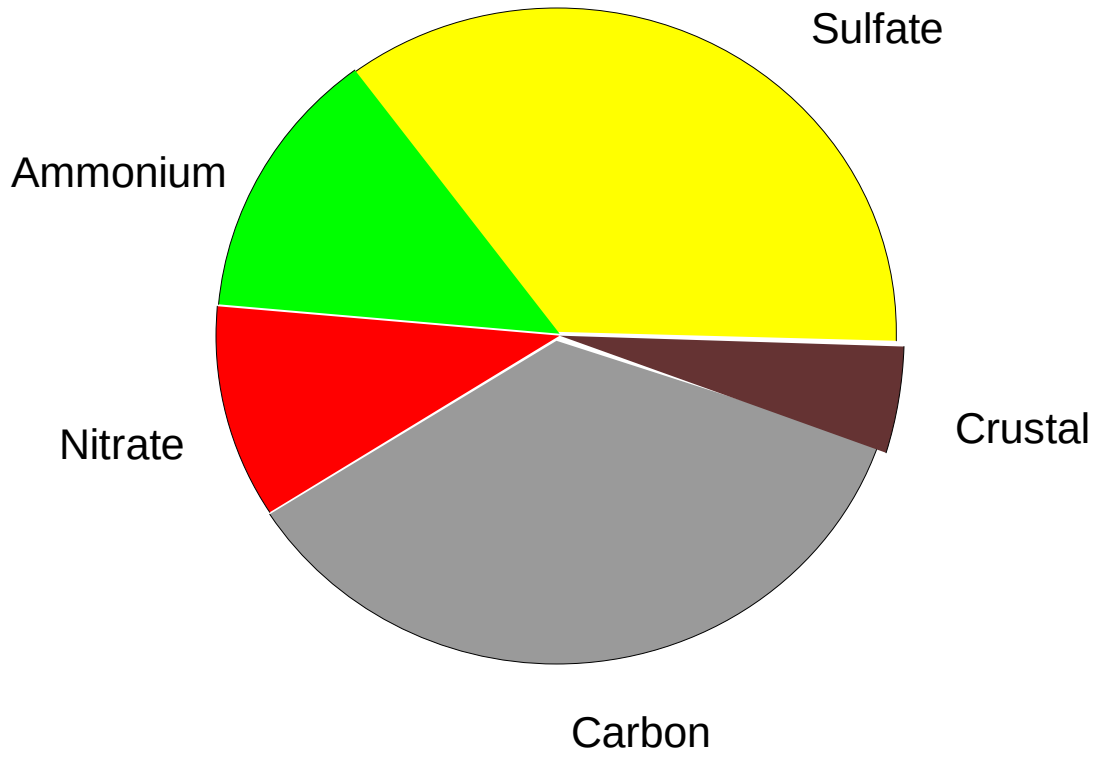
Topics

- **What is a PM Emission Inventory?**
- **Why is a PM emission inventory needed?**
- **Who has (or is building) a PM inventory?**
- **How are PM emission inventories developed?**
- **How much is emitted? From what sources?**
- **Issues and uncertainties.**

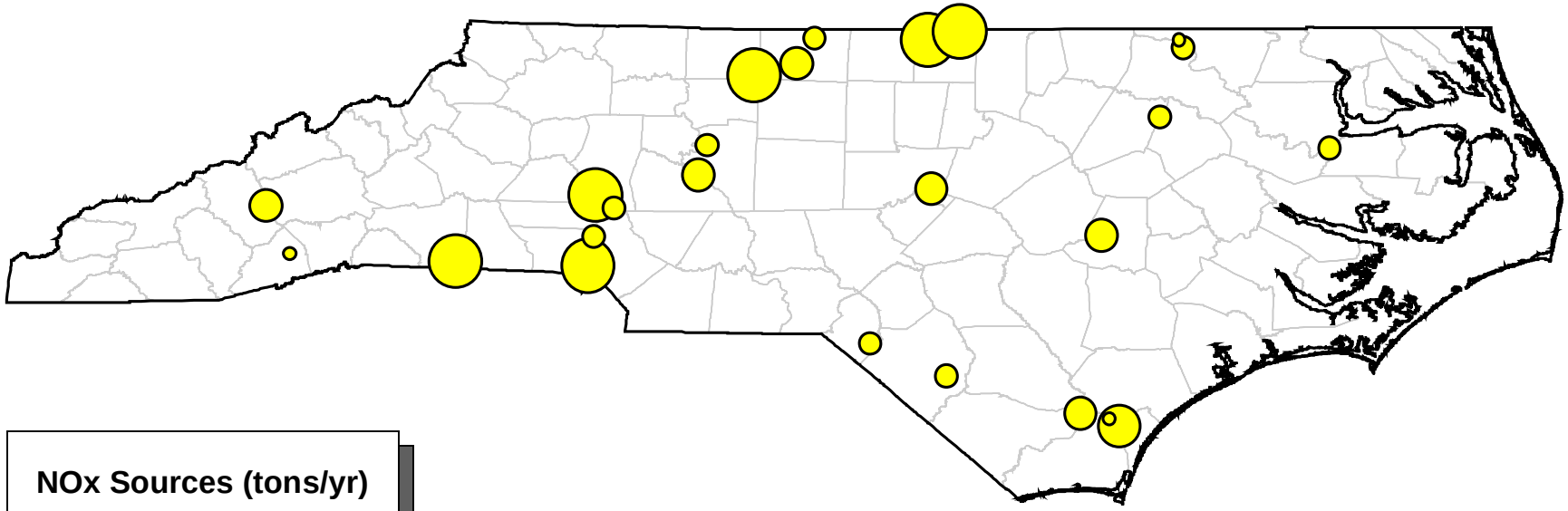
PM2.5 Composition – One Eastern Nonattainment Area



What is a PM Emission Inventory?

- **PM10, PM2.5, SO2, NOx, Ammonia, VOC, and CO.**
  - Point sources
    - County, Latitude, and Longitude.
    - Units and processes within each source.
    - Release parameters – stack height, etc.
    - Process description code (SCC); business type code (SIC).
    - Control equipment type and efficiency, ideally.
  - Area & Mobile Sources by County
    - 400 categories of Highway & Non road Mobile.
    - Over 300 categories of Area sources.
- **Annual emissions, but possibly shorter periods also.**
- **Other data fields.**
- **Documentation.**

NOx Point Sources in N.C.



NOx Sources (tons/yr)

- 1, 000 - 2,000
- 2,001 - 4,000
- 4,001 - 6,000
- 6,001 - 8,000
- 8,001 - 70,000

Note: Data are from draft 1999 NEI v3 (8/27/03)

Related Information, Usually Not In the Inventory File Itself

- PM2.5 speciation profiles.
  - Standard practice: Organic carbon, black carbon, sulfate, nitrate, crustal.
  - Not: Elements, ions, specific organics.
- VOC speciation profiles.
- Spatial allocation factors.
- Temporal allocation factors.
- “Transport factors” for fugitive dust.

Why Is a PM Emission Inventory Needed?

- Air quality model development.
- Preliminary control strategy explorations for PM and Regional Haze.
- Emission rule adoption – federal or state/local.
- SIP attainment demonstrations.
- Tracking trends, accountability.
- Public information requests.

Who Has (or is building) a PM Inventory?

- States
- EPA – National Emissions Inventory (NEI)
  - Merges state inventories, replaces some data values, and fills in gaps.
  - Roughly $1 million/year (including air toxics).
  - Version 2 of 1999 NEI available now.
  - Version 3 of 1999 by November 1, 2003.
  - Version 1 of 2002 by January 1, 2004.
- 5 Regional Planning Organizations.

How Are PM Emission Inventories Developed?

- Point sources
  - ≥100 tons, but lower in some states
  - Inventory data almost always comes from self-reports to state/local/tribal agencies
    - For powerplants, also self-reports to DOE and EPA
  - Emissions estimated by continuous stack monitors (SO2 and NOx), emission factors, or single tests
  - EPA estimates missing PM and NH3, if possible
  - Last resort – Re-use old data for earlier years

How Are PM Emission Inventories Developed? , **continued**

- Area sources
  - Over 300 possible categories.
  - Estimated by state/local/tribal agency or by EPA.
    - For the NEI, EPA fills in certain missing categories.
  - Mixed and evolving suite of methods and data sources.
    - Methods and coverage inconsistent across agencies.
    - Methods evolve from one version to another.
  - Last resort -- Old data from an earlier inventory.
  - Issue – Double counting with point sources.

How Are PM Emission Inventories Developed? , **continued**

- Highway mobile sources
  - Estimated by state/local/tribal agency, or by EPA.
  - VMT.
    - By county.
    - By type of road, maybe by individual roadway.
    - By type of vehicle.
  - Emission factor model – MOBILE5, MOBILE6, EMFAC.
  - Many possible levels of fine tuning, so estimates may differ by organization.
  - Current NEI Issue – Transferring estimation inputs to allow consistent projections, scenarios, etc.

How Are PM Emission Inventories Developed? , **continued**

- Nonroad mobile sources
  - Estimated by state/local/tribal agency, or by EPA.
  - NONROAD2002 model from EPA.
    - Construction equipment, lawn and garden, recreational vehicles, etc.
  - Planes, locomotives, and commercial marine.
    - Various methods and data bases for local estimates.
    - EPA estimates national emissions and allocates to counties based on activity surrogates.
    - Military base emissions are a continuing problem.
  - Current NEI Issue – Transferring estimation inputs to allow consistent projections, scenarios, etc.

How Are PM Emission Inventories Developed? , **continued**

- Biogenic sources
  - Need to estimate emissions by hour for air quality modeling.
    - BELD data on vegetation coverage.
    - BEIS emissions model.
    - Meteorology data/model, e.g. MM5.
  - Annual inventory estimates are useful for general information.
    - EPA has annual estimates for 1996, will create new ones for 2001 by running every day.

How Are PM Emission Inventories Developed? , **continued**

- Data Exchange and Management
  - Separate data systems in each jurisdiction.
  - EPA has defined a common exchange format – “NIF” -- for getting data from states and sharing our data with others.
  - Volume of data is huge.
  - Many chances for oversights, errors, and miscommunication.
  - QA, accuracy, transparency, access, query tools, and timely corrections will be continuing challenges.

How Is Inventory Development Changing?

- New Consolidated Emissions Reporting Rule (CERR).
  - 2001 – large point sources.
  - 2002 -- all sources, all pollutants.
  - Including condensible PM.
  - States should have changed source reporting requirements to match.
- 5 Regional Planning Organizations are investing heavily in inventory development, QA, and improvement.
- EPA planning changes for 2002 NEI.

New Developments for the 2002 NEI

- **2002 ~ Base year for PM2.5 and Regional Haze SIPs.**
- **Many new facets**
  - Formal, independent peer review. (First time)
  - Only one round of state input. (2 rounds for 1999)
  - New EPA methods for some area source types, e.g., animal feeding, road dust.
  - Use the new National Mobile Inventory Model (NMIM)?
  - New EPA data standards and information quality guidelines.
- **Schedule**
  - Version 1 for Criteria Pollutants due out Jan. 1, 2004.
  - Version 2 DRAFT (with state/local/tribal submissions) due out Fall 2004.
- **Also, updates to related information on species, spatial, temporal allocation.**

How much is emitted?
By What Source Types?

Important PM2.5 Source Categories in the NEI

DIRECT EMISSIONS

Combustion [a, b]

- **Open Burning (all types)**
- **Non-Road & On-Road Mobile**
- **Residential Wood Burning**
- **Wildfires**
- Power Gen
- Boilers (Oil, Gas, Coal)
- Boilers (Wood)

Crustal / Metals [b]

- **Fugitive Dust**
- Mineral Prod Ind
- Ferrous Metals

PRECURSOR EMISSIONS

SO2 [c]

- **Power Gen (Coal)**
- **Boilers (Coal)**
- Power Gen (Oil)
- Boilers (Oil)
- Industrial Processes

NOx

- **On-Road Mobile (Gas, Diesel)**
- **Power Gen (Coal)**
- **Non-Road Mobile (Diesel)**
- **Boilers (Gas)**
- Boilers (coal)
- Residential (Gas, Oil)
- Industrial Processes

NH3

- **On-Road Mobile**
- **Animal Husbandry**
- **Fertilizer Application**
- Wastewater Treatment
- Boilers

VOC [d]

- **Biogenics**
- **Solvent use**
- **On-Road (Gas)**
- Storage and Transport
- Residential Wood
- Petrochemical Industry
- Waste Disposal

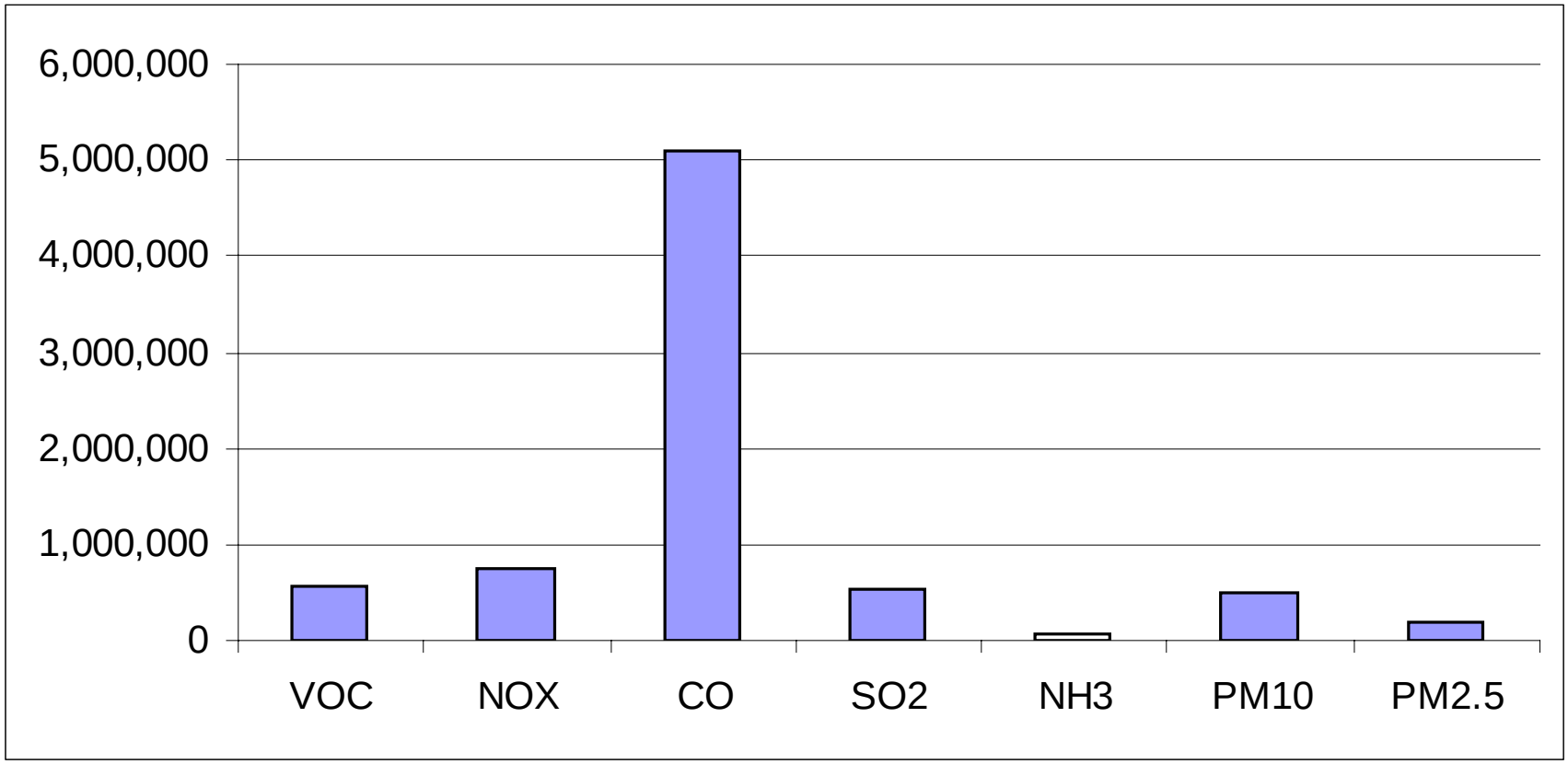
a Includes primary organic particles, elemental carbon and condensible organic particles; also some flyash
b Impact of carbonaceous emissions on ambient PM 5 to 10 times more than crustal emissions impact
c Includes SO_2, and SO_3 and H_2SO_4 condensible inorganics
d Contributes to formation of secondary organic aerosols

NOTE: Categories in **BOLD** are most important nationally. Their relative importance varies among and between urban and rural areas.

1999 Emissions in New York State

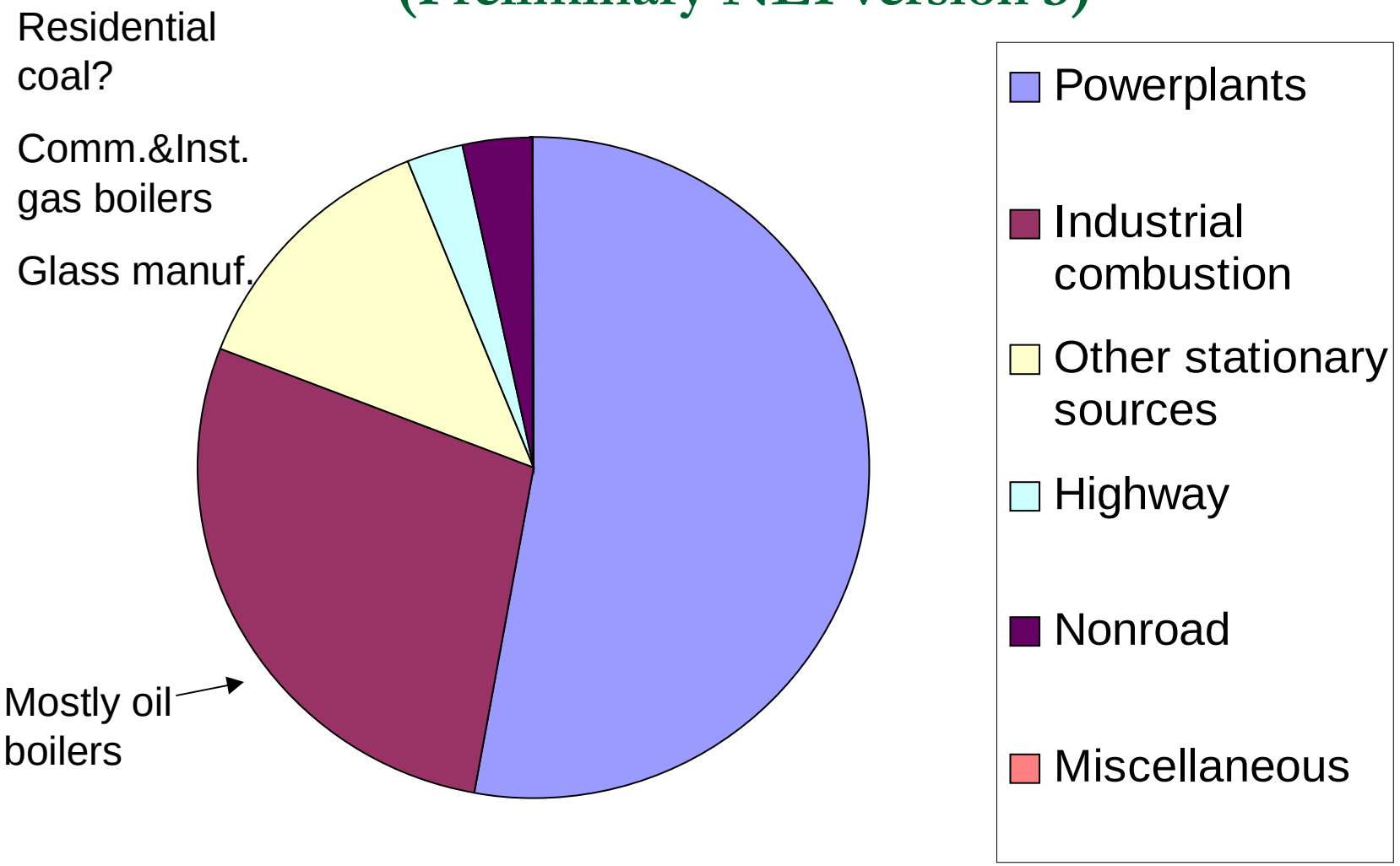
Tons/Year

(Preliminary NEI version 3)



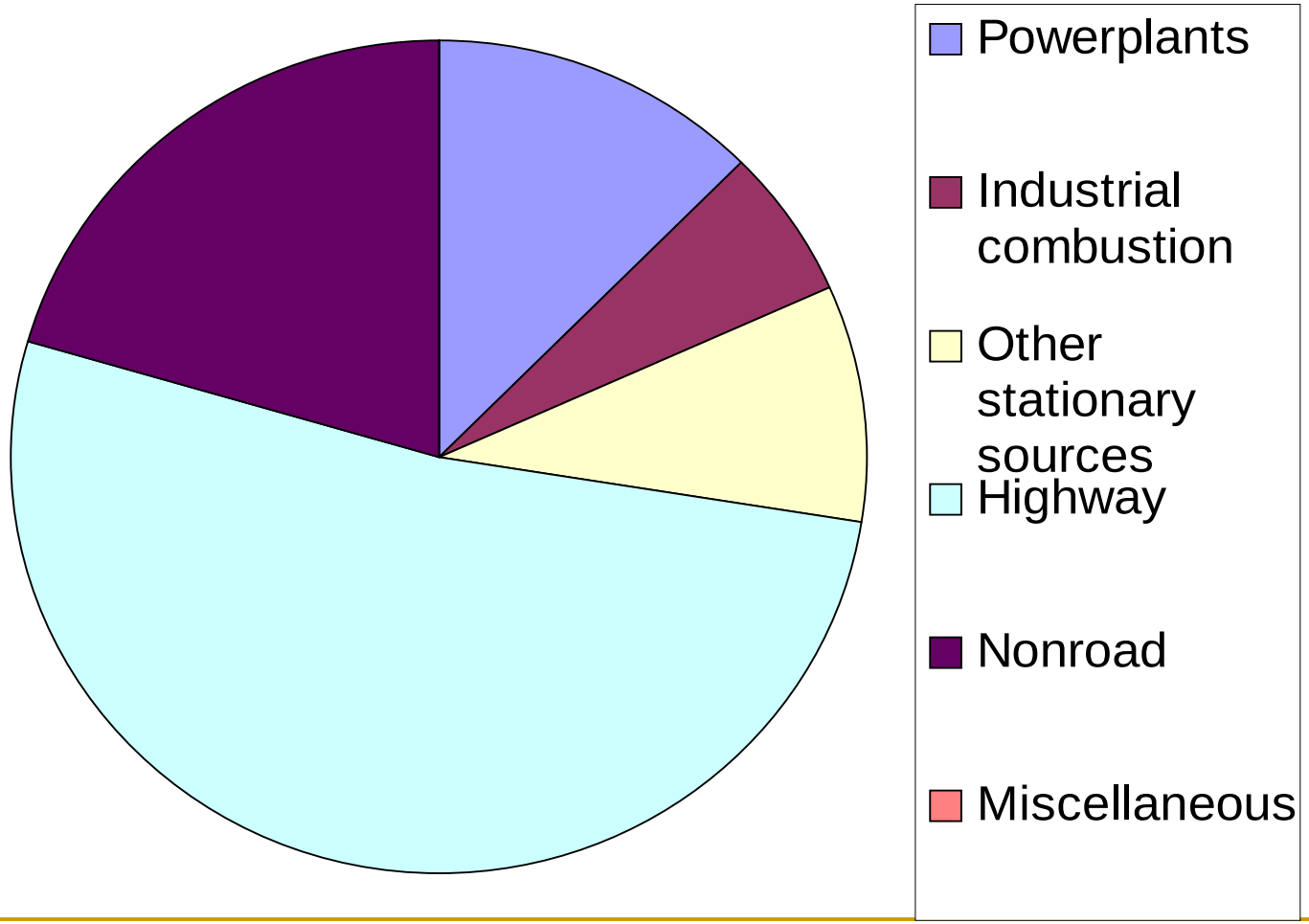
1999 SO_2 Emissions in New York State

(Preliminary NEI version 3)



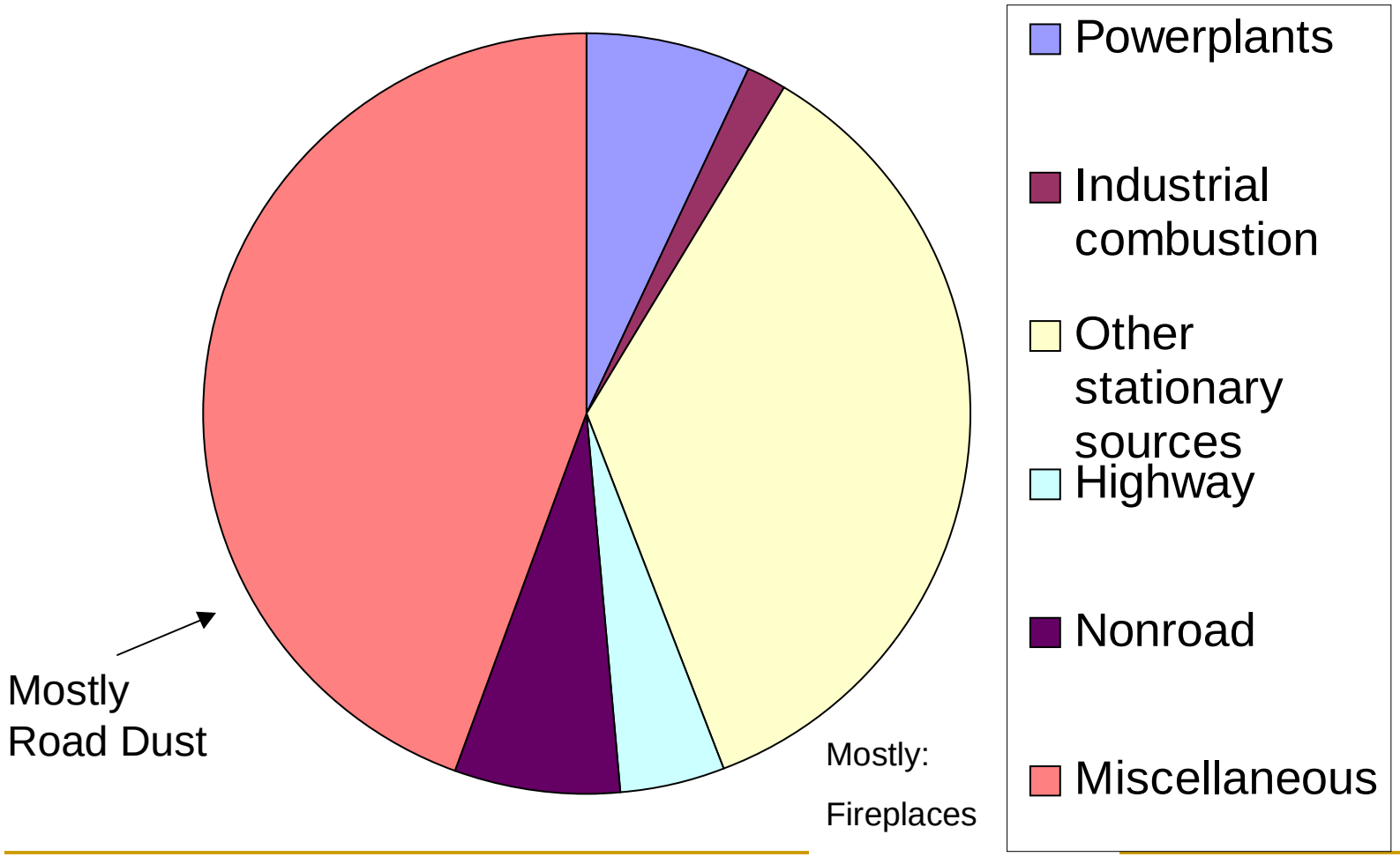
1999 NOx Emissions in New York State

(Preliminary NEI version 3)

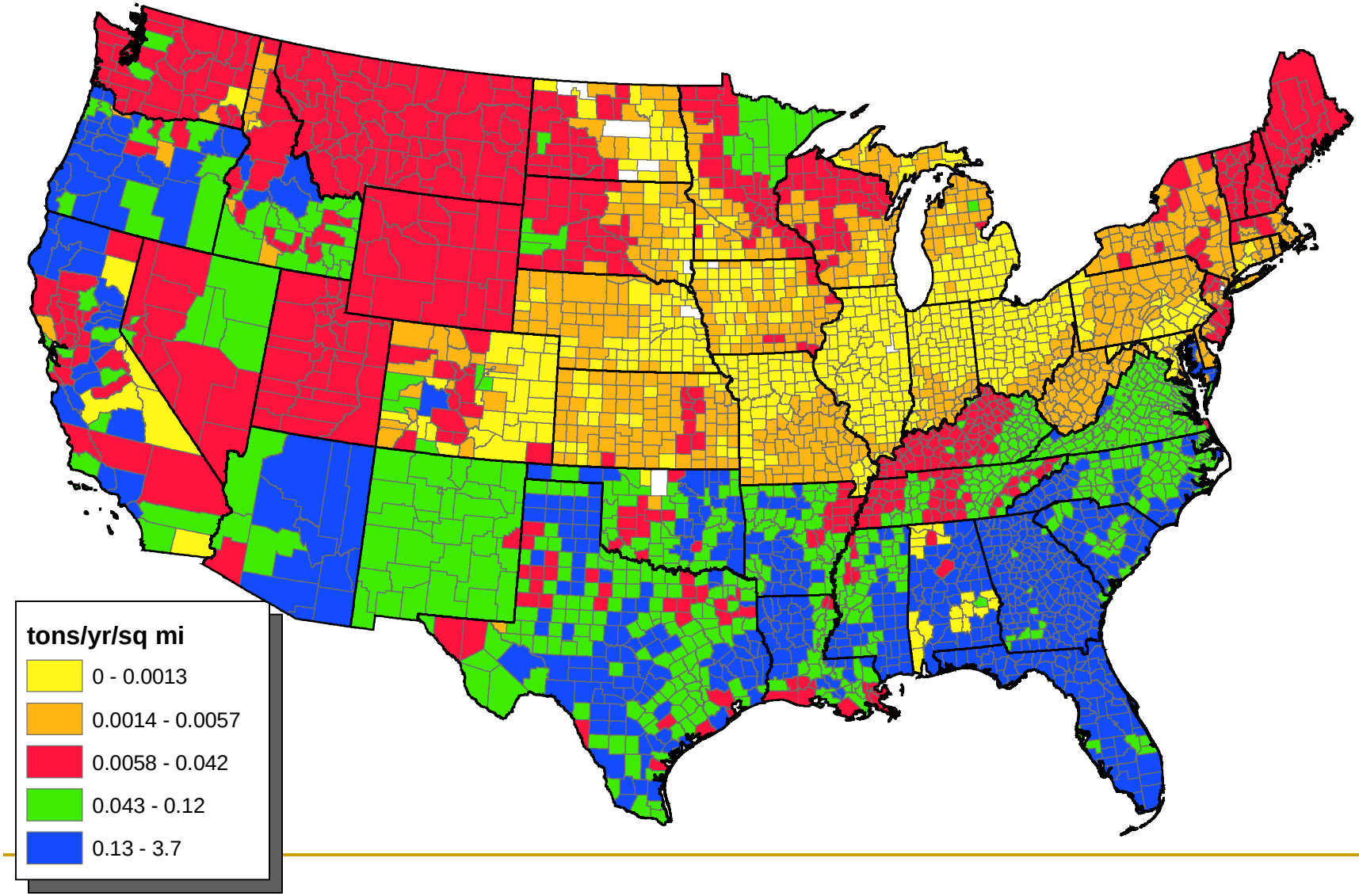


1999 PM2.5 in New York State

(Preliminary NEI version 3)

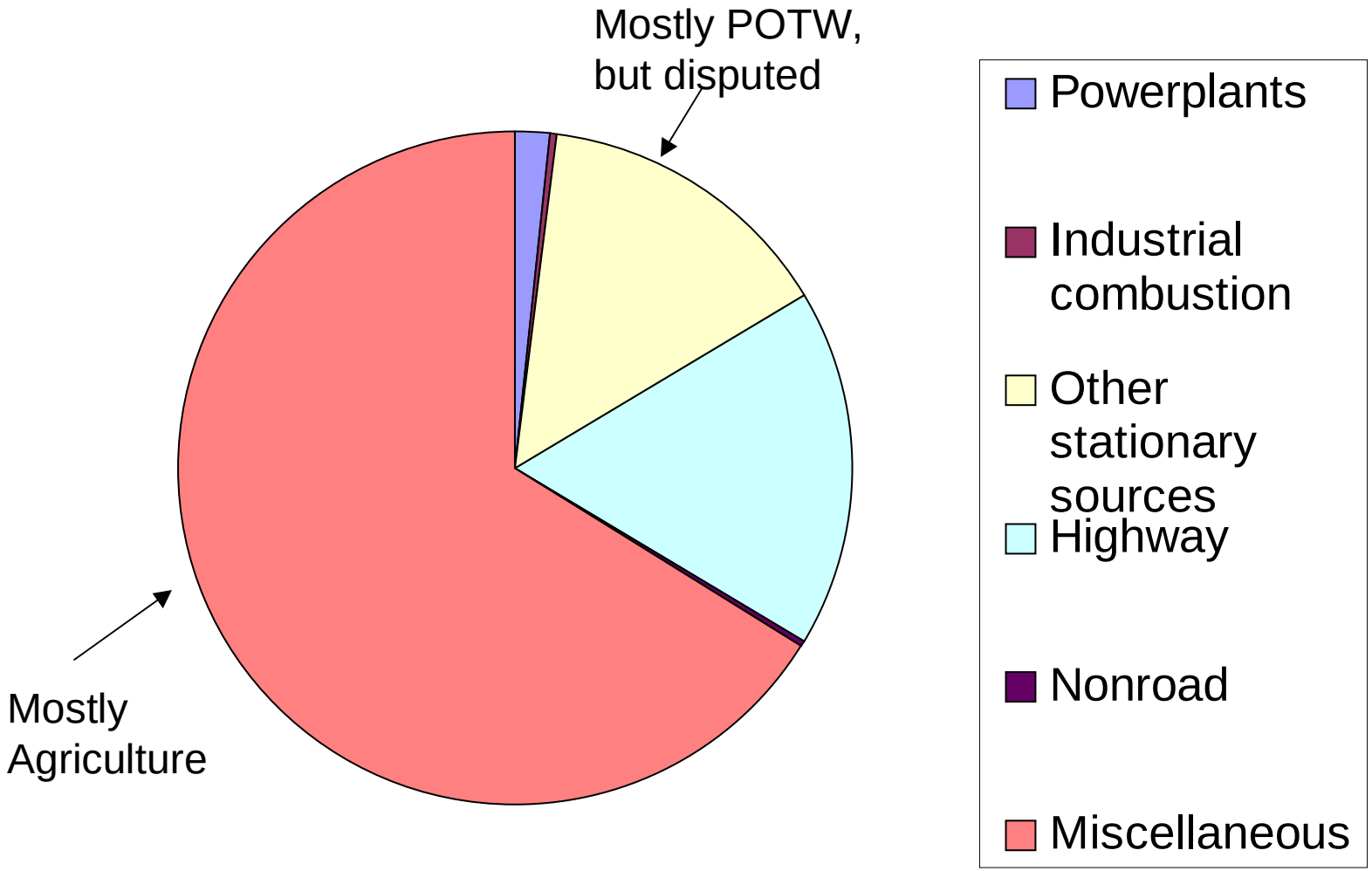


Prescribed Burning – PM2.5 Emissions



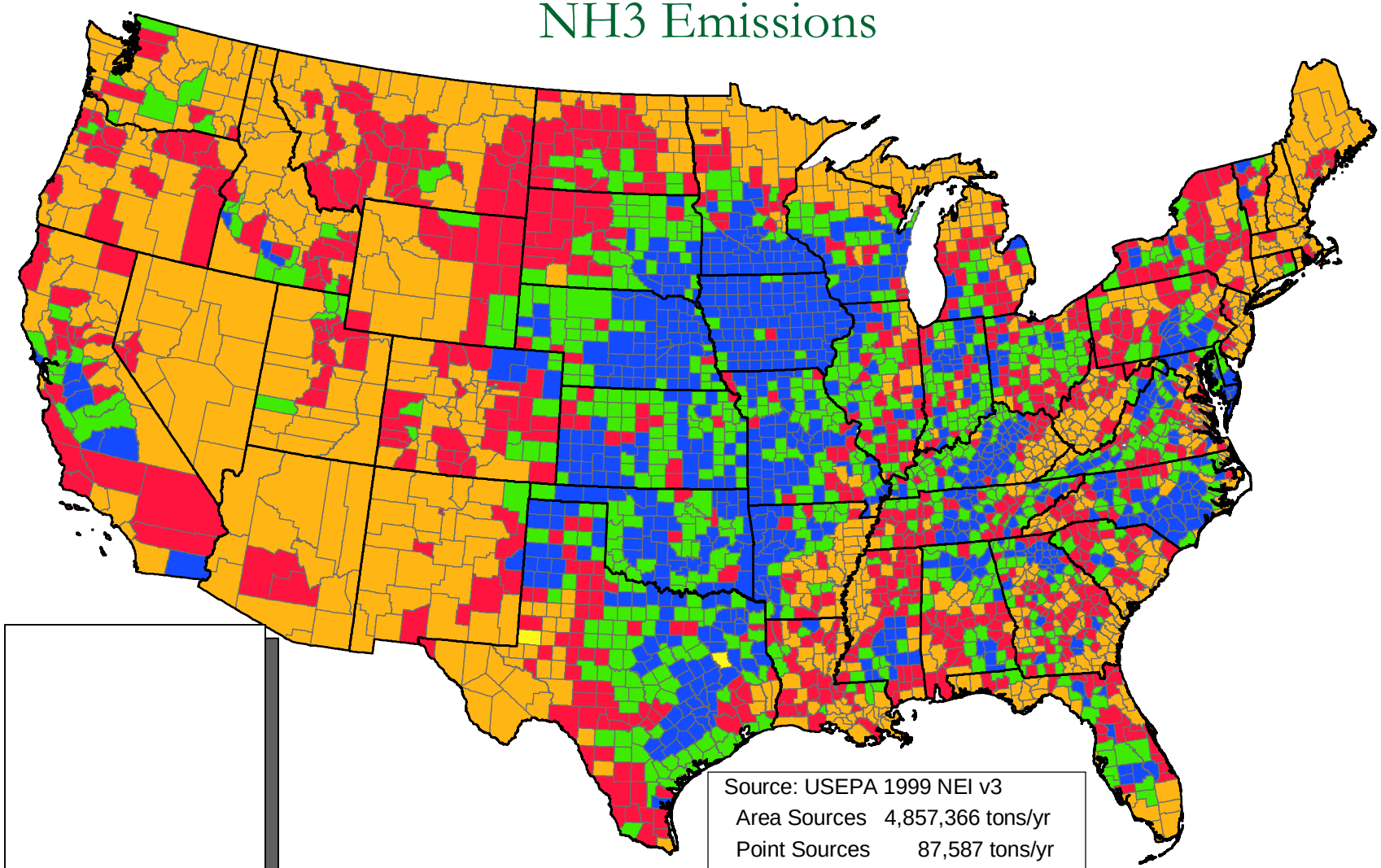
1999 Ammonia Emissions in New York State

(Preliminary NEI version 3)



Animal Husbandry in U.S.

NH3 Emissions



Source: USEPA 1999 NEI v3

Area Sources	4,857,366 tons/yr
Point Sources	87,587 tons/yr
Onroad Sources	266,821 tons/yr
Nonroad Sources	3,130 tons/yr

Issues and Uncertainties

- New York City metro area is no doubt poorly represented by standard area source methods.
- Old estimates for some area source types stay in the system if state does not ask EPA to delete them.
- Nonindustrial & open sources of carbon PM2.5
  - Fires, open burning, fireplaces & stoves.
  - Real world mobile source emissions.
- Road dust and other fugitive dust (crustal).
- Ammonia – probably overestimated in 1999 NEI.
  - Projects to improve are underway by EPA and RPOs.

Issues and Uncertainties, continued

- Industrial sources of PM2.5 – mild uncertainties compared to open sources.
  - Condensible PM -- missing and/or disputed
    - E.g., API says EPA's AP-42 factor for natural gas is 25X too high.
  - Missing emission factors, uncertain control efficiencies, etc.
- SO2 and NOx inventories are pretty solid.
  - However, New York DEP has a special problem with stacks.

Summary

- PM inventories exist.
  - 1999 NEI covers the whole US.
- PM inventories have issues, but are going to get better in the next few years.
- 2002 is an important inventory year.
- Ask both…
  - What the PM inventory can do for you.
  - What you can do for the PM inventory.