

U.S. National Emissions Inventory (NEI) Overview and Method Improvements

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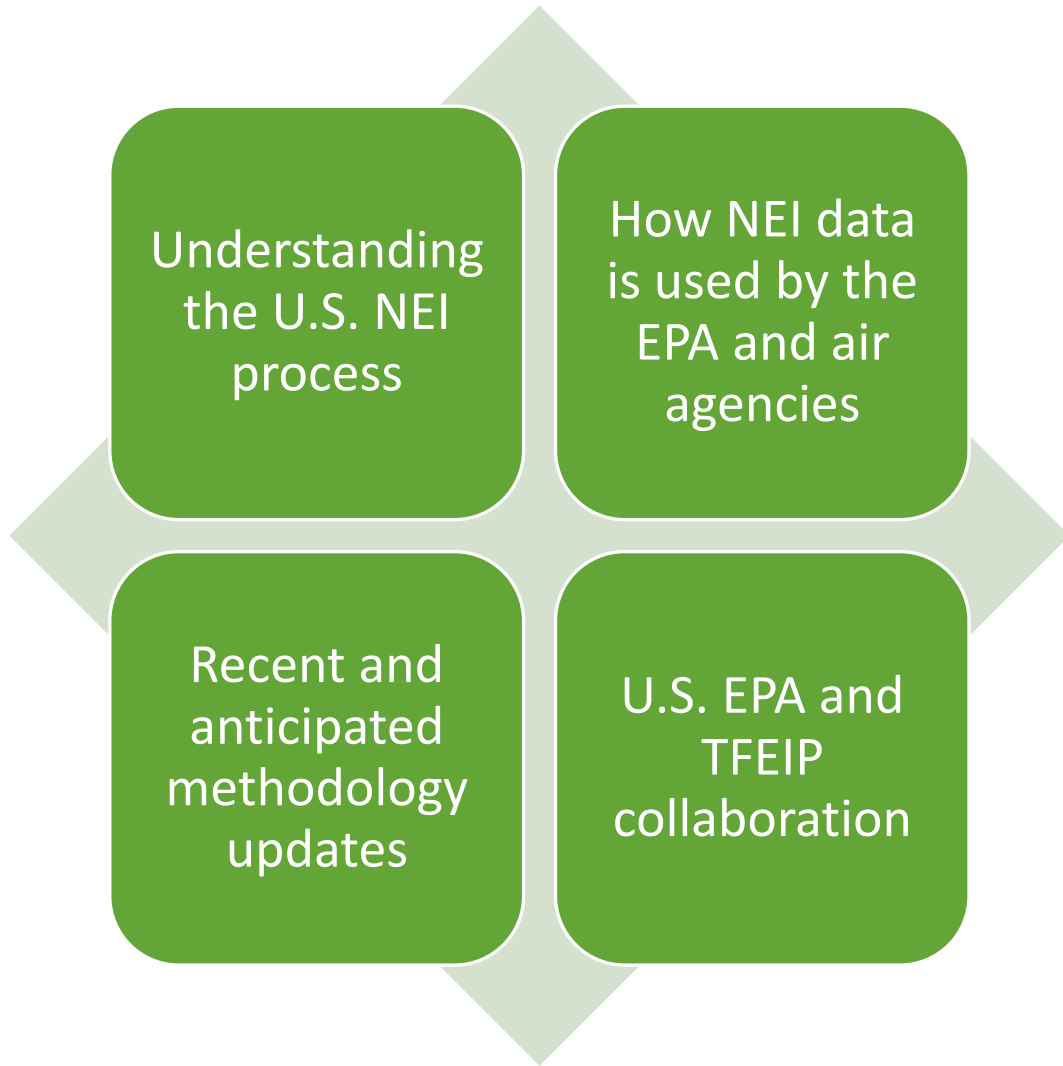
U.S. EPA OFFICE OF AIR QUALITY PLANNING AND STANDARDS

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TASK FORCE ON EMISSION INVENTORIES AND PROJECTIONS ANNUAL MEETING

DESSAU, GERMANY





Main Takeaways

Outline

What is the NEI?

- Key goals
- Regulatory background

NEI Uses by EPA and Others

- Examples: Modeling and emission trends

2020 NEI High Level Summary

Methodology Improvements

- EPA methods team
- New methods as of the 2020 NEI and example
- Future improvements

Collaboration between the U.S. EPA and TFEIP

What is EPA's National Emissions Inventory (NEI)?

The NEI is a comprehensive and detailed estimate of air emissions of criteria pollutants, criteria precursors, and hazardous air pollutants from air emissions sources.

- There are thousands of source classification codes (SCCs) in the NEI, to describe emission sources
- SCCs are broadly aggregated to point sources, non-point sources, onroad sources, nonroad sources, and fires (wildfires, prescribed fires, and agricultural burning)

The NEI is released every three years based primarily upon data provided by State, Local, and Tribal air agencies for sources in their jurisdictions and supplemented by data developed by the U.S. EPA.

- 2020 is the most recent public facing NEI

The NEI is built using the Emissions Inventory System (EIS) which collects the data from State, Local, and Tribal air agencies and then blends that data with other data sources.

More information at: <https://www.epa.gov/air-emissions-inventories/national-emissions-inventory-nei>

NEI Key Goals

1. **All emissions** to the atmosphere included, whether regulated or unregulated, for all counties/tribes including Puerto Rico and the Virgin Islands
2. **Represents the year** of the inventory
3. **Utilize best available information** and the **best possible science** in EPA methods
4. **Full Transparency** – include origin of emissions (who provided, factor, activity, method)
5. **Timely** development and release

NEI Regulatory Background

Clean Air Act (CAA) 110 (a)(2)(F) authorizes EPA administrator to collect emissions data as needed to support the National Ambient Air Quality Standards (NAAQS) program

CAA 182(a)(3) requires triennial emissions for O₃ nonattainment areas

Air Emissions Reporting Rule (AERR) - Current

- Criteria air pollutants and precursors (CAPs) required
- Hazardous Air Pollutants (HAPs) and Greenhouse Gases (GHGs) voluntary
- Point sources for NAAQS major sources (potential-to-emit thresholds) and voluntarily lower, with Lead at 0.5 tons/year actual
- Events (fires) voluntary
- All other sources (mobile + nonpoint) county level
- Complete triennial inventory with annual very-large (Type A) point sources

NEI Uses by EPA and Others

Air quality modeling

- NAAQS regulatory and regional haze
 - Starting point for State Implementation Plan (SIP) inventory requirements for O₃, PM_{2.5}, transport, and regional haze SIPs
 - Used in development of transport rules and NAAQS regulatory impact analysis (RIA)
- International transport modelling
- Used in EPA tools
 - Risk results from tools such as AirToxScreen are used by SLTs
- Centers for Disease Control and Prevention (CDC) air quality analysis
- Global modeling inventories used by international community

Emissions trends – national and state

- Used in air trends report, international agreements, and public and press requests

Public Information available via NEI website

- NEI query tools, technical support documentation, submittal instructions, guidance, plan, instructions

Example of NEI Use: Air quality modeling

NEI Data

NEI

$$E(s, t, l) = f(A, EF, CF, M)$$

where:

- *s*: sector ranges from broad to specific
- *t*: time ranging from annual to hourly;
- *x*: location ranging from state to point
- *A*: activity data
- *EF*: emission factor
- *CF*: control factors
- *M*: Meteorology
- **State-Tribe-Local supersedes EPA where available**

Ancillary Data: profiles and cross references

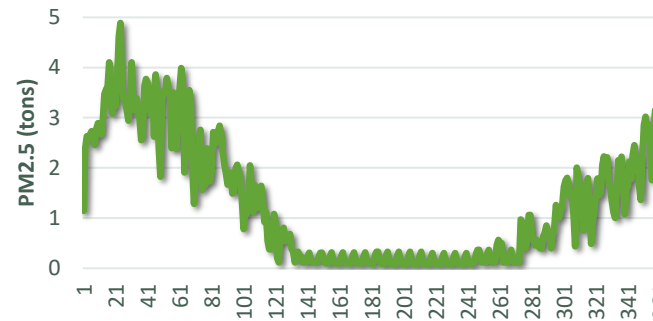
Temporal Profiles

Base and Future Inventories (annual, monthly, daily, hourly)
Met. Data

Speciation Profiles

Spatial Surrogates

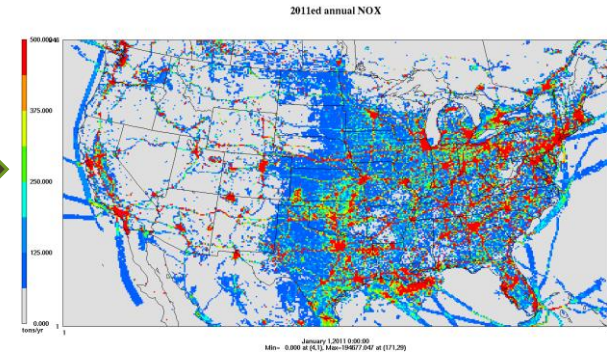
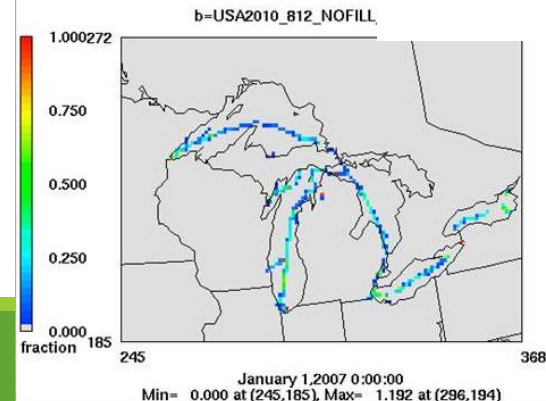
Sparse Matrix Operator Kernel Emissions (SMOKE)



SMOKE software system performs **temporal allocation, speciation, and spatial allocation** to create...

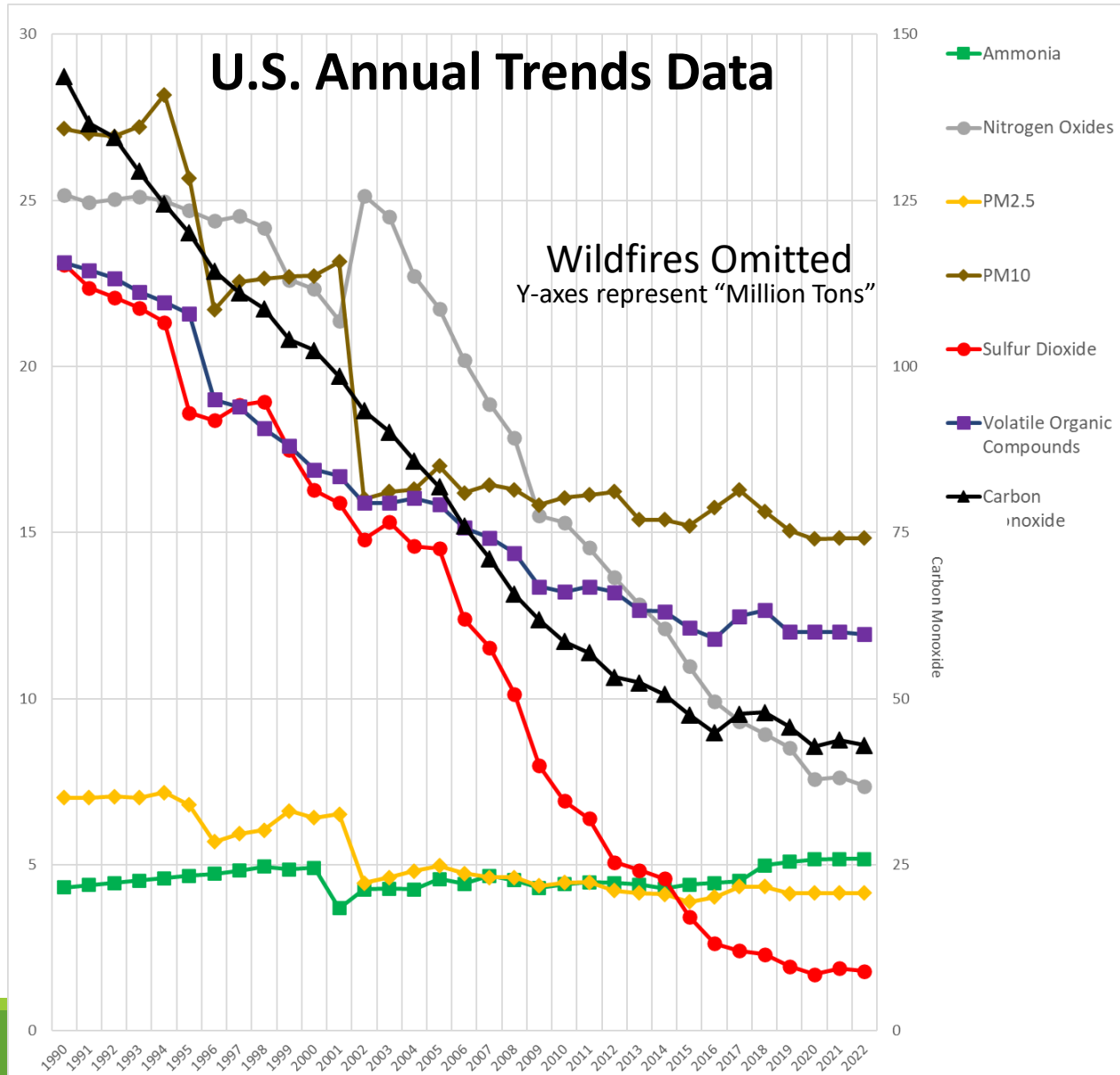


812: Great Lakes Shipping Lane NOx Activity



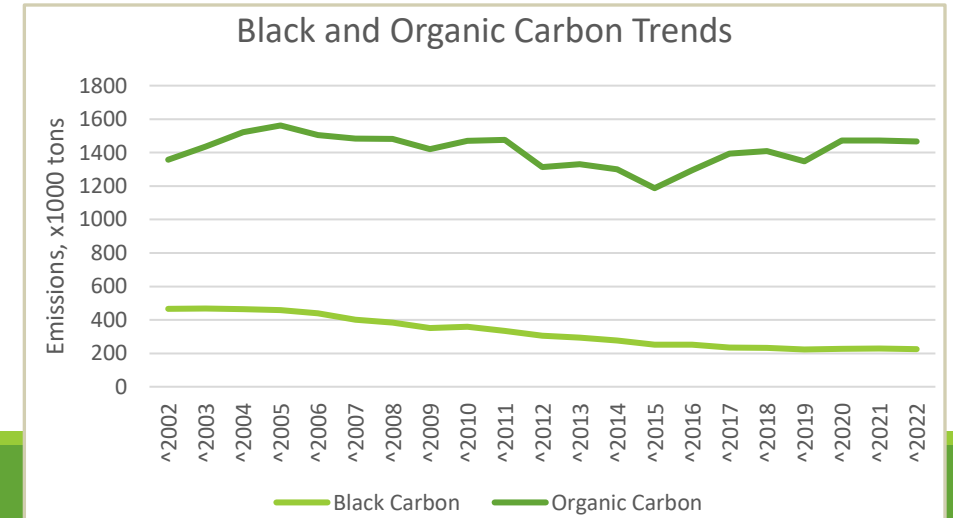
Final product: gridded, hourly, speciated emissions in a format for an air quality model

Example of NEI Use: Emissions Trends



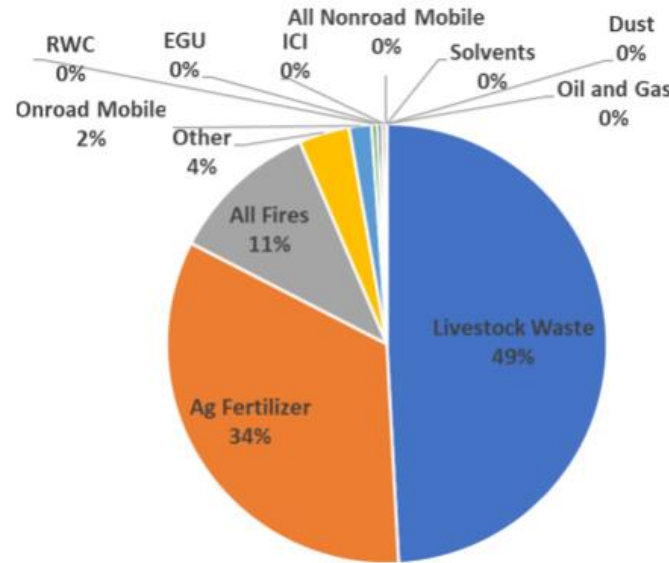
Items to note:

- PM2.5 shows static trends over time since 2002, POC shows similar trends
- NH3 shows an increasing trend in recent years up to 2020
- VOC flattening trends in recent years
- Large point source SO2 reductions leading to other sectors playing a role (O&G contributes about 10%) in 2020
- From 2002-2019, these trends reflect EQUATES data, which minimizes time series effects due to method changes

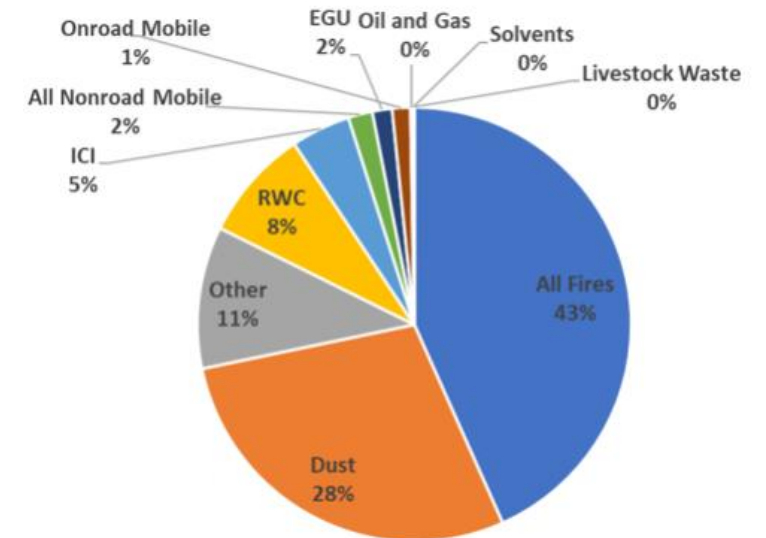


Latest NEI data: Pollutant Source Category Breakdown *2020 NEI*

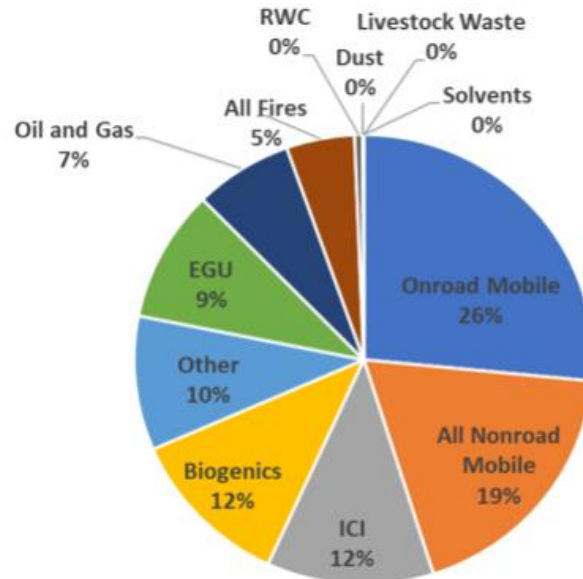
NH3
Total: 5.3 M tons



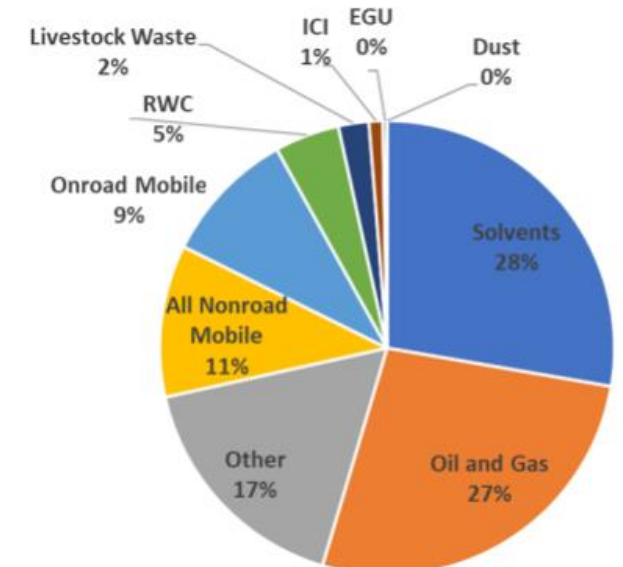
PM2.5
Total: 5.8 M tons



NOx
Total: 8.8 M tons



VOC
Total: 10 M tons



NEI Methodology Improvements: EPA Methods Team

- The EPA Methods Team* prioritizes areas of the NEI for methodological improvements.
 - Improvements can be scientific updates to existing emission sources or the addition of a new source type to the inventory.
 - Prioritization accounts for estimated contributions to NAAQS violations, key Hazardous Air Pollutant (HAP) sources, input from stakeholders, and new scientific work suggesting updates necessary for existing methods.
- The team leads, collaborates on, or incorporates outside work that improves the prioritized items within the inventory development process
 - Including emission quantification, future projections, speciation, or temporal and spatial allocation.

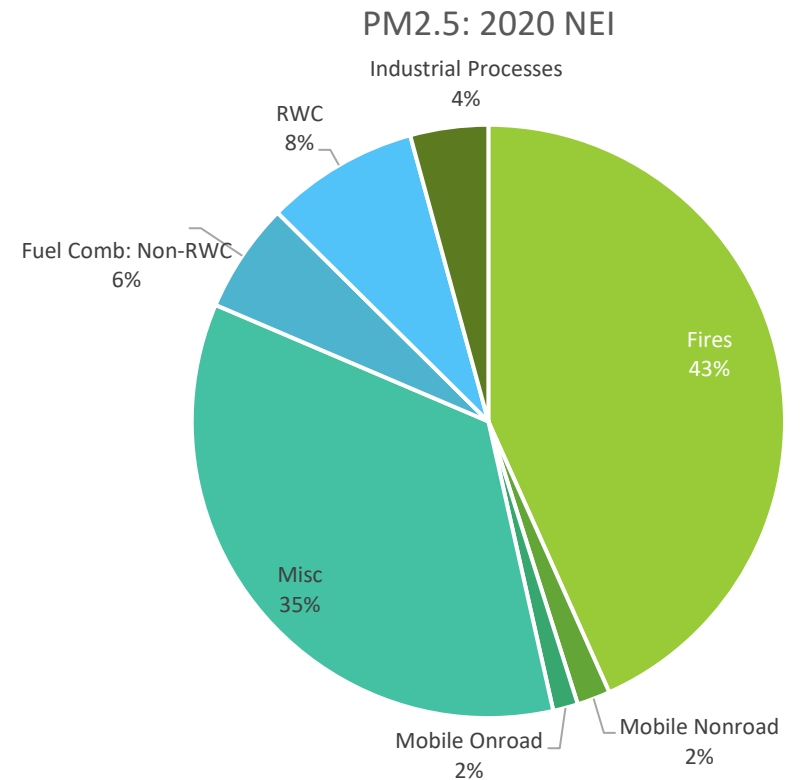
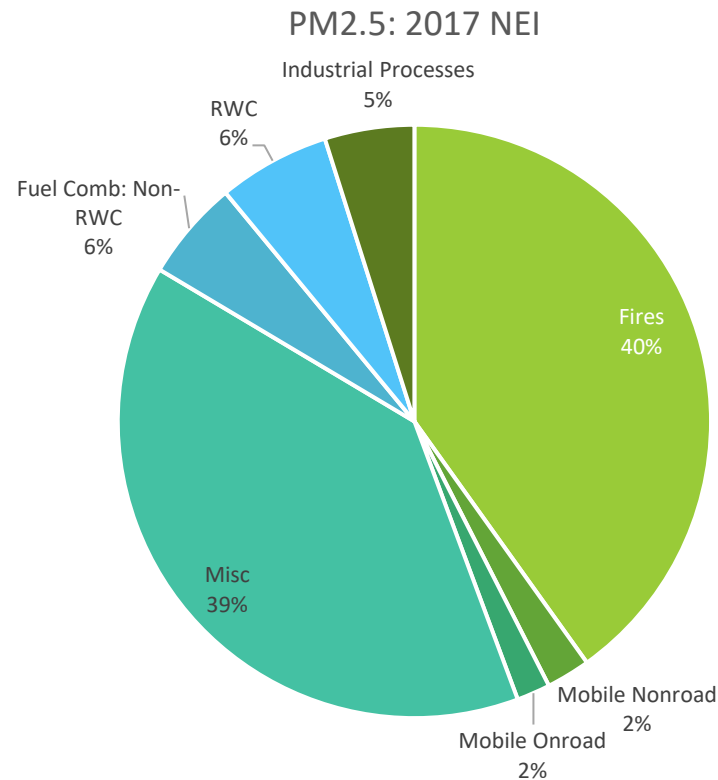
* weblink: <https://www.epa.gov/air-emissions-inventories/emissions-science-improvements-emission-sectors>

New Emission Methods in the 2020 NEI

- Nonpoint solvent utilization
 - Complete update, including new emission methods and speciation
- Nonpoint agricultural silage
 - New VOC & HAP emissions source
- Nonpoint hot-mix and warm-mix asphalt paving
 - New VOC & HAP emissions source
- VOC and PM_{2.5} speciation updates
 - Released SPECIATE5.2
 - 100 or so updated/improved VOC and PM profiles
 - Profile type updates and species property updates
- Use of Bluesky Pipeline for wildland fire emissions
- Inclusion of lead (Pb) as a pollutant from wildland fires
- Improvement to residential wood combustion emission factors & speciation
- Biogenic model updates
 - Updated emissions factors
 - Use of gridded biomass data from USFS
 - Improved transition of seasons

Example: PM2.5 and Residential Wood Combustion (RWC)

- Improved methodologies to RWC implemented in the 2020 NEI led to a 44% increase in PM2.5 RWC emissions compared to the 2017 NEI



Future NEI Methods improvements

- Roofing Asphalt Emissions (VOCs, HAPs)
- Improving cooking emission methods and/or adding residential cooking (criteria air pollutants and precursors (CAPs), HAPs)
- Solvent usage in oil and gas operations (VOCs, HAPs)
- Abandoned oil and gas wells (VOCs, HAPs)
- NH₃ emissions for non-Ag sources (human activities, pets, wild animals)
- Wildland-urban interface and structural/motor vehicle fires (CAPs, HAPs)
- Include dioxins/furans (HAPs), in process
- Continued improvements to residential wood combustion methods (activity, emission factors, speciation)—(CAPs, HAPs), **in process**
- Spatial allocation improvements, temporal allocation improvements, speciation updates, **continual improvements**
- Establishing HAP emission trends, **will be a major effort**
- Improving dust estimates, and including wind-blown dust

Collaboration between U.S. EPA and TFEIP

Goals: Share progress and challenges related to emission inventories and methodologies at a technical level and identify joint topics of interest.

Potential areas of interest include:

- Residential wood combustion
 - What are the most pressing questions? What are the different methods and resolutions being used? What outcomes would be beneficial?
- Fireworks
- Wildfire/Prescribed Fire
- Condensable PM
- Connecting with experts on specific sources

Interest in hearing TFEIP member feedback

- What would be useful to come out of this collaboration?
- What are the most pressing questions in RWC or other sectors of interest?
- What other topics should be delved into?

Thank You!

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