Particulate Carbon Emissions in the National Emissions Inventory (NEI)

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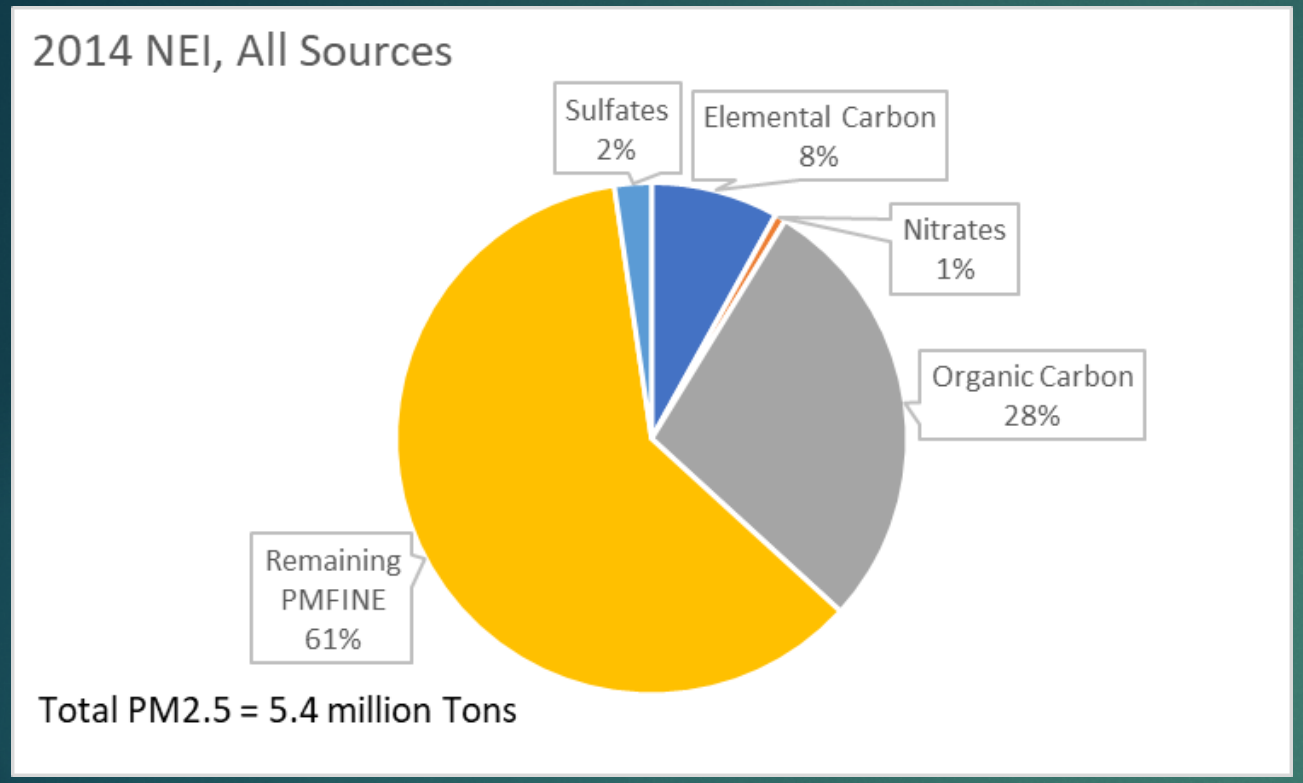
What Is Particulate Carbon and Why Is It Important?

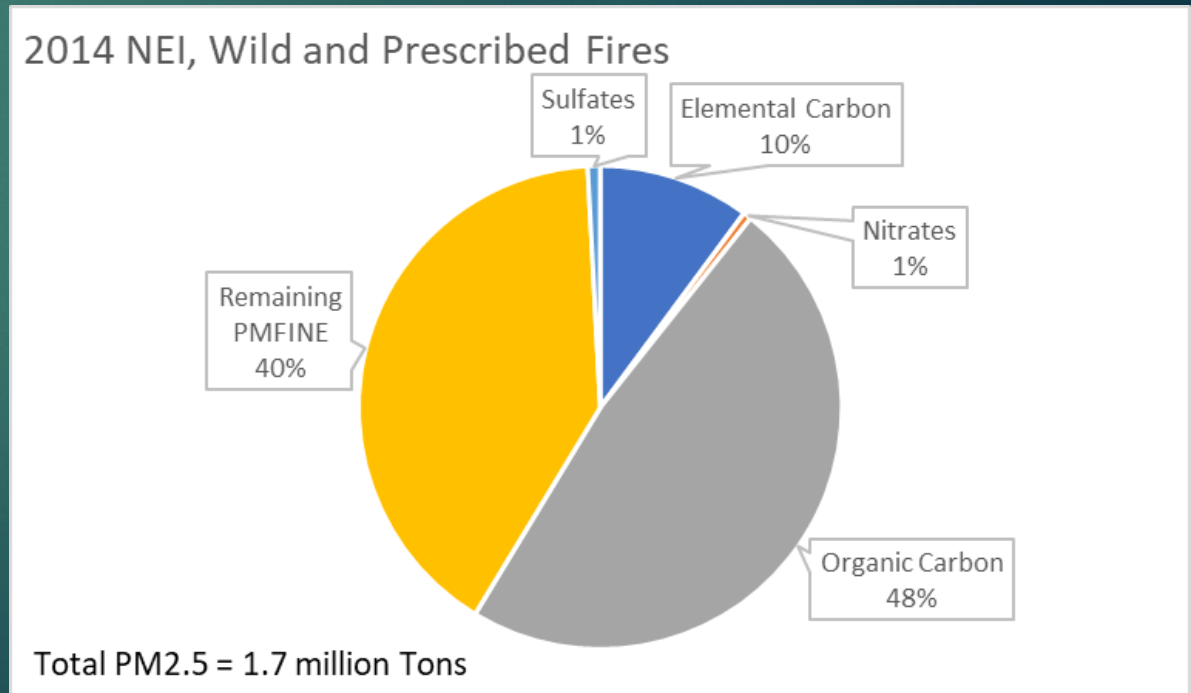
- PM2.5 consists of separate chemical components, of which five are considered major contributors to mass: sulfates, nitrates, "crustal" material, elemental carbon (EC) and organic carbon (OC)
- For many sources, EC and OC in sum are the major constituent of PM2.5 emissions
  - As such, and also due to controls on nitrogen oxides (NOx) and sulfur dioxide (SO2) emissions, carbon tends make up much of the remaining PM2.5 in non-attainment areas
  - Carbon also is critical for climate assessments and modeling, as black carbon is a strong absorber of light
- Often, BC (Black Carbon) is set equal to EC

PM2.5 Components in the 2014 NEI



When you look at all sources together in the NEI, more than 60% of PM2.5 consists of "Remaining PMFINE", which are trace metals, non-carbon organic mass, and other mass needed to balance out PM2.5

When you look at fires alone, carbon is a much larger contributor at 58%



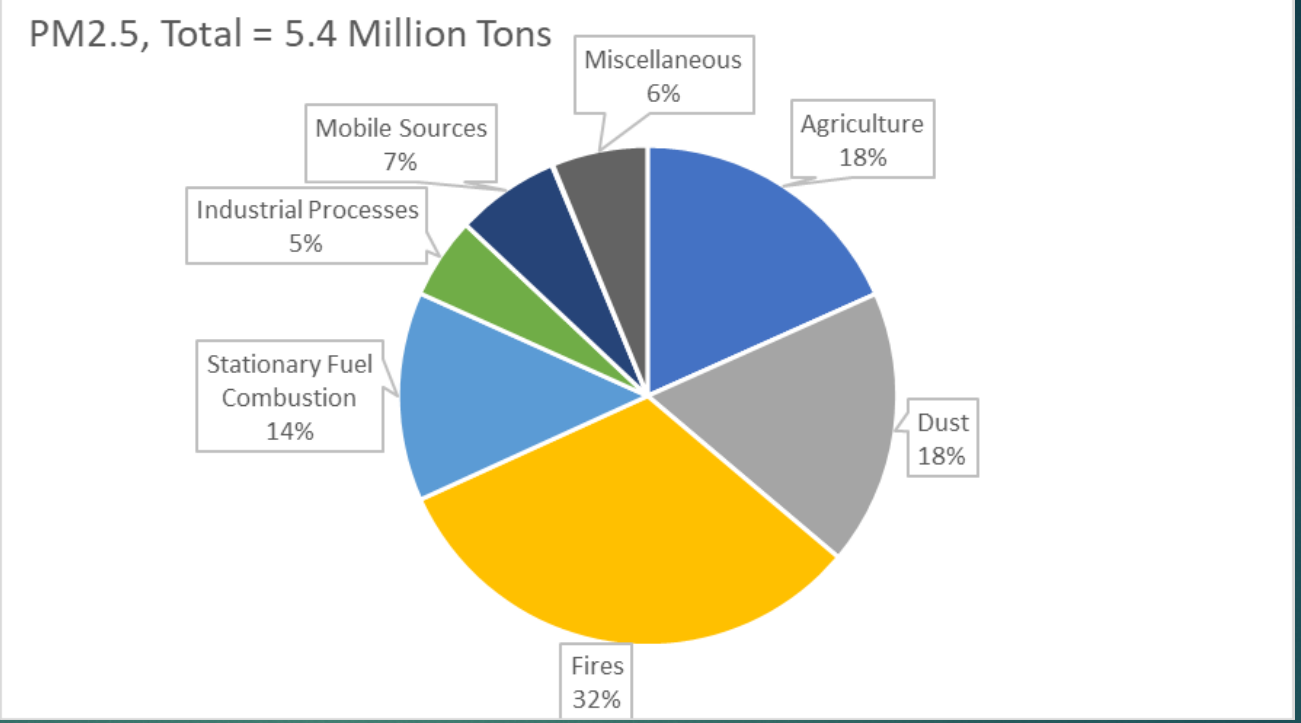
How is Particulate Carbon Estimated in the NEI?

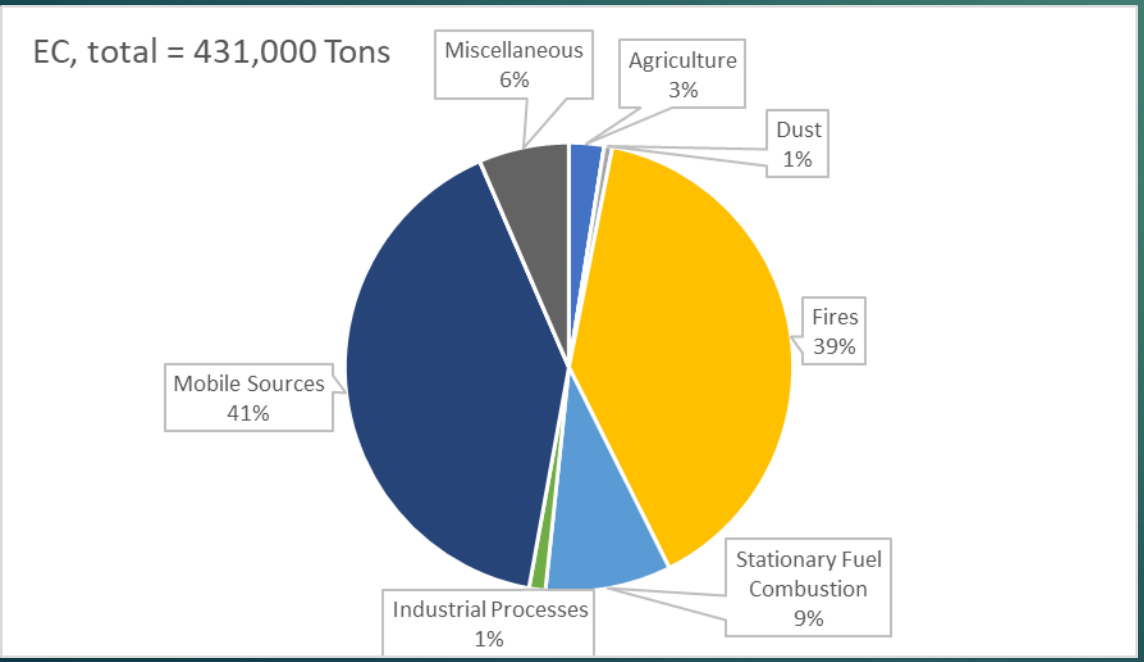
- For most sources in the NEI, OC and EC are estimated by applying a fraction to the PM2.5 estimates
  - These fractions are available in EPA's SPECIATE database, which contains carbon fractions for hundreds of sources
  - EPA assigns carbon fractions from SPECIATE to sources in the NEI
    - Only about 80 SPECIATE profiles are mapped to thousands of sources
  - For on-road mobile sources, the MOVES model directly provides EC emission factors (SPECIATE needed for OC)
- The robustness of the carbon estimates thus depends on the PM2.5 estimates, on the source measurements in SPECIATE to get the PM2.5 fractions, and how well the SPECIATE profile represents carbon fractions for the NEI source
- Coarse PM is not speciated in the NEI nor for air quality modeling

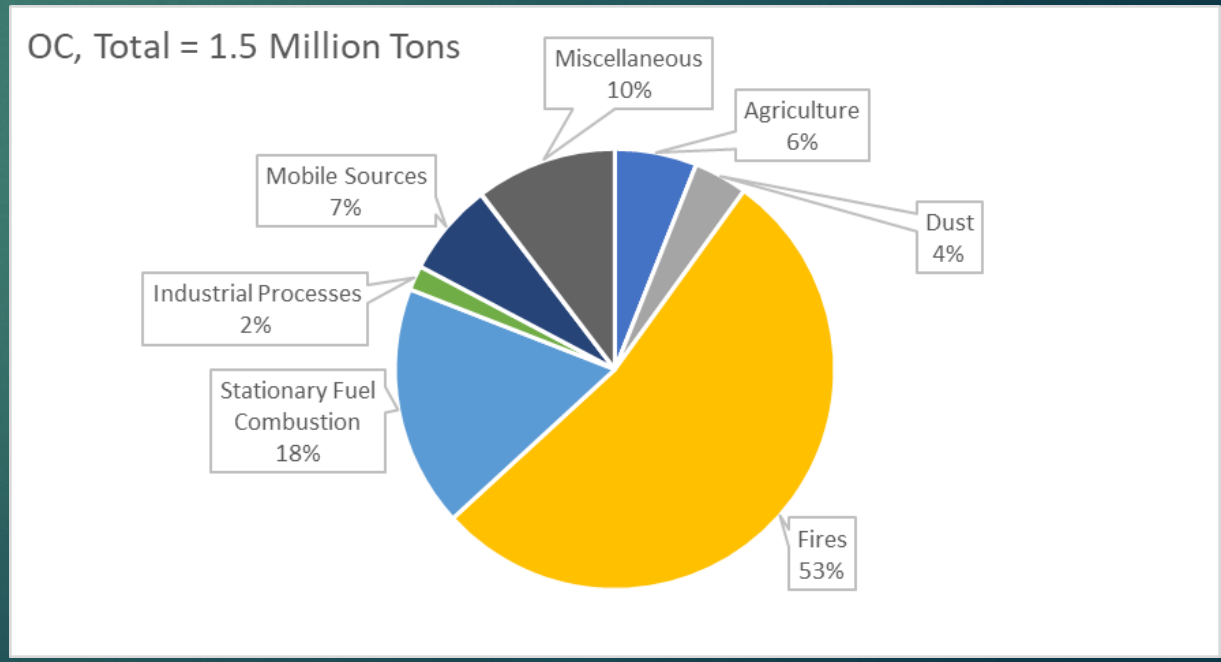
2014 NEI National Source Contributions

EC, about 8-9% of PM2.5

OC, about 30% of PM2.5







Closing Remarks

- Source type varies greatly for PM2.5, OC, and EC in the inventories
- Improving SPECIATE data is very important to continue to improve carbon estimates in the NEI
  - EPA encourages researchers to consult our priority assessment regarding needed improvements to PM2.5 speciation data
  - https://www.sciencedirect.com/science/article/pii/S135223101930175X
- Improving PM2.5 estimates also important
  - Condensable particulate matter (see Joe Mangino's poster for more details)
  - Improved test methods and measurements for sources
- Moving forward to understand the composition of OC
  - Fourier Transform Infrared Spectroscopy (FTIR) measurements
  - Functional group identification…can be markers for certain key sources