

# Mapping Diesel Particulate Pollution Exposure

## Appendix: Methodology

[ <https://www.ucsusa.org/resources/diesel-pollution-maps>]

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This methodology document will describe the processes we used in making state maps of diesel particulate pollution exposure.

## 1. Emissions Modeling using InMAP

The major analytical step in this analysis was to translate air pollutant emissions to changes in ambient air quality. This was done using InMAP, a reduced complexity air quality model with high spatial resolution (up to 1km x 1km grid), which estimates annual-average changes in primary and secondary fine particle (PM2.5) concentrations. This was chosen given the lack of expertise and computing resources associated with more comprehensive chemical transport models (e.g. CAMx, CMAQ, WRF-Chem, GATOR-GCMOM). The major simplifying assumption InMAP uses is using an annual-average basis rather than the highly time-resolved performance of a full CTM. Other similar models include AP3/APEEP and EASIUR.

InMAP can be downloaded via GitHub [here](#) (make sure to download a stable release, either via git or your browser). The README explains the installation process well, but may require some tweaks such as reversing the / to \ for Windows machines in directory names.

Inputs to InMAP include :

- Preprocessed baseline meteorology and pollutant data
- Variable grid data
- **Emissions shapefiles**
  - This analysis utilized 2014 National Emissions Inventory data, readily usable in the InMAP grid by the InMAP authors.
  - For diesel emissions, we manually selected the EPA Source Classification Codes including « Diesel » at the third level. This includes refueling.
- Population baseline (US Census American Community Survey)
- Basline mortality rate

InMAP is a linear model, so running the model for different emissions sources separately and then adding them together would yield the same result as running the model with all sources together.

The total PM2.5 concentration numbers aggregate particulate pollution from primary PM2.5 and secondary PM2.5 from various sources : Particulate sulfate (pSO4), Particulate nitrate (pNO3), Particulate ammonium (pNH4), and Secondary organic aerosol (SOA). InMAP outputs shapefiles with a variety of parameters in its grid. This total number was then area-weighted-averaged to the census tract level to be shown in the maps.

Reach out to [kshen@ucsusa.org](mailto:kshen@ucsusa.org) if you'd like the ready-to-use data files related to this analysis.

## 2. Traffic Data through FHWA HPMS

Traffic road data in the maps is solely meant to give more context to the emissions concentrations, by showing easily identifiable roads (e.g. your nearest local highway), and also showing how pollution largely follows areas of highest truck traffic.

The Federal Highway Administration's Highway Performance Monitoring System (HPMS) has Annual Average Daily Traffic (AADT) numbers for major roads in the National Highway System and separate AADT numbers for Combination trucks and Single trucks. These are conveniently placed in shapefile format.

These maps use the AADT\_Combination numbers and separate groups by rough quantiles in order to illustrate areas of high and low traffic. This is meant to solely provide more context, not as a major part of the analysis.

### 3. Mapping in QGIS and Inkscape

There are many resources online to help with mapping a census tract level choropleth map in QGIS/ArcGIS. The only choices to note here are the use of state-wide quantiles to illustrate within-state disparities.

The QGIS maps were then exported to vector graphics format for further formatting within Inkscape (comparable to Adobe Illustrator).

### 4. Context and caveats

Some of the major benefits of the analysis are its spatial scale (relatively granular) and its simplicity (easy to reproduce, just primary and secondary particulate matter). It illustrates the possibilities of reduced complexity models as well for useful but not regulatory-grade work.

A similar study recently came out by [Clean Air Task Force](#), which used COBRA to model the health impacts of all diesel emissions. Our analysis is complementary to this given its finer spatial scale and its more sophisticated dispersion modeling (i.e. COBRA uses a crude county-level source-receptor matrix). Future work can include translating our exposure numbers to health impacts using a health benefits model such as BenMAP.

And probably most importantly, it is important to note that these are *modeled numbers*, and so inherently come with some simplification and can easily be different from what is experienced on the ground. Block-level spatial detail or more guaranteed accuracy could benefit from a different methodology, such as [satellite measurement](#) or [hyperlocal air quality monitoring](#).

Modeling air quality does though have the benefits of source attribution (i.e. we can attribute this amount of PM2.5 to diesel trucks, it is more difficult to distinguish in measured numbers), easier execution, and the possibility of modeling different future scenarios.

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