Appendix A: Benchmark iF Values

Appendix A includes three tables and a brief description of intake fraction estimates from peer-reviewed literature.

Tables A1 through A3 include iF values estimated for ground-level emissions in previous studies, separated by pollutant family. These values represent a summary of iFs estimated in each study.

Primary $PM_{2.5}$ iF values, shown in Table A1 below, range from 1 to 35 ppm for overall means. The range shifts to 4 to 49 ppm in urban areas and 0.1 to 4 ppm in rural areas, reflecting that on average, iFs in an urban setting may differ by a factor of 100 from iFs in a rural setting. Among different specific locations, iF estimates may show an even greater range of variability, often from three to four orders of magnitude, depending on local population density and other meteorological conditions (Lobscheid et al., 2012; Marshall et al., 2005). Modeling domain and methodology can also lead to an order of magnitude difference among iF values. There are many sources of uncertainty in iF estimation from air quality models, including uncertainty introduced by the model inputs and the various assumptions and simplifications used in simulating physicochemical atmospheric processes. In addition, the spatial resolution of a model can also produce a positive bias in iF estimates (Lobscheid et al., 2012).

Table A1: Intake fraction for primary $PM_{2.5}$ reported in previous studies. Values are normalized to a breathing rate of 14.5 m^3/day. (Fantke et al., 2017; Greco et al., 2007; Humbert et al., 2011; Lamancusa et al., 2017; Lobscheid et al., 2012; Marshall et al., 2005; Tainio et al., 2014)

iF (ppm)	Reference		Notes
General			
5.23	Marshall	2005	Population-weighted mean for US counties from Nat. Toxics Inventory
1.16	Greco	2007	Mean for ground-level sources across contiguous US counties
1.81	Greco	2007	Emissions-weighted mean
27.88	Humbert	2011	Population-weighted mean (literature review, not US-specific)
8.91	Lobscheid	2012	Population-weighted mean for US census tracts
35.34	Fantke	2017	Population-weighted mean (global)
15.68	Fantke	2017	Population-weighted mean (US/Canada)
Urban			
6.30	Marshall	2005	Mean for urban ground-level sources, one-compartment model
3.57	Marshall	2005	Median for urban ground-level sources, one-compartment model
24.96	Marshall	2005	Population-weighted mean for urban ground-level sources

iF (ppm)	Reference		Notes
49.08	Humbert	2011	Archetype for urban emissions
15.95	Tainio	2014	Emissions-weighted urban mean, Krakow
9.55	Lamancusa	2017	Urban median (10 cities)
Rural			
4.24	Humbert	2011	Archetype for rural emissions
0.11	Humbert	2011	Archetype for remote emissions
0.65	Lamancusa	2017	Rural median (3 sites)

Intake fractions for precursor pollutants are given in Tables A2 and A3. These intake fractions express the ratio of the mass of secondary $PM_{2.5}$ constituents – $(NH_4)_2SO_4$ (ammonium sulfate) and NH_4NO_3 (ammonium nitrate) – to the mass of SO_2 or NO_x emitted. Precursor iF values are lower than primary $PM_{2.5}$ iFs by a factor of 10 or more for SO_2 and a factor of 100 for NO_x. Values range from 0.3 to 1.3 ppm for SO_2 and 0.05 to 0.2 ppm for NO_x. The difference between urban and rural iFs are smaller for secondary pollutants, although one exceptional value was modeled for NO_x emissions in Krakow, Poland, perhaps due to the specific location of NO_x sources in that city. The variation among the models included here is lower than that for primary $PM_{2.5}$, due in part to the smaller number of studies that model secondary $PM_{2.5}$ iFs.

One literature review also included an average iF for NH_3 emissions of 1.9 ppm for both rural and urban areas (Humbert et al., 2011). Volatile and semivolatile organic species also contribute substantially to $PM_{2.5}$ exposure, but due to the complexity in modeling their behavior there are few studies that model and report intake fractions of secondary PM2.5 formed by VOC and SVOC (Humbert et al., 2011).

Table A 2: Intake fraction for secondary $PM_{2.5}$ formed from SO_2 emissions reported in previous studies. Values are normalized to a breathing rate of 14.5 m^3/day. (Greco et al., 2007; Humbert et al., 2011; Tainio et al., 2014)

iF (ppm)	Reference		Notes
0.30	Greco	2007	Mean for ground-level sources across contiguous US counties
0.48	Greco	2007	Emissions-weighted mean
1.10	Humbert	2011	Archetype for urban emissions
0.88	Humbert	2011	Archetype for rural emissions
0.99	Humbert	2011	Population-weighted mean (literature review)
1.31	Tainio	2014	Emissions-weighted urban mean (Krakow, Poland)

Table A3: Intake fraction for secondary $PM_{2.5}$ formed from NO_x emissions reported in previous studies. Values are normalized to a breathing rate of 14.5 m^3/day. (Greco et al., 2007; Humbert et al., 2011; Tainio et al., 2014)

iF (ppm)	Reference		Notes
0.05	Greco	2007	Mean for ground-level sources across contiguous US counties
0.09	Greco	2007	Emissions-weighted mean (US)
0.22	Humbert	2011	Archetype for urban emissions
0.19	Humbert	2011	Archetype for rural emissions
0.20	Humbert	2011	Population-weighted mean (literature review)
9.43	*Tainio*	*2014*	*Emissions-weighted urban mean (Krakow, Poland)*

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Appendix B: Model Evaluation and Uncertainty

Appendix B describes sources of uncertainty from the InMAP model and provides comparisons against other modeling and empirical measurements of $PM_{2.5}$

In the report, we highlight several simplifying assumptions that are potential sources of error or bias in modeled concentrations of ambient $PM_{2.5}$ generated by the InMAP model and average exposure concentration:

1. We apply an algorithm to exclude extreme outlier emissions, as they are likely spatially misallocated. By excluding emissions from the inventory that may be valid but occurred at another location, we may underestimate total concentrations of ambient $PM_{2.5}$.
2. $PM_{2.5}$ concentrations were modeled based only on anthropogenic sources within the modeling domain. This results in an underestimation of total $PM_{2.5}$ concentrations since natural emission sources and long-range transport were not included.
3. A source-receptor matrix (or a model based on S-R derived metrics like intake fraction) expresses simplified meteorology and rates of the atmospheric physicochemical transformation that drives transport, formation, and removal of $PM_{2.5}$. This results in less accurate concentration estimates compared to other more complex models, especially for concentrations of secondary pollutants.
4. The S-R matrix uses fixed baseline concentrations to calculate secondary $PM_{2.5}$ formation rates, so model bias and error increase when the conditions being modeled diverge from that fixed baseline.

We include here a brief comparison of the concentration data generated in this analysis with results from an additional implementation of the InMAP S-R model and several other external datasets to broadly characterize how each of the assumptions contribute to uncertainty or bias, and how that is relevant to the interpretation of model output.

Outlier exclusion

In some rare cases, the emissions from an activity, e.g. agricultural tilling emissions by a specific company, are incorrectly assumed to occur at an address associated with the company (e.g., its headquarters) rather than at the location where the activity occurs. These often occur in the NEI emissions data as extreme outliers within the source category. To address this issue, a step was added to the analysis to querying the emissions database to find locations where emissions exceed 20× the standard deviation within that species and source category. We performed two iterations of source-specific impacts and EJ calculations, one including outliers and a second with those values removed.

The effect of filtering emissions data was calculated during QA/QC procedures for this study. A comparison is shown in Table B1. The largest systematic difference, based on the slopes of the linear model fit between model results with and without outliers, appears for sulfate (31% difference in predicted concentrations: 0.11 ug/m^3 vs 0.16 ug/m^3) as several significant area sources of SO_2 were flagged for removal. However, even including outlier sources, sulfate accounts for a small (2%) share of total exposure concentration. The removal of outliers caused the most variable effects for SOA (i.e., the SOA R^2 value in Table E1 [0.86] is lower than R^2 for other species), but only resulted in 5% change in average exposure concentration (0.92 vs 0.97 ug/m^3). The overall difference in population-weighted exposure concentration was less than 5%. We determine that the application of the algorithm was appropriate as the effect on the total population exposure was relatively small and it removed some spurious localized patterns. However, the algorithm may contribute to the underestimation of particulate sulfate concentrations.

Table B1: Effects of outlier removal on modeled $PM_{2.5}$ species

	% change in primary or precursor emissions	**R^2**	**Slope of linear regression**	**Intercept of linear regression**	**Pop.-wtd exp. conc. with outliers**	**Pop-wtd exp. conc. without outliers**
Primary $PM_{2.5}$	-19%	0.93	0.90	0.19	2.73	2.71
pNO_3 $PM_{2.5}$	-14%	0.97	0.93	0.02	0.81	0.78
pSO_4 $PM_{2.5}$	-30%	0.96	0.65	0.01	0.16	0.11
pNH_4 $PM_{2.5}$	-13%	0.97	1.09	-0.14	2.34	2.24
SOA $PM_{2.5}$	-25%	0.86	0.84	0.06	0.97	0.92
Total $PM_{2.5}$	-	0.95	1.00	-0.09	7.01	6.78

Omission of non-California and biogenic emissions

We compare our results against published results from an implementation of the InMAP S-R model at the national scale (Tessum et al., 2019). That study provides a useful point of comparison because it also uses the 2014 NEI to model $PM_{2.5}$ concentrations, but (unlike the runs conducted for the present report) includes (1) natural emission sources including biogenics and wildfires, and (2) the effect of long-range transport from throughout the continental United States, Mexico, and Canada.

Compared to the national-scale model results, we underestimate population-weighted average exposure concentration by 23%. The two models show high agreement for total $PM_{2.5}$, with R^2=0.82 and a linear regression equation of:

$$PM_{2.5\_CaliforniaModel} = 1.04 \times PM_{2.5\_NationalModel} - 1.55 \quad \text{(Eq. 1)}$$

The equation indicates that there is an approximately 1:1 relationship between the models but that the additional emissions (i.e., non-California and biogenic) increase concentrations in the national model by 1.55 μg/m^3. Most secondary inorganic components of $PM_{2.5}$ showed high agreement (R^2 >0.9) with the exception of particulate sulfate, with an R^2 = 0.45 and a mean fractional bias (see Eq. 4 below) of -143%. The magnitude of underestimation is much larger than that shown from outlier removal, reflecting in part that natural sources (wildfires) are an important source of particulate sulfate in California: they contributed an estimated ~40% of total SO_X emissions in 2014 (California Emissions Projection Analysis Model (CEPAM), 2018). In addition, long-range transport from non-California emissions (e.g., Eastern states; China) where SO_2 emissions are much higher, likely plays a role in particulate sulfate concentrations in California.

Metrics for model evaluation

In line with the evaluation of the national-scale implementation of the InMAP source-receptor model (Tessum et al., 2019), we assess model-measurement agreement with fixed-site monitors (U.S. Environmental Protection Agency, 2018) using several metrics: mean bias (MB; Eq. 2), mean error (ME; Eq. 3), mean fractional bias (MFB; Eq. 4), and mean fractional error (MFE; Eq. 5), as well as linear regression slope (*S*) and squared Pearson correlation coefficient (R^2) values. In Eqs. 1–4, *i* corresponds to one of *n* comparisons, and *X* and *Y* are the annual average modeled or measured values we are comparing.

$$\mathrm{MB} = \frac{1}{n}\sum_{i=1}^{n}(Y_i - X_i) \quad \text{(Eq. 2)}$$

$$\mathrm{ME} = \frac{1}{n}\sum_{i=1}^{n}|Y_i - X_i| \quad \text{(Eq. 3)}$$

$$\mathrm{MFB} = \frac{1}{n}\sum_{i=1}^{n}\frac{2(Y_i - X_i)}{(Y_i + X_i)} \quad \text{(Eq. 4)}$$

$$\mathrm{MFE} = \frac{1}{n}\sum_{i=1}^{n}\frac{2|Y_i - X_i|}{(Y_i + X_i)} \quad \text{(Eq. 5)}$$

Model error and bias

To evaluate model performance, we compare concentrations against two publicly available external datasets: (a) gridded 2014 $PM_{2.5}$ concentrations based on satellite remote sensing (van Donkelaar, Martin, Li, & Burnett, 2019), and (b) measured concentrations from the US EPA monitoring network, including sites with chemical speciation data (U.S. Environmental Protection Agency, 2018)

Satellite remote sensing

The comparison against satellite data was performed by overlaying the InMAP grid on the satellite-based concentration raster and using the zonal statistics tool in QGIS to calculate the mean concentration within each grid cell.

Table B2: Model performance compared to satellite-based gridded $PM_{2.5}$. S is the slope of the linear regression equation, i is the intercept.

	MFB	MFE	MB (μg/m³)	ME (μg/m³)	S	i (μg/m³)	R^2	Sat. pop-wtd conc (μg/m³)	Modeled pop-wtd exp. conc (μg/m³)
Total $PM_{2.5}$	-71%	72%	-4.89	5.02	0.82	-3.0	0.52	11.28	6.78

Our concentrations show moderately good correlation with satellite-based gridded concentrations (R^2 = 0.51) and a linear regression equation of

$$PM_{2.5\_CaliforniaModel} = 0.82 \times PM_{2.5\_Satellite} - 3.0 \quad \text{(Eq. 6)}$$

As with the comparison against the national-scale InMAP S-R model results, the negative intercept indicates that satellite-based concentrations are incrementally higher, as expected, also indicated by the mean bias of -4.89. Overall, our values underestimate gridded concentrations by 71% (area-weighted), resulting in an underestimate of population-weighted average concentration of 40%. Those differences reflect in part that the model runs here omit important emissions (non-California emissions; biogenic emissions).

Monitoring network

The comparison against monitoring data was performed by using a spatial join to match the concentration at the monitor location to the grid cell that contains it. For this comparison, we used particulate sulfate concentrations including outlier emissions sources to control for that additional source of model error.

Table B3: Model performance compared to 2014 monitoring data.

	MFB	MFE	MB	ME	S	R^2	Monitor-based pop-wtd. exp. conc. (μg/m³)[1]	Modeled pop-wtd. exp. conc. (μg/m³)
Ammonium N=24	88%	92%	1.23	1.25	2.2	0.43	0.47	1.27
Sulfate N=44	-166%	166%	-0.66	0.66	0.13	0.44	0.66	0.06
Nitrate N=42	-37%	67%	-0.50	0.62	0.39	0.70	0.90	0.52
Total $PM_{2.5}$ N=133	-66%	73%	-3.87	4.86	0.60	0.26	8.85	4.71

[1] Population-weighted exposure concentration

In Table B3, S is the slope of the linear regression equation and N is the number of monitors included in the comparison. The population-weighted average concentration is based only on grid cells containing monitors, so it differs from the overall modeled value. Organic aerosol is not included in this comparison because InMAP predicts secondary organic aerosol (SOA), while monitoring sites report total organic aerosol (OA), the sum of SOA and primary organic aerosol (POA). In InMAP, POA is included as part of primary $PM_{2.5}$.

Based on the linear regression against n=133 fixed site measurements, we find fair correlation (R^2 = 0.26), which places model performance between the 25th and 50th percentile of typical model performance (Simon, Baker, & Phillips, 2012). Similar performance results were found for the national-scale InMAP S-R model, and the authors state

> *This comparison suggests that the performance of the model here is generally within the range of contemporary air quality models, with the exception of a low-bias for particulate sulfate predictions. Although in most cases the performance reported here is not among the best reported by Simon et al., the simplified nature of InMAP allows us to perform the many simulations required to produce the detailed results herein*
> *(19 end-user types × 389 end-use categories × 5,434 categories of emitters = 40,162,694 simulations per simulation year). This analysis would be computationally infeasible using any of the models reviewed by Simon et al.*

We find again that this model underestimates PM2.5 concentrations, with MFB = -66%, MB = -3.87, and a regression slope of 0.60. Based on the populations of grid cells containing monitoring sites, our population-weighted average concentration is ~45% lower than that based on monitoring stations. These results are consistent with the comparison with the satellite-based grid (40% underestimate). Both show underestimation greater than what we find when comparing against the national-scale InMAP S-R results (23% underestimation).

Comparing our results against speciated monitoring data, we find that model performance varies significantly among the inorganic secondary species. The model performs well in predicting nitrate formation (R^2 = 0.70, MFB = -37%), but shows two contrasting patterns for particulate ammonium and sulfate. While spatial variability of both species is explained fairly well by the model (R^2 = 0.43 and 0.44, respectively), sulfate is significantly underpredicted (MFB = -166%). As discussed previously, this result can be explained in large part to non-California and biogenic SO_X emissions, which are not included in the emissions inventory we used. It may also be the case that our model underestimates particulate sulfate formation. Conversely, ammonium is overpredicted by 89% (the national-scale model shows a similar MFE for grid cells in California); this result suggests a model bias in overestimating particulate ammonium formation. Total PM2.5 predictions may be more accurate than are predictions for individual chemical species, as a result of compensating errors (overestimating some species, underestimating other species).

Baseline concentration differences

Ammonia plays a critical role in inorganic secondary $PM_{2.5}$ formation in California. Based on airborne observation made during the CalNex campaign, Schiferl et al. estimate that through the formation of ammonium nitrate and ammonium sulfate, anthropogenic ammonia leads to 40-60% of surface inorganic $PM_{2.5}$ in California during the summer, and up to 78% in winter (Schiferl et al., 2014). Furthermore, the 2013 DISCOVER-AQ campaign found that the formation of ammonium nitrate in the San Joaqin valley is limited by HNO_3 availability, indicating that reductions of NO_X emissions reduce the formation rate of particulate ammonia in parts of California (Kelly et al., 2018; Pusede et al., 2016). NO_X emissions reduced dramatically in California between 2005 and 2014 while ammonia emissions have remained steady (California Emissions Projection Analysis Model (CEPAM), 2018). InMAP's overestimation of particulate ammonium formation rates likely reflects its use of baseline concentrations from 2005. This problem does not appear to occur for particulate nitrate or sulfate.

Implications for source-specific EJ comparisons

Underprediction of total $PM_{2.5}$ concentrations, owing in part to omitted emission sources, impact the accuracy of absolute exposure disparity estimates. However, the omission of other emission sources does not affect the modeling of exposure concentration estimates from anthropogenic sources, which are the basis of the EJ analysis presented in the main report. In addition, while simplifying assumptions result in error in total concentration estimates, these assumptions are applied consistently across all source categories, and thus may have a lesser effect on uncertainty in source ranking and relative impact estimates. Overprediction of some secondary species and underprediction of others may have an effect on conclusions about rankings and relative impact if one source category is dominated by a precursor for overpredicted species (ammonia) while another is dominated by a precursor for an underpredicted species (sulfate). Figure B1 presents the source-specific impact bar charts divided by precursor species, showing that source rankings vary substantially for different $PM_{2.5}$ species.

Sources that result in differential EJ effects due to primary emissions or due to a blend of precursor emissions are less affected by uncertainties in the formation rates of a specific precursor species, while sources with impacts dominated by one precursor pollutant be viewed as more uncertain. Table B4 – B6 show specific examples of species-specific EJ impacts of three source categories: gasoline passenger vehicles, livestock, and industrial fuel combustion. Exposure concentration from gasoline passenger vehicles (Table B4) results from primary $PM_{2.5}$ and a blend of precursor emissions, and exposure disparity patterns are similar across all contributing species. The EJ impacts of this source are less sensitive to model bias in calculating the formation of a single secondary species. In contrast, exposure concentration from livestock production in the agricultural sector (Table B5) is dominated by formation of particulate ammonium from ammonia emissions. This leads to greater uncertainty for results from this emission category, as the formation of particulate ammonium has more modeling uncertainty than for other species. Finally, fuel combustion from industrial sources (Table B6) is an example of a source where exposure concentration is dominated by primary $PM_{2.5}$ emissions; although EJ impacts for industrial fuel combustion come from one pollutant category, results are also not strongly affected by the uncertainty in modeling to secondary $PM_{2.5}$ formation rates, so the uncertainty in these results is less than uncertainty for livestock production. It is recommended that species-specific results be considered when comparing the impacts of specific subcategories.

Table B4: Species-specific EJ impacts of the gasoline passenger vehicle subcategory of on-road mobile source emissions.

On-road mobile sources: Gasoline Passenger Vehicles	**% contribution to source exp. conc.**	**Δ White**	**Δ Hispanic**	**Δ Asian**	**Δ Black**	**Δ Other**
Primary $PM_{2.5}$	**33%**	*-25%*	21%	14%	21%	*-16%*
SOA $PM_{2.5}$	**21%**	*-16%*	15%	3%	16%	*-11%*
pSO_4 $PM_{2.5}$	**<1 %**	*-15%*	14%	3%	10%	*-10%*
pNO_3 $PM_{2.5}$	**16%**	*-14%*	15%	0%	10%	*-10%*
pNH_4 $PM_{2.5}$	**30%**	*-24%*	19%	14%	19%	*-16%*
Total $PM_{2.5}$	**100%**	*-21%*	18%	9%	17%	*-14%*

Table B5: Species-specific EJ impacts of the livestock subcategory of agricultural emissions.

Agriculture: Livestock	**% contribution to source exp. conc.**	**Δ White**	**Δ Hispanic**	**Δ Asian**	**Δ Black**	**Δ Other**
Primary $PM_{2.5}$	**< 1%**	14%	10%	*-51%*	*-34%*	*-21%*
SOA $PM_{2.5}$	**1%**	*-4%*	24%	*-40%*	*-26%*	*-11%*
pSO_4 $PM_{2.5}$	**0%**					
pNO_3 $PM_{2.5}$	**0%**					
pNH_4 $PM_{2.5}$	**99%**	*-14%*	17%	*-2%*	5%	*-12%*
Total $PM_{2.5}$	**100%**	*-14%*	17%	*-2%*	5%	*-12%*

Table B6: Species-specific EJ impacts of the fuel combustion subcategory of industrial emissions.

Industry: Fuel Combustion	**% contribution to source exp. conc.**	**Δ White**	**Δ Hispanic**	**Δ Asian**	**Δ Black**	**Δ Other**
Primary $PM_{2.5}$	**96%**	*-27%*	23%	13%	24%	*-14%*
SOA $PM_{2.5}$	**4%**	*-24%*	22%	13%	5%	*-18%*
pSO_4 $PM_{2.5}$	**< 1%**	*-4%*	14%	*-20%*	*-17%*	*-8%*
pNO_3 $PM_{2.5}$	**< 1%**	*-4%*	16%	*-23%*	*-1%*	*-9%*
pNH_4 $PM_{2.5}$	**< 1%**	0%	9%	*-23%*	*-6%*	*-6%*
Total $PM_{2.5}$	**100%**	*-27%*	23%	13%	23%	*-14%*

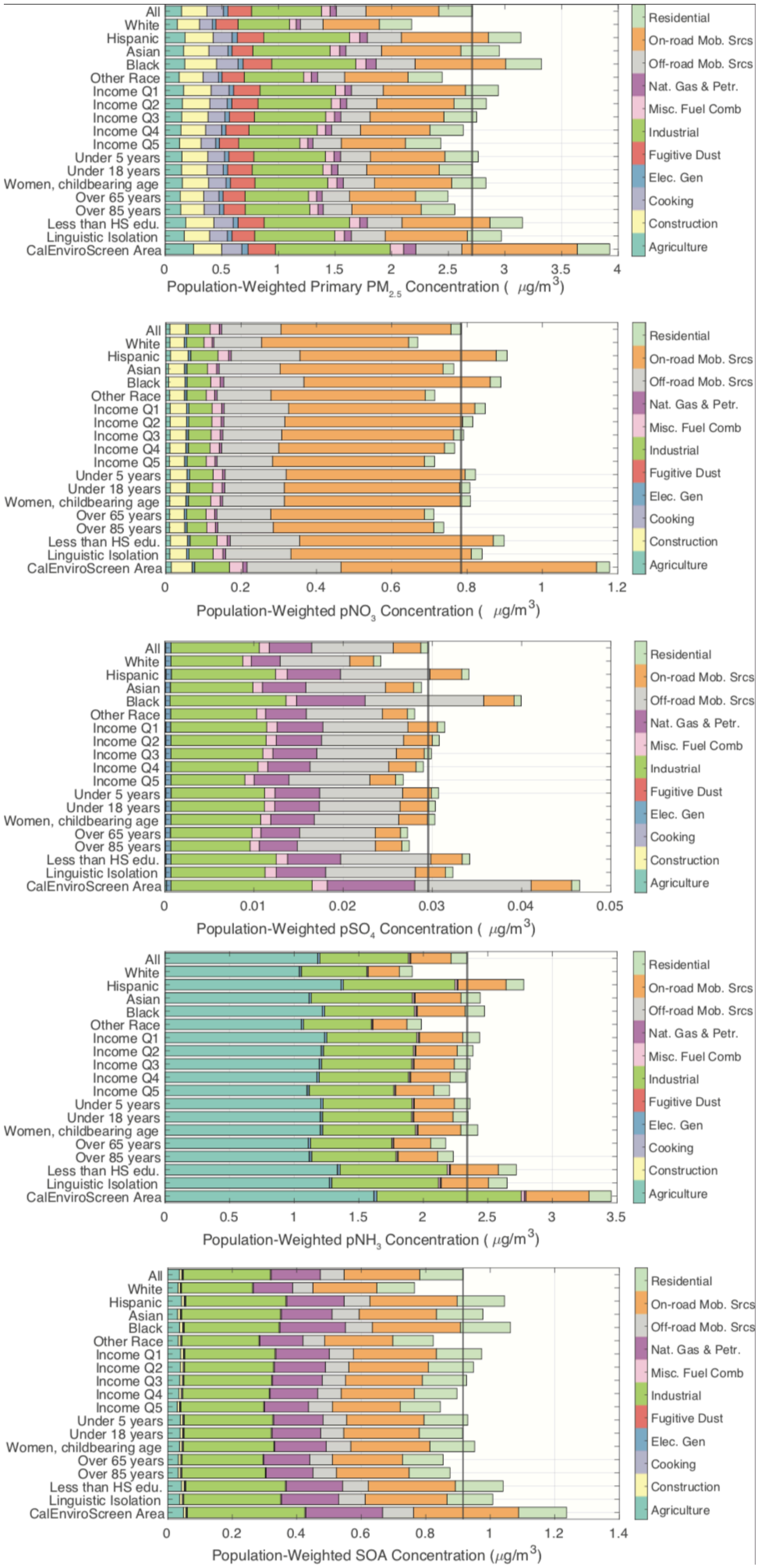

Figure B1: Species-specific population-weighted exposure for different demographic groups in California

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Appendix C: Sector Category Descriptions and Emissions Breakdowns

Appendix C provides tables of emission totals within the modeling domain for each source category based on the input data from the US NEI. It also describes in more detail the specific source types and emission-generating activity within each of the source categories.

Emission totals are based on the U.S. EPA NEI for 2014, limited to the InMAP-CA modeling domain. Emissions in the NEI are categorized as point, nonpoint (area), on-road, or non-road for the purposes of spatial distribution. Point sources are individual locations or facilities with specific coordinates. Area sources include individual emissions sources or distributed emissions sources that are reported at a more aggregated level (e.g., by county) and are distributed using spatial surrogate data. The spatial distribution of on-road and non-road emissions are modeled using EMFAC for the state of California and MOVES/MOVESNONROAD for other states.

NEI Emissions were allocated to the InMAP grid using the Air Emissions Processor (AEP), an open-source program that is included in the InMAP codebase.[2] It operates by breaking up emissions into detailed chemical groups, spatially allocating the emissions to a grid, and then temporally allocating emissions to specific times of the year. AEP uses a detailed set of spatial surrogates to scale and divide emissions among grid cells. AEP was run at the national scale and those emissions were adapted to the InMAP grid over the California domain.

Category descriptions are summarized from the U.S. EPA source classification codes and information provided by the National Emissions Inventory (NEI) Technical Support Document.[3] In many cases, NEI emissions for California are based in whole or in part on data provided to the U.S. EPA by CARB, noted in source-specific tables in the NEI Technical Support Document. Emissions from areas bordering are in some cases supplied by state environmental agencies, but coverage is limited. California is the only state to supply the U.S. EPA with on-road emissions totals based on the EMFAC model; some on-road emissions categories generated by EMFAC are simplified or aggregated for consistency in the NEI.

During a quality control stage of this project we performed spot-checks on individual sources with atypically high emissions. In some rare cases the emissions from an activity, e.g. agricultural tilling emissions by a specific company, are incorrectly assumed to occur at an address associated with the company (e.g., its headquarters) rather than at the location where the activity occurs. The spatial misassignment of emissions to a concentrated area with higher surrounding population density could

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[2] https://github.com/spatialmodel/inmap/tree/master/emissions/aep
[3] https://www.epa.gov/sites/production/files/2018-07/documents/nei2014v2_tsd_05jul2018.pdf

introduce substantial error to impact and impact-based EJ metrics. Since manual correction of spatial misassignment was not within the scope of this project, we applied an algorithm to remove extreme outlier emissions, defined conservatively as individual point or area sources with emissions greater than 20 times of the standard deviation over the mean. Emissions listed in the tables below represent totals after extreme outliers were removed.

Table C1: Sector emissions by species (metric tons per year)

	Primary $PM_{2.5}$	NO_X	SO_2	NH_3	VOCs
Agriculture					53,277
Construction	6,960			31	4,651
Cooking	3,059	0	0	0	1,534
Electricity Generation	4,966	25,384	3,688	4,386	3,438
Fugitive Road Dust	14,228	0	0	0	0
Industrial Sources	33,659	69,664	15,959	37,347	167,790
Natural Gas & Petroleum	2,544	6,132	3,596	237	135,164
Off-Road Mobile Sources	11,286	215,986	33,689	74	69,564
On-Road Mobile Sources	14,322	284,429	1,806	13,135	134,175
Residential	11,845	18,326	718	5,349	77,709
Miscellaneous	2,828	25,231	1,179	467	2,944
Total	**115,473**	**696,442**	**60,759**	**405,355**	**650,245**

Agriculture
The agriculture sector contains 7 subcategories: fertilizer application, agriculture-specific industrial processes, livestock production, off-road mobile agricultural equipment, pesticide application, and tilling. $PM_{2.5}$-related emissions in this overall category are dominated by ammonia (NH_3). Agriculture is also a significant source of VOCs, NO_X, and primary $PM_{2.5}$. Agricultural emissions are modeled primarily as area sources based on land-use designations, with some livestock waste subcategories modeled as point sources.
Note: Harvesting was identified as a category of interest, but due to state-to-state inconsistencies in emissions categorization, it was omitted from the analysis

Table C2: Agricultural emissions by species (metric tons per year)

	Primary $PM_{2.5}$	NO_X	SO_2	NH_3	VOCs
Fertilizer Application					0
Industrial (Ag. Specific)	2,334			255	4,940
Livestock	621	0	0	253,844	22,081
Off-road Mobile Sources (Ag. Specific)	2,225	19,863	19	14	4,760
Pesticide	0	0	0	0	21,495
Tilling	4,596	0	0	0	0
Total	**9,776**	**20,109**	**86**	**344,330**	**53,277**

Fertilizer Application

These emissions are associated with the application of chemical fertilizers to crops. These typically consist of ammonium species with nitrate, sulfate, and phosphate, as well as calcium ammonium nitrate, urea, anhydrous or aqueous NH_3, and other miscellaneous fertilizers.

The only $PM_{2.5}$-related emissions in this category are NH_3, and fertilizer accounts for 23% of NH_3 emissions from the agricultural sector.

Off-road Mobile Equipment

Emissions from off-road mobile agricultural equipment include exhaust emissions from tractors, mowers, balers, combines, tillers, and other equipment which may run on gasoline, diesel, liquefied petroleum gas (LPG), or compressed natural gas (CNG). This category accounts for nearly all NO_X emissions within the category, and substantially contributes to primary $PM_{2.5}$ and VOCs.

Industrial Processes

Agriculture-specific industrial processes include the manufacture and processing of feed and grain; processing of crops and agricultural products such as seeds and nuts, sugar cane and beets, starch, and vegetable oil; processing of fish, meat, and dairy products; and the production of beer, wine, and other alcoholic products. Emissions in this category are dominated by primary $PM_{2.5}$ and VOCs.

Livestock

The livestock category includes emissions associated with the raising and processing of dairy and beef cattle, poultry, swine, goats, and sheep. These are emissions primarily from animal confinement, waste emissions, manure handling and storage, and land application of manure. Major $PM_{2.5}$-related emissions in this category are ammonia, and livestock production accounts for the majority (76%) of emissions from the agricultural sector. Livestock also contributes to emissions of primary $PM_{2.5}$ and VOCs.

Pesticide Application
Agricultural pesticide application emissions include surface application and soil incorporation of insecticides, herbicides, fungicides, and rodenticides. Emissions within this category consist of VOCs that are emitted during application or by evaporation after application.

Tilling (Fugitive Dust)
This category covers airborne soil particulate emissions (fugitive dust) from land breaking and tilling for crop production. Fugitive dust consists only of primary $PM_{2.5}$.

Construction
The construction sector is divided into five categories: off-road mobile construction equipment, fugitive emissions during road construction (fugitive dust) from other construction activities, demolitions, and site preparation.

Table C3: Construction emissions by species (tons per year)

	Primary $PM_{2.5}$	NO_X	SO_X	NH_3	VOCs
Off-road Mobile Sources (Constr. Specific)					4,628
Road Construction	1,354			0	0
Other Dust	1,921	0	0	0	0
Demolitions	12	20	2	0	16
Site Preparations	74	8	0	0	7
Total	**6,960**	**31,181**	**40**	**31**	**4,651**

Off-road Mobile Construction Equipment
This category consists of the exhaust emissions from off-road mobile sources used for construction. A wide variety of off-road equipment is used for excavation, materials preparation and assembly, and finishing processes including drill rigs, cranes, tractors, forklifts, loaders, cement mixers, rollers, etc. Equipment may be powered by diesel, gasoline, LPG, or CNG engines. This category accounts for the greatest emissions of all pollutants within the sector, and produces 54% of all primary $PM_{2.5}$ and nearly 100% of all precursor species.

Fugitive Dust (Road Construction and Other)
Emissions in these two categories consist of dust generated when soil is removed from a site for the construction of roads or new buildings. Fugitive dust in both categories consists only of primary $PM_{2.5}$.

Demolitions and Site Preparations
These two categories play a minor role in the overall impacts of the construction sector. Demolition activity results in emissions of primary $PM_{2.5}$, NOx, and VOCs in roughly equal measure, while site preparation emissions consist mostly of primary $PM_{2.5}$ from fugitive dust.

Cooking

Cooking emissions include two types of activities: charbroiling and frying. Cooking creates emissions of both primary $PM_{2.5}$ and VOCs. Emissions in this category are modeled as an area source based on county-level assessment of the number of restaurants and the level of charbroiling and frying activity at each restaurant.

Table C4: Cooking emissions by species (tons per year)

	Primary $PM_{2.5}$	NO_2 and NO	SO_X	NH_3	VOCs
Cooking	3,059	0			1,534

Electricity Generation

Electricity generation emissions are broken down by the type of fuel used by the facility: coal (of varying grades), residual oil, distillate oil, natural gas, process gas, landfill gas, and various minor fuel types contained in an "other" category. Electricity generation facilities are point sources that emit both at ground-level and in elevated stacks.

Table C5: Electricity generation emissions by species (tons per year)

	Primary $PM_{2.5}$	NO_2 and NO	SO_X	NH_3	VOCs
Coal					0
Distillate Oil	66	1,289	30	0	120
Residual Oil	28	252	3,195	4	4
Natural Gas	4,009	22,476	180	1,392	2,143
Landfill Gas	135	683	196	23	183
Process Gas	2	16	8	0	1
Other	415	668	79	2,967	987
Total	**4,966**	**25,384**	**3,688**	**4,386**	**3,438**

<u>Coal Burning</u>

Although coal burning is a major means of generating electricity in the United States as a whole, coal-powered facilities are rare in California and the surrounding areas: only four anthracite or lignite-burning facilities operate in California and four bituminous coal burning facilities. The majority of $PM_{2.5}$-forming emissions from these sources are primary $PM_{2.5}$, with marginal emissions of precursor species. Although coal is known for its high contribution of SO_X emissions, the low level of coal burning activity within the modeling domain generates less than 1 ton per year.

Oil Burning: Distillate and Residual

Distillate and residual oil differ in the degree of processing and refinement each undergoes before it is burned. Distillate oil is higher grade, higher volatility, and contains a lower concentration of impurities. It includes number 1 and number 2 fuel oil (gasoline and diesel), and denser number 4 fuel oil. Distillate oil combustion results primarily in emissions of NO_X, with minor contribution of VOCs, primary $PM_{2.5}$, and SO_4. The modeling domain includes 2235 distillate oil facilities. Residual oil is the high-viscosity remains from distillation of lighter oils. Residual oil has a high sulfur content, which results in emissions dominated by SO_X. There are four residual oil facilities in the domain. Two of these are located in CA, both in remote locations (Sonoran Desert, Sierra Nevadas).

Gas Burning: Natural, Landfill, and Process

Gas-powered electricity generation is dominated by natural gas facilities, the largest contributor to $PM_{2.5}$-related emissions within the sector. The 580 natural gas facilities within the domain generate 85% of the sector's NO_X emissions and the majority of primary $PM_{2.5}$, NH_3, and VOCs. A smaller contribution is made by 76 facilities that burn recovered waste or landfill gas, and a minor contribution is made by the 8 process gas facilities.

Other

Other fuels used to power electrical generating facilities include petroleum coke, liquified petroleum gas (LPG), kerosene, gasified coal, wood and waste crop biomass, solid and liquid waste, and geothermal sources. As a whole, these contribute the majority of NH_3 emissions from the electricity generation sector, 31% of VOCs, and make a modest contribution to emissions of other pollutants.

Industrial Sources
Industrial emission sources include a variety of types of facilities and several different types of processes in the extraction, manufacturing, storage, and distribution of materials such as minerals, metals, biofuels, wood products, textiles, organic solvents, and cement. This category also includes emissions that result from the manufacture of secondary products derived from these materials. The 10 subcategories for industrial sources are organized broadly by the processes involved in industrial activity: surface mining and stone quarrying (non-metal), fuel combustion, metals processing, chemical and allied product manufacturing, solvent utilization, storage and transport of materials, waste disposal and incineration, and other miscellaneous industrial processes. Two specific materials of interest -- cement/concrete and cogeneration facilities -- are considered separately.

Table C6: Industrial emissions by species (tons per year)

	Primary $PM_{2.5}$	NO_2 and NO	SO_4	NH_3	VOCs
Mining and Quarrying					67
Fuel Combustion	8,108			3,204	7,018
Metals Processing	686	134	56	22	178
Chemical Manufacturing	665	571	362	318	3,227
Solvent Utilization	496	4	0	14	121,769
Storage, Transport, and Marketing	695	218	220	5,874	3,124
Waste Disposal & Incin.	3,601	1,559	410	27,587	18,994
Other	10,180	8,186	2,336	150	12,867
Cogeneration	497	1,999	103	173	399
Concrete and Cement	1,420	4,955	240	5	146
Total	**33,659**	**69,664**	**15,959**	**37,347**	**167,790**

<u>Surface Mining and Quarrying</u>
This category includes mining and material handling of coal, salt, asbestos, and other nonmetallic minerals, and the production and processing of sand and gravel. Emissions from this category are primarily primary $PM_{2.5}$. Metal mining is included in the Metals Processing category.

<u>Fuel Combustion</u>
This category includes combustion of a range of fuel types to power industrial equipment such as heaters, boilers, incinerators, and engines. Fuel types include coal, distillate oil, natural gas, process gas, and wood. Fuel combustion is a major source of industrial emissions. It accounts for the majority of NO_X and SO_X emissions within the Industrial sector and is a substantial contributor to primary $PM_{2.5}$ and other precursors.

Metals Processing
Metals processing includes both primary processes (e.g., mining, ore processing, primary smelting) and secondary processes (e.g., foundry activity, secondary smelting, casting) of aluminum, copper, lead, zinc, ferrous metals (iron and iron-containing metals), and other metals.

Chemical and Allied Product Manufacturing
Products manufactured within this category include agricultural chemicals (e.g., fertilizers and pesticides), inorganic chemicals (e.g., sodium carbonate, hydrochloric and sulfuric acid, hydrogen and other elemental chemicals), organic chemicals, pharmaceuticals, and others.

Solvent Utilization
This category includes solvent evaporation during cleaning, stripping and degreasing; surface coating operations; solvent used during printing and publishing; dry cleaning; and consumer product manufacturing. Emissions from solvent utilization are primarily VOCs, and it accounts for 80% of VOC emissions within this sector.

Storage, Transport, and Marketing
Storage, transport, and marketing of industrial materials results in emissions from working and breathing losses from storage tanks; fugitive emissions from tanks, open stockpiles, and storage bins; and emissions from loading and unloading of materials. Fugitive emissions during storage and transport are primarily NH_3, VOCs, and primary $PM_{2.5}$.

Waste Disposal and Incineration
Treatment of sewage and industrial waste water; treatment, storage, and disposal facilities (TSDF); landfills; open burning; and incineration. This category includes both private and publicly owned waste disposal facilities. Waste treatment and landfills result primarily in emissions of NH_3 and VOCs, while burning and incineration produce both primary $PM_{2.5}$ and VOCs.

Other
Industrial activity that does not fit into the other categories includes the manufacture of a variety of goods and materials: electrical equipment; pulp, paper, and wood products; rubber and miscellaneous plastics; textiles; mineral products; and fabricated metal products. Mineral products include clay and ceramics, glass and fiberglass, bricks, and other bulk mineral products. Metal fabrication includes welding, electroplating, abrasion, and machining. These activities contribute substantially to industrial emissions of primary $PM_{2.5}$, NO_X, and SO_X (27%, 15%, and 12%, respectively).

Cogeneration
In cogeneration facilities, an electricity generating unit is integrated in tothe industrial fuel burning system, allowing excess heat from fuel combustion to be converted into electricity or used to enhance cooling system performance. This reduces the facility’s consumption of externally-generated electricity, lowering costs and carbon intensity of

facility operation. Some cogeneration facilities generate excess electricity and provide electricity to the power grid, so this category is relevant both to the industrial and electricity generation sector. In line with EPA categorization we have included this category in the industrial sector. Emissions by cogeneration facilities are primarily NO_X, with minor contributions to other precursor pollutants and primary $PM_{2.5}$.

Concrete and Cement
Production of cement includes crushing, grinding, heating, storage, and transport of raw materials. Concrete production, which includes cement as an ingredient, includes the material storage and transport and operation of cement mixers. This specific category of industrial activity generates 13% of NO_X emissions and 4% of primary $PM_{2.5}$ emissions from the sector.

Fugitive Road Dust
Fugitive road dust includes resuspended primary PM_2 emissions from paved and unpaved roads and road sanding/salting. Road dust emissions within California are provided to the EPA by CARB. Elsewhere they are calculated on a county level based on road type and vehicle activity. Fugitive dust from other sources, including construction and agriculture, are included within subsections of those sectors.

Table C7: Fugitive road dust emissions by species (tons per year)

	Primary $PM_{2.5}$	NO_2 and NO	SO_X	NH_3	VOCs
Paved					0
Unpaved	8,338	0	0	0	0
Total	14,228	0	0	0	0

Natural Gas & Petroleum
The natural gas and petroleum industry is considered separately from other industrial activity because it is a major contributor to VOC emissions and is of particular interest for environmental justice concerns. The categories included in this sector are oil and gas production; petroleum refining; petroleum storage, transport, and marketing; and asphalt manufacturing.

Table C8: Natural gas and petroleum emissions by species (tons per year)

	Primary $PM_{2.5}$	NO_2 and NO	SO_X	NH_3	VOCs
Oil & Gas Production					67,383
Petroleum Refining	1,706	4,085	3,232	136	13,527
Petroleum Storage, Transport, & Marketing	11	14	1	0	52,481
Asphalt Manufacturing	204	110	23	0	1,773
Total	2,544	6,132	3,596	237	135,164

Oil and Gas Production
This category includes emissions from exploration and drilling at oil, gas, and coal bed methane wells and the equipment used at well sites. Venting and fugitive emissions from extraction equipment is a major source of VOCs in this category. Flaring and fuel combustion also contribute to NO_X and primary $PM_{2.5}$ emissions from oil and gas production.
Note: It is observed in the EPA Technical Support Document that emissions from oil and gas production supplied to the EPA by CARB are low in comparison to emissions in other states. An explanation for the discrepancy is provided in section 4.16 of the Technical Support Document.

Petroleum Refining
Emissions from petroleum refining result from processing (e.g., cracking, distilling, etc.), waste treatment, cooling towers, breathing loss from tanks, and other fugitive emissions. Emissions in this category are primarily VOCs, and petroleum refining also contributes substantially to emissions of other pollutants within this sector.

Petroleum Storage, Transport, and Marketing
Storage, transport, and marketing emissions sources include non-refinery storage tanks; storage on tank cars, trucks, marine vessels, and other means of transportation; equipment used for loading and unloading; and storage at service stations. Emissions from this category are dominated by fugitive VOCs, with minor emissions from loading equipment. This category does not include exhaust emissions from transport vehicles – these are included in the on- and off-road vehicle sectors.

Asphalt Manufacturing
Asphalt manufacturing is a subset of the petroleum industry that does not fall under the other categories. Asphalt products include roofing material and asphalt concrete. Emissions from this category are primarily VOCs, with minor contributions to primary $PM_{2.5}$, NO_X, and SO_X from fugitive dust, processing, and application.

Off-Road Mobile Sources

This sector includes emissions from a diverse range of mobile equipment that operate off-road. They include three major means of passenger and goods transport – aircraft, marine, and rail – as well as a variety of industrial, commercial, and recreational equipment powered by diesel, gasoline, or an alternative fuel. Off-road emissions within California are provided to the EPA by CARB. Several categories of off-road mobile sources are accounted for in other sectors: equipment used for agriculture or construction are featured in their respective sections, and lawn and garden equipment are featured in the residential section.

Table C9: Off-road mobile source emissions by species (tons per year)

	Primary $PM_{2.5}$	NO_2 and NO	SO_X	NH_3	VOCs
Aviation	857	13,717	1,441	0	3,344
Marine	4,885	136,096	32,102	12	5,433
Rail	1,778	36,229	90	17	2,956
Diesel	1,427	12,816	25	14	2,450
Gasoline	2,264	14,603	31	21	55,219
Other	75	2,523	0	10	162
Total	**11,286**	**215,986**	**33,689**	**74**	**69,564**

Aviation

This category includes aircraft exhaust emissions at airports as well as emissions from airport ground support equipment and aircraft auxiliary power units. Aircraft include commercial, air taxi, military, and general (other) aviation. Emissions of NO_X, SO_X, and primary $PM_{2.5}$ are modest in comparison with other off-road sources, but significant in the context of subcategories in other sectors. The concentration of emissions activity at airport locations has the potential to result in more dramatic exposure disparity than categories with more distributed emissions.

Marine Vessels

This category includes boats and ships used for commercial or military activity. Emissions at port and while vessels are underway are calculated separately. Large commercial vessels are powered primarily with residual fuel blends which contain more impurities than distillate fuels and result in high SO_X emissions. Commercial marine vessels are also the dominant source of NO_X and primary $PM_{2.5}$ emissions within the sector.

Rail

This category includes emissions occurring during locomotive travel along railways, railyard activity, and railway maintenance. Passenger trains, commuter lines, and commercial operations are included in locomotive travel. This category is second highest in NOX production within the sector and also contributes to primary $PM_{2.5}$ and VOC emissions.

Other Diesel, Gasoline, and Alternative Fuel Sources
The remaining sources are divided within this sector by fuel type, but each fuel category contains many of the same types of equipment. These generally include commercial equipment such as generator sets and air/gas compressors, logging equipment (industrial sector) equipment, and off-road recreational equipment such as personal watercraft and ATVs. Gasoline equipment accounts for 82% of VOCs within the sector; gasoline engines on off-road sources are subject to less stringent emission controls than on-road gasoline engines. This category also contributes to NO_X and primary $PM_{2.5}$ emissions.

On-Road Mobile Sources
On-road mobile sources include light-, medium- and heavy-duty vehicles used for passenger transport, goods transport, and municipal services. This sector accounts for tailpipe, brake, and tire-wear emissions from mobile sources as well as fugitive VOC emissions at fueling stations. As noted above, the mobile source emissions inventory for California was developed by CARB and provided to the EPA, while the inventories for all other states are based on EPA modeling. On-road mobile sources are the largest contributor to NO_X emissions in the modeling domain, and a major contributor to primary $PM_{2.5}$ and VOCs.

Note: Emissions inventories of non-electric alternative fuel vehicles (e.g., CNG, LPG, and ethanol) for the state of California were missing from the NEI, perhaps due to source miscategorization. This category was omitted from the analysis. Due to the minor share of these fuel technologies in the overall fleet, emissions from this category are small relative to the overall sector. Exposure disparity among demographic groups for alternative fuel vehicles can be assumed to be similar to gasoline vehicles of the same type.

Table C10: On-road mobile source emissions by species (tons per year)

	Primary $PM_{2.5}$	NO_2 and NO	SO_X	NH_3	VOCs
Diesel Heavy-Duty					7,073
Gasoline Passenger Vehicles	6,285			12,012	112,183
Diesel Light Commercial	613	24,364	27	19	1,071
Gasoline Light Commercial	253	11,452	73	580	7,818
Diesel Passenger Vehicles	202	1,269	8	11	305
Gasoline Heavy-Duty	120	4,249	25	74	2,130
Vehicle Refueling	0	0	0	0	4,116
Total	**14,322**	**284,429**	**1,806**	**13,135**	**134,175**

Diesel Heavy Duty Vehicles

This category is composed of diesel-powered short- and long-haul trucks, refuse trucks, school buses, transit buses, intercity buses, and motor homes. Although diesel HDVs account for fewer vehicle-miles traveled than other vehicle types, they have higher per-km emission rates and produce the majority of primary $PM_{2.5}$ and VOC emissions within the sector.

Gasoline Passenger Vehicles

This category is composed of light-duty gasoline-powered passenger cars, passenger trucks, and motorcycles. This category accounts for the greatest share of vehicle-miles traveled, the second-largest share of primary $PM_{2.5}$ and NO_X, and the majority of emissions of other precursors.

Diesel Passenger Vehicles

This category shares the same vehicle types as gasoline passenger vehicles. Diesel vehicles make up a smaller share of passenger vehicles and result in lower overall emissions.

Gasoline and Diesel Light Commercial Vehicles

These categories include only light commercial trucks, which cannot be categorized as either heavy-duty or passenger vehicles.

Gasoline Heavy Duty Vehicles

This category shares the same vehicle types as diesel heavy-duty vehicles. A lower share of the heavy-duty fleet is fueled by gasoline engines because they do not achieve the same fuel efficiency as diesel engines. This category is a minor contributor to overall emissions in the sector.

Vehicle Refueling

This category includes fugitive emissions that occur during vehicle refueling and consists only of VOCs.

Residential Sources
Residential emissions sources include burning of wood, natural gas, and other fuels; residential solvent use; and lawn and garden equipment.

Table C11: Residential source emissions by species (tons per year)

	Primary $PM_{2.5}$	NO_2 and NO	SO_X	NH_3	VOCs
Wood Fireplace					5,822
Woodstove	1,479		27	73	1,714
Other Wood Burning	337	49	6	16	334
Natural Gas	985	10,264	104	4,902	1,007
Other Fuels	1,724	2,057	402	11	652
Solvent Use	0	0	0	0	34,336
Lawn and Garden Equip.	752	5,059	21	16	33,843
Total	11,845	18,326	718	5,349	77,709

Miscellaneous
This final category includes various sources that did not fit into the previous categories: fuel combustion for commercial processes, fuel used in engine testing, and several generic/unspecified source categories.

Table C12: Miscellaneous source emissions by species (tons per year)

	Primary $PM_{2.5}$	NO_2 and NO	SO_X	NH_3	VOCs
Miscellaneous	2,828	25,231	1,179	467	2,944

Appendix D: In-Depth Intake Fraction Database

Appendix D provides ten tables with additional intake fraction summary values, including population-weighted intake fraction for all demographic groups, emissions-weighted intake fraction for all demographic groups, and source-specific emissions-weighted intake fraction by sector and subsector.

Data in these tables are also available as Excel spreadsheets, as described in Appendix F.

Table D1: Population-weighted intake fraction by demographic group, ground level and low stack emissions (ppm)

	Ground-level and low stack emissions (0-57 m)				
	NH_3	**NOx**	**Primary**	**SOx**	**VOC**
Total	5.620	0.441	12.213	0.850	0.476
Asian	1.546	0.100	3.405	0.162	0.125
Black	0.949	0.061	2.211	0.070	0.074
Hispanic	3.448	0.251	7.855	0.395	0.284
Other Race	0.194	0.017	0.432	0.028	0.018
White	1.705	0.154	3.674	0.280	0.163
Income Q1	1.436	0.107	3.325	0.162	0.121
Income Q2	1.077	0.083	2.448	0.136	0.093
Income Q3	1.155	0.091	2.557	0.165	0.101
Income Q4	1.154	0.094	2.476	0.184	0.100
Income Q5	1.376	0.108	2.858	0.224	0.117
85 and Over	0.103	0.008	0.219	0.015	0.009
Over 64	0.649	0.050	1.380	0.103	0.056
Under 18	1.291	0.108	2.900	0.193	0.115
Under 5	0.371	0.031	0.837	0.053	0.033
Women, Childbearing Age	1.410	0.106	3.062	0.201	0.117
Disadvantaged Communities	5.140	0.357	12.287	0.428	0.398
Ling. Isolation	1.440	0.101	3.082	0.205	0.112
Less than HS Edu.	1.105	0.078	2.545	0.115	0.089

Table D2: Population-weighted intake fraction by demographic group, medium- and high-stack emissions (ppm)

	Medium- and high-stack emissions (57-140 m)				
	NH_3	**NOx**	**Primary**	**SOx**	**VOC**
Total	2.205	0.186	4.547	0.876	0.185
Asian	0.407	0.031	0.852	0.161	0.032
Black	0.243	0.017	0.537	0.072	0.019
Hispanic	1.214	0.093	2.587	0.429	0.097
Other Race	0.066	0.006	0.139	0.028	0.006
White	0.628	0.063	1.268	0.268	0.060
Income Q1	0.498	0.039	1.068	0.173	0.040
Income Q2	0.395	0.032	0.839	0.144	0.033
Income Q3	0.446	0.037	0.933	0.172	0.038
Income Q4	0.458	0.040	0.936	0.188	0.039
Income Q5	0.496	0.045	0.983	0.218	0.042
85 and Over	0.037	0.003	0.074	0.015	0.003
Over 64	0.254	0.021	0.515	0.104	0.022
Under 18	0.507	0.045	1.066	0.202	0.044
Under 5	0.141	0.012	0.296	0.055	0.012
Women, Childbearing Age	0.534	0.043	1.101	0.207	0.044
Disadvantaged Communities	1.615	0.114	3.593	0.482	0.120
Ling. Isolation	0.568	0.042	1.153	0.214	0.044
Less than HS Edu.	0.365	0.027	0.786	0.125	0.029

Table D3: Population-weighted intake fraction by demographic group, high plume emissions, >760m (ppm)

	NH_3	NOx	Primary	SOx	VOC
Total	0.531	0.055	1.023	0.415	0.049
Asian	0.077	0.007	0.148	0.061	0.006
Black	0.039	0.003	0.081	0.028	0.003
Hispanic	0.278	0.025	0.552	0.212	0.024
Other Race	0.015	0.002	0.030	0.012	0.002
White	0.160	0.019	0.298	0.125	0.017
Income Q1	0.107	0.010	0.212	0.082	0.010
Income Q2	0.091	0.009	0.179	0.070	0.008
Income Q3	0.108	0.011	0.210	0.084	0.010
Income Q4	0.115	0.012	0.219	0.089	0.011
Income Q5	0.117	0.013	0.216	0.092	0.011
85 and Over	0.008	0.001	0.016	0.007	0.001
Over 64	0.062	0.006	0.118	0.049	0.006
Under 18	0.127	0.014	0.249	0.100	0.012
Under 5	0.034	0.004	0.067	0.027	0.003
Women, Childbearing Age	0.123	0.012	0.237	0.096	0.011
Disadvantaged Communities	0.280	0.023	0.582	0.205	0.021
Ling. Isolation	0.126	0.012	0.240	0.097	0.011
Less than HS Edu.	0.077	0.007	0.154	0.059	0.007

Table D4: Population-weighted intake fraction by race/ethnicity divided by income quintile, Ground-level and low stack emissions, 0-57m (ppm)

	NH_3	**NOx**	**Primary**	**SOx**	**VOC**
Asian Income Q1	0.286	0.018	0.627	0.029	0.023
Asian Income Q2	0.167	0.011	0.372	0.018	0.013
Asian Income Q3	0.243	0.016	0.535	0.027	0.019
Asian Income Q4	0.332	0.022	0.728	0.036	0.027
Asian Income Q5	0.601	0.039	1.342	0.056	0.050
Black Income Q1	0.328	0.021	0.769	0.023	0.026
Black Income Q2	0.161	0.010	0.381	0.012	0.013
Black Income Q3	0.192	0.012	0.446	0.014	0.015
Black Income Q4	0.167	0.011	0.387	0.012	0.013
Black Income Q5	0.121	0.008	0.279	0.009	0.009
Other Race Income Q1	0.034	0.003	0.077	0.005	0.003
Other Race Income Q2	0.029	0.003	0.068	0.004	0.003
Other Race Income Q3	0.038	0.003	0.086	0.006	0.004
Other Race Income Q4	0.046	0.004	0.103	0.007	0.004
Other Race Income Q5	0.059	0.004	0.126	0.008	0.005
Hisp/Latinx Income Q1	0.752	0.057	1.757	0.081	0.063
Hisp/Latinx Income Q2	0.741	0.055	1.709	0.083	0.062
Hisp/Latinx Income Q3	0.821	0.060	1.867	0.096	0.068
Hisp/Latinx Income Q4	0.734	0.053	1.652	0.085	0.060
Hisp/Latinx Income Q5	0.463	0.032	1.029	0.053	0.037
White Income Q1	0.239	0.022	0.535	0.038	0.024
White Income Q2	0.198	0.019	0.448	0.032	0.021
White Income Q3	0.284	0.028	0.632	0.047	0.029
White Income Q4	0.384	0.036	0.828	0.064	0.037
White Income Q5	0.696	0.055	1.446	0.106	0.061

Table D5: Population-weighted intake fraction by race/ethnicity divided by income quintile, medium- and high-stack emissions, 57-140m (ppm)

	NH_3	NOx	Primary	SOx	VOC
Asian Income Q1	0.074	0.005	0.155	0.028	0.006
Asian Income Q2	0.049	0.004	0.103	0.019	0.004
Asian Income Q3	0.073	0.005	0.150	0.028	0.006
Asian Income Q4	0.092	0.007	0.191	0.036	0.007
Asian Income Q5	0.133	0.010	0.286	0.054	0.011
Black Income Q1	0.083	0.005	0.183	0.024	0.006
Black Income Q2	0.043	0.003	0.096	0.012	0.004
Black Income Q3	0.048	0.003	0.106	0.014	0.004
Black Income Q4	0.043	0.003	0.094	0.013	0.003
Black Income Q5	0.030	0.002	0.066	0.010	0.002
Other Race Income Q1	0.012	0.001	0.026	0.005	0.001
Other Race Income Q2	0.011	0.001	0.023	0.004	0.001
Other Race Income Q3	0.013	0.001	0.028	0.005	0.001
Other Race Income Q4	0.015	0.001	0.032	0.006	0.001
Other Race Income Q5	0.016	0.001	0.034	0.007	0.001
Hisp/Latinx Income Q1	0.263	0.020	0.571	0.089	0.021
Hisp/Latinx Income Q2	0.262	0.020	0.562	0.091	0.021
Hisp/Latinx Income Q3	0.292	0.022	0.622	0.104	0.024
Hisp/Latinx Income Q4	0.257	0.019	0.543	0.092	0.020
Hisp/Latinx Income Q5	0.153	0.011	0.319	0.057	0.012
White Income Q1	0.093	0.009	0.191	0.037	0.009
White Income Q2	0.077	0.008	0.160	0.031	0.008
White Income Q3	0.109	0.011	0.223	0.045	0.011
White Income Q4	0.144	0.015	0.291	0.062	0.014
White Income Q5	0.223	0.021	0.440	0.099	0.020

Table D6: Population-weighted intake fraction by race/ethnicity divided by income quintile, high-plume emissions, >760m (ppm)

	NH_3	NOx	Primary	SOx	VOC
Asian Income Q1	0.074	0.005	0.155	0.028	0.006
Asian Income Q2	0.049	0.004	0.103	0.019	0.004
Asian Income Q3	0.073	0.005	0.150	0.028	0.006
Asian Income Q4	0.092	0.007	0.191	0.036	0.007
Asian Income Q5	0.133	0.010	0.286	0.054	0.011
Black Income Q1	0.083	0.005	0.183	0.024	0.006
Black Income Q2	0.043	0.003	0.096	0.012	0.004
Black Income Q3	0.048	0.003	0.106	0.014	0.004
Black Income Q4	0.043	0.003	0.094	0.013	0.003
Black Income Q5	0.030	0.002	0.066	0.010	0.002
OtherRace Income Q1	0.012	0.001	0.026	0.005	0.001
OtherRace Income Q2	0.011	0.001	0.023	0.004	0.001
OtherRace Income Q3	0.013	0.001	0.028	0.005	0.001
OtherRace Income Q4	0.015	0.001	0.032	0.006	0.001
OtherRace Income Q5	0.016	0.001	0.034	0.007	0.001
Hisp/Latinx Income Q1	0.263	0.020	0.571	0.089	0.021
Hisp/Latinx Income Q2	0.262	0.020	0.562	0.091	0.021
Hisp/Latinx Income Q3	0.292	0.022	0.622	0.104	0.024
Hisp/Latinx Income Q4	0.257	0.019	0.543	0.092	0.020
Hisp/Latinx Income Q5	0.153	0.011	0.319	0.057	0.012
White Income Q1	0.093	0.009	0.191	0.037	0.009
White Income Q2	0.077	0.008	0.160	0.031	0.008
White Income Q3	0.109	0.011	0.223	0.045	0.011
White Income Q4	0.144	0.015	0.291	0.062	0.014
White Income Q5	0.223	0.021	0.440	0.099	0.020

Table D7: Emissions-weighted intake fraction by demographic group (ppm). No high-point values are included as calculations do not account for plume-rise.

	Ground-level emissions (0-57 m)					Low-point emissions (57-140 m)				
	NH_3	**NOx**	**Primary**	**SOx**	**VOC**	**NH_3**	**NOx**	**Primary**	**SOx**	**VOC**
Total	1.241	0.269	6.002	0.386	0.346	2.483	0.110	2.485	0.530	0.156
Asian	0.166	0.034	0.845	0.058	0.048	0.359	0.013	0.340	0.074	0.021
Black	0.075	0.017	0.416	0.024	0.023	0.135	0.006	0.161	0.034	0.010
Hispanic	0.548	0.116	2.584	0.151	0.147	1.135	0.048	1.124	0.231	0.068
Other Race	0.041	0.010	0.211	0.014	0.012	0.075	0.004	0.082	0.018	0.005
White	0.411	0.092	1.945	0.138	0.116	0.779	0.039	0.777	0.172	0.052
Income Q1	0.252	0.056	1.264	0.072	0.071	0.478	0.022	0.507	0.105	0.031
Income Q2	0.217	0.048	1.076	0.063	0.061	0.424	0.019	0.442	0.093	0.027
Income Q3	0.256	0.055	1.243	0.077	0.072	0.511	0.023	0.519	0.110	0.032
Income Q4	0.261	0.056	1.233	0.082	0.072	0.534	0.024	0.523	0.113	0.033
Income Q5	0.248	0.052	1.149	0.089	0.068	0.523	0.022	0.478	0.106	0.032
85 and Over	0.021	0.004	0.098	0.007	0.006	0.041	0.002	0.040	0.009	0.003
Over 64	0.151	0.032	0.723	0.049	0.042	0.302	0.013	0.302	0.066	0.019
Under 18	0.295	0.065	1.416	0.089	0.082	0.586	0.027	0.595	0.127	0.037
Under 5	0.081	0.018	0.395	0.024	0.023	0.159	0.007	0.163	0.034	0.010
Women, Childbearing Age	0.282	0.061	1.380	0.087	0.079	0.569	0.024	0.565	0.119	0.035
Disadvantaged Communities	0.416	0.092	1.966	0.106	0.106	0.874	0.037	0.889	0.182	0.051
Ling. Isolation	0.248	0.051	1.164	0.076	0.067	0.522	0.021	0.498	0.107	0.032
Less than HS Edu.	0.162	0.035	0.782	0.045	0.044	0.325	0.014	0.331	0.068	0.020

Table D8: Population-weighted intake fraction by race/ethnicity divided by income quintile (ppm). No high-point values are included as calculations do not account for plume-rise.

	Ground-level emissions (0-57 m)					Low-point emissions (57-140 m)				
	NH_3	**NOx**	**Primary**	**SOx**	**VOC**	**NH_3**	**NOx**	**Primary**	**SOx**	**VOC**
Asian Income Q1	0.029	0.006	0.143	0.009	0.008	0.063	0.002	0.059	0.013	0.004
Asian Income Q2	0.020	0.004	0.101	0.007	0.006	0.044	0.002	0.042	0.009	0.003
Asian Income Q3	0.029	0.006	0.146	0.010	0.008	0.065	0.002	0.061	0.013	0.004
Asian Income Q4	0.037	0.008	0.188	0.013	0.011	0.082	0.003	0.077	0.017	0.005
Asian Income Q5	0.050	0.011	0.267	0.019	0.015	0.105	0.004	0.101	0.022	0.006
Black Income Q1	0.023	0.005	0.132	0.007	0.007	0.041	0.002	0.050	0.011	0.003
Black Income Q2	0.014	0.003	0.077	0.004	0.004	0.024	0.001	0.030	0.006	0.002
Black Income Q3	0.014	0.003	0.081	0.005	0.004	0.026	0.001	0.031	0.007	0.002
Black Income Q4	0.013	0.003	0.073	0.004	0.004	0.025	0.001	0.029	0.006	0.002
Black Income Q5	0.010	0.002	0.053	0.003	0.003	0.018	0.001	0.021	0.005	0.001
OtherRace Income Q1	0.008	0.002	0.042	0.003	0.002	0.014	0.001	0.017	0.004	0.001
OtherRace Income Q2	0.007	0.002	0.036	0.002	0.002	0.013	0.001	0.014	0.003	0.001
OtherRace Income Q3	0.008	0.002	0.043	0.003	0.002	0.015	0.001	0.017	0.004	0.001
OtherRace Income Q4	0.009	0.002	0.046	0.003	0.003	0.016	0.001	0.018	0.004	0.001
OtherRace Income Q5	0.009	0.002	0.044	0.003	0.002	0.016	0.001	0.017	0.004	0.001
Hisp/Latinx Income Q1	0.115	0.025	0.550	0.030	0.031	0.230	0.010	0.238	0.048	0.014
Hisp/Latinx Income Q2	0.119	0.026	0.563	0.032	0.032	0.243	0.011	0.245	0.051	0.015
Hisp/Latinx Income Q3	0.134	0.028	0.626	0.037	0.036	0.280	0.012	0.274	0.056	0.016
Hisp/Latinx Income Q4	0.114	0.024	0.534	0.032	0.030	0.240	0.010	0.233	0.048	0.014
Hisp/Latinx Income Q5	0.066	0.013	0.311	0.020	0.018	0.142	0.005	0.134	0.028	0.008
White Income Q1	0.066	0.015	0.307	0.020	0.018	0.122	0.006	0.125	0.027	0.008
White Income Q2	0.056	0.013	0.266	0.017	0.016	0.102	0.006	0.107	0.023	0.007
White Income Q3	0.076	0.017	0.362	0.025	0.022	0.140	0.007	0.144	0.032	0.010
White Income Q4	0.093	0.021	0.439	0.031	0.026	0.177	0.009	0.177	0.039	0.012
White Income Q5	0.121	0.026	0.570	0.045	0.034	0.238	0.011	0.224	0.051	0.015

Table D9: Population-weighted per-capita intake fraction by demographic group (values$\times 10^{12}$)

	Ground-level emissions (0-57 m)					Low-point emissions (57-140 m)					High-point emissions (>760 m)				
	NH_3	**NOx**	**Primary**	**SOx**	**VOC**	**NH_3**	**NOx**	**Primary**	**SOx**	**VOC**	**NH_3**	**NOx**	**Primary**	**SOx**	**VOC**
Total	0.131	0.010	0.286	0.020	0.011	0.052	0.004	0.106	0.020	0.004	0.012	0.001	0.024	0.010	0.001
Asian	0.280	0.018	0.617	0.029	0.023	0.074	0.006	0.154	0.029	0.006	0.014	0.001	0.027	0.011	0.001
Black	0.395	0.025	0.920	0.029	0.031	0.101	0.007	0.223	0.030	0.008	0.016	0.001	0.034	0.012	0.001
Hispanic	0.216	0.016	0.492	0.025	0.018	0.076	0.006	0.162	0.027	0.006	0.017	0.002	0.035	0.013	0.002
Other Race	0.117	0.010	0.260	0.017	0.011	0.040	0.004	0.084	0.017	0.004	0.009	0.001	0.018	0.007	0.001
White	0.099	0.009	0.214	0.016	0.009	0.036	0.004	0.074	0.016	0.003	0.009	0.001	0.017	0.007	0.001
Income Q1	0.173	0.013	0.402	0.020	0.015	0.060	0.005	0.129	0.021	0.005	0.013	0.001	0.026	0.010	0.001
Income Q2	0.147	0.011	0.334	0.019	0.013	0.054	0.004	0.115	0.020	0.005	0.012	0.001	0.024	0.010	0.001
Income Q3	0.132	0.010	0.293	0.019	0.012	0.051	0.004	0.107	0.020	0.004	0.012	0.001	0.024	0.010	0.001
Income Q4	0.127	0.010	0.273	0.020	0.011	0.051	0.004	0.103	0.021	0.004	0.013	0.001	0.024	0.010	0.001
Income Q5	0.151	0.012	0.314	0.025	0.013	0.054	0.005	0.108	0.024	0.005	0.013	0.001	0.024	0.010	0.001
85 and Over	0.139	0.011	0.295	0.020	0.012	0.049	0.004	0.099	0.020	0.004	0.011	0.001	0.021	0.009	0.001
Over 64	0.116	0.009	0.247	0.018	0.010	0.045	0.004	0.092	0.019	0.004	0.011	0.001	0.021	0.009	0.001
Under 18	0.128	0.011	0.287	0.019	0.011	0.050	0.004	0.106	0.020	0.004	0.013	0.001	0.025	0.010	0.001
Under 5	0.135	0.011	0.303	0.019	0.012	0.051	0.004	0.107	0.020	0.004	0.012	0.001	0.024	0.010	0.001
Women, Childbearing Age	0.150	0.011	0.326	0.021	0.012	0.057	0.005	0.117	0.022	0.005	0.013	0.001	0.025	0.010	0.001
Disadvantaged Communities	0.528	0.037	1.261	0.044	0.041	0.166	0.012	0.369	0.050	0.012	0.029	0.002	0.060	0.021	0.002
Ling. Isolation	0.190	0.013	0.406	0.027	0.015	0.075	0.006	0.152	0.028	0.006	0.017	0.002	0.032	0.013	0.001
Less than HS Edu.	0.230	0.016	0.531	0.024	0.019	0.076	0.006	0.164	0.026	0.006	0.016	0.001	0.032	0.012	0.001

Table D10: Population-weighted per-capita intake fraction by race/ethnicity divided by income quintile (values×10^{12})

	Ground-level emissions (0-57 m)					Low-point emissions (57-140 m)					High-point emissions (>760 m)				
	NH_3	**NOx**	**Primary**	**SOx**	**VOC**	**NH_3**	**NOx**	**Primary**	**SOx**	**VOC**	**NH_3**	**NOx**	**Primary**	**SOx**	**VOC**
Asian Income Q1	0.322	0.020	0.706	0.032	0.025	0.084	0.006	0.174	0.032	0.006	0.016	0.001	0.031	0.013	0.001
Asian Income Q2	0.258	0.017	0.576	0.028	0.021	0.077	0.006	0.160	0.029	0.006	0.015	0.001	0.029	0.012	0.001
Asian Income Q3	0.259	0.017	0.572	0.029	0.021	0.078	0.006	0.160	0.030	0.006	0.015	0.001	0.030	0.012	0.001
Asian Income Q4	0.269	0.017	0.590	0.029	0.022	0.074	0.006	0.155	0.029	0.006	0.014	0.001	0.028	0.011	0.001
Asian Income Q5	0.332	0.022	0.740	0.031	0.028	0.073	0.006	0.158	0.030	0.006	0.012	0.001	0.023	0.010	0.001
Black Income Q1	0.438	0.028	1.027	0.031	0.034	0.110	0.007	0.245	0.032	0.009	0.017	0.001	0.035	0.012	0.001
Black Income Q2	0.360	0.023	0.851	0.026	0.030	0.095	0.006	0.215	0.027	0.008	0.016	0.001	0.033	0.011	0.001
Black Income Q3	0.416	0.027	0.966	0.030	0.032	0.104	0.007	0.230	0.031	0.008	0.016	0.001	0.033	0.012	0.001
Black Income Q4	0.388	0.025	0.901	0.029	0.030	0.100	0.007	0.219	0.030	0.008	0.016	0.001	0.034	0.012	0.001
Black Income Q5	0.382	0.025	0.881	0.030	0.029	0.096	0.007	0.209	0.030	0.007	0.016	0.001	0.033	0.012	0.001
OtherRace Income Q1	0.096	0.009	0.220	0.014	0.009	0.034	0.004	0.074	0.014	0.003	0.008	0.001	0.016	0.007	0.001
OtherRace Income Q2	0.101	0.009	0.236	0.015	0.010	0.037	0.004	0.080	0.015	0.004	0.009	0.001	0.018	0.007	0.001
OtherRace Income Q3	0.109	0.010	0.250	0.016	0.011	0.038	0.004	0.082	0.016	0.004	0.009	0.001	0.017	0.007	0.001
OtherRace Income Q4	0.132	0.011	0.294	0.019	0.012	0.043	0.004	0.093	0.018	0.004	0.010	0.001	0.019	0.008	0.001
OtherRace Income Q5	0.180	0.013	0.383	0.024	0.015	0.050	0.005	0.103	0.022	0.004	0.011	0.001	0.020	0.009	0.001
Hisp/Latinx Income Q1	0.222	0.017	0.520	0.024	0.019	0.078	0.006	0.169	0.026	0.006	0.017	0.002	0.035	0.013	0.002
Hisp/Latinx Income Q2	0.213	0.016	0.490	0.024	0.018	0.075	0.006	0.161	0.026	0.006	0.017	0.002	0.034	0.013	0.002
Hisp/Latinx Income Q3	0.211	0.015	0.479	0.025	0.018	0.075	0.006	0.160	0.027	0.006	0.017	0.002	0.035	0.013	0.002
Hisp/Latinx Income Q4	0.224	0.016	0.504	0.026	0.018	0.078	0.006	0.165	0.028	0.006	0.018	0.002	0.035	0.014	0.002
Hisp/Latinx Income Q5	0.242	0.017	0.538	0.028	0.019	0.080	0.006	0.167	0.030	0.006	0.018	0.002	0.035	0.014	0.002
White Income Q1	0.084	0.008	0.189	0.013	0.009	0.033	0.003	0.068	0.013	0.003	0.009	0.001	0.016	0.007	0.001
White Income Q2	0.080	0.008	0.182	0.013	0.009	0.031	0.003	0.065	0.013	0.003	0.008	0.001	0.016	0.006	0.001
White Income Q3	0.086	0.009	0.192	0.014	0.009	0.033	0.003	0.068	0.014	0.003	0.009	0.001	0.016	0.007	0.001
White Income Q4	0.099	0.009	0.214	0.017	0.010	0.037	0.004	0.075	0.016	0.004	0.010	0.001	0.018	0.007	0.001
White Income Q5	0.146	0.012	0.304	0.022	0.013	0.047	0.004	0.093	0.021	0.004	0.011	0.001	0.020	0.009	0.001

Table D11: Emissions-weighted intake fraction by source category and pollutant (ppm). Values are for total population.

Agriculture	Ground-level emissions (0-57 m)
NH_3	0.773
NOx	0.122
Primary	3.198
SOx	0.335
VOC	0.152
Construction	
NH_3	0.669
NOx	0.309
Primary	7.130
SOx	0.049
VOC	0.381
Cooking	
NH_3	
NOx	
Primary	10.686
SOx	
VOC	0.435
Fugitive Dust	
NH_3	0.000
NOx	0.000
Primary	3.238
SOx	0.000
VOC	0.000

Elec. Gen	Ground-level emissions (0-57 m)	Med-, High-stack (57-140 m)
NH_3	1.092	0.713
NOx	0.075	0.034
Primary	2.298	1.061
SOx	0.159	0.446
VOC	0.120	0.056
Industrial		
NH_3	5.677	2.679
NOx	0.257	0.121
Primary	5.865	2.522
SOx	0.387	0.391
VOC	0.401	0.141
Misc. Fuel Comb		
NH_3	8.544	3.975
NOx	0.296	0.137
Primary	8.449	3.546
SOx	0.452	0.454
VOC	0.262	0.106
Nat. Gas & Petr.		
NH_3	6.533	3.021
NOx	0.299	0.176
Primary	6.225	3.178
SOx	1.070	1.068
VOC	0.343	0.163

Off-road Mob. Srcs	Ground-level emissions (0-57 m)
NH_3	1.848
NOx	0.165
Primary	5.153
SOx	0.342
VOC	0.238
On-road Mob. Srcs	
NH_3	5.379
NOx	0.359
Primary	10.164
SOx	0.753
VOC	0.396
Residential	
NH_3	5.234
NOx	0.331
Primary	5.524
SOx	0.413
VOC	0.390

Table D12: Emissions-weighted intake fraction by source subcategory and pollutant (ppm). Values are for total population.

	Ground-level emissions (0-57 m)					Low-point emissions (57-140 m)				
	NH_3	**NOx**	**Primary**	**SOx**	**VOC**	**NH_3**	**NOx**	**Primary**	**SOx**	**VOC**
Agriculture										
Ag., Fert. App.	0.423									
Ag. (industrial sector)	2.302	0.219	10.896	0.352	0.244					
Ag., Livestock	0.896		1.028		0.075					
Ag., Off-road	0.393	0.121	1.298	0.227	0.080					
Ag., Pesticide					0.224					
Ag., Tilling			0.723							
Construction										
Con., Demolitions		0.016	0.524		0.025					
Con., Fug. Dust, other		0.059	5.656	0.025	0.133					
Con., Fug. Dust, road			6.577							
Con., Mobile	0.669	0.309	7.826	0.058	0.382					
Con., Site Prep		0.062	0.142	0.045	0.641					
Cooking										
Cooking			10.686		0.435					
Elec. Gen										
Elec, Bitum. Coal			0.752	0.000	0.561	0.000	0.000	0.802	0.000	0.099
Elec, Dist. Oil	0.691	0.229	4.149	0.306	0.164	0.454	0.108	1.431	0.282	0.078
Elec, Landfill Gas	5.902	0.321	6.020	0.768	0.333					
Elec, Nat. Gas	2.324	0.052	2.116	0.615	0.122	1.258	0.029	0.923	0.570	0.066
Elec, Other	0.447	0.101	0.690	0.210	0.033	0.458	0.072	0.720	0.223	0.034
Elec, Proc. Gas	1.731	0.155	2.693	0.464	0.150					
Elec, Res. Oil	0.137	0.015	0.215	0.107	0.009					
Elec., Anth./Lig. Coal		0.081	3.657	0.222	0.083	0.000	0.037	3.230	0.215	0.028

	Ground-level emissions (0-57 m)					Low-point emissions (57-140 m)				
	NH_3	**NOx**	**Primary**	**SOx**	**VOC**	**NH_3**	**NOx**	**Primary**	**SOx**	**VOC**
Fugitive Dust										
Fug. Dust, paved			6.225							
Fug. Dust, unpaved			1.069							
Industrial										
Ind, Mining	5.550	0.025	0.714	0.168	0.047	2.937	0.017	0.481	0.180	0.033
Ind, Other	3.458	0.263	7.936	0.380	0.314	1.622	0.103	3.319	0.390	0.128
Ind, Solvent	2.846	0.173	15.603	0.968	0.416	0.000	0.000	0.000	0.000	0.000
Ind, TSM	10.649	0.014	4.173	0.101	0.411	4.725	0.007	1.851	0.106	0.199
Ind, Waste	4.628	0.192	2.400	0.466	0.266	2.271	0.144	2.575	0.544	0.120
Ind., Chem. Manuf.	1.491	0.222	7.204	0.922	0.333	0.657	0.109	3.591	0.959	0.129
Ind., Co-gen.	1.355	0.137	1.675	0.343	0.134	0.816	0.087	1.017	0.356	0.067
Ind., Concrete	4.339	0.038	2.117	0.029	0.241	2.729	0.037	1.264	0.032	0.134
Ind., Fuel Comb.	6.545	0.285	9.044	0.384	0.433	2.836	0.134	3.717	0.384	0.199
Ind., Metal	0.335	0.080	4.827	0.146	0.206	0.167	0.038	1.521	0.142	0.068
Misc. Fuel Comb										
Misc.	8.544	0.296	8.449	0.452	0.262	3.975	0.137	3.546	0.454	0.106
Nat. Gas & Petr.										
Gas & Pet., asph	8.716	0.192	8.237	0.394	0.202	0.000	0.000	0.000	0.000	0.000
Gas & Pet., oilgas	2.955	0.156	1.637	0.452	0.367	1.488	0.104	1.034	0.456	0.185
Gas & Pet., refinery	9.030	0.371	7.402	1.140	0.270	4.091	0.210	3.953	1.128	0.148
Gas & Pet., TSM	9.085	0.280	4.259	0.000	0.339	4.793	0.119	1.190	0.000	0.139

	Ground-level emissions (0-57 m)				
	NH_3	**NOx**	**Primary**	**SOx**	**VOC**
Off-road Mob. Srcs					
Off-Rd. Other		0.488	4.129		0.206
Off-Rd. Rail	1.019	0.213	5.031	0.071	0.284
Off-Rd., Aviation		0.569	8.574	1.481	0.397
Off-Rd., Diesel	0.249	0.390	10.797	0.385	0.390
Off-Rd., Gas	0.051	0.355	6.704	0.293	0.234
Off-Rd., Marine	4.451	0.064	1.993	0.292	0.081
On-road Mob. Srcs					
On-Rd., Dsl HDV	3.348	0.377	9.081	0.406	0.374
On-Rd., Dsl LCV	0.249	0.373	6.417	0.192	0.297
On-Rd., Dsl Psgr	0.738	0.177	6.986	0.000	0.187
On-Rd., Gas LCV	3.182	0.270	6.692	0.096	0.336
On-Rd., Gas Other	0.951	0.394	3.879	0.149	0.410
On-Rd., Gas Psgr	5.502	0.340	11.571	0.788	0.404
On-Rd., Refuel					0.325
Residential					
Resid., Fireplace	1.016	0.227	4.865	0.416	0.213
Resid., Lawn & Gard.		0.328	7.416	0.064	0.411
Resid., Nat. Gas	5.575	0.367	12.274	0.275	0.364
Resid., Other Fuel	0.269	0.186	6.190	0.356	0.236
Resid., Other Wood	0.410	0.053	2.238	0.009	0.116
Resid., Solvents					0.417
Resid., Woodstove	0.671	0.041	2.437	0.025	0.130

Appendix E: Environmental Justice Metric Tables

Appendix E provides 144 additional tables of EJ metrics supporting the graphics shown in the main report: population-weighted exposure concentration totals, absolute difference in population-weighted exposure concentration, and percent difference in population-weighted exposure concentration from the population as a whole. Tables are divided by sector and demographic groupings.

All sources

Table E1: Population-weighted exposure concentration (μg/m^3) by race (all sectors)

	Average	White	Hispanic	Asian	Black	Other
Agriculture	1.37	1.19	1.59	1.32	1.44	1.22
Construction	0.28	0.24	0.30	0.27	0.33	0.26
Cooking	0.15	0.12	0.17	0.17	0.19	0.14
Elec. Gen	0.06	0.05	0.07	0.06	0.07	0.06
Fugitive Dust	0.21	0.20	0.23	0.18	0.25	0.20
Industrial	1.64	1.23	2.02	1.83	1.81	1.35
Misc. Fuel Comb	0.12	0.09	0.14	0.13	0.13	0.10
Nat. Gas & Petr.	0.22	0.17	0.26	0.23	0.32	0.20
Off-road Mob. Srcs	0.50	0.40	0.58	0.57	0.66	0.46
On-road Mob. Srcs	1.65	1.33	1.94	1.73	1.94	1.45
Residential	0.58	0.53	0.60	0.66	0.65	0.56
Total	6.78	5.55	7.90	7.16	7.79	5.99

Table E2: Population-weighted exposure concentration (µg/m^3) by income category (all sectors)

	Average	Q1	Q2	Q3	Q4	Q5
Agriculture	1.37	1.45	1.41	1.39	1.36	1.27
Construction	0.28	0.30	0.29	0.29	0.27	0.24
Cooking	0.15	0.16	0.16	0.15	0.14	0.13
Elec. Gen	0.06	0.07	0.07	0.06	0.06	0.06
Fugitive Dust	0.21	0.23	0.23	0.22	0.20	0.17
Industrial	1.64	1.71	1.69	1.67	1.63	1.51
Misc. Fuel Comb	0.12	0.13	0.12	0.12	0.11	0.11
Nat. Gas & Petr.	0.22	0.24	0.23	0.23	0.22	0.20
Off-road Mob. Srcs	0.50	0.54	0.51	0.50	0.49	0.48
On-road Mob. Srcs	1.65	1.82	1.72	1.66	1.59	1.47
Residential	0.58	0.59	0.58	0.58	0.57	0.59
Total	6.78	7.23	7.01	6.86	6.65	6.22

Table E3: Population-weighted exposure concentration (µg/m^3) by age group (all sectors)

	Average	Age under 5	Age under 18	Women of child-bearing age	Age over 65	Age over 85
Agriculture	1.37	1.40	1.40	1.40	1.28	1.30
Construction	0.28	0.28	0.28	0.28	0.26	0.25
Cooking	0.15	0.15	0.15	0.16	0.14	0.14
Elec. Gen	0.06	0.06	0.06	0.06	0.06	0.06
Fugitive Dust	0.21	0.22	0.22	0.22	0.20	0.19
Industrial	1.64	1.67	1.65	1.71	1.50	1.54
Misc. Fuel Comb	0.12	0.12	0.12	0.12	0.11	0.11
Nat. Gas & Petr.	0.22	0.23	0.22	0.23	0.21	0.21
Off-road Mob. Srcs	0.50	0.51	0.50	0.53	0.46	0.48
On-road Mob. Srcs	1.65	1.69	1.65	1.73	1.50	1.57
Residential	0.58	0.58	0.57	0.60	0.55	0.57
Total	6.78	6.91	6.81	7.04	6.26	6.43

Table E4: Population-weighted exposure concentration (μg/m^3) by other group (all sectors)

	Average	Average over 25 (edu. compar.)	Less than HS education	Linguistic Isolation	Disadvantaged Communities
Agriculture	1.37	1.35	1.57	1.49	1.93
Construction	0.28	0.27	0.30	0.28	0.31
Cooking	0.15	0.15	0.17	0.16	0.18
Elec. Gen	0.06	0.06	0.07	0.07	0.09
Fugitive Dust	0.21	0.21	0.23	0.20	0.24
Industrial	1.64	1.62	1.98	1.90	2.61
Misc. Fuel Comb	0.12	0.12	0.14	0.13	0.18
Nat. Gas & Petr.	0.22	0.22	0.26	0.26	0.38
Off-road Mob. Srcs	0.50	0.50	0.58	0.57	0.77
On-road Mob. Srcs	1.65	1.63	1.93	1.83	2.52
Residential	0.58	0.58	0.60	0.62	0.64
Total	6.78	6.73	7.85	7.50	9.84

Table E5: Difference in population-weighted exposure concentration (μg/m^3) by race (all sectors)

	Δ White	Δ Hispanic	Δ Asian	Δ Black	Δ Other
Agriculture	-0.18	0.22	-0.06	0.06	-0.15
Construction	-0.03	0.03	0.00	0.06	-0.02
Cooking	-0.03	0.02	0.02	0.04	-0.01
Elec. Gen	-0.01	0.01	0.00	0.01	-0.01
Fugitive Dust	-0.02	0.02	-0.03	0.04	-0.01
Industrial	-0.41	0.38	0.19	0.17	-0.29
Misc. Fuel Comb	-0.02	0.02	0.01	0.02	-0.01
Nat. Gas & Petr.	-0.05	0.04	0.01	0.09	-0.02
Off-road Mob. Srcs	-0.11	0.07	0.07	0.15	-0.05
On-road Mob. Srcs	-0.32	0.29	0.09	0.30	-0.20
Residential	-0.05	0.02	0.08	0.07	-0.02
Total	-1.23	1.12	0.38	1.01	-0.78

Table E6: Difference in population-weighted exposure concentration (μg/m³) by income category (all sectors)

	Δ Q1	Δ Q2	Δ Q3	Δ Q4	Δ Q5
Agriculture	0.08	0.04	0.02	-0.01	-0.11
Construction	0.02	0.02	0.01	-0.01	-0.04
Cooking	0.01	0.01	0.00	0.00	-0.02
Elec. Gen	0.00	0.00	0.00	0.00	-0.01
Fugitive Dust	0.02	0.02	0.01	-0.01	-0.04
Industrial	0.07	0.05	0.03	-0.01	-0.13
Misc. Fuel Comb	0.01	0.00	0.00	0.00	-0.01
Nat. Gas & Petr.	0.02	0.01	0.00	-0.01	-0.03
Off-road Mob. Srcs	0.03	0.01	-0.01	-0.02	-0.02
On-road Mob. Srcs	0.17	0.08	0.02	-0.06	-0.17
Residential	0.01	0.00	0.00	-0.01	0.01
Total	0.45	0.23	0.08	-0.13	-0.56

Table E7: Difference in population-weighted exposure concentration (μg/m³) by age group (all sectors)

	Δ Age under 5	Δ Age under 18	Δ Women of child-bearing age	Δ Age over 65	Δ Age over 85
Agriculture	0.03	0.03	0.03	-0.09	-0.07
Construction	0.01	0.00	0.01	-0.02	-0.02
Cooking	0.00	0.00	0.01	-0.01	-0.01
Elec. Gen	0.00	0.00	0.00	0.00	0.00
Fugitive Dust	0.01	0.01	0.01	-0.02	-0.02
Industrial	0.03	0.01	0.07	-0.14	-0.10
Misc. Fuel Comb	0.00	0.00	0.01	-0.01	-0.01
Nat. Gas & Petr.	0.01	0.00	0.01	-0.02	-0.02
Off-road Mob. Srcs	0.01	-0.01	0.02	-0.04	-0.02
On-road Mob. Srcs	0.04	0.00	0.08	-0.15	-0.08
Residential	0.00	-0.01	0.02	-0.03	-0.01
Total	0.13	0.03	0.27	-0.52	-0.35

Table E8: Difference in population-weighted exposure concentration (μg/m³) by other group (all sectors)

	∆ Less than HS education	∆ Linguistic Isolation	∆ Disadvantaged Communities
Agriculture	0.22	0.12	0.56
Construction	0.03	0.00	0.04
Cooking	0.02	0.01	0.03
Elec. Gen	0.01	0.00	0.02
Fugitive Dust	0.02	-0.01	0.03
Industrial	0.35	0.26	0.97
Misc. Fuel Comb	0.02	0.01	0.06
Nat. Gas & Petr.	0.04	0.04	0.16
Off-road Mob. Srcs	0.08	0.06	0.26
On-road Mob. Srcs	0.30	0.18	0.87
Residential	0.02	0.04	0.06
Total	1.12	0.72	3.06

Table E9: Relative percent difference in population-weighted exposure concentration by race (%) (all sectors)

	∆ White	∆ Hispanic	∆ Asian	∆ Black	∆ Other
Agriculture	-13%	16%	-4%	5%	-11%
Construction	-12%	11%	0%	21%	-6%
Cooking	-21%	14%	16%	30%	-8%
Elec. Gen	-15%	18%	-5%	9%	-11%
Fugitive Dust	-7%	10%	-13%	20%	-7%
Industrial	-25%	23%	12%	10%	-18%
Misc. Fuel Comb	-20%	18%	9%	13%	-12%
Nat. Gas & Petr.	-23%	19%	3%	42%	-8%
Off-road Mob. Srcs	-21%	14%	14%	30%	-9%
On-road Mob. Srcs	-19%	18%	5%	18%	-12%
Residential	-9%	3%	14%	12%	-3%
Total	-18%	17%	6%	15%	-12%

Table E10: Relative percent difference in population-weighted exposure concentration (µg/m^3) by income category (all sectors)

	Δ Q1	Δ Q2	Δ Q3	Δ Q4	Δ Q5
Agriculture	6%	3%	1%	-1%	-8%
Construction	7%	7%	4%	-2%	-13%
Cooking	8%	6%	2%	-3%	-11%
Elec. Gen	4%	3%	1%	-1%	-10%
Fugitive Dust	11%	10%	6%	-3%	-19%
Industrial	5%	3%	2%	-1%	-8%
Misc. Fuel Comb	9%	3%	0%	-3%	-8%
Nat. Gas & Petr.	8%	4%	2%	-2%	-12%
Off-road Mob. Srcs	7%	1%	-1%	-3%	-4%
On-road Mob. Srcs	10%	5%	1%	-3%	-10%
Residential	1%	-1%	-1%	-1%	2%
Total	7%	3%	1%	-2%	-8%

Table E11: Relative percent difference in population-weighted exposure concentration (µg/m^3) by age group (all sectors)

	Δ Age under 5	Δ Age under 18	Δ Women of child-bearing age	Δ Age over 65	Δ Age over 85
Agriculture	2%	2%	2%	-6%	-5%
Construction	3%	1%	3%	-7%	-7%
Cooking	1%	-2%	5%	-8%	-7%
Elec. Gen	2%	0%	2%	-4%	0%
Fugitive Dust	5%	3%	3%	-7%	-10%
Industrial	2%	1%	4%	-8%	-6%
Misc. Fuel Comb	1%	-1%	5%	-8%	-5%
Nat. Gas & Petr.	2%	1%	4%	-8%	-7%
Off-road Mob. Srcs	1%	-1%	5%	-8%	-4%
On-road Mob. Srcs	3%	0%	5%	-9%	-5%
Residential	0%	-2%	3%	-4%	-1%
Total	2%	0%	4%	-8%	-5%

Table E12: Relative percent difference in population-weighted exposure concentration (μg/m^3) by age group (all sectors)

	Δ Less than HS education	Δ Linguistic Isolation	Δ Disadvantaged Communities
Agriculture	16%	9%	41%
Construction	11%	1%	13%
Cooking	16%	7%	21%
Elec. Gen	13%	6%	35%
Fugitive Dust	11%	-5%	15%
Industrial	22%	16%	59%
Misc. Fuel Comb	19%	13%	55%
Nat. Gas & Petr.	18%	16%	70%
Off-road Mob. Srcs	16%	12%	52%
On-road Mob. Srcs	18%	11%	53%
Residential	3%	6%	11%
Total	17%	11%	45%

Agriculture

Table E13: Population-weighted exposure concentration (μg/m^3) by race (agriculture sector)

	Average	White	Hispanic	Asian	Black	Other
Fertilizer Application	0.17	0.18	0.18	0.12	0.15	0.16
Industrial	0.12	0.08	0.16	0.14	0.15	0.10
Livestock	1.02	0.87	1.19	1.00	1.07	0.90
Off-Rd Mobile	0.03	0.03	0.03	0.02	0.02	0.02
Pesticide	0.02	0.02	0.02	0.02	0.02	0.02
Tilling	0.01	0.02	0.01	0.02	0.02	0.02
Total	1.37	1.19	1.59	1.32	1.44	1.22

Table E14: Population-weighted exposure concentration (μg/m^3) by income category (agriculture sector)

	Average	Q1	Q2	Q3	Q4	Q5
Fertilizer Application	0.17	0.17	0.18	0.17	0.17	0.15
Industrial	0.12	0.14	0.13	0.12	0.12	0.11
Livestock	1.02	1.07	1.04	1.03	1.01	0.95
Off-Rd Mobile	0.03	0.03	0.03	0.03	0.03	0.02
Pesticide	0.02	0.02	0.02	0.02	0.02	0.02
Tilling	0.01	0.02	0.01	0.01	0.01	0.01
Total	1.37	1.45	1.41	1.39	1.36	1.27

Table E15: Population-weighted exposure concentration (µg/m³) by age group (agriculture sector)

	Average	Age under 5	Age under 18	Women of child-bearing age	Age over 65	Age over 85
Fertilizer Application	0.17	0.18	0.18	0.17	0.17	0.16
Industrial	0.12	0.13	0.12	0.13	0.11	0.11
Livestock	1.02	1.04	1.03	1.05	0.95	0.96
Off-Rd Mobile	0.03	0.03	0.03	0.02	0.02	0.02
Pesticide	0.02	0.02	0.02	0.02	0.02	0.02
Tilling	0.01	0.01	0.01	0.02	0.02	0.02
Total	1.37	1.40	1.40	1.40	1.28	1.30

Table E16: Population-weighted exposure concentration (µg/m³) by other group (agriculture sector)

	Average	Average over 25 (edu. compar.)	Less than HS education	Linguistic Isolation	Disadvantaged Communities
Fertilizer Application	0.17	0.16	0.18	0.17	0.19
Industrial	0.12	0.12	0.16	0.15	0.23
Livestock	1.02	1.01	1.17	1.11	1.44
Off-Rd Mobile	0.03	0.02	0.03	0.02	0.03
Pesticide	0.02	0.02	0.03	0.02	0.02
Tilling	0.01	0.02	0.02	0.01	0.02
Total	1.37	1.35	1.57	1.49	1.93

Table E17: Difference in population-weighted exposure concentration (μg/m^3) by race (agriculture sector)

	∆ White	**∆ Hispanic**	**∆ Asian**	**∆ Black**	**∆ Other**
Fertilizer Application	0.01	0.01	-0.05	-0.02	-0.01
Industrial	-0.04	0.03	0.02	0.03	-0.02
Livestock	-0.15	0.17	-0.02	0.05	-0.12
Off-Rd Mobile	0.00	0.00	-0.01	-0.01	0.00
Pesticide	0.00	0.00	0.00	0.00	0.00
Tilling	0.00	0.00	0.00	0.00	0.00
Total	-0.18	0.22	-0.06	0.06	-0.15

Table E18: Difference in population-weighted exposure concentration (μg/m^3) by income category (agriculture sector)

	∆ Q1	**∆ Q2**	**∆ Q3**	**∆ Q4**	**∆ Q5**
Fertilizer Application	0.01	0.01	0.00	0.00	-0.02
Industrial	0.02	0.01	0.00	-0.01	-0.02
Livestock	0.05	0.02	0.01	-0.01	-0.07
Off-Rd Mobile	0.00	0.00	0.00	0.00	0.00
Pesticide	0.00	0.00	0.00	0.00	0.00
Tilling	0.00	0.00	0.00	0.00	0.00
Total	0.08	0.04	0.02	-0.01	-0.11

Table E19: Difference in population-weighted exposure concentration (μg/m^3) by age group (agriculture sector)

	∆ Age under 5	**∆ Age under 18**	**∆ Women of child-bearing age**	**∆ Age over 65**	**∆ Age over 85**
Fertilizer Application	0.01	0.01	0.00	0.00	-0.01
Industrial	0.00	0.00	0.01	-0.01	-0.01
Livestock	0.02	0.01	0.03	-0.07	-0.06
Off-Rd Mobile	0.00	0.00	0.00	0.00	0.00
Pesticide	0.00	0.00	0.00	0.00	0.00
Tilling	0.00	0.00	0.00	0.00	0.00
Total	0.03	0.03	0.03	-0.09	-0.07

Table E20: Difference in population-weighted exposure concentration (μg/m^3) by other group (agriculture sector)

	∆ Less than HS education	**∆ Linguistic Isolation**	**∆ Disadvantaged Communities**
Fertilizer Application	0.01	0.00	0.02
Industrial	0.04	0.02	0.11
Livestock	0.16	0.10	0.42
Off-Rd Mobile	0.00	0.00	0.01
Pesticide	0.00	0.00	0.00
Tilling	0.00	0.00	0.00
Total	0.22	0.12	0.56

Table E21: Relative percent difference in population-weighted exposure concentration by race (%) (agriculture sector)

	∆ White	∆ Hispanic	∆ Asian	∆ Black	∆ Other
Fertilizer Application	4%	8%	-29%	-10%	-3%
Industrial	-32%	27%	16%	25%	-18%
Livestock	-14%	17%	-2%	5%	-12%
Off-Rd Mobile	0%	14%	-28%	-24%	-5%
Pesticide	-14%	16%	-6%	15%	-10%
Tilling	1%	-8%	17%	4%	7%
Total	-13%	16%	-4%	5%	-11%

Table E22: Relative percent difference in population-weighted exposure concentration (μg/m^3) by income category (agriculture sector)

	∆ Q1	∆ Q2	∆ Q3	∆ Q4	∆ Q5
Fertilizer Application	3%	4%	3%	1%	-9%
Industrial	14%	6%	1%	-4%	-14%
Livestock	5%	2%	1%	-1%	-6%
Off-Rd Mobile	4%	6%	4%	1%	-13%
Pesticide	9%	9%	4%	-3%	-15%
Tilling	20%	-1%	-6%	-8%	-6%
Total	6%	3%	1%	-1%	-8%

Table E23: Relative percent difference in population-weighted exposure concentration (µg/m³) by age group (agriculture sector)

	∆ Age under 5	∆ Age under 18	∆ Women of child-bearing age	∆ Age over 65	∆ Age over 85
Fertilizer Application	4%	5%	-2%	-2%	-3%
Industrial	3%	0%	6%	-10%	-6%
Livestock	2%	1%	3%	-7%	-6%
Off-Rd Mobile	9%	10%	-3%	-6%	-7%
Pesticide	4%	2%	3%	-8%	-9%
Tilling	-6%	-8%	3%	1%	6%
Total	0.02	0.02	0.02	-0.06	-0.05

Table E24: Relative percent difference in population-weighted exposure concentration (µg/m³) by age group (agriculture sector)

	∆ Less than HS education	∆ Linguistic Isolation	∆ Disadvantaged Communities
Fertilizer Application	8%	-2%	13%
Industrial	30%	20%	87%
Livestock	16%	9%	41%
Off-Rd Mobile	16%	-2%	28%
Pesticide	19%	5%	14%
Tilling	5%	-2%	10%
Total	16%	9%	41%

Construction

Table E25: Population-weighted exposure concentration (μg/m^3) by race (construction sector)

	Average	White	Hispanic	Asian	Black	Other
Demolitions	0.00	0.00	0.00	0.00	0.00	0.00
Other Dust	0.05	0.05	0.06	0.05	0.07	0.05
Road Construction Dust	0.04	0.04	0.05	0.04	0.05	0.04
Mobile Sources	0.18	0.15	0.20	0.18	0.22	0.17
Site Preparations	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.28	0.24	0.30	0.27	0.33	0.26

Table E26: Population-weighted exposure concentration (μg/m^3) by income category (construction sector)

	Average	Q1	Q2	Q3	Q4	Q5
Demolitions	0.00	0.00	0.00	0.00	0.00	0.00
Other Dust	0.05	0.06	0.06	0.06	0.05	0.04
Road Construction Dust	0.04	0.05	0.05	0.05	0.04	0.04
Mobile Sources	0.18	0.19	0.19	0.18	0.17	0.16
Site Preparations	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.28	0.30	0.29	0.29	0.27	0.24

Table E27: Population-weighted exposure concentration (μg/m^3) by age group (construction sector)

	Average	Age under 5	Age under 18	Women of child-bearing age	Age over 65	Age over 85
Demolitions	0.00	0.00	0.00	0.00	0.00	0.00
Other Dust	0.05	0.06	0.06	0.06	0.05	0.04
Road Construction Dust	0.04	0.05	0.05	0.05	0.04	0.04
Mobile Sources	0.18	0.19	0.19	0.18	0.17	0.16
Site Preparations	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.28	0.30	0.29	0.29	0.27	0.24

Table E28: Population-weighted exposure concentration (µg/m^3) by other group (construction sector)

	Average	Average over 25 (edu. compar.)	Less than HS education	Linguistic Isolation	Disadvantaged Communities
Demolitions	0.00	0.00	0.00	0.00	0.00
Other Dust	0.05	0.05	0.06	0.05	0.05
Road Construction Dust	0.04	0.04	0.05	0.04	0.05
Mobile Sources	0.18	0.18	0.20	0.18	0.21
Site Preparations	0.00	0.00	0.00	0.00	0.00
Total	0.28	0.27	0.30	0.28	0.31

Table E29: Difference in population-weighted exposure concentration (µg/m^3) by race (construction sector)

	∆ White	∆ Hispanic	∆ Asian	∆ Black	∆ Other
Demolitions	0.00	0.00	0.00	0.00	0.00
Other Dust	0.00	0.00	0.00	0.01	0.00
Road Construction Dust	-0.01	0.01	0.00	0.01	0.00
Mobile Sources	-0.02	0.02	0.01	0.04	-0.01
Site Preparations	0.00	0.00	0.00	0.00	0.00
Total	-0.03	0.03	0.00	0.06	-0.02

Table E30: Difference in population-weighted exposure concentration (µg/m^3) by income category (construction sector)

	∆ Q1	∆ Q2	∆ Q3	∆ Q4	∆ Q5
Demolitions	0.00	0.00	0.00	0.00	0.00
Other Dust	0.00	0.01	0.00	0.00	-0.01
Road Construction Dust	0.00	0.00	0.00	0.00	-0.01
Mobile Sources	0.01	0.01	0.01	0.00	-0.02
Site Preparations	0.00	0.00	0.00	0.00	0.00
Total	0.02	0.02	0.01	-0.01	-0.04

Table E31: Difference in population-weighted exposure concentration (µg/m³) by age group (construction sector)

	∆ Age under 5	**∆ Age under 18**	**∆ Women of child-bearing age**	**∆ Age over 65**	**∆ Age over 85**
Demolitions	0.00	0.00	0.00	0.00	0.00
Other Dust	0.00	0.01	0.00	0.00	-0.01
Road Construction Dust	0.00	0.00	0.00	0.00	-0.01
Mobile Sources	0.01	0.01	0.01	0.00	-0.02
Site Preparations	0.00	0.00	0.00	0.00	0.00
Total	0.02	0.02	0.01	-0.01	-0.04

Table E32: Difference in population-weighted exposure concentration (µg/m³) by other group (construction sector)

	∆ Less than HS education	**∆ Linguistic Isolation**	**∆ Disadvantaged Communities**
Demolitions	0.00	0.00	0.00
Other Dust	0.00	0.00	0.00
Road Construction Dust	0.00	0.00	0.01
Mobile Sources	0.02	0.00	0.03
Site Preparations	0.00	0.00	0.00
Total	0.03	0.00	0.04

Table E33: Relative percent difference in population-weighted exposure concentration by race (%), const (construction sector)

	∆ White	∆ Hispanic	∆ Asian	∆ Black	∆ Other
Demolitions	-6%	7%	-38%	79%	-1%
Other Dust	-7%	5%	-6%	27%	-3%
Road Construction Dust	-12%	13%	-7%	17%	-7%
Mobile Sources	-14%	12%	3%	21%	-6%
Site Preparations	-12%	21%	-37%	33%	-10%
Total	-12%	11%	0%	21%	-6%

Table E34: Relative percent difference in population-weighted exposure concentration ($\mu g/m^3$) by income category (construction sector)

	∆ Q1	∆ Q2	∆ Q3	∆ Q4	∆ Q5
Demolitions	16%	18%	9%	-7%	-32%
Other Dust	9%	10%	5%	-3%	-17%
Road Construction Dust	5%	4%	3%	1%	-12%
Mobile Sources	7%	7%	3%	-2%	-12%
Site Preparations	24%	16%	5%	-10%	-31%
Total	7%	7%	4%	-2%	-13%

Table E35: Relative percent difference in population-weighted exposure concentration ($\mu g/m^3$) by age group (construction sector)

	∆ Age under 5	∆ Age under 18	∆ Women of child-bearing age	∆ Age over 65	∆ Age over 85
Demolitions	16%	18%	9%	-7%	-32%
Other Dust	9%	10%	5%	-3%	-17%
Road Construction Dust	5%	4%	3%	1%	-12%
Mobile Sources	7%	7%	3%	-2%	-12%
Site Preparations	24%	16%	5%	-10%	-31%
Total	7%	7%	4%	-2%	-13%

Table E36: Relative percent difference in population-weighted exposure concentration ($\mu g/m^3$) by age group (construction sector)

	∆ Less than HS education	∆ Linguistic Isolation	∆ Disadvantaged Communities
Demolitions	9%	-5%	0%
Other Dust	8%	-5%	-3%
Road Construction Dust	9%	1%	24%
Mobile Sources	13%	3%	16%
Site Preparations	30%	8%	72%
Total	11%	1%	13%

Outdoor Emissions from Commercial Cooking

Table E37: Population-weighted exposure concentration (μg/m^3) by race (outdoor emissions from commercial cooking)

	Average	White	Hispanic	Asian	Black	Other
Total	0.15	0.12	0.17	0.17	0.19	0.14

Table E38: Population-weighted exposure concentration (μg/m^3) by income category (outdoor emissions from commercial cooking)

	Average	Q1	Q2	Q3	Q4	Q5
Total	0.15	0.16	0.16	0.15	0.14	0.13

Table E39: Population-weighted exposure concentration (μg/m^3) by age group (outdoor emissions from commercial cooking)

	Average	Age under 5	Age under 18	Women of child-bearing age	Age over 65	Age over 85
Total	0.15	0.15	0.15	0.16	0.14	0.14

Table E40: Population-weighted exposure concentration (μg/m^3) by other group (outdoor emissions from commercial cooking)

	Average	Average over 25 (edu. compar.)	Less than HS education	Linguistic Isolation	Disadvantaged Communities
Total	0.15	0.15	0.17	0.16	0.18

Table E41: Difference in population-weighted exposure concentration (μg/m^3) by race (outdoor emissions from commercial cooking)

	∆ White	∆ Hispanic	∆ Asian	∆ Black	∆ Other
Total	-0.03	0.02	0.02	0.04	-0.01

Table E42: Difference in population-weighted exposure concentration (μg/m³) by income category (outdoor emissions from commercial cooking)

	∆ Q1	**∆ Q2**	**∆ Q3**	**∆ Q4**	**∆ Q5**
Total	0.01	0.01	0.00	0.00	-0.02

Table E43: Difference in population-weighted exposure concentration (μg/m³) by age group (outdoor emissions from commercial cooking)

	∆ Age under 5	**∆ Age under 18**	**∆ Women of child-bearing age**	**∆ Age over 65**	**∆ Age over 85**
Total	0.00	0.00	0.01	-0.01	-0.01

Table E44: Difference in population-weighted exposure concentration (μg/m³) by other group (outdoor emissions from commercial cooking)

	∆ Less than HS education	**∆ Linguistic Isolation**	**∆ Disadvantaged Communities**
Total	0.02	0.01	0.03

Table E45: Relative percent difference in population-weighted exposure concentration by race (%) (outdoor emissions from commercial cooking)

	∆ White	∆ Hispanic	∆ Asian	∆ Black	∆ Other
Total	-21%	14%	16%	30%	-8%

Table E46: Relative percent difference in population-weighted exposure concentration (μg/m³) by income category (outdoor emissions from commercial cooking)

	∆ Q1	∆ Q2	∆ Q3	∆ Q4	∆ Q5
Total	8%	6%	2%	-3%	-11%

Table E47: Relative percent difference in population-weighted exposure concentration (μg/m³) by age group (outdoor emissions from commercial cooking)

	∆ Age under 5	∆ Age under 18	∆ Women of child-bearing age	∆ Age over 65	∆ Age over 85
Total	1%	-2%	5%	-8%	-7%

Table E48: Relative percent difference in population-weighted exposure concentration (μg/m^3) by age group (outdoor emissions from commercial cooking)

	Δ Less than HS education	Δ Linguistic Isolation	Δ Disadvantaged Communities
Total	16%	7%	21%

Electricity Generation

Table E49: Population-weighted exposure concentration (µg/m³) by race (electricity generation sector)

	Average	White	Hispanic	Asian	Black	Other
Coal, Anthracite/Lignite	0.00	0.00	0.01	0.00	0.01	0.00
Coal, Bituminous	0.00	0.00	0.00	0.00	0.00	0.00
Distillate Oil	0.00	0.00	0.00	0.00	0.00	0.00
Landfill Gas	0.01	0.00	0.01	0.01	0.01	0.01
Natural Gas	0.04	0.03	0.05	0.04	0.05	0.04
Other	0.01	0.01	0.01	0.01	0.01	0.01
Process Gas	0.00	0.00	0.00	0.00	0.00	0.00
Residual Oil	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.06	0.05	0.07	0.06	0.07	0.06

Table E50: Population-weighted exposure concentration (µg/m³) by income category (electricity generation sector)

	Average	Q1	Q2	Q3	Q4	Q5
Coal, Anthracite/Lignite	0.00	0.00	0.01	0.01	0.00	0.00
Coal, Bituminous	0.00	0.00	0.00	0.00	0.00	0.00
Distillate Oil	0.00	0.00	0.00	0.00	0.00	0.00
Landfill Gas	0.01	0.01	0.01	0.01	0.01	0.01
Natural Gas	0.04	0.05	0.05	0.04	0.04	0.04
Other	0.01	0.01	0.01	0.01	0.01	0.01
Process Gas	0.00	0.00	0.00	0.00	0.00	0.00
Residual Oil	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.06	0.07	0.07	0.06	0.06	0.06

Table E51: Population-weighted exposure concentration (μg/m³) by age group (electricity generation sector)

	Average	Age under 5	Age under 18	Women of child-bearing age	Age over 65	Age over 85
Coal, Anthracite/Lignite	0.00	0.01	0.01	0.00	0.00	0.00
Coal, Bituminous	0.00	0.00	0.00	0.00	0.00	0.00
Distillate Oil	0.00	0.00	0.00	0.00	0.00	0.00
Landfill Gas	0.01	0.01	0.01	0.01	0.01	0.01
Natural Gas	0.04	0.04	0.04	0.04	0.04	0.04
Other	0.01	0.01	0.01	0.01	0.01	0.01
Process Gas	0.00	0.00	0.00	0.00	0.00	0.00
Residual Oil	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.06	0.06	0.06	0.06	0.06	0.06

Table E52: Population-weighted exposure concentration (μg/m³) by other group (electricity generation sector)

	Average	Average over 25 (edu. compar.)	Less than HS education	Linguistic Isolation	Disadvantaged Communities
Coal, Anthracite/Lignite	0.00	0.00	0.01	0.01	0.01
Coal, Bituminous	0.00	0.00	0.00	0.00	0.00
Distillate Oil	0.00	0.00	0.00	0.00	0.00
Landfill Gas	0.01	0.01	0.01	0.01	0.01
Natural Gas	0.04	0.04	0.05	0.05	0.07
Other	0.01	0.01	0.01	0.01	0.00
Process Gas	0.00	0.00	0.00	0.00	0.00
Residual Oil	0.00	0.00	0.00	0.00	0.00
Total	0.06	0.06	0.07	0.07	0.09

Table E53: Difference in population-weighted exposure concentration (μg/m^3) by race (electricity generation sector)

	Δ White	Δ Hispanic	Δ Asian	Δ Black	Δ Other
Coal, Anthracite/Lignite	0.00	0.00	0.00	0.00	0.00
Coal, Bituminous	0.00	0.00	0.00	0.00	0.00
Distillate Oil	0.00	0.00	0.00	0.00	0.00
Landfill Gas	0.00	0.00	0.00	0.00	0.00
Natural Gas	-0.01	0.01	0.00	0.00	-0.01
Other	0.00	0.00	0.00	0.00	0.00
Process Gas	0.00	0.00	0.00	0.00	0.00
Residual Oil	0.00	0.00	0.00	0.00	0.00
Total	-0.01	0.01	0.00	0.01	-0.01

Table E54: Difference in population-weighted exposure concentration (μg/m^3) by income category (electricity generation sector)

	Δ Q1	Δ Q2	Δ Q3	Δ Q4	Δ Q5
Coal, Anthracite/Lignite	0.00	0.00	0.00	0.00	0.00
Coal, Bituminous	0.00	0.00	0.00	0.00	0.00
Distillate Oil	0.00	0.00	0.00	0.00	0.00
Landfill Gas	0.00	0.00	0.00	0.00	0.00
Natural Gas	0.00	0.00	0.00	0.00	-0.01
Other	0.00	0.00	0.00	0.00	0.00
Process Gas	0.00	0.00	0.00	0.00	0.00
Residual Oil	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	-0.01

Table E55: Difference in population-weighted exposure concentration (μg/m³) by age group (electricity generation sector)

	∆ Age under 5	∆ Age under 18	∆ Women of child-bearing age	∆ Age over 65	∆ Age over 85
Coal, Anthracite/Lignite	0.00	0.00	0.00	0.00	0.00
Coal, Bituminous	0.00	0.00	0.00	0.00	0.00
Distillate Oil	0.00	0.00	0.00	0.00	0.00
Landfill Gas	0.00	0.00	0.00	0.00	0.00
Natural Gas	0.00	0.00	0.00	0.00	0.00
Other	0.00	0.00	0.00	0.00	0.00
Process Gas	0.00	0.00	0.00	0.00	0.00
Residual Oil	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00

Table E56: Difference in population-weighted exposure concentration (μg/m³) by other group (electricity generation sector)

	∆ Less than HS education	∆ Linguistic Isolation	∆ Disadvantaged Communities
Coal, Anthracite/Lignite	0.00	0.00	0.00
Coal, Bituminous	0.00	0.00	0.00
Distillate Oil	0.00	0.00	0.00
Landfill Gas	0.00	0.00	0.00
Natural Gas	0.01	0.00	0.02
Other	0.00	0.00	0.00
Process Gas	0.00	0.00	0.00
Residual Oil	0.00	0.00	0.00
Total	0.01	0.00	0.02

Table E57: Relative percent difference in population-weighted exposure concentration by race (%) (electricity generation sector)

	∆ White	∆ Hispanic	∆ Asian	∆ Black	∆ Other
Coal, Anthracite/Lignite	-26%	38%	-40%	40%	-25%
Coal, Bituminous	-13%	35%	-48%	-15%	-24%
Distillate Oil	0%	-20%	47%	13%	22%
Landfill Gas	-24%	21%	18%	-3%	-6%
Natural Gas	-21%	24%	-5%	9%	-18%
Other	24%	-25%	-13%	0%	29%
Process Gas	-14%	31%	-29%	-34%	-12%
Residual Oil	6%	0%	-9%	-24%	1%
Total	-15%	18%	-5%	9%	-11%

Table E58: Relative percent difference in population-weighted exposure concentration (μg/m^3) by income category (electricity generation sector)

	∆ Q1	∆ Q2	∆ Q3	∆ Q4	∆ Q5
Coal, Anthracite/Lignite	1%	7%	8%	5%	-20%
Coal, Bituminous	20%	15%	3%	-8%	-26%
Distillate Oil	-6%	-11%	-7%	0%	21%
Landfill Gas	-9%	-3%	2%	4%	2%
Natural Gas	7%	5%	1%	-3%	-14%
Other	-4%	-4%	0%	2%	4%
Process Gas	-14%	2%	6%	6%	1%
Residual Oil	-14%	-6%	-4%	10%	10%
Total	4%	3%	1%	-1%	-10%

Table E59: Relative percent difference in population-weighted exposure concentration (μg/m^3) by age group (electricity generation sector)

	∆ Age under 5	∆ Age under 18	∆ Women of child-bearing age	∆ Age over 65	∆ Age over 85
Coal, Anthracite/Lignite	6%	12%	1%	-17%	-24%
Coal, Bituminous	16%	14%	-3%	-14%	-17%
Distillate Oil	-1%	-5%	4%	-4%	0%
Landfill Gas	2%	3%	3%	-7%	-10%
Natural Gas	2%	0%	3%	-5%	1%
Other	-6%	-3%	-4%	12%	13%
Process Gas	10%	7%	0%	-6%	0%
Residual Oil	1%	-2%	2%	-4%	0%
Total	2%	0%	2%	-4%	0%

Table E60: Relative percent difference in population-weighted exposure concentration (μg/m^3) by age group (electricity generation sector)

	∆ Less than HS education	∆ Linguistic Isolation	∆ Disadvantaged Communities
Coal, Anthracite/Lignite	29%	15%	25%
Coal, Bituminous	42%	8%	75%
Distillate Oil	-13%	-5%	-27%
Landfill Gas	15%	21%	63%
Natural Gas	18%	8%	52%
Other	-18%	-21%	-51%
Process Gas	21%	-5%	-17%
Residual Oil	-17%	-14%	-61%
Total	13%	6%	35%

Fugitive Dust

Table E61: Population-weighted exposure concentration (μg/m³) by race (fugitive dust)

	Average	White	Hispanic	Asian	Black	Other
Paved	0.17	0.14	0.19	0.16	0.22	0.15
Unpaved	0.04	0.05	0.04	0.03	0.04	0.04
Total	0.21	0.20	0.23	0.18	0.25	0.20

Table E62: Population-weighted exposure concentration (μg/m³) by income category (fugitive dust)

	Average	Q1	Q2	Q3	Q4	Q5
Paved	0.17	0.18	0.18	0.17	0.16	0.14
Unpaved	0.04	0.05	0.05	0.05	0.04	0.03
Total	0.21	0.23	0.23	0.22	0.20	0.17

Table E63: Population-weighted exposure concentration (μg/m³) by age group (fugitive dust)

	Average	Age under 5	Age under 18	Women of child-bearing age	Age over 65	Age over 85
Paved	0.17	0.17	0.17	0.17	0.15	0.15
Unpaved	0.04	0.05	0.05	0.04	0.04	0.04
Total	0.21	0.22	0.22	0.22	0.20	0.19

Table E64: Population-weighted exposure concentration (μg/m³) by other group (fugitive dust)

	Average	Average over 25 (edu. compar.)	Less than HS education	Linguistic Isolation	Disadvantaged Communities
Paved	0.17	0.16	0.19	0.17	0.21
Unpaved	0.04	0.04	0.04	0.03	0.03
Total	0.21	0.21	0.23	0.20	0.24

Table E65: Difference in population-weighted exposure concentration (μg/m³) by race (fugitive dust)

	∆ White	∆ Hispanic	∆ Asian	∆ Black	∆ Other
Paved	-0.03	0.02	-0.01	0.05	-0.01
Unpaved	0.01	0.00	-0.02	-0.01	0.00
Total	-0.02	0.02	-0.03	0.04	-0.01

Table E66: Difference in population-weighted exposure concentration (μg/m³) by income category (fugitive dust)

	∆ Q1	∆ Q2	∆ Q3	∆ Q4	∆ Q5
Paved	0.02	0.01	0.01	-0.01	-0.03
Unpaved	0.00	0.01	0.00	0.00	-0.01
Total	0.02	0.02	0.01	-0.01	-0.04

Table E67: Difference in population-weighted exposure concentration (μg/m³) by age group (fugitive dust)

	∆ Age under 5	∆ Age under 18	∆ Women of child-bearing age	∆ Age over 65	∆ Age over 85
Paved	0.01	0.00	0.01	-0.02	-0.02
Unpaved	0.00	0.00	0.00	0.00	0.00
Total	0.01	0.01	0.01	-0.02	-0.02

Table E68: Difference in population-weighted exposure concentration (μg/m³) by other group (fugitive dust)

	∆ Less than HS education	∆ Linguistic Isolation	∆ Disadvantaged Communities
Paved	0.03	0.00	0.04
Unpaved	0.00	-0.01	-0.01
Total	0.02	-0.01	0.03

Table E69: Relative percent difference in population-weighted exposure concentration by race (%) (fugitive dust)

	∆ White	∆ Hispanic	∆ Asian	∆ Black	∆ Other
Paved	-16%	15%	-5%	29%	-8%
Unpaved	24%	-9%	-43%	-13%	-4%
Total	-7%	10%	-13%	20%	-7%

Table E70: Relative percent difference in population-weighted exposure concentration (µg/m^3) by income category (fugitive dust)

	∆ Q1	∆ Q2	∆ Q3	∆ Q4	∆ Q5
Paved	11%	9%	5%	-3%	-18%
Unpaved	11%	14%	9%	-3%	-26%
Total	11%	10%	6%	-3%	-19%

Table E71: Relative percent difference in population-weighted exposure concentration (µg/m^3) by age group (fugitive dust)

	∆ Age under 5	∆ Age under 18	∆ Women of child-bearing age	∆ Age over 65	∆ Age over 85
Paved	4%	3%	4%	-9%	-11%
Unpaved	6%	6%	-1%	-1%	-4%
Total	5%	3%	3%	-7%	-10%

Table E72: Relative percent difference in population-weighted exposure concentration (µg/m^3) by age group (fugitive dust)

	∆ Less than HS education	∆ Linguistic Isolation	∆ Disadvantaged Communities
Paved	16%	2%	26%
Unpaved	-6%	-29%	-28%
Total	11%	-5%	15%

Industrial

Table E73: Population-weighted exposure concentration (μg/m^3) by race (industrial sector)

	Average	White	Hispanic	Asian	Black	Other
Chemical Manufacturing	0.02	0.02	0.03	0.03	0.03	0.02
Cogeneration	0.01	0.00	0.01	0.00	0.01	0.00
Concrete and Cement	0.01	0.01	0.01	0.01	0.02	0.01
Fuel Combustion	0.36	0.26	0.45	0.40	0.44	0.31
Waste Disposal & Incin.	0.46	0.37	0.55	0.52	0.39	0.37
Metals Processing	0.01	0.01	0.01	0.02	0.02	0.01
Surface Mining	0.02	0.02	0.02	0.02	0.02	0.02
Other	0.28	0.20	0.35	0.31	0.32	0.23
Solvent Utilization	0.26	0.20	0.30	0.30	0.29	0.22
TSM[4]	0.21	0.13	0.29	0.23	0.28	0.15
Total	1.64	1.23	2.02	1.83	1.81	1.35

Table E74: Population-weighted exposure concentration (μg/m^3) by income category (industrial sector)

	Average	Q1	Q2	Q3	Q4	Q5
Chemical Manufacturing	0.02	0.02	0.02	0.02	0.02	0.02
Cogeneration	0.01	0.01	0.01	0.01	0.00	0.00
Concrete and Cement	0.01	0.01	0.01	0.01	0.01	0.01
Fuel Combustion	0.36	0.39	0.38	0.37	0.35	0.32
Waste Disposal & Incin.	0.46	0.44	0.45	0.47	0.48	0.46
Metals Processing	0.01	0.01	0.01	0.01	0.01	0.01
Surface Mining	0.02	0.02	0.02	0.02	0.02	0.02
Other	0.28	0.30	0.29	0.29	0.27	0.25
Solvent Utilization	0.26	0.27	0.27	0.26	0.25	0.24
TSM	0.21	0.24	0.23	0.21	0.20	0.18
Total	1.64	1.71	1.69	1.67	1.63	1.51

[4] Transport, Storage, and Marketing

Table E75: Population-weighted exposure concentration (µg/m^3) by age group (industrial sector)

	Average	Age under 5	Age under 18	Women of child-bearing age	Age over 65	Age over 85
Chemical Manufacturing	0.02	0.02	0.02	0.02	0.02	0.02
Cogeneration	0.01	0.01	0.01	0.01	0.00	0.00
Concrete and Cement	0.01	0.01	0.01	0.01	0.01	0.01
Fuel Combustion	0.36	0.37	0.37	0.38	0.33	0.33
Waste Disposal & Incin.	0.46	0.46	0.47	0.48	0.42	0.44
Metals Processing	0.01	0.01	0.01	0.01	0.01	0.01
Surface Mining	0.02	0.02	0.02	0.02	0.02	0.02
Other	0.28	0.29	0.28	0.29	0.25	0.26
Solvent Utilization	0.26	0.26	0.26	0.27	0.24	0.25
TSM	0.21	0.21	0.21	0.23	0.19	0.20
Total	1.64	1.67	1.65	1.71	1.50	1.54

Table E76: Population-weighted exposure concentration (µg/m^3) by other group (industrial sector)

	Average	Average over 25 (edu. compar.)	Less than HS education	Linguistic Isolation	Disadvantaged Communities
Chemical Manufacturing	0.02	0.02	0.03	0.02	0.04
Cogeneration	0.01	0.00	0.01	0.01	0.01
Concrete and Cement	0.01	0.01	0.01	0.01	0.01
Fuel Combustion	0.36	0.36	0.44	0.42	0.59
Waste Disposal & Incin.	0.46	0.45	0.52	0.52	0.63
Metals Processing	0.01	0.01	0.01	0.01	0.01
Surface Mining	0.02	0.02	0.02	0.02	0.01
Other	0.28	0.28	0.35	0.33	0.49
Solvent Utilization	0.26	0.26	0.30	0.29	0.37
TSM	0.21	0.21	0.29	0.28	0.45
Total	1.64	1.62	1.98	1.90	2.61

Table E77: Difference in population-weighted exposure concentration (μg/m^3) by race (industrial sector)

	∆ White	∆ Hispanic	∆ Asian	∆ Black	∆ Other
Chemical Manufacturing	-0.01	0.00	0.00	0.01	0.00
Cogeneration	0.00	0.00	0.00	0.00	0.00
Concrete and Cement	0.00	0.00	0.00	0.00	0.00
Fuel Combustion	-0.10	0.09	0.04	0.07	-0.05
Waste Disposal & Incin.	-0.09	0.09	0.06	-0.07	-0.09
Metals Processing	0.00	0.00	0.01	0.01	0.00
Surface Mining	0.00	0.00	0.00	0.00	0.00
Other	-0.08	0.07	0.03	0.04	-0.05
Solvent Utilization	-0.06	0.05	0.04	0.03	-0.04
TSM	-0.08	0.08	0.02	0.07	-0.06
Total	-0.41	0.38	0.19	0.17	-0.29

Table E78: Difference in population-weighted exposure concentration (μg/m^3) by income category (industrial sector)

	∆ Q1	∆ Q2	∆ Q3	∆ Q4	∆ Q5
Chemical Manufacturing	0.00	0.00	0.00	0.00	0.00
Cogeneration	0.00	0.00	0.00	0.00	0.00
Concrete and Cement	0.00	0.00	0.00	0.00	0.00
Fuel Combustion	0.02	0.02	0.01	-0.01	-0.04
Waste Disposal & Incin.	-0.02	-0.01	0.01	0.02	0.00
Metals Processing	0.00	0.00	0.00	0.00	0.00
Surface Mining	0.00	0.00	0.00	0.00	0.00
Other	0.02	0.01	0.01	-0.01	-0.03
Solvent Utilization	0.01	0.01	0.00	0.00	-0.02
TSM	0.03	0.02	0.00	-0.01	-0.03
Total	0.07	0.05	0.03	-0.01	-0.13

Table E79: Difference in population-weighted exposure concentration (µg/m^3) by age group (industrial sector)

	∆ Age under 5	∆ Age under 18	∆ Women of child-bearing age	∆ Age over 65	∆ Age over 85
Chemical Manufacturing	0.00	0.00	0.00	0.00	0.00
Cogeneration	0.00	0.00	0.00	0.00	0.00
Concrete and Cement	0.00	0.00	0.00	0.00	0.00
Fuel Combustion	0.01	0.01	0.02	-0.03	-0.03
Waste Disposal & Incin.	0.00	0.01	0.02	-0.04	-0.02
Metals Processing	0.00	0.00	0.00	0.00	0.00
Surface Mining	0.00	0.00	0.00	0.00	0.00
Other	0.01	0.00	0.01	-0.03	-0.02
Solvent Utilization	0.00	0.00	0.01	-0.02	-0.01
TSM	0.00	0.00	0.01	-0.02	-0.01
Total	0.03	0.01	0.07	-0.14	-0.10

Table E80: Difference in population-weighted exposure concentration (µg/m^3) by other group (industrial sector)

	∆ Less than HS education	∆ Linguistic Isolation	∆ Disadvantaged Communities
Chemical Manufacturing	0.00	0.00	0.02
Cogeneration	0.00	0.00	0.00
Concrete and Cement	0.00	0.00	0.00
Fuel Combustion	0.09	0.06	0.23
Waste Disposal & Incin.	0.06	0.06	0.17
Metals Processing	0.00	0.00	0.00
Surface Mining	0.00	0.00	-0.01
Other	0.07	0.05	0.21
Solvent Utilization	0.05	0.04	0.11
TSM	0.08	0.06	0.23
Total	0.35	0.26	0.97

Table E81: Relative percent difference in population-weighted exposure concentration by race (%) (industrial sector)

	Δ White	Δ Hispanic	Δ Asian	Δ Black	Δ Other
Chemical Manufacturing	-25%	18%	17%	27%	-4%
Cogeneration	-8%	17%	-25%	11%	-12%
Concrete and Cement	-12%	8%	-1%	34%	-3%
Fuel Combustion	-27%	24%	11%	21%	-15%
Waste Disposal & Incin.	-19%	20%	14%	-15%	-20%
Metals Processing	-18%	-7%	46%	57%	20%
Surface Mining	7%	-1%	-23%	12%	2%
Other	-28%	26%	11%	16%	-17%
Solvent Utilization	-22%	18%	14%	13%	-14%
TSM	-38%	36%	10%	32%	-29%
Total	-25%	23%	12%	10%	-18%

Table E82: Relative percent difference in population-weighted exposure concentration (μg/m^3) by income category (industrial sector)

	Δ Q1	Δ Q2	Δ Q3	Δ Q4	Δ Q5
Chemical Manufacturing	4%	1%	2%	1%	-8%
Cogeneration	13%	6%	-1%	-6%	-11%
Concrete and Cement	3%	1%	-1%	-2%	0%
Fuel Combustion	7%	5%	3%	-2%	-12%
Waste Disposal & Incin.	-5%	-2%	2%	4%	1%
Metals Processing	-4%	-10%	-6%	1%	17%
Surface Mining	2%	8%	7%	0%	-17%
Other	9%	5%	2%	-2%	-12%
Solvent Utilization	6%	3%	1%	-1%	-7%
TSM	15%	8%	1%	-5%	-17%
Total	5%	3%	2%	-1%	-8%

Table E83: Relative percent difference in population-weighted exposure concentration (μg/m³) by age group (industrial sector)

	Δ Age under 5	Δ Age under 18	Δ Women of child-bearing age	Δ Age over 65	Δ Age over 85
Chemical Manufacturing	3%	2%	4%	-9%	-9%
Cogeneration	5%	3%	1%	-6%	-5%
Concrete and Cement	7%	7%	0%	-7%	-12%
Fuel Combustion	3%	2%	4%	-9%	-8%
Waste Disposal & Incin.	1%	2%	3%	-8%	-5%
Metals Processing	0%	-2%	5%	-7%	-5%
Surface Mining	1%	3%	-2%	2%	-13%
Other	2%	1%	5%	-9%	-6%
Solvent Utilization	1%	0%	4%	-7%	-5%
TSM	0%	-1%	7%	-10%	-5%
Total	2%	1%	4%	-8%	-6%

Table E84: Relative percent difference in population-weighted exposure concentration (μg/m³) by age group (industrial sector)

	Δ Less than HS education	Δ Linguistic Isolation	Δ Disadvantaged Communities
Chemical Manufacturing	21%	11%	71%
Cogeneration	17%	6%	47%
Concrete and Cement	4%	0%	3%
Fuel Combustion	25%	16%	64%
Waste Disposal & Incin.	14%	13%	36%
Metals Processing	-2%	5%	15%
Surface Mining	-3%	-15%	-34%
Other	26%	16%	75%
Solvent Utilization	19%	14%	44%
TSM	37%	30%	111%
Total	22%	16%	59%

Miscellaneous

Table E85: Population-weighted exposure concentration (μg/m³) by race (miscellaneous sources)

	Average	White	Hispanic	Asian	Black	Other
Total	0.12	0.09	0.14	0.13	0.13	0.10

Table E86: Population-weighted exposure concentration (μg/m³) by income category (miscellaneous sources)

	Average	Q1	Q2	Q3	Q4	Q5
Total	0.12	0.13	0.12	0.12	0.11	0.11

Table E87: Population-weighted exposure concentration (μg/m³) by age group (miscellaneous sources)

	Average	Age under 5	Age under 18	Women of child-bearing age	Age over 65	Age over 85
Total	0.12	0.12	0.12	0.12	0.11	0.11

Table E88: Population-weighted exposure concentration (μg/m³) by other group (miscellaneous sources)

	Average	Average over 25 (edu. compar.)	Less than HS education	Linguistic Isolation	Disadvantaged Communities
Total	0.12	0.12	0.14	0.13	0.18

Table E89: Difference in population-weighted exposure concentration (μg/m³) by race (miscellaneous sources)

	Δ White	Δ Hispanic	Δ Asian	Δ Black	Δ Other
Total	-0.02	0.02	0.01	0.02	-0.01

Table E90: Difference in population-weighted exposure concentration (μg/m³) by income category (miscellaneous sources)

	Δ Q1	Δ Q2	Δ Q3	Δ Q4	Δ Q5
Total	0.01	0.00	0.00	0.00	-0.01

Table E91: Difference in population-weighted exposure concentration (µg/m^3) by age group (miscellaneous sources)

	∆ Age under 5	**∆ Age under 18**	**∆ Women of child-bearing age**	**∆ Age over 65**	**∆ Age over 85**
Total	0.00	0.00	0.01	-0.01	-0.01

Table E92: Difference in population-weighted exposure concentration (µg/m^3) by other group

	∆ Less than HS education	**∆ Linguistic Isolation**	**∆ Disadvantaged Communities**
Total	0.02	0.01	0.06

Table E93: Relative percent difference in population-weighted exposure concentration by race (%)

	∆ White	∆ Hispanic	∆ Asian	∆ Black	∆ Other
Total	-20%	18%	9%	13%	-12%

Table E94: Relative percent difference in population-weighted exposure concentration (µg/m^3) by income category

	∆ Q1	∆ Q2	∆ Q3	∆ Q4	∆ Q5
Total	9%	3%	0%	-3%	-8%

Table E95: Relative percent difference in population-weighted exposure concentration (µg/m^3) by age group

	∆ Age under 5	∆ Age under 18	∆ Women of child-bearing age	∆ Age over 65	∆ Age over 85
Total	1%	-1%	5%	-8%	-5%

Table E96: Relative percent difference in population-weighted exposure concentration (µg/m^3) by age group

	∆ Less than HS education	∆ Linguistic Isolation	∆ Disadvantaged Communities
Total	19%	13%	55%

Oil & Petroleum

Table E97: Population-weighted exposure concentration (μg/m^3) by race (oil and petroleum sector)

	Average	White	Hispanic	Asian	Black	Other
Asphalt Manufact.	0.01	0.01	0.01	0.01	0.01	0.01
Oil & Gas Production	0.09	0.07	0.11	0.09	0.12	0.07
Petroleum Refining	0.07	0.05	0.08	0.07	0.12	0.07
Petroleum TSM[5]	0.06	0.05	0.06	0.06	0.06	0.05
Total	0.22	0.17	0.26	0.23	0.32	0.20

Table E98: Population-weighted exposure concentration (μg/m^3) by income category (oil and petroleum sector)

	Average	Q1	Q2	Q3	Q4	Q5
Asphalt Manufact.	0.01	0.01	0.01	0.01	0.01	0.01
Oil & Gas Production	0.09	0.10	0.09	0.09	0.09	0.08
Petroleum Refining	0.07	0.07	0.07	0.07	0.07	0.06
Petroleum TSM	0.06	0.06	0.06	0.06	0.05	0.05
Total	0.22	0.24	0.23	0.23	0.22	0.20

Table E99: Population-weighted exposure concentration (μg/m^3) by age group (oil and petroleum sector)

	Average	Age under 5	Age under 18	Women of child-bearing age	Age over 65	Age over 85
Asphalt Manufact.	0.01	0.01	0.01	0.01	0.01	0.01
Oil & Gas Production	0.09	0.09	0.09	0.09	0.08	0.09
Petroleum Refining	0.07	0.07	0.07	0.07	0.06	0.06
Petroleum TSM	0.06	0.06	0.06	0.06	0.05	0.05
Total	0.22	0.23	0.22	0.23	0.21	0.21

[5] Transport, Storage, and Marketing

Table E100: Population-weighted exposure concentration (μg/m^3) by other group (oil and petroleum sector)

	Average	Average over 25 (edu. compar.)	Less than HS education	Linguistic Isolation	Disadvantaged Communities
Asphalt Manufact.	0.01	0.01	0.01	0.01	0.01
Oil & Gas Production	0.09	0.09	0.10	0.11	0.15
Petroleum Refining	0.07	0.07	0.08	0.08	0.14
Petroleum TSM	0.06	0.06	0.06	0.06	0.07
Total	0.22	0.22	0.26	0.26	0.38

Table E101: Difference in population-weighted exposure concentration (μg/m^3) by race (oil and petroleum sector)

	∆ White	∆ Hispanic	∆ Asian	∆ Black	∆ Other
Asphalt Manufact.	0.00	0.00	0.00	0.00	0.00
Oil & Gas Production	-0.02	0.02	0.00	0.04	-0.01
Petroleum Refining	-0.02	0.01	0.00	0.05	0.00
Petroleum TSM	-0.01	0.01	0.00	0.01	0.00
Total	-0.05	0.04	0.01	0.09	-0.02

Table E102: Difference in population-weighted exposure concentration (μg/m^3) by income category (oil and petroleum sector)

	∆ Q1	∆ Q2	∆ Q3	∆ Q4	∆ Q5
Asphalt Manufact.	0.00	0.00	0.00	0.00	0.00
Oil & Gas Production	0.01	0.00	0.00	0.00	-0.01
Petroleum Refining	0.01	0.00	0.00	0.00	-0.01
Petroleum TSM	0.00	0.00	0.00	0.00	-0.01
Total	0.02	0.01	0.00	-0.01	-0.03

Table E103: Difference in population-weighted exposure concentration (μg/m^3) by age group (oil and petroleum sector)

	∆ Age under 5	**∆ Age under 18**	**∆ Women of child-bearing age**	**∆ Age over 65**	**∆ Age over 85**
Asphalt Manufact.	0.00	0.00	0.00	0.00	0.00
Oil & Gas Production	0.00	0.00	0.00	-0.01	0.00
Petroleum Refining	0.00	0.00	0.00	-0.01	-0.01
Petroleum TSM	0.00	0.00	0.00	0.00	0.00
Total	0.01	0.00	0.01	-0.02	-0.02

Table E104: Difference in population-weighted exposure concentration (μg/m^3) by other group (oil and petroleum sector)

	∆ Less than HS education	**∆ Linguistic Isolation**	**∆ Disadvantaged Communities**
Asphalt Manufact.	0.00	0.00	0.01
Oil & Gas Production	0.01	0.02	0.07
Petroleum Refining	0.02	0.01	0.07
Petroleum TSM	0.01	0.00	0.01
Total	0.04	0.04	0.16

Table E105: Relative percent difference in population-weighted exposure concentration by race (%) (oil and petroleum sector)

	∆ White	∆ Hispanic	∆ Asian	∆ Black	∆ Other
Asphalt Manufact.	-25%	26%	0%	22%	-14%
Oil & Gas Production	-23%	20%	4%	40%	-17%
Petroleum Refining	-31%	22%	3%	70%	4%
Petroleum TSM	-13%	13%	1%	13%	-8%
Total	-23%	19%	3%	42%	-8%

Table E106: Relative percent difference in population-weighted exposure concentration (µg/m³) by income category (oil and petroleum sector)

	∆ Q1	∆ Q2	∆ Q3	∆ Q4	∆ Q5
Asphalt Manufact.	4%	4%	4%	-1%	-9%
Oil & Gas Production	10%	3%	0%	-4%	-9%
Petroleum Refining	8%	5%	3%	-1%	-16%
Petroleum TSM	7%	6%	3%	-2%	-11%
Total	8%	4%	2%	-2%	-12%

Table E107: Relative percent difference in population-weighted exposure concentration (µg/m³) by age group (oil and petroleum sector)

	∆ Age under 5	∆ Age under 18	∆ Women of child-bearing age	∆ Age over 65	∆ Age over 85
Asphalt Manufact.	6%	4%	5%	-13%	-14%
Oil & Gas Production	0%	-2%	5%	-7%	-3%
Petroleum Refining	5%	4%	3%	-9%	-13%
Petroleum TSM	2%	0%	3%	-7%	-6%
Total	2%	1%	4%	-8%	-7%

Table E108: Relative percent difference in population-weighted exposure concentration (µg/m³) by age group (oil and petroleum sector)

	∆ Less than HS education	∆ Linguistic Isolation	∆ Disadvantaged Communities
Asphalt Manufact.	25%	7%	57%
Oil & Gas Production	17%	25%	74%
Petroleum Refining	24%	14%	102%
Petroleum TSM	13%	4%	24%
Total	18%	16%	70%

Off-Road Mobile Sources

Table E109: Population-weighted exposure concentration (µg/m³) by race (off-road mobile sources)

	Average	White	Hispanic	Asian	Black	Other
Aviation	0.08	0.05	0.09	0.07	0.17	0.06
Diesel	0.10	0.07	0.11	0.11	0.12	0.08
Gasoline	0.15	0.13	0.16	0.18	0.16	0.14
Marine	0.09	0.08	0.08	0.12	0.11	0.10
Other	0.01	0.01	0.01	0.01	0.01	0.01
Rail	0.08	0.06	0.11	0.07	0.08	0.06
Total	0.50	0.40	0.58	0.57	0.66	0.46

Table E110: Population-weighted exposure concentration (µg/m³) by income category (off-road mobile sources)

	Average	Q1	Q2	Q3	Q4	Q5
Aviation	0.08	0.09	0.08	0.08	0.07	0.06
Diesel	0.10	0.10	0.10	0.10	0.09	0.09
Gasoline	0.15	0.15	0.15	0.15	0.15	0.16
Marine	0.09	0.09	0.08	0.08	0.09	0.10
Other	0.01	0.01	0.01	0.01	0.01	0.01
Rail	0.08	0.10	0.09	0.08	0.07	0.06
Total	0.50	0.54	0.51	0.50	0.49	0.48

Table E111: Population-weighted exposure concentration (µg/m³) by age group (off-road mobile sources)

	Average	Age under 5	Age under 18	Women of child-bearing age	Age over 65	Age over 85
Aviation	0.08	0.08	0.08	0.08	0.07	0.07
Diesel	0.10	0.10	0.10	0.10	0.09	0.09
Gasoline	0.15	0.15	0.15	0.16	0.14	0.15
Marine	0.09	0.09	0.08	0.09	0.09	0.09
Other	0.01	0.01	0.01	0.01	0.01	0.01
Rail	0.08	0.09	0.08	0.08	0.07	0.07
Total	0.50	0.51	0.50	0.53	0.46	0.48

Table E112: Population-weighted exposure concentration (μg/m^3) by other group (off-road mobile sources)

	Average	Average over 25 (edu. compar.)	Less than HS education	Linguistic Isolation	Disadvantaged Communities
Aviation	0.08	0.08	0.10	0.09	0.15
Diesel	0.10	0.10	0.12	0.11	0.15
Gasoline	0.15	0.15	0.16	0.17	0.20
Marine	0.09	0.09	0.09	0.10	0.10
Other	0.01	0.01	0.01	0.01	0.02
Rail	0.08	0.08	0.11	0.08	0.16
Total	0.50	0.50	0.58	0.57	0.77

Table E113: Difference in population-weighted exposure concentration (μg/m^3) by race (off-road mobile sources)

	∆ White	∆ Hispanic	∆ Asian	∆ Black	∆ Other
Aviation	-0.03	0.02	-0.01	0.09	-0.01
Diesel	-0.02	0.02	0.02	0.02	-0.01
Gasoline	-0.02	0.01	0.03	0.01	-0.01
Marine	-0.01	-0.01	0.03	0.02	0.01
Other	0.00	0.00	0.00	0.00	0.00
Rail	-0.02	0.03	-0.01	0.00	-0.02
Total	-0.11	0.07	0.07	0.15	-0.05

Table E114: Difference in population-weighted exposure concentration (μg/m^3) by income category (off-road mobile sources)

	∆ Q1	∆ Q2	∆ Q3	∆ Q4	∆ Q5
Aviation	0.02	0.01	0.00	-0.01	-0.01
Diesel	0.01	0.00	0.00	0.00	-0.01
Gasoline	0.00	0.00	0.00	0.00	0.01
Marine	0.00	-0.01	-0.01	0.00	0.01
Other	0.00	0.00	0.00	0.00	0.00
Rail	0.02	0.01	0.00	-0.01	-0.02
Total	0.03	0.01	-0.01	-0.02	-0.02

Table E115: Difference in population-weighted exposure concentration (µg/m^3) by age group (off-road mobile sources)

	∆ Age under 5	**∆ Age under 18**	**∆ Women of child-bearing age**	**∆ Age over 65**	**∆ Age over 85**
Aviation	0.00	0.00	0.01	-0.01	-0.01
Diesel	0.00	0.00	0.01	-0.01	0.00
Gasoline	0.00	0.00	0.01	-0.01	0.00
Marine	0.00	-0.01	0.00	0.00	0.00
Other	0.00	0.00	0.00	0.00	0.00
Rail	0.01	0.01	0.00	-0.01	-0.01
Total	0.01	-0.01	0.02	-0.04	-0.02

Table E116: Difference in population-weighted exposure concentration (µg/m^3) by other group (off-road mobile sources)

	∆ Less than HS education	**∆ Linguistic Isolation**	**∆ Disadvantaged Communities**
Aviation	0.02	0.02	0.08
Diesel	0.02	0.01	0.05
Gasoline	0.01	0.02	0.04
Marine	-0.01	0.01	0.01
Other	0.00	0.00	0.01
Rail	0.03	0.01	0.08
Total	0.08	0.06	0.26

Table E117: Relative percent difference in population-weighted exposure concentration by race (%) (off-road mobile sources)

	∆ White	∆ Hispanic	∆ Asian	∆ Black	∆ Other
Aviation	-35%	24%	-10%	122%	-15%
Diesel	-26%	19%	19%	20%	-14%
Gasoline	-14%	7%	21%	7%	-8%
Marine	-7%	-8%	32%	27%	11%
Other	-29%	22%	24%	17%	-17%
Rail	-30%	37%	-8%	5%	-21%
Total	-21%	14%	14%	30%	-9%

Table E118: Relative percent difference in population-weighted exposure concentration ($\mu g/m^3$) by income category

	∆ Q1	∆ Q2	∆ Q3	∆ Q4	∆ Q5
Aviation	20%	9%	-1%	-11%	-19%
Diesel	7%	3%	0%	-2%	-7%
Gasoline	-1%	-3%	-2%	0%	4%
Marine	-4%	-9%	-6%	0%	15%
Other	6%	2%	0%	-2%	-5%
Rail	20%	12%	4%	-7%	-25%
Total	7%	1%	-1%	-3%	-4%

Table E119: Relative percent difference in population-weighted exposure concentration ($\mu g/m^3$) by age group (off-road mobile sources)

	∆ Age under 5	∆ Age under 18	∆ Women of child-bearing age	∆ Age over 65	∆ Age over 85
Aviation	4%	-1%	8%	-14%	-11%
Diesel	1%	-1%	5%	-9%	-5%
Gasoline	-1%	-3%	4%	-5%	0%
Marine	-4%	-7%	4%	-2%	4%
Other	2%	-1%	5%	-10%	-6%
Rail	8%	7%	3%	-13%	-12%
Total	1%	-1%	5%	-8%	-4%

Table E120: Relative percent difference in population-weighted exposure concentration ($\mu g/m^3$) by age group (off-road mobile sources)

	∆ Less than HS education	∆ Linguistic Isolation	∆ Disadvantaged Communities
Aviation	30%	20%	100%
Diesel	21%	15%	55%
Gasoline	6%	12%	29%
Marine	-6%	7%	7%
Other	24%	19%	63%
Rail	42%	7%	100%
Total	16%	12%	52%

On-Road Mobile Sources

Table E121: Population-weighted exposure concentration (μg/m^3) by race (on-road mobile sources)

	Average	White	Hispanic	Asian	Black	Other
Diesel HDV	0.53	0.43	0.62	0.52	0.64	0.47
Diesel LCV	0.06	0.06	0.07	0.06	0.07	0.06
Diesel Passenger	0.01	0.01	0.01	0.01	0.01	0.01
Gasoline LCV	0.05	0.04	0.05	0.05	0.05	0.04
Gasoline HDV	0.02	0.02	0.02	0.02	0.02	0.02
Gasoline Passenger	0.97	0.77	1.15	1.07	1.14	0.84
Refueling	0.01	0.00	0.01	0.01	0.01	0.00
Total	1.65	1.33	1.94	1.73	1.94	1.45

Table E122: Population-weighted exposure concentration (μg/m^3) by income category (on-road mobile sources)

	Average	Q1	Q2	Q3	Q4	Q5
Diesel HDV	0.53	0.60	0.56	0.54	0.50	0.45
Diesel LCV	0.06	0.07	0.07	0.07	0.06	0.06
Diesel Passenger	0.01	0.01	0.01	0.01	0.01	0.01
Gasoline LCV	0.05	0.05	0.05	0.05	0.04	0.04
Gasoline HDV	0.02	0.02	0.02	0.02	0.02	0.02
Gasoline Passenger	0.97	1.06	1.01	0.98	0.95	0.89
Refueling	0.01	0.01	0.01	0.01	0.01	0.00
Total	1.65	1.82	1.72	1.66	1.59	1.47

Table E123: Population-weighted exposure concentration (µg/m^3) by age group (on-road mobile sources)

	Average	Age under 5	Age under 18	Women of child-bearing age	Age over 65	Age over 85
Diesel HDV	0.53	0.55	0.54	0.55	0.48	0.49
Diesel LCV	0.06	0.07	0.07	0.07	0.06	0.06
Diesel Passenger	0.01	0.01	0.01	0.01	0.01	0.01
Gasoline LCV	0.05	0.05	0.05	0.05	0.04	0.04
Gasoline HDV	0.02	0.02	0.02	0.02	0.02	0.02
Gasoline Passenger	0.97	0.99	0.96	1.03	0.89	0.94
Refueling	0.01	0.01	0.01	0.01	0.00	0.01
Total	1.65	1.69	1.65	1.73	1.50	1.57

Table E124: Population-weighted exposure concentration (µg/m^3) by other group (on-road mobile sources)

	Average	Average over 25 (edu. compar.)	Less than HS education	Linguistic Isolation	Disadvantaged Communities
Diesel HDV	0.53	0.52	0.62	0.57	0.81
Diesel LCV	0.06	0.06	0.07	0.06	0.09
Diesel Passenger	0.01	0.01	0.01	0.01	0.01
Gasoline LCV	0.05	0.05	0.05	0.05	0.06
Gasoline HDV	0.02	0.02	0.02	0.02	0.03
Gasoline Passenger	0.97	0.97	1.15	1.11	1.50
Refueling	0.01	0.01	0.01	0.01	0.01
Total	1.65	1.63	1.93	1.83	2.52

Table E125: Difference in population-weighted exposure concentration (µg/m^3) by race (on-road mobile sources)

	∆ White	∆ Hispanic	∆ Asian	∆ Black	∆ Other
Diesel HDV	-0.09	0.09	0.00	0.11	-0.05
Diesel LCV	-0.01	0.01	0.00	0.01	0.00
Diesel Passenger	0.00	0.00	0.00	0.00	0.00
Gasoline LCV	-0.01	0.01	0.00	0.01	0.00
Gasoline HDV	0.00	0.00	0.00	0.00	0.00
Gasoline Passenger	-0.21	0.18	0.09	0.17	-0.13
Refueling	0.00	0.00	0.00	0.00	0.00
Total	-0.32	0.29	0.09	0.30	-0.20

Table E126: Difference in population-weighted exposure concentration (µg/m^3) by income category (on-road mobile sources)

	∆ Q1	∆ Q2	∆ Q3	∆ Q4	∆ Q5
Diesel HDV	0.07	0.03	0.01	-0.02	-0.07
Diesel LCV	0.01	0.00	0.00	0.00	-0.01
Diesel Passenger	0.00	0.00	0.00	0.00	0.00
Gasoline LCV	0.00	0.00	0.00	0.00	-0.01
Gasoline HDV	0.00	0.00	0.00	0.00	0.00
Gasoline Passenger	0.09	0.04	0.01	-0.03	-0.08
Refueling	0.00	0.00	0.00	0.00	0.00
Total	0.17	0.08	0.02	-0.06	-0.17

Table E127: Difference in population-weighted exposure concentration (μg/m^3) by age group (on-road mobile sources)

	Δ Age under 5	Δ Age under 18	Δ Women of child-bearing age	Δ Age over 65	Δ Age over 85
Diesel HDV	0.02	0.01	0.02	-0.05	-0.03
Diesel LCV	0.00	0.00	0.00	-0.01	0.00
Diesel Passenger	0.00	0.00	0.00	0.00	0.00
Gasoline LCV	0.00	0.00	0.00	0.00	0.00
Gasoline HDV	0.00	0.00	0.00	0.00	0.00
Gasoline Passenger	0.01	-0.01	0.05	-0.08	-0.04
Refueling	0.00	0.00	0.00	0.00	0.00
Total	0.04	0.00	0.08	-0.15	-0.08

Table E128: Difference in population-weighted exposure concentration (μg/m^3) by other group (on-road mobile sources)

	Δ Less than HS education	Δ Linguistic Isolation	Δ Disadvantaged Communities
Diesel HDV	0.10	0.04	0.29
Diesel LCV	0.01	0.00	0.03
Diesel Passenger	0.00	0.00	0.00
Gasoline LCV	0.01	0.00	0.02
Gasoline HDV	0.00	0.00	0.01
Gasoline Passenger	0.18	0.13	0.53
Refueling	0.00	0.00	0.00
Total	0.30	0.18	0.87

Table E129: Relative percent difference in population-weighted exposure concentration by race (%) (on-road mobile sources) (on-road mobile sources)

	Δ White	Δ Hispanic	Δ Asian	Δ Black	Δ Other
Diesel HDV	-18%	17%	-1%	20%	-10%
Diesel LCV	-10%	13%	-8%	9%	-6%
Diesel Passenger	-19%	16%	5%	25%	-11%
Gasoline LCV	-15%	13%	1%	18%	-7%
Gasoline HDV	-17%	15%	5%	16%	-11%
Gasoline Passenger	-21%	18%	9%	17%	-14%
Refueling	-15%	14%	5%	13%	-11%
Total	-19%	18%	5%	18%	-12%

Table E130: Relative percent difference in population-weighted exposure concentration (μg/m^3) by income category (on-road mobile sources)

	Δ Q1	Δ Q2	Δ Q3	Δ Q4	Δ Q5
Diesel HDV	13%	7%	1%	-5%	-14%
Diesel LCV	9%	5%	2%	-2%	-12%
Diesel Passenger	12%	7%	2%	-5%	-14%
Gasoline LCV	9%	5%	2%	-3%	-11%
Gasoline HDV	9%	4%	1%	-3%	-9%
Gasoline Passenger	9%	4%	1%	-3%	-8%
Refueling	8%	4%	1%	-3%	-9%
Total	10%	5%	1%	-3%	-10%

Table E131: Relative percent difference in population-weighted exposure concentration (µg/m^3) by age group (on-road mobile sources)

	Δ Age under 5	Δ Age under 18	Δ Women of child-bearing age	Δ Age over 65	Δ Age over 85
Diesel HDV	5%	2%	4%	-10%	-6%
Diesel LCV	6%	4%	3%	-9%	-5%
Diesel Passenger	1%	-2%	5%	-8%	-5%
Gasoline LCV	2%	0%	4%	-8%	-5%
Gasoline HDV	2%	0%	5%	-8%	-3%
Gasoline Passenger	1%	-1%	5%	-9%	-4%
Refueling	2%	-1%	4%	-7%	-3%
Total	3%	0%	5%	-9%	-5%

Table E132: Relative percent difference in population-weighted exposure concentration (µg/m^3) by age group (on-road mobile sources)

	Δ Less than HS education	Δ Linguistic Isolation	Δ Disadvantaged Communities
Diesel HDV	19%	8%	54%
Diesel LCV	13%	1%	40%
Diesel Passenger	18%	10%	43%
Gasoline LCV	14%	6%	35%
Gasoline HDV	16%	10%	48%
Gasoline Passenger	19%	14%	54%
Refueling	15%	10%	39%
Total	18%	11%	53%

Residential Sources of Outdoor Emissions

Table E133: Population-weighted exposure concentration (µg/m^3) by race (residential sources of outdoor emissions)

	Average	White	Hispanic	Asian	Black	Other
Wood Fireplace	0.15	0.16	0.14	0.19	0.15	0.17
Natural Gas	0.19	0.15	0.21	0.23	0.23	0.17
Lawn & Garden	0.10	0.08	0.11	0.11	0.11	0.09
Other Fuels	0.05	0.05	0.05	0.06	0.05	0.05
Other Wood	0.00	0.01	0.00	0.00	0.00	0.00
Solvent Use	0.06	0.05	0.07	0.07	0.08	0.06
Woodstove	0.02	0.02	0.01	0.01	0.03	0.02
Total	0.58	0.53	0.60	0.66	0.65	0.56

Table E134: Population-weighted exposure concentration (µg/m^3) by income category (residential sources of outdoor emissions)

	Average	Q1	Q2	Q3	Q4	Q5
Wood Fireplace	0.15	0.14	0.14	0.15	0.16	0.18
Natural Gas	0.19	0.20	0.19	0.19	0.19	0.19
Lawn & Garden	0.10	0.10	0.10	0.10	0.10	0.10
Other Fuels	0.05	0.05	0.05	0.05	0.05	0.06
Other Wood	0.00	0.00	0.00	0.00	0.00	0.00
Solvent Use	0.06	0.07	0.07	0.07	0.06	0.05
Woodstove	0.02	0.02	0.02	0.02	0.02	0.01
Total	0.58	0.59	0.58	0.58	0.57	0.59

Table E135: Population-weighted exposure concentration (µg/m^3) by age group (residential sources of outdoor emissions)

	Average	Age under 5	Age under 18	Women of child-bearing age	Age over 65	Age over 85
Wood Fireplace	0.15	0.15	0.15	0.16	0.15	0.16
Natural Gas	0.19	0.19	0.18	0.20	0.18	0.19
Lawn & Garden	0.10	0.10	0.10	0.10	0.09	0.09
Other Fuels	0.05	0.05	0.05	0.05	0.05	0.05
Other Wood	0.00	0.00	0.00	0.00	0.00	0.00
Solvent Use	0.06	0.06	0.06	0.07	0.06	0.06
Woodstove	0.02	0.02	0.02	0.02	0.02	0.01
Total	0.58	0.58	0.57	0.60	0.55	0.57

Table E136: Population-weighted exposure concentration (µg/m^3) by other group (residential sources of outdoor emissions)

	Average	Average over 25 (edu. compar.)	Less than HS education	Linguistic Isolation	Disadvantaged Communities
Wood Fireplace	0.15	0.15	0.14	0.15	0.14
Natural Gas	0.19	0.19	0.22	0.22	0.27
Lawn & Garden	0.10	0.10	0.10	0.10	0.11
Other Fuels	0.05	0.05	0.05	0.06	0.05
Other Wood	0.00	0.00	0.00	0.00	0.00
Solvent Use	0.06	0.06	0.07	0.07	0.07
Woodstove	0.02	0.02	0.02	0.01	0.00
Total	0.58	0.58	0.60	0.62	0.64

Table E137: Difference in population-weighted exposure concentration (µg/m^3) by race (residential sources of outdoor emissions)

	Δ White	Δ Hispanic	Δ Asian	Δ Black	Δ Other
Wood Fireplace	0.00	-0.01	0.03	-0.01	0.01
Natural Gas	-0.04	0.02	0.04	0.04	-0.02
Lawn & Garden	-0.01	0.01	0.01	0.01	-0.01
Other Fuels	0.00	0.00	0.01	0.00	0.00
Other Wood	0.00	0.00	0.00	0.00	0.00
Solvent Use	-0.01	0.01	0.00	0.02	0.00
Woodstove	0.00	0.00	-0.01	0.01	0.00
Total	-0.05	0.02	0.08	0.07	-0.02

Table E138: Difference in population-weighted exposure concentration (µg/m^3) by income category (residential sources of outdoor emissions)

	Δ Q1	Δ Q2	Δ Q3	Δ Q4	Δ Q5
Wood Fireplace	-0.01	-0.01	-0.01	0.00	0.03
Natural Gas	0.01	0.00	0.00	-0.01	0.00
Lawn & Garden	0.00	0.00	0.00	0.00	0.00
Other Fuels	0.00	0.00	0.00	0.00	0.01
Other Wood	0.00	0.00	0.00	0.00	0.00
Solvent Use	0.01	0.01	0.00	0.00	-0.01
Woodstove	0.00	0.01	0.00	0.00	-0.01
Total	0.01	0.00	0.00	-0.01	0.01

Table E139: Difference in population-weighted exposure concentration (μg/m^3) by age group (residential sources of outdoor emissions)

	Δ Age under 5	Δ Age under 18	Δ Women of child-bearing age	Δ Age over 65	Δ Age over 85
Wood Fireplace	0.00	0.00	0.00	0.00	0.01
Natural Gas	0.00	-0.01	0.01	-0.01	0.00
Lawn & Garden	0.00	0.00	0.00	0.00	0.00
Other Fuels	0.00	0.00	0.00	0.00	0.00
Other Wood	0.00	0.00	0.00	0.00	0.00
Solvent Use	0.00	0.00	0.00	0.00	-0.01
Woodstove	0.00	0.00	0.00	0.00	0.00
Total	0.00	-0.01	0.02	-0.03	-0.01

Table E140: Difference in population-weighted exposure concentration (μg/m^3) by other group (residential sources of outdoor emissions)

	Δ Less than HS education	Δ Linguistic Isolation	Δ Disadvantaged Communities
Wood Fireplace	-0.02	0.00	-0.02
Natural Gas	0.02	0.03	0.08
Lawn & Garden	0.01	0.01	0.01
Other Fuels	0.00	0.00	0.00
Other Wood	0.00	0.00	0.00
Solvent Use	0.01	0.00	0.01
Woodstove	0.00	-0.01	-0.02
Total	0.02	0.04	0.06

Table E141: Relative percent difference in population-weighted exposure concentration by race (%) (residential sources of outdoor emissions)

	∆ White	∆ Hispanic	∆ Asian	∆ Black	∆ Other
Wood Fireplace	2%	-10%	22%	-5%	9%
Natural Gas	-19%	12%	20%	21%	-11%
Lawn & Garden	-13%	8%	13%	11%	-7%
Other Fuels	-4%	-1%	16%	2%	-2%
Other Wood	55%	-37%	-65%	-1%	3%
Solvent Use	-16%	13%	3%	26%	-7%
Woodstove	25%	-18%	-54%	53%	13%
Total	-9%	3%	14%	12%	-3%

Table E142: Relative percent difference in population-weighted exposure concentration (µg/m^3) by income category (residential sources of outdoor emissions)

	∆ Q1	∆ Q2	∆ Q3	∆ Q4	∆ Q5
Wood Fireplace	-8%	-9%	-4%	2%	18%
Natural Gas	6%	0%	-2%	-3%	-1%
Lawn & Garden	1%	1%	1%	0%	-2%
Other Fuels	-5%	-6%	-3%	1%	11%
Other Wood	18%	26%	16%	-7%	-45%
Solvent Use	10%	8%	4%	-4%	-15%
Woodstove	18%	29%	18%	-8%	-48%
Total	1%	-1%	-1%	-1%	2%

Table E143: Relative percent difference in population-weighted exposure concentration ($\mu g/m^3$) by age group (residential sources of outdoor emissions)

	∆ Age under 5	∆ Age under 18	∆ Women of child-bearing age	∆ Age over 65	∆ Age over 85
Wood Fireplace	0%	-1%	1%	-1%	5%
Natural Gas	-2%	-4%	6%	-7%	-1%
Lawn & Garden	0%	-1%	3%	-5%	-4%
Other Fuels	-2%	-3%	3%	-2%	3%
Other Wood	1%	3%	0%	0%	-9%
Solvent Use	2%	0%	4%	-8%	-9%
Woodstove	4%	4%	-1%	0%	-18%
Total	0%	-2%	3%	-4%	-1%

Table E144: Relative percent difference in population-weighted exposure concentration ($\mu g/m^3$) by age group (residential sources of outdoor emissions)

	∆ Less than HS education	∆ Linguistic Isolation	∆ Disadvantaged Communities
Wood Fireplace	-11%	0%	-12%
Natural Gas	13%	16%	43%
Lawn & Garden	8%	7%	10%
Other Fuels	-5%	8%	1%
Other Wood	-24%	-57%	-100%
Solvent Use	17%	5%	15%
Woodstove	-5%	-40%	-99%
Total	3%	6%	11%

Appendix F: Description of Additional Data

Appendix F includes a list and description of data files created for this project which are available from the California Air Resources Board.

Source-Receptor Matrix:
File name: ca_isrm.ncf
File description: NetCDF file (28.35 GB)
Contents: This file contains the source-receptor matrix used to calculate intake, intake fraction, and concentrations for this work. This file can be used as an input to the InMAP model, or data may be accessed directly via a scripting language. To request additional information, go to https://inmap.run/.

Intake Fraction Spatial Database:
Folder name: iF_SpatialDatabase (282 MB)
Contents: InMAP grid shapefile, intake fraction spatial databases (222 comma-separated text files), and gridded population data (46 comma-separated text files).
File names and descriptions provided in README-SpatialDatabase.txt, contained in the folder.

Intake Fraction Summary Database:
Folder name: iF_SummaryDatabase
Contents: 4 spreadsheets (1.8 MB) including (1) average iF values (population-weighted, emissions-weighted, and sector average) and (2) per-capita intake and exposure concentration-change values by: demographic group, pollutant, height, sector, and subsector.
File names and descriptions provided in README-SummaryDatabase.txt, contained in the folder.

Source Category Database:
File name: CategorySCCList.xlsx
File description: Spreadsheet (365 kB)
Contents: Database providing the SCC identifier, SCC descriptions, and NEI Tier 1-3 descriptions for the detailed source categories included in each of the sector and subsectors described in this work.