April 2024

2020 Periodic Emissions Inventory: Errata

Maricopa County
Air Quality Department
Planning and Analysis

Commercial Cooking

The Maricopa County Air Quality Department (MCAQD) used the 2020 Wagon Wheel Tool, developed by the U.S. Environmental Protection Agency (EPA), to estimate commercial cooking emissions for the 2020 Periodic Emissions Inventory (PEI)[1]. The 2020 Wagon Wheel Tool used data on the number of restaurants in each county from the Dun & Bradstreet Hoovers Database, which classified restaurants into five types: ethnic food, fast food, family, seafood, and steak & barbeque. Then, the tool used data from a 2001 survey of 655 restaurants, conducted for the California Air Resource Board, to estimate the number of cooking devices and the amount of meat cooked on each type of cooking device at each type of restaurant. Finally, the tool used emission factors for each type of meat and cooking device to estimate emissions from commercial cooking.

After the PEI reports were made available for public comment, finalized, and published, EPA notified state and local agencies that the 2020 Wagon Wheel Tool overestimated the total amount of meat cooked in the United States, and the resulting emissions from commercial cooking. EPA identified this problem by comparing the total amount of meat cooked in the United States (estimated using the 2020 Wagon Wheel Tool) to estimates of total meat consumption from the U.S. Department of Agriculture (USDA).[2] The 2020 Wagon Wheel Tool predicted that commercial establishments cooked 82,684,929 tons of meat, including steak, hamburger, poultry, pork, seafood, and other meat products, which is more than double the 38,962,024 tons of meat consumed in the U.S. based on USDA data.

Meat Type	2020 Wagon Wheel Tool (tons)	USDA Meat Consumption Statistics (tons)
Steak	10,659,881	9,620,124
Hamburger	21,403,948	
Poultry	25,760,847	18,609,197
Pork	5,297,171	8,498,334
Seafood	9,525,427	2,006,500
Other	10,037,655	227,869
Total	**82,684,929**	**38,962,024**

[1] EPA. (2017). Nonpoint Emissions Methodologies and Operator Instructions (NEMO) for Commercial Cooking.
[2] Seltzer, Karl. (January 17, 2024). Proposed Cooking Emissions Methods: 2023 National Emissions Inventory. *Presentation to the Nonpoint Methods Advisory Group.*

Method Updates

Due to the discrepancy between the meat consumption estimates from the 2020 Wagon Wheel Tool and the USDA statistics, EPA developed a method action plan to refine the commercial cooking methods for the 2023 NEI[3]. In the new method, EPA will develop scaling factors for each NEI year based on total retail consumption of meat products from the USDA Food Availability Data System. The scaling factors will assume that 65 percent of meat is consumed at home and 35% of meat is consumed in commercial establishments (including restaurants, schools, food trucks, etc.). The scaling factors will adjust the amount of meat prepared, in each county, at each type of restaurant, and on each type of advice, so that the total amount of each type of meat is equal to 65 percent of the amount of each type of meat consumed per USDA statistics. The draft method action plan includes scaling factors that were developed based on 2020 data as an example of how the scaling factor will be developed and applied for the 2023 NEI.

Revised 2020 Emissions Estimates

The MCAQD evaluated the information provided by EPA and the revised method action plan and determined that it would be beneficial to revise the commercial cooking estimates in the 2020 PEIs for ozone precursors and particulate matter. The original results indicated that commercial cooking was a significant source of emissions, contributing 6% of particulate matter less than 10 microns in diameter (PM_{10}), 18% of particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), 0.3% (520.7 tons) of volatile organic compounds (VOC), and 0.4% (1,454.2 tons) of carbon monoxide (CO). The 2020 PEI estimates need to be as accurate as possible, because the estimates will be used to project 2026 commercial cooking emissions for the serious ozone plan. In addition, the revised National Ambient Air Quality Standards for particulate matter are generating public interest on sources of $PM_{2.5}$ emissions. To ensure the accuracy of the estimates, the 2020 commercial cooking emissions were recalculated in accordance with the revised method action plan developed by EPA. The revised estimates indicate that commercial cooking contributes 2.2% of PM_{10}, and 7.3% of $PM_{2.5}$ in Maricopa County. The revised contribution estimate for $PM_{2.5}$ from commercial cooking is consistent with research that indicates commercial cooking may contribute ~8% of observed $PM_{2.5}$ in urban areas.[4]

The following table shows revised emissions estimates for commercial cooking in Maricopa County.

[3] EPA. (2024). Method Action Plan for Commercial Cooking.
[4] id.

Source Category	Annual Emissions (tons/year)			
	CO	VOC	PM_{10}	$PM_{2.5}$
Conveyorized Char-broilers	46.4	14.5	66.5	66.5
Underfired Char-broilers	184.5	61.3	435.7	435.7
Deep-Fat Fryers	52.8	14.7	586.8	586.8
Flat Griddles	17.1	11.6	199.9	199.9
Clamshell Griddles	3.9	0.1	7.9	7.9
Total Commercial Cooking	**304.6**	**102.2**	**1,296.8**	**1,296.8**
Percent of Total Emissions	**0.1%**	**0.1%**	**2.2%**	**7.3%**

Other Nonpoint Categories

While updating the total emissions to include the revised estimates for commercial cooking, MCAQD discovered two linking errors in the spreadsheet where total emissions from all source categories were calculated. These errors were related to the residential wood combustion and fabricated metal categories.

Residential Wood Combustion

The following table shows original and revised emissions estimates for residential wood combustion in Maricopa County.

	Annual Emissions (tons/year)							
	PEI for Ozone Precursors			PEI for Particulate Matter				
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_X	NH_3
Original	1,798.6	187.1	11,193.6	1,666.1	1,620.5	186.1	33.9	91.7

	Annual Emissions (tons/year)							
	PEI for Ozone Precursors			PEI for Particulate Matter				
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_X	NH_3
Revised	1,784.0	185.5	11,102.5	1,660.8	1,615.3	185.5	33.8	91.4

Fabricated Metals

The following table shows original and revised emissions estimates for fabricated metal products manufacturing in Maricopa County.

	Annual Emissions (tons/year)							
	PEI for Ozone Precursors			PEI for Particulate Matter				
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_X	NH_3
Original	7.2	8.3	1.6	30.4	12.0	1.2	0.0	0.0
Revised	7.2	1.2	0.3	30.4	12.0	1.2	0.0	0.0

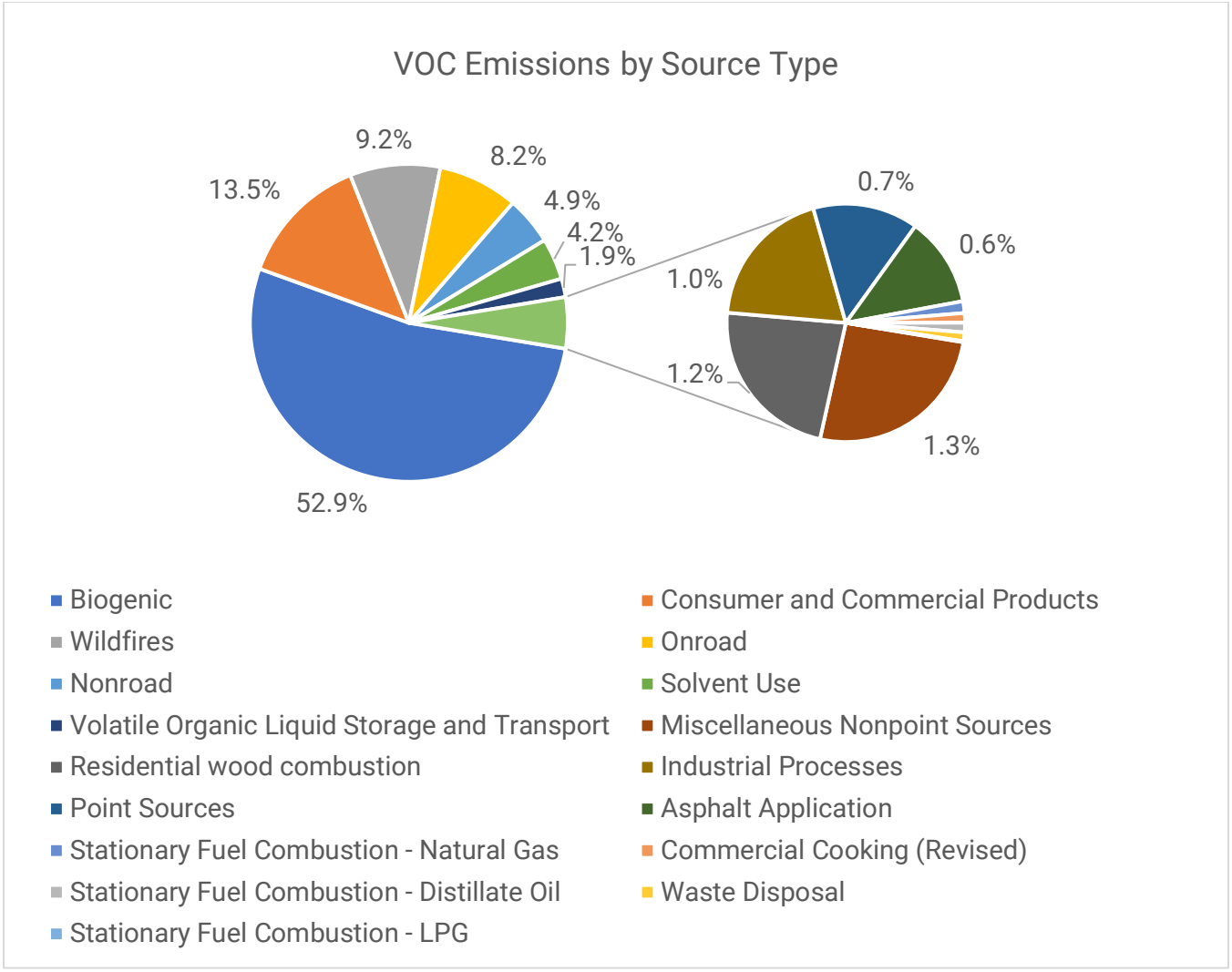
Updated Emissions by Source Category

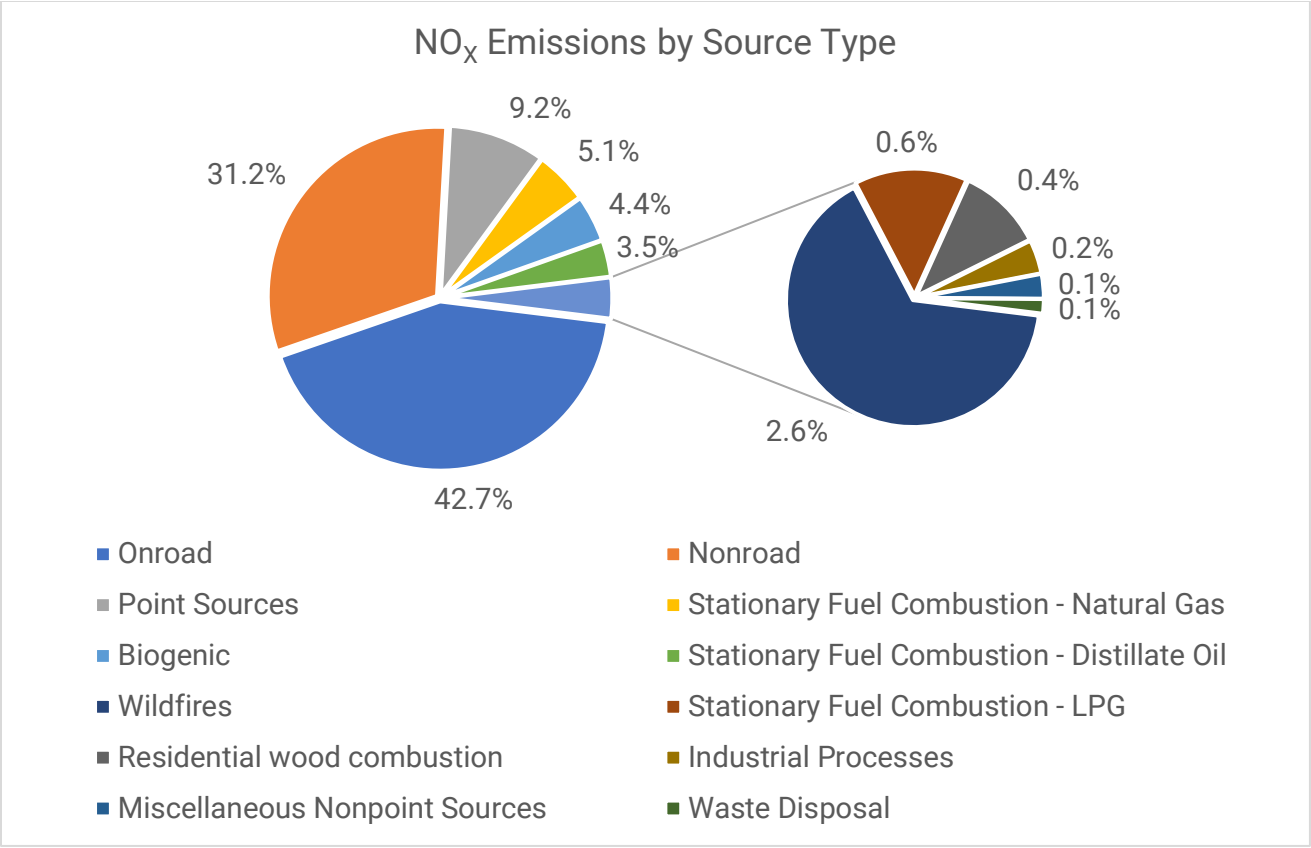
The following table shows the original emissions estimates for point sources, nonroad mobile sources, onroad mobile sources, and biogenic sources, along with revised estimates for nonpoint sources and total emissions.

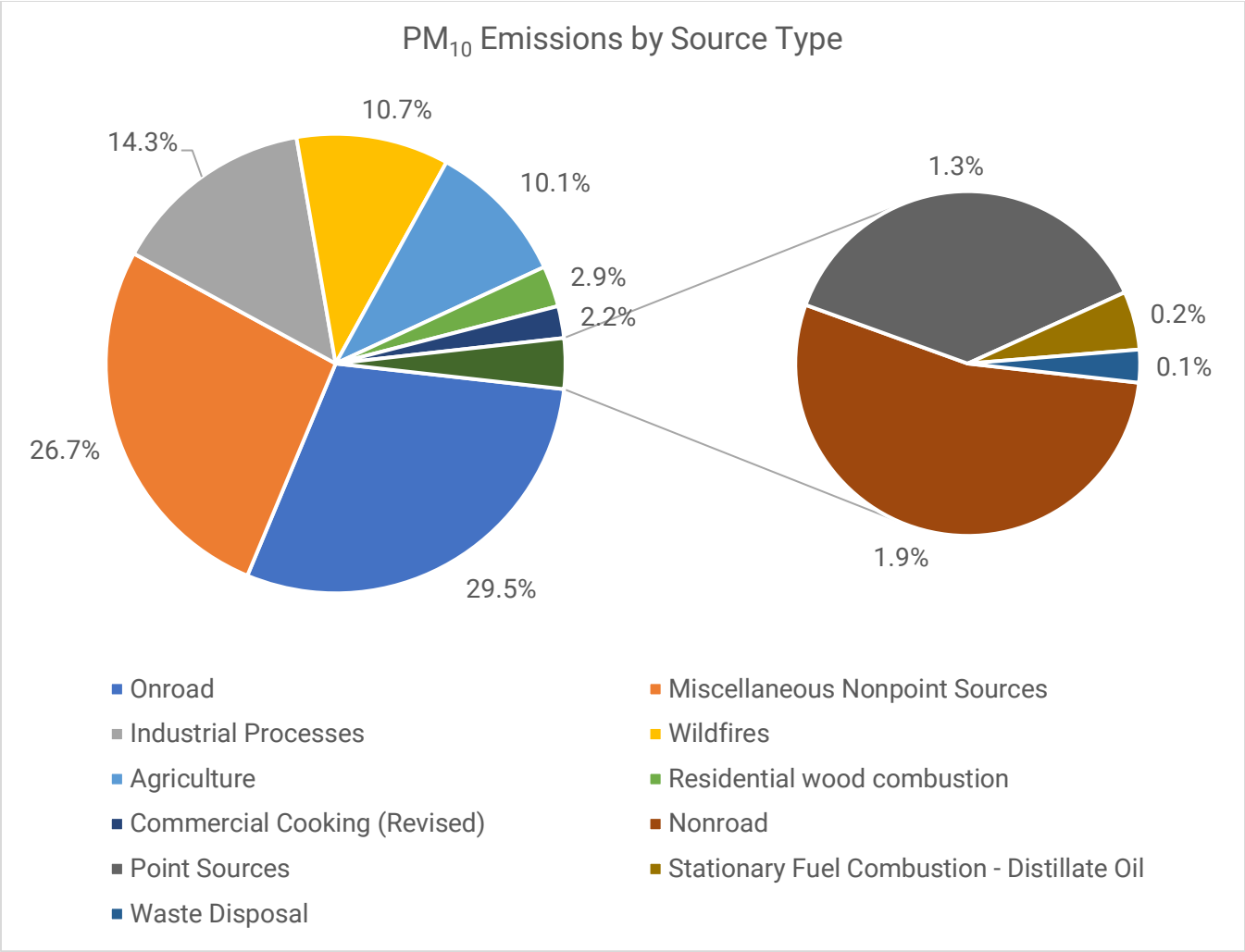
	Annual Emissions (tons/year)							
	Ozone Precursors			Particulate Matter and Precursors				
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_X	NH_3
Point	1,117.6	4,001.0	1,706.7	772.9	649.2	4,001.0	139.6	232.3
Nonpoint	49,737.0	5,417.2	72,990.6	38,791.9	12,657.8	5,417.2	752.3	23,952.3
Nonroad Mobile	7,363.6	13,569.5	110,385.0	1,102.2	1,056.3	13,569.5	294.4	25.3

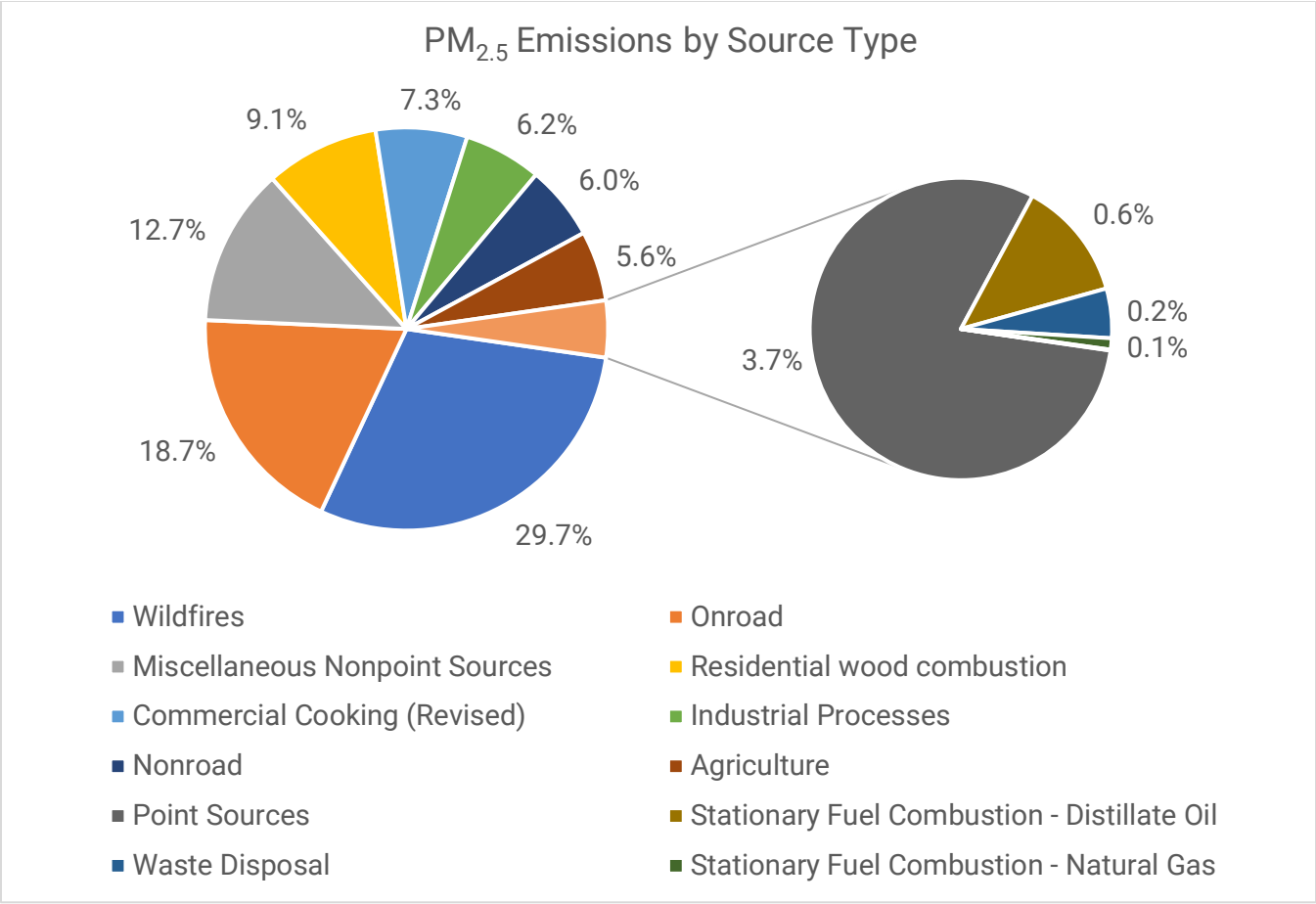
	Annual Emissions (tons/year)							
	Ozone Precursors			Particulate Matter and Precursors				
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_X	NH_3
Onroad Mobile	12,225.3	18,604.8	170,377.8	17,010.2	3,312.8	18,604.8	78.6	1,120.4
Biogenic	79,213.2	1,934.0	4,989.1	0.0	0.0	1,934.0	0.0	0.0
Total Emissions	149,656.7	43,526.4	360,449.2	57,677.2	17,676.1	43,526.5	1,264.9	25,330.3

Emissions by Source Category




NOX Emissions by Source Type
9.2%
5.1%
31.2%
4.4%
3.5%
0.6%
0.4%
0.2%
0.1%
0.1%
2.6%
42.7%
Onroad
Nonroad
Point Sources
Stationary Fuel Combustion - Natural Gas
Biogenic
Stationary Fuel Combustion - Distillate Oil
Wildfires
Stationary Fuel Combustion - LPG
Residential wood combustion
Industrial Processes
Miscellaneous Nonpoint Sources
Waste Disposal


PM10 Emissions by Source Type
10.7%
14.3%
10.1%
2.9%
2.2%
26.7%
29.5%
1.3%
0.2%
0.1%
1.9%
Onroad
Miscellaneous Nonpoint Sources
Industrial Processes
Wildfires
Agriculture
Residential wood combustion
Commercial Cooking (Revised)
Nonroad
Point Sources
Stationary Fuel Combustion - Distillate Oil
Waste Disposal


PM2.5 Emissions by Source Type
29.7%
18.7%
12.7%
9.1%
7.3%
6.2%
6.0%
5.6%
3.7%
0.6%
0.2%
0.1%
Wildfires
Onroad
Miscellaneous Nonpoint Sources
Residential wood combustion
Commercial Cooking (Revised)
Industrial Processes
Nonroad
Agriculture
Point Sources
Stationary Fuel Combustion - Distillate Oil
Waste Disposal
Stationary Fuel Combustion - Natural Gas

Maricopa County
Air Quality Department
Planning and Analysis
Maricopa.gov/AQ