Addendum to 2019-2023 Austin-Round Rock-Georgetown MSA Regional Air Quality Plan

November 10, 2021

Prepared by the Capital Area Council of Governments

EXECUTIVE SUMMARY

The Addendum to 2019-2023 Austin-Round Rock-Georgetown Metropolitan Statistical Area (MSA) Regional Air Quality Plan (Plan) is intended to:

1. Include fine particulate matter ($PM_{2.5}$), as a focus of this plan in order to comply with the Plan's two objectives:
    a. Primary objective: maximize the probability of compliance with the NAAQS region-wide; and
    b. Secondary objective: otherwise minimizing the health and environmental impacts of regional air pollution.
2. Update the Plan's end date from December 31, 2023, to December 31, 2026, to account for EPA's announced reconsideration of the 2020 review of the Particulate Matter (PM) National Ambient Air Quality Standards (NAAQS) and the results of the review of the ozone (O_3) NAAQS due in 2025; and

In order to support these objectives, this Plan calls for:

1. Implementation of controls on the direct emissions of $PM_{2.5}$;
2. Outreach, education, and technical support to enhance $PM_{2.5}$ emission reductions;
3. Outreach and education to reduce public exposure to PM when high enough to be considered "moderate" or worse based on the U.S. Environmental Protection Agency's (EPA's) Air Quality Index (AQI);
4. PM monitoring;
5. Other PM research and planning activities; and
6. Policy advocacy.

The Plan identifies regional particulate matter (PM) issues, defines objectives for addressing these issues, establishes strategies for achieving these objectives, and lays out actions that will advance these strategies.

This Addendum to the Plan was developed by the Capital Area Council of Governments (CAPCOG) Air Quality Program in consultation with the Central Texas Clean Air Coalition (CAC), the CAC Advisory Committee (CACAC), and other stakeholders throughout 2020 and 2021. This Addendum to the Plan was adopted by the CAC in August 2021.

From April 2021 – July 2021, members of the CAC adopted PM emission reduction commitments to support this Plan. CAPCOG has prepared a summary of these commitments in Appendix A. These commitments from the CAC will be updated periodically to reflect changes in membership in the CAC or changes in the commitments by individual organizations. CAPCOG will include any such updates in an annual report that will be distributed in July of each year.

This addendum will also serve as the CAC's "Path Forward" on participating in EPA's PM Advance Program.

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2 INTRODUCTION

This Addendum to the 2019-2023 Austin-Round Rock-Georgetown MSA Regional Air Quality Plan (Plan) is intended to:

1. Include particulate matter (PM), and especially fine particulate matter ($PM_{2.5}$), as a focus in order to comply with the Plan's two objectives:
    a. Primary objective: maximize the probability of compliance with the NAAQS region-wide;
    b. Secondary objective: otherwise minimizing the health and environmental impacts of regional air pollution; and
2. Extend the Plan's timeframe from 2023 to 2026.

In order to achieve these objectives, this plan calls for:

1. Implementation of controls on the emissions of $PM_{2.5}$;
2. Outreach, education, and technical support to enhance $PM_{2.5}$ emission reductions;
3. Outreach and education to reduce public exposure to PM when high enough to be considered "moderate" or worse based on the U.S. Environmental Protection Agency's (EPA's) Air Quality Index (AQI);
4. PM monitoring;
5. Other PM research and planning activities; and
6. Policy advocacy.

3 PARTICULATE MATTER

3.1 BACKGROUND

In a fall 2019 response to CAPCOG's 2018 Annual Air Quality Report, staff from the EPA noted the increases in the Austin area's PM "design values" in recent years and suggested that the CAC may wish to consider participating in EPA's PM Advance Program. At the time, EPA staff had recently released a draft "Policy Assessment" for its current review of the PM National Ambient Air Quality Standards (NAAQS) that recommended that the EPA Administrator consider strengthening the NAAQS for annual fine particulate matter ($PM_{2.5}$) from 12.0 micrograms per cubic meter ($\mu g/m^3$) to between 8.0 and 11.9 $\mu g/m^3$, in order to improve public health protections. The Austin-Round Rock-Georgetown Metropolitan Statistical Area's (MSA's) 2017-2019 annual $PM_{2.5}$ "design value" was 9.8 $\mu g/m^3$, so this proposal indicated that the MSA's annual $PM_{2.5}$ concentrations might exceed the level of the NAAQS. If so, it could have put the region at risk of a nonattainment designation for the annual $PM_{2.5}$ NAAQS in 2022 or 2023 if EPA changed the PM NAAQS in late 2020.

In response, at its November 2019 meeting, CAPCOG's 2020 air quality program work plan, which was approved by the CAC, included conducting an analysis of the region's potential participation in EPA's PM Advance Program and seeking a recommendation from the CAC Advisory Committee (CACAC). At its July 30, 2020, meeting, the CACAC voted unanimously to recommend participation in PM Advance.

Subsequently, at the meeting on August 12, 2020, the CAC voted unanimously to request EPA's approval to participate in its PM Advance Program.

CAPCOG worked with the CAC and CACAC over the next year to develop an update to the 2019-2023 Regional Air Quality Plan to add measures designed to reduce annual or peak 24-hour $PM_{2.5}$ concentrations beyond the measures that are already being implemented to reduce peak 8-hour O_3 concentrations. This involved asking existing CAC members to consider adopting new measures targeted at reducing PM air pollution.

3.2 Health Effects of $PM_{2.5}$

PM contains microscopic solids or liquid droplets that are so small that they can be inhaled and cause serious health problems. Some particles less than 10 micrometers in diameter can get deep into the lungs and some may even get into the bloodstream. Therefore, $PM_{2.5}$ poses the greatest risk to health. Additionally, exposure to $PM_{2.5}$ can disproportionately affect certain populations such as people of color, low income households, linguistic isolation, and education levels. These groups are known as Environmental Justice (EJ) communities.

During EPA's review of the $PM_{2.5}$ and O_3 NAAQS in 2019 and 2020, EPA released the health effects of these pollutants in the Integrated Science Assessments (ISAs) for PM[1] and O_3[2]. The table below lists the pollutants and which health effects are either "casual" or "likely casual." As the table shows, both long-term and short-term exposure to PM2.5 are associated with much more serious health effects than O3 is now associated with. EPA's ISAs for both pollutants also indicated that there was no clear threshold below which harm was not occurring for these pollutants. For the ISA's "short-term" exposure was defined as exposures of up to 1 month, and "long-term" exposure was defined as exposures of more than 1 month.

Table 2-1. "Causal" or "Likely Causal" Health Effects of Exposure to Eleveated O_3 and $PM_{2.5}$

Health Endpoint	Short-Term O_3	Long-Term O_3	Long-Term $PM_{2.5}$	Short-Term $PM_{2.5}$
Respiratory Effects	☑	☑	☑	☑
Cardiovascular Effects	☐	☐	☑	☑
Metabolic Effects	☑	☐	☐	☐
Nervous System Effects	☐	☐	☑	☐
Reproduction & Fertility	☐	☐	☐	☐
Pregnancy and Birth Outcomes	☐	☐	☐	☐
Cancer	☐	☐	☑	☐
Mortality	☐	☐	☑	☑

Notable changes in the public health effect assessments from the ISAs are:

- $PM_{2.5}$:
  - Cancer effects upgraded from "suggestive of, but insufficient to infer" to "likely to be causal"

[1] https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=347534
[2] https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=348522

  - Nervous system effects newly evaluated, assessed as “likely to be causal” for long-term exposure
- O_3:
  - Metabolic effects newly evaluated, assessed as “likely to be causal” for short-term exposure
  - Cardiovascular effects and total mortality from short-term exposure downgraded from “likely to be causal” to “suggestive of, but not sufficient to infer”

Therefore, from a public health standpoint, elevated $PM_{2.5}$ concentrations are a greater concern than elevated O_3 concentrations for the CAC.

EPA finalized its review of the PM NAAQS on December 7, 2020, without changes.[3] EPA then finalized the O_3 NAAQS on December 23, 2020, without changes.[4] With the change in federal leadership, on January 20, 2021, President Biden tasked the EPA to review the prior administration’s decision to retain the PM and O_3 NAAQS[5]. Subsequently, on June 10, 2021, the EPA announced that it will reconsider the December 2020 decision to retain the PM NAAQS because “available scientific evidence and technical information indicate that the current standards may not be adequate to protect public health and welfare, as required by the Clean Air Act.” [6] EPA expects to make a proposal in Summer 2022 with finalization in 2023. If EPA revises the PM NAAQS, the subsequent area designation process would extend to either 2025 or, in certain circumstances, 2026.

One of the key issues for the region is that even though it is attaining the NAAQS, there are still potentially significant benefits from reducing ambient $PM_{2.5}$ levels. EPA released the following graphs of daily and annual $PM_{2.5}$ exposure that indicate that there is no threshold for exposure to $PM_{2.5}$ were health effects are not observed[7]. The current NAAQS for daily (AKA, short-term) $PM_{2.5}$ is 35.0 $\mu g/m^3$, and the NAAQS for annual (AKA, long-term) $PM_{2.5}$ is 12.0 $\mu g/m^3$.

[3] https://www.govinfo.gov/content/pkg/FR-2020-12-18/pdf/2020-27125.pdf
[4] https://www.federalregister.gov/documents/2020/12/31/2020-28871/review-of-the-ozone-national-ambient-air-quality-standards
[5] https://www.whitehouse.gov/briefing-room/statements-releases/2021/01/20/fact-sheet-list-of-agency-actions-for-review/
[6] https://www.epa.gov/newsreleases/epa-reexamine-health-standards-harmful-soot-previous-administration-left-unchanged
[7] EPA. *Integrated Science Assessment for Particulate Matter*. 2019: https://www.epa.gov/isa/integrated-science-assessment-isa-particulate-matter

Figure 2-1. EPA Short-Term $PM_{2.5}$ Exposure

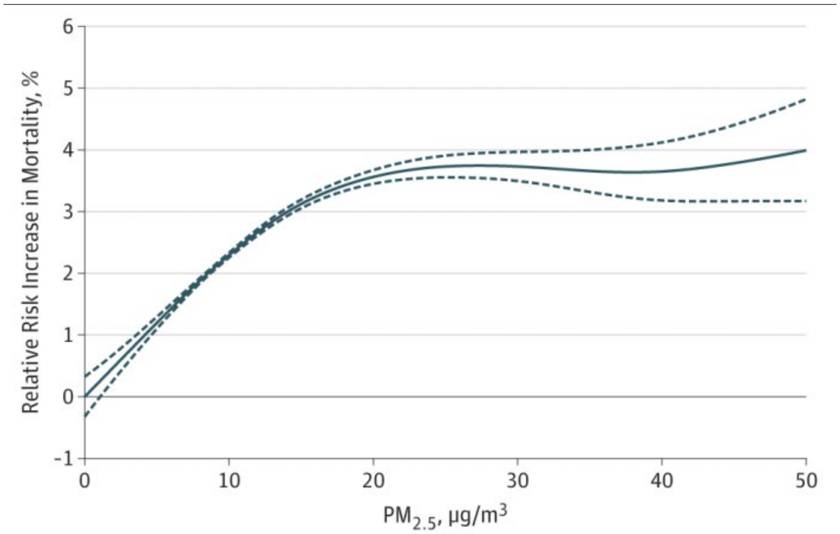
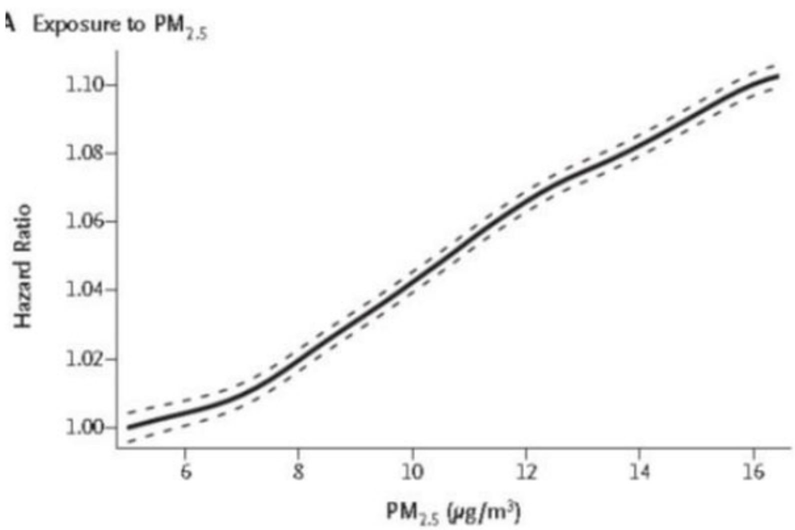


Figure 2-2. EPA Long-Term $PM_{2.5}$ Exposure

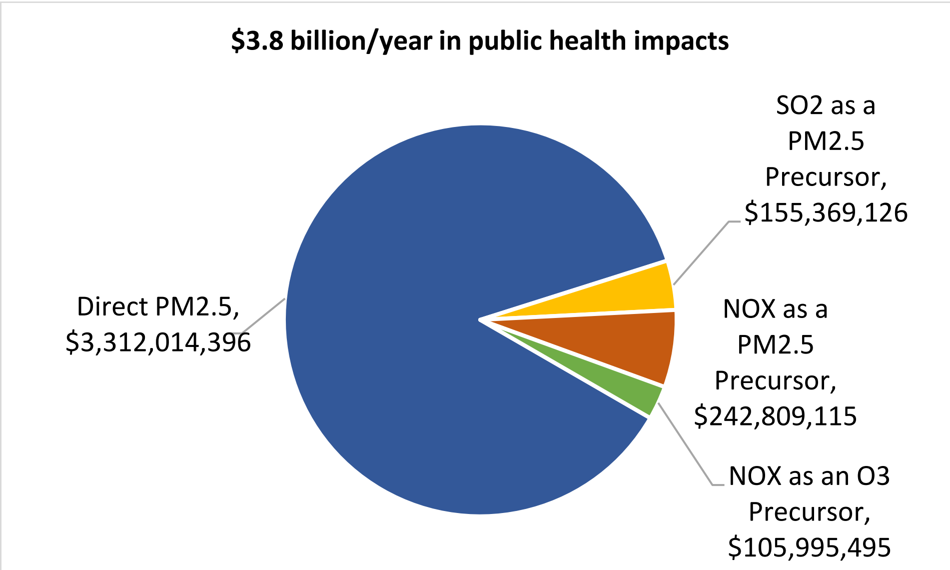


Another tool for understanding the benefits of $PM_{2.5}$ reductions are EPA's monetization of the health impacts of PM-related emissions are the nation-wide "benefit per ton" ratios for reducing three types of $PM_{2.5}$ precursor emissions: primary $PM_{2.5}$ (i.e., direct emissions of 2.5 micrometers or smaller), SO_2 (which forms secondary sulfate particles), and NO_X (which forms secondary nitrate particles).[8] Using this data in conjunction with data from the 2017 National Emissions Inventory (NEI), CAPCOG calculated an estimate of the monetized impacts of the MSA's 2017 $PM_{2.5}$, SO_2, and NO_X emissions, shown in the pie chart below.[9] Caution should be taken in citing/quoting these statistics, since they are based on national-level modeling and many broad planning assumptions, but they do provide a useful "order-of-magnitude"-level assessment of the negative public health/economic externalities of the region's

[8] https://www.epa.gov/benmap/sector-based-pm25-benefit-ton-estimates
[9] https://www.epa.gov/air-emissions-inventories/2017-national-emissions-inventory-nei-data

criteria air pollution. Additionally, it provides a useful point of comparison between the relative importance of PM as a public health concern.

Figure 2-3. Estimated Monetized Impacts of Regional Emissions of NO_X, SO_2, and $PM_{2.5}$



Of note is how the topline number of $3.8 billion/year significantly exceeds the $1.5 billion/year in the "worst-case scenario" estimates of the cost of an O_3 nonattainment designation from 2018-2046 in CAPCOG's "Cost of O_3 Nonattainment" study in 2015[10]. This suggests that the public benefits of taking action to reduce regional PM levels may exceed the public benefits of reducing regional O_3 levels.

EPA's NAAQS review indicated that certain individuals are more susceptible to the effects of $PM_{2.5}$ pollution either due to physiological factors or socioeconomic factors (i.e., disproportionately high exposure to pollution). Those populations include:

- Babies, children, and teenagers;
- Senior citizens;
- Adults with respiratory and/or cardiovascular illnesses;
- Overweight or obese;
- Low socio-economic status;
- Current or former smokers;
- People with specific genetic variants; and
- Non-white (due to differential exposure).

3.3 Regional PM Levels

For the NAAQS, there are two pollutants that comprise particulate matter (PM) - coarse particulate matter (PM_{10}), particles that are 10 μm and smaller, and $PM_{2.5}$, particles that are 2.5 μm and smaller.

[10] https://www.capcog.org/wp-content/uploads/2021/07/Possible-Costs-of-a-Nonattainment-Designation-9-22-15.pdf

$PM_{2.5}$ is further broken down into annual design value and 24-hour or daily design values. All of the NAAQS for PM use three years of data to determine compliance.

- The annual $PM_{2.5}$ NAAQS is 12.0 µg/m^3 is intended to provide protection from long-term exposure to $PM_{2.5}$, which is most strongly associated with serious health impacts;
- The 24-hour $PM_{2.5}$ NAAQS is 35 µg/m^3, based on the 98th percentile of daily 24-hour concentrations, in order to provide added protection from short-term spikes in $PM_{2.5}$ concentrations;
- The 24-hour PM_{10} NAAQS is 150 µg/m^3, which is not allowed to be exceeded more than an average of 1 time per year, in order to protect added protection from short-term exposure to particles 2.5 – 10 µm small.

Within the Austin-Round Rock-Georgetown MSA, TCEQ operates Federal Reference Method (FRM) or Federal Equivalent Method (FEM) PM monitors at four locations in Travis County:

- CAMS 3: $PM_{2.5}$ sampler collects continuous $PM_{2.5}$ data
- CAMS 38: PM_{10} sampler collects 24-hour samples once every six days
- CAMS 171: $PM_{2.5}$ sampler collects continuous $PM_{2.5}$ data, PM_{10} sampler collects 24-hour samples once every six days
- CAMS 1068: $PM_{2.5}$ sampler collects continuous $PM_{2.5}$ data

Figure 2-4. Map of TCEQ PM Monitors in the Austin-Round Rock-Georgetown MSA, 2021

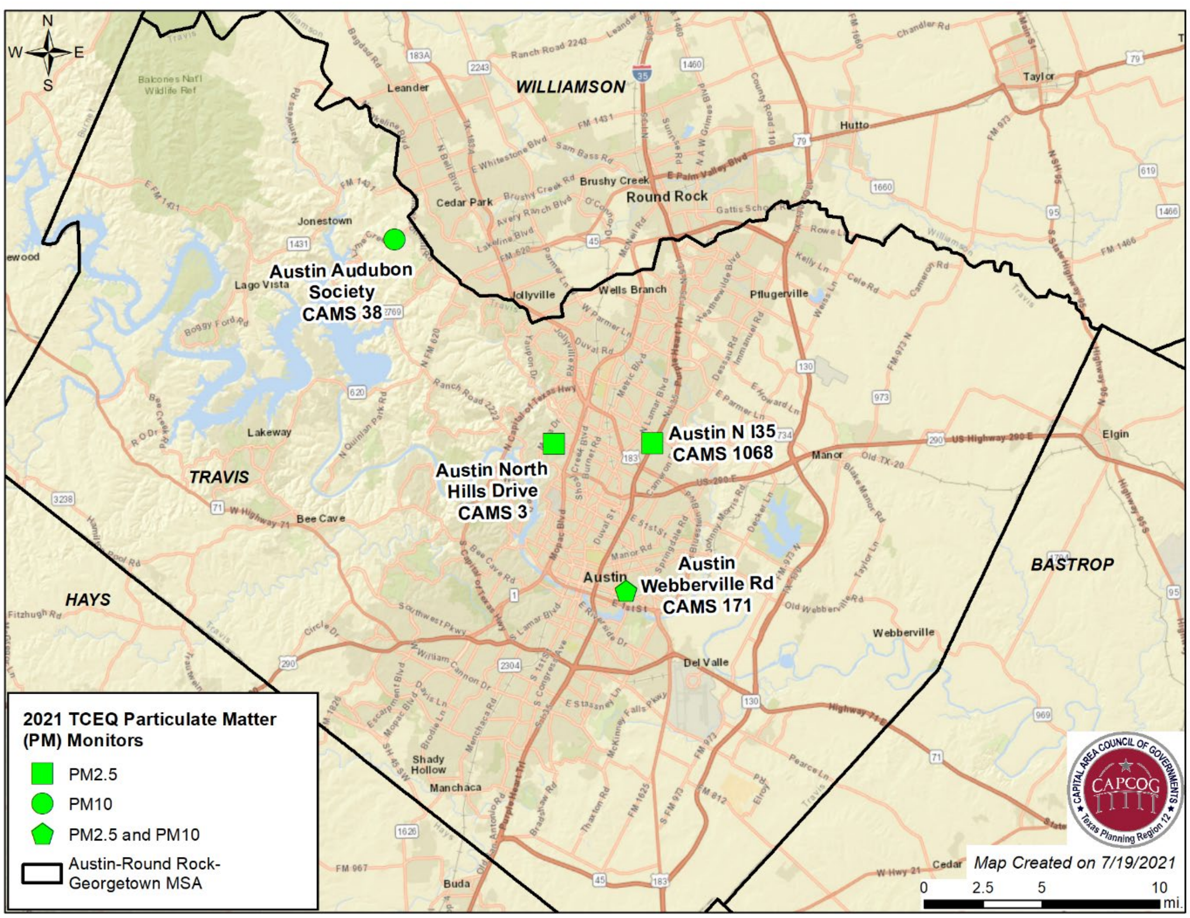
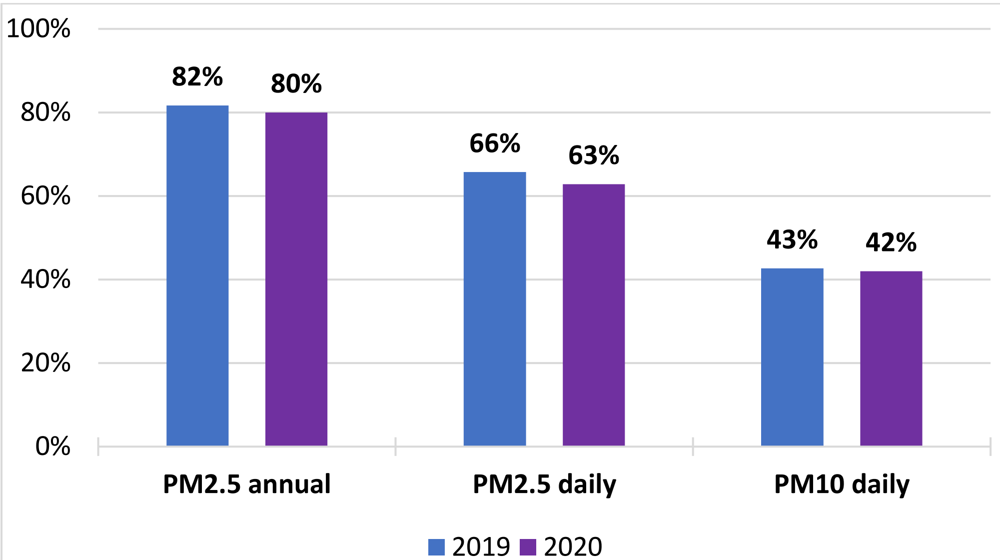


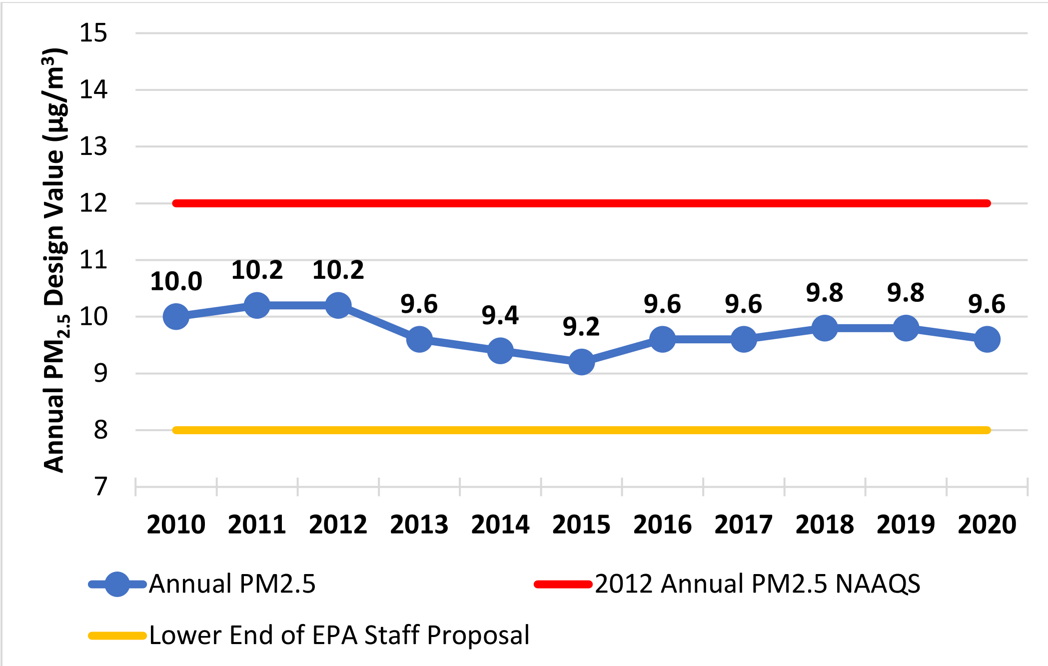
Figure 3-2 below illustrates the MSA's 2019 and 2020 PM design values compared to each primary NAAQS. As evident in the figure, the MSA is closest to violating the $PM_{2.5}$ annual NAAQS. Although, there was a decrease from 2019 to 2020.

Figure 2-5. Austin-Round Rock-Georgetown MSA PM as a Percentage of Maximum Pollution Allowable Under Current Primary NAAQS, 2019-2020



From a NAAQS compliance standpoint, the PM NAAQS of most concern is the annual $PM_{2.5}$ NAAQS. Figure 3-3 displays the annual $PM_{2.5}$ design values from 2010-2020 and the levels of the 2012 $PM_{2.5}$ annual NAAQS of 12.0 $\mu g/m^3$. As evident in the figure, the $PM_{2.5}$ annual design value has fluctuated over time, and the region's most recent annual $PM_{2.5}$ concentrations exceed regional PM2.5 concentrations five years ago.

Figure 2-6. Austin-Round Rock-Georgetown MSA Annual $PM_{2.5}$ Design Values, 2010-2020



3.4 Implementation of Controls on the Emissions of $PM_{2.5}$

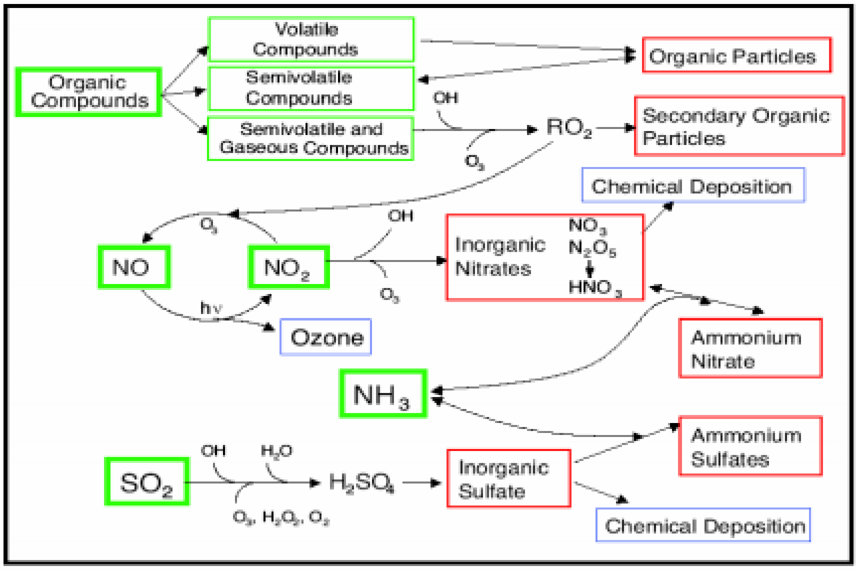
The existing regional air quality plan focuses on reducing O_3-season NO_X emissions to control peak 8-hour O_3 levels, and in almost all cases, these measures should also reduce annual average annual $PM_{2.5}$ concentrations, 24-hour $PM_{2.5}$ concentrations, or both. However, it appears that the strategies being implemented at the federal, state, and local level to date have not led to the kind of reductions in $PM_{2.5}$ levels year-over-year that we have been seeing in the region for O_3. Therefore, this update to the regional air quality plan adds reducing direct emissions of $PM_{2.5}$ as a priority on par with reducing O_3-season NO_X emissions to support both NAAQS compliance and general public health.

3.4.1 Sources of the Region's PM Pollution

While O_3 and $PM_{2.5}$ are both secondary pollutants (i.e., formed in the atmosphere due to chemical reactions between "primary" pollutant emissions), $PM_{2.5}$ can also be a "primary" pollutant. O_3's precursors are NO_X and VOC; these pollutants are also precursors for $PM_{2.5}$. However, $PM_{2.5}$ precursors also include direct $PM_{2.5}$ emissions, ammonia (NH_3) emissions, and sulfur dioxide (SO_2) emissions.

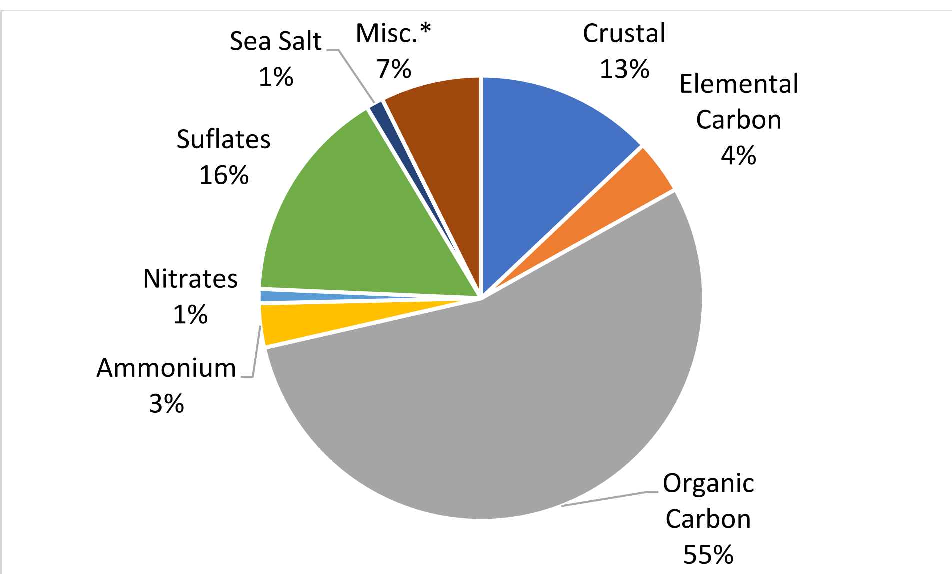
The following figure helps explain the various sources of $PM_{2.5}$, with green boxes representing primary gaseous emissions and their related $PM_{2.5}$ particles.

Figure 2-7. Diagram Showing Relationships Between Gaseous Emissions and Various Types of $PM_{2.5}$ Particles[11]



Direct $PM_{2.5}$ emissions can be further characterized as "crustal" $PM_{2.5}$ (i.e., dust and soil), organic carbon $PM_{2.5}$ (particles including hydrogen and carbon), and elemental carbon (particles consisting of graphite). Whereas modeling tells us that about 99% of peak O_3 formation in the region is due to NO_X emissions, organic carbon is the primary contributor to annual $PM_{2.5}$ concentrations in the region.

Figure 2-8. Modeled Speciation of Austin-Round Rock-Georgetown MSA Annual $PM_{2.5}$ Design Value, 2016[12]



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[11] Hodan, William M; and William Barnard. "Evaluating the Contribution of PM2.5 Precursor Gases and Re-entrained Road Emissions to Mobile Source PM2.5 Particulate Matter Emissions." Prepared by MACTAC for the Federal Highway Administration. Presented at EPA's 13 International Emissions Inventory Conference in Clearwater, Florida, June 10, 2004. Available online at: https://www3.epa.gov/ttnchie1/conference/ei13/mobile/hodan.pdf

[12] Data available at: ftp://newftp.epa.gov/Air/aqmg/SMAT/capcog/

3.4.2 Continuation of Existing State Controls

This plan counts on the continuation of a number of existing state-level emission reduction and control measures applicable to sources in the MSA that reduce or limit PM emissions. Many of these measures have been incorporated into the State Implementation Plan (SIP) as a part of the state's strategy to attain and maintain compliance with the NAAQS throughout the state codified in 30 TAC Chapter 111, Subchapter A: Visible Emissions and Particulate Matter and Subchapter B: Outdoor Burning. The plan also counts on PM emissions limits included in permits issued by TCEQ.

3.4.3 Regional and Local Measures Implemented by CAC Members

Beyond the PM reduction impact of continuing the state-level measures applicable to the region, additional local and regional actions would be needed to help the region stay in compliance with the $PM_{2.5}$ NAAQS. The CAC will implement a number of new measures and existing measures that target emissions from construction and demolition activities, commercial cooking and charbroiling, road dust, mining and quarrying activities, prescribed burning and open burning, mobile sources, and stationary combustion sources. In addition to these measures, the CAC will implement the installation of additional $PM_{2.5}$ sensor or monitors and promote the awareness of the health effects of PM air pollution. Each CAC member has selected measures that it commits to implement during the term of this Plan, and it will provide annual updates to CAPCOG on the status of these measures.

These measures are grouped into three categories:

- Implement within the CAC member's organizational operations;
- Encourage or require for third party organizations to implement; and
- Educate and encourage the public at large to implement.

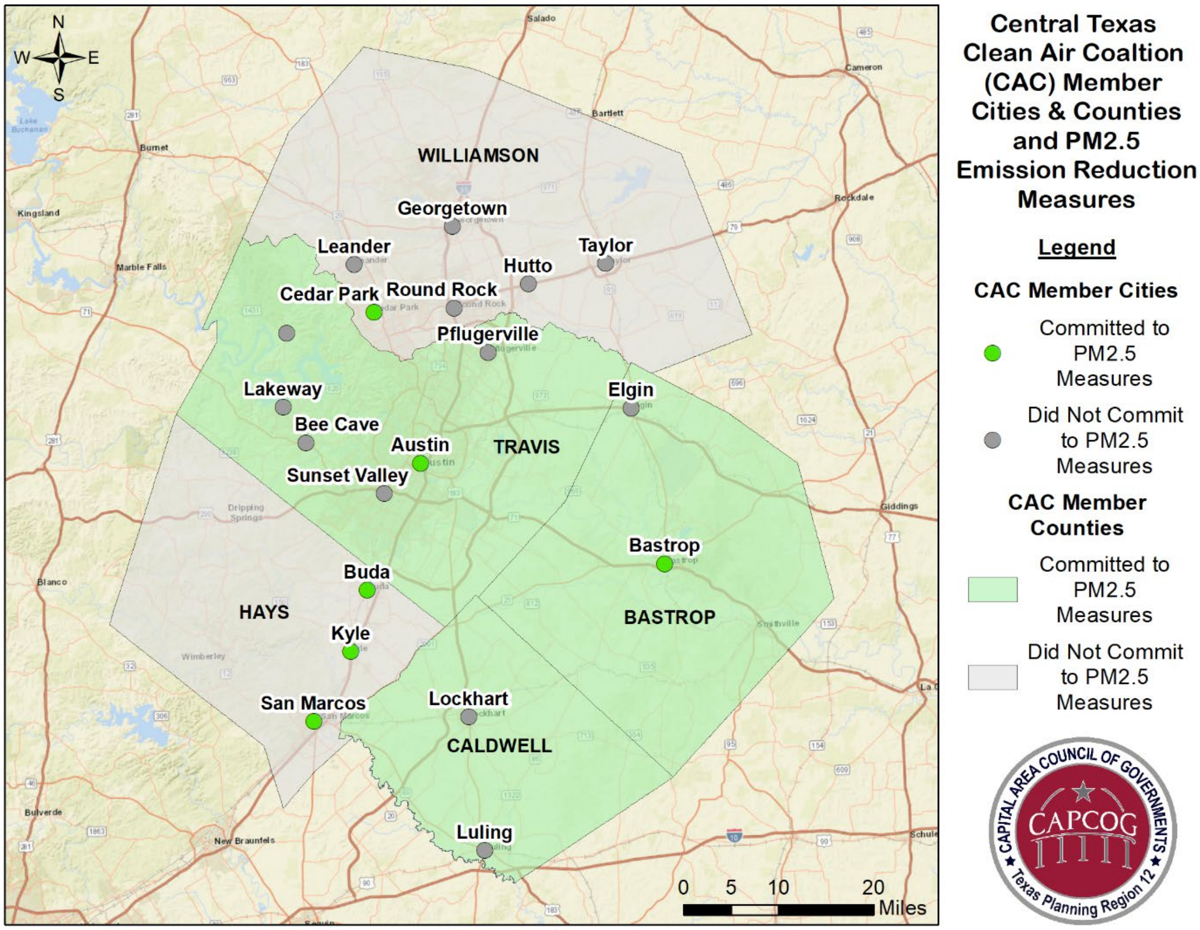
The individual measures are listed below in each category. Additionally, the number of CAC members that have committed to implement the measure are included. Some measures were taken from the existing plan since the reductions in nitrogen oxides (NO_x) has a co-benefit in reducing PM. Therefore, each measure is identified whether it is a new or existing measure.

Table 2-2. $PM_{2.5}$ Measures for Austin-Round Rock-Georgetown MSA Air Quality Plan

Measure and Status (i.e., new or existing)	Implement within own organization's operations	Encourage or require 3rd party organizations to implement	Educate and encourage the public at large to implement
1: Reduce PM emissions from construction and demolition activities (new)	6 CAC Members	6 CAC Members	7 CAC Members
2: Reduce PM emissions from commercial cooking/charbroiling (new)	0 CAC Members	0 CAC Members	3 CAC Members
3: Reduce PM emissions from road dust (new)	7 CAC Members	8 CAC Members	7 CAC Members
4: Reduce PM emissions from mining and quarrying activities (new)	1 CAC Member	1 CAC Member	3 CAC Members
5: Reducing PM emissions from open burning (new)	6 CAC Members	5 CAC Members	9 CAC Members
6: Reduce PM emissions or impact of PM emissions from prescribed burning on high PM days (new)	4 CAC Members	5 CAC Members	7 CAC Members
7: Reduce emissions from mobile sources year-round (existing)	5 CAC Members	5 CAC Members	8 CAC Members
8: Reduce emissions from stationary combustion sources year-round (existing)	3 CAC Members	3 CAC Members	4 CAC Members
9: Installation additional $PM_{2.5}$ monitors/sensors within the region (new)	4 CAC Members	4 CAC Members	5 CAC Members
10: Promote awareness of health effects of PM air pollution (new)	8 CAC Members	5 CAC Members	12 CAC Members

The CAC member cities and counties that PM emission reduction commitments are displayed in the map below.

Figure 2-9. CAC Member Cities and Counties and $PM_{2.5}$ Emission Reduction Measure Commitments



Additionally, the following is a list of CAC member organizations that provided PM emission reduction commitments, which includes other CAC members that are not cities and counties.

1. Bastrop County
2. Caldwell County
3. CAPCOG
4. City of Austin
5. City of Bastrop
6. City of Buda
7. City of Cedar Park
8. City of Kyle
9. City of San Marcos
10. Lower Colorado River Authority (LCRA)
11. Movability
12. Sierra Club, Lone Star Chapter
13. Texas Commission on Environmental Quality (TCEQ)
14. Travis County

A compilation of the specific CAC member PM emission reduction commitments is listed in Appendix A.

3.5 Outreach, Education, and Technical Support to Enhance $PM_{2.5}$ Emission Reductions

Outreach, Education, and Technical Support to Enhance $PM_{2.5}$ Reductions helps advance both of the objectives in this plan. This type of outreach is focused on persuading people to take action to reduce emissions or otherwise providing them with the information needed to take action to maximize the amount of $PM_{2.5}$ emissions reductions that they can achieve. This strategy includes:

- Outreach to the public to encourage them to take actions to reduce $PM_{2.5}$ emissions;
- Outreach to business and other institutions to encourage them to take action to reduce emissions;
- Providing technical support to CAC members and others to help them maximize the amount of $PM_{2.5}$ emissions that they can achieve; and
- Providing technical and logistical support to CAC members and others interested in applying for grant funding for activities that would reduce $PM_{2.5}$ emissions.

3.5.1 Air Central Texas Outreach and Education Campaign

CAPCOG and other members of the CAC conduct region-wide public air quality outreach and education under the banner of "Air Central Texas" (ACT).

Figure 2-10. Air Central Texas Logo

AIR CENTRAL TEXAS

CAPCOG maintains the Air Central Texas website, social media accounts, conducts in-person outreach throughout the region, and, when funding is available, purchases advertising to promote air quality awareness and encourage the public to take action to reduce emissions. Key messages include general air quality awareness, encouraging residents to drive less, drive cleaner, and conserve. With this Plan addendum, CAPCOG plans on updating ACT with information specific to PM so that the public will have a comprehensive resource for the pollutants of most concern in the MSA.

[13].

3.5.2 Business and Institutional Outreach

Outreach to businesses and institutions is particularly important because of the magnitude of potential impact they have in influencing behavior and emissions-generating activity. Getting a large emission

[13] https://www.capcog.org/wp-content/uploads/2019/10/2019-2023_Regional_Air_Quality_Plan.pdf

generating owner to take action to reduce emissions can have many times the air quality impact that thousands of people taking action to reduce their personal emissions could achieve. With this in mind, on-going business and institutional outreach will continue to be an important part of the Regional Air Quality Plan.

3.5.2.1 Recruitment of New CAC Members

CAPCOG plans to continue recruiting businesses and organizations to participate in the Regional Air Quality Plan. In 2020, CAPCOG recruited three organizations to participate in the Plan. The three organizations were Movability (a Regional Transportation Management Association), St. Edward's University, and Huston-Tillotson University.

3.5.3 CAPCOG Technical Assistance to CAC Members

CAPCOG will provide technical assistance to CAC members in their implementation of pollution control measures in order to expand adoption of measures and enhance their performance for the region. Technical assistance will include:

- Assistance with applications for grants that can reduce PM emissions;
- Development of model fleet management policies and other operations policies that can reduce PM emissions;
- Hosting workshops to share information amongst CAC members on PM emission reduction strategies and issues;
- Development of outreach and education material that CAC members can share with the public and businesses; and
- Analysis of emission reductions and co-benefits that can be achieved through different options under consideration by CAC members.

3.6 Outreach and Education to Reduce Exposure to PM

3.6.1 Explain Health Effects of PM Pollution and Vulnerable Populations

Part of the outreach CAPCOG and other CAC members will undertake moving forward is educating the public, with a special focus on vulnerable populations, on the health effects of PM pollution as a way to help them better protect themselves from PM exposure and to help activate public behavior change that can help reduce PM pollution.

3.6.2 Air Quality Forecasting and Real-Time Air Quality Data

Air quality forecasting and real-time air quality data are key tools for helping reduce air pollution exposure.

3.6.2.1 Daily Air Quality Forecasts

'Today's Texas Air Quality Forecast' from TCEQ is based on EPA's Air Quality Index (AQI) scale for O_3, $PM_{2.5}$, and PM_{10}. The forecast is issued for 17 forecast regions across the state, including Austin. It is updated daily on normal TCEQ work days, and it may also be updated on weekends or holidays, when air pollution levels are high. The forecast is posted on the Today's Texas Air Quality Forecast webpage and disseminated via e-mail whenever updates are made. These forecasts provide a comprehensive forecast of the region's expected air quality for the week. Additionally, the AQI forecast for the forecast regions can be viewed on EPA's AirNow for the current day and the following day.

Figure 2-11. Example of TCEQ Air Quality Forecast

Forecast is for Ozone, PM2.5, & PM10, and is based on EPA's Air Quality Index (AQI)

Forecast Region (Click name for AIRNOW version)	Mon 07/19/2021	Tue 07/20/2021	Wed 07/21/2021	Thu 07/22/2021
Amarillo	Ozone/PM2.5	Ozone/PM2.5	Ozone/PM2.5	Ozone
Austin	Good	PM2.5	Ozone/PM2.5	PM2.5
Beaumont-Port Arthur	Good	Good	PM2.5	PM2.5
Big Bend	PM2.5	Good	PM2.5	Good
Brownsville-McAllen	Good	Good	Good	Good
Bryan-College Station	Good	Good	PM2.5	PM2.5
Corpus Christi	Good	Good	Good	Good
Dallas-Fort Worth	Good	Ozone/PM2.5	Ozone/PM2.5	Ozone/PM2.5
El Paso	Ozone/PM2.5	Ozone	Ozone/PM2.5	Ozone
Houston	Good	Ozone/PM2.5	Ozone/PM2.5	Ozone/PM2.5
Laredo	Good	Good	Good	Good
Lubbock	Ozone	Ozone/PM2.5	Ozone/PM2.5	Ozone
Midland-Odessa	Ozone	Ozone/PM2.5	Ozone/PM2.5	Ozone
San Antonio	Good	PM2.5	Ozone/PM2.5	Good
Tyler-Longview	Good	PM2.5	PM2.5	PM2.5
Victoria	Good	Good	Good	Good
Waco-Killeen	Good	PM2.5	Ozone/PM2.5	Good

An asterisk (*) indicates that an Ozone Action Day is or will be in effect for the indicated region.

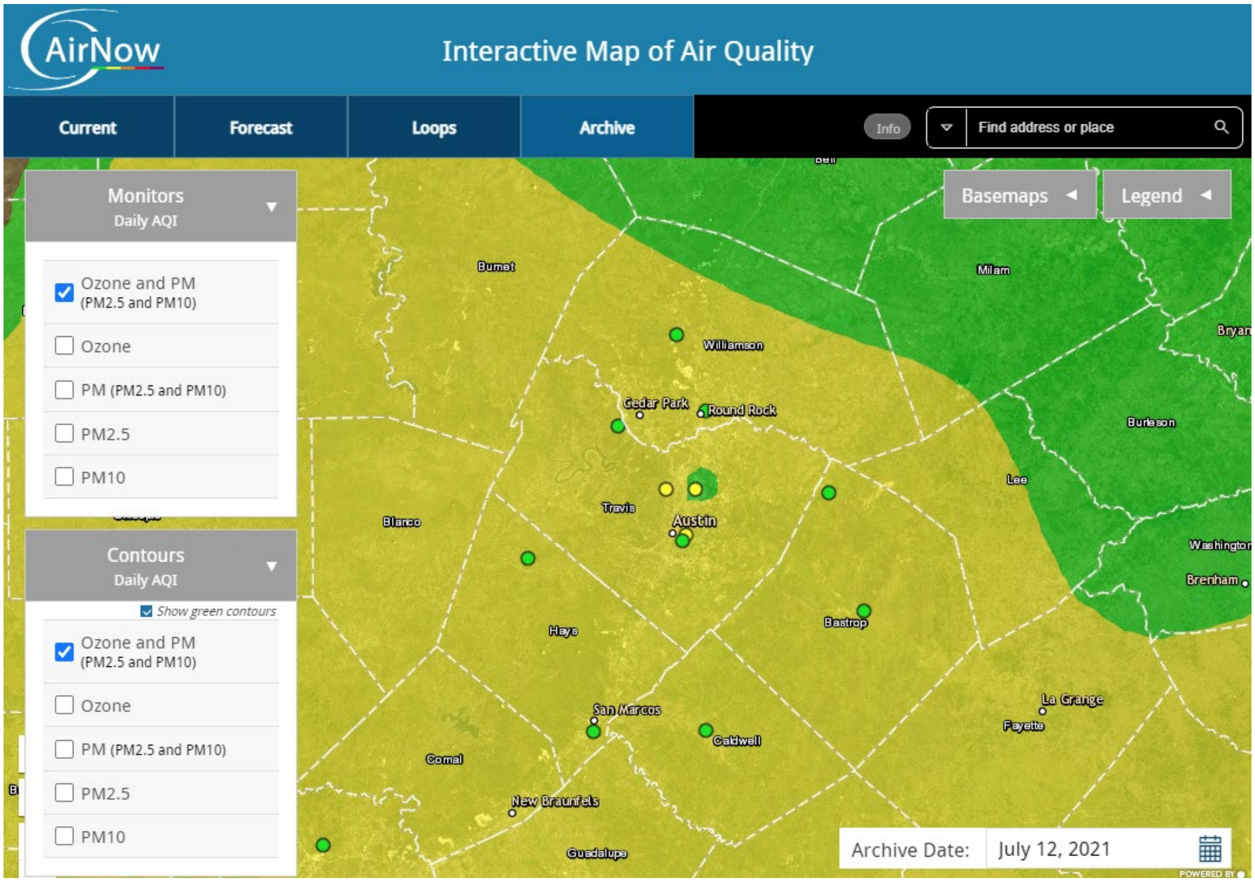
A caret (^) indicates that levels of PM may exceed the applicable short-term NAAQS. For more information see the following TCEQ websites: **Air Pollution from Particulate Matter** and **Voluntary Tips for Citizens and Business to Reduce Emissions.**

Real-time air quality data can be a valuable tool in helping advise the public of when air quality conditions within their vicinity are poor in order to assist them in taking pollution-avoiding actions.

3.6.2.2.1 EPA's AirNow

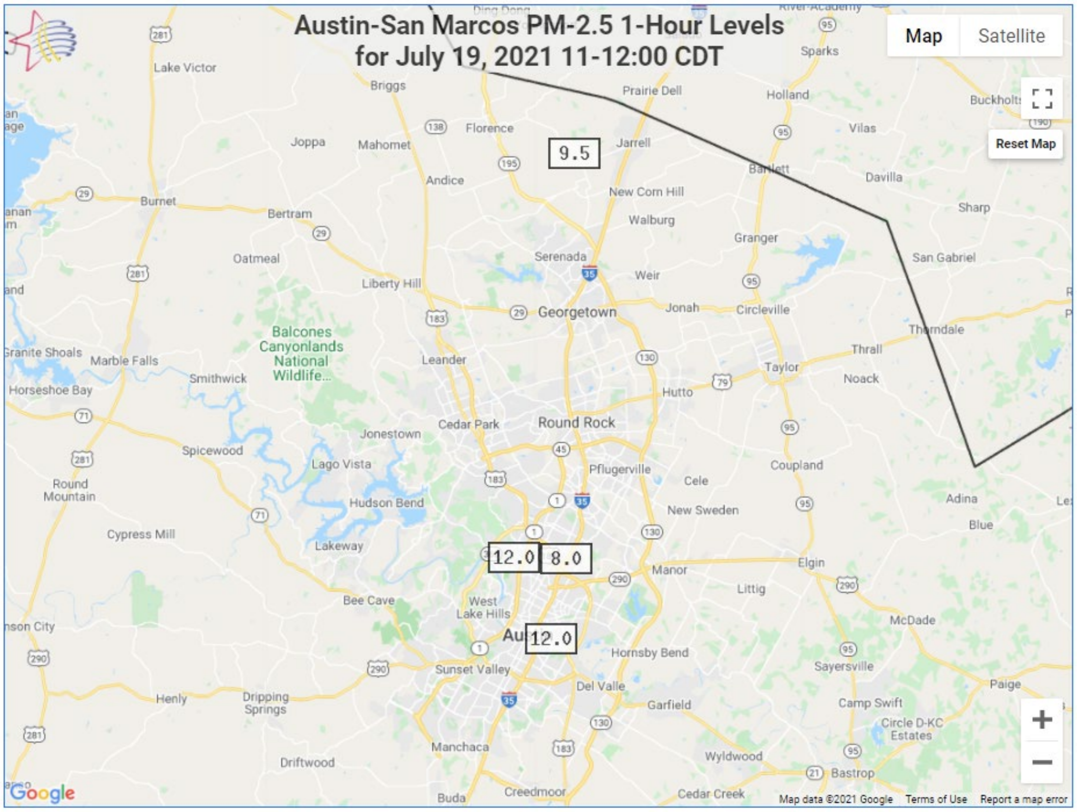
EPA's AirNow system allows users to enter their city, state, or zip code in order to find out the current air quality conditions within their area based on the AQI. There is both a desktop version and a mobile app for AirNow. AirNow uses O_3 and PM levels to determine the current AQI. Therefore, the public can view the overall AQI or the AQI by pollutant (O_3, $PM_{2.5}$, and PM_{10}) at each monitoring station that reports to AirNow. As part of its outreach efforts, CAPCOG promotes the use of AirNow by residents and organizations participating in the Plan in order to obtain real-time assessments of air quality conditions.

Figure 2-12. Example of AirNow Map for Central Texas



In addition to AirNow, the public can also look up the latest hourly $PM_{2.5}$ air quality data from T[CEQ's PM monitors on their website](). However, the TCEQ website is in a less user-friendly format compared to AirNow.

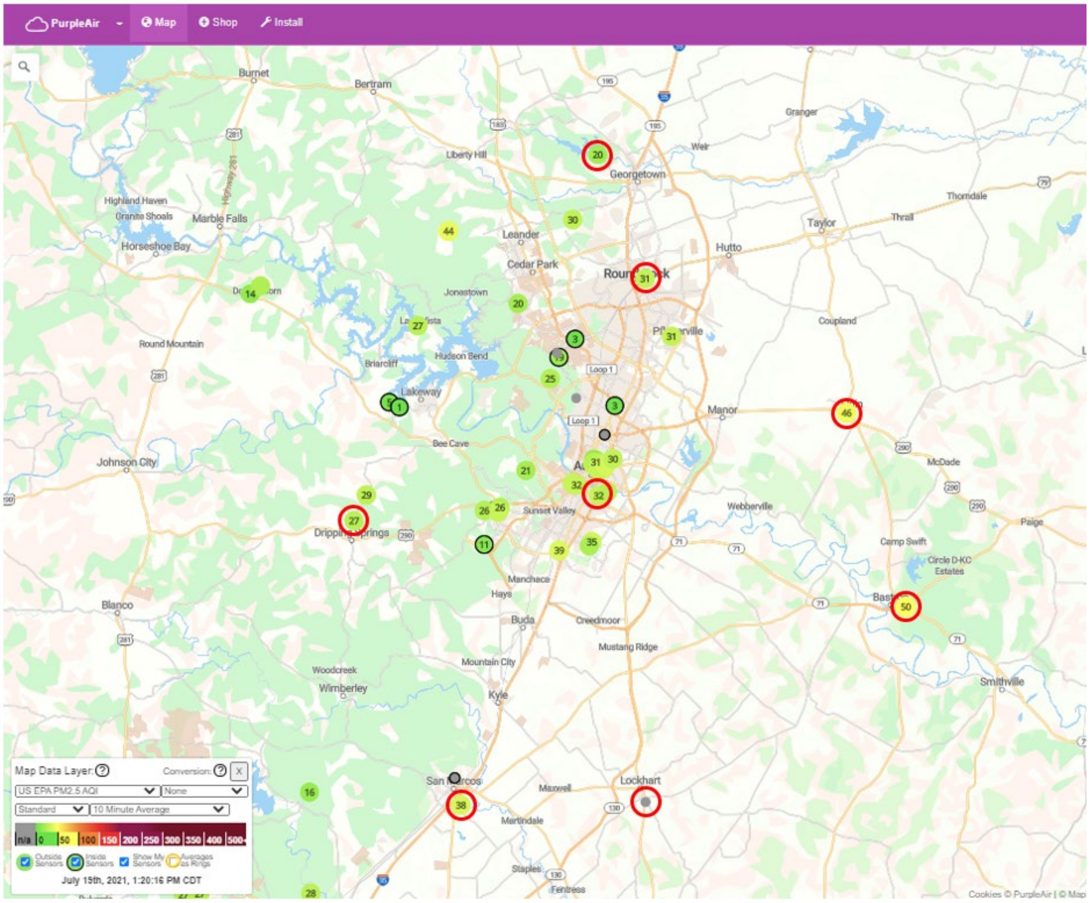
Figure 2-13. Example of TCEQ PM2.5 Map for the Austin Area



The low-cost sensor technology is a growing market. One of the most popular PM sensors are called [PurpleAir sensors](). These sensors use a new generation of laser particle counters to provide real-time measurement of ultra-fine particulate matter (PM1.0), PM2.5, and PM10. PurpleAir sensors are easy to install and only require a power outlet and Wi-Fi to report in real time to the PurpleAir map. These sensors can be used outdoors for ambient air quality and indoors to measure indoor air quality. Due to their affordability and ease of installation, these sensors are utilized by the public, businesses, organizations, and governmental entities to provide hyper-local PM data. PM data can be viewed in terms of the AQI and in actual concentrations.

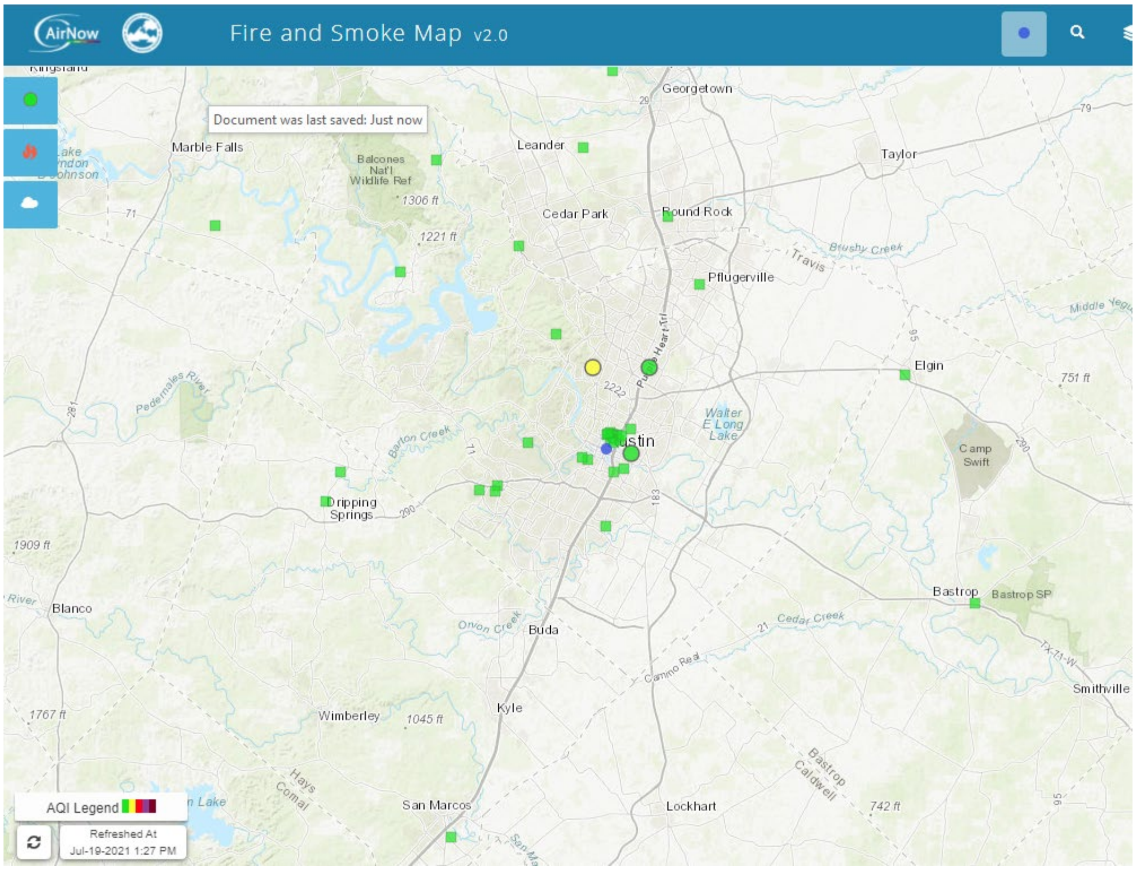
In late 2020 and early 2021, CAPCOG purchased 8 PurpleAir sensors to install at CAPCOG's O_3 monitoring sites. The image below shows a clip of the PurpleAir map with the CAPCOG sensors circled in red.

*Figure 2-14. Example of PurpleAir Map for Central Texas and CAPCOG Sensors Circled**



In addition to the PM sensor data display on the PurpleAir map, AirNow has incorporated PurpleAir sensor data into [AirNow's Fire and Smoke Map](). This map shows regulatory PM monitoring station data, PurpleAir $PM_{2.5}$ sensor data, fire location information, and smoke plume extents. Only outdoor PurpleAir sensors are included on the map. Additionally, the sensors must have passed EPA's quality control screening. As a result, only certain PurpleAir sensors meet the criteria to be included on the Fire and Smoke Map. An example of the AirNow Fire and Smoke Map is below. Note that all the CAPCOG PurpleAir sensors are included with the exception of Lockhart since it was offline at the time of this publication.

Figure 2-15. Example of AirNow Fire and Smoke Map for Central Texas



It is important that the region's meteorologists stay well-informed on air quality forecasts and issues. Of additional importance is that local meteorologist's regularly include air quality forecasts in their weather forecasts each day. One of the ways that the CAC has helped ensure this high level of awareness among the region's meteorologists is to co-sponsor meteorologist meetings and events with the CAF and/or the City of Austin. CAPCOG intends to work with CAF and the City of Austin to ensure that this outreach continues throughout the term of this plan, particularly in light of the fact that most people's awareness about air quality is as a directly result of hearing information about it from their local news. Similar to all activities that increase overall awareness about air quality, outreach to meteorologists also helps enhance the chances that members of the public and organizations within the region will take action to reduce PM emissions and avoid exposure to high levels of PM.

3.6.4 Outreach and Education by Individual CAC Members

In addition to the PM emission reduction measures, this Plan includes outreach measures targeted at promoting awareness of PM, promoting PM emission reduction measures in the community, and reducing residents' exposure when air pollution levels are high.

The CAC includes organizations representing tens of thousands of employees and over 2 million residents of the region. Therefore, repeated exposure to air quality messages can only enhance the effectiveness of this plan.

3.7 PM Monitoring

Air monitoring is a critical strategy for achieving the region's air quality objectives. The current Regional Air Quality Plan lists the purposes for monitoring from the EPA. TCEQ operates the only FRM or FEM PM monitors in the MSA. However, since low-cost PM sensors, such as the PurpleAir sensor, are widely used, PM sensors can be a good tool to understand local PM levels without a FEM/FRM PM monitor. Therefore, CAPCOG plans to support the monitoring objectives listed in the current Plan by continuing to operate the PurpleAir sensors at the eight CAPCOG monitoring stations. Additionally, CAPCOG may purchase more PurpleAir sensors to place in the region to understand PM levels in areas that lack sensor data.

3.8 Other PM Research and Planning Activities

Ongoing research and planning activities beyond simply collecting air quality data is important for the region's ability to achieve its air quality objectives. These activities are necessary for continual improvement in reducing emissions, reducing exposure to poor air quality, and working with counterparts at the state and federal level to avoid a nonattainment designation for the region, if the area does measure air quality that violates the NAAQS. Throughout the period covered by this plan, CAPCOG will continue to coordinate the region's on-going planning and air quality research activities with an additional focus on PM.

3.9 PM Policy Advocacy

From time to time, the CAC has weighed in on policy matters at the TCEQ, the legislature, and EPA, and within the region because of the potential impact on the region's air quality, regulations related to air quality, and our ongoing air quality planning efforts. Over the years, a number of principles have been consistently articulated by the CAC in these advocacy efforts. While these principles are not intended to be binding on any CAC member in its own advocacy efforts, they are intended to capture the sense of the CAC and can be helpful in guiding policy advocacy by the CAC or its members in ways that would be consistent with prior CAC comments and this air quality plan. Moving forward, the CAC will make PM-related issues an area of advocacy.

3.10 Gaps

During this planning effort, CAPCOG and the CACAC identified a number of important gaps to our technical knowledge about regional PM pollution and issues related to $PM_{2.5}$ that this plan does not yet address. Moving forward, CAPCOG and the CAC will track these issues and work on ways to try to close these knowledge or policy gaps.

3.10.1 Lack of Speciated $PM_{2.5}$ Monitoring Data within the Region

$PM_{2.5}$ is a very complex air quality issue to address, and one of the key pieces of information that is needed to guide planning and emission reduction efforts is what species of $PM_{2.5}$ are contributing to the region's overall $PM_{2.5}$ concentrations. While this planning effort used high-quality modeling data for this purpose, speciated $PM_{2.5}$ monitoring within the region would help enable tracking of changes in concentrations of various species over time. In its 2021 comment letter to the TCEQ on its annual monitoring network plan, the CAC requested that TCEQ consider deploying a speciated monitor in the region. While at this time, they declined to do so, they did point out that speciated $PM_{2.5}$ monitoring data at CAMS 38 is available from 2007 – 2013. CAPCOG plans to analyze this data in the future and it should provide some insight, but it will be sufficient to understand the high $PM_{2.5}$ levels observed in the urban core.

3.10.2 Limited Spatial Coverage of $PM_{2.5}$ Monitors within the Region

There are only a few $PM_{2.5}$ monitors operated within the region and all of them are located in Travis County, providing limited insight into geographic variability in $PM_{2.5}$ concentrations and regional transport of $PM_{2.5}$ into and within the region. For O_3 on the other hand, in addition to the 2 regulatory monitors TCEQ operates in Travis County, there are an additional nine research-grade monitors located within the region, with at least two in each county.

3.10.3 Lack of Concrete Batch Plants within National/State/Regional Emissions Inventories

In the course of this planning effort, CAPCOG discovered that concrete batch plants appear to not be accounted for anywhere within the National Emissions Inventory (NEI) data for the region. While these facilities are subject to a standard permit from the TCEQ, they do not report emissions annually to TCEQ as a point source, and EPA does not have a non-point source emissions category covering these emissions. There are numerous concrete batch plants across the region, including in locations very close to residential areas, and the lack of emissions data from this source is a potentially very significant gap in our understanding of PM pollution within the region. Since there are also controls available that can significantly reduce PM pollution from these facilities as well, the lack of emissions data also limits our understanding of the extent to which emissions from these facilities can be further controlled. A regional concrete batch plant emissions inventory would be very useful to close this gap.

3.10.4 High Degrees of Uncertainty in Nonpoint Emissions Estimates

Beyond concrete batch plants, the overall emissions inventory for $PM_{2.5}$ within the region is characterized by a high degree of uncertainty. The majority of $PM_{2.5}$ emissions are in the “nonpoint” category, meaning the county-level estimates are based on very broad national-level surrogate data, emissions rates, and assumptions about the region of PM_{10} to $PM_{2.5}$ emissions. Additional emissions inventory research into the largest estimated sources of $PM_{2.5}$ within the region would help improve planning efforts moving forward.

3.10.5 Difficulty in Quantifying Emission Reductions

Along with difficulty in estimating $PM_{2.5}$ emissions within the region, there is also significant difficulty in estimating $PM_{2.5}$ emission reductions. Unlike controls for combustion sources, the efficacy of controls for PM pollution may not be able to be measured well under even the best of circumstances. This means that planning efforts have to focus more on steps that are known to reduce PM pollution without being able to assess costs and benefits very well.

3.10.6 Lack of Modeling Data

In addition to the lack of monitoring data, there is also a lack of good modeling data on $PM_{2.5}$, both within the region and across the state. Since both the region and the state have been primarily focused on O3 pollution over the years, there is a large amount of high-quality O_3 modeling data available to help guide air quality decision-making, but there is very little $PM_{2.5}$ modeling data available. The 2019 Regional Haze modeling data was the only source that we were able to identify that could be used for this planning effort, and it does not include information that would enable the region to understand, for example, what the local contribution to PM2.5 was versus the rest of the state versus other states, etc.

3.10.7 Lack of Grant Programs for PM

The two major air quality grant programs that the region relies on for its air quality planning efforts are both focuses on O3 rather than PM, and in the case of the Rider 7 local air quality planning grant program, can only be used on O3. While the TERP grant program achieves PM2.5 emission reductions through vehicle replacements and selected stationary source grants, there are no grant programs currently in place that can be used to fund PM-specific emission reduction measures. Under the TERP statute, TCEQ has the authority to establish new programs that could serve this purpose, but without funding or direction from the legislature to do so or what to include, they have understandably not used this authority yet to create any kind of PM emission reduction grant program.

The region also lacks the ability to take advantage of the Supplemental Environmental Project (SEP) policy that has helped other regions fund special projects like a PM reduction program. There are pre-approved organizations focused on Central Texas in place that could accept and implement a PM reduction program when funds do become available through SEPs. CAPCOG and the CACAC evaluated the possibility of CAPCOG serving this role, but due to the limited about of SEP funding in the region, the large amount of administrative work that would be involved in getting approval, and the uncertainty as to what specific projects might be able to be funded led us to conclude that this was not a viable option. However, a region-specific SEP could help address this issue.

3.10.8 Lack of Understanding about PM Pollution Within the Community and the Legislature

The public generally does not pay much attention to air pollution unless there is an Ozone Action Day and over the past 20 years, the public in the Austin-Round Rock-Georgetown metro area have also become accustomed to only talking about O_3 when talking about air pollution. Shifting public awareness to also include PM pollution will be a long-term challenge, and since the issue relates to long-term exposure rather than short-term exposure, different strategies will need to be pursued to engage the public on PM pollution issues.

To some extent, the same may be true of the Texas Legislature. Since many parts of the state have been engaged planning related to O_3 over the past several decades, it is doubtful that many legislators, even among those knowledgeable about air pollution, are fully aware of the risks many parts of the state face from a potential “nonattainment” designation for $PM_{2.5}$. Targeted changes to existing grant programs could help address the issues the Austin area is facing, but the region will need help from the legislature to make the kind of impact that may be needed mitigate these risks.

4 Extension of Plan Timeframe

The rationale behind the 2023 end date to the current plan beyond maintaining consistency for five-year planning periods was so that the plan would cover the 2-3 year designation period following completion of the PM and O_3 NAAQS reviews due in 2020 if either NAAQS were revised. EPA finalized these reviews on December 4, 2020, and December 23, 2020, respectively, with no change to the standards. Based on these dates, the next NAAQS reviews for PM and O_3 would be due on December 4, 2025, and December 23, 2025, respectively.

On January 20, 2021, the new administration issued an Executive Order that included direction to EPA to review the prior administration's decisions to retain the existing PM and O_3 NAAQS. [14] EPA announced on June 10, 2021, that it was initiating a formal "reconsideration" of the decision to leave the PM NAAQS unchanged, with an anticipated proposed rulemaking in Summer 2022 and final rule in Spring 2023.[15] If, as is anticipated, this reconsideration led to more stringent PM NAAQS, EPA would be required to complete a new round of attainment/nonattainment designations for all areas of the country by the end of 2025 or 2026.

Moving the end date of the region's air quality plan from December 31, 2023, to December 31, 2026, will cover the entire period in which EPA is expected to use for determining which areas to designation "nonattainment" for any revised PM standard if that occurs in 2023. It also would provide for a year after the next O_3 and PM NAAQS reviews currently are due to prepare any update or extension to the plan at that time, if needed.

[14] https://www.whitehouse.gov/briefing-room/statements-releases/2021/01/20/fact-sheet-list-of-agency-actions-for-review/

[15] https://www.epa.gov/newsreleases/epa-reexamine-health-standards-harmful-soot-previous-administration-left-unchanged

5 Appendix A: Summary of PM Emission Reduction Measures by the CAC

The following table summarizes the commitments made by CAC members specifically for this plan as of July 19, 2021. All CAC members are expected to annually report whatever measures they do implement to CAPCOG. Therefore, additional CAC members may implement measures that are not reflected in the table. CAPCOG is authorized to update this appendix table and the related spreadsheet as organizations are added and commitments are updated without this plan needing direct approval by the CAC.

Table 5-1. CAC PM Emission Reduction Measures for the Category - Implement within Own Organization's Operations

CAC Member	1: Reduce PM emissions from construction and demolition activities (new)	2: Reduce PM emissions from commercial cooking/charbroiling (new)	3: Reduce PM emissions from road dust (new)	4: Reduce PM emissions from mining and quarrying activities (new)	5: Reducing PM emissions from open burning (new)	6: Reduce PM emissions or impact of PM emissions from prescribed burning on high PM days (new)	7: Reduce emissions from mobile sources year-round (existing)	8: Reduce emissions from stationary combustion sources year-round (existing)	9: Installation additional PM2.5 monitors/sensors within the region (new)	10: Promote awareness of health effects of PM air pollution (new)
Bastrop County	Yes	N/A	Yes	N/A	N/A	N/A	Yes	Yes	No	Yes
Caldwell County	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	Yes
CAPCOG	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes
City of Austin	Yes	No	Yes	N/A	Yes	Yes	Yes	Yes	Yes	Yes
City of Bastrop	N/A	N/A		N/A	Yes	Yes	N/A	N/A	Yes	Yes
City of Buda	Yes	N/A	Yes	N/A	Yes	N/A	Yes	N/A	Yes	Yes
City of Cedar Park	No	No	Yes	Yes	No	No	No	No	No	No
City of Kyle	Yes	No	Yes	N/A	Yes	No	No	No	No	Yes
City of San Marcos	Yes	No	Yes	N/A	N/A	N/A	N/A	N/A	No	N/A
Lower Colorado River Authority (LCRA)	No	No	No	No	Yes	Yes	Yes	Yes	No	No
Movability	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sierra Club, Lone Star Chapter	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Texas Commission on Environmental Quality (TCEQ)	N/A	N/A	N/A	N/A	N/A	N/A	No	N/A	No	N/A
Travis County	Yes	No	Yes	N/A	Yes	Yes	Yes	N/A	Yes	Yes

Table 5-2. CAC PM Emission Reduction Measures for the Category - Encourage or Require Third Party Organizations to Implement

CAC Member	1: Reduce PM emissions from construction and demolition activities (new)	2: Reduce PM emissions from commercial cooking/charbroiling (new)	3: Reduce PM emissions from road dust (new)	4: Reduce PM emissions from mining and quarrying activities (new)	5: Reducing PM emissions from open burning (new)	6: Reduce PM emissions or impact of PM emissions from prescribed burning on high PM days (new)	7: Reduce emissions from mobile sources year-round (existing)	8: Reduce emissions from stationary combustion sources year-round (existing)	9: Installation additional PM2.5 monitors/sensors within the region (new)	10: Promote awareness of health effects of PM air pollution (new)
Bastrop County	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Caldwell County	No	No	No	No	No	No	No	No	No	No
CAPCOG	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
City of Austin	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
City of Bastrop	N/A	N/A	Yes	N/A	N/A	Yes	N/A	N/A	Yes	Yes
City of Buda	Yes	No	Yes	No	Yes	Yes	Yes	Yes	N/A	N/A
City of Cedar Park	No	No	Yes	Yes	No	No	No	No	No	No
City of Kyle	Yes	No	Yes	N/A	Yes	N/A	No	No	No	No
City of San Marcos	Yes	No	Yes	N/A	N/A	N/A	N/A	N/A	No	No
Lower Colorado River Authority (LCRA)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Movability	No	No	No	No	No	No	Yes	No	No	Yes
Sierra Club, Lone Star Chapter	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Texas Commission on Environmental Quality (TCEQ)	N/A	No	No	N/A	No	No	No	No	No	No
Travis County	Yes	No	Yes	N/A	Yes	Yes	Yes	N/A	Yes	Yes

Table 5-3. CAC PM Emission Reduction Measures for the Category - Educate and Encourage the Public at Large to Implement

CAC Member	1: Reduce PM emissions from construction and demolition activities (new)	2: Reduce PM emissions from commercial cooking/charbroiling (new)	3: Reduce PM emissions from road dust (new)	4: Reduce PM emissions from mining and quarrying activities (new)	5: Reducing PM emissions from open burning (new)	6: Reduce PM emissions or impact of PM emissions from prescribed burning on high PM days (new)	7: Reduce emissions from mobile sources year-round (existing)	8: Reduce emissions from stationary combustion sources year-round (existing)	9: Installation additional PM2.5 monitors/sensors within the region (new)	10: Promote awareness of health effects of PM air pollution (new)
Bastrop County	Yes	No	Yes	No	Yes	Yes	Yes	Yes	No	Yes
Caldwell County	No	N/A	No	N/A	No	No	No	No	No	Yes
CAPCOG	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City of Austin	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
City of Bastrop	Yes	Yes	Yes	N/A	Yes	Yes	N/A	N/A	Yes	Yes
City of Buda	Yes	No	No	No	Yes	No	Yes	No	N/A	Yes
City of Cedar Park	No	No	Yes	Yes	No	No	No	No	No	No
City of Kyle	No	No	No	N/A	Yes	N/A	No	No	No	Yes
City of San Marcos	N/A	No	N/A	N/A	N/A	N/A	N/A	N/A	No	Yes
Lower Colorado River Authority (LCRA)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Movability	No	No	No	No	No	No	Yes	No	No	Yes
Sierra Club, Lone Star Chapter	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Texas Commission on Environmental Quality (TCEQ)	N/A	N/A	N/A	N/A	Yes	Yes	Yes	N/A	N/A	Yes
Travis County	Yes	No	Yes	N/A	Yes	Yes	Yes	N/A	Yes	Yes

6 APPENDIX B: PM MODELING

CAPCOG used air quality modeling data provided by EPA in 2020 for this planning process to help answer some key technical and questions:

1. Are projected annual $PM_{2.5}$ levels exceeding 8 µg/m^3 (the lowest level EPA staff proposed to be considered for a revised annual $PM_{2.5}$ NAAQS)?
2. How are annual $PM_{2.5}$ concentrations expected to change over the next 10 years?
3. What types of $PM_{2.5}$ are contributing to the region's peak $PM_{2.5}$ concentrations?
4. What is the spatial extent of elevated $PM_{2.5}$ concentrations?
5. Is the existing monitoring network deployed to capture the highest PM2.5 concentrations within the region?
6. Are there differences in $PM_{2.5}$ exposure by race and ethnicity within the region, as EPA indicated was the case nationally in its integrated science assessment?

The modeling results were produced by EPA in 2019 in support of the Regional Haze program. [16] EPA staff made CAPCOG-specific modeling available for use in this planning effort.

6.1 PROJECTED DESIGN VALUE

On question 1, the modeling indicated that the answer is yes: **the projected 2028 annual $PM_{2.5}$ design value for the region would be 9.19 µg/m^3**. This puts it above the lowest level suggested by EPA staff of 8 µg/m^3 and suggests that the region would be at risk of a nonattainment designation following the promulgation of a tighter PM NAAQS in the next few years.

6.2 RATE OF CHANGE IN POLLUTION LEVELS

On question 2, the modeling indicated that **the region's annual $PM_{2.5}$ design value would decrease by 0.47 µg/m^3 from 2016-2028, or 0.04 µg/m^3 per year**. This pace strongly suggests that significant additional local emission reductions would be needed to accelerate the pace of $PM_{2.5}$ reductions within the next few years. This change represents a 5% reduction from baseline levels over this period.

6.3 MODELED CONTRIBUTIONS OF DIFFERENT $PM_{2.5}$ SPECIES TO DESIGN VALUES

On question 3, the modeling indicated that **the majority of the region's annual $PM_{2.5}$ design value, and all of the difference in design values at the two monitoring stations evaluated, was attributable to organic carbon $PM_{2.5}$.**

The following table shows the baseline and projected design values at both monitoring stations, along with the contributions of different types of species of $PM_{2.5}$.

[16] https://www.epa.gov/visibility/technical-support-document-epas-updated-2028-regional-haze-modeling

Table 5-1. Modeled 2016 Baseline and 2028 Annual $PM_{2.5}$ Concentrations and Speciation at Austin Area Monitors

Item	CAMS 38 2016 Baseline	CAMS 38 2028 Projection	CAMS 171 2016 Baseline	CAMS 171 2028 Projection
Blank $PM_{2.5}$ (µg/m^3)	0.20	0.20	0.20	0.20
Crustal $PM_{2.5}$ (µg/m^3)	1.29	1.32	1.25	1.28
Elemental $PM_{2.5}$ (µg/m^3)	0.40	0.27	0.38	0.25
Organic Carbon $PM_{2.5}$(µg/m^3)	3.28	3.26	5.27	5.20
NH_4 $PM_{2.5}$ (µg/m^3)	0.33	0.29	0.31	0.28
NO_3 $PM_{2.5}$ (µg/m^3)	0.12	0.10	0.10	0.08
SO_4 $PM_{2.5}$ (µg/m^3)	1.55	1.33	1.52	1.34
Water $PM_{2.5}$ (µg/m^3)	0.50	0.43	0.51	0.44
Salt $PM_{2.5}$ (µg/m^3)	0.11	0.11	0.12	0.12
Design Value (µg/m^3)	**7.78**	**7.30**	**9.66**	**9.19**

- **Blank**: a default of 0.2 µg/m^3, representing a contamination of filters used for $PM_{2.5}$ monitoring from handling or contact with the equipment – this is an important component of the total mass measurement, but simply represents a measurement error, and does not change over time;
- **Crustal**: primary $PM_{2.5}$ consisting of dust/airborne soil particles[17]
- **Elemental Carbon (EC)**: particles that contain carbon in its elemental (graphite) form
- **Organic Carbon (OC)**: these are particles that include hydrocarbon molecules; can be either primary $PM_{2.5}$ or formed through secondary reactions with other chemicals, including ozone (O_3); all volatile organic compounds (VOC) contain organic carbon, but there are also some other types of organic compounds that are not considered VOC that contribute to organic carbon $PM_{2.5}$;
- **NH_4**: ammonium particles; secondary particles formed as a result of NH_3 emissions;
- **NO_3**: nitrate particles; secondary particles formed as a result of NO_X emissions
- **SO_4**: sulfate particles; secondary particles formed as a result of SO_2 emissions
- **Water**: water contained in particles of ammoniated sulfate and ammonium nitrate[18]
- **Salt**: particles from sea salt

6.4 Geographic Variability

On question 4, CAPCOG used the modeled annual PM2.5 concentrations for each 12 km x 12 km modeling grid cell over the CAPCOG region to assess the extent of the geographic variability of $PM_{2.5}$ pollution within the region. This enabled an "unmonitored area" analysis and some indication as to what the annual PM2.5 design value of these areas might be if a regulatory monitor was located there. The following table summarizes the range of modeled 2016 $PM_{2.5}$ design values for each county in the CAPCOG region.

Table 5-2. Modeled 2016 Annual $PM_{2.5}$ Concentrations Across the CAPCOG Region

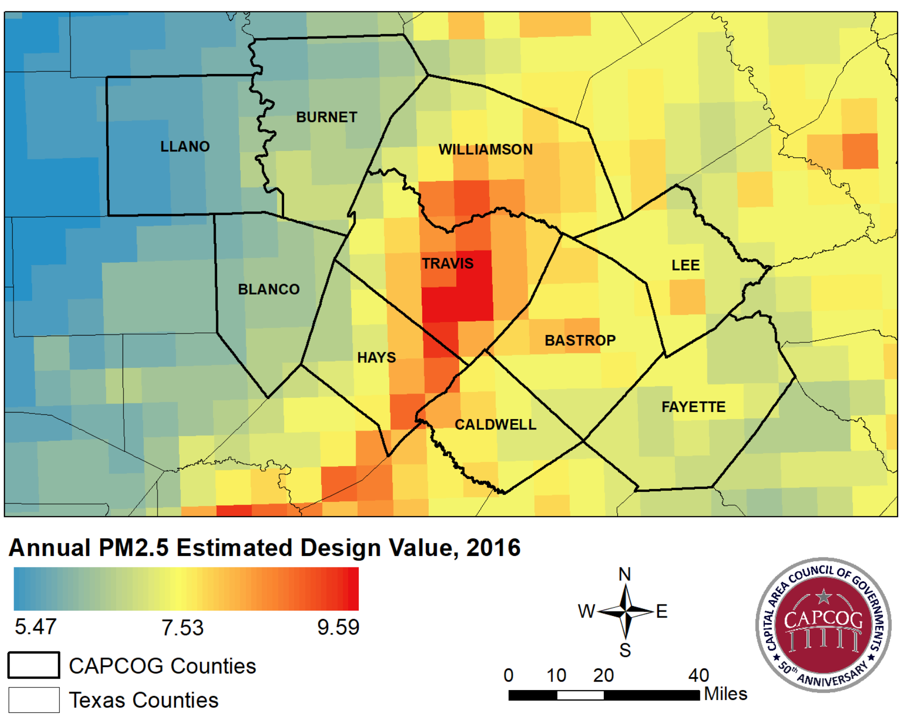
Area	Min. (µg/m^3)	Max. (µg/m^3)	Avg. (µg/m^3)	Range (µg/m^3)	Range as % of Max.
Bastrop County	7.16	8.23	7.58	1.07	13%

[17] https://www3.epa.gov/ttn/scram/guidance/guide/O3-PM-RH-Modeling_Guidance-2018.pdf, section 4.4.4.6
[18] Ibid., section 4.4.4.4

Area	Min. (µg/m³)	Max. (µg/m³)	Avg. (µg/m³)	Range (µg/m³)	Range as % of Max.
Blanco County	6.23	6.87	6.59	0.64	9%
Burnet County	6.17	6.99	6.62	0.82	12%
Caldwell County	7.25	8.16	7.61	0.91	11%
Fayette County	7.02	7.52	7.17	0.50	7%
Hays County	6.82	8.91	7.62	2.09	23%
Lee County	7.08	8.11	7.42	1.03	13%
Llano County	5.73	6.72	6.08	0.99	15%
Travis County	7.10	9.59	8.30	2.49	26%
Williamson County	6.91	9.01	7.76	2.10	23%
Austin-Round Rock-Georgetown MSA	**6.82**	**9.59**	**7.82**	**2.77**	**29%**
CAPCOG Region	**5.73**	**9.59**	**7.26**	**3.86**	**40%**

Figure 4-3 illustrates the modeled 2016 $PM_{2.5}$ design values in and around the CAPCOG region. Unlike O_3, which tends to have its highest concentrations towards the northwest of the urban core, the modeled annual $PM_{2.5}$ concentrations appear to be highest within the urban core.

Figure 5-1. Annual $PM_{2.5}$ Modeled Design Value, 2016



CAPCOG also looked up the design values modeled at all currently active air monitoring stations, only three of which are currently equipped with $PM_{2.5}$ sampling equipment (CAMS 3, CAMS 171, and CAMS 1068).

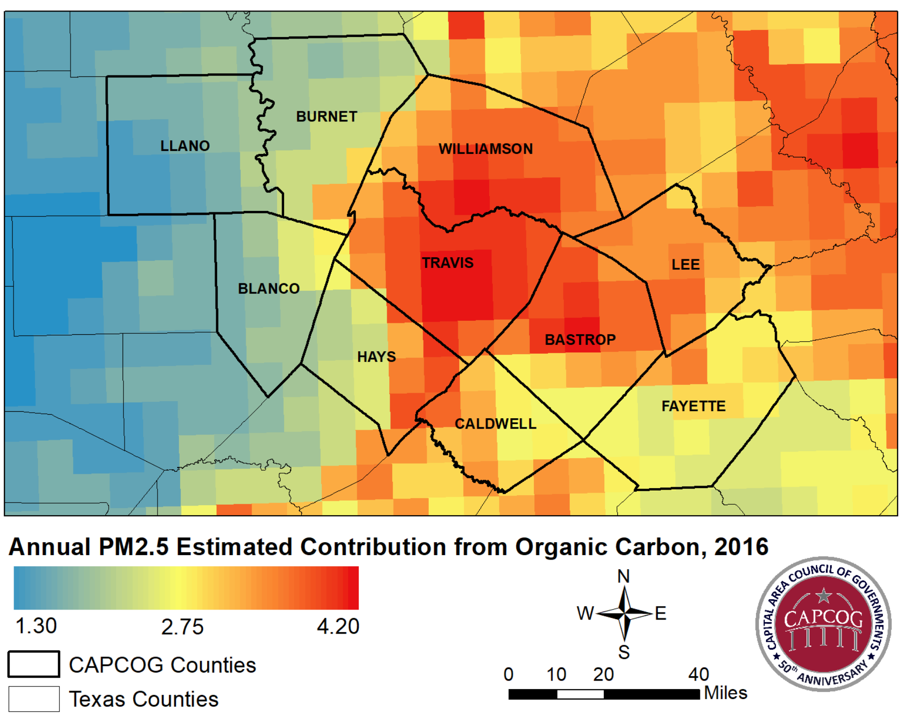
Table 5-3. Modeled 2016 and 2028 Design Values at Regional Monitoring Stations

CAMS	Location	Owner	Modeled Baseline 2016 Design Value	Modeled Future 2028 Design Value
3	Austin	TCEQ	8.91	8.38
38	Austin	TCEQ	7.52	7.07
171*	Austin	TCEQ	9.47	8.99
614	Dripping Springs	CAPCOG	7.41	6.88
690	Georgetown	CAPCOG	8.25	7.83
1068	Austin	TCEQ	9.57	9.01
1604	Lockhart	CAPCOG	7.78	7.36
1605	Austin	St. Edwards University	9.59	9.03
1612	Bastrop	CAPCOG	8.23	7.77
1613	Elgin	CAPCOG	7.82	7.36
1619*	Austin	CAPCOG	9.47	8.99
1675	San Marcos	CAPCOG	8.91	8.43
6602	Hutto	CAPCOG	8.46	8.01

**CAMS 171 and CAMS 1619 share the same 12 km x 12 km grid cell used for modeling*

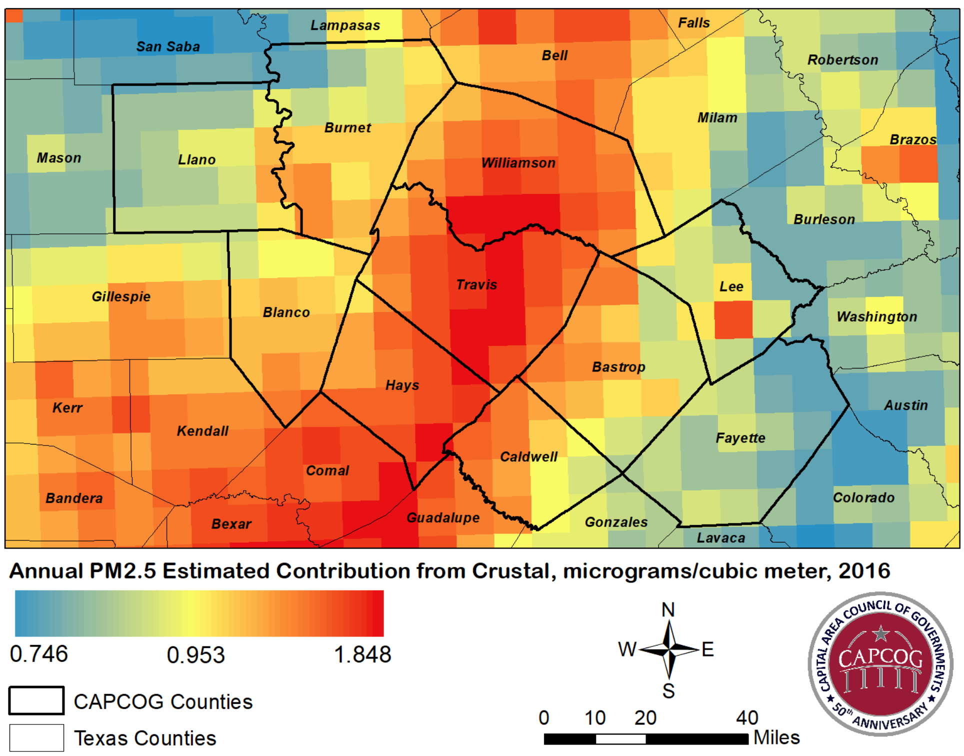
Figure 5-2, below, illustrates the estimated contribution of organic carbon to the modeled 2016 $PM_{2.5}$ concentrations around the CAPCOG region (note – scale differs from Figure 2).

Figure 5-2. Organic Carbon Contribution to Annual $PM_{2.5}$ Modeled Design Value, 2016



While sulfate $PM_{2.5}$ is the 2nd-highest contributor to annual $PM_{2.5}$ within the region, there are no significant sources of SO2 emissions within the MSA, so CAPCOG did not closely evaluate the sulfate modeling data. However, crustal $PM_{2.5}$ is the 3rd largest contributor, and there are significant local sources of crustal $PM_{2.5}$ emissions. The following map shows the total crustal $PM_{2.5}$ contributions to annual $PM_{2.5}$ concentrations across the region.

Figure 5-3. Modeled Crustal PM2.5 Contribution to Annual PM2.5 Concentrations, 2016

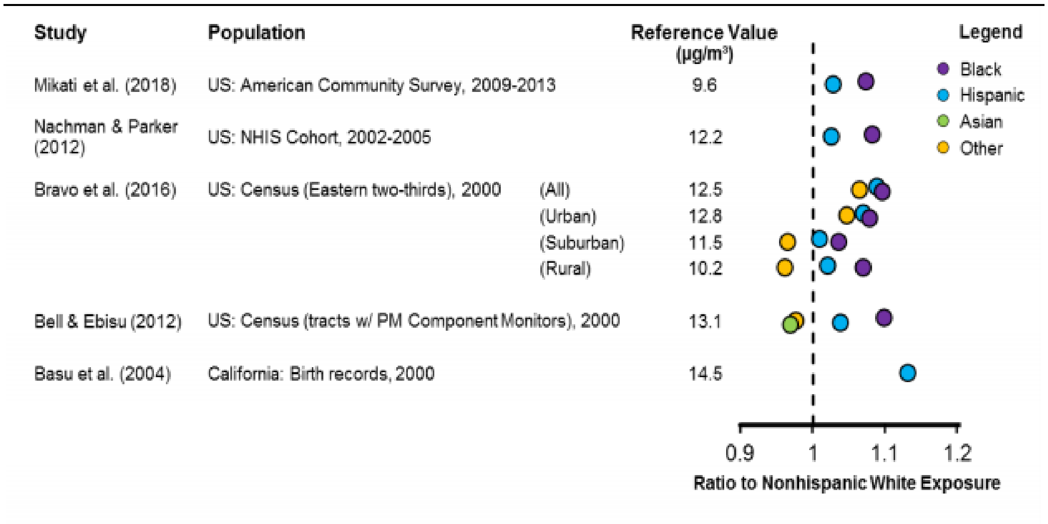


6.5 ENVIRONMENTAL JUSTICE ANALYSIS

EPA's ISA for the PM NAAQS indicated that evidence was "adequate to conclude that race and ethnicity modify $PM_{2.5}$-related risk and that nonwhites, particularly blacks, are at increased risk for $PM_{2.5}$-related health effects, in part due to disparities in exposure."[19] The following figure showed disparities in $PM_{2.5}$ exposure by race. The ISA also indicated that evidence was "suggestive that low [socioeconomic status] populations are at increased risk for PM2.5-related health effects compared with populations of higher [socioeconomic status].

[19] https://ofmpub.epa.gov/eims/eimscomm.getfile?p_download_id=539935

Figure 5-4. Differences in $PM_{2.5}$ Exposure by Race from EPA PM ISA



µg/m³ = microgram per cubic meter; NHIS = National Health Interview Survey; PM = particulate matter; $PM_{2.5}$ = particulate matter with a nominal mean aerodynamic diameter less than or equal to 2.5 µm.

Note: Group for reference exposure is non-Hispanic whites.

Source: Mikati et al. (2018), Nachman and Parker (2012), Bravo et al. (2016), Bell and Ebisu (2012), Basu et al. (2004).

CAPCOG reviewed the $PM_{2.5}$ modeling data in conjunction with demographic data from the American Community Survey (ACS) in order to assess the extent to which average annual $PM_{2.5}$ exposure may vary based on race/ethnicity and income within the region. This analysis involved estimating the average $PM_{2.5}$ concentration for each census block group based on the 12 km x 12 km grid cell it was contained within or multiple grid cells if it was not wholly contained within one cell. The following figures show the annual average $PM_{2.5}$ concentrations by demographic group.

In addition to vulnerable populations, CAPCOG conducted an EJ analysis of differences in annual $PM_{2.5}$ exposure within the MSA using $PM_{2.5}$ modeling data provided by the EPA. Using demographic grouping identified by EPA as part of its “EJ Screen” tool[20], in conjunction with 2014-2018 American Community Survey (ACS) data, CAPCOG calculated population-weighted average annual $PM_{2.5}$ concentrations across the Austin-Round Rock-Georgetown MSA:

- Region-wide: 8.67 µg/m³
- By income:
    - Household income ≥ 2 times poverty level: 8.62 µg/m³
    - Household income 1.85 – 1.99 times poverty level: 8.72 µg/m³
    - Household income 1.50 – 1.84 times poverty level: 8.75 µg/m³
    - Household income 1.25 – 1.49 times poverty level: 8.76 µg/m³
    - Household income 1.00 – 1.24 times poverty level: 8.78 µg/m³
    - Household income 0.50 – 0.99 times poverty level: 8.83 µg/m³
    - Household income 0.50 – 0.99 times poverty level : 8.87 µg/m³
- By race and ethnicity:

[20] https://www.epa.gov/ejscreen

- Non-Hispanic/Latino White Alone: 8.58 µg/m^3
- Everyone else/Persons of Color: 8.77 µg/m^3

- By linguistic isolation status:
  - Non-isolated households: 8.69 µg/m^3
  - Linguistically isolated households: 8.97 µg/m^3
- By education:
  - Age 25+ w/ HS[21] diploma or equivalent: 8.67 µg/m^3
  - Age 25+ w/o HS diploma or equivalent: 8.77 µg/m^3
- By age:
  - 0 – 4 years old: 8.69 µg/m^3
  - 5 – 64 years old: 8.69 µg/m^3
  - 65+ years old: 8.51 µg/m^3 (2% lower than 5 – 64-year olds)

With the exception of seniors, these results are broadly consistent with EJ communities having higher exposure to annual $PM_{2.5}$ concentrations. Although, the differences are not nearly as pronounced as seen in other areas of the country[22].

Though the differences are less pronounced than the nation-wide differences identified in the PM ISA, they are fully consistent with them, showing the highest burden of $PM_{2.5}$ exposure within the region falling on non-Hispanic Black/African American residents and among the lowest-income residents of the region. Non-Hispanic/Latino Black/African American residents had average $PM_{2.5}$ exposures that were 2.9% higher than Non-Hispanic/Latino Whites, and households with incomes less than half of the federal poverty level had average $PM_{2.5}$ exposures 2.8% higher than households with incomes 2 or more times higher than the federal poverty level.

[21] HS = high school

[22] https://www.scientificamerican.com/article/people-of-color-breathe-more-unhealthy-air-from-nearly-all-polluting-sources/

7 APPENDIX C: PM EMISSIONS DATA

CAPCOG reviewed the 2017 National Emissions Inventory (NEI) data for the region in order to identify the largest sources of $PM_{2.5}$ emissions. While there are numerous precursors to ambient $PM_{2.5}$ concentrations, we know that direct $PM_{2.5}$ emissions are contributing to ambient PM2.5 concentrations, and the limited modeling data we have suggests that organic carbon is a special concern, so we also focused on sources of organic carbon $PM_{2.5}$.

Table 6-1. Largest sources of $PM_{2.5}$ and Organic Carbon $PM_{2.5}$ Emissions in the region, 2017

Source Category	Tons per year $PM_{2.5}$	% of Total $PM_{2.5}$ Emissions	Tons per year OC $PM_{2.5}$	% of Total OC $PM_{2.5}$ Emissions
Road Dust	2,325	22%	153	6%
Construction Dust	1,693	16%	78	3%
Open Burning	1,574	15%	611	26%
Prescribed Fires	861	8%	403	17%
Agricultural Dust	793	8%	24	1%
Commercial Cooking	417	4%	279	12%
Mining and Quarrying	326	3%	0	0%
Subtotal	**7,989**	**76%**	**1,548**	**65%**

7.1 PM EMISSIONS FROM CONSTRUCTION AND DEMOLITION ACTIVITIES

Construction and demolition activities constitute a large share of the region's $PM_{2.5}$ emissions, and due to the role that local governments and other CAC members have in authorizing, sponsoring, and regulating construction activities, there may be some unique opportunities to achieve significant $PM_{2.5}$ emission reductions by targeting this source of emissions

The following table shows EPA's estimates for $PM_{2.5}$ emissions from the construction and demolition sector in the Austin-Round Rock-Georgetown MSA. EPA's methodology calculates PM_{10} emissions and then assumes that $PM_{2.5}$ emissions are a fixed 10% of PM_{10} emissions.

Table 6-2. 2017 Construction and Demolition Emissions, Austin-Round Rock-Georgetown MSA

SCC	Short Description	$PM_{2.5}$ Emissions (tpy)	% of $PM_{2.5}$ Total
2311010000	Construction - Residential	171.90	1.64%
2311020000	Construction - Non-Residential	764.46	7.28%
2311030000	Construction - Road	756.19	7.20%
TOTAL	**TOTAL**	**1,692.55**	**16.13%**

These estimates are based primarily on the estimated number of acres disturbed from construction and standard assumptions about the amount of emissions generated per acre of land disturbed. For non-residential construction, EPA used activity surrogates including the value of national-level construction spending for non-residential construction and converting it into acres based on prior research that had been conducted, and used county-level employment data in the construction sector to allocate activity to each county. For residential construction, EPA used the number of housing starts in each county, estimated by national-level building starts and county-level permit data. EPA then, determining the amount of soil disturbed for 1-unit homes, and determining the amount of surface soil disturbed for all building types. Road construction emissions are based on state-level road construction spending by roadway type, converted into acres disturbed by road type using conversion factors from the Florida Highway Department Administration, and allocated to each county based on the proportion of building starts in each county.

Emissions factors are then based on county-specific data related to precipitation, evaporation, and dry silt content in each county. EPA assumed no controls.

7.2 PM Emissions from Mining and Quarrying Activities

The "Mining and Quarrying" nonpoint emissions source category is listed as Source Classification Code (SCC) 2325000000. EPA's 2017 NEI includes the following estimates of the direct PM emissions from this SCC, and the percentage of total PM emissions, for the Austin-Round Rock-Georgetown MSA.

Table 6-3. Nonpoint Mining and Quarrying Direct PM Emissions in the 2017 NEI for the Austin-Round Rock-Georgetown MSA

2017 NEI Code	Description	2017 Emissions (tons per year)	% of Total Emissions
EC	Elemental Carbon portion of $PM_{2.5}$-PRI	0.00	0.00%
OC	Organic Carbon portion of $PM_{2.5}$-PRI	0.00	0.00%
NO_3	Nitrate portion of $PM_{2.5}$-PRI	0.17	0.24%
SO_4	Sulfate Portion of $PM_{2.5}$-PRI	0.94	0.46%
PMFINE	Remaining PMFINE portion of $PM_{2.5}$-PRI	324.92	4.55%
PM25-FIL	$PM_{2.5}$ Filterable	326.02	3.86%
PM25-PRI	$PM_{2.5}$ Primary (Filt + Cond)	326.02	3.11%
PM-CON	PM Condensible	0.00	0.00%
DIESEL-PM10[23]	PM_{10}-Primary from certain diesel engines	0.00	0.00%
PM10-FIL	PM_{10} Filterable	2,608.15	5.35%
PM10-PRI	PM_{10} Primary (Filt + Cond)	2,608.15	5.04%

Note that PM25-PRI = PM25-FIL = EC + OC + NO3 + SO4 + PMFINE. The "PMFINE" total represents the "crustal" $PM_{2.5}$ emissions in the $PM_{2.5}$ modeling that CAPCOG has previously analyzed.

Additionally, if also accounting for two other point sources - Austin White Lime and Texas Lehigh Cement company – there is an additional 392 tpy of PM_{10} and 176 tpy of $PM_{2.5}$. The table below shows the combined totals. This accounts for all PM emissions from these facilities, not just the mining and quarrying operations.

Table 6-4. Nonpoint Mining and Quarry SCC plus Austin White Lime and Texas Lehigh Direct PM Emissions in the 2017 NEI

2017 NEI Code	Description	2017 Emissions (tons)	% of Total Emissions
EC	Elemental Carbon portion of $PM_{2.5}$-PRI	4.31	0.63%
OC	Organic Carbon portion of $PM_{2.5}$-PRI	18.52	0.77%

[23] Note – this is accounted for in the non-road construction and mining equipment emissions inventory

2017 NEI Code	Description	2017 Emissions (tons)	% of Total Emissions
NO_3	Nitrate portion of $PM_{2.5}$-PRI	6.95	10.11%
SO_4	Sulfate Portion of $PM_{2.5}$-PRI	28.16	13.72%
PMFINE	Remaining PMFINE portion of $PM_{2.5}$-PRI	444.09	6.21%
PM25-FIL	$PM_{2.5}$ Filterable	480.13	5.68%
PM25-PRI	$PM_{2.5}$ Primary (Filt + Cond)	502.00	4.78%
PM-CON	PM Condensible	19.76	7.91%
DIESEL-PM10	PM_{10}-Primary from certain diesel engines	0.00	0.00%
PM10-FIL	PM_{10} Filterable	2,959.36	6.07%
PM10-PRI	PM_{10} Primary (Filt + Cond)	3,000.22	5.79%

7.3 Estimate of Contribution of Mining and Quarrying Activity to Annual $PM_{2.5}$ Concentrations in the Region

Absent more detailed modeling, the only way to estimate the contribution of mining and quarrying emissions to $PM_{2.5}$ concentrations in the region is to use the emissions and modeling data in conjunction with one another. The range between the highest and lowest crustal modeled $PM_{2.5}$ contribution within the region (the entire region, not just locations where current monitors are located) was 0.94 $\mu g/m^3$. This difference can be assumed to represent approximately the upper limit of the "local" contribution of crustal $PM_{2.5}$ emissions to overall annual $PM_{2.5}$ concentrations. If we use this value in conjunction with the 2017 NEI data showing emissions from Austin White Lime, Texas Lehigh Cement Company, and Nonpoint Mining and Quarrying accounting for 6.24% of the MSA's crustal $PM_{2.5}$ emissions, we can estimate that the local contribution of these sources to annual $PM_{2.5}$ concentrations in the region at approximately 0.06 $\mu g/m^3$.

EPA's estimates of emissions from Austin White Lime and Texas Lehigh Cement Company are based on each company's responses to TCEQ's annual emissions inventory questionnaire (EIQ), since both facilities are considered "point" sources for emissions inventory reporting purposes. The nonpoint mining and quarrying emissions estimates were developed by EPA based on activity estimates and emissions factors document in a memo available on EPA's website.[24] Activity estimates are based on statewide estimates of the quantities of coal, metallic ore, and non-metallic ore handled at surface mines from the U.S. Geological Service (USGS) and the number of employees in applicable sectors in each county as detailed in the U.S. County Business Patterns estimates.

The applicable North American Industrial Classification System (NAICS) codes are listed below.

Table 6-5. NAICS codes used for Mining and Quarrying Emissions Estimates

NAICS Code	Description
2122	Metal Ore Mining
212210	Iron Ore Mining
21222	Gold Ore and Silver Ore Mining
212221	Gold Ore Mining
212222	Silver Ore Mining

24 ftp://newftp.epa.gov/air/nei/2017/doc/supporting_data/nonpoint/Mining%20&%20quarrying%20NEMO%202017%20FINAL_4-2%20update.docx

21223	Copper, Nickel, Lead, and Zinc Mining
212231	Lead Ore and Zinc Ore Mining
212234	Copper Ore and Nickel Ore Mining
21229	Other Metal Ore Mining
212291	Uranium-Radium-Vanadium Ore Mining
212299	All Other Metal Ore Mining
2123	Nonmetallic Mineral Mining and Quarrying
21231	Stone Mining and Quarrying
212311	Dimension Stone Mining and Quarrying
212312	Crushed and Broken Limestone Mining and Quarrying
212313	Crushed and Broken Granite Mining and Quarrying
212319	Other Crushed and Broken Stone Mining and Quarrying
21232	Sand, Gravel, Clay, and Ceramic and Refractory Minerals Mining and Quarrying
212321	Construction Sand and Gravel Mining
212322	Industrial Sand Mining
212324	Kaolin and Ball Clay Mining
212325	Clay and Ceramic and Refractory Minerals Mining
21239	Other Nonmetallic Mineral Mining and Quarrying
212391	Potash, Soda, and Borate Mineral Mining
212392	Phosphate Rock Mining
212393	Other Chemical and Fertilizer Mineral Mining
212399	All Other Nonmetallic Mineral Mining

7.4 PM Emissions from Commercial Cooking Activities

The “Commercial Cooking” nonpoint emissions source category includes the following SCCs:

- 2302002100 – Conveyorized Charbroiling;
- 2302002200 – Under Fire Charbroiling;
- 2302003100 – Flat Griddled Frying; and
- 2302003200 – Clamshell Frying.

EPA’s 2017 NEI includes the following estimates of the direct PM emissions from these SCCs, and the percentage of total PM emissions, for the Austin-Round Rock-Georgetown MSA.

Table 6-6. Nonpoint Commercial Cooking Direct PM Emissions in the 2017 NEI for the Austin-Round Rock-Georgetown MSA

2017 NEI Code	Description	2017 Emissions (tons per year)	% of Total Emissions
EC	Elemental Carbon portion of $PM_{2.5}$-PRI	19.35	2.84%
OC	Organic Carbon portion of $PM_{2.5}$-PRI	377.20	15.76%
NO3	Nitrate portion of $PM_{2.5}$-PRI	2.78	4.05%
SO4	Sulfate Portion of $PM_{2.5}$-PRI	1.56	0.76%
PMFINE	Remaining PMFINE portion of $PM_{2.5}$-PRI	176.40	2.47%
PM25-FIL	$PM_{2.5}$ Filterable	577.24	6.83%
PM25-PRI	$PM_{2.5}$ Primary (Filt + Cond)	577.24	5.50%
PM-CON	PM Condensible	0.00	0.00%

2017 NEI Code	Description	2017 Emissions (tons per year)	% of Total Emissions
DIESEL-PM10[25]	PM_{10}-Primary from certain diesel engines	0.00	0.00%
PM10-FIL	PM_{10} Filterable	619.30	1.27%
PM10-PRI	PM_{10} Primary (Filt + Cond)	619.30	1.20%

Note that PM25-PRI = PM25-FIL = EC + OC + NO3 + SO4 + PMFINE. The "PMFINE" total represents the "crustal" $PM_{2.5}$ emissions in the $PM_{2.5}$ modeling that CAPCOG has previously analyzed.

100% of the direct PM emissions from commercial cooking come from the charbroiling SCCs. The SCCs related to frying contribute volatile organic compound (VOC) emissions. However, due to lack of source apportionment modeling at sufficient resolution to enable an understanding of the relative importance of local VOC emissions to local direct organic carbon (OC) $PM_{2.5}$ emissions, it is not clear what the extent of the additional contribution of these VOC emissions may have to local $PM_{2.5}$ concentrations. As Table 4-11 above shows, commercial cooking accounts for a significant share of the OC $PM_{2.5}$ emissions within the region that accounts for the vast majority of the variation in $PM_{2.5}$ concentrations within the region.

Absent more detailed modeling, the only way to estimate the maximum contribution of commercial cooking OC $PM_{2.5}$ emissions to $PM_{2.5}$ concentrations in the region is to use the emissions and modeling data in conjunction with one another. The range between the highest and lowest modeled OC $PM_{2.5}$ contribution within the region (the entire region, not just locations where current monitors are located) was 2.10 $\mu g/m^3$. This difference can be assumed to represent approximately the upper limit of the "local" contribution of OC $PM_{2.5}$ emissions to overall annual $PM_{2.5}$ concentrations. If we use this value in conjunction with the 2017 NEI data showing emissions from commercial accounting for 15.76% of the MSA's OC $PM_{2.5}$ emissions, we can estimate that the local contribution of these sources to annual $PM_{2.5}$ concentrations in the region at approximately 0.33 $\mu g/m^3$. Using this same approach for the other components as well, the total contribution from commercial cooking could be estimated at approximately 0.36 $\mu g/m^3$.

EPA's methodology for estimating commercial cooking are documented in a memo available on EPA's website.[26] Activity estimates are based on the number of several different types of commercial cooking establishments within each county, the estimated average number of pieces of charbroiling equipment at each type of establishment, the average quantity of meat cooked per year on each type of equipment at each type of establishment, and the average emissions rate per pound of meat cooked from each type of charbroiling (under fire or conveyorized). EPA assumed that there were no controls in place.

[25] Note – this is accounted for in the nonroad construction and mining equipment emissions inventory

[26] ftp://newftp.epa.gov/air/nei/2017/doc/supporting_data/nonpoint/Commercial%20Cooking%20NEMO%20FINAL_4-2%20update.docx