Regional Air Pollution Measure Guide for the Austin-Round Rock MSA 2019-2023 Air Quality Plan

August 31, 2018

1 General Information on Regional Air Pollution Measures

1.1 Purpose of this Guide

This purpose of this guide is to provide members of the Central Texas Clean Air Coalition with guidance on the selection and implementation of air pollution measures in support of the Austin-Round Rock MSA's 2019-2023 Air Quality Plan, the goals of which are to: 1) maximize the probability of compliance with the National Ambient Air Quality Standards (NAAQS), and 2) to otherwise minimize the health and environmental impacts of regional air pollution.

1.2 Primary Focus on NO_X Emissions

Since the air pollutant that the region is at most risk for violating a NAAQS is ground-level ozone (O_3), and NO_X emissions are by far the greatest contributor to ground-level O_3 levels in the region, this guide focuses primarily on measures to reduce NO_X emissions. However, while the primary driver for reducing NO_X emissions is the impact of NO_X on O_3, reducing NO_X emissions also helps reduce ambient nitrogen dioxide (NO_2) concentrations, fine particulate matter ($PM_{2.5}$) concentrations, and regional haze conditions in national parks. Ground-level O_3 is also a greenhouse gas, so reductions in ground-level O_3 can also help reduce the impact of climate change. And measures taken to reduce NO_X emissions often also reduce emissions of a host of other pollutants, including direct emissions of other criteria pollutants ($PM_{2.5}$, carbon monoxide (CO), sulfur dioxide (SO_2), and volatile organic compounds (VOC)) and greenhouse gases (carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and various fluorinated gases. Implementing these measures can also have various other environmental, economic, and social benefits, such as reducing resource consumption and improving transportation outcomes. Where possible, in this guide, CAPCOG identifies relevant co-benefits associated with measures targeted at impacting NO_X emissions. Measures designed to reduce air pollution from NO_X emissions support both goals of the region's air quality program.

1.3 Secondary Focus on Public Awareness and Notification

Apart from the region's efforts to control and reduce air pollution, the region periodically experiences air pollution levels that are "moderate" or worse, based on EPA's Air Quality Index (AQI). When these conditions occur, there are public health benefits that can be achieved by ensuring that members of the public are aware of the conditions and take appropriate steps to limit exposure. While increases in awareness about air quality generally should lead members of the public to take additional action to reduce emissions, there is a public health benefit to public awareness and notification associated with exposure avoidance even if these measures don't lead to any additional emission reductions.

1.4 Categorization of Measures

For the 2019-2023 plan, there are four broad categories of measures:

1. Measures to reduce air pollution from the use of personal vehicles
2. Measures to reduce air pollution from the use of fleet/commercial vehicles and equipment

3. Measures to reduce air pollution from power plants and other stationary combustion sources
4. Measures to promote awareness of air quality and reduce the public's exposure when air pollution levels are high

1.5 Estimated Sources of NO_X Emissions within the Region

The following table shows the estimated ozone-season day (OSD) NO_X emissions for personal vehicles, fleet/commercial vehicles and equipment, and stationary sources for the region for 2017 - 2023.

Table 1. Estimated Anthropogenic Ozone Season Day NO_X Emissions, Austin-Round Rock MSA (tons per day)

Source	2017	2018	2019	2020	2021	2022	2023
Personal Vehicles	15.0002	13.4057	12.0961	10.9761	10.0249	9.2971	8.6878
Commercial Vehicles and Non-Road Equipment	32.1516	29.2648	26.9243	25.0379	23.4698	22.1678	21.0651
Stationary Sources	28.3722	28.3722	28.3722	28.3722	26.2085	24.3948	24.3948
TOTAL	**75.5240**	**71.0427**	**67.3925**	**64.3861**	**59.7032**	**55.8597**	**54.1476**

There are also "biogenic" NO_X emissions:

- 2011: 10.8475 tpd NO_X
- 2014: 4.8991 tpd NO_X

These emissions are from soils, and include emissions from nitrogen-enriched fertilizers. While biogenic NO_X emissions are not usually targeted as part of regional air quality plans, the 2019-2023 air quality plan for the Austin-Round Rock MSA includes measures designed to control NO_X emissions from the use of nitrogen-enriched fertilizers.

1.6 General Strategies for Reducing Ground-Level O_3 in the Region

There are four general strategies that can be used to reduce or control ground-level O_3 formation within the region:

- Reduce the NO_X rates for combustion equipment (i.e., lbs NO_X/VMT, lbs NO_X/kWh)
- Reduce the use of combustion equipment (i.e., reduce VMT, reduce electricity consumption)
- Modify the timing of NO_X emissions (i.e., postpone errands until the afternoon)
- Modify the location of NO_X emissions (i.e., encourage a new point source to locate downwind from the urban core rather than upwind from it)

1.7 Impact of Timing of NO_X Emissions on O_3 Formation

One important thing to understand is that, while reducing NO_X emissions year-round will undoubtedly reduce O_3 formation, there are ways that organizations can target actions for just those months when O_3 levels are expected to be highest and for times of the day when NO_X emissions contribute most to peak O_3 formation. By doing so, organizations can that can improve the effectiveness and cost-effectiveness of its air pollution reduction efforts. Sometimes, simply changing the time of day, day of week, or month when emissions occur can dramatically reduce the impact of those emissions.

The following summarizes the impact of timing of NO_X emissions on O_3:

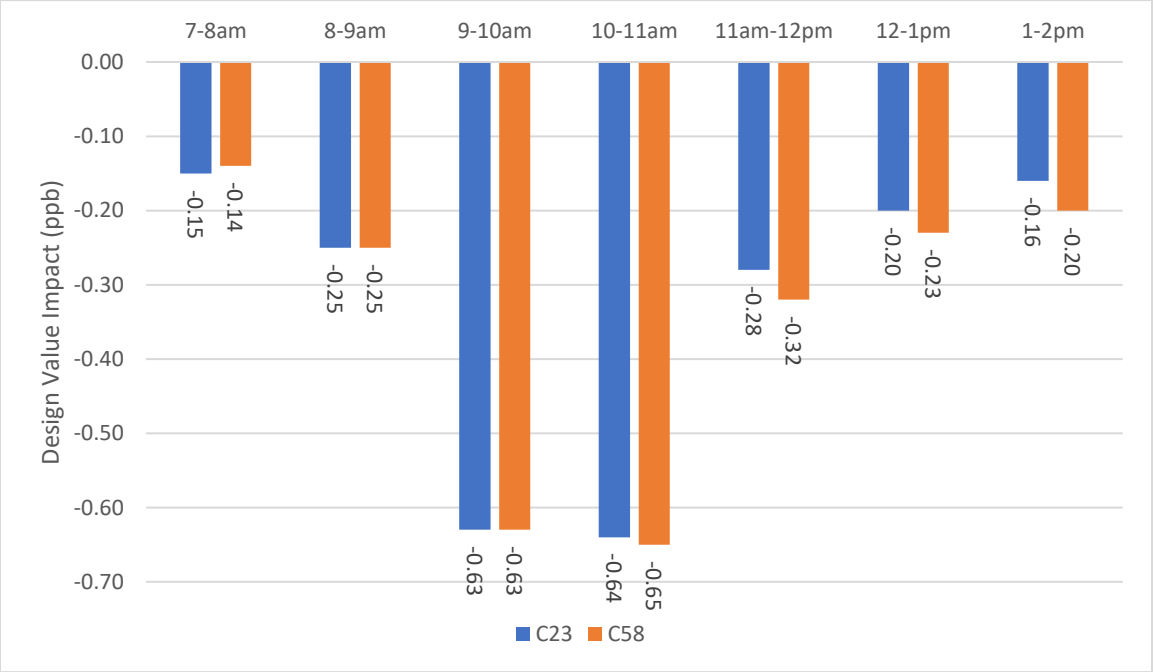
1. NO_X emissions that occur between 9 am and 11 am will have a much higher impact on that day's peak 8-hour O_3 average than NO_X emissions occurring in any other hour
2. NO_X emissions that occur between 7 am and 8 am have less of an impact on peak O_3 than NO_X emissions between 8 am and 9 am
3. For every hour after 10 am – 11 am, the impact of NO_X emissions on peak O_3 diminishes

1.7.1 Impact of Time of Day

The impact that NO_X emissions can have on peak 8-hour O_3 levels is heavily influenced by the time of day in which the emissions occur. Average 8-Hour O_3 concentrations exceeding 70 ppb have started as early as 9 am (through 5 pm) and as late as 1 pm (through 9 pm). Apart from whether a particular hour falls within an 8-hour O_3 concentration over 70 ppb, the impact of time of day can also be related to higher chemical reaction rates during certain hours of the day.

The following figure shows the impact of a 1 ton reduction in on-road NO_X emissions on the design values at monitoring stations in the San Antonio area. The impact would be similar in the Austin area.

Figure 1. Impact of a 1 ton reduction in on-road NO_X emissions on San Antonio O_3 design values

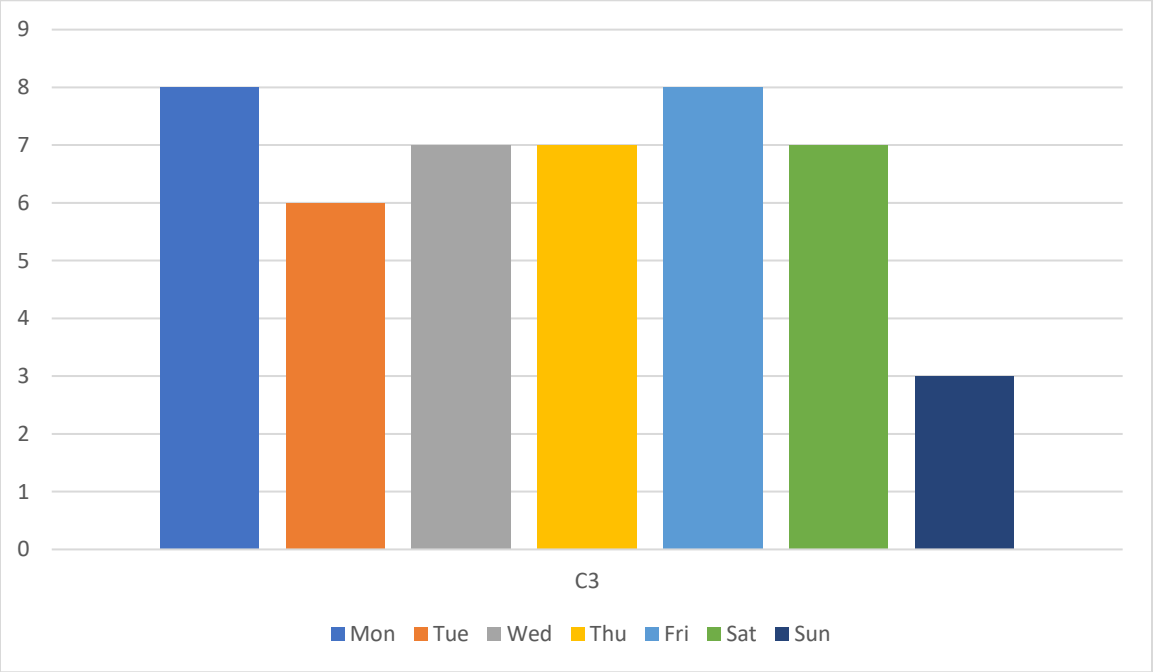


Based on this modeling, one ton of on-road NO_X emissions that occur between 7 am and 8 am has 40-44% effect on a day's peak O_3 levels as the same ton of on-road NO_X emissions if it occurred between 8 am and 9 am. Likewise, that same ton of NO_X has only 22-24% of the impact on the day's peak O_3 levels as it would if it occurred between 9 am and 10 am. Similarly, the impact of NO_X emissions from 11 am – 12 pm is much lower than the impact from 10 am – 11 am, and each hour thereafter has a smaller impact than the prior hour. The key take-way from this modeling is that avoiding or reducing NO_X emissions between 9 am and 11 am will have a much more significant impact on the region's ability to comply with the O_3 NAAQS than reducing NO_X emissions during any other hour of the day.

1.7.2 Impact of Day of Week

One of the other factors that can influence the impact of NO_X emissions on the region's chances of complying with the O_3 NAAQS is the day of the week in which the emissions occur. In general, NO_X emissions tend to be the highest on Friday, followed by Monday-Thursday, Saturday, and Sunday. Within the Austin-Round Rock MSA, data from January 2010-August 2018 clearly shows that the chances of O_3 levels exceeding 70 ppb are much lower on Sundays than any other day of the week at CAMS 3, the region's key regulatory O_3 monitor.

Figure 2. Number of Days with MDA8 O_3 >70 ppb at CAMS 3 and CAMS 38 by Day of Week, January 2010 - August 2018

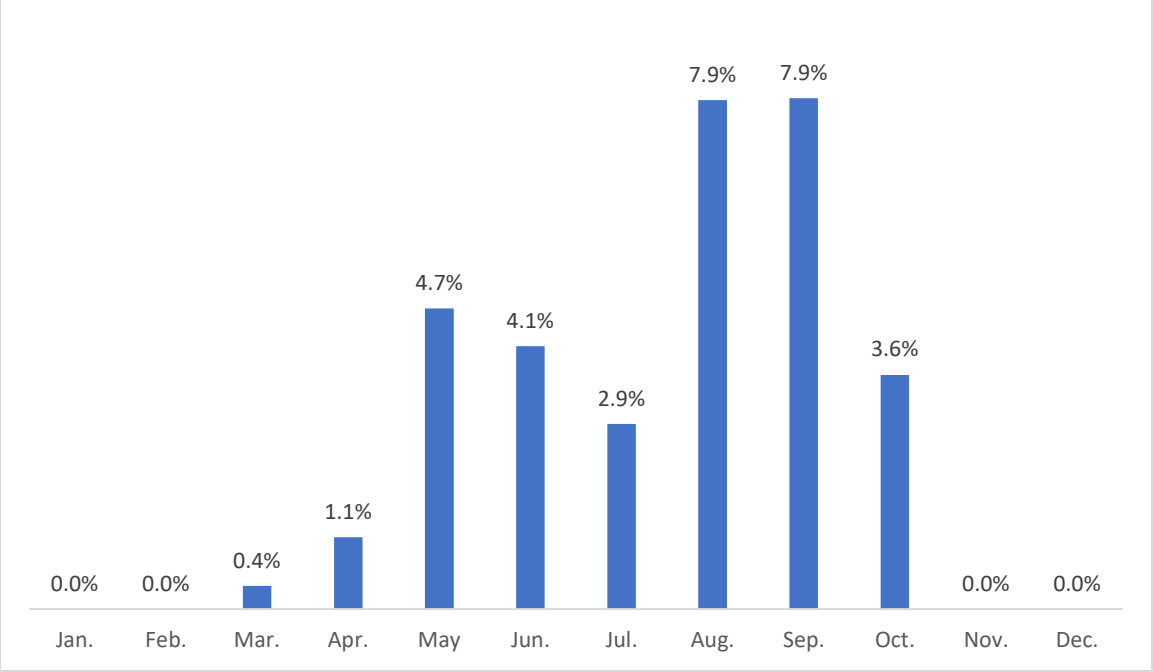


1.7.3 Impact of Month

The official "ozone season" for the Austin-Round Rock MSA is March 1 – November 30. This is the time frame in which EPA requires O_3 monitoring due to O_3 levels approaching 70 ppb as early as March and as late as November. As described in CAPCOG's 2010-2015 O_3 conceptual model and in subsequent analyses of O_3 data collected in 2016 and 2017, 8-hour O_3 levels over 70 ppb have been recorded within the region as early as March 25 and as late as October 17. For the Austin-Round Rock MSA's two regulatory O_3 monitors, dates with the four-highest maximum daily 8-hour O_3 averages (MDA8) have occurred as early as February 12 and as late as October 24. Based on these dates, reducing NO_X emissions in November, December, and January would not be expected to have any impact on the region's ability to comply with the O_3 NAAQS.

Within these months, some months are much more likely to record high O_3 levels than others. Namely, O_3 levels over 70 ppb are much more likely to occur in August and September than in any other months. These two months have accounted for 48% of all instances in which 8-hour O_3 has exceeded 70 ppb within the region. The following chart shows the likelihood of O_3 exceeding 70 ppb somewhere in the region on any given day for each month from January 2010 -August 2018.

Figure 3. Likelihood of O_3 exceeding 70 ppb on any given day by month, January 2010-August 2018



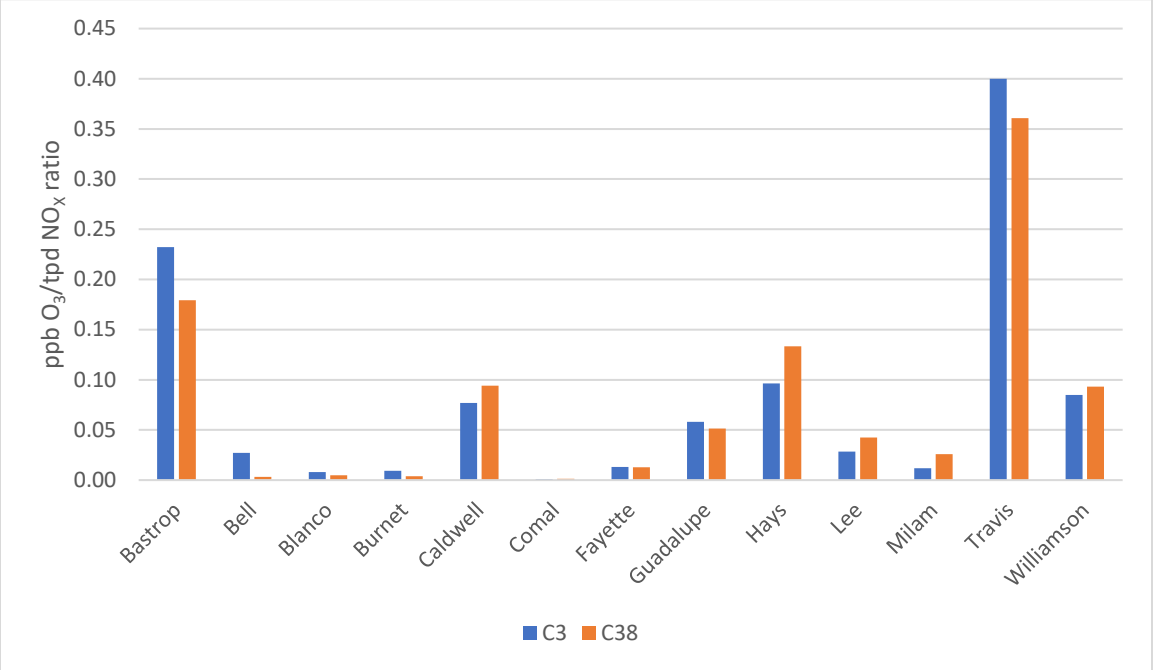
1.8 Impact of Location of NO_X Emissions on O_3 Formation

The geographic location of NO_X emissions is one of the major factors that affects the impact on the region's peak O_3 levels. In general:

- The closer NO_X emissions are to the Austin urbanized core, the higher of an impact they will have on the region's peak O_3 concentrations
- NO_X emissions that occur in or upwind of the Austin urbanized core will have a higher impact on the region's peak O_3 concentrations than NO_X emissions that occur elsewhere
- The more concentrated the geographic area over which NO_X emissions occur, the higher the potential impact on peak O_3 concentrations

The following figure shows the average O_3 impact of OSD NO_X emissions (ppb O_3/tpd NO_X) from each county in the MSA and each adjacent county on peak O_3 levels at CAMS 3 based on modeling conducted by CAPCOG and AACOG in 2017. This illustrates the extent to which the location of NO_X emissions impacts its impact on the region's O_3 levels.

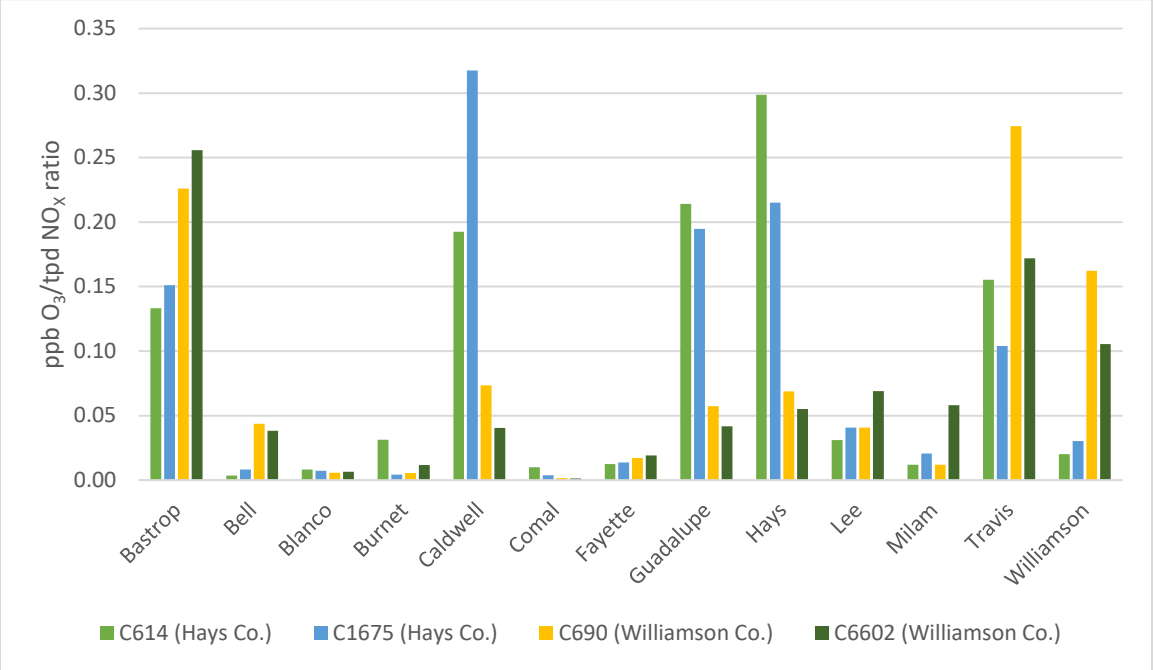
Figure 4. Average Peak 8-Hour O_3 Impact at C3 and 38 per TPD NO_X Emissions from 2017 Air Quality Modeling by County (ppb O_3/tpd NO_X)



All else being equal, a ton per day of NO_X emissions reductions that take place within Travis County would be expected to have 2-4 times the O_3 impact at CAMS 3 and 38 of NO_X emission reductions that take place within Bastrop, Caldwell, Hays, and Williamson Counties.

Similarly, NO_X reductions close to any of the non-regulatory monitors have a disproportionate impact on the O_3 levels at those monitoring stations. The following figure shows the results for non-regulatory stations in Hays and Williamson Counties.

Figure 5. Average Peak 8-Hour O_3 Impact at C614, 690, 1675, and 6602 per TPD NO_X Emissions from 2017 Air Quality Modeling by County (ppb O_3/tpd NO_X)



1.9 Tier 1-Level Measures Recommended for all CAC Members

CAPCOG has identified a package of basic "Tier 1" measures that are recommended for all CAC members. These measures are low-threshold measures should not necessarily require the use of financial resources, but instead involve an organization focus on air pollution.

- Measures to reduce air pollution from the use of personal vehicles:
  - Where feasible, encourage employees to telecommute at least once a week and on all Ozone Action Days;
  - When employees are not telecommuting, encourage them to take low-emission modes of transportation, such as carpooling, vanpooling, transit, biking, and walking;
  - Where flexible schedules are allowed, encourage employees to consider work schedules with start times earlier than 8 am rather than later in the morning due to the higher impact of emissions on O_3 levels later in the morning;
- Measures to reduce air pollution from the use of fleet/commercial vehicles and equipment:
  - Establish and enforce idling restriction policies for use of the organization's vehicles, equipment, and property;
  - Establish fleet management policies that prioritize the use of vehicles and equipment with low NO_X rates;
  - Educate fleet users on driving and equipment operation practices that can reduce NO_X emissions;
  - Seek funding to accelerate replacement of older, higher-emitting vehicles and equipment with newer, cleaner vehicles and equipment, such as Texas Emission Reduction Plan (TERP) grants;
- Measures to reduce air pollution from power plants and other stationary combustion sources:

    - Conserve energy, particularly on Ozone Action Days;
    - Schedule discretionary emission-generating activities such as engine testing to the afternoon, particularly on Ozone Action Days;
- Measures to promote awareness of air quality and reduce residents' exposure when air pollution levels are high
    - Educating employees about regional air quality and encouraging them to sign up for daily air quality forecasts and Ozone Action Day alerts

Organizations that commit to implement all of these measures will be identified in the plan will be identified as "Tier 1" participants in the plan. Subsequently, organizations that in fact implemented all of these measures in the prior year will be identified as a "Tier 1" participant in that year's air quality report. Organizations committing to implement or implementing some but not all of these measures will be listed as "supporting" participants, but not as "Tier 1" participants.

1.10 Tier 2-Level Measures

There are also a number of Tier 2-level measures that CAPCOG has identified would go beyond the Tier 1 measures identified above, but would require some outlay of resources.

- Measures to reduce air pollution from the use of personal vehicles:
    - Provide incentives to employees to avoid single-occupancy vehicle commuting, particularly on Ozone Action Days
- Measures to reduce air pollution from the use of fleet/commercial vehicles and equipment:
    - Establish low-NO_X purchasing policies for new on-road vehicles, non-road equipment, and stationary equipment
    - Establish "green" contracting policies to encourage the use of low-NO_X vehicles and equipment and avoid the use of engines during the morning on Ozone Action Days
    - Purchase higher-grade gasoline with lower sulfur content in August and September
    - Enforce vehicle idling restrictions within the community [either through an ordinance if a city or a memorandum of agreement with TCEQ if a county]
- Measures to reduce air pollution from power plants and other stationary combustion sources:
    - Optimize combustion and pollution controls for NO_X reductions, particularly on Ozone Action Days and between 9 am and 3 pm
- Measures to promote awareness of air quality and reduce residents' exposure when air pollution levels are high
    - Educating the public about regional air quality and encouraging them to sign up for daily air quality forecasts and Ozone Action Day alerts

If an organization commits to implement all Tier 1 measures and at least one Tier 2 measure identified above, the organization will be identified as a Tier 2-Level participant in the plan. Similarly, if an organization in fact implements and reports on all Tier 1 measures and at least one Tier 2 measure in a particular calendar year, CAPCOG will identify the organization as a Tier 2-level participant in the plan in that year's air quality report.

1.11 Other Measures

The list above is not exhaustive of measures that CAC members can take in support of the region's air quality goals. To the extent that a jurisdiction wishes to identify a measure it is committing to implement or has implemented in support of these goals, CAPCOG encourages the CAC member to submit information on these measures to CAPCOG.

2 Details on Tier 1 and Tier 2 Air Pollution Measures

This section of the guide provides additional explanation and details on the Tier 1 and Tier 2 air pollution measures identified by CAPCOG.

2.1 Measures to reduce air pollution from the use of personal vehicles

Every organization has employees and can have an influence on their employees' commuting. Actions taken to reduce air pollution from the use of personal vehicles can have a disproportionate impact on O_3 formation due to the high concentration of personal vehicle use in the urban core during the morning hours when NO_X emissions have the highest impact. Personal vehicles remain the largest single source of NO_X emissions within the MSA.

2.1.1 Where feasible, encourage employees to telecommute at least once a week and on all Ozone Action Days

While there is an increasing number of people who primarily work from home, it is possible to achieve significant reductions in commuting-related emissions by encouraging employees who commute using a Single Occupancy Vehicle (SOV) to telecommute once or twice a week. Telecommuting has the benefit of entirely avoiding both the "start" emissions associated with trips of any length and the "running" emissions associated with traveling over a distance. By removing a vehicle from the road, telecommuting also has the added benefit of reducing congestion on the transportation system, which can reduce the percentage of time vehicles spend operating at the high NO_X rates associated with low vehicle speeds (i.e., below 20 mph).

2.1.2 When employees are not telecommuting, encourage them to take low-emission modes of transportation, such as carpooling, vanpooling, transit, biking, and walking

To the extent that employees need to be physically present at their work site, encouraging them to use modes other than a SOV helps reduce the impact of their commuting. Encouraging employees to commute by carpool, vanpool, transit, biking, and walking rather than SOV commuting, regularly or periodically, can significantly reduce the impact of their commuting on regional air pollution. These measures both reduce the emissions from the SOV itself, but also reduce emissions from other vehicles on the transportation system by reducing congestion and the percentage of time vehicles spend operating at the high NO_X rates associated with low vehicle speeds (i.e., below 20 mph).

2.1.3 Where flexible schedules are allowed, encourage employees to consider work schedules with start times earlier than 8 am rather than later in the morning due to the higher impact of emissions on O_3 levels later in the morning

Therefore, to the extent that employees are allowed to use flexible schedules, flexible schedules that involve an earlier start time are preferable to ones that have a later start time. Figure 1 aboveshows the impact of a 1 ton reduction in on-road NO_X emissions on monitoring stations in the San Antonio area – we would expect to see similar impacts in the Austin area.

2.1.4 Provide incentives to employees to avoid single-occupancy vehicle commuting, particularly on Ozone Action Days

Beyond simply encouraging employees to avoid single-occupancy vehicle commuting, organizations can take more tangible action to incentivize employees to reduce SOV commuting, particularly on ozone action days. Examples of such incentives include:

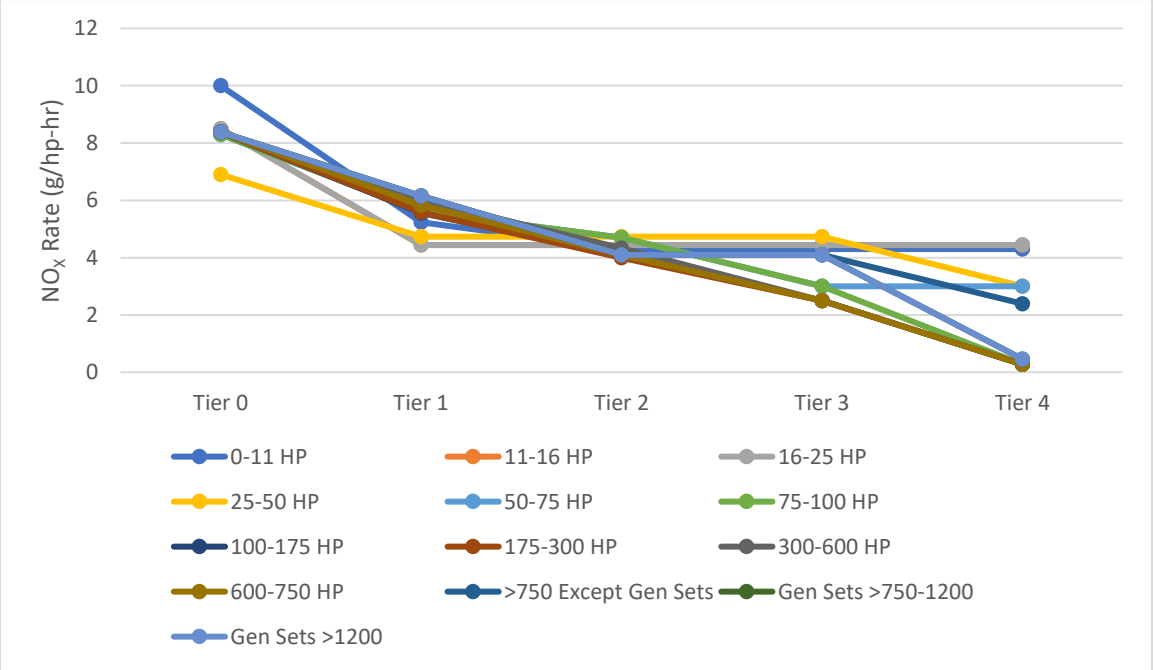
- The City of Austin's Smart Commute Rewards program, which involves awarding administrative leave to employees who regularly use a sustainable mode of commuting
- Travis County's subsidized bus pass program

- Travis County's policy allowing certain employees to start their work day when they log onto their computer on a CapMetro commuter bus or train
- An organization providing an additional subsidy for the unsubsidized portion of the costs for participation in CapMetro's MetroRideshare vanpool program
- A parking cash-out program that pays employees to forgo a parking pass
- Charging for parking if parking is currently free

2.2 Measures to reduce air pollution from the use of fleet/commercial vehicles and equipment

Reducing emissions from commercial equipment – either an organization's own fleet of vehicles and equipment or the vehicles and equipment used by contractors – is one of the most direct ways that an organization can reduce its impact on air pollution. A large share of commercial vehicles and equipment are older and do not meet new, stringent NO_X standards, making strategies targeted at these vehicles one of the easiest ways to achieve large amounts of NO_X reductions. For example, the following figure shows the NO_X emissions rates (pounds of NO_X emitted per vehicle-mile traveled) for diesel-powered non-road equipment based on their emissions certification level.

Figure 6. Tier 0-4 Diesel Non-Road Equipment NO_X Standards (g/hp-hr)[1]



2.2.1 Establish and enforce idling restriction policies for use of an organization's own vehicles, equipment, and property

One way that organizations can have an immediate impact on air pollution is to establish and enforce restrictions on idling of vehicles or equipment owned by the organization or on the organization's property. Posting signs in vehicles and around the property (similar to no-smoking signs) can be effective at ensuring that people are aware of these restrictions. For local governments that have idling

[1] https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10081UI.pdf

restrictions for the community at large in place, ensuring that their own fleet operators and any contractors are not idling can also be important to ensuring that the community adheres to any anti-idling ordinances as well.

2.2.2 Establish fleet management policies that prioritize the use of vehicles and equipment with low NO_X rates

Without needing to invest in any new equipment, organizations can reduce air pollution from their own operations by simply prioritizing the use of vehicles and equipment with low NO_X rates. In general, the following types of vehicles and equipment will have the lowest NO_X rates available:

- Light-duty vehicles and trucks: Tier 3 (model year 2017 and newer)
- Heavy-duty vehicles: Model Year 2010 and newer
- Diesel-powered non-road equipment: Tier 4 (model years 2014 and newer)
- Large gasoline, LPG, or CNG-powered non-road equipment: Phase 2 (model years 2007 and newer)
- Small hand-held gasoline, LPG, or CNG-powered non-road equipment: Phase 3 (model years 2012 and newer)

2.2.3 Educate fleet users on driving and equipment operation practices that can reduce NO_X emissions

Educating fleet users on driving and equipment operators on practices that can reduce NO_X emissions can be helpful in reducing NO_X emissions. Often, the same types of practices that reduce wear and tear on a vehicle – such as heavy acceleration and deceleration – also increase a vehicle's NO_X emissions rate. Providing training or other types of education for fleet users to help them operate vehicles and equipment in ways that minimize NO_X emissions is a small but meaningful step that organizations can take to reduce air pollution.

2.2.4 Seek funding to accelerate replacement of older, higher-emitting vehicles and equipment with newer, cleaner vehicles and equipment, such as Texas Emission Reduction Plan (TERP) grants

One of the best ways that organizations can reduce NO_X emissions is by accelerating the replacement of older, higher-emitting vehicles and equipment with newer vehicles and equipment that meet much stricter emissions standards. The Texas Commission on Environmental Quality (TCEQ) and the U.S. Environmental Protection Agency (EPA) both have programs designed to incentivize this type of early retirement of older diesel-powered vehicles: the TCEQ's Texas Emission Reduction Plan (TERP) grant program and the EPA's Diesel Emission Reduction Act (DERA) grants. These grants can cover the incremental costs of moving up the retirement date of older equipment that would otherwise continue to be used. CAPCOG can assist CAC members in applying for these grants.

2.2.5 Establish low-NO_X purchasing policies for new on-road vehicles, non-road equipment, and stationary equipment

Organizations can also help reduce NO_X emissions from their operations by establishment procurement policies targeted at minimizing NO_X emissions from any new equipment acquired by the organization. EPA's national emissions standards apply to vehicle and equipment manufacturers and require that they achieve average emissions rates across all of the vehicles or equipment that they sell, but they are allowed to sell some vehicles or equipment that have NO_X emissions rates above the fleetwide standards as long as they also sell an equivalent amount of vehicles or equipment that have NO_X emissions rates below the standards. The following table illustrates the differences between the

fleetwide average emissions standards and the emission limits for individual vehicles that are permitted under current standards.

Figure 7. Examples of Mobile Source Fleetwide Emission Standards and Not-to-Exceed Limits

Vehicle/Equipment Type	Fleetwide Average Standard	Not-to-Exceed Limits
Tier 4 Diesel Non-Road Equipment < 19 kW Except Gen. Sets[2]	7.5 g NO_X + HC/kW-hr	9.5 g NO_X + HC/hp-hr
Tier 4 Diesel Non-Road Equipment 19-56kW Except Gen Sets[3]	4.7 g NO_X + HC/kW-hr	7.5 g NO_X + HC/hp-hr
Tier 4 Diesel Non-Road Equipment 56-560 kW Except Gen. Sets[4]	0.40 g NO_X/kW-hr	3.8 g NO_X/hp-hr
Tier 4 Diesel Non-Road Generator Sets[5]	0.67 g NO_X/kW-hr	3.8 g NO_X/hp-hr
Model Year 2010 and Later Diesel Heavy-Duty Vehicles[6]	0.20 g NO_X/hp-hr	0.50 g NO_X/hp-hr
Model Year 2008 and Later Gasoline, LPG, or CNG Vehicles, GVWR 8,500 – 10,000	0.2 g NO_X/mile	0.9 g NO_X/mile
Model Year 2008 and Later Gasoline, LPG, or CNG Vehicles, GVWR 8,500 – 10,000	0.4 g NO_X/mile	1.0 g NO_X/mile
Full Phase-In of Tier 3 Light-Duty Vehicle Exhaust Standards[7]	0.030 g NMOG + NO_X/mile	0.160 g NMOG + NO_X/mile

As the table above shows, purchasing a new piece of non-road equipment does not guarantee that the NO_X emissions rate is going to be in line with the fleet-wide average. By establishing emissions specifications in a procurement, an organization can help avoid purchasing vehicles or equipment that have high NO_X rates despite being new. Examples of such specifications include:

- Requiring that the engine has a lower NO_X rate than the "not-to-exceed" limits;
- Requiring that the engine has a NO_X emissions rate that is at least as stringent as the fleetwide average standard; or

[2] 40 CFR 1039.101
[3] Ibid
[4] Ibid
[5] Ibid
[6] 40 CFR 86.007-11
[7] 40 CFR 86.1811-17

- Requiring that the engine has a NO_X emissions rate that is more stringent than the fleetwide average standard.

When considering whether to purchase a new or used vehicle or piece of equipment, purchasing policies can also take account of the differences in emissions rates for newer and older engines. CAPCOG can assist any organization interested in establishing such policies.

2.2.6 Establish "green" contracting policies to encourage the use of low-NO_X vehicles and equipment and avoid the use of engines during the morning on Ozone Action Days

There are a number of ways that an organization can reduce its air pollution impact through contracting policies. Two key ways that this can be achieved are by specifying or incentivizing the use of low-NO_X vehicles and equipment and avoiding the use of engines during the morning on Ozone Action Days.

EPA's Tier 4 NO_X emission standards for non-road diesel engines reduce NO_X emissions rates substantially below uncontrolled rates and even below rates for EPA's Tier 1 – 3 standards. Tier 4 equipment rated at 75 – 750 HP have NO_X emissions rates 97% below uncontrolled rates, 95% below Tier 1 rates, 93% below Tier 2 rates, and 89-91% below Tier 3 rates.

When contracting for services that will require the use of non-road equipment, specifying or incentivizing the use of equipment that meets tier 4 standards if diesel or phase II standards if gasoline, LPG, or CNG, can achieve substantial reduction in NO_X emissions, as well as reductions in CO, $PM_{2.5}$, PM_{10}, VOC, and CH_4 emissions.

Another way that organizations can reduce the O_3 impact of these types of activities is to include provisions that avoid using this equipment between 9 am and 11 am in particular so as to avoid the impact of the emissions on peak 8-hour ozone averages. Contracts can also treat OADs as "bad weather days" similar to what happens if it rains.

2.2.7 Purchase higher-grade gasoline with lower sulfur content in August and September

CAC members can achieve NO_X reductions from on-road vehicles by purchasing higher-grade gasoline due to lower sulfur content in the gasoline. Sulfur interferes with the efficiency of a vehicle's pollution control system and limits the amount of NO_X reductions that can be achieved from the use of newer, cleaner vehicles. The effects of sulfur contamination of pollution control systems can also persist over time.

The Austin area consistently had the highest gasoline sulfur levels in the state: TCEQ's fuel sampling studies in 2011[8], 2014[9], and 2017[10] all showed the Austin region having the state's highest levels. The 2017 average fuel sulfur levels were substantially higher (30 ppm) than what TCEQ and EPA had previously modeled (10 ppm) for nation-wide gasoline fuel sulfur levels after new gasoline regulations took effect in January 2017. The following table shows the gasoline sulfur levels sampled at Austin-area gas stations in 2017.

[8] https://www.tceq.texas.gov/assets/public/implementation/air/am/contracts/reports/mob/5821199776FY1103-20110831-ergi-summer_2011_fuels.pdf

[9] https://www.tceq.texas.gov/assets/public/implementation/air/am/contracts/reports/mob/5821199776FY1420-20140815-ergi-summer_2014_fuels.pdf

[10] https://www.tceq.texas.gov/assets/public/implementation/air/am/contracts/reports/ei/582177149010-20170831-ergi-2017SummerFuelFieldStuday.pdf

Table 2. Gasoline Fuel Sulfur Content from TCEQ 2017 Fuel Sampling Study (ppm)

Station	Regular	Medium	Premium
7-Eleven Store 36600, 1625 E. Parmer Ln., Austin, TX 78753	36	26	17
Discover Food Mart 1, 7200 N. IH 35, Austin, TX 78752	35	29	19
M & S Food Mart, 5511 Cameron Rd., Austin, TX 78723	35	26	20
Average	**35.3**	**27.0**	**18.7**

An analysis conducted by the Mid-Atlantic Regional Air Management Association (MARAMA) indicated that NO_X emissions from gasoline-powered vehicles are 35% lower when gasoline has 10 ppm sulfur content compared to 30 ppm sulfur content.[11] Based on these figures and the Austin-area data, the use of medium-grade gasoline in the region would be expected to reduce NO_X emissions by approximately 13% compared to regular grade, and the use of premium-grade gasoline reduces NO_X emissions by approximately 27% compared to regular-grade. The average prices for regular-grade, medium-grade, and regular-grade gasoline for March – July 2018 are shown below[12]:

- Regular: $2.557 per gallon
- Medium: $2.850 per gallon ($0.293 more than regular)
- Premium: $3.101 per gallon ($0.544 more than regular)

Purchasing higher-grade gasoline is one way that CAC members can reduce their NO_X emissions, particularly during the key months of August and September.

2.3 Enforce vehicle idling restrictions within the community [either through an ordinance if a city or a memorandum of agreement with TCEQ if a county]

Cities and Counties can enforce idling restrictions within their jurisdiction and several jurisdictions within the Austin-Round Rock MSA currently have idling restrictions in place. Counties are able to enforce idling restrictions on heavy-duty vehicles by entering into a Memorandum of Agreement (MOA) with the Texas Commission on Environmental Quality (TCEQ). In the Austin-Round Rock MSA, Bastrop and Travis County have MOAs in place, but these agreements are set to expire at the end of 2018. For Bastrop and Travis County to be able to continue enforcing these rules, they will need to enter into new MOAs with TCEQ before the end of 2018. For more information on the TCEQ MOAs, visit TCEQ's website at: https://www.tceq.texas.gov/airquality/mobilesource/vehicleidling.html

City governments may also enforce heavy-duty idling restrictions through an MOA with TCEQ, but they are also able to enact idling restrictions through municipal ordinances without an MOA with TCEQ. Municipal idling ordinances can be more stringent than the restrictions that local governments can enforce through an MOA with TCEQ. The following cities within the Austin-Round Rock MSA currently have municipal ordinances restricting idling:

- City of Austin (also has an MOA with TCEQ)
- City of Bastrop
- City of Elgin
- City of Georgetown (also has an MOA with TCEQ)
- City of Hutto

[11] https://www.epa.gov/sites/production/files/2017-10/documents/mcdill.pdf
[12] EIA. Weekly Retail Gasoline and Diesel Prices. Texas – Monthly. https://www.eia.gov/dnav/pet/pet_pri_gnd_dcus_stx_m.htm

- City of Lockhart
- City of Round Rock
- City of San Marcos

Jurisdictions that adopt idling restrictions should also develop standard operating procedures and protocols for implementing these idling restrictions and keep track of warnings and citations issued for idling in order to ensure that these restrictions are actually achieving emission reductions.

2.4 Measures to reduce air pollution from power plants and other stationary combustion sources

CAC members can reduce NO_X emissions from stationary combustion sources, both directly by controlling emissions from their own stationary combustion equipment, or indirectly by conserving electricity and thereby reducing NO_X emissions from fossil-fueled power plants.

2.4.1 Conserve energy, particularly on Ozone Action Days

There are many ways that organizations can conserve energy, including:

- Reducing the temperature of hot-water heaters (whether heated by natural gas or electricity)
- Reducing demand for electricity by increasing thermostats
- Using energy-efficient appliances and equipment
- Generating electricity from zero-emissions sources locally (such as rooftop solar)
- Purchasing electricity from zero-emissions sources from the grid

While 100% of the NO_X emission reductions associated with an organization's efforts to conserve energy from its own fuel combustion will occur within the Austin-Round Rock MSA, the NO_X reduction benefit from conserving electricity is spread out across the entire ERCOT grid due to the distributed nature of electricity generation. For example, approximately 89% of the ozone season NO_X emissions associated with the City of Cedar Park's 2017 electricity consumption occurred outside of the Austin-Round Rock MSA based on modeling conducted using EPA's "AVERT" tool for estimating air quality benefits from energy efficiency/renewable energy (EE/RE) measures. While this percentage will fluctuate day to day and hour to hour, these efforts may be the only way to reduce NO_X emissions from local peaker plants in the short term. However, organizations should be aware that most of the NO_X reductions associated with electricity conservation measures will be occurring outside of the MSA.

2.4.2 Schedule discretionary emission-generating activities such as engine testing to the afternoon or night, particularly on Ozone Action Days

One of the simplest ways that organizations can reduce their air pollution impact is to reschedule discretionary use of combustion equipment from the morning to the afternoon, and particularly avoid the high-impact 9 am – 11 am period when NO_X emissions can have a disproportionate impact on high 8-hour O_3 averages. For example:

- Many organizations conduct weekly testing of backup generators in the morning on a set day of the week – these tests could instead be conducted in the late afternoon when they would have a much smaller impact on peak 8-hour O_3
- Scheduling landscaping activities for the afternoon rather than the morning can dramatically reduce the impact of those activities on peak 8-hour O_3
- Scheduling roadway construction activities during the evening and night entirely avoids the impact of these emissions on peak 8-hour O_3

2.4.3 Optimize combustion and pollution controls for NO_X reductions, particularly on Ozone Action Days and between 9 am and 3 pm

One way to reduce NO_X emissions is to optimize combustion and pollution controls for NO_X reductions. For example:

- Combustion sources tend to have lower NO_X emissions rates when operated at a steady load than when they are ramped up and down
- By shifting the timing for the demand for electricity, district cooling using chilled water can enable power plants to operate at a more stable load than if the cooling was powered directly by electricity during peak demand periods
- Reducing peak combustion temperature can reduce NO_X emissions for external combustion sources like heaters and boilers. This involves a slight reduction in combustion efficiency but a significant reduction in NO_X emissions. For example, an EPA guidance document suggests that a 1% reduction in combustion from efficiency can reduce NO_X emissions rates by over 35%[13]
- Point sources equipped with selective non-catalytic reduction (SNCR) can maximize NO_X reduction efficiency during periods that would have a significant impact on peak 8-hour O_3. For example, Texas Lehigh Cement Company maximizes NO_X reductions from 9 am to 3 pm on predicted high O_3 days.

This measure does not necessarily involve installation of any new equipment, but rather, operating the equipment in a way that minimizes NO_X emissions. Any measure that meets this description would be useful to be included in the region's air quality plan.

2.5 Measures to promote awareness of air quality and reduce public exposure when air pollution levels are high

Apart from reducing the region's air pollution levels, organizations can also help reduce public exposure to air pollution when it does reach high levels.

2.5.1 Educating employees about regional air quality and encouraging them to sign up for daily air quality forecasts and Ozone Action Day alerts

Organizations can educate employees about regional air quality and encourage them to sign up for daily air quality forecasts and ozone action day alerts from TCEQ's website and EPA's "AirNow" website.

- TCEQ: https://www.tceq.texas.gov/airquality/monops/ozone_email.html
- EPA: https://www.airnow.gov/

2.5.2 Educating others about regional air quality and encouraging them to sign up for daily air quality forecasts and Ozone Action Day alerts

Beyond their own employees, organizations can take additional actions to promote air quality awareness within the community through advertising and other activities.

3 Updates to this Document

CAPCOG will periodically update this document in order to reflect measures that organizations have implemented and new information. For questions about this guidebook, contact CAPCOG at

[13] https://www3.epa.gov/ttncatc1/dir1/fnoxdoc.pdf