Independent Review of the Tennessee Department of Environment and Conservation's Clean Air Act Section 110(l) Noninterference Demonstration for the Removal of the Inspection and Maintenance Program in the Middle Tennessee Area

Prepared for:

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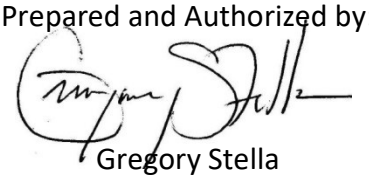


Gregory Stella
Managing Partner

November 19, 2019

My name is Gregory Stella. I am currently a Managing Partner of Alpine Geophysics, LLC, ("Alpine") a firm that offers highly specialized research and engineering services in the atmospheric sciences.

From 1997 until 2003, I served as an emissions and modeling specialist at the U.S. Environmental Protection Agency ("EPA" or "Agency"), Office of Air Quality Planning and Standards, where I managed and prepared the emission inventories, control strategies, and associated temporal, spatial, and speciation data for the Regional Transport NOx SIP Call, Section 126 rulemaking, Tier-2 tailpipe standards, 1-hour attainment demonstrations, Heavy-Duty Diesel Engine standards, Multi-Pollutant legislation, Clear Skies Analysis, and US/Canadian Air Quality Agreements. For my efforts while at EPA, I received two U.S. EPA Gold Medals, for the NOx SIP Call Rulemaking (1999) and the Tier-2 Tailpipe Standard (2001), as well as a U.S. Department of Justice Certificate of Commendation for working with the Environment and Natural Resources Division (2000) and multiple Bronze Medals for Commendable Service.

Since 2003, I have been with Alpine where I am internationally recognized as a technical authority in the planning, design, development, evaluation, application, and modeling of local, national, and international emission inventories. My focus is on the policy options used for the projection and control of ozone and particulate matter pollutants and precursors. I have coordinated with Federal, State, Regional, Local, International, Tribal, and private workgroups; modeling centers; and stakeholders to develop, evaluate, and apply alternative control measures and control program designs in support of emissions and air quality analyses.

In September 2011 and again in June 2018, I was invited by and provided testimony before the U.S. House of Representatives Committee on Space, Science and Technology regarding work conducted by Alpine in modeling U.S. air quality, including discussion of analyses related to recent technological and air quality changes, and corresponding attainment results for federal ozone and particulate matter standards.

I have been tasked by the law firm of Waller Lansden Dortch & Davis, LLP, on behalf of Opus Inspection, Inc., to provide a review of the Tennessee Department of Environment and Conservation's (TDEC) assumptions related to its proposed change to the State Implementation Plan (SIP) under the authority of Tennessee Code Annotated, Section 68-201-105. This review is in preparation for a public hearing that has been called to consider TDEC's " Clean Air Act Section 110(l) Noninterference Demonstration for the Removal of the Inspection and Maintenance in the Middle Tennessee Area" (Noninterference Demonstration), which supports the removal of the program for Davidson, Williamson, Wilson, Sumner and Rutherford Counties' inspection and maintenance (I/M) programs from the SIP. Public Chapter No. 953, signed into law on May 15, 2018, requires the elimination of the Inspection & Maintenance program 120 days after final EPA approval of the 110(l) report.

Summary of Observations

Based on my review of TDEC's proposed SIP changes and associated technical documentation[1], a summary of my observations follows. Justifications for the observations and recommendations for additional analyses are presented later in this report.

1. While current NAAQS-related design values are below levels of the standard in the Middle Tennessee domain, recent observations in air quality in the region have shown an upward trend in highest concentrations across all monitors indicating the reversal of improvements resulting from existing control programs. Between 2014 and 2018, 4th high maximum daily average (MDA8) values have remained the same or increased at every monitor in the domain.

2. TDEC has failed to simulate the impact of removal of the I/M program using air quality modeling. Ozone concentrations have non-linear correlation to NOx and VOC emission changes and cannot adequately be estimated exclusively using scaling ratios based on emission reduction sensitivities.

3. TDEC bases both its base year and future year emission assumptions on a version of EPA's 2014 National Emission Inventory (NEI) that is now multi-versions old. TDEC should consider revising its analysis using the most current, more appropriate version of the NEI that is based on a 2016 calendar year and was developed with significant input from state and regional organizations.

4. 2014 was not a conducive year for ozone sensitivity simulations, nor did it contain high ozone periods that would adequately allow for the determination of impact of control strategies and air quality response.

5. TDEC relies on a technical analysis completed in 2014 and that is based on inventories and assumptions now considered aged in their application of ozone sensitivity factors to estimate the impact of the removal of the I/M program. The factors generated from that work were identified as being inappropriate for other simulations beyond the scope of the original work.

6. TDEC makes an assumption that each ton of a pollutant precursor emission has an equal impact on air quality as compared to every other ton of the same pollutant precursor, regardless of emission source and where in the state the emissions occur. Recent modeling on this subject demonstrates that local motor vehicle source emissions have significantly greater impact on local air quality compared to all other source categories and regions.

[1] https://www.tn.gov/content/dam/tn/environment/air/documents/publicnotices/apc_SIP_IM_Removal_Middle_TN_08-28-19.pdf

7. Category-specific source apportionment analyses conducted elsewhere indicate that NOx emissions from Tennessee's motor vehicle source category may have a much greater impact on local air quality than estimated by TDEC.

8. TDEC includes in its assumptions that existing emission control programs will remain in force during the foreseeable future. As has been demonstrated by EPA, a significant number of federal air quality regulations have been "rolled back", removed from requirements, or are in the courts pending review and decision. Should these regulations be partially or completely stricken from the list of required control programs, assumptions included that assume emission decreases and associated air quality improvements will be invalidated.

The following statement has been taken from TDEC's website[2] and stresses the importance of the current I/M program on maintaining clean air in the Middle Tennessee region today and in the future (emphasis added):

> *"The State of Tennessee developed more restrictive regulations to control air pollution from mobile sources in counties that were not meeting the new 8-hour ozone Federal Standards for air quality. As a result, certain vehicles registered in Hamilton, Davidson, Rutherford, Sumner, Williamson and Wilson counties are required to pass a vehicle emission test. Gasoline and diesel vehicles with a model year of 1975 and newer and a Gross Vehicle Weight Rate (GVWR) of 10,500 lbs or less must pass an emission test before the vehicle's registration can be renewed. Motorcycles are exempt.*
>
> *Inspection programs such as the one implemented in Tennessee have proven to be very beneficial in reducing harmful ozone air pollution. Emissions from an individual car are generally low, relative to the smokestack image many associate with air pollution. But in numerous cities across the country,* ***the personal automobile is the single greatest polluter, as emissions from millions of vehicles on the road add up****. Driving a private car is probably a typical citizen's most "polluting" daily activity. Ozone levels in many cities have been reduced with the introduction of lower volatility gasoline, and as newer cars with improved emission control systems replaced older models. There has been significant progress in reducing vehicle emissions, but the number of cars on the road and the miles they travel make mobile sources an ongoing problem. Unless we dramatically reduce the amount of pollution vehicles emit in actual use, or drastically cut back on the amount we drive, smog-free air may become a problem for many of our cities."*

With this statement, TDEC recognizes the importance of emission control programs in Tennessee for achieving the clean air quality objectives required by EPA and for ensuring that people of the state can breathe freely without fear of health issues resulting from these emission sources. Compromising residents health and the current attainment status by removing the I/M program in the Middle Tennessee area is contrary to TDEC's objectives.

[2] https://www.tn.gov/environment/program-areas/apc-air-pollution-control-home/apc/vehicle-inspection-program/important-information.html

1. Design Values Are On The Rise

While current 3-year averaged, NAAQS-related design values are below levels of the standard in the Middle Tennessee domain, recent observations in air quality in the region have shown an upward trend in highest ozone concentrations across regional regulatory monitors (listed in Table 1 and presented in Figure 1) indicating the reversal of improvements resulting from existing control programs inclusive of Tennessee's I/M program.

Table 1. Middle Tennessee regulatory ozone monitors.

AQS Site ID	County Name	Local Site Name
470370011	Davidson	East Health
470370026	Davidson	Percy Priest Dam
471650007	Sumner	Hendersonville Ozone Site at Old Hickory Dam
471870106	Williamson	Fairview Middle School
471890103	Wilson	Cedars of Lebanon

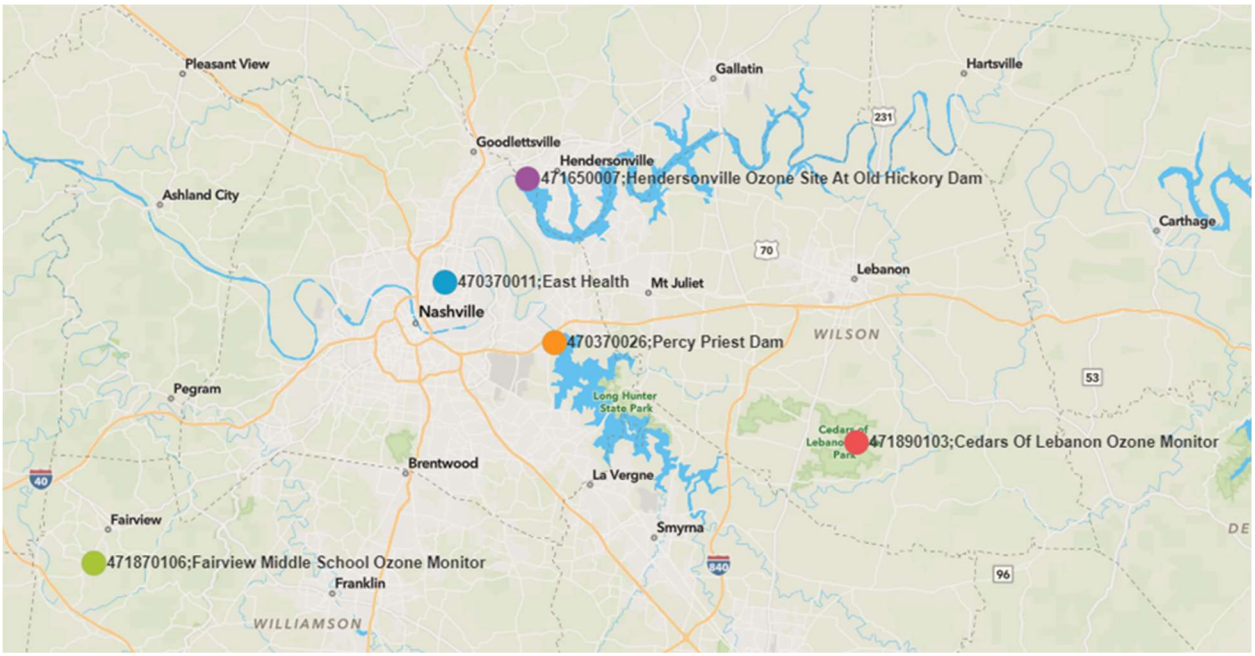


Figure 1. Location of Middle Tennessee regulatory ozone monitors.

Figure 2 presents the highest four observed MDA8 values across all monitors in the Middle Tennessee Core Based Statistical Area (CBSA) of Nashville-Davidson-Murfreesboro-Franklin, Tennessee for the years of 2014 through 2018. As can be seen in this figure, for each of the top four observations each year, the trend has shown an increase (noted by the linear trend; dotted line).

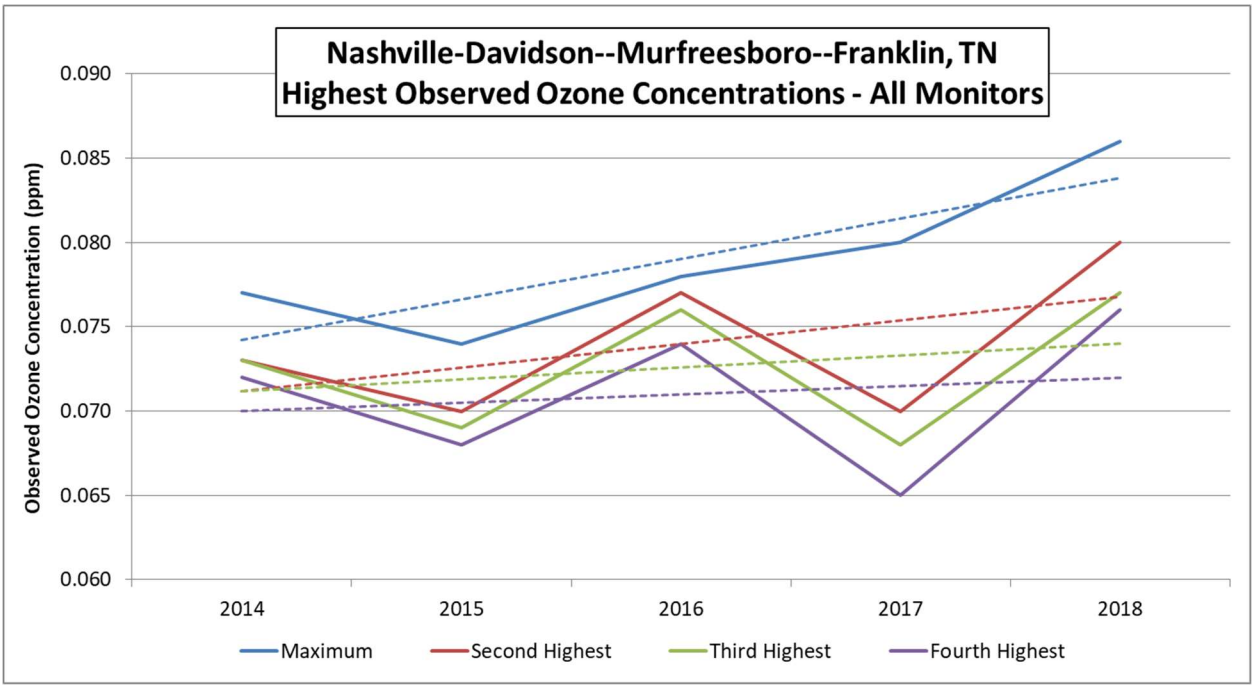


Figure 2. Increasing trend of MDA8 ozone concentrations at Middle Tennessee monitors between 2014 and 2018.

Additionally, when comparing monitor-level 4th high ozone MDA8 concentrations for receptors in the Middle Tennessee region, values that are used by EPA in determining ozone attainment and designations, not a single monitor has shown a decrease between 2014 and 2018. In fact, of the five monitors in the domain, as shown in Figure 3, three show no change in 4th high MDA8 concentrations between the two years while the other two monitors show an increase of up to 3 parts per billion (ppb) in the MDA8 concentration observed.

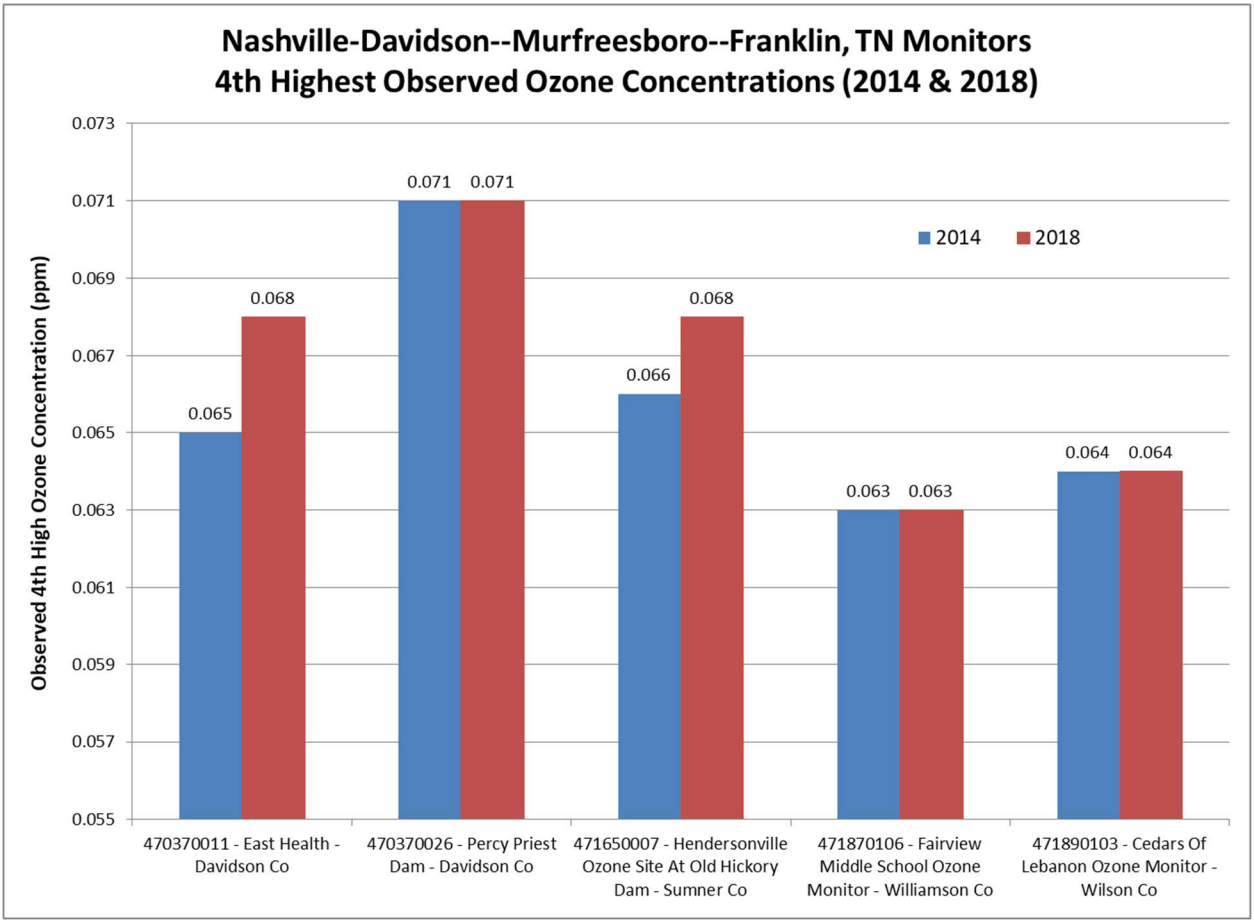


Figure 3. Comparison of 4th High MDA8 Ozone Concentrations at Regulatory Monitors in Middle Tennessee Region.

2. Air Quality Modeling Is Absent In The Analysis

TDEC has failed to simulate the impact of removal of the I/M program using air quality modeling. Ozone concentrations have non-linear correlation to NOx and VOC emission changes and cannot adequately be estimated exclusively using scaling ratios based on emission reduction sensitivities.

EPA SIP modeling guidance[3] notes that "[t]he application of a chemical transport grid model on a regional or local scale is the best tool available to judge the impacts of changes in future year emissions on concentrations." It further goes on to say "[a]ir agencies should determine whether a control program scenario will provide sufficient emission reductions to demonstrate attainment of the NAAQS using the modeled attainment test. The modeled attainment test is a technical procedure in which an air quality model is used to simulate base year and future air pollutant concentrations for the purpose of demonstrating attainment of the relevant NAAQS."

[3] https://www3.epa.gov/ttn/scram/guidance/guide/O3-PM-RH-Modeling_Guidance-2018.pdf

Formulation of a successful strategy against ozone pollution requires knowledge of the chemical regime for ozone production. Successive generations of atmospheric chemistry models have been developed to address this issue. Generally, air quality models are regarded as the most appropriate tools for assessing the expected impacts of a change in emissions.

TDEC, however, has failed to simulate the impacts of the I/M program removal with any air quality modeling. Instead, it has chosen to use external ozone sensitivity factors (inappropriate for this purpose as discussed elsewhere in this document) to estimate the changes in Tennessee air quality relative to the removal of this program.

While it may be possible to evaluate progress towards or degradation away from attainment of the ozone or PM2.5 NAAQS based on measured historical trends of air quality and emissions, there are several elements to that type of analysis that are difficult to quantify. First, in most cases, the ambient data trends are best assessed by normalizing to account for year-to-year meteorological variations. Second, one must have an accurate accounting of the year-to-year changes in actual emissions (NOx, VOC, and/or SO2 and NH3) for the given area and any surrounding areas, the emissions from which may impact local concentrations. Third, one must have a solid conceptual model of how ozone or PM2.5 is formed in the local area (e.g., influence of meteorology, NOx-limited, ammonia limited, transport-influenced, etc.).

Because TDEC has chosen to forego this most important step of simulating the removal of the I/M program with an air quality run, results presented in the noninterference demonstration cannot be considered technically complete.

It is my recommendation that TDEC conduct a full air quality simulation of the impact of removal of the I/M program in Middle Tennessee before making any determination of its interference effect.

3. Newer Modeling Platforms Are Available for Use

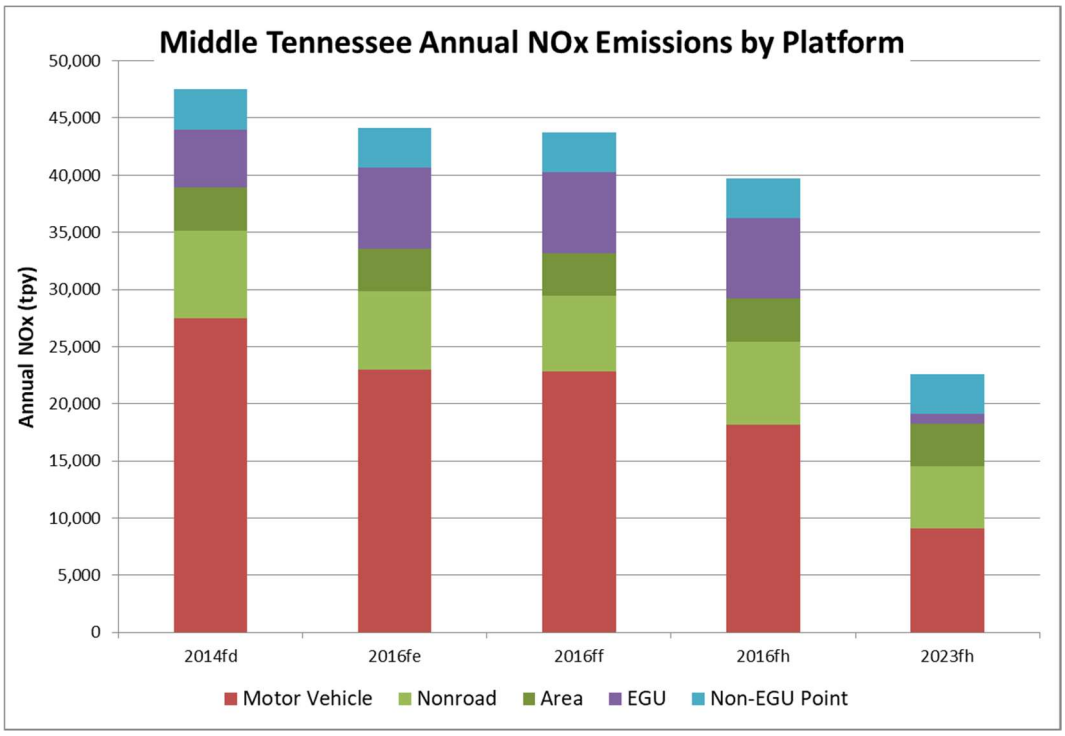
TDEC bases both its base year and future year emission assumptions on a version of EPA's 2014 National Emission Inventory (NEI), version 2 that is now multi-versions old. TDEC should revise its analysis using the most current version of the NEI that is based on a 2016 calendar year that was developed with significant input from state and regional organizations.

Since the publication of EPA's 2014v2 NEI modeling platform (2014fd in Figure 4 below), EPA has released three incrementally newer modeling platforms using national, state, and local data sources[4]. These updated platforms improve estimates for emissions activity, magnitude, and temporal and spatial distribution, and use newer emission factors, methods, and models to derive their values.

The most current version of EPA's modeling platform is the 2016v1 (2016fh in Figure 4 below) platform that is described as a coordinated effort across over 245 state and regional air agency, EPA, and Federal Land Manager employees. Figure 4 below demonstrates the differences published in Middle Tennessee

[4] https://www.epa.gov/air-emissions-modeling/2014-2016-version-7-air-emissions-modeling-platforms

counties, annual emissions for NOx and VOC by major category across the multiple platforms and associated projections, including the two discussed above.



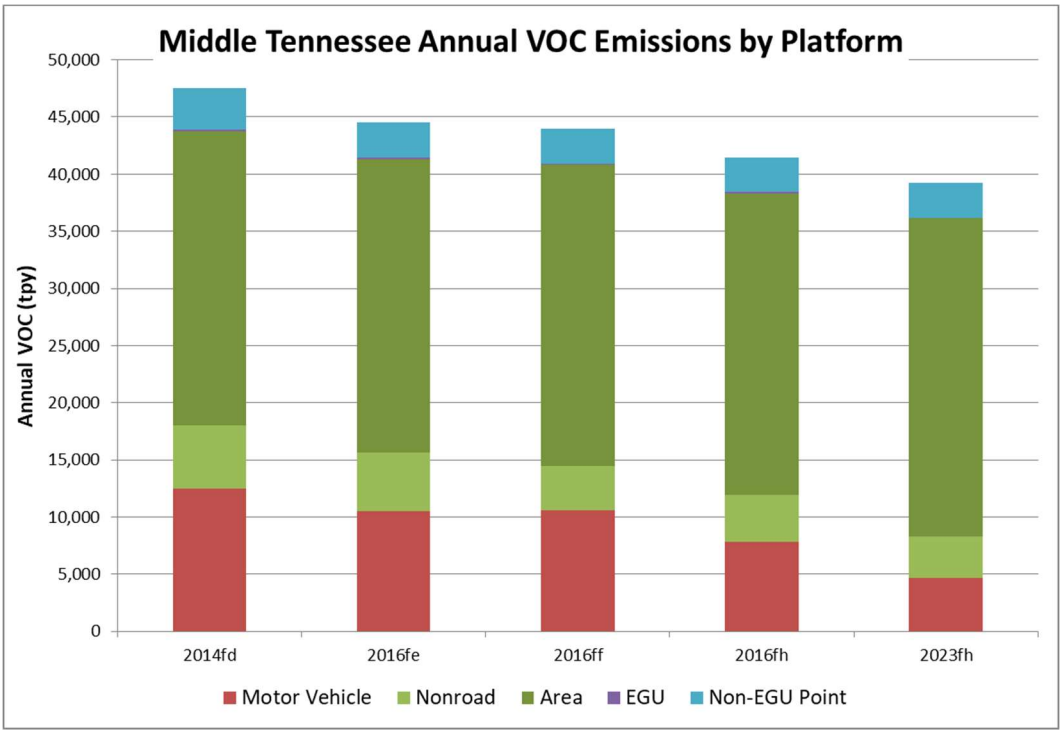


Figure 4. Annual emission summary of various EPA modeling platforms and associated projections for NOx (top) and VOC (bottom) Middle Tennessee counties.

The 2016fh platform and associated emission projections are demonstrably different in annual NOx and VOC from anthropogenic sources compared to the 2014fd platform cited by TDEC in its sensitivity analysis and likely contain updated emission estimates for Middle Tennessee (and regionally impacting) source categories. Additionally, the fact that current emission estimates for motor vehicles in the Middle Tennessee region are decreasing, yet air quality has deteriorated in recent years, indicates that an additional increase in emissions, via the removal of the I/M program, may have an additional, accelerated deterioration impact on local air quality.

It is my recommendation that the most current modeling platform and associated emission projections be used to update the I/M analysis conducted by TDEC to account for improvements in emission estimates.

4. 2014 Inventory Is A Bad Year For Sensitivity Analysis

As noted in TDEC's Noninterference Demonstration, TDEC selected 2014 as a base year to develop estimated air quality impacts of the removal of the I/M program in Middle Tennessee.

Meteorological conditions including temperature, humidity, winds, solar radiation, and vertical mixing affect the formation and transport of ambient ozone concentrations. Ozone is more readily formed on warm, sunny days when the air is stagnant and/or when the winds are favorable for transport from upwind source areas. Conversely, ozone production is more limited on days that are cloudy, cool, rainy, and windy. In general, below average temperatures are an indication that meteorological conditions are unconducive for ozone formation, whereas above average temperatures are an indication that meteorology is conducive to ozone formation.

EPA notes in its ozone and PM modeling guidance document that the selection of a base year for SIP and sensitivity modeling is dependent on model performance evaluations and the response to emissions controls over time periods that include a ramp-up to a high ozone period and a ramp-down to cleaner conditions. This allows for a more complete evaluation of model performance under a variety of meteorological conditions. EPA recommends that one should choose time periods which reflect a variety of meteorological conditions that frequently correspond with observed 8-hour daily maximum concentrations greater than the level of the NAAQS at monitoring sites in the nonattainment area.

We note, as do EPA and others, that 2014 was not a conducive year for such an analysis, nor did it contain high ozone periods that would adequately allow for the determination of impact of control strategies and air quality response. In recent modeling documentation[5], EPA notes that the summer of 2014 was not particularly conducive for ozone formation in the Upper Midwest, Ohio Valley, South, and Southeast. EPA provides supporting information from NOAA's Temperature, Precipitation, and Drought website[6] that shows 2014 was a below average temperature year (Figure 5) and an above average precipitation year (Figure 6).

[5] http://www.midwestozonegroup.com/files/EPA_maintenance_flexibility_Oct_19_2018.pdf
[6] https://www.ncdc.noaa.gov/temp-and-precip/

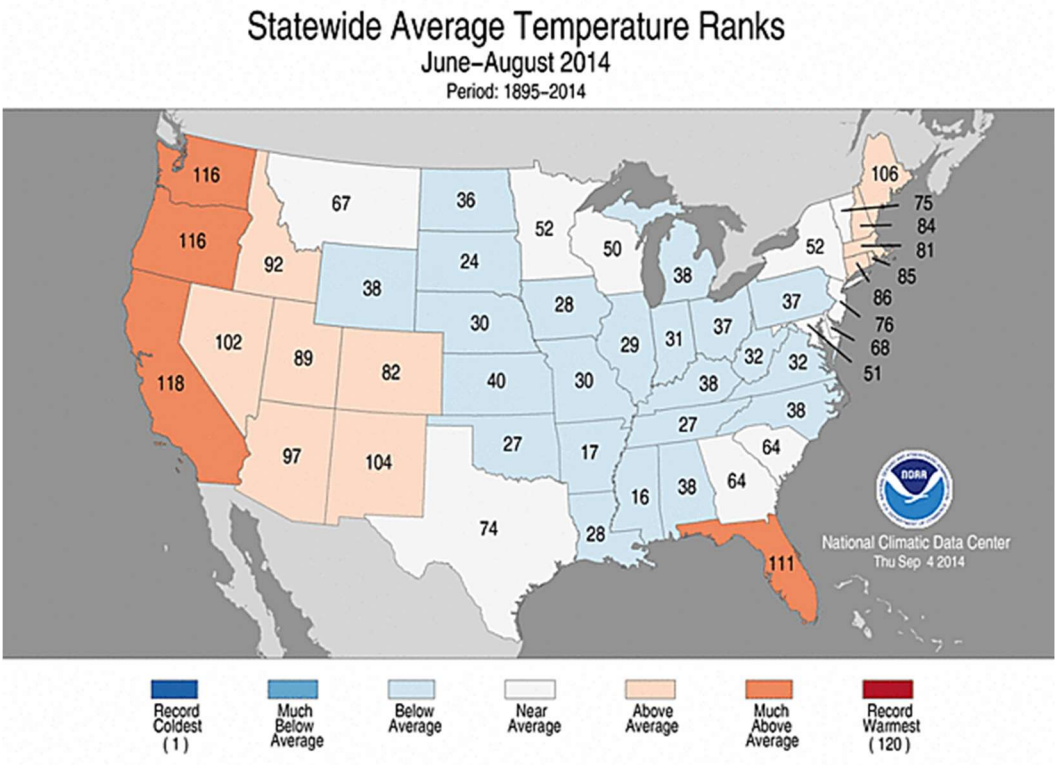


Figure 5. Statewide average temperature ranks, summer 2014.

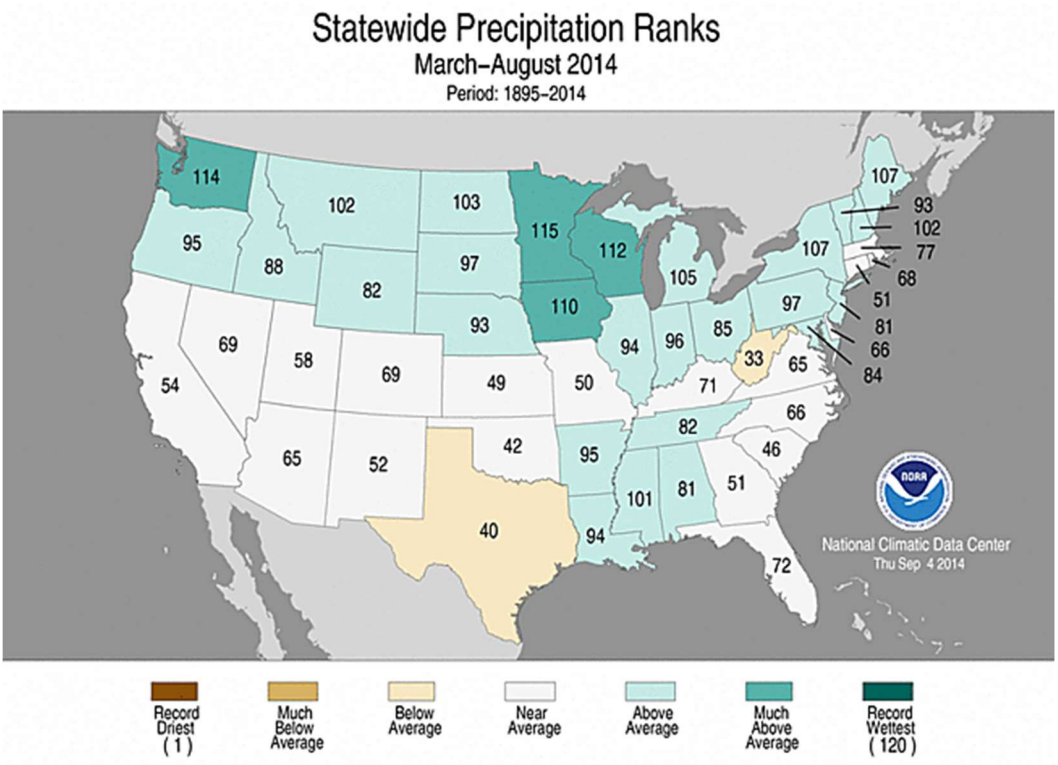


Figure 6. Statewide average precipitation ranks, summer 2014.

In contrast, 2016 was an abnormally above average temperature year (Figure 7) for Tennessee and the Southeast, providing an alternative base year (as further discussed below) for this type of sensitivity to be conducted. This year is also consistent with EPA's latest modeling platform that could be used for this purpose.

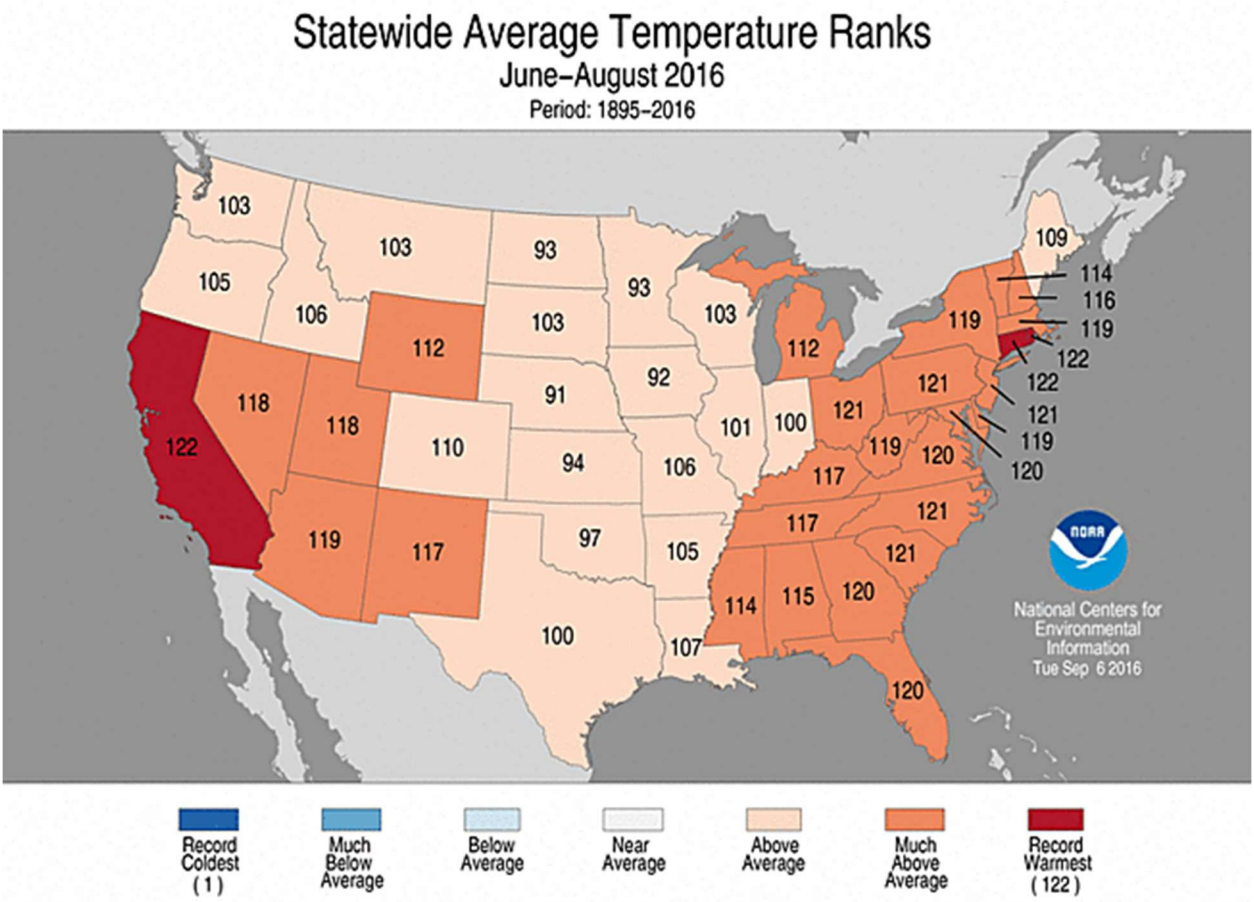


Figure 7. Statewide average temperature ranks, summer 2016.

It is my recommendation that TDEC conduct future ozone and PM modeling using a meteorological and associated base year inventory that meets the requirements of EPA guidance for the determination of impact of control strategies and air quality response.

5. Ozone Sensitivity Factors Are Based On 2007 Data Projected to 2018

TDEC relies on a technical analysis completed in 2014 that is based on inventories and assumptions now considered aged in their application of ozone sensitivity factors to estimate the impact of the removal of the I/M program. The "brute force" factors generated from this work are not applicable to current conditions and to the mix of sources and emissions in the analyzed region and are based on a calculation of emission reductions across all source sectors (not just I/M impacted sources) and across the entire state of Tennessee (not just the Nashville, Middle Tennessee region).

TDEC has relied on an analysis[7] conducted by Georgia Tech in 2014 (SEMAP) that is based on a 2007 base year emission inventory with 2018 projections using assumptions considered "On The Way" or "On The Books" at that time. My review of this study and platform find the following issues related to the study's use in TDEC's ozone sensitivity analysis.

To start, total Tennessee annual anthropogenic NOx emissions projected to 2018 in the SEMAP analysis (267,700 tpy) are 25% greater than actual emissions currently reported in Tennessee in the 2016v1 platform (214,542 tpy). This direction is reversed for anthropogenic VOC emissions where EPA's 2016v1 platform is 7% higher than the SEMAP 2018 projection (227,090 tpy v 210,706 tpy). This initially complicates the ozone sensitivity factor, as the ratio of ozone to NOx and VOC used by TDEC is based on emission levels significantly different than actual, current conditions.

Furthermore, when looking at motor vehicle source emission comparisons exclusively, EPA estimates that in 2016, onroad annual NOx (106,069 tpy) comprises 49% of total anthropogenic emissions from Tennessee. The SEMAP analysis estimated a significantly lower composition (36%; 95,973 tpy) in its 2018 projections used to create the ozone sensitivy factors used by TDEC. Annual motor vehicle VOC emissions also differ in contribution with SEMAP estimating 19% of total anthropogenic VOC (40,676 tpy) in 2018 from motor vehicle sources compared to EPA's 24% (53,649 tpy) from this same category-state combination. Figures 8 and 9 present this comparison for NOx and VOC, respectively.

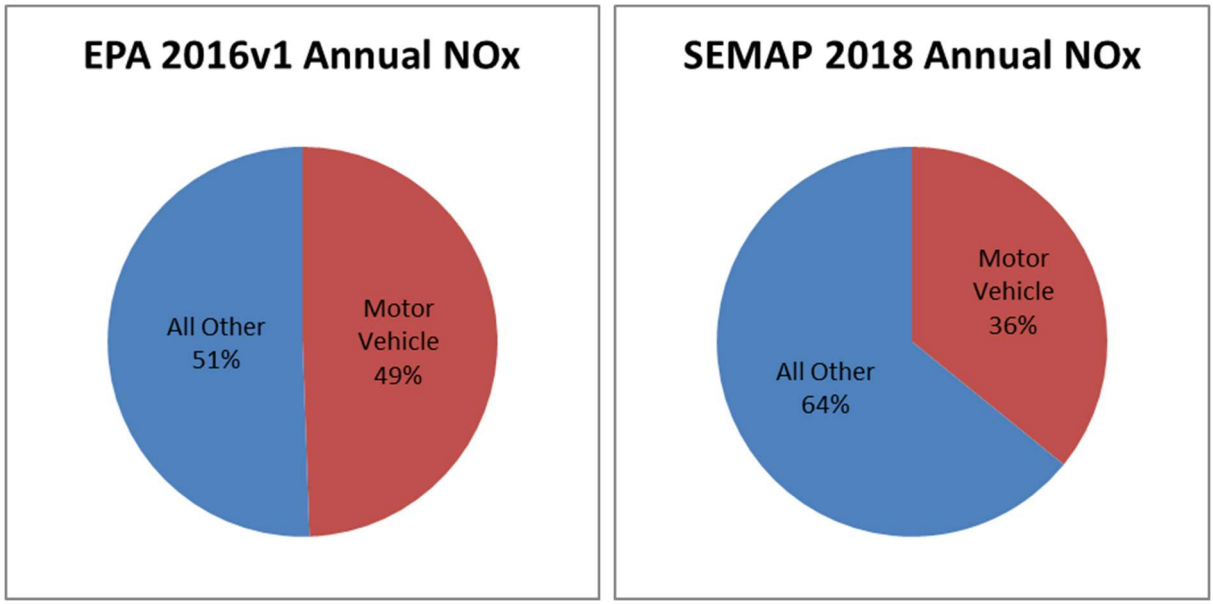


Figure 8. Comparison of annual NOx emissions from Tennessee motor vehicle sources as a percentage of total Tennessee NOx emissions.

[7] http://semap.ce.gatech.edu/sites/default/files/files/SEMAP-Revised-Final-Report_Final.pdf

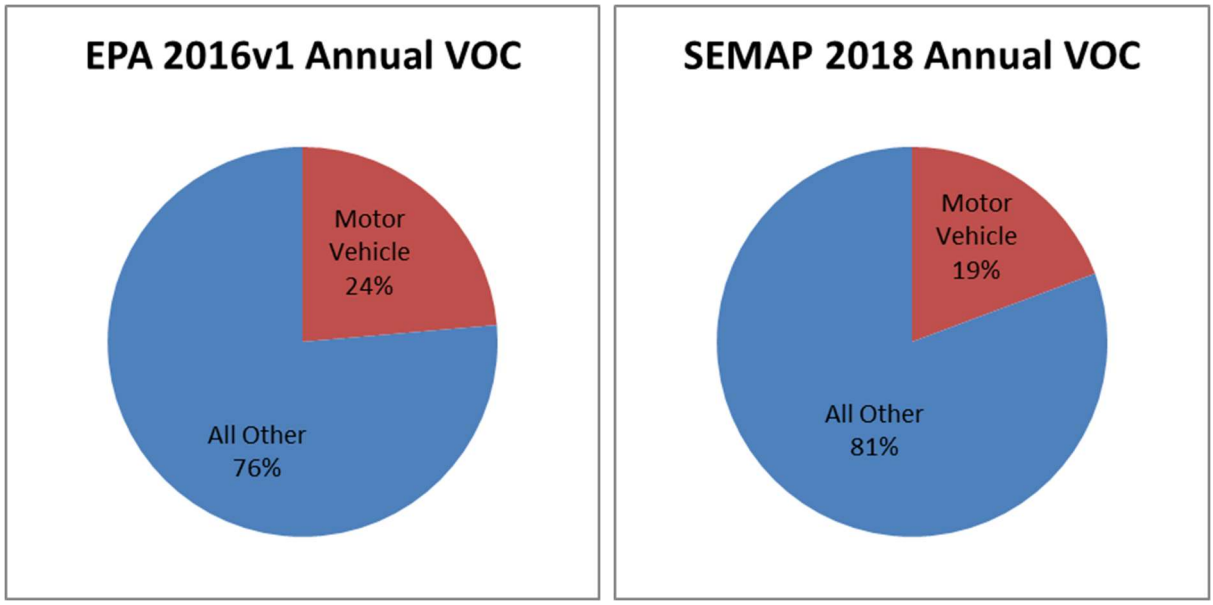


Figure 9. Comparison of annual VOC emissions from Tennessee motor vehicle sources as a percentage of total Tennessee VOC emissions.

As a result, the SEMAP calculated ozone sensitivity factor is based on an emissions magnitude AND a presumed source category emission ratio significantly different than today's actual distribution ratio as represented in the 2016v1 platform. This results in a sensitivity factor (ppb/ton reduced) calculated from the SEMAP work that is not directly applicable to today's ozone conditions and that is likely not representative of the air quality change reflected in the removal of the I/M program.

It is my recommendation that TDEC consider alternate methods and air quality modeling than using an outdated modeling platform and projections, with source category distribution assumptions, significantly different than today's actual category and emissions mix, to determine the air quality impact of removing Middle Tennessee's I/M program.

6. TDEC's Misuse of the SEMAP Ozone Sensitivity Factor

TDEC notes in the Noninterference Demonstration document (page 14) that:

> *"Although the SEMAP study projected emissions and ozone concentrations in 2018, it is estimated that a similar response to NOx and VOC reductions would occur in 2022."*

In fact, the SEMAP report itself indicates the limitations of using these data for purposes other than identical to the conditions in that analysis. Specifically, the report notes[8]:

> *"Since ozone response is nonlinear the results are most accurate for the amount of reduction used here, i.e., 30% of either NOx or VOC emissions. Caution should be exercised if the results are used for other purposes, for example in attempts to calculate the responses to other levels of*

[8] Id. Page 5-1.

emission reductions, especially those larger than 30%, or responses to combined NOx and VOC reductions. An extreme attempt might be to extrapolate the results to 100% and calculate interstate contributions. The nonlinear nature of the relation between ozone and NOx or VOC emissions should be kept in mind in such interpretations of the results. Any such attempt can only be a first estimate and should be followed by simulations of the actual emission reduction case."

This caveat to the SEMAP results is clear in noting that (1) the sensitivity factors generated from the analysis are most accurate for reducing NOx or VOC emissions across all categories across the entire state by 30%, (2) caution should be exercised if the results are to be used for purposes other than the original intent of the analysis, (3) using the sensitivity factors should only be considered a first estimate and not a final application of the emission change, and (4) an actual emission reduction scenario and air quality modeling simulation should be conducted with the strategy outlined.

TDEC has made no documented effort to follow this guidance from the SEMAP report and from where the ozone sensitivity factors were taken.

It is my recommendation that TDEC consider using alternate methods and air quality modeling to determine the air quality impact of removing Middle Tennessee's I/M program.

7. Calculations Show Onroad Emissions From Tennessee Have The Greatest Ozone Formation Potential

By using the SEMAP ozone sensitivity factors, TDEC makes an assumption that each ton of a pollutant precursor emission has an equal impact on air quality as compared to every other ton of the same pollutant precursor, regardless of emission source. Recent modeling on this subject demonstrates that local motor vehicle source emissions have significantly greater impact on local air quality compared to all other source categories and regions.

Assuming that non-linear ozone formation and the use of an older modeling platform and associated emission projections were to be acceptable approaches to reviewing the impact of air quality change resulting from removal of the I/M program, recent category-specific source apportionment analyses conducted elsewhere by Alpine indicate that NOx emissions from Tennessee's motor vehicle source category have a much greater impact on local air quality than estimated by TDEC.

In the statement from TDEC's website presented above, the following sentence has significant relevance to the review here:

"But in numerous cities across the country, the personal automobile is the single greatest polluter, as emissions from millions of vehicles on the road add up."

Using methods previously established under other work[9], Alpine has reviewed the recent EPA modeling platform used in the Cross-State Air Pollution Rule (CSAPR) Close-Out modeling and developed ozone source apportionment results and relationships between State-source category specific ozone source apportionment modeling and the seasonal NOx emissions used to develop the ozone concentrations. We used the **C**omprehensive **A**ir quality **M**odel with e**X**tensions/**O**zone **S**ource **A**pportionment **T**echnology[10] (CAMx/OSAT) technique to quantify the contribution of 2023 base case NOx and VOC emissions from anthropogenic source categories in each region to projected 2023 ozone concentrations at ozone monitoring sites based on EPA's CSAPR "Closeout" base case scenario from EPA's 2011/2023en modeling platform.

This analysis is important as the results provide indicators of relative contribution of source regions (states) and categories (e.g., motor vehicle) NOx and VOC emissions to downwind monitor ozone concentrations. Our findings for the 2023 simulation at Middle Tennessee monitors are presented in Figures 10 through 13 below.

Each figure presents the relative contribution of NOx and VOC emissions to the modeled ozone concentration at the presented receptor. The relative height of the bars indicates the source region (x-axis) of contribution with taller bars indicating greater relative contribution. The individual colored segments of each bar (e.g., red indicating motor vehicles) indicate the relative contribution of source categories within each region to the monitor's modeled ozone concentration.

In all cases listed in the following four Figures, emissions from motor vehicle sources contribute the greatest relative concentration from U.S. anthropogenic emissions to the four monitors presented (e.g., red portion of bar from Tennessee). Based on the understanding of local impact from mobile sources, it could also be estimated that more localized reductions (e.g., Middle Tennessee counties only) would have an even greater relative impact on ozone concentrations per ton than a statewide estimation.

Note that the blue "BC" bar indicates contribution from emissions generated from boundary condition sources that include, but are not limited to, concentrations transported into the national modeling domain (e.g., international transport, stratospheric intrusion, domain initialization conditions) and are not controllable by U.S. regulation.

9 http://midwestozonegroup.com/files/RelativeImpactofStateandSourceCategoryNOxEmissionsonDownwindMonitorsIdentifiedUsingthe2017CrossStateAirPollutionRuleModelingPlatform.pdf

10 http://www.camx.com/files/camxusersguide_v6-40.pdf

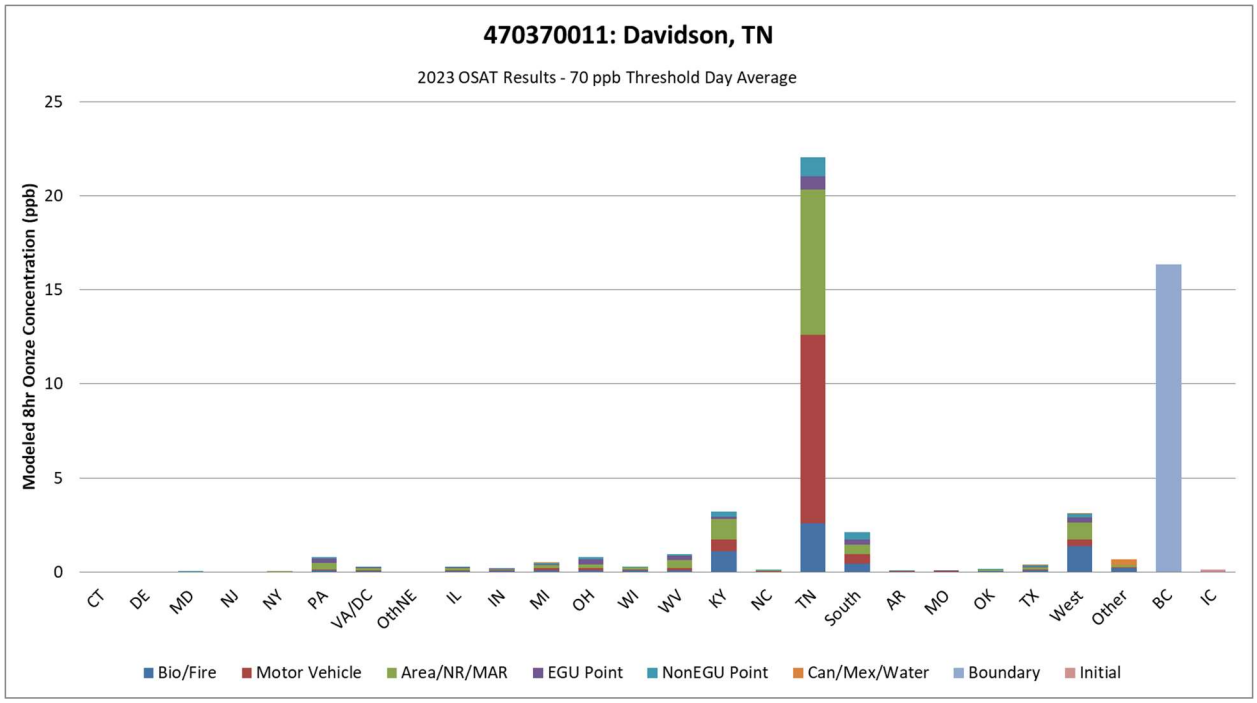


Figure 10. Relative contribution of ozone concentration (ppb) from source region and category combinations for East Health monitor.

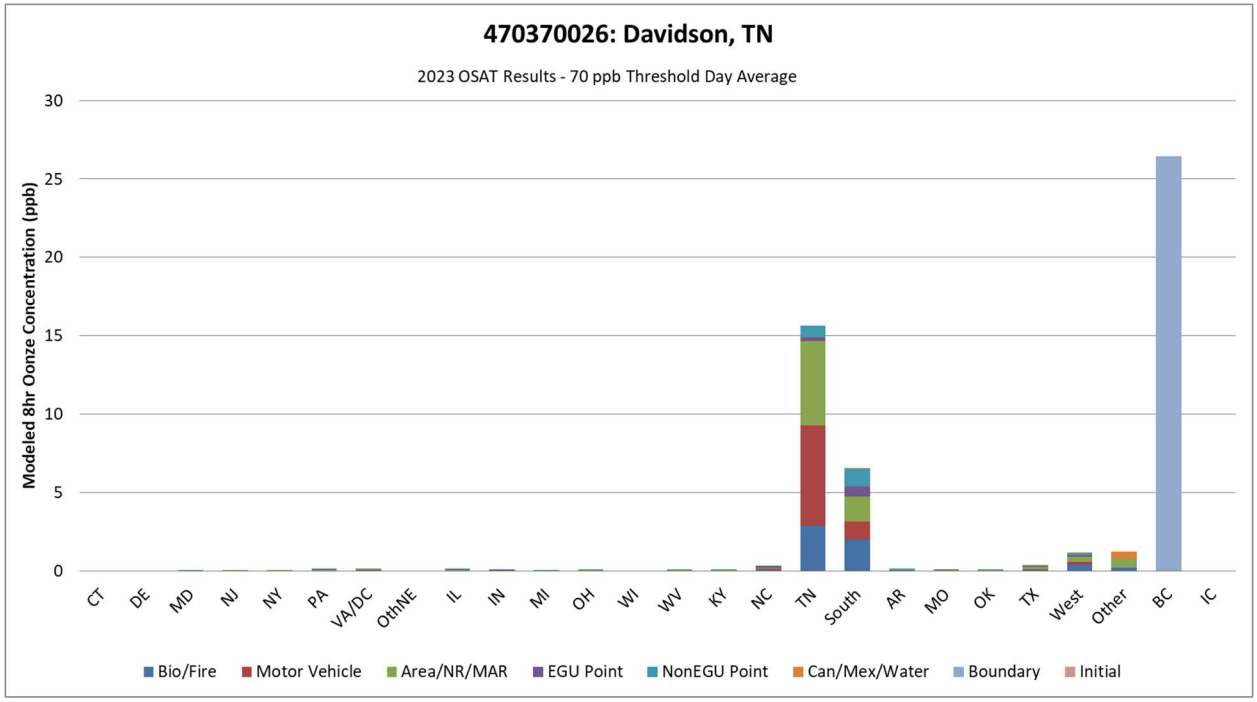


Figure 11. Relative contribution of ozone concentration (ppb) from source region and category combinations for Percy Priest Dam monitor.

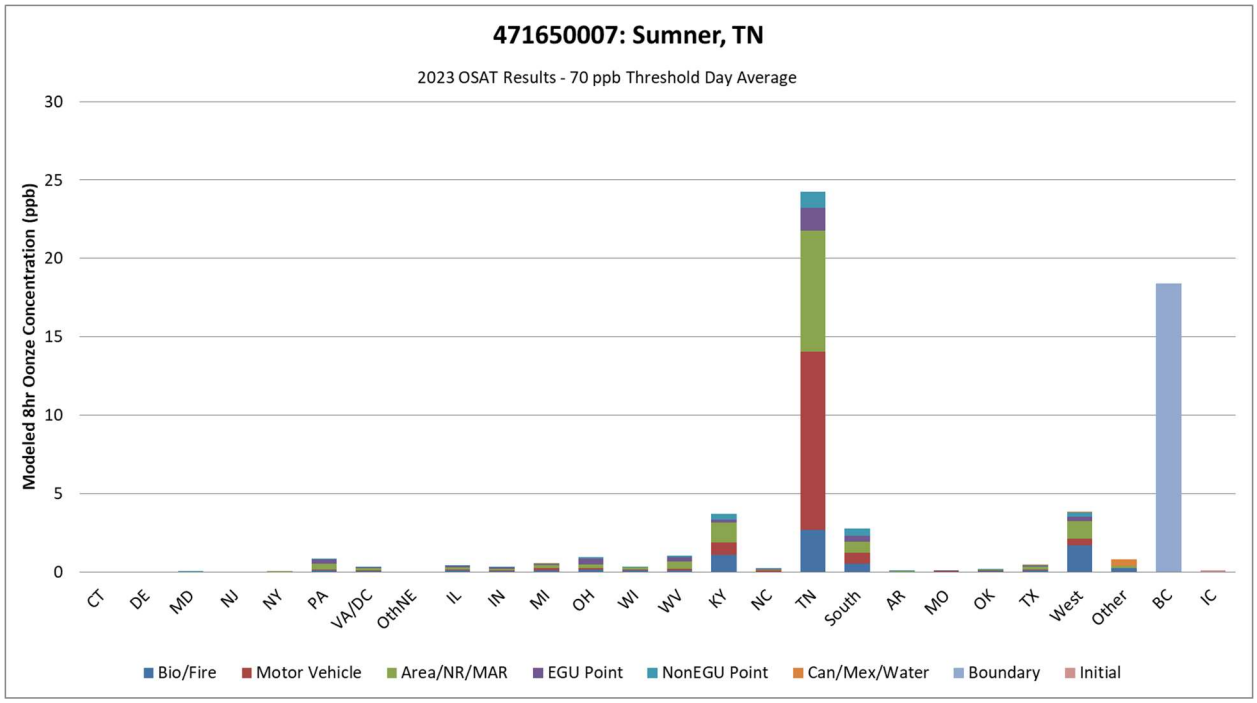


Figure 12. Relative contribution of ozone concentration (ppb) from source region and category combinations for Hendersonville Ozone Site at Old Hickory Dam.

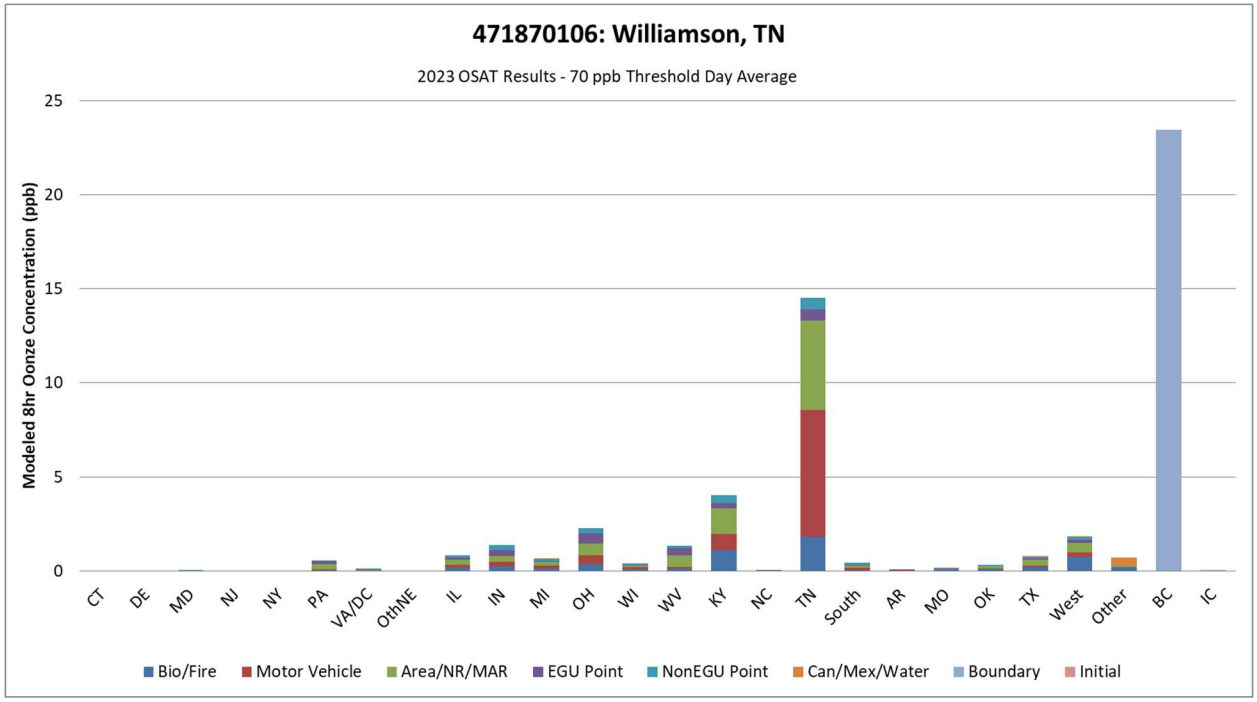


Figure 13. Relative contribution of ozone concentration (ppb) from source region and category combinations for Fairview Middle School monitor.

Furthermore, using these same source apportionment results and monthly, county, and source category specific emissions published by EPA, we developed relational "impact factors" (units of ppb/ton). We define this "impact factor" as representative of the relative contribution of modeled emissions (tons) to resultant ozone concentrations (in ppb), similar to TDEC's used SEMAP ozone sensitivity factor.

In Alpine's analysis, using updated emissions, projections, and models, we find that the relative impact of NOx emissions from mobile sources in Tennessee have factors significantly higher than most other regional-category combinations, leading us to conclude that motor vehicle and nonroad source emissions have the greatest impact on ozone concentrations in the Middle Tennessee region at the monitors reviewed.

The following four figures present the graphical results of our analysis for four Middle Tennessee monitors (presented above) with representation by state and major source sector of the impact factor calculation for the 2023 projection simulation. In all cases, either the emissions from motor vehicle sources from Tennessee (red bar) or contributions from the nonroad mobile source sector (portion of green bar) are visibly greater in relative contribution impact than any other state or category.

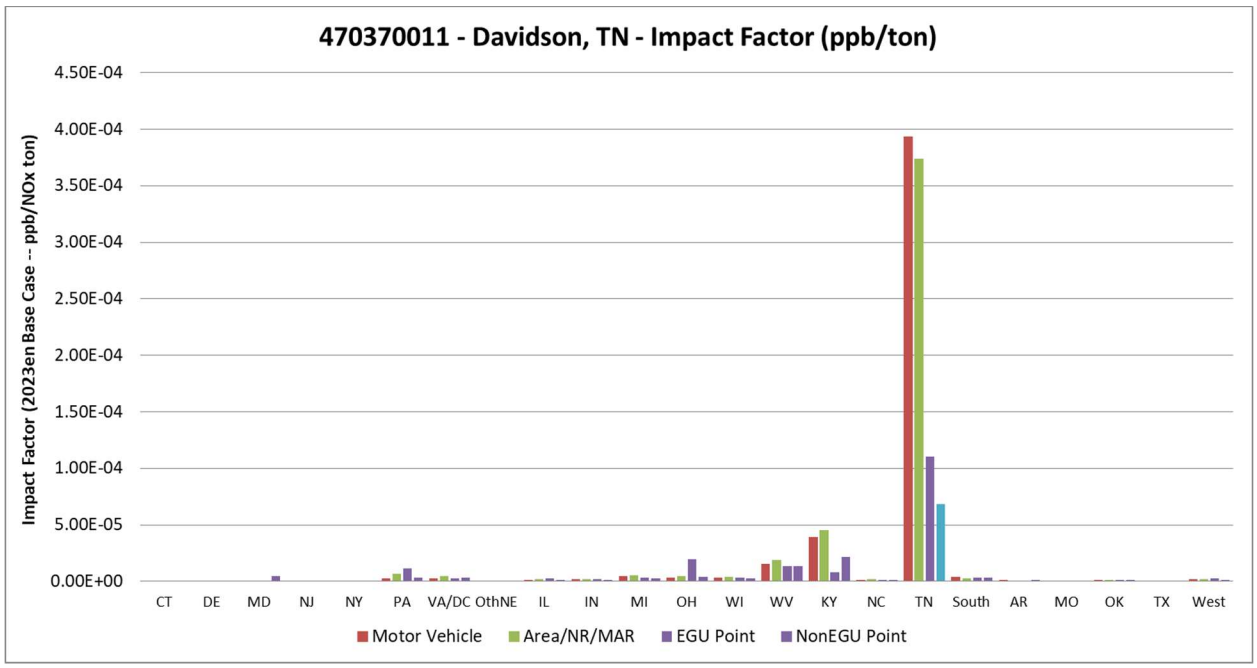


Figure 14. Impact factor calculation (ppb/ton) from source region and category combinations for East Health monitor.

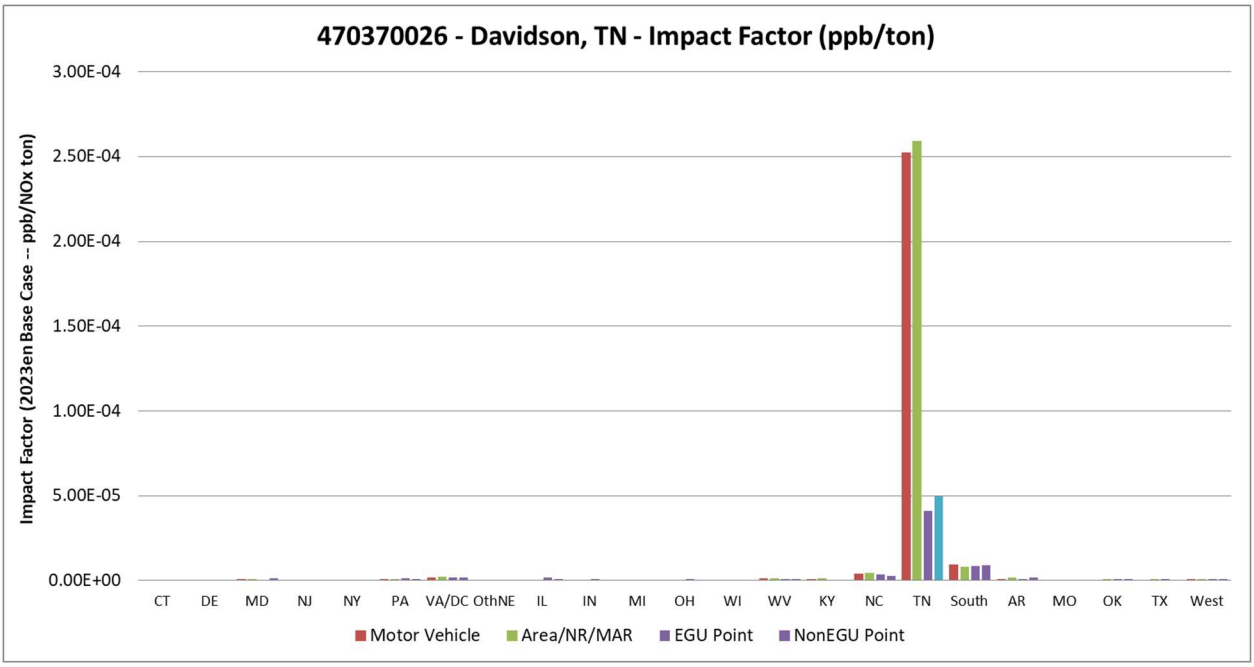


Figure 15. Impact factor calculation (ppb/ton) from source region and category combinations for Percy Priest Dam monitor.

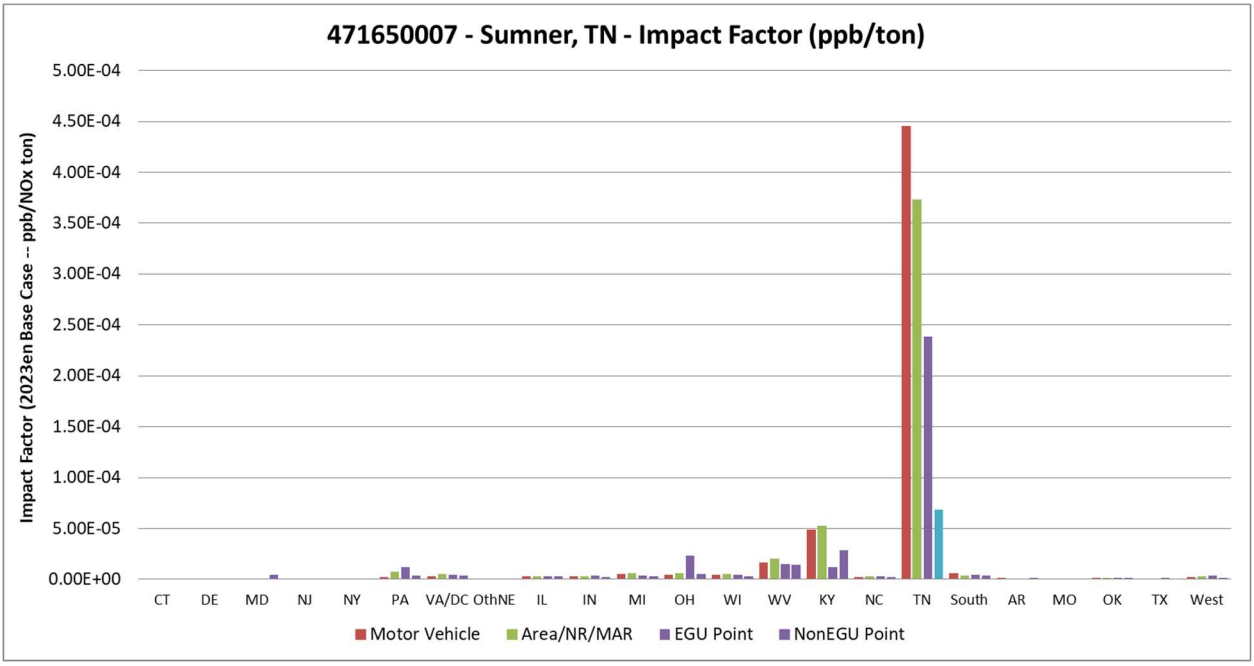


Figure 16. Impact factor calculation (ppb/ton) from source region and category combinations for Hendersonville Ozone Site at Old Hickory Dam.

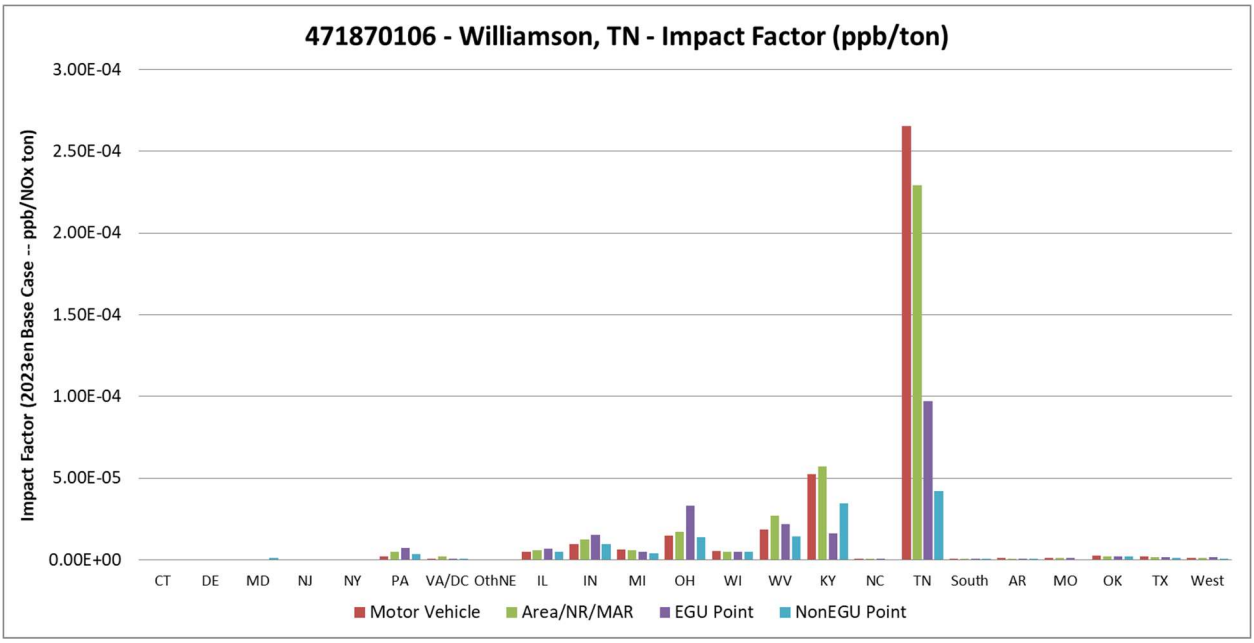


Figure 17. Impact factor calculation (ppb/ton) from source region and category combinations for Fairview Middle School monitor.

Using the results of these recent state and source category specific source contribution modeling analyses, I believe that the ozone sensitivity factors used by TDEC to estimate the impacts of the removal of the I/M program in the Middle Tennessee domain are inapplicable to current conditions based on TDEC's generic calculation and brute force application, and that actual air quality modeling is necessary to estimate the air quality impact of this action.

It is my recommendation that TDEC consider using alternate methods and air quality modeling to determine the air quality impact of removing Middle Tennessee's I/M program. Absent the decision to run an air quality simulation, it is my recommendation that should TDEC consider using an "impact factor"-like application to determine the impact of the removal of the I/M program in Middle Tennessee, it should use county and motor vehicle specific factors to make this first step assessment.

8. EPA Is Rolling Back Other Regulations That Will Likely Increase Emissions

TDEC includes in its assumptions that existing non-mobile control programs will remain in force during the foreseeable future. As has been demonstrated by EPA, a significant number of federal air quality regulations have been "rolled back", removed from requirements, or are in the courts pending review and decision. Should these regulations be stricken from the list of required control programs, assumptions included that assume emission decreases and associated air quality improvements will be invalidated.

Multiple sources, including EPA itself, have summarized the dozens of air quality related regulatory programs that have been "rolled back", challenged in the courts, or are no longer being enforced in the past few years and that have demonstrated negative impact on air quality progress. These rules,

whether related to motor vehicle and nonroad mobile sources (proposing weakening existing fuel economy standards, lifting summertime ban on ethanol-based fuel blends, etc.), electric generating utilities (proposing repeal of Clean Power Plan; Power Plant Startup, Shutdown, and Malfunction Rule; etc.), or other categories and emission sources that impact air quality in Middle Tennessee have all been part of earlier improvements in ozone and PM concentration observations in the region.

However, now that these rules have been and continue to be eliminated, air quality in the region has shown deterioration and movement towards nonattainment of the various NAAQS. Removal of yet another regional rule like the I/M program will only work to worsen air quality for the population of Nashville and the entire Middle Tennessee region.

It is my recommendation that TDEC collectively consider the impact of these additional regulations before removing the I/M program from Middle Tennessee.

Summary of Recommendations

The Tennessee Department of Environment and Conservation , Air Pollution Control Division has requested that the United States Environmental Protection Agency remove the requirement for an Inspection and Maintenance program for the five-county Middle Tennessee area, which includes Davidson, Sumner, Wilson, Rutherford, and Williamson Counties, from Tennessee's State Implementation Plan. To support this request, TDEC has conducted a demonstration designed to show that removing the I/M program from Tennessee's SIP will not interfere with attainment or maintenance of various air quality NAAQS.

Based on a technical review conducted of the request for removal and associated documentation, I have concluded that the Noninterference Demonstration is inadequate to support the conclusion that removal of the I/M program from the SIP will not interfere with attainment of the NAAQS. In addition, I have made the following recommendations that are further detailed above.

- It is my recommendation that TDEC conduct a full air quality simulation of the impact of removal of the I/M program in Middle Tennessee before making any determination of its interference effect.
- It is my recommendation that the most current modeling platform and associated emission projections be used in this air quality simulation to update the I/M analysis conducted by TDEC to account for improvements in emission estimates.
- It is my recommendation that TDEC conduct this air quality modeling using a meteorological and associated base year inventory that meets the requirements of EPA guidance for the determination of impact of control strategies and air quality response.
- It is my recommendation that should TDEC still consider alternate methods to air quality modeling, that it use sensitivity factors based on source category distribution assumptions consistent with today's actual category and emissions mix to estimate the impact of removing Middle Tennessee's I/M program.

- It is my recommendation that TDEC consider the collective impact of additional regulations currently rolled back or in courts pending rollback decisions, before removing the I/M program from Middle Tennessee.