OZONE TRANSPORT COMMISSION

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Environmental Protection Agency
EPA Docket Center (EPA/DC)
Mailcode 28221T
Attention Docket ID No. EPA-HQ-OAR-2018-0225
1200 Pennsylvania Avenue, NW
Washington, DC 20460

RE: OTC Comments on the EPA's Proposed Determination Regarding Good Neighbor Obligations for the 2008 Ozone National Ambient Air Quality Standard (CSAPR Close-Out).

Docket ID: **EPA-HQ-OAR-2018-0225.**

The Ozone Transport Commission (OTC) would like to take this opportunity to comment on the United States Environmental Protection Agency's (EPA) proposed *Determination Regarding Good Neighbor Obligations for the 2008 Ozone National Air Quality Standard* otherwise known as the "Cross-State Air Pollution Rule (CSAPR) Close-Out" (Docket ID: EPA-HQ-OAR-2018-0225). The OTC opposes the proposed determination that certain upwind states' "good neighbor" obligations for the 2008 Ozone National Air Quality Standard (NAAQS) are fully addressed by the Cross-State Air Pollution Rule Update (CSAPR Update). OTC offers the following comments and technical assessment to support why EPA needs to withdraw the proposed determination. The OTC also continues to support a collaborative process, and reaffirms that support. The OTC provided oral testimony on August 1, 2018 on this proposal. OTC also provided comments on the earlier EPA modeling analysis (April 2017). OTC's "Technical Assessment" that is part of today's comments more fully addresses EPA's more recent (October 2017) modeling and data analysis that EPA is using to support this proposal.

The OTC is a multi-state organization created by Congress in the Clean Air Act (CAA). OTC is led by Governors and state air officials from 12 states and the District of Columbia to advise the EPA on finding and implementing solutions to the persistent problem among member states of ground level ozone and precursor pollutants. The Commission strives to ensure public health and welfare protection by identifying practical and cost-effective emissions reduction solutions. Ground-level ozone is a criteria pollutant that is transported across state lines directly affecting the health of more than 66 million people in the northeast and mid-Atlantic region particularly the young, elderly, and persons with compromised health.

In the CSAPR Close-Out EPA states that the CSAPR Update represented only a partial remedy for the 2008 ozone NAAQS when it was finalized. However, based on additional information and analysis, EPA now finds that the CSAPR Update is a full remedy. EPA finds that with the

CSAPR Update fully in place, the states covered by the rule are not expected to contribute significantly to nonattainment in or interfere with maintenance by any other state. EPA concludes that no additional requirements are needed for sources to further reduce transported ozone pollution under the "good neighbor" provision of the CAA and that EPA is under no obligation to issue FIPs nor are states required to submit SIPs to establish any additional emissions reductions. EPA comes to this conclusion through the use of photochemical modeling results that shows no nonattainment or maintenance areas for the 2008 ozone NAAQS in 2023. This modeling, which was conducted for the 2015 ozone NAAQS (not 2008) was released to the public with an accompanying memo on October 27, 2017.

The modeling EPA relies upon to conclude that all remaining nonattainment areas are eliminated and that no significant contribution remains for the 2008 ozone NAAQS is flawed. There are several techniques used by EPA in recent CSAPR Update and "good neighbor" transport modeling that make the modeling results inappropriate for either approving "good neighbor" State Implementation Plans (GN SIPs) or determining that transport obligations under the "good neighbor" provision of the CAA have been met. The unenforceable and unrealistic assumptions made in EPA's modeling create substantial uncertainties which can only lead to the conclusion that upwind states have not adequately addressed their emissions contributions to downwind states. Therefore, the OTC is opposed to EPA's current proposal for addressing CAA section 110(a)(2)(D)(i)(I), also referred to as the "good neighbor" provision, and specifically disagrees with the choice of the year 2023 for determining ozone transport obligations for the 2008 ozone standard have been resolved. OTC earlier concerns and opposition were also documented in an earlier response to EPA submitted on April 6, 2017[1]. The OTC has three areas of concern that must be addressed prior to approval of the proposed rule:

1. The deterministic use of a modeled 2023 projection year is done without regard to attainment dates subjecting millions of people to breathe unhealthy air for years to come.
2. The emissions and modeling process introduces significant and inherent uncertainties. This results in significantly over-predicted improvements in future air quality. EPA also optimistically assumes reductions in future emissions without the necessary assurance of federal enforceability.
3. Finally, EPA fails to address how the ozone problem has changed, particularly ignoring the need to address emissions on days that matter most.

TIMING: The EPA Proposal Delays Ozone Attainment in the Ozone Transport Region (OTR)

The New York City Metropolitan nonattainment area did not attain the 2008 ozone NAAQS by the "moderate" nonattainment area deadline of July 20, 2018 and will therefore be reclassified to "serious" nonattainment with an attainment deadline of July 20, 2021, with 2020 being the last ozone season in which data can be used to determine design values and attainment designations. GN SIPs from upwind contributing states were due in 2011 to address emissions contributing significantly to nonattainment and/or interfering with maintenance of the 2008 Ozone NAAQS.

[1] April 6, 2017 OTC Comments to U.S. EPA; Docket ID No: EPA-HQ-OAR-2016-0751; RE: Notice of Availability of the Environmental Protection Agency's Preliminary Interstate Ozone Transport Modeling Data for the 2015 Ozone National Ambient Air Quality Standard (NAAQS)

The New York Metropolitan area is not the only area struggling with attaining and maintaining the 2008 ozone NAAQS. EPA designated 12 areas in the OTR as marginal or moderate nonattainment for the 2008 NAAQS. Based on 2015-2017 design values[2], 4 of those areas, including NY, continue to struggle to either attain or maintain the standard. Furthermore, modeling conducted by OTC clearly indicates significant areas of nonattainment of the 2008 ozone NAAQS in 2020. Rather than focus on attaining by 2021 (effectively 2020), EPA instead arbitrarily chose the projected year of 2023 to perform its 2008 ozone NAAQS transport modeling. By choosing the year 2023, EPA essentially extended the attainment deadline, and in doing so, failed to consider the consequences on downwind states that could be bumped–up into higher nonattainment classifications. A bump-up in nonattainment classification and its associated consequences may be completely avoidable if EPA requires upwind states to fulfill their transport obligations as expeditiously as practicable. The year 2023 is simply the wrong year for determining whether good neighbor obligations have been met for the 2008 ozone NAAQS. Additional uncertainties in predicting emissions and using model results deterministically only reinforce that EPA's 2023 modeling as unreliable and inappropriately applied. As a result, ozone attainment in the OTR is being unnecessarily delayed and public health is being needlessly harmed.

With this decision EPA is permitting upwind contributing states to forestall or completely disregard implementation of even simple operational changes that can reduce emissions prior to 2020 and help clean the air for millions of people located downwind. The clear Congressional intent of the "good neighbor" provision in the CAA is that upwind states address their emissions **before** downwind nonattainment areas develop a plan for attainment of the NAAQS. States within the OTR have already implemented emission reduction programs that are much more stringent than any of the upwind states, and certainly the most advanced programs in the eastern United States. Upwind states must now fulfill their obligations to fully reduce their emissions transported into the OTR, as well as to address their localized air quality issues, without any more delay. It is critical to timely attainment in the OTR that EPA ensure that upwind states are held accountable for meeting statutory transport obligations.

UNCERTAINTIES: The Process Used by EPA Introduces Inherent Uncertainties that are Further Compounded by Overly Optimistic Assumptions about Future Air Quality

The understanding of the science of ozone formation, transport, and what is needed as a remedy has meaningfully changed, particularly in more recent years. The OTC Technical Assessment within these comments clearly demonstrates that the EPA modeling to support its proposed "CSAPR Close-Out" does not integrate this understanding, particularly as it relates to a remedy for upwind states' GN obligations. In general, OTC notes that EPA has made modeling decisions that are inconsistent with a collaborative process that involves OTC states and that EPA modeling assessment performed for this proposal has not adequately kept up with the current understanding of ozone formation and transport. This results in an unusable solution to a recalcitrant problem. While cost effective solutions for upwind states do exist, they are just not fully expressed or enforceable in the CSAPR Update. Cost effective actions can be taken now to address impacts on downwind states by requiring existing NOx controls to be operated and

[2] EPA's 2017 Design Value reports for 2008 8-hour ozone; https://www.epa.gov/air-trends/air-quality-design-values#report

optimized throughout the ozone season and assuring that emission limits are consistent with the averaging time of the standard.

The CSAPR Update is nearing the end of its second year of implementation and nonattainment persists, states in the OTR already far surpass their upwind neighbor states in controlling emissions, and there is clear evidence that additional measures beyond the CSAPR Update are required for upwind states to fulfill their obligations. This proposal ignores this simple reality.

The OTC Technical Assessment that is included as part of these comments discusses in detail the uncertainties that support the conclusion that the EPA emissions and modeling predictions are overly optimistic and upwind state's still have remaining transport obligations under the 2008 ozone NAAQS. Individually and collectively, these factors skew or bias modeling results to under-predict ozone contributions from upwind states. Notably, there are several techniques used by the EPA in recent CSAPR Update and "good neighbor" transport modeling that make the modeling inappropriate:

- Determining contribution thresholds based on projection modeling is much more difficult, unpredictable and particularly inappropriate for declaring that contribution thresholds will be satisfied in the future. In this context, 2023 is an inappropriate year to model while also inconsistent with GN requirements in the CAA. Rather than continually attempting to predict contributions in the future, EPA should determine contribution thresholds from a historic year (e.g. 2017);

- EPA relies on its untested and unproved "Engineering Analytics" technique to forecast EGU emissions that likely underestimates future year emissions versus the state generated ERTAC emissions forecasts;

- EPA relies on CAMx modeling results that predict a more optimistic outcome than CMAQ modeling results; however, CMAQ generally performs better in the OTR;

- EPA broadly applied a near-water monitor technique to model results. It is premature, given the technique still needs to be tested and verified, to apply corrections to near-water monitor model performance in regulatory applications;

- The manner contribution threshold metrics are applied can affect contribution results; specifically, moving to a higher threshold, specifically moving to a 1 ppb) threshold, results in a higher threshold to determine significance or interference. The result would be a showing that contradicts reality, that even fewer states contributing to the ozone problem;

- The use of a large bank of cheap allowances can lead to uncertainties in daily emissions. EPA's modeling appears to have already included EGU's optimizing controls, although this is not supported or enforceable through the CSAPR Update;

- EGU operational control optimization is important, particularly in the near-term to address interstate transport obligations, but optimization requirements must be federally enforceable;

- Meteorological variability, including different transport regimes, is not adequately captured in EPA modeling which leads to variability in contribution results;

- EPA's contribution modeling fails to address ozone formation and transport for high ozone days that matter most in the OTR;

- There are uncertainties created by the Administration's recent regulatory relief proposals that create biases toward higher, rather than lower, emissions; and

- Varying estimations of model boundary conditions can introduce uncertainties in contribution.

For additional information and details, please see the attached Technical Assessment.

UNENFORCEABLE FUTURE: Projection Year Modeling Depends on an Unenforceable Future for Determining Upwind Contributions

Several decades of emission projection modeling have demonstrated that model forecasts are ill-suited for assuming real-world futures. Also, analysis of modeling has shown that the further emissions are projected into the future, the greater the uncertainty becomes. In particular, EPA's contribution analysis uses future year modeling that is based on assumptions and projections of emissions reductions that are not guaranteed by federally enforceable requirements. Because these are purely assumptions, there is no clear path to budgets or emissions reductions becoming federally enforceable. This runs counter to the CAA's and EPA's direction that emissions reductions be permanent and federally enforceable. Ultimately, the reality is that downwind nonattainment areas cannot rely on assumed emission reductions from upwind areas. The OTC is also concerned that a theme of regulatory relief for both mobile and stationary sectors by this administration will further erode emissions reductions for programs already on the books, and at a minimum, the confidence that these programs will be as effective in 2023, as well as earlier years that will be critical to attaining the Ozone NAAQS.

There is a reasonable probability that emissions in 2023 will be higher than projected in the EPA analysis because there is no legal mechanism to require reductions. Should the projected emissions reductions not occur, or other areas of the emission inventory unexpectedly grow, then EPA would have failed to provide enough transport relief for downwind states to achieve attainment within the OTR. This will only add to the regulatory burden of downwind states by requiring them to find even more emissions reductions.

To minimize this risk, EPA should reduce its reliance on projecting emissions and seek more legally enforceable measures in the form of GN SIPs that provide relief before 2020.

DAYS THAT MATTER: The EPA Proposal Ignores the Need to Address Emissions on Days that Matter the Most

Over the past several decades, the scientific understanding behind ozone formation and transport has evolved significantly. With the wealth of new information and technical analyses, we now know that each day matters in the production and transport of ozone into downwind areas.

Simply relying on seasonal averages is a flawed approach, and wholly ignores the contribution of daily variability of emissions and their impact on downwind nonattainment. Ozone concentrations and upwind contributions to downwind ozone vary continuously. This must be understood and accounted for in order for EPA to develop a successful solution to the problem of ozone nonattainment in the OTR.

It is important to understand and address the role of high emitting sources before and during high ozone days. It is critical that emission controls to be run optimally during these high ozone periods. Data collected by EPA's Clean Air Market Division (CAMD) shows that many electric generation units (EGU) still do not fully optimize already installed emissions control technology, even with the CSAPR Update fully in effect. EPA's own assessment of the success of the CSAPR Update 2017 ozone season indicates that many units with advanced post-combustion controls were operating at rates twice what they expected they should have achieved. Clearly, EPA must agree that there are still opportunities for units to fully optimize their controls. Also, because many upwind states, particularly concentrated just upwind of the OTR, do not require short term averaging (i.e. 24-hour/daily limits), even 'well controlled' EGUs are not required to reduce their emissions on the most critical days. These sources can also exploit the use of banked allowance credits on higher ozone days rather than operate installed emissions controls further exacerbating the impact of daily emissions. The CSAPR Update is completing its second year of implementation; however, projections of banked allowances that could be utilized during high ozone events are already exceeding EPA CAMD's original projection in the rule. Relying on banked allowances simply allows EGUs to offset higher emissions, particularly on days that matter the most for ozone formation.

The EPA supported its selection of 2023 as the future-year for modeling by stating that uncontrolled EGUs needed that extra time to install controls due to manpower and resource constraints. While that may be true for *uncontrolled* units, EPA has neglected to require EGU's with controls *already* in place to fully optimize said controls. This optimization requirement does not take years of engineering and construction to accomplish as these EGUs already have installed pollution controls in place. The requirement to optimize already installed controls should be federally enforceable and can be implemented before 2020.

LEADERSHIP: The OTC has been a Leader in Emission Reductions to Address Ozone Transport

The states of the OTR have reduced emissions more than any other area in the eastern United States. When Congress created the OTC, it required substantial reductions including applying region-wide Reasonable Available Control Technology (RACT) requirements on electric generating power plants and other major sources and vehicle emissions inspection and maintenance programs. However, beyond these requirements that set the OTR apart from other states in the eastern U.S., most states in the OTR, particularly those hit hardest by persistent high ozone, also substantially reduce their emissions by requiring daily emission limits on major stationary sources and have implemented the cleaner California vehicle program.

The unfortunate reality we are addressing today is that the CSAPR Update, a partial remedy now re-named the CSAPR Close-Out does not sufficiently address ozone transport obligations under the 2008 ozone NAAQS. The issues discussed above must be addressed before there is any potential for EPA's projection modeling to be more credible.

Despite the work that the OTC states have done, EPA must take a leadership position and ensure upwind states understand and provide a full remedy that addresses their transport obligations. While reducing emissions from large stationary sources is critical, the OTC recognizes that mobile sources will be a larger percentage of future year emission inventories and encourages the EPA address these emissions including to expeditiously update federal heavy-duty engine NOx standards[3]. Also, any update to the current 2010 standards should provide deep and continuous emission reductions that will provide benefits nationwide.

On November 15, 2017, the OTC passed a GN SIP Resolution[4] that defined its commitment to work with EPA to identify the elements of a full remedy for a Good Neighbor SIP. That Resolution also identified high priority NOx emission sources that should be considered in GN SIPs, and requested the EPA to work with states to refine the modeling described in the EPA October 2017 Memo to accurately inform states of their Good Neighbor SIP for the 2008 and 2015 ozone NAAQS.

The high priority NOx emissions sources identified in the OTC Resolution included but was not limited to:

- Requiring existing coal-fired EGUs that have installed SCR or SNCR NOx control technology to optimize the use of those control technologies each day of the ozone season,
- Requiring existing coal-fired EGUs that have not installed SCR or SNCR NOx control technology to install SCR or SNCR control technology if determined to be cost effective and to optimize the use of such control technology each day of the ozone season,
- If appropriate to the source categories within the state, implementing the OTC's recommendations for natural gas pipeline compressor fuel-fired prime movers,
- Implementing the aftermarket catalyst program being developed as part of a public-private partnership among the states, the EPA, and the private sector, and
- Implementing an idle reduction program to reduce NOx emissions from mobile sources that is generally consistent with the OTC's Idling Reduction Documents.

These high priority NOx sources are either largely not included in EPA's proposed determination, or are represented as unenforceable emissions reductions in upwind states.

CONCLUSION

OTC needs EPA's help and leadership in addressing air pollution transport into our region. Delaying relief to 2023 will harm the citizens and economies of the OTR. This is especially

[3] Statement of The Ozone Transport Commission and Mid-Atlantic/Northeast Visibility Union Regarding Expediting Adoption by the U.S. Environmental Protection Agency of more protective Heavy-Duty Engine NOx Emission Standards; Adopted June 7, 2018

[4] Resolution of the Ozone Transport Commission Requesting the United States Environmental Protection Agency Take All Actions Necessary to Fully Address the Good Neighbor Provision for the 2008 and 2015 Ozone National Ambient Air Quality Standards. Adopted November 15, 2017; https://otcair.org/upload/Documents/Formal%20Actions/GoodNeighSIPResolu_Final.pdf

egregious when there are actions that can be taken immediately to, at least, ease high ozone concentrations observed in the OTR. The OTC states are determined to achieve attainment as expeditiously as practicable, but they need the EPA to keep pace with using the latest scientific understanding and be a willing partner to ensure the good health of OTC states' populations.

The OTC shares in the desire and the need for giving downwind areas the ability to plan and achieve attainment; but neither the proposed CSAPR Close-Out rule nor the modeling behind it satisfies that goal. The OTC urges the EPA to withdraw this proposal for all of the reasons discussed above.

Please feel free to contact me at (202) 318-0190 to discuss these comments further.

Sincerely,

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Executive Director
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CC: OTC Commissioners and Air Directors

OZONE TRANSPORT COMMISSION'S TECHNICAL ASSESSMENT – Attachment 1

Photochemical Air Quality Modeling Application Needed for Assessment of Attainment and Significant Contribution, and to Determine the Approvability of Good Neighbor SIPs

This paper has been developed by the Ozone Transport Commission (OTC) to identify key issues that must be included in air quality attainment and contribution modeling to be used in State Implementation Plans (SIPs). These modeling requirements incorporate the most scientifically sound approaches for meeting Clean Air Act (CAA) requirements for states required to submit attainment or Good Neighbor SIPs (GN SIP). At issue are the photochemical modeling data and techniques as they are applied for GN SIPs to support the Cross-State Air Pollution Rule (CSAPR). The modeling methodology for this, and other modeling work, was originally developed in collaboration with the states. Since that time, the Environmental Protection Agency (EPA) has independently adopted assumptions and new techniques beyond what was discussed during collaboration. These include the adoption of the near-water technique for calculating relative response factors (RRFs) which has not been peer reviewed, and a technique for how to calculate interstate contribution during high ozone days.

The goal of this paper is to describe the minimum modeling elements needed by states for modeling demonstration of attainment and GN SIPs, and by EPA in development of Federal rules, GN SIP support modeling, and for developing guidance on the approvability of GN SIPs. These minimum requirements for modeling will be critical in the near term for the states' development of GN transport SIPs for the 2008 and 2015 ozone standards, and in the future for those states required by EPA to develop attainment SIPs.

This is also especially important since EPA's Transport Team has been holding conference calls with interested stakeholders to obtain feedback on the March 27, 2018 memorandum, *Information on the Interstate Transport State Implementation Plan Submissions for the 2015 Ozone National Ambient Air Quality Standards under Clean Air Act Section 110(a)(2)(D)(i)(I)*[5]. This memorandum provides projected air quality modeling results for ozone in 2023, including projected ozone concentrations at potential nonattainment and maintenance sites for the 2015 ozone NAAQS. The memorandum also provides projected upwind state contribution data. EPA held conference calls regarding the memorandum and in particular, to seek feedback on the memorandum's Attachment A which contains a preliminary list of potential flexibilities for developing a GN SIP. At this point in time, EPA is not officially responding to the comments nor accepting additional comments on potential flexibilities, including thresholds for determining significant contribution. Modeling is a critical tool when developing work products and EPA needs to engage stakeholders at many levels before moving forward with policy and guidance. The Clean Air Act specifically established the Ozone Transport Region (and OTC) for this purpose and this call is a step for improving the modeling efforts as they relate to future EPA actions.

Introduction

Modeling used to support approvable GN SIPs must be consistent with the current conceptual understanding of how ozone is formed. This science and the requirements of the CAA affect the determination of model years (base and future), assessment of confidence in Comprehensive Air Quality Model with extensions (CAMx) and other modeling results, the techniques used in the modeling to

[5] https://www.epa.gov/sites/production/files/2018-03/documents/transport_memo_03_27_18_1.pdf

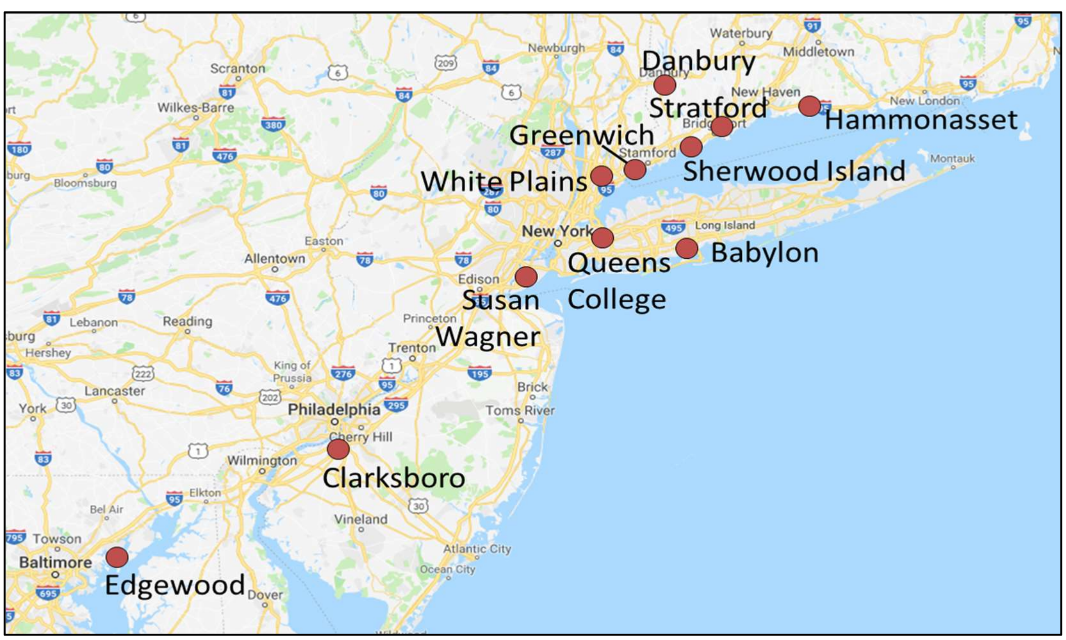
capture real world temporal and spatial variations in emissions from electric generating units (EGUs), use of models and techniques for projection of EGUs, identification of modeling methods and approaches for determining significant contribution, and use of modeling results for SIP purposes.

As discussed in section 2 of this paper, when the OTC ran the Community Multiscale Air Quality (CMAQ) model with similar emissions to those used in CAMx modeling, dramatically different results were obtained for a number of the key monitoring sites in the New York City area. The differences suggest uncertainty regarding future attainment conditions during attainment years. These differences also introduce variations regarding which states would owe GN SIPs that consider linkage to nonattainment receptors. In fact, when EPA updated its 2023 modeling emission inventory from version ‘`el’ to ‘`en’, predicted concentrations changed by fractions of a part per billion (ppb) which were enough to change which monitors exceeded the NAAQS along with the corresponding list of significantly contributing states. Such sensitivity requires careful examination of uncertainties. How certain are the projected year emissions, for example? How certain are the precision and accuracy of EPA’s choice of only considering one model’s predictions (when OTC finds benefit in using another model)? In regulatory modeling (including permit modeling), EPA typically considers uncertainties by ensuring predictions of attainment of the National Ambient Air Quality Standards (NAAQS) include a sufficient margin of conservatism.

In this paper, the OTC discusses the various parameters, models, and techniques for using photochemical modeling to project ozone attainment, for supporting an approvable GN SIP and for determining significant contribution linkages for GN SIPs requirements. The OTC believes that state or federal modeling used to support GN SIPs is not approvable unless the issues described in this document are addressed.

The monitors shown in Figure 1 serve as the selected monitors presented in tables within this paper. The selected monitors are some of the OTC’s high ozone monitors and many of them are located near water.

Figure 1: Monitor Location (Select monitors included in tables)



Issues and Discussion

There are at least seven areas in which the OTC would like to discuss modeling decisions and techniques. These include:

1. Ensuring that the modeling is consistent with current conceptual understanding of how ozone is formed.
2. Model selection.
3. Choosing years to model to project attainment or to determine contribution linkages.
4. Application of near-water monitor data processing.
5. Emission inventory modeling for EGUs.
6. Technique for determining significant contribution linkage, including ensuring that important transport regimes are considered and the daily nature of nonattainment is accurately captured.
7. Boundary conditions.

1. Ensuring that the modeling used to support state SIPs is consistent with current conceptual understanding of how ozone is formed

Although ozone design values in the East have dropped dramatically over the past ten years, there is still a large population that is exposed to ozone concentrations in excess of the 2008 and 2015 NAAQS. As ozone emission precursor emissions have been reduced, the way in which high ozone days occur has also changed. Historically, high levels of local emissions would combine with regionally produced emissions to form widespread ozone exceedances across the Ozone Transport Region (OTR). As states in the OTR worked individually and collaboratively to address local and regional ozone transport in order to meet the 1990 1-hour, 1997 8-hour, and 2008 8-hour ozone NAAQS, emissions and corresponding ozone concentrations came down significantly. During the process virtually every cost-effective emission reduction was studied and pursued, and the continuing need for emission reductions resulted in incrementally higher costs.

In the 1990s, the Ozone Transport Assessment Group (OTAG) was formed to study ozone transport beyond the established Northeast OTR. Upon conclusion, they found that ozone and its precursor emissions could transport hundreds of miles through various meteorological regimes. Measurements taken around this time found that high-ozone events in the Northeast were linked to widespread regional transport episodes, where regional aloft ozone would routinely reach concentrations of 70 to 90 ppb. This regional aloft “reservoir” was found to mix down into lower elevations where local emissions are released during the mid-morning to create high levels of ground-level ozone, often well above the standard, across the East. The OTAG process concluded with EPA implementing the NOx SIP Call, which successfully reduced inter-regional ozone transport and enabled many eastern locations to attain the ozone NAAQS.

Since the 1990s, additional regional and national emission measures have been implemented including the Clean Air Interstate Rule (CAIR), CSAPR, and low emission vehicles and clean fuel requirements, but perhaps one of the biggest recent drivers of cleaner air in the eastern U.S. was a regulation at all. It was an economic driver created by increasing low-cost natural gas supplies through improved fracking technology. Electric generating companies and large industry often found it more economical to switch to low cost natural gas that naturally meets most environmental regulations than it was to continue to operate with higher emitting fuels and operate post-combustion technology. While this economic driver was very effective in reducing emissions and lowering ozone concentrations across the East, it comes with an uncertain future that's dependent on an assumption that future year economics will continue to support low cost natural gas. It also comes with changes in how high ozone events in the East are formed.

In recent years, the worst ozone days in the East are still almost always linked to regional events. Regional nitrogen oxide emissions (NOx) from EGUs still create an aloft reservoir that mixes down, but ozone levels in the reservoir are more likely in the 50 to 70 ppb range compared to 70 to 90 ppb range observed ten years ago. Local emissions and short-range transport (West Virginia and Pennsylvania to Maryland, Maryland to New Jersey, New Jersey to Connecticut, etc.) have become more critical, adding up to 15 to 30 ppb of ozone to the 50 to 70 ppb of ozone mixing down from aloft. This can be the difference between exceeding or not exceeding the 2008 and 2015 standards. Driven by local meteorology, local geography and day-specific emissions, contribution from local emissions and short-range transport vary from one high ozone day to another. Modeling needs to account for fine scale topographical and emission features and have good model replication of the aloft transport reservoir.

Sea and bay breezes are currently an important phenomenon at many of the high ozone monitoring locations in the OTR. These events can create large gradients between high and low ozone locations. Model performance in these locations is not strong enough to forecast with certainty to fractions of a ppb. Modelers have explored removing data from the calculations, but this is unproven and the source of additional uncertainties. Ideally, future modeling will include fine enough resolution where the near water model performance issue for high ozone monitors can be resolved to improve performance and certainty.

Another important detail that needs to be carefully accounted for in current modeling is how emissions change on high temperature days. These high temperature periods are often also periods of high electricity demand where base load EGUs run at maximum capacity and peaking or load-following EGUs, that don't run every day, are also running at a high capacity. Infrequently operating peaking units, which often lack emission controls and have proven difficult to account for in the ozone modeling emission inventories. Such units have their emissions "averaged" over long durations rather than being concentrated on just a few days, or even hours, in the way sources in the real world operate during high electricity demand periods.

Support modeling for GN SIPs introduces a new level of required modeling sophistication where fractions of a ppb become even more important. The results of this work determine which states owe emission reductions in their GN SIPs to address modeled violations of the ozone NAAQS. Getting this wrong can leave downwind areas facing failure to attain the NAAQS with insufficient help in reducing transport. For this test, EPA uses the model to predict future year (2023) design values and how much transport will exist from upwind states to a monitor predicted to violate the NAAQS. There are many ways to evaluate transport and there are many large uncertainties including the use of future year expected emissions and meteorological variability. Section 6 of this document explores how different contribution metrics result in differing answers as to who significantly contributes to a modeled future year ozone violation. Since the form of the ozone NAAQS considers the four highest ozone days per year for a given monitor, it makes sense to look at significant transport in a way that also considers the four largest individual day ozone contributions occurring during the highest modeled ozone days, rather than to average state ozone contributions on the top ten modeled ozone days. Such a metric would naturally improve consideration of key meteorological regimes (e.g., along corridor, westerly transport, local recirculation, etc.); however, the uncertainty of year to year meteorology would still limit transport consideration of meteorological regimes to those inherent to the base year meteorology.

Overall, photochemical modeling has historically done well with predicting larger ozone changes, where fractions of a ppb were of less importance. Today, there are widespread areas that are just a few ppb above the ozone NAAQS and the role of modeling and emission uncertainties is becoming increasingly important. Additional steps need to be taken to bring current support modeling for GN SIPs and the Cross State Air Pollution Rule (CSAPR) up to date with current conceptual understanding of ozone formation.

2. Which Model to Use?

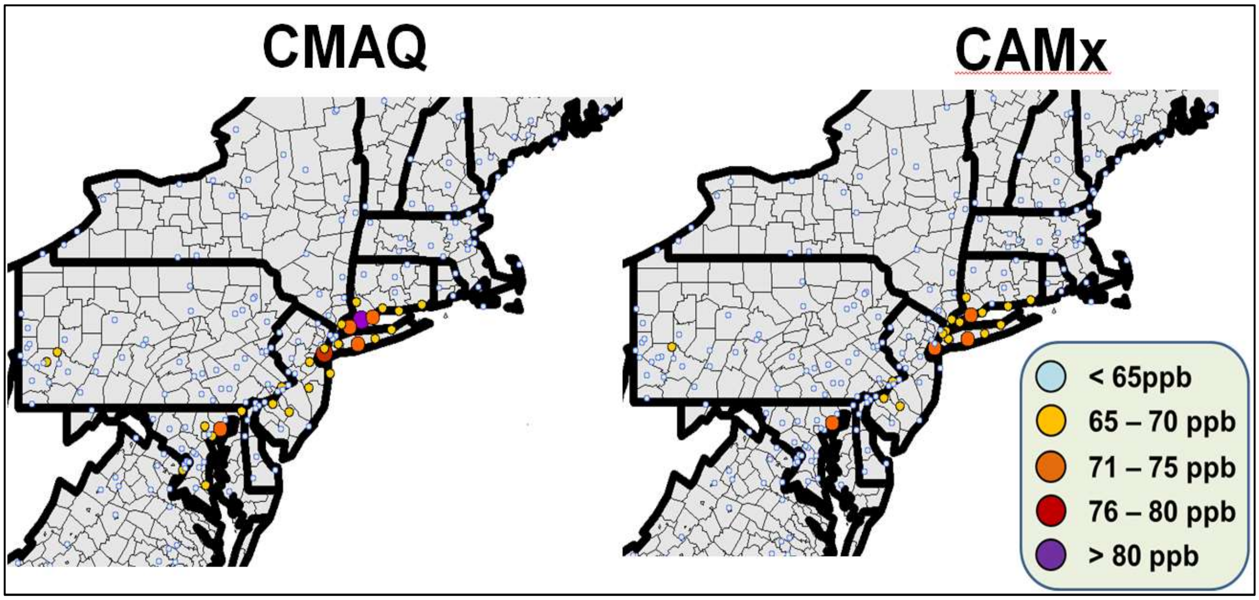
EPA currently uses the CAMx model for contribution modeling. The model has many features that make it attractive for this type of work and, in general, it produces reasonable results. CMAQ is another commonly used model that has the ability to produce contribution assessments and has historically served as the default model to serve in ozone attainment demonstrations and regional haze SIPs. CAMx is now commonly being used to perform contribution modeling rather than CMAQ for reasons that include a tagging function and fast run time. Both models have demonstrated solid performances compared to the monitored data.

OTC has the capability to run both models, taking advantage of their individual strengths, and OTC has found that together they can help identify areas of uncertainty. One such case is high ozone concentrations measured at near-water monitors in the Northeast. CMAQ predicts higher ozone concentrations at many of these locations than CAMx (Figure 2 and Table 1).

It is clear from the Table 1 that the CAMx model more optimistically predicts 2023 region-wide attainment of the 2008 ozone NAAQS (green and orange colors) compared to the CMAQ model which predicts failure to attain (purple color). Relying only on CAMx results means that fewer upwind states would be linked with downwind nonattainment and therefore there would be less emission reductions required for upwind areas. However, if CMAQ more accurately predicts 2023 projected ozone design values, then relying only on CAMx determined linkages to nonattainment will fail to provide sufficient relief of transported ozone. It is of great concern for OTC that EPA does not account for this uncertainty in their data and modeling analyses. This is not consistent with EPA's guidance recommendation for a conservative approach for dealing with uncertainty.

A model performance test is used to ensure the model results are reasonably realistic. This is typically done by comparing 2011 base year model results to actual observed 2011 base ambient air quality monitored concentrations. In model performance testing, OTC found that CMAQ generally performs better than CAMx across the OTR, having a lower mean fractional bias. CMAQ however does have greater uncertainty over some near water monitors in the New York City area, resulting in a tendency to over predict 2011 base year ozone compared with the CAMx model. However, there is no way to know with certainty which model performs better with future year projected emissions without knowing future year ambient air quality monitoring data to verify the results. OTC did the next best thing in comparing its CMAQ modeled 2017 future year design values (DVFs), based on projected (beta) emissions inventory (on a 2011 based modeling platform), to actual observed 2015-17 ozone design values. The results of this analysis found that CMAQ performed well overall, but had some tendency to under-predict when compared to 2015 to 2017 ozone monitored design values (Figure 3 and Table 2). These results suggest that CAMx would predict even lower ozone for 2017 than CMAQ, compounding the potential for CAMx to under-predict future ozone levels. There are many uncertainties introduced when projecting into the future, including meteorological differences and making informed assumptions regarding future year emissions, but these uncertainties need to be better accounted for in the process.

Figure 2: Comparison of OTC 2023 CMAQ and CAMx Modeled DVFs



** "DVF" means the predicted future Design Value*

Table 1: Comparison of OTC 2023 CMAQ and CAMx Modeled DVFs at Select Monitors

AQS Code	County	Site	2023 Gamma CMAQ (ppb)	2023 Gamma CAMx (ppb)
090019003	Fairfield	Sherwood Island Westport	**81.1**	**71.9**
360850067	Richmond	SUSAN WAGNER HS	**76.9**	**71.1**
240251001	Harford	Edgewood	**74.1**	**71.8**
090010017	Fairfield	Greenwich Point	**72.3**	69.5
090013007	Fairfield	Lighthouse-Stratford	**73.7**	70.6
361030002	Suffolk	BABYLON	**71.4**	**72.0**
090099002	New Haven	Hammonasset State Park-Madison	69.7	69.9
360810124	Queens	QUEENS COLLEGE 2	68.8	69.4
361192004	Westchester	WHITE PLAINS	69.5	68.1
340150002	Gloucester	Clarksboro	69.1	67.5
090011123	Fairfield	Danbury	68.0	66.3

Note: Purple shading indicates predicted DVFs that are above the 2008 O3 NAAQS. Orange shading indicates predicted DVFs that are above the 2015 O_3 NAAQS.

Figure 3: Comparison of OTC 2017 CMAQ DVFs and Observed 2015-17 Design Values

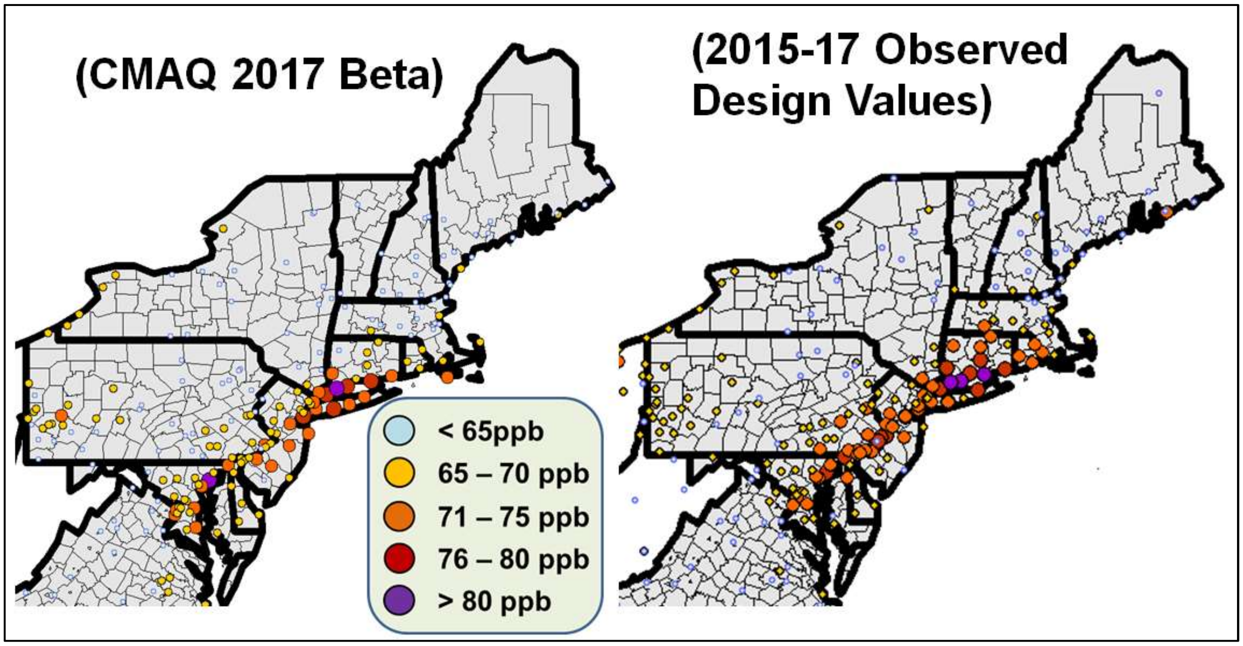


Table 2: Comparison of CMAQ 2017 DVFs with 2015-17 Monitored Design Values

AQS Code	County	Site	2017 Beta CMAQ (ppb)	2015-17 Design Values (ppb)
090019003	Fairfield	Sherwood Island Westport	83	83
360850067	Richmond	SUSAN WAGNER HS	78	76
240251001	Harford	Edgewood	81	75
090010017	Fairfield	Greenwich Point	77	79
090013007	Fairfield	Lighthouse-Stratford	77	83
361030002	Suffolk	BABYLON	77	76
090099002	New Haven	Hammonasset State Park-Madison	77	82
360810124	Queens	QUEENS COLLEGE 2	74	74
361192004	Westchester	WHITE PLAINS	73	73
340150002	Gloucester	Clarksboro	74	74
090011123	Fairfield	Danbury	74	77

All available modeling with adequate performance should be considered as part of attainment demonstrations, GN SIPs and determining the adequacy of GN SIPs.

3. Which Year to Model?

Tests for significant contribution can be based on current or projected future emission year modeling. OTC prefers relying on base year emissions and contribution analyses to determine who contributes what and then accounting for future year emissions adjustment as part of meeting transport obligations. "Base year" modeling consists of a year where an actual emissions inventory estimate has been developed that is of SIP quality. Using the base year has the added advantage of having current monitoring data that can help determine how well the model performs and removes uncertainty from meteorology mismatch in future years. The "base year" modeling can be based on the most available National Emissions Inventory or a "base year" chosen by EPA and states due to ozone-conducive meteorology.

For contribution modeling with future year emission projections, the future meteorology is assumed to be the same as the base year, and the future year selected is normally reflective of statutory attainment dates. For example, a scenario to model estimated 2017 projected emissions on a 2011 based modeling platform would be modeled with base year 2011 meteorology and the selection of 2017 would reflect the moderate attainment date for the 2008 ozone NAAQS. If one wanted to use 2017 actual emissions with 2017 actual meteorology they would need to wait until the 2019/20 timeframe when the NEI and meteorological data could be processed. Emission inventory development is a resource- and time-consuming task that normally takes years to reach SIP quality.

Contribution modeling with future year emission projections allows for the assessment of future year conditions that account for anticipated emissions changes, but depends on a greater level of assumptions, such as whether or not future year meteorology patterns will match the base year, and whether predicted emissions for the future will occur with a reasonable level of certainty. Since more assumptions need to be made, future year modeling needs to account for more uncertainties.

In the recent attainment and transport modeling, EPA paired 2023 projected emissions with 2011 meteorology for the transport modeling test for its recent proposal to address the GN provision for the 2008 ozone NAAQS[6]. OTC recently performed similar modeling using its own emissions inventory. The selection of 2023 for a future year emission projection is helpful for attainment planning for areas designated as moderate nonattainment for the 2015 ozone NAAQS, but is an unusual selection for application to the 2008 ozone NAAQS in the East because no areas currently have a 2023 attainment date. Instead, choosing 2020 would have made more sense. Relying on 2023 projected year contribution modeling provides an overly-optimistic view of OTC monitors reaching attainment since the modeling doesn't reflect actual attainment dates. EPA does not provide an assessment for contribution modeling for the actual attainment date of 2020. OTC did, however, perform 2020 modeling. CMAQ 2020 and 2023 modeling results are in Table 3.

Which year and method are the best to use? There are arguments for each, but because of the uncertainties inherent to future year emission inventories and assuming future year meteorological patterns will match those of the base year, there is a need to better account for possible emission and meteorology variability. Too often, modeling results are calculated to sub-part per billion levels and a bright line threshold is applied. The future year attainment test is designed to be realistic, which is a strength, but also a weakness if uncertainties are not accounted for.

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[6] See EPA's modeling technical support document at https://www.epa.gov/sites/production/files/2018-06/documents/aq_modelingtsd_updated_2023_modeling_o3_dvs.pdf.

Table 3: Comparison of OTC 2020 and 2023 CMAQ Modeled DVFs at Select Monitors

AQS Code	County	Site	2020 Gamma CMAQ (ppb)	2023 Gamma CMAQ (ppb)
090019003	Fairfield	Sherwood Island Westport	**83.4**	**81.1**
360850067	Richmond	SUSAN WAGNER HS	**79.5**	**76.9**
240251001	Harford	Edgewood	**77.6**	**74.1**
090010017	Fairfield	Greenwich Point	**76.2**	**72.3**
090013007	Fairfield	Lighthouse-Stratford	**76.8**	**73.7**
361030002	Suffolk	BABYLON	**75.2**	**71.4**
090099002	New Haven	Hammonasset State Park-Madison	**73.9**	69.7
360810124	Queens	QUEENS COLLEGE 2	**72.0**	68.8
361192004	Westchester	WHITE PLAINS	**72.7**	69.5
340150002	Gloucester	Clarksboro	**72.4**	69.1
090011123	Fairfield	Danbury	**71.1**	68.0

Recent EPA transport modeling has demonstrated that even small changes in assumptions, such as updating 2023 emissions for a few sectors results in modeling, can cause the monitors projected to be over the 2015 ozone NAAQS of 70ppb to change. Predicted ozone concentrations only changed by fractions of a ppb, but it was enough to change which monitors failed the test and which states would be linked to those failures. Since projected emissions are being forecasted years into the future as future actual rather than future allowable, there is a considerable range in the magnitude of future year emissions that could really occur. There is also uncertainty in future year meteorological patterns and boundary condition influences.

One thing is clear: If a future emissions year is selected, it needs to be a sound selection under the framework of the CAA rather than one based on convenience. For example, EPA's selection of 2023 as the future projection year for 2008 ozone NAAQS transport modeling does not make sense. The year 2023 is 12 years after the March 2011 deadline for submitting the GN transport SIPs per the CAA, and 6 years after attainment is required for the nonattainment areas classified as "moderate", i.e., by the 2017 ozone season.

4. Modeling Near-Water Monitors

OTC performed screening modeling with experimental concepts to determine how to most effectively model near-water monitors measuring high ozone concentrations. According to EPA guidance, DVFs are derived by taking the highest predicted value in a 3x3 grid cell matrix where the monitor is located. In many cases, ozone concentrations are predicted (often correctly) to be higher in the overwater grid cells, which can affect DVFs and model performance for those given monitors, raising concerns about uncertainty when assessing near-water monitors. Because several OTC high ozone monitors are located along the shores of the Atlantic Ocean, Long Island Sound, and Chesapeake Bay (see Figure 1), and a number of these locations have at least some portion of their local 3x3 grid cell matrix over water. OTC experimented with techniques that might improve model accuracy and developed a routine that simply excludes overwater grid cells from the 3x3 grid cell calculation. A similar analysis was used by EPA in its 2023 Transport Modeling Assessment and used a Weather Research and Forecasting (WRF) model land use masking routine much like OTC's experimental approach. OTC used the WRF LWMASK to determine if a cell should be treated as being over land or water. EPA treats a cell as being over water if more than 50% of the grid cell area is considered water.

As seen in Table 4, the near-water technique explored by OTC shows promise, but when OTC experimented with it, it was not adopted because it was never fully vetted and there were concerns that overwater ozone can, and does, blow onshore during sea-breezes. A special near-water technique may not be needed if a finer grid cell resolution is applied and tested. More testing and documentation of this technique and how it affects performance and RRF calculations must be completed before it is accepted for use in regulatory modeling. EPA should complete this work, perhaps in partnership with the states, before the technique is adopted for regulatory purposes.

Table 4: Comparison of OTC 2023 CAMx and CMAQ Near-water Modeled DVFs at Select Monitors

AQS Code	County	Site	CAMx 3x3 (ppb)	CAMx Less Water (ppb)	CMAQ 3x3 (ppb)	CMAQ Less Water (ppb)
090019003	Fairfield	Sherwood Island Westport	**71.9**	69.1	**81.1**	**73.1**
360850067	Richmond	SUSAN WAGNER HS	**71.1**	65.7	**76.9**	68.2
240251001	Harford	Edgewood	**71.8**	**71.8**	**74.1**	**73.9**
090010017	Fairfield	Greenwich Point	69.5	68.4	**72.3**	**82.0**
090013007	Fairfield	Lighthouse-Stratford	70.6	69.5	**73.7**	**72.2**
361030002	Suffolk	BABYLON	**72.0**	**73.3**	**71.4**	**72.8**
090099002	New Haven	Hammonasset State Park-Madison	69.9	68.7	69.5	66.1
360810124	Queens	QUEENS COLLEGE 2	69.4	69.3	68.8	70.1
361192004	Westchester	WHITE PLAINS	68.1	62.8	69.5	66.1
340150002	Gloucester	Clarksboro	67.5	67.5	69.1	69.1
090011123	Fairfield	Danbury	66.3	66.3	68.0	68.0

5. EGU Emission Inventory Modeling

Traditionally, EPA has used the Integrated Planning Model (IPM) for performing EGU operation and emissions projection for future years. IPM is a powerful model that has many features, but from a state perspective, it is not a viable option since it is an expensive model to run. Since it is proprietary, and it is non-transparent in how its forecasts are produced, several years ago states worked together via the Eastern Regional Technical Advisory Committee (ERTAC) to develop a new EGU projection modeling tool (ERTAC-EGU). ERTAC-EGU has now been thoroughly tested and adopted for use by OTC as well as LADCO, SESARM and some CENSARA states. The ERTAC-EGU model can be run locally with fully transparent assumptions and calculations. Although states have worked with EPA to validate the ERTAC-EGU model, the EPA still chooses other methodologies for its regulatory photochemical modeling. In its most recent modeling, EPA used a method referred to as engineering analysis which has not yet been thoroughly vetted by the states. Several states have concerns as to whether peaking units are being correctly accounted for in the modeled emissions.

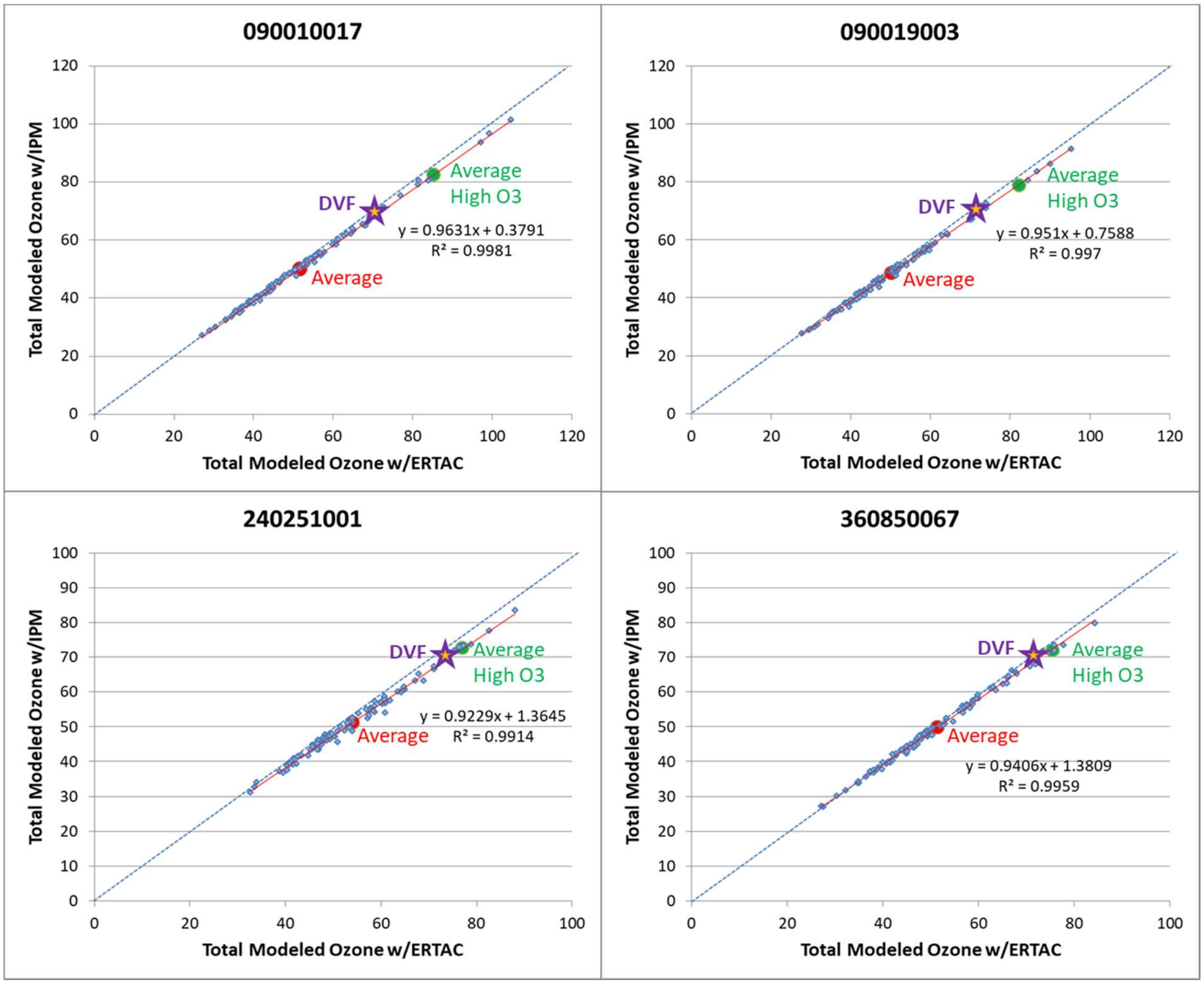
Ideally, modeling with IPM/engineering analysis and ERTAC would yield nearly identical EGU emissions, but because ERTAC-EGU includes fewer unit shutdowns, added controls, and replacements with new and cleaner units than the EPA approach, the tendency is for ERTAC-EGU to predict higher EGU emissions. States use information provided by utilities regarding their future plans for EGU units along with regulatory and legislative information as inputs to ERTAC-EGU; this often produces higher future year EGU emission projections than produced by IPM. IPM bases its decisions heavily on anticipated economics, but has regularly projected unit shut downs that states have reason to believe will not occur in the forecasted time frame.

When 2023 projected ERTAC-EGU and IPM/engineering analysis emissions were run through the OTC photochemical model, ERTAC projected emissions for 2023 tended to result in higher modeled ozone concentrations at problem monitor locations in the OTR than the EPA engineering analysis approach, by up to five percent (see Figures 4 through 7 below). The different emission sets for EGUs seem to produce little difference in DVFs for these monitors, but in terms of source contribution calculations, ERTAC-EGU with its higher emission predictions produces higher EGU culpability to those DVFs.

EPA recently released an updated version of MOVES that corrects an over-prediction of NOx emissions for the NonRoad sector. Since the CSAPR and GN SIP support modeling use the older version of MOVES, the source apportionment modeling is likely further biased away from EGU contribution and more against local emissions, such as mobile sources.

EPA’s decision to modify its EGU emission projection process but still use a different approach from the states naturally highlights additional uncertainties that should be accounted for during application of the contribution test. Ideally, EPA and the states can bring EGU forecasting under a similar framework rather than perpetuate competing systems. Since it is unknown which EGU projection system works best for future year modeling, contribution modeling results used by EPA and the states should account for the uncertainties.

Figures 4-7: Comparison of OTC 2023 CAMx Modeling with ERTAC-EGU and IPM at Select Monitors (Daily maximum 8-hour ozone predictions in ppb)



6. How to Determine Significant Contribution Linkage?

The currently applied test to determine significant contribution is based on photochemical modeling that tags the emissions from each state and then identifies interstate linkages during higher ozone days, i.e., highest ten modeled ozone days. The widely applied significant contribution threshold is 1 percent of the NAAQS, which equates to 0.76ppb for the 2008 ozone NAAQS and 0.71ppb for the 2015 NAAQS. At the time that this paper was written, EPA started exploring modifying the 1 percent contribution threshold to a 1 ppb threshold for determining significant contribution. Such a change would decrease the burden for contribution states and shift it to emission sources closer to areas of violation. Using a fixed threshold rather than one based on a percentage makes it inflexible to potential changes in the NAAQS.

EPA Modeling Approaches for Determining State Contributions:

2018: Average contributions during top ten modeled ozone days

- Unless fewer than 5 days exceeding 60ppb, then drop calculation for location.

2016: Average contribution of days exceeding 71ppb

- If fewer than 5 exceedance days, then average top 5 days,
- Unless fewer than 5 days exceeding 60ppb, then drop calculation for location.

The linkage test connecting upwind contributing states to downwind ozone violation monitors takes model predicted state contributions during daily 8-hour maximum periods at each modeled monitor and averages values to predict the NAAQS (or other) threshold. This averaged data is then normalized to a modeled DVF in a process that uses the relative response factor technique. This estimates a relative state contribution to a projected year of emissions.

A recent OTC study of EPA and OTC 2023 contribution modeling identified concerns about overlooked contribution variability when a simple average test of high ozone days is applied. When there are only a small number of days exceeding the test threshold, the uncertainty is relatively small, but when modeled high ozone days climb beyond five, uncertainty in identification of interstate linkages increases because there can be differing transport regimes, some of which might be excluded from the final calculation. Linkages can be missed where four or more days are linked by the modeling, but the link average is below the test threshold because of the larger number of days of low connection. For example, in the case of the Edgewood, Maryland monitor, OTC CAMx modeling for 2023 indicated that there were ten modeled days that would exceed 71ppb. On four of those days, Illinois contributed more than 0.71ppb and on six of the ten days it contributed less. Using a ten day average, Illinois contributed less than 0.71ppb and would not be considered a significant contributor to the Edgewood monitor. The importance of Illinois is diminished because it contributes during less than half of the high ozone days in 2011. However, Edgewood has multiple transport regimes and Illinois could be an important contributor on days when certain transport scenarios occur (e.g., pollution being transported from the Midwest and Ohio River Valley).

In the OTC analysis, nine methods for determining significant linkage between monitors and upwind emission sources were assessed. The study used states as upwind emission sources to be consistent with EPA's application of significant contribution.

It should be noted that contributions vary from day to day and even hour by hour. Some states have concerns regarding how sub-daily contribution can affect attainment and how it influences significant ozone transport.

Some of the methods explored by OTC for significant contribution linkage include:

1. Adjusted average of top ten ozone days (similar to EPA's 2023 ‘`en' modeling).
2. Adjusted average of modeled contributions on high ozone days (i.e., high ozone days or NAAQS) (Similar to EPA's previous 2016 contribution modeling).
3. Number of days significantly contributing on high ozone days (with potential threshold of 4).
4. Average of four largest state contribution percentages of U.S. Anthropogenic contributions within top ten modeled ozone days.
5. Adjusted average of top 4 modeled contributions.

6. Maximum modeled ozone contribution (on high ozone days if 4 or more, otherwise on top 4 ozone days).
7. 4th maximum modeled ozone contribution (on high ozone days if 4 or more, otherwise on top 4 ozone days).

Methods 1 and 2 are used most often, but can average-out potentially important contributors that contribute less frequently than others. When EPA adjusted the significant contribution test from one similar to method 2 to one that is similar to method 1, the resulting list of included states was nearly identical.

Methods 3, 6 and 7 are simple to apply but are not inherently robust in data and may not achieve the intended goal of identifying frequent significant contributors.

Methods 4 and 5 are newly considered and identify significant contributors that may occur on at least 4 high ozone days, but perhaps on less than half of all the modeled high ozone days. The techniques create pools of high ozone days, or at minimum a pool of the top 4 modeled ozone days, and searches for the top 4 contributions from within that pool and averages them. This process identifies important contributors that are missed by other techniques. It also creates a pool of at least 4 days that may average over the threshold even if not all the days exceed the threshold individually. Finally, methods 4 and 5 introduce a small degree of conservatism which helps to account for some of the modeling uncertainties discussed previously.

Table 5 compares five contribution test methods based on OTC CAMx 2023 contribution modeling for the 2015 ozone NAAQS. As stated above, OTC finds occurrences of some upwind states being averaged out of identification as a contributing state because there were a large number of modeled exceedance days and the state contributed to less than half, but still at least four high ozone days. As a result, OTC would like to see further testing of more robust significant contribution determination methodologies.

Table 5: Comparison of OTC 2023 CAMx Modeling Contribution Modeling Methodologies at Select Monitors (2015 NAAQS)

AQS	090019003	360850067	240251001	090099002	090013007	361030002	Cumul-ative
County	Fairfield	Richmond	Harford	New Haven	Fairfield	Suffolk	
Site	Sherwood Island Westport	Susan Wagner HS	Edgewood	Hammonasset State Park-Madison	Lighthouse-Stratford	Babylon	
2023 O_3 OTC /EPA	71.9 /72.7*	71.1/ 71.9*	71.8 /71.4*	69.9 /71.2*	70.6 /71.2*	72.0 /72.5*	
AL		6	5, 6			6	5,6
CT	1, 2, 3, 5, 6	6		1, 2, 3, 5, 6	1, 2, 3, 5, 6	5, 6	1,2,3,5,6
DC			5, 6				5,6
DE	5, 6	5, 6	6	6	5, 6	6	5,6
GA		6	6			6	6
IL	5, 6	1, 2, 3, 5, 6	3, 5, 6	5, 6	5, 6	2, 5, 6	1,2,3,5,6
IN	5, 6	1, 2, 3, 5, 6	1, 2, 3, 5, 6	5, 6	5, 6	2, 5, 6	1,2,3,5,6
KY	5, 6	1, 2, 5, 6	1, 2, 3, 5, 6	5, 6	5, 6	5, 6	1,2,3,5,6
MD	1, 2, 3, 5, 6	1, 2, 3, 5, 6	1, 2, 3, 5, 6	1, 2, 3, 5, 6	1, 2, 3, 5, 6	1, 2, 5, 6	1,2,3,5,6
MI	5, 6	1, 2, 5, 6	1, 2, 3, 5, 6	5, 6	5, 6	1, 2, 3, 5, 6	1,2,3,5,6
MO	6	6	5, 6	6	6	6	5,6
NC	6	5, 6	6	5, 6	5, 6	5, 6	5,6
NJ	1, 2, 3, 5, 6	1, 2, 3, 5, 6	5, 6	1, 2, 3, 5, 6	1, 2, 3, 5, 6	1, 2, 3, 5, 6	1,2,3,5,6
NY	1, 2, 3, 5, 6	1, 2, 3, 5, 6	5, 6	1, 2, 3, 5, 6	1, 2, 3, 5, 6	1, 2, 3, 5, 6	1,2,3,5,6
OH	1, 2, 5, 6	1, 2, 3, 5, 6	1, 2, 3, 5, 6	1, 2, 5, 6	1, 2, 5, 6	1, 2, 3, 5, 6	1,2,3,5,6
PA	1, 2, 3, 5, 6	1, 2, 3, 5, 6	1, 2, 3, 5, 6	1, 2, 3, 5, 6	1, 2, 3, 5, 6	1, 2, 3, 5, 6	1,2,3,5,6
TN	6	5, 6	5, 6	6	6	6	5,6
VA	1, 2, 5, 6	1, 2, 5, 6	1, 2, 3, 5, 6	1, 2, 5, 6	1, 2, 5, 6	1, 2, 5, 6	1,2,3,5,6
WI		6	6				6
WV	1, 2, 3, 5, 6	1, 2, 3, 5, 6	1, 2, 3, 5, 6	2, 5, 6	1, 5, 6	1, 2, 3, 5, 6	1,2,3,5,6

* *EPA 2023 '`en' modeling DVF used "less water" technique. Ozone concentration values are in ppb.*

1. *Adjusted average contribution of top 10 ozone days.*
2. *Average of adjusted contributions on all exceedance days.*
3. *Number of significant contributions on exceedance days (threshold of 4).*
5. *Adjusted average of top 4 contributions.*
6. *Maximum contribution on exceedance day (threshold of 0.71ppb).*

Note: Methods 1 and 5 (shown in blue) incorporate adjusted averages

It is worth noting that, should EPA revise the significant contribution threshold from 1 percent of the NAAQS to 1 ppb, the test threshold would become 30 percent less stringent in the case of the 2015 ozone NAAQS. Table 6 summarizes potential contributing state changes when applying EPA methodology (method 1 - average contribution of top 10 days):

Table 6: Comparison of Potential Significance Threshold Changes for 2015 Ozone NAAQS

AQS Code	County	Site	1% NAAQS	1ppb
090019003	Fairfield	Sherwood Island Westport	CT, MD, NJ, NY, OH, PA, VA, WV	CT, MD, NJ, NY, OH, PA, VA
360850067	Richmond	SUSAN WAGNER HS	IL, IN, KY, MD, MI, NJ, NY, OH, PA, VA, WV	MD, MI, NJ, NY, OH, PA, VA, WV
240251001	Harford	Edgewood	IN, KY, MD, MI, OH, PA, VA, WV	IN, KY, MD, OH, PA, VA, WV
090010017	Fairfield	Greenwich Point	CT, MD, NJ, NY, OH, PA, VA	CT, MD, NJ, NY, PA, VA
090013007	Fairfield	Lighthouse-Stratford	CT, MD, NJ, NY, OH, PA, VA, WV	CT, MD, NJ, NY, OH, PA, VA
361030002	Suffolk	BABYLON	MD, MI, NJ, NY, OH, PA, VA, WV	MD, NJ, NY, OH, PA, VA,
090099002	New Haven	Hammonasset State Park-Madison	CT, MD, NJ, NY, OH, PA, VA	CT, MD, NJ, NY, OH, PA, VA
360810124	Queens	QUEENS COLLEGE 2	MD, MI, NJ, NY, OH, PA, VA, WV	MD, MI, NJ, NY, OH, PA, VA
361192004	Westchester	WHITE PLAINS	CT, MD, NJ, NY, OH, PA, VA, WV	CT, MD, NJ, NY, OH, PA, VA
340150002	Gloucester	Clarksboro	DE, IL, IN, KY, MD, MI, NJ, NY, OH, PA, VA, WV	DE, MD, KY, NJ, OH, PA, VA, WV
090011123	Fairfield	Danbury	CT, MD, NJ, NY, OH, PA, VA, WV	CT, MD, NJ, NY, OH, PA, VA

Note: Contributing states shown in red are those that would contribute under the 1% methodology but not the 1 ppb methodology

7. Boundary Conditions

EPA has held collaborative discussions on the role and methods for considering the impacts of boundary conditions on local ozone concentrations. Indeed, boundary conditions are usually significant contributors to modeled high ozone concentrations but are mostly out of reach for states to seek remedy. In the Northeast, boundary contributions during high ozone days are commonly in the range of 20 to 30 percent while boundary condition influence at higher elevations can be significantly higher. It is common to also measure more ozone aloft than at the surface during overnight and early morning periods. We believe this to be a mix of transported ozone from upwind states and international emissions, but we have concerns that the models are not yet able to fully get aloft ozone transport replicated correctly. It is easy for states to point to the large ozone contribution from boundary conditions and claim that it's so large that the task of meeting attainment is unreasonable. States of the OTC have learned that addressing our local emissions and obtaining inter-regional and national relief achieves significant air quality improvements, even when boundary condition contributions are large.

OTC performed screening modeling to assess the sensitivity of modifying boundary condition magnitude in the Northeast with the CMAQ model and 2023 projected emissions. The modeling included one set of boundary conditions developed with 2011 base case emissions, and a second set derived from EPA United States Continental [lower 48 state] (CONUS) modeling with the 2023 emissions. Since the OTC modeling domain is a subset of the national CONUS domain, this allows for the remainder of the CONUS domain emission sources to be grown to 2023, even if the CONUS domain boundary conditions themselves are not also grown. OTC modeling found that differences could be seen by updating boundary conditions throughout the Northeast, including the OTC high ozone monitors (Table 7). Because the US and Canadian emissions in 2023 are expected to be lower than in 2011, modeling shows general decreases in DVFs of a few parts per billion, but up to 2 ppb in some cases. Growth in emission sources located beyond the CONUS could counteract emission decreases from within CONUS, but it's important to understand what influence is coming from what locations.

Table 7: Comparison of CMAQ Modeling DVFs with 2011 and 2023 Boundary Conditions

AQS Code	County	Site	2023 Gamma CMAQ 2011BC (ppb)	2023 Gamma CMAQ 2023BC (ppb)
090019003	Fairfield	Sherwood Island Westport	**81.1**	**80.5**
360850067	Richmond	SUSAN WAGNER HS	**76.9**	**76.3**
240251001	Harford	Edgewood	**74.1**	**73.2**
090010017	Fairfield	Greenwich Point	**72.3**	**72.2**
090013007	Fairfield	Lighthouse-Stratford	**73.7**	**73.4**
361030002	Suffolk	BABYLON	**71.4**	**71.2**
090099002	New Haven	Hammonasset State Park-Madison	69.7	69.6
360810124	Queens	QUEENS COLLEGE 2	68.8	68.3
361192004	Westchester	WHITE PLAINS	69.5	69.4
340150002	Gloucester	Clarksboro	69.1	67.1
090011123	Fairfield	Danbury	68.0	67.3

We appreciate the proposal for developing future year projections for developing model boundary conditions and welcome collaborating with EPA and others to complete this task. Accounting for this transported pollution is important in understanding current and future conditions, but should not be used as an excuse for avoiding local, regional and national remedies that can at least offer exposure relief and improve air quality.

Summary

There are several techniques used by EPA in recent CSAPR update and GN transport modeling that make the modeling inappropriate for approving GN SIPs. OTC would like to work with EPA to help correct these errors. Some techniques introduce uncertainties that do not appear to be adequately accounted for as the modeling gets translated into regulatory action. In many cases, the techniques appear to minimize future year projected nonattainment and/or which upwind states may be linked as contributing states. Should EPA change the 1 percent of the NAAQS significant contribution threshold to a 1 ppb threshold, this would further tip the ability to attain out of favor of OTC states. Technical decisions can and will influence ability to attain in an equitable way and as such, those decisions need to be well vetted and documented with proper accounting for uncertainties.