TECHNICAL MEMORANDUM

PREPARED BY: ALPINE GEOPHYICS, LLC
RE: REVIEW OF EPA'S USE OF AQAT IN THE FEDERAL IMPLEMENTATION PLAN FOR THE 2015 OZONE NAAQS TRANSPORT PROPOSED RULE
DATE: JUNE 16, 2022

Overview

EPA states in the Technical Support Document for its Ozone Transport Policy Analysis for the proposed Federal Implementation Plan (FIP) for the 2015 Ozone National Ambient Air Quality Standards (NAAQS) Transport Proposed Rule, that due to timing and resource constraints, and not for technical reasons, it was unable to perform full-scale photochemical air quality modeling in support of quantifying the impact of air quality improvements associated with various control cases considered for adoption in the proposed FIP [1]. Instead, EPA applied a "simplified" Air Quality Assessment Tool[2] (AQAT) as the method for estimating the impacts of the control cases in Step 3 of the 4-step transport analysis. EPA concedes that "[a]ir quality modeling would be the optimal way to estimate the air quality impacts at each cost threshold level from EGUs and non-EGUs emissions reductions" and that "AQAT is not the equivalent of photochemical air quality modeling."[3] Moreover, EPA's own ozone attainment demonstration guidance calls for using a photochemical air quality modeling simulation for this purpose, not a simplified estimation method. Despite EPA's recognition of the deficiencies in using the AQAT approach rather than following its own guidance, EPA persisted in using AQAT.

In this memorandum, we review some the inputs and assumptions made by EPA in using the simplified AQAT and document where shortcomings in this method compromise the technical findings and impact of proposed controls in this proposed rule. This memorandum outlines just a handful of the myriad steps taken by EPA to estimate the emissions and air quality impact of the final remedy control case and discusses how this methodology compromised the scientific credibility of the proposed rule.

The Regulatory Impact Analysis (RIA) to this proposed rule shows that application of the simplified AQAT leads to maximum estimated air quality improvements at downwind receptors by no more than two tenths (0.2) of a part per billion (ppb) ozone.[4] Further, as estimated by the AQAT method, no upwind state linkage was broken from receptors in downwind states. For the reasons discussed herein, we assert that at a minimum, EPA should have prepared a final air quality simulation, consistent with the base case runs and following EPA guidance, to determine whether actual modeled improvements would be seen.

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[1] Ozone Transport Policy Analysis Technical Support Document (TSD), EPA-HQ-OAR-2021-0668-0133, p. 32.
[2] *Ibid*.
[3] *Ibid*.
[4] EPA-HQ-OAR-2021-0668-0151, p. 3B-6.

Background

EPA's *Modeling Guidance for Demonstrating Air Quality Goals for Ozone, PM2.5 and Regional Haze*[5] ("Modeling Guidance") reflects the EPA's recommendations for how air agencies should conduct air quality modeling and related technical analyses to satisfy model attainment demonstration requirements for the 2015 ozone NAAQS. The document describes how to apply air quality models to generate the predictions used to evaluate attainment, primarily to nonattainment areas for which modeling is required, or desired. The guidance is intended for use by "the EPA headquarters and Regional offices; federal land managers of mandatory Class I federal areas; state, local and tribal air quality management authorities, and the general public."[6]

This Modeling Guidance outlines the process for utilizing the photochemical model to assess proposed control strategies for attaining air quality goals. When EPA's modeling guidance is followed, the photochemical model is run several times in a consistent manner so that the results of the model runs are comparable. First, the air quality model is setup and run for a base year using emissions and meteorological data for a past year. The meteorological and air quality model results are evaluated against available observations and a decision is made if the model performance is adequate for air quality planning. In the next step, a future year base case emissions inventory is prepared and input into the model to assess the future year air quality concentrations. The final step is to apply controls to the sources in the emissions inventory for a future year emissions inventory and re-run the future year model. The results of the future year control case model to are compared to the future year base case to determine the air quality benefit of the proposed control strategy.

In the proposed rule, the approach that EPA took, using the simplified AQAT instead of conducting photochemical air quality modeling, introduced large uncertainties into this conceptually simple approach which have rendered the results technically uncertain and too tenuous to support the imposition of the proposed control measures.

The Comprehensive Air Quality Model with Extensions (CAMx version 7.10) and CAMx Ozone Source Apportionment Technology/Anthropogenic Precursor Culpability Analysis (OSAT/APCA) technique was used to model ozone contributions in Step 1 (attainment determination) and in Step 2 (upwind state linkage) of the transport rule framework. These base case simulations were also used as the basis for the 2026 projection year sensitivity scenario where all EGU and non-EGU NOx emissions were reduced by 30% in each state.

In the CAMx photochemical model EPA utilized electric generating unit (EGU) emissions projections estimated using the Integrated Planning Model (IPM), a linear programming model that accounts for variables and information such as energy demand, planned unit retirements, and planned rules to forecast unit-level energy production and configurations. According to EPA, the IPM model output is a reflection of the system's modeled compliance response to the policy associated with the base case scenario (e.g., all promulgated controls on-the-books or on-the-way by 2023 or 2026 accounting for

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[5] EPA-HQ-OAR-2021-0668-0072.

[6] *Id*.

economic and environmental constraints).[7] The EPA's base case model projections are calculated using a set of base year reference data (including NEEDS[8]), the ratio of the future year seasonal generation in the IPM parsed file, and the base year seasonal generation at each unit for each fuel type in the unit as derived from recent Energy Information Administration (EIA) tables and the National Emission Inventory (NEI). The CAMx based case model outputs reflect EPA's future year air quality projections without the proposed changes to CSAPR.

Independent of these air quality simulations, EPA prepared an alternative projection of EGU emissions using an adjusted historical data ("Engineering Analytics" (EA)) approach. This EA approach uses the historical representative emissions and operating data reported under 40 CFR Part 75 for covered units (which were 2021 ozone-season data at the time of EPA analysis for the proposed rule) and were used as the basis for state-level budget calculation and the control and cost assessments of the policy cases in the AQAT.[9] EPA states that the EA approach is a tool that builds estimates of future unit-level and state-level emissions based on exogenous changes to historical heat input and emissions data reflecting fleet changes that will occur after the last year of available data.[10] However, the EA approach results in emission projections at individual units and facilities that in many cases are distinctly different than what was generated by the IPMv6 summer 2021 reference case.

EPA concedes that AQAT is not the equivalent of photochemical air quality modeling and that air quality modeling would be the optimal way to estimate the ozone impacts at each cost threshold level from EGU and non-EGU emissions reductions[11]. However, they state that due to time and resource limitations they were unable to use photochemical air quality modeling for all but a few emissions scenarios. Therefore, to estimate the air quality impacts for the various levels of emission reductions, EPA used a simplified air quality assessment tool. The simplified tool required "calibration" to estimate the changes in ozone concentration at downwind receptors relative to changes in upwind emissions. This calibration involves the development of relationships between two photochemical air quality model simulations and ozone season emission changes (a metric represented as ppb/ton) at the state level. While EPA indicates that these relationships and calibration factors are "adequate" for this purpose, they recognize the significant limitations in using AQAT and that the simplified tool's approach does not account for the impact of spatial and category specific emission changes on downwind ozone concentrations.

EPA notes that "this downwind air quality improvement is assumed to be indifferent to the source sector or the location of the particular emission source within the state where the ton was reduced. For

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[7] See: https://www.epa.gov/system/files/documents/2021-09/epa-platform-v6-summer-2021-reference-case-09-11-21-v6.pdf

[8] National Electric Energy Data System or "NEEDS" database contains the generation unit records used to construct the "model" plants that represent existing and planned/committed units in EPA modeling applications of IPM. NEEDS includes basic geographic, operating, air emissions, and other data on these generating units. https://www.epa.gov/power-sector-modeling/national-electric-energy-data-system-needs-v6; see also the description of how the IPM process at: https://www.epa.gov/power-sector-modeling/documentation-epas-power-sector-modeling-platform-v6-summer-2021-reference.

[9] Ozone Transport Policy Analysis TSD, EPA-HQ-OAR-2021-0668-0133, p. 4.

[10] *Ibid*.

[11] Ozone Transport Policy Analysis TSD, EPA-HQ-OAR-2021-0668-0133, p. 32.

example, reducing one ton of NOX emissions from the power sector is assumed to have the same downwind ozone reduction as reducing one ton of NOX emissions from the non-EGU source sector. Similarly, when we are using the alternative calibration factors, we assume that reducing a ton of emissions from the power sector has the same effect as reducing a ton of emissions from the mobile source sector."[12]

Note that EPA's emissions modeling platform used for the proposed rule is the 2016v2 platform. EPA developed this platform in the spring-summer of 2021 because it had received comments as part of the prior Revised CSAPR Update rulemaking that it was using out of date emissions inventory data. EPA agreed, stating that "by spring of 2021 it was necessary to make updates to the inventories to perform credible / defensible modeling in CY202113". EPA stated that it used some more up-to-date sources (2017 NEI data, MOVES3, and AEO2021) for projections; but EPA did not make the 2016v2 platform available until September 2021 and requested states and stakeholders to comment on that platform by mid-December 2021. EPA did not use the supplied emissions update for this proposed rulemaking.

Notwithstanding the fact that EPA had requested, but has not yet incorporated, comments[14] on the 2016v2 emissions modeling platform and associated emissions projections of that platform, EPA's use of one modeling projection for the basis of the air quality calculations (CAMx using IPM, 2016v2 platform) and a separate, different, one (AQAT/EA based) for the estimate of the state level emission budgets and potential control case analyses in Step 3, is inconsistent, at best.

EGU Emission Projection Differences

As noted earlier, EPA projects future year ozone design values and links upwind state emissions to future year downwind nonattainment based on future year EGU emission inventories calculated with IPM[15]. Included in the IPM/CAMx simulation are assumptions related to emissions distribution associated with the operation, control, or retirement of individual EGUs within the scenario[16]. Therefore, EPA's calculation of future year base case air quality, including the design values and significant contribution calculations, reflects the operating characteristics of individual EGUs on a handful of modeled days and associated meteorologically-derived back trajectories in 2016 and each future year.

In contrast to the IPM and resultant CAMx modeling, EPA additionally has calculated state level budgets, control costs, and associated emission reductions utilizing an alternative base case using its EA method. This EA is used in Step 3 of this proposed rules and is inconsistent with projections used in Step 1 and Step 2.

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[12] Ozone Transport Policy Analysis TSD, EPA-HQ-OAR-2021-0668-0133, p. 33.

[13] See EPA Summary of Comments on the 2016v2 platform, available at: https://gaftp.epa.gov/Air/emismod/2016/v2/reports/comments/Summary_of_2016v2_comments_by_sector_01312022.pdf.

[14] *Ibid*.

[15] EPA-HQ-OAR-2021-0668-0099.

[16] EPA-HQ-OAR-2021-0668-0064

EPA's pairing of the CAMx base case air quality results generated by IPM emissions projections with emission changes from the EA approach is fundamentally flawed. Emission changes in the photochemical model alter the reactivity of the atmosphere. Calculated changes in EA-generated emissions will have different ozone formation impacts when applied to air quality projections generated with IPM.

We have identified multiple consistency issues using this Step 3 projection approach.

1. The IPM/CAMx-developed calibration factors for AQAT include units operating at certain levels of control or have already been retired as estimated by IPM. These photochemical model-derived calibration factors are based on the specific emissions inventory and unit level operating conditions estimated by IPM.
2. The emission reductions calculated with the EA, under the AQAT approach, include changes associated with units that have been retired in the IPM base case simulations. For these IPM-retired units and the states in which these units are located, these calibration factors are not applicable as EA generated emission reductions cannot technically be associated with a unit that has been retired. We have identified thousands of ozone season NOx tons that EPA includes as emissions reductions from EGUs that EPA had already modeled as retired in the future base case.
3. At multiple units, the resulting emission budgets (post-control) calculated with the EA, under the AQAT approach, are found to be higher than the emissions originally used in the photochemical air quality simulations from IPM/CAMx modeling and used to prepare the calibration factors for the simplified AQAT.
4. In multiple states, the resulting emission budgets (post-control) calculated with the EA are found to be higher than the emissions originally used in the AQ modeled base case simulations and used in the calibration factors for the simplified AQAT.

Examples of the inconsistency identified as items 1 and 2 above, are shown in Table 1 below. In this comparison, IPM predicts several units from linked upwind states to have zero ozone season operation or to be retired by 2023 (IPM-2023 in table below) as demonstrated with zero NOx emissions. Under the EA/AQAT method, these same units are projected in 2023 to be operating with positive tonnage (EA-2023 in table below), reflecting thousands of tons budgeted during this period.

EPA calculated state emission budgets, emissions reductions and costs, and associated air quality improvement resulting from the various remedy scenarios, emission levels, and operating characteristics using the EA approach methodology. In the EA approach method, EPA assumed the below identified units will be in operation and have emissions which can be reduced via control optimization. EPA then estimated an associated improvement in air quality from the purported emission reduction. This is in direct conflict with EPA's calculation of base case conditions (the CAMx run using IPM), which modeled these units with zero emissions in the base case, prior to any remedy scenario.

						Ozone Season NOx Emissions (Tons)	
FIPS	**State**	**County**	**ORISD**	**BLRID**	**Plant Name**	**IPM-2023**	**EA-2023 Budget**
17021	IL	Christian Co	876	1	Kincaid Generating Station	0	304
18051	IN	Gibson Co	6113	4	Gibson	0	531
18125	IN	Pike Co	994	4	IPL - Petersburg Generating Station	0	509
18147	IN	Spencer Co	6166	MB1	Rockport	0	800
18147	IN	Spencer Co	6166	MB2	Rockport	0	886
18165	IN	Vermillion Co	1001	1	Cayuga	0	477
21015	KY	Boone Co	6018	2	East Bend	0	815
21183	KY	Ohio Co	6823	W1	D B Wilson	0	609
22077	LA	Pointe Coupee Par	6055	2B3	Big Cajun 2	0	673
27061	MN	Itasca Co	1893	4	Boswell Energy Center	0	826
27061	MN	Itasca Co	1893	3	Boswell Energy Center	0	314
39095	OH	Lucas Co	2878	1	Bay Shore	0	210
42021	PA	Cambria Co	10143	AAB01	Colver Green Energy	0	142
42063	PA	Indiana Co	3122	3	Homer City	0	323
49015	UT	Emery Co	6165	1	Hunter	0	1,298
49015	UT	Emery Co	8069	2	Huntington	0	1,593
51195	VA	Wise Co	56808	2	Virginia City Hybrid Energy Center	0	143
54049	WV	Marion Co	10151	1A	Grant Town Power Plant	0	73
55011	WI	Buffalo Co	4271	B1	J P Madgett	0	341
55079	WI	Milwaukee Co	4041	8	South Oak Creek	0	223
56037	WY	Sweetwater Co	8066	BW74	Jim Bridger	0	354
88687			7790	1-1	Bonanza	0	2,098

Table 1. Comparison of 2023 ozone season NOx emissions between IPM and Engineering Analytics method for multiple units located in linked upwind states assumed with no operation in IPM.

Therefore, using the alternative EA/AQAT approach, emission reductions were improperly applied to states with units that already had no modeled emissions and potential incremental air quality improvement was purported at receptors where none should be estimated.

Like the issue of retirements, alternative non-zero operating levels of emissions have also been identified for many upwind state EGU units using the EA approach. Table 2 compares the NOx ozone season emission projections for several EGUs for both the IPM simulation and the EA method. As shown in Table 2, hundreds of tons of ozone season emissions reductions are used in the remedy calculation that have already been reduced beyond budget levels in the IPM air quality simulation. In other words, EPA is claiming air quality improvement from emissions reductions that were already modeled in the future base case. In these cases, EPA is double counting emissions reductions as part of its showing that the proposed rule results in improvement in ozone concentrations at nonattainment monitors.

						Ozone Season NOx Emissions (Tons)	
FIPS	State	County	Plant Name	ORISD	BLRID	IPM-2023	EA-2023 Budget
01073	AL	Jefferson Co	James H Miller Jr	6002	2	491	782
01073	AL	Jefferson Co	James H Miller Jr	6002	4	481	760
05063	AR	Independence Co	Independence	6641	2	1,012	1,515
17021	IL	Christian Co	Kincaid Generating Station	876	2	24	315
26115	MI	Monroe Co	Monroe	1733	2	115	594
26115	MI	Monroe Co	Monroe	1733	1	116	609
26139	MI	Ottawa Co	J H Campbell	1710	3	473	751
40133	OK	Seminole Co	Seminole (2956)	2956	3	59	331
47161	TN	Stewart Co	Cumberland	3399	1	230	818
47161	TN	Stewart Co	Cumberland	3399	2	226	893
48395	TX	Robertson Co	Oak Grove	6180	1	774	1,125
48395	TX	Robertson Co	Oak Grove	6180	2	757	1,099
49015	UT	Emery Co	Hunter	6165	2	359	1,360
49015	UT	Emery Co	Hunter	6165	3	1,236	1,777
49027	UT	Millard Co	Intermountain	6481	1SGA	1,604	2,316
49027	UT	Millard Co	Intermountain	6481	2SGA	1,724	2,436
55021	WI	Columbia Co	Columbia	8023	2	191	711
56031	WY	Platte Co	Laramie River	6204	1	289	764

Table 2. Comparison of 2023 ozone season NOx emissions between IPM and Engineering Analytics method for multiple units located in linked upwind states.

Here we note that instead of being modeled with zero emissions in the photochemical air quality modeling base case, these units had different emissions (either higher or lower) that would have impacted the calibration of the simplified AQAT. Again, incremental emission reductions calculated using the EA method would have been inappropriately applied within the impacted states.

Finally, we recognize that from these findings, multiple states have aggregate EGU emissions from the EA calculated base and budget allocation that are greater than the base case modeled IPM estimates and vice-versa. Again, emission reductions calculated using the EA projections are not consistent with the IPM-based emissions used in the air quality modeling, significant contribution calculations, and that were used to “calibrate” the simplified AQAT. Running the photochemical model with these different emissions would influence the reactivity of the model and emission changes would result in different ozone impacts.

Table 3 presents a comparison of the ozone season NOx emissions modeled for EGUs using the 2023 (IPM-derived) platform compared to the EA generated 2023 base case and budget cases.

	Ozone Season EGU NOx Emissions (Tons)[17]		
State	**2023 (IPM)[18]**	**Base 2023 (EA)**	**Budget 2023 (EA)**
AL	5,329	6,648	6,364
AR	6,250	8,955	8,889
DE	233	423	384
IL	14,707	7,662	7,364
IN	17,174	12,351	11,151
KY	8,222	13,900	11,640
LA	9,377	9,987	9,312
MD	2,778	1,208	1,187
MI	14,161	10,737	10,718
MN	7,293	4,207	3,921
MO	15,229	20,094	11,857
MS	3,046	5,097	5,024
NJ	2,490	915	799
NV	561	2,346	2,280
NY	7,325	3,927	3,763
OH	16,286	10,295	8,369
OK	9,844	10,463	10,265
PA	14,139	12,242	8,855
TN	2,497	4,319	4,234
TX	42,521	40,860	38,284
UT	9,194	15,500	14,981
VA	4,696	3,415	3,090
WI	4,409	5,933	5,963
WV	17,620	14,686	12,478
WY	6,588	10,191	9,125
Grand Total	**241,969**	**236,361**	**210,297**

Table 3. Comparison of 2023 ozone season NOx emissions between IPM and Engineering Analytics method for proposed rule states.

Regardless of how much "calibration" is conducted by EPA in attempting to scale EA generated emission budgets to the IPM-generated air quality results, and therefore ozone improvements, it is unlikely that most of these significant differences in ozone season emissions could be overcome***. In fact, the emissions delta associated with the reduction in NOx between the EA generated base and budget is oftentimes far outweighed by the difference in the CAMx-modeled base case and the EA base case from which incremental reductions were assumed.***

Throughout all of the CSAPR rules to date, and prior interstate transport actions, the EPA has used IPM at Steps 1 and 2 because it is "best suited for projecting emissions in an airshed, at projecting emissions for time horizons more than a few years out (for which changes would not yet be announced and thus projecting changes is critical), and for scenarios where the assumed change in emissions is not being codified into a state emissions reduction requirement."[19] Using IPM at Steps 1 and 2 helps the EPA avoid

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[17] EPA-HQ-OAR-2021-0668-0133, Table B-6.

[18] https://gaftp.epa.gov/Air/emismod/2016/v2/2023emissions/

[19] 87 FR 20064

overstating future year receptor values (Step 1) and future year linkages (Step 2) by reflecting reductions anticipated to occur within the airshed in the relevant timeframe.

EPA notes that EA has been used "for Step 3 state-level emissions reduction estimates in CSAPR rulemaking, because at that step EPA is dealing with more geographic granularity (state-level as distinguished from regional air shed), more near-term (as distinguished from medium-term) assessments, and scenarios where reduction estimates are codified into regulatory requirements."[20] Using the Engineering Analytics tool at this step, EPA says, "ensures that the EPA is not codifying into the base case, and consequently into state emissions budgets, changes in the power sector that are merely modeled to occur rather than announced by real-world actors."[21]

While that goal is laudable, EPA's approach introduces another major inconsistency. Because the air quality modeling results from IPM are at the unit (sub-state) level to calculate significant contribution values, it is arbitrary that EPA has selected to use an alternative emission projection to determine an optimized control case cost which does not include the same assumptions as the air quality base case. The Step 2 significant contribution is at a state level of contribution and assumes certain levels of operation, control, and/or retirement for units within the regulated region as predicted by IPM. In contrast, the EA projection assumes an alternative level of operation, control, and/or retirement for units for the same period (2023 or 2026). EPA then uses these EA-based controls to calculate a projected emission improvement and control costs resulting from the remedy case, without ever reprocessing and modeling the resulting emissions with a photochemical model to determine the air quality improvement or consistency with the IPM-generated results.

EPA should have determined the single best way to estimate future year EGU emissions and then used that method to conduct photochemical modeling for the future case and for any potential additional controls on that future case. That approach would have been consistent with guidance and prevented inconsistent EGU forecasts from being used in multiple steps of the analysis and would have provided a more definitive picture of air quality changes, updated state-receptor linkages, and ozone concentration changes using consistent methods and data across Steps 1, 2, and 3 of the transport framework.

AQAT Calibration for Ozone Policy Assessment

As an extension to the 2026 base case source apportionment runs for EGUs and non-EGUs, EPA conducted a state-by-state source apportionment model run for 2026 in which NOx emissions from EGUs and non-EGUs were cut by 30 percent.[22] The outputs from this run were used to inform the development of additional "calibration" factors for use in the ozone policy assessment for this proposed rule.[23] In addition, EPA calculated contribution metric values at individual monitoring sites from the tags

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[20] *Ibid*.

[21] *Ibid*.

[22] EPA-HQ-OAR-2021-0668-0099

[23] EPA-HQ-OAR-2021-0668-0133

in the state-EGU and state-non-EGU source apportionment runs as well as the 30 percent EGU+Non-EGU NOx sensitivity run.[24]

A common concern across the comments above is the inconsistent use of emission projections and operating characteristics for individual sources. Similarly, EPA's use of an across-the-board EGU and non-EGU 30% NOx reduction makes two assumptions that further complicate the science behind the analysis.

First, EPA has included potential emission reductions, calculated outside of the photochemical modeling input stream, at facilities where controls have already been installed and/or IPM has assumed units to not be in operation.[25] By calculating Step 1 and Step 2 metrics using one set of operating conditions (IPM) and then applying potential emission reductions using an alternative set of operating conditions (EA) at many facilities in the impacted modeling domain, EPA chooses to ignore its own recognition of non-linear ozone formation and the temporal and spatial uniqueness of emission source impact on downwind concentrations. As noted above, EPA recognizes that photochemical modeling is the best way to estimate the impacts of projected reductions, and use of AQAT is not comparable in its ability to project air quality impacts.

In the RIA to this proposed rule, EPA acknowledges that ozone is a secondary pollutant, meaning that it is formed through a series of complex chemical reactions which are highly dependent on the relative concentrations of precursors, ozone and other reactants or inhibitors at all levels of the atmosphere at any specific time. As a result of the physical meteorological processes and time necessary for precursors to mix in the atmosphere and for these reactions to occur, ozone is typically not highest at the location of the precursor emissions but rather peaks at some distance downwind of those emissions sources. The spatial gradients of ozone depend on a multitude of factors including the spatial patterns of NOx and VOC emissions (both anthropogenic and biogenic) and the meteorological conditions on a particular day. Thus, on any individual day, high ozone concentrations may be found in narrow plumes downwind of specific point sources, may appear as urban outflow with large concentrations downwind of urban source locations, or may have a more regional signal.

EPA's failure to use a consistent inventory for pre- and post-control scenarios influences both the magnitude and spatial distribution of emissions within the modeling domain and ozone season episode analyzed in this proposed rule.

Second, the downwind air quality improvement estimated by EPA's use of the simplified AQAT is assumed to be indifferent to the source sector or the location of the emission source within the state where the ton of emissions was reduced. For example, under the AQAT approach, reducing one ton of NOx emissions from the power and industrial source sector is assumed to have the same downwind ozone reduction as reducing one ton of NOX emissions from the mobile source sector. This "one ton equals one ton" estimate is demonstrably false as it grossly over-simplifies the non-linear chemistry of ozone formation and change associated with emission reductions. The EA method also ignores

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[24] *Id*.

[25] EPA-HQ-OAR-2021-0668-0064

important source characteristics (i.e., emissions from the power sector are largely from tall stacks in comparison to other types of source emissions which can be released at ground level). The change in air quality associated with emission reductions is highly dependent on the source and location of the emission reductions and this over simplification in the AQAT methodology is further exacerbated by the use of multiple inventories for the various steps of the rulemaking process.

While EPA tries to further "calibrate" the simplified AQAT to account for this discrepancy, the matter cannot adequately be addressed without additional photochemical modeling using the unique temporal-spatial patterns of the emission inventories consistently throughout each of the proposed rule's steps. Ultimately, one is left with emission reduction to ozone concentration change ratios and resulting ozone improvement estimates that are not reliable and have no basis in the air quality modeling analysis upon which the EPA relies upon as a basis for the proposed FIP.

AQAT Use for Cost-Benefit Calculation

EPA notes that state-sector source apportionment modeling was performed for 2026 to obtain contributions from EGUs and from non-EGU point sources in each state at each monitoring site, nationwide.[26] In the EGU run, EPA tagged emissions from the "ptegu" emissions source sector in each state and on tribal lands. In addition to the state and tribal tags, there were separate tags for initial and boundary conditions, biogenics, as well as a tag the included the total of all other emissions within the modeling domain. For the non-EGU run EPA tagged the emissions from sources in the "ptnonipm" sector plus emissions from Pipeline Transportation of Natural Gas and Basic Chemical Manufacturing.

As described in Chapter 3 of the RIA, the outputs from the state-sector modeling were used to construct spatial fields of ozone season (April through September) mean Maximum Daily 8 Hour Average (MDA8) ozone concentrations to support the cost-benefit analysis of alternative EGU and non-EGU control cases.[27] This use of the entire April through September mean MDA8 is contrary to EPA's guidance which states that the photochemical modeling results for the highest days should be used in assessing future ozone levels[28]. This use of the entire April through September average and comparison back to the photochemical model derived ozone forecast using just the top modeled days is yet another level of inconsistency in EPA's use of the simplified AQAT tool.

EPA also notes a limitation in using this scaling method "is that the source apportionment contributions represent the spatial and temporal distribution of the emissions from each source tag as they occur in the 2026 modeled case. Thus, the contribution modeling results do not allow us to represent any changes to "within tag" spatial distributions. As a result, the method does not account for any changes of spatial patterns that would result from changes in the relative magnitude of sources within a source tag in the scenarios investigated here."[29] This is a significant deficiency.

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[26] EPA-HQ-OAR-2021-0668-0099

[27] RIA, Chapter 3, EPA-HQ-OAR-2021-0668-0151.

[28] EPA-HQ-OAR-2021-0668-0072

[29] EPA-HQ-OAR-2021-0668-0151 , pp. 3-17.

There is also a discrepancy between the non-EGU emissions estimates modeled in the 2023 and 2026 base case simulations and the identification of impactful industries and potential control of these industries outlined in the RIA. As discussed in the Emission Inventory TSD,[30] emissions for 2023 and 2026 were based on a 2016 modeling platform and projected to each future year assuming specific levels of economic and environmental constraints. The future year design values, significant contribution calculations, and impactful industry determinations were based on unique operating and emissions conditions for the non-EGU sector using the 2023 modeling platform. However, like the state budget establishment method described earlier, EPA chose to use an alternative data set of emissions for the screening assessment and calculation of impacts of the regulatory cases for non-EGUs. In contrast to using the same 2023 and 2026 projection year inventories developed using EPA's Control Strategy Tool (CoST)[31] and used for the base case air quality simulations within the photochemical model run, EPA has chosen an independent data source for the impactful industry screening assessment.

Specifically, EPA notes:

> "Using the projected inventory also introduced challenges associated with the growth of emissions at sources over time. EPA determined that the 2019 inventory was appropriate because it provided a more accurate prediction of potential near term emissions reductions. In switching to the 2019 inventory, however, we did not account for any growth or decrease in emissions that might occur at individual units. Because the controls applied by CoST have efficiencies, or percent reductions, **this means we could be over- or under-estimating the emission reductions and their ppb impacts**."[32]

(Emphasis added.)

As discussed above, EPA establishes a base set of nonattainment and linkage metrics using a unique configuration of CoST-derived 2023 source-based operation and characteristics within the base case photochemical modeling simulation and then chooses to apply an alternate set of potential control measures based on a completely different source of emissions data (e.g., the 2019 National Emissions Inventory). EPA states that the screening assessment for non-EGUs is not intended to be a replacement for unit-specific analysis that fully evaluates the feasibility of potential incremental controls on non-EGUs in the named sectors but is to be used only for illustrative control strategy analysis. Regardless, the emission reductions, purported air quality improvements, and costs of this step are used by EPA to further justify non-EGU controls in the proposed rule[33].

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[30] EPA-HQ-OAR-2021-0668-0064

[31] See: https://www.epa.gov/economic-and-cost-analysis-air-pollution-regulations/cost-analysis-modelstools-air-pollution

[32] EPA-HQ-OAR-2021-0668-0150, Footnote 21.

[33] See: https://www.epa.gov/system/files/documents/2022-03/nonegu-reductions-ppb-impacts-2015-o3-transport-fip-final-memo.pdf

EPA's Projected Impacts on DV and Downwind Contributions

Overall, in 2023, the estimated ozone reductions using the AQAT approach from the proposed, more stringent, and less stringent control cases are projected to be less than 0.1 ppb at most receptors.[34] The exceptions are at certain receptors in Connecticut, Illinois, Texas, and Utah where the projected ozone reductions are between 0.1 and 0.2 ppb.[35] In 2026 the largest reductions in ozone from the proposed control strategy are estimated at the two receptors in Texas (i.e., Brazoria County and Harris County, where the average reduction is 1.3 ppb).[36]

Using the simplified and error filled AQAT methodology, EPA found that in 2026, 19 of the 24 linked upwind states are estimated to have their downwind contribution to ozone reduced by 0.01 ppb or more to at least one receptor. In 12 of these 19 states, the largest estimated reduction in downwind ozone contribution is at least 0.05 ppb. In half of these 12 states, the largest estimated reduction in downwind ozone contribution is 0.10 ppb or more.

For all linked states, in all years, across all cost threshold levels, **EPA did not see any instances where all the state's contributions dropped below 1% of the NAAQS assessed across all its linkages to remaining downwind receptors**. That is, for a single receptor, if a state was linked to that receptor in the base case for that year the state almost always remained linked with a contribution greater than or equal to 1% of the NAAQS at all cost threshold levels.[37]

In the end, the application of the simplified AQAT demonstrates that maximum estimated air quality improvements at downwind receptors improves by no more than tenths of a ppb at any receptor and that no upwind state linkage was broken to downwind states. A remedy to downwind nonattainment was not generated and significant contribution from upwind states was not removed because of the analysis from controls under this proposed rule.

No Comparison to Air Quality Modeling Result of Final Remedy

As described earlier, EPA chose to ignore their own guidance and used the simplified AQAT methodology to assess the air quality impacts of various emission control strategies, including the final proposed control case proposed in the rule. At no time in this proposed rulemaking did EPA run a full photochemical model simulation accounting for the source and region-specific reductions that considers the unique temporal-spatial characteristics in emissions to evaluate the air quality change associated with the final proposed control case.

As documented above, as part of the multi-step data population, calibration, and additional adjustment of the simplified AQAT, EPA has complicated and compromised individual steps and incremental adjustments which lead to their final findings and control decisions.

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[34] EPA-HQ-OAR-2021-0668-0151, p. 3B-6.

[35] *Ibid*.

[36] *Ibid*.

[37] EPA-HQ-OAR-2021-0668-0133, p. 48.

In place of a direct comparison of the final remedy to an air quality simulation, EPA can only provide a comparison of various calibration factors as justification for their conclusion that the simplified AQAT provides reasonable estimates of air quality concentration changes at individual receptors at magnitudes in the hundredths (0.01) of ppb – an infinitesimally small value.

Considering the importance of this regulation, significant cost to impacted industries and electric consumers, potential impact on electric supply reliability, and miniscule air quality benefit projected for the required control scenario, at a minimum, EPA should have run an air quality simulation to corroborate its findings with the simplified AQAT. Anything less constitutes arbitrary and capricious action.