COMMENTS

submitted on behalf of

URBAN AIR INITIATIVE, INC.,

AND

THE ILLINOIS, INDIANA, IOWA, KANSAS, KENTUCKY,

MICHIGAN, MISSOURI, NEBRASKA, OHIO, AND WISCONSIN

CORN GROWERS ASSOCIATIONS

AND

AMERICAN COALITION FOR ETHANOL

Concerning the U.S. Environmental Protection Agency's

Proposed Determination for Renewable Fuels and Air Quality Pursuant to Clean

Air Act Section 211(v);

Docket ID No. EPA-HQ-OAR-2020-0240

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INTRODUCTION

Commenters support EPA's proposed determination "that no additional fuel control measures are necessary under Clean Air Act section 211(v) to mitigate adverse air quality impacts of required renewable fuel volumes" under the Renewable Fuel Standard.[1] But they vehemently dispute the conclusions of the anti-backsliding study that informs the Agency's § 211(v) determination.[2]

The anti-backsliding study concludes that the replacement of E0 gasoline with an E10 gasoline-ethanol blend has increased vehicle air pollution.[3] According to the study's emission inventories, in 2016, using E10 instead of E0 in "conventional" (i.e. non-reformulated) gasoline areas resulted in the following increases in emissions from on-road gasoline vehicles:[4]

Pollutant	**Increase (tons per year)**	**% diff total on-road gasoline vehicle emissions**
NO_X	+113,947	+6%
VOC	+106,451	+6.6%
PM_{10}	+715	+0.5%
$PM_{2.5}$	+634	+1.3%
SO_2	+663	+3.1
Acetaldehyde	+8,045	+110%
Acrolein	+70	+8.5%
Formaldehyde	+900	+7.4%

As explained in more detail below, these inventories, which were input to the anti-backsliding study, are erroneous and biased against ethanol because they were developed

[1] EPA, Proposed Determination for Renewable Fuels and Air Quality Pursuant to Clean Air Act Section 211(v) 1, EPA-420-20-003 (May 2020) (Proposed Determination).

[2] EPA, Clean Air Section 211(v)(1) Anti-Backsliding Study, EPA-420-R-20-008 (May 2020) (Anti-Backsliding Study).

[3] *Id.* at 35–52.

[4] *Id.* at 20–21, Table 6.2. The county-level and state-level inventories are reported in a zip file, available at https://www3.epa.gov/otaq/rfs-abs-supplemental-materials/ABS-Inventory-Summaries.zip.

using EPA's flawed Motor Vehicle Emissions Simulator (MOVES2014) model.[5] "An inviolable law of data analysis" is "garbage in; garbage out."[6] Because the emission inventories generated by MOVES2014 are unsound, the anti-backsliding study's air quality conclusions based on those inventories are also unsound. The anti-backsliding study therefore cannot be used to justify any determination that fuel control measures are necessary under the Clean Air Act.

Not only is the anti-backsliding study scientifically flawed, it is procedurally defective, as EPA failed to comply with the Administrative Procedure Act and the Federal Advisory Committee Act when finalizing the underlying MOVES2014 model. These legal deficiencies, alone, justify the withdrawal of the anti-backsliding study until EPA submits its model for public notice and comment.

Moreover, the EPA should acknowledge that its prediction of increased acetaldehyde emissions from E10 is contrary to real world trends, and that in any event additional fuel control measures are not "necessary," because ambient acetaldehyde levels remain below the threshold levels that would raise substantial public health concerns and that would warrant costly fuel control measures.

Finally, contrary to the anti-backsliding study's conclusions, E10 reduces the most harmful vehicular air pollution by reducing the fuel's aromatic hydrocarbon content. Any fuel control measures that restrict ethanol blending in gasoline would only encourage refiners to increase aromatic content, contributing to benzene and particulate emissions that threaten human health. Fuel control measures that restrict ethanol blending in gasoline are therefore not just unnecessary, but counterproductive. If any fuel control measures are "necessary," it is controls on gasoline aromatic hydrocarbons that contribute to benzene and particulate ambient air pollution.

I. THE ANTI-BACKSLIDING STUDY IS SCIENTIFICALLY AND LEGALLY FLAWED.

A. The Anti-Backsliding Study Relies on a Flawed Fuel Effects Model.

The MOVES2014 model relies on statistical models developed in the EPAct/V2/E-89 fuel effects study (EPAct study) to estimate the effect of ethanol content and four other fuel properties (Reid Vapor Pressure (RVP), aromatic content, T50, and T90) on exhaust emissions from all 2001 and later vehicles.[7] The EPAct study is outdated and biased against ethanol, so MOVES2014 is incapable of producing accurate emissions inventory inputs for the anti-backsliding study.

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[5] *Id.* at 14.

[6] *Mississippi v. EPA*, 744 F.3d 1334, 1352 (D.C. Cir. 2013).

[7] *See* EPA, Fuel Effects on Exhaust Emissions from On-road Vehicles in MOVES2014 68 (Feb. 2016).

First, the EPAct study's fuel effects model is outdated and fails to consider "available vehicle technologies," as required by § 211(v).[8]

The EPAct study relied exclusively on model year 2008 Tier 2 vehicles certified with an indolene test fuel (E0).[9] It is likely that current Tier 3 vehicles certified to comply with EPA's emission standards using an E10 test fuel would have different fuel effects—particularly the effect of fuel ethanol content—than vehicles certified on indolene.[10] The EPAct study ignores these likely differences for Tier 3 vehicles.

The anti-backsliding study attempts to sidestep this limitation of the EPAct study by arbitrarily limiting its "with" and "without" E10 analysis to 2016, before the new Tier 3 standards took effect.[11] This limited focus on 2016 fails to consider that 2017 model year and later motor vehicles will be optimized to meet Tier 3 emission standards using an E10 test fuel, and not E0. It therefore misleads the public regarding potential air quality impacts of E10 beyond 2016.

Moreover, all of the EPAct study test vehicles used port-fuel injection (PFI) engines. But vehicles with gasoline direct injection (GDI) engines have accounted for about 50% of new vehicle sales in recent years.[12] GDI-equipped vehicles are likely to have different fuel effects than PFI vehicles.[13] The EPAct study ignores these differences. Indeed, even EPA staff have concluded that "PM [particulate matter] fuel effects in [GDI] vehicles" are not "well explained by existing models" (i.e., the EPAct study) and have suggested that the agency needs to "collect more fuel effects data on Tier 3 compliant [GDI] vehicles."[14] Because the anti-backsliding study fails to address differences arising from the widespread adoption of GDI engines, it fails to consider "available vehicle technologies" as required by § 211(v).[15]

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[8] 42 U.S.C. § 7545(v)(1)(A).

[9] *Id.* at 68.

[10] *See* Nigel Clark et al., Effects of Ethanol Blends on Light-Duty Vehicle Emissions: A Critical Review 57 (Dec. 24, 2018) ("Adopting a certification test fuel that is reflective of real-world fuels is likely to enhance emissions performance and fuel economy on the road by aligning regulatory requirements with the vehicle's mission.").

[11] Anti-Backsliding Study at 5.

[12] *See* EPA, Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2017 at 61 (Jan. 2018) ("Engines using GDI were first introduced into the market with very limited production in MY 2007. Only 9 years later GDI engines were installed in about 48% of MY 2016 vehicles, and are projected to achieve a 52% market share in MY 2017.").

[13] Nigel Clark et al., Effects of Ethanol Blends on Light-Duty Vehicle Emissions: A Critical Review 57 (Dec. 24, 2018) (arguing that studies with GDI engines show different NO_X and PM effects for ethanol than studies with PFI engines).

[14] Aaron Butler & Rafal Sobotowksi, PM Emission Trends in LDVs Using Tier 2 & Tier 3 Certification Test Gasolines 15 (Mar. 28, 2017).

[15] 42 U.S.C. § 7545(v)(1)(A).

Second, the EPAct study is erroneous even for the Tier 2 PFI vehicles it attempts to model. The EPAct study is premised on the notion that accurate fuel-effect models can be derived using unrealistic test fuels designed to have T50, T90, ethanol, aromatic content, and RVP properties arbitrarily matched to extreme levels.[16] The reality is that the EPAct study's match-blending approach led to uncontrolled differences in the test fuels that biased the results against ethanol. In particular, EPA's attempt to match T50 across pre-determined ethanol, RVP, aromatics, and T90 levels required blending gymnastics that "distort[ed] the expected distillation curve" of the ethanol-blended test fuels and that contradicted how refiners blend fuels in the market.[17] This distortion is apparent in the elevated upper distillation temperatures of the EPAct study's ethanol-blended test fuels.[18] Indeed, the T70 temperature of the ethanol-blended test fuels was so elevated that two out of nine E10 test fuels, two out of three E15 test fuels, and three out of seven E20 test fuels had T70 temperatures that were in excess of the highest T70 value (270°F) reported by the 2006 Auto Alliance survey that EPA relied on when designing the EPAct study.[19] By contrast, not a single E0 test fuel had elevated T70 temperatures. (If anything, the T70 temperature of the E0 test fuels used in the EPAct study was depressed.)[20] The elevated T70 temperature of the ethanol-blends used in the EPAct study is important, because "[h]igher T60, T70, and T80 values will likely have an adverse impact in tailpipe emissions (similar in magnitude as the T50 and T90 impacts)."[21] Indeed, a statistical analysis of the EPAct study's data showed that T70 adversely affected PM emissions, confounding the results of the study.[22]

As a result of the study's flawed match-blending design, the EPAct study's fuel effects model makes nonsensical predictions that are likely the result of confounding. One striking example is the EPAct model's $T50^2$ term. The $T50^2$ term aims to capture non-linear changes in emissions as T50 increases or decreases.[23] The model term's coefficients predict that, all other things being equal, Bag 1 (cold start) PM and NMOG emissions *increase* when T50

[16] T50 and T90 are the temperatures at which 50% and 90% of a fuel's volume vaporizes. Reid Vapor Pressure is a measure of the fuel's tendency to vaporize at 100°F.

[17] Clark et al., *supra* note 13, at 81.

[18] *See* State of Kansas et al., Request for Correction re EPAct/V2/E-89 Fuel Effects Study and Motor Vehicle Emissions Simulator Model (MOVES2014), RFC # 17001, at 38 (Jan. 19, 2017) (RFC # 17001), *available at* https://www.epa.gov/quality/epa-information-quality-guidelines-requests-correction-and-requests-reconsideration#17001; *see also* ASTM D4818-16e ("high levels of certain blending components (such as reformate) can cause the distillation curve to have a hump between the 50 % and 90 % evaporated temperatures that is centered at the 70 % evaporated temperature.").

[19] RFC # 17001, *supra* note 18, at 38. T70 is the temperature at which 70% of a fuel's volume vaporizes.

[20] Steven VanderGriend, Ethanol's Emission Effects in MOVES2014 39 (Mar. 2018), https://www.epa.gov/moves/march-2018-moves-model-review-work-group-meeting-materials.

[21] *See* James Anderson et al., *Issues with T50 and T90 as Match Criteria for Ethanol-Gasoline Blends*, 7 SAE Int'l J. Fuels & Lubr. 1027, 1031 (2014)

[22] Thomas L. Darlington et al., *Analysis of EPAct Emission Data Using T70 as an Additional Predictor of PM Emissions from Tier 2 Gasoline Vehicles*, SAE Technical Paper 2016-01-0996, at 1.

[23] Anderson et al., *supra* note 21, at 1035.

temperatures fall below 185°F.[24] That prediction is contradicted by fundamental combustion chemistry. Reducing the boiling point of the fuel's hydrocarbons can only reduce these emissions.[25] The model's $T50^2$ effect is instead likely attributable to the EPAct study's uncontrolled T70: significantly, the test fuels designed to have a T50 below 190°F had disproportionately elevated T70 temperatures.[26] This can be verified by calculating the fuels' deviation from a linear distillation profile at T70—what ASTM labels the T70 "bump."[27] As illustrated in the table below, test fuels with T50 design temperatures at or above 190°F had depressed T70 temperatures compared to a linear distillation profile. By contrast, test fuels with T50 design temperatures below 190°F had significantly elevated T70 temperatures compared to a linear distillation profile. This correlation was largely due to the EPAct study's attempt to match T50 and T90.

Low T50 Fuels (< 190°F)		**High T50 Fuels (≥ 190°F)**	
Fuel No.	**T70 "Bump" (°F)**	**Fuel No.**	**T70 "Bump" (°F)**
1	-0.4	2	-16.7
12	29.1	3	-13.2
20	4.1	4	-9.7
21	18.9	5	-10.1
22	3.6	6	3.3
23	20.5	7	-17.1
24	14.5	8	-15.8
25	29.2	9	-7.0
26	27.5	10	11.7
30	28.9	11	7.5
31	25.3	13	-10.4
Average	**18.3**	**Average**	**-7.0**

[24] *Id.*

[25] *Id.*

[26] https://www.epa.gov/sites/production/files/2016-05/epact-v2-e89-fuel-properties-dha.xlsx.

[27] T70 Bump = T70 – ((T50 +T90) /2). ASTM D4818-16e, X1.12.5, at 16.

Moreover, as shown in the table below, test fuels with not only a low T50 design temperature (i.e., below 190°F) but also a high or intermediate T90 temperature (i.e., ≥ 325°F) had extreme non-linearities centered around T70, with the upper distillation profile of these test fuels resembling a "dumbbell." This resulted in impaired driveability and higher emissions from those fuels.[28] The EPAct study misattributes these unaccounted-for differences in distillation profiles to the effect of $T50^2$.

Low T50 (< 190°F) & High or Intermediate T90 (≥ 325°F) Fuels							
Fuel No.	12	23	24	25	26	30	31
T70 "Bump" (°F)	29.1	20.5	14.5	29.2	27.5	28.9	25.3

Including the misattributed $T50^2$ term in the EPAct study model results in a bias against ethanol, because the addition of ethanol to a fuel reduces T50, and E10 often has a T50 temperature that is below 190 degrees Fahrenheit.[29]

In the past, EPA has rejected this criticism of the EPAct study model for two reasons. Both are flawed.

First, EPA argues that "T70 was not a design parameter and has uncontrolled correlations with other fuel parameters also being included in the models."[30] But that is precisely the problem. T70 temperature is uncontrolled in the EPAct study, even though elevated T70 is correlated with higher ethanol content in the EPAct study. As a result, any T70-induced effects will be confounded with ethanol or other effects. Second, EPA has disputed that "T70 is a more important predictor of PM emissions" than T90. But nobody makes that assertion. Instead, the assertion is that gasoline blendstocks with a higher T70 temperature, much like blendstocks with a higher T90 temperature, lead to higher PM emissions, because hydrocarbons that boil at higher temperatures contribute more to PM emissions.[31] EPA does not dispute this scientific fact, and it cannot rebut the evidence that the uncontrolled upper distillation temperatures of the EPAct study's gasoline-ethanol test fuels biased the EPAct study's fuel effects model against ethanol.

[28] "Vehicle testing has shown" that driveability is degraded for fuels with a T70 bump in excess of "22°F." ASTM D4818-16e, X1.12.5, at 16. By this standard, five out of seven test fuels with a low T50 and intermediate or high T90 had impaired driveability.

[29] EPA's fuel formulation tables are available here: https://www3.epa.gov/otaq/rfs-abs-supplemental-materials/ABS-MOVES-FuelFormulation-Tables.zip.

[30] EPA Response to RFC # 17001, at 52

[31] *See* Koichiro Aikawa et al., Development of a Predictive Model for Gasoline Vehicle Particulate Matter Emissions, SAE 2010-01-2115 (demonstrating the correlation between high-boiling-point aromatics hydrocarbons and PM exhaust emissions).

As a result of this and other biases, MOVES2014 makes predictions that are inconsistent with reality. In 2016, scientists from Wyle Laboratories and Volpe, within the Department of Transportation, issued a report comparing the emissions projected by MOVES2014 to ten third-party studies. The report concluded that "other researchers have found ethanol fuel blend emissions trends that appear in many cases to be different than the predictions of the MOVES2014 model."[32]

Because the anti-backsliding study uses the outdated and flawed EPAct study fuel effects model, its predictions are misleading and inaccurate. EPA should acknowledge that the EPAct study's fuel effect model is flawed, and that without a new fuel effects model, it lacks an appropriate technical basis to model the fuel effects of Tier 3 vehicles or Tier 2, GDI-equipped vehicles.

B. The Anti-Backsliding Study Relies on Flawed Fuel Property Adjustments.

The anti-backsliding study is also flawed and biased against ethanol because it uses the inaccurate MOVES2014 model's default fuel property adjustments to predict how fuel properties change when using E0 instead of E10.[33] These default fuel property adjustments use the results of refinery modeling performed for the Tier 3 rulemaking for both summertime and wintertime fuel blends, for conventional *and* reformulated gasoline areas, not just conventional gasoline areas.[34]

The adjustments are provided in Table 5.3 of the anti-backsliding study and reproduced below:

Table 5.3 - Adjustment factors for Moving from E10 to E0

ETHANOL ADJUSTMENT FACTORS (from E10 to E0)										
FUEL	DESCRIPTION	RVP	SULF	AROM	OLEF	BENZ	E200	E300	T50	T90
E10 S	E10 Summer Fuel	-1.00		2.02	0.46	-	-3.11	-0.39	6.34	1.77
E10 W	E10 Winter Fuel	-1.00		3.65	2.07	-	-4.88	-0.54	9.96	2.45

The adjustments falsely predict that E10 blending has only a minor impact on lowering T90 and aromatic content in conventional gasoline areas, fuel properties associated with significant increases in harmful motor vehicle emissions.[35] Specifically, the ethanol adjustment factors used by the anti-backsliding study imply that refiners who modify their summertime conventional gasoline blendstocks to produce E0 instead of E10 would increase

[32] Roger L. Wayson et al., Evaluation of Ethanol Fuel Blends in EPA MOVES2014 Model 100 (Jan. 2016), *available at* http://bit.ly/1Q3L4u9. In these studies, "[i]ndividual fuel property variables were shown to often display different effects or effects of a different magnitude than predicted by MOVES2014." *Id.*

[33] Anti-Backsliding Study at 13–14.

[34] EPA, Fuel Supply Defaults: Regional Fuels and the Fuel Wizard in MOVES2014, at 11 (Nov. 2016).

[35] *See* Aikawa et al., *supra* n.31.

aromatic content by only 2.02%, and increase T90 by only 1.77°F. Similarly, the factors imply that refiners who modify their wintertime conventional gasoline blendstocks to produce finished E0 instead of E10 increase aromatic content by only 3.65%, and increase T90 by only 2.45°F.[36]

These E10 adjustments appear to be inconsistent with EPA's own fuel trend statistics. EPA's fuel trends report shows that, in the year 2000, summertime conventional gasoline (CG) had an average ethanol content of 0.84%, as E10 consumption was marginal in the surveyed areas.[37] To meet anti-knock fuel specifications, refiners in CG areas relied heavily on reformate streams, and summertime CG thus had an average aromatic content of 28.5%.[38] By 2016, gasoline properties had changed significantly. Summertime CG had an average ethanol content of 9.28%, due to the market dominance of E10, and average aromatic content in these summertime blends had declined to 21.76%.[39] The widespread use of E10 in CG areas was therefore correlated with a 6.74% drop in average aromatic content.[40] The trends for wintertime CG show a similar correlation.[41] Correlation, to be sure, does not imply causation. As EPA has argued, changes in the refinery economics of reforming and alkylation may also be partially responsible for the decline in aromatic content over this period.[42] But the substantial correlation between E10 and lower average aromatic content strongly suggest that EPA's refinery modeling is inconsistent with actual refinery decision-making in conventional gasoline areas. Given these trends, it seems particularly unlikely that refiners reduce aromatic content by only 2.02% in CG areas during the summer when they match blend for E10. That would imply that refiners simply dilute aromatics with ethanol, which is economically unlikely given that ethanol is a "high octane blendstock which has been priced lower than reformate."[43] In its 2007 MSAT rule, EPA projected that when gasoline blendstocks are designed to be finished with 10% ethanol instead of E0, refiners "will reduce aromatics by about 5%," not 2%.[44] Indeed, the anti-backsliding study itself acknowledges that "due to the high octane of ethanol, it greatly reduces the need for other high-octane components including aromatics such as toluene (which is the major aromatic compound in gasoline)."[45] That statement cannot be reconciled with the anti-backsliding study's fuel property adjustments,

[36] So far, E15 has been overwhelmingly splash blended into E10 blendstocks at retail stations and some terminals, so these comments will be limited to E10.

[37] EPA Fuel Trends Report: Gasoline 2006 – 2016 26 (Oct. 2017).

[38] *Id.*

[39] *Id.*

[40] *Id.*

[41] *Id.*

[42] *Id.* 23–24.

[43] *Id.* 24

[44] EPA Control of Hazardous Air Pollutants from Mobile Sources, Summary of Analysis of Comments 4-14 (Feb. 2007).

[45] Anti-Backsliding Study at 61.

which assume virtually no reduction in the need to use aromatics to increase octane levels in the absence of E10.

EPA's fuel trends report also show substantial reductions in T90 with the shift from E0 to E10. In summertime CG, average T90 declined from 339.9°F to 321°F, a decline of 18.6°F.[46] In wintertime CG, average T90 declined from 327.6°F to 313°F, a decline of 14.5%. This substantial drop in T90 is correlated with a widespread increase in the use of E10. As EPA admits, "ethanol blending is a factor" in the trend toward lower concentrations of high-boiling-point hydrocarbons and therefore lower T90.[47] Again, other factors like increased demand for diesel may have contributed to lower T90 temperatures.[48] But the trend suggests that EPA's adjustment factor is likely too low to reflect actual refinery behavior. Given these fuel trends, it seems particularly unlikely that refiners reduce T90 by only 1.77°F, as is suggested by the EPA's adjustment factors, in CG areas during the summer when they match blend for E10.

While EPA relied on black-box refinery models to predict the 2016 E0 fuel properties necessary for its MOVES2014 simulations, more accurate fuel property data can be derived from the data in EPA's own Fuel Trends Report. Analyzing changes in fuel properties between 2006 (when there was significant E0 in the marketplace) and 2016 (when E10 dominated the market), AIR, Inc. calculated differences in fuel properties of E10 relative to E0 in CG areas.[49] AIR's analysis shows that EPA's adjustments are inaccurate—leading the EPA to significantly overstate the impact of E10 on projected emissions—and need to be corrected.

Comparing the change in fuel properties between 2006 (primarily E0) and 2016 (primarily E10), and considering other market factors (e.g., shifts to diesel), AIR calculated the difference in key fuel properties between E0 and E10 based on observed fuel trend data.[50] Based on its extracted fuel property data, AIR calculated fuel adjustment factors for summertime and wintertime blends:[51]

AIR Adjustment Factors Based on Fuel Trends Data (from E0 to E10)					
	RVP	Aromatics	Olefins	T50	T90
E10 Summer Fuel	0.9	-6.5	-2.0	-16.3	-6.8
E10 Winter Fuel	0.2	-6.0	-2.8	-12.2	-6.8

[46] *Id.* at 26. E300 data is converted to T90 using the formula $T90 = 4.5454 \times (155.47 - E300)$.

[47] *Id.*

[48] *Id.* at 29, 109.

[49] Growth Energy Comments, Exhibit 1 at 4.

[50] *Id.* at 5-6.

[51] *Id.* at 7, tbl. 5.

AIR's analysis shows that EPA's refinery model significantly understates the decrease in aromatic content, T50, and T90 achieved by moving from E0 to E10 in CG areas.[52] Notably, AIR calculates a 6.5% decrease in summertime aromatics for E10, compared to EPA's estimate of a 2.02% decrease,[53] a significant difference considering the considerable effects of aromatic content on PM and other vehicle emissions.

Using their corrected fuel property adjustment factors, AIR calculated the percent changes in on-road gasoline emissions due to the adoption of E10 in CG areas (excluding California). AIR's results, compared to those obtained in the EPA anti-backsliding study, are shown in the table below.[54]

Percent Changes in On-Road Emissions Due to E10 in CG Areas (Excluding California)		
	EPA Anti-backsliding Study	AIR analysis using Fuel Trends data
NO_x	+6%	+3.1%
VOC	+6.6%	+1.8%
PM 2.5	+1.3%	-3.0%
CO	-5.6%	-7.3%
Benzene	-12.4%	-15.2%
1,3 Butadiene	-12.2%	-13.8%
Acetaldehyde	+110%	+79%
Acrolein	+8.5%	+2.1%
Formaldehyde	+7.4%	+7.6%

The differences between the EPA's and AIR's results are significant. When using fuel property adjustment factors based on observed data, AIR's analysis shows that "VOC, NO_x, acetaldehyde, and acrolein increase much less than in the EPA analysis. Fine particulate flips from a 1.3% increase to a 3.0% decrease. Carbon monoxide shows a greater decline. The benzene decline is even more substantial –15.2%. 1,3 butadiene also shows a greater decrease."[55] As the AIR analysis notes, these changes in emission outputs will "alter the EPA air quality analysis as well."[56]

Because the § 211(v) anti-backsliding study prepared by EPA is based on faulty fuel properties that do not reflect how crude oil refiners would blend gasoline in the absence of E10, it cannot yield accurate results. EPA should withdraw the flawed anti-backsliding study and perform new modeling that considers the real-world reductions that E10 adoption has on aromatic, T50, and T90 fuel properties. At a minimum, EPA should acknowledge that AIR's

[52] *Id.* at 6, tbl. 4.

[53] *Id.*

[54] *Id.* at 8, tbl. 6.

[55] *Id.* at 8.

[56] *Id.*

analysis underscores that fuel control measures are not "necessary" to mitigate any air quality impacts.

C. The Anti-Backsliding Study Relies on Flawed Fuel Speciation Tables.

The MOVES2014 model's predictions are also flawed because the model relies on flawed speciation profiles for non-methane organic gas (NMOG) emissions. To determine the composition of NMOG exhaust and evaporative emissions, MOVES2014 uses the "SPECIATE" database.[57] For evaporative emissions, the SPECIATE database relies on data from test fuels with "match-blended" aromatics levels for E0 and E10, contrary to market practice.[58] As a result, MOVES2014 significantly overstates the evaporative aromatics emissions of E10.

This will bias the resulting air quality modeling. As EPA acknowledges, aromatics are responsible for practically all secondary organic aerosol (SOA) formation from gasoline,[59] MOVES2014's faulty speciation inputs, which lead to an *overstatement* of E10 aromatic emissions, will cause EPA's air quality model to *underpredict* the formation of particulate matter attributable to using E0 instead of E10.[60] Because MOVES2014 cannot lead to accurate SOA formation predictions, the anti-backsliding study's conclusions about PM emissions are erroneous.

D. The Anti-Backsliding Study is Procedurally Defective.

The anti-backsliding study is also procedurally defective, for at least two reasons.

First, the MOVES2014 model was imposed in a binding rule without notice and without an opportunity for comment as required by the Administrative Procedure Act.[61] Indeed, until it issued MOVES2014, EPA had promulgated all major revisions of its vehicular emissions model following notice and comment procedures. States, however, were required to immediately begin using MOVES2014 in developing their State Implementation Plans (SIPs) for compliance with the Clean Air Act's National Ambient Air Quality Standards (NAAQS). The States of Kansas and Nebraska challenged EPA's release of MOVES2014 in the D.C. Circuit, but they did not have standing because they were not yet in nonattainment with the NAAQS.[62] EPA's continued failure to allow affected stakeholders to comment on the

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[57] EPA, Speciation of Total Organic Gas and Particulate Matter Emissions from On-road Vehicles in MOVES2014, EPA-420-R-18-012, at 15 (July 2018).

[58] *Id.* at 18–19 (citing CRC E-77-2b and the EPAct study for evaporative emission profiles); see also ; SPECIATE, https://www.epa.gov/air-emissions-modeling/speciate/.

[59] Anti-Backsliding Study at 59–65.

[60] Anti-Backsliding Study at 59–65.

[61] Official Release of the MOVES2014 Motor Vehicle Emissions Model for SIPs and Transportation Conformity, 79 Fed. Reg. 60343, 60344 (Oct. 7, 2014) (hereinafter Official Release of MOVES2014).

[62] *Kansas v. EPA*, 638 Fed. App'x 11 (D.C. Cir. 2016).

MOVES2014 model justifies withdrawing the anti-backsliding study until EPA conforms to the Administrative Procedure Act by taking public comment on the MOVES2014 model.[63]

Second, the MOVES2014 model and its underlying studies were finalized in violation of the Federal Advisory Committee Act, which governs the establishment and operation of agency advisory committees.[64] To finalize the MOVES2014 model, EPA relied on the MOVES Review Work Group, an "advisory committee" established by EPA in the interest of obtaining the advice of outside stakeholders on the MOVES model.[65] This advisory committee failed to comply with the procedural requirements and safeguards of the Federal Advisory Committee Act.[66] Specifically, the advisory committee's activities and recommendations were "inappropriately influenced by the appointing authority," EPA.[67] The group was co-chaired by an EPA employee, and the schedule, format, and agenda for the MOVES Review Work Group's meetings, as well as the substance of the work group's collective recommendations, were virtually dictated by the EPA co-chair and other EPA staff, and not by outside advisors.[68] The advisory committee was also not "fairly balanced in terms of the points of view represented," because it included no ethanol or renewable fuel industry representatives.[69] And the advisory committee failed to comply with the statute's chartering and transparency requirements.[70] Moreover, to conduct the studies that the MOVES2014 model relies on to estimate ethanol's effects on various vehicle emissions, EPA also relied on procedurally-defective and biased advisory committees composed solely of oil company consultants.[71]

II. AMBIENT ACETALDEHYDE CONCENTRATIONS DO NOT POSE A SUBSTANTIAL RISK TO PUBLIC HEALTH.

The anti-backsliding study predicts significant increases in acetaldehyde emissions and finds "that in many locations Tier 3 standards will not fully offset the acetaldehyde increases

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[63] RFC # 17001, *supra* note 18, at 61.

[64] 5 U.S.C. App. 2 §§ 1-16.

[65] *Id.* § 3(2) (defining an advisory committee to include a "subgroup" established by an agency in the interest of obtaining advice); Report from MSTRS MOVES Review Work Group 16 (Jan. 12, 2011) (acknowledging that the MOVES Review Work Group was established by EPA "to provide input *to EPA* on MOVES development") (emphasis added), https://bit.ly/2wCfTCW.

[66] *See, e.g., id.* § 10.

[67] *Id.* § 5(b), 5(c).

[68] MSTRS MOVES Review Work Group 8 (July 31, 2012), https://www.epa.gov/sites/production/files/2016-06/documents/01-moves-review-work-group-intro_2.pdf.

[69] 5 U.S.C. App. 2 §§ 5(b), 5(c); MSTRS MOVES Review Work Group 6–8 (July 31, 2012), https://www.epa.gov/sites/production/files/2016-06/documents/01-moves-review-work-group-intro_2.pdf.

[70] *Id.* §§ 9(c), 10.

[71] RFC # 17001, *supra* note 18, at 17.

identified in the anti-backsliding study."[72] EPA nevertheless finds that additional fuel control measures are not "necessary" because "that would run directly counter to meeting the renewable fuel requirements of section 211(o)."[73]

In the final determination, EPA should acknowledge two other separate and independent reasons against adopting fuel control measures to lower ambient acetaldehyde concentrations.

First, the finding that E10 has increased acetaldehyde emissions is contrary to real world trends, which demonstrate that acetaldehyde ambient air concentrations have fallen as ethanol consumption has increased. The California Air Resources Board (CARB), for example, has found that acetaldehyde concentrations in California declined as ethanol content in gasoline fuel blends increased in California.[74] CARB found that "other components of California gasoline, such as aromatic and alkenes, were . . . primarily responsible for the formation of acetaldehyde."[75] And increased ethanol blending has reduced concentrations of aromatics and alkenes (olefins) in gasoline,[76] which should decrease resultant acetaldehyde formation.

Second, the disadvantages of regulation outweigh any advantages. Even if the use of E10 has caused increases in ambient acetaldehyde levels, the concentration of acetaldehyde in the air is far too low to cause significant public health harms that would justify regulatory action. At extremely high exposure levels, acetaldehyde may cause "coughing," "pulmonary edema," and "necrosis."[77] But no adverse respiratory effects from acetaldehyde have been observed below 273 milligrams per cubic meter of air, equivalent to roughly 152,000 parts per billion (ppb).[78] California's Office of Environmental Health Hazard Assessment's (OEHHA's) estimate of the lowest level at which exposure to acetaldehyde may cause bronchoconstriction (constriction of the lungs resulting in coughing, wheezing, and shortness of breath) is 260 ppb.[79] The concentration of acetaldehyde in the ambient air is far too low to

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[72] Proposed Determination at 7.

[73] *Id.*

[74] Ralph Propper et al., *Ambient and Emission Trends of Toxic Air Contaminants in California*, 49 Environ. Sci. & Tech. 11,329, 11,334 (2015) (concluding that there was no increase in "acetaldehyde concentrations between 2002 and 2004, when MTBE in gasoline was replaced with ethanol in California").

[75] *Id.*

[76] *See* EPA, Fuel Trends Report: Gasoline 2006-2014 29 (Oct. 2017), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100T5J6.pdf ("As high octane ethanol increased in the gasoline pool, it displaced . . . aromatics in the gasoline pool."); *id.* ("Ethanol dilutes olefins causing a reduction in that gasoline property.").

[77] EPA, Acetaldehyde Hazard Summary https://www.epa.gov/sites/production/files/2016-09/documents/acetaldehyde.pdf.

[78] 1 part per million (ppm) of acetaldehyde is equal to 1.8 milligrams per cubic meter. EPA, *Acetaldehyde Hazard Summary*. 273 milligrams per cubic meter divided by 1.8 is equal to 152 ppm. Multiplying 152 ppm by 1,000 to convert ppm to ppb results in 152,000 ppb of acetaldehyde.

[79] OEHHA, TSD for Noncancer RELs App'x D 6 (Dec. 2008, updated July 2014), https://oehha.ca.gov/media/downloads/crnr/ appendixd1final.pdf.

cause these effects. Even in the worst hotspots of Los Angeles, acetaldehyde concentrations do not exceed 32 ppb, well below the threshold for respiratory effects.[80] The estimated carcinogenic risks of acetaldehyde ambient air concentrations are also very low, so fuel controls are not necessary to prevent an increase in the incidence of cancer effects.[81] Fuel control measures to control acetaldehyde, a combustion product of ethanol, would also be costly, given that eliminating ethanol from gasoline would strand significant investments, particularly in rural communities, and significantly increase the cost of gasoline for consumers by raising the price of octane.

III. IF FUEL CONTROLS ARE NECESSARY, EPA SHOULD CONTROL AROMATIC HYDROCARBONS.

"[T]he reduction of PM emissions with the addition of ethanol . . . has been demonstrated in many studies and is supported by fundamental combustion chemistry considerations."[82] Tailpipe or "primary" PM emissions from motor vehicles are caused by incomplete combustion of the fuel-air mixture and the resulting impingement of fuel droplets on the engine's cylinder walls, a phenomenon that is strongly correlated with the presence of high-boiling-point aromatic hydrocarbons, which like ethanol, are added to gasoline to increase octane rating.[83]

Much of the PM emission attributable to motor vehicles in urban areas is "secondary" PM, in the form of secondary organic aerosols (SOA) "formed through atmospheric chemical reactions" of precursor gases (*i.e.*, sulfur oxides, NO_X, and organic gases) in the ambient air.[84]

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[80] EPA, *Acetaldehyde Hazard Summary*.

[81] *Id.* ("EPA estimates that, if an individual were to continuously breathe air containing acetaldehyde at an average of 0.5 μg/m 3 (5 x 10 -4 mg/m 3) over his or her entire lifetime, that person would theoretically have no more than a one-in-a-million increased chance of developing cancer as a direct result of breathing air containing this chemical. Similarly, EPA estimates that breathing air containing 5.0 μg/m 3 (5 x 10 -3 mg/m 3) would result in not greater than a one-in-a hundred thousand increased chance of developing cancer, and air containing 50.0 μg/m 3 (5 x 10 - 2 mg/m 3) would result in not greater than a one-in-ten thousand increased chance of developing cancer. For a detailed discussion of confidence in the potency estimates, please see IRIS. (4))"); *see also* EPA, 2014 National Air Toxics Assessment (modeling lifetime cancer risks from acetaldehyde ambient air exposures at 2.4 per million persons), https://www.epa.gov/national-air-toxics-assessment/2014-nata-assessment-results.

[82] James Anderson et al., *Issues with T50 and T90 as Match Criteria for Ethanol-Gasoline Blends*, 7 SAE Int'l J. Fuels & Lubr. 1027, 1031 & nn.1, 13, 14, 15, 16, 17 (2014) (citing ten "particularly well documented" studies); *see also* Robert A. Stein et al., *An Overview of the Effects of Ethanol-Gasoline Blends on SI Engine Performance, Fuel Efficiency, and Emissions*, SAE Tech. Paper 2013-01-1635, at 12 & nn.24, 44, 49, 52, 53, 54 ("Numerous studies have shown reduced PM emissions with increasing ethanol content in blends with gasoline.").

[83] *See* Koichiro Aikawa et al., *Development of a Predictive Model for Gasoline Vehicle Particulate Matter Emissions*, 3 SAE Int'l J. Fuels & Lubr. 610, 611 (2010); *see also* Georgios Karavalakis et al., *Evaluating the Effects of Aromatics Content in Gasoline on Gaseous and Particulate Matter Emissions from SI-PFI and SIDI Vehicles*, 49 Environ. Sci. & Tech. 7021, 7027 (2015) (finding "higher PM emissions with increasing aromatics in the fuel," consistent with the bulk of available studies) (hereinafter Karavalakis, *Effects of Aromatics*).

[84] *See* Drew R. Gentner et al., *Review of Urban Secondary Organic Aerosol Formation from Gasoline and Diesel Motor Vehicle Emissions*, 51 Environ. Sci. & Tech. 1074, 1078 (Dec. 21, 2016).

SOA concentrations in urban areas are produced primarily by gasoline aromatic emissions, particularly single-ring aromatic emissions: benzene, toluene, ethylbenzene, and xylene (BTEX).[85] Smog chamber studies and studies of "air pollution events in [California's] South Coast air basin" identify "aromatic compounds" as "key anthropogenic precursors with prevalent emissions from motor vehicles."[86] Some studies find that "96% of SOA" from gasoline "arise from single-ring aromatics" while others have attributed the *entire* SOA-forming potential of gasoline to BTEX.[87]

As a result, aromatic hydrocarbons have significant effects on public health. A 2013 study by Harvard Center for Risk Analysis and EPA scientists estimates that SOA formation from gasoline aromatic hydrocarbons causes 1,800 to 4,700 premature deaths every year, at a social cost of $13.6 to $34.9 billion, in 2006 dollars.[88] If any fuel control measures are necessary, the science is clear: EPA must control hazardous aromatic hydrocarbons in gasoline, not clean-burning ethanol.

CONCLUSION

In general, E10 has not caused an increase in ambient air pollution from motor vehicles. To the extent the use of E10 has increased some air pollutants, the costs of available fuel control measures would dwarf any health benefits. Accordingly, EPA must determine that fuel control measures are not "necessary" under § 211(v). If any fuel control measures are "necessary," it is fuel control measures to control aromatics content, not ethanol.

[85] *Id.* at 1078.

[86] *Id.* at 1075.

[87] *Id.* at 1078; J.R. Odum et al., *The Atmospheric Aerosol-Forming Potential of Whole Gasoline Vapor*, 276 Science 96, 96 (1997) ("[T]he atmospheric organic aerosol formation potential of whole gasoline vapor can be accounted for solely in terms of the aromatic fraction of the fuel.").

[88] Katherine Von Stackelberg et al., *Public Health Impacts of Secondary Particulate Formation from Aromatic Hydrocarbons in Gasoline*, 12 Enviro. Health (2013).