REQUEST FOR CORRECTION OF INFORMATION

submitted on behalf of

THE STATE OF KANSAS, THE STATE OF NEBRASKA,

THE ENERGY FUTURE COALITION, and URBAN AIR INITIATIVE

Concerning the U.S. Environmental Protection Agency's

EPAct/V2/E-89 FUEL EFFECTS STUDY

and

MOTOR VEHICLE EMISSIONS SIMULATOR MODEL (MOVES2014)

Docket ID Nos. EPA–420-R-13-002, FRL-9917-26-OAR

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EXECUTIVE SUMMARY

The States of Kansas and Nebraska, the Energy Future Coalition, and Urban Air Initiative petition the United States Environmental Protection Agency (EPA) for correction of information concerning motor vehicle fuel emissions represented in the Motor Vehicle Emissions Simulator model (MOVES2014) and the EPAct/V2/E-89 fuel effects study (EPAct study) on which it is based.

The EPAct study and MOVES2014 model are subject to the highest information quality standards, because the States are required to use the MOVES2014 in developing State Implementation Plans for air quality standards. For such "influential" information with "a clear and substantial impact on important public policies," EPA is required to use the best available science and data collection methods and to conform to the highest standards of objectivity, utility and integrity.

The EPAct study fails these standards. It is not "accurate, reliable, and unbiased," and its flawed design thwarted its intended purpose of "predicting emissions for the majority of in-use fuels."

The EPAct study was designed by self-serving market participants to undermine ethanol. EPA records obtained through the Freedom of Information Act reveal that the Agency directly solicited financial contributions and technical input, "especially on the fuel matrix," from the Coordinating Research Council (CRC), a group funded by the oil industry. The oil industry had an incentive to participate because, as EPA emphasized, the "[r]esults generated will be critical to future policy decisions," including policies related to "[f]uture [b]iofuel use." In response, CRC executives visited EPA personnel, expressing their "interest in this project and . . . in participating with some additions to the fuel matrix." Two CRC test fuels were ultimately selected by a Chevron employee and added to EPA's matrix. CRC's investment in the design of the EPAct study explains why CRC purchased all of the test vehicles, so EPA could complete testing.

EPA hosted conference calls with oil industry employees "to resolve several outstanding issues related to this fuel matrix." EPA then re-designed the test fuel matrix based on their "feedback" and asked several oil industry employees what test fuels they would "prefer to see tested." The oil industry employees responded with detailed input on the test fuel parameters, outlining possible "compromises."

EPA and its oil industry collaborators expected their test fuels to produce bad results for ethanol. When preliminary testing showed that higher ethanol fuels lowered emissions of nitrogen oxide and other pollutants, EPA considered "chang[ing] the program midstream" to obtain different results "[i]f we continue seeing no NO_X effect." In the end, EPA decided to exclude the relevant test fuels from the program, and otherwise altered its slate of test fuels to "emphasiz[e] ethanol effects."

As a result of EPA's changes to the design of its test fuels, to accommodate the oil industry, the statistical robustness of the experimental design decreased from a "G-

efficiency" of 83.6% to a G-efficiency of 51.6%—below the level EPA initially considered minimally satisfactory.

The EPAct test fuels did not "span the ranges of in-use fuel properties," as the Agency intended. The EPAct study purported to measure the emissions effects of five fuel properties (ethanol, aromatics, RVP, T50, and T90) in isolation, by artificially fixing them at pre-determined levels. But this fundamentally flawed "match-blending" methodology resulted in unrealistic test fuels with key parameters far outside the norm. For example:

- **Octane ratings.** The E10 test fuels' octane ratings were much higher than normal (between 90.6 and 94.7 AKI compared to the market average 88.3 AKI for regular gasoline, because EPA *added* pollution-causing high-octane hydrocarbons to the ethanol test fuels to artificially match T50 and T90 distillation temperatures, even though refiners *reduce* these costly additives before adding ethanol.
- **Distillation temperatures.** Although the EPAct study purported to measure the effect of T50 and T90 on real-world emissions, the T50 values of the test fuels (165–240°F) were much higher than in the market (154.8–226.5°F), because EPA artificially elevated the T50 of the higher ethanol test fuels—the opposite of what happens in the real world.
- **Driveability.** Because of the artificially high T50 values, one of the test fuels the ASTM driveability index maximum of 1250. Two test fuels fail to comply with today's standard.
- **Aromatics.** The range of aromatics levels in the test fuels (14.1–35.8%) was narrower and, on average, higher (25.6%) than in market fuels (21.4%), and exceeded design values by as much as 10%.

The EPAct study failed to control for confounding variables. Although EPA tried to control the five target fuel properties, it left many other fuel properties uncontrolled, even though these properties affect emissions. For example, the reported results do not account for differences in the test fuels':

- **Octane ratings.** The octane additives that EPA used to artificially elevate the ethanol test fuels' distillation temperatures contribute to pollution.
- **Distillation temperatures.** The EPAct study did not control for distillation temperatures other than T50 and T90. This resulted in elevated T60–T80 distillation temperatures in the ethanol test fuels, artificially increasing their emissions. Adding a T70 term would have changed the study's results in favor of ethanol.
- **Aromatics species.** EPA tried to match the test fuels' total aromatics levels, but it had to lower the proportion of high-distillate aromatics in some high aromatics fuels "[a]s a practical matter of meeting the distillation targets." This biased the study against ethanol fuels, which were spiked with a higher proportion of pollution-causing high-distillate aromatics, as reflected in the higher Particulate Matter Index (PMI) values of their blendstocks.
- **Density.** The EPAct study does not account for the ethanol test fuels' unrealistically high density, a characteristic associated with emissions. Historically density has

fallen as ethanol content has increased, but EPA's match-blending methodology produced the opposite trend.

- **Saturates and Olefins.** EPA used saturates and olefins to artificially elevate the distillation temperatures of the ethanol test fuels, but it did not account for the emissions effects of these additives.
- **Test Order.** EPA generally tested ethanol fuels toward the end of the study. This biased the results against ethanol, because the detergent-free test fuels caused pollution-causing engine build-up to accumulate over time.

The EPAct study's results are flawed because it relied on a biased subset of 12 fuels to measure air toxic species, disproportionately selecting ethanol test fuels that had characteristics associated with high emissions.

The EPAct study was not "complete and unbiased," because it failed to measure the most harmful pollutants—ultrafine particles and polycyclic aromatic hydrocarbons, which are reduced by ethanol.

The EPAct study's results are wrong, as a result of its flawed design and confounding variables. The study's conclusions that ethanol increases emissions of each of these pollutants are contradicted by peer reviewed studies finding the opposite:

- **Particulate Matter (PM)**
- **Nitrogen Oxide (NO_X)**
- **Total Hydrocarbon (THC), Non-Methane Organic Gas (NMOG), and Non-Methane Hydrocarbons (NMHC)**
- **Formaldehyde**

The MOVES2014 model does not meet EPA's information quality standards, because its tailpipe emissions factors are based on the EPAct study and incorporate all its flaws.

The MOVES2014 model's evaporative emissions estimates are equally flawed, because the model's ethanol "fuel adjustment" for permeation emissions is based on four biased, oil-funded studies (CRC E-65, CRC E-65-3, CRC E-77-2, and CRC E-77-2b).

The underlying CRC studies were systemically biased against ethanol as a result of their test fuel composition.

- **Aromatics. "**Permeation increases exponentially with fuel aromatic content," but in least three of the four CRC studies, the ethanol test fuels contained higher levels of aromatics. In the real world, however, increasing ethanol content has historically yielded lower levels of aromatics.
- **Confounding Variables.** The CRC studies ignore other confounding variables known to affect permeation emissions, including olefin content, octane, density, and

aromatics speciation, and paraffin species. In each case, the studies blamed ethanol for the permeation effects of these other properties.

- **High-Emitter Vehicles.** Two of the CRC studies were dominated by the permeation emissions of a single vehicle with unusually high emissions.

The MOVES2014 model's ethanol fuel adjustment is inconsistent with the CRC studies.

- **E85.** EPA's model assumes that adding any amount of ethanol to gasoline has the same effect on permeation emissions—more than doubling them. But only one of the underlying studies (CRC E-65-3) tested E85, and that study found that E85 emitted 28% less pollution through permeation than E0.
- **"Near Zero" Emissions Vehicles.** EPA's model assigns the same fuel adjustment to cleaner "near zero" emission vehicles as it does to vehicles meeting the earlier, less stringent standard. But the "near zero" vehicles tested in the CRC studies exhibited a more muted response to the high ethanol (and high aromatics) test fuels.
- **New Model Year Vehicles.** CRC itself has recently criticized the MOVES2014 model's evaporative emissions estimates, because they predict higher emissions from newer vehicles (2001 to 2015) than from older ones (1999 to 2000), even though the CRC studies EPA purported to rely on show that newer vehicles are "less sensitive to the increase in permeation [purportedly] due to ethanol."

The MOVES2014 models' default fuel parameters are inaccurate. State regulators are required to use the model's defaults under ordinary circumstances, so the model would generate flawed results even if its emissions factors were correct. For example:

- **T50.** Market fuel survey data shows that reformulated gasoline (RFG) tends to have higher T50 than conventional (non-RFG) gasoline, because of RFG's low RVP. But the regional default T50 values reverse this relationship: In the model, RFG has significantly lower T50 than conventional gasoline.
- **T90.** The MOVES2014 model defaults for T90 (327.3°F) are much higher than the real-world averages for both RFG (314.9°F) and conventional gasoline (317.7°F).

EPA Failed to Submit the EPAct study and the MOVES2014 model to the Science Advisory Board. EPA's Official Release of the MOVES2014 model is a regulation binding on the States. As such, EPA was required to submit the model and the underlying fuel effects study to the Science Advisory Board. The Agency's Information Quality Guidelines acknowledge that submission to the Board helps EPA "ensure the quality of information we disseminate."

Petitioners request that EPA cease disseminating erroneous information from the EPAct study and MOVES2014 model. Until a corrected model can be developed following notice and comment rulemaking and review by the Science Advisory Board, EPA should immediately lock the model's ethanol parameter at 10% to prevent spurious estimates of ethanol's emissions effects.

REQUEST FOR CORRECTION OF INFORMATION

INTRODUCTION

The States of Kansas and Nebraska, the Energy Future Coalition, and Urban Air Initiative (Petitioners) respectfully petition the United States Environmental Protection Agency (EPA) for correction of information concerning motor vehicle emissions represented in the Motor Vehicle Emissions Simulator model (MOVES2014[1]) and the EPAct/V2/E-89 fuel effects study (EPAct study)[2] on which it is based. As described below, both the model and the study seriously mischaracterize the air pollution effects of blending ethanol into gasoline.

This is a story of data manipulated to produce a policy-driving scientific model whose results are precisely the opposite of what occurs in the real world. In the real world, blending ethanol into ordinary gasoline reduces harmful emissions produced when gasoline combusts in an engine. Ethanol accomplishes this salutary effect both by diluting the most harmful components in gasoline with its own clean octane and by lowering the temperature at which various proportions of the fuel mixture combust, which further lowers pollution.

These proven facts about ethanol's emissions effects would have been confirmed by any study that simply added ethanol to an existing gasoline blendstock as occurs at refineries across the country, allowing ethanol to dilute the fuel's hydrocarbon content and to lower its distillation profile.

Instead the EPAct study's designers—which included employees of Chevron and BP—did the opposite. They artificially reversed ethanol's beneficial effects, dumping in more of the most polluting fuel additives—high-boiling-point hydrocarbons—to elevate the distillation profile of the ethanol-gasoline blends, though not required by any law or private standard. As a result, the EPAct study unfairly attributes to ethanol the emissions effects of the hydrocarbons used to match the targeted distillation temperatures.

EPA's MOVES2014 vehicular emissions model incorporates the EPAct study's conclusions about ethanol's tailpipe emissions effects and an equally erroneous measure of ethanol's effect on evaporative emissions, based on four flawed oil-funded studies. EPA requires States to adopt MOVES2014's mistaken conclusions about the causes of vehicular air pollution when they decide how to come into compliance with EPA's air quality standards.

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[1] EPA updated MOVES2014 on November 4, 2015, with a minor revision known as MOVES2014a. This revision "does not significantly change the criteria pollutant emissions results of MOVES2014 and therefore is not considered a new model for SIP and transportation conformity purposes." MOVES2014a Questions and Answers, available at http://1.usa.gov/1PccgEE. All references to "MOVES2014" in this Request for Correction include MOVES2014a and any subsequent versions of EPA's vehicular emissions model that are based on the results of the EPAct study.

[2] EPA, Assessing the Effect of Five Gasoline Properties on Exhaust Emissions from Light-Duty Vehicles Certified to Tier 2 Standards: Analysis of Data from EPAct Phase 3 (EPAct/V2/E-89), Final Report (Apr. 2013) (hereinafter EPAct Final Report), http://bit.ly/2bHswCu.

A. The EPAct Study

The EPAct study is an ambitious but misguided analysis of the emissions effects of five fuel parameters (ethanol content, aromatics content, Reid Vapor Pressure (RVP), T50, and T90) based on 15 vehicles and 27 test fuels including so-called straight gasoline (E0) and blends of gasoline with 10%, 15%, and 20% ethanol (E10, E15, and E20).

EPA conducted the EPAct study with the assistance of Southwest Research Institute (SwRI) and the Coordinating Research Council (CRC), a non-profit organization supported by the American Petroleum Institute,[3] and petroleum industry employees.[4] Contrary to EPA's own requirements of "objectivity" and "unbiased" information,[5] EPA did not solicit input from environmental or business interests outside the ambit of the oil industry.

EPA could have modeled ethanol's emissions effects by simply adding ethanol to commercial gasoline blendstocks ("splash blending"), or mimicking real-world refinery practices. Instead, the EPAct study's designers created novel fuels through an arbitrary "match blending" process in which they first adjusted the gasoline blendstock to hold constant selected parameters, including T50 and T90—the "distillation temperatures" at which 50% and 90% of the contents of the fuel are vaporized—even though refineries operate under no such constraints. In order to match the T50 and T90 of fuels with varying ethanol concentrations, high distillate aromatic and saturated hydrocarbons were added to fuels with higher ethanol content to counteract ethanol's beneficial effect of lowering T50 and T90.

But there is no good reason in science, engineering, or law to hold T50 and T90 constant when testing different levels of ethanol. Any semblance of uniformity among the test fuels is illusory, for the distillation profiles of blended fuels are not straight lines. The resulting test fuels deviated significantly from one another and from fuels available in the market—with some test fuels, for example, exceeding legal limits on driveability (a measure of cold-start and warm-up performance) and others containing unrealistically high octane ratings, thanks to the addition of costly and harmful high-distillate hydrocarbons.

The result of this "match blending" was the EPAct study's conclusion that "other factors being equal, increasing ethanol is associated with an increase in emissions."[6] This

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[3] In 2009, the CRC certified that it was "organized and operated exclusively for the benefit of, to perform the functions of, or to carry out the purposes" of the American Petroleum Institute. Return of Organization Exempt from Income Tax 2009, http://bit.ly/2dvu5b8. CRC's board of directors included several oil company employees. *See* CRC, Annual Report 80 (2009), *available at* http://bit.ly/2fwtjrw.

[4] Affiliated oil companies include BP, Chevron, ExxonMobil, Aramco, Marathon Petroleum, and Shell. *See* CRC, CRC Organizational Overview 5 (June 22, 2015), http://bit.ly/1T2nlfD.

[5] EPA, Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by the Environmental Protection Agency 15 (Oct. 2002) (hereinafter Information Quality Guidelines), *available at* http://www.epa.gov/QUALITY/informationguidelines/documents/EPA_InfoQualityGuidelines.pdf.

[6] *Id.* at 7.

conclusion is misleading at best, because other factors are never equal in the real world.[7] There is no regulatory, mechanical, or health justification for adding high-boiling-point hydrocarbons to test fuels for the purpose of measuring ethanol's effect on tailpipe emissions.[8] And that is the only way to account for the EPAct study's results: ethanol has been shown in numerous empirical studies to *decrease* emissions.

Even when one accounts for the other four fuel parameters (aromatics, T50, T90, and RVP), it is impossible to derive accurate results from the EPAct study. The study fails to control for differences in the full range the test fuels' distillation temperatures (other than T50 and T90). Because of ethanol's non-linear effect on gasoline distillation, raising the T50 of higher ethanol blends to *match* the T50 of E0 and E10 blends results in elevated T60-80 distillation temperatures. This skewed the results of the higher ethanol fuels, because those high upper distillation temperatures impede complete combustion, producing pollution. And whenever more heat is required to vaporize fuel components, more emissions result. The EPAct study also fails to account for differences in the speciation of the test fuels' hydrocarbon content. The high-distillate hydrocarbons used to raise T50 and T90 have the greatest effect on emissions, but for purposes of its match blending methodology, the EPAct study treats all aromatics alike.[9] EPA's neglect of these confounding variables undermines the objectivity, utility, and integrity of the results.

B. The MOVES2014 Model

The MOVES model, developed by EPA's Office of Transportation and Air Quality (OTAQ), estimates emissions for mobile sources at the national, county, and project level for criteria pollutants, greenhouse gases, and air toxics. The Clean Air Act requires EPA to update its mobile source emissions models regularly. MOVES2014 is the latest major revision of EPA's vehicular emissions model. States must immediately begin using the latest version of the model in developing their State Implementation Plans (SIPs) for compliance with the National Ambient Air Quality Standards (NAAQS).[10]

The MOVES2014 model incorporates the EPAct study, and the model's negative treatment of the tailpipe emission effects of ethanol blends is based directly on the conclusions of the EPAct study. In addition, the model includes inaccurate evaporative emissions factors based on four flawed oil-funded studies.

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[7] *See* Anderson et al., *Issues with T50 and T90 as Match Criteria for Ethanol-Gasoline Blends*, 7 SAE Int'l J. Fuels & Lubr. 1027, 1034 (2014) ("[O]ther factors are not equal when ethanol is added to gasoline. Depending on the blendstock, the added ethanol reduces T50 due to near-azeotropic behavior and reduces T90 and aromatics content by dilution. Considered as a whole, these factors tend to reduce emissions with increasing ethanol.").

[8] *Id.* at 1030 ("[Blendstock] modifications should generally not be needed to control these parameters in studies evaluating the effects of ethanol content on emissions if starting with an E10 fuel or using an E10 intended [blendstock].").

[9] *See infra* at 31.

[10] 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).

Because the EPAct study and MOVES2014 model fall short of EPA's information quality standards, Petitioners respectfully request that EPA immediately withdraw the EPAct study and lock the MOVES2014 model's ethanol variable at 10% to prevent false comparisons between fuels with different levels of ethanol. EPA should then develop a replacement model with corrected emissions factors based on an objective, accurate, and unbiased fuel effects study, following a meaningful opportunity for public comment.

I. PETITIONERS' INTEREST IN THE EPACT STUDY AND MOVES2014 MODEL

The States of Kansas and Nebraska are directly regulated by EPA's Official Release of the MOVES2014 model, which requires the States to use the model in constructing State Implementation Plans (SIPs) for compliance with the National Ambient Air Quality Standards (NAAQS). The model therefore imposes an administrative burden on the States. Because the emissions factors in MOVES2014 are erroneous, the model makes it more difficult for the States to develop a working SIP, delays compliance with the NAAQS, and impairs air quality. MOVES2014 also diminishes State revenues derived from Kansas and Nebraska's agricultural industries because it encourages all States to develop SIPs that limit the sale and consumption of ethanol in motor vehicle fuel.

The Energy Future Coalition is a bipartisan public policy initiative that brings together business, labor, and environmental leaders to address the challenges and opportunities of the transition to cleaner energy technologies. The Coalition seeks to identify and advance innovative policy options that appeal to a diverse array of competing interests and attract broad political support.

Urban Air Initiative is a group of concerned citizens, non-profit groups, agriculture organizations, businesses of all types, and other stakeholders determined to reduce the threat to public health posed by the use of petroleum-based fuels, especially in urban areas where citizens are exposed to mobile source emissions at especially dangerous levels.

The Petitioners filed a prior version of this Request for Correction in 2015.[11] EPA declined to consider the Request at that time because of pending litigation.[12] But EPA invited Petitioners to resubmit their RFC if their concerns were not addressed.[13] At EPA's invitation, Petitioners submit this revised RFC to afford the Agency another opportunity to correct and replace the challenged model and underlying fuel effects study.

[11] Request for Correction 15002 (Mar. 6, 2015).

[12] *Kansas v. EPA*, No. 14-1268 (D.C. Cir. Dec. 5, 2014).

[13] Letter from Janet G. McCabe to Adam Gustafson (May 11, 2015).

II. THE AGENCY'S INFORMATION QUALITY GUIDELINES REQUIRE THE EPACT STUDY AND MOVES2014 MODEL TO MEET HIGH STANDARDS OF OBJECTIVITY, UTILITY, AND INTEGRITY.

Pursuant to the Information Quality Act[14] and the implementing guidelines of the Office of Management and Budget,[15] EPA promulgated its own Information Quality Guidelines.[16] Those Guidelines reflect the Agency's goal that "[d]isseminated information should adhere to a basic standard of quality, including objectivity, utility, and integrity."[17]

For information to be objective, it must be "accurate, reliable, and unbiased," and it must "be[] presented in an accurate, clear, complete, and unbiased manner."[18]

To meet the "utility" standard, information must be "useful[] . . . to its intended users"[19]—in this case the States who must use the MOVES2014 model in constructing their SIPs.

The "integrity" requirement demands that information be protected "from unauthorized access or revision, to ensure that the information is not compromised through corruption or falsification."[20]

A. The EPAct Study and the MOVES2014 Model Are Subject to the Information Quality Guidelines.

EPA's Information Quality Guidelines apply to "information" that is "disseminated" by the Agency.[21] The EPAct study and the MOVES2014 model, including their conclusions about ethanol's effect on vehicular emissions, qualify as "information." "Information" is defined to include "any communication or representation of knowledge such as facts or data, in any medium or form."[22] The EPAct study and MOVES2014 model were "disseminated"

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[14] Pub. L. 106-554, § 1(a)(3), 114 Stat. 2763, 2763A-153 (Dec. 21, 2000), *codified in* 44 U.S.C. § 3516, note (requiring OMB to promulgate guidelines that "require that each Federal agency . . . issue guidelines ensuring and maximizing the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by the agency" and "establish administrative mechanisms allowing affected persons to seek and obtain correction of information maintained and disseminated by the agency that does not comply with the [OMB] guidelines").

[15] Office of Management and Budget, Information Quality Guidelines (Oct. 1, 2002), *available at* http://www.whitehouse.gov/sites/default/files/omb/inforeg/iqg_oct2002.pdf.

[16] Information Quality Guidelines, *supra* note 5.

[17] *Id.* at 3.

[18] *Id.* at 15.

[19] *Id.*

[20] *Id.*

[21] *Id.*

[22] *Id.*; *see also id.* ("Preliminary information EPA disseminates to the public is also considered 'information' for purposes of the Guidelines.").

when they were published to the Agency's website,[23] and again when they were used in support of EPA's mandate that the States employ MOVES2014 in their SIPs.[24]

EPA's Information Quality Guidelines apply equally to information generated by contractors, "[s]ince EPA is responsible for managing the work assigned to contractors" and thus "has a relatively high degree of control over the quality of this information." *Id.* at 6.

B. The EPAct Study and MOVES2014 Model Are "Influential" Information Subject to the Highest Standards of Quality.

The Agency's Information Quality Guidelines adopt a graded approach, in which the applicable standard of quality depends upon the importance of the information in question. "EPA recognizes that some of the information it disseminates includes influential scientific, financial, or statistical information, and that this category should meet a higher standard of quality."[25] Indeed, in its contract with SwRI to conduct the EPAct study, EPA specified that "[t]he Contractor shall comply with the higher-level quality standard," namely ANSI/ASQC E4 ("Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs").[26]

1. The EPAct Study and MOVES2014 Model Are "Influential" Information.

The EPAct study and the MOVES2014 model that incorporates its findings both contain "influential" information for purposes of the Information Quality Guidelines and thus "should adhere to a rigorous standard of quality."[27] For at least three reasons, the EPAct study and MOVES2014 model are among the classes of information that EPA "generally consider[s] . . . to be influential."[28]

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[23] *See* EPAct Final Report, *supra* note 2; MOVES (Motor Vehicle Emission Simulator), http://www.epa.gov/otaq/models/moves/; Information Quality Guidelines, *supra* note 5, at 15 ("EPA initiates a distribution of information if EPA prepares the information and distributes it to support or represent EPA's viewpoint.").

[24] Official Release of MOVES2014, 79 Fed. Reg. at 60344; *see* Information Quality Guidelines, *supra* note 5, at 15 ("EPA initiates a distribution of information if EPA prepares the information and distributes it . . . to formulate or support a regulation, guidance, or other Agency decision or position.").

[25] *Id.* at 19.

[26] Exhibit A, at A-4 (Contract No. EP-C-07-028, at E-1).

[27] *Id.* at 20.

[28] *Id.* at 20.

First, the EPAct study itself, and the MOVES2014 model reflecting its conclusions, are presumptively "influential," because the EPAct study represents a "[m]ajor work product[] undergoing peer review as called for under the Agency's Peer Review Policy."[29]

Second, the EPAct study is itself a "top Agency Action," and both the EPAct study and the MOVES2014 model were "disseminated in support of [a] top Agency action"—namely, the Official Release of the MOVES2014 model, EPA's final action ordering MOVES2014 to be used to estimate air pollution emissions in official State- (and possibly EPA-) authored plans for bringing nonattainment areas into compliance with the NAAQS for all criteria pollutants.[30] "Top Agency actions" include "studies" like the EPAct study, as well as "rules, substantive notices, policy documents, [and] guidance," such as the Official Release of the MOVES2014 model "that demand the ongoing involvement of the Administrator's Office," or involve "issues that have the potential to result in major cross-Agency or cross-media policies, or provide a significant opportunity to advance the Administrator's priorities."[31]

The EPAct study's conclusions about ethanol and the MOVES2014 model's incorporation of those conclusions will be particularly influential, since the optimal use of ethanol in gasoline is a subject of ongoing debate in Congress and the public square with major ramifications for the biofuels and automobile industries in the United States.[32] Although ethanol has been proven to reduce emissions of criteria pollutants and their precursors when added to gasoline, EPA's model will force States to write new SIPs under the false assumption that the opposite is true. This will encourage States to implement policies (for SIP credit) that discourage the sale and consumption of ethanol. If MOVES2014 were replaced with an accurate emissions model, States could gain SIP credit for policies that encourage the sale of higher blends of ethanol and the vehicles that run on them.

Third, and relatedly, the Official Release of the MOVES2014 model, in support of which the EPAct study and MOVES2014 model were disseminated, is an "Economically Significant action,"[33] that may determine the future not only of the biofuels industry but of the automobile industry. Automakers' ability to design next-generation high-compression engines for compliance with EPA and NHTSA's fuel efficiency greenhouse gas emissions

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[29] *Id.* at 20; *see* EPA Response to Comments on the Peer Review of Assessing the Effect of Five Gasoline Properties on Exhause Emissions from Light-Duty Vehicles Certified to Tier-2 Standards (EPAct/V2/E-89: Phase 3)—Part II: Data Analysis and Model Development (Apr. 5, 2013), *available at* http://bit.ly/2aWkTqs.

[30] EPA has ordered states to use MOVES2014 in SIP development "as expeditiously as possible." 79 Fed. Reg. at 60344. After a two-year grace period, the States must also use the MOVES2014a model to ensure that highway and transit projects using federal funding conform to the relevant SIPs. *Id.* at 60345.

[31] Information Quality Guidelines, *supra* note 5, at 20.

[32] *See id.* at 20 ("Top Agency actions usually have potentially great or widespread impacts on the private sector, the public or state . . . governments.").

[33] *Id.* at 20 (citing Executive Order 12866, Regulatory Planning and Review, 58 Fed. Reg. 51735 (Oct. 4, 1993)).

regulations and depends upon the octane rating of the fuel, which is related to its ethanol content, since ethanol is currently the least expensive high octane fuel additive.[34]

Finally, the EPAct "model will likely be used to evaluate the effects of future ethanol content in gasoline by government agencies, industry, academia, and special interest groups,"[35] so it will "have a clear and substantial impact on important public policies or private sector decisions."[36]

2. Because They Are Influential, the EPAct Study and MOVES2014 Model Must Use the Best Available Science and the Best Available Data Collection Methods.

Because the EPAct study and MOVES2014 model constitute "influential" information, they are "subject to a higher degree of quality (for example, transparency about data and methods) than information that may not have a clear and substantial impact on important public policies or private sector decisions."[37]

The EPAct study results and MOVES2014 emissions factors are also part of a subset of "influential" information that involves "human health, safety or environmental risk assessments."[38] The Information Quality Guidelines provide that for such health-related information, "EPA will ensure, to the extent practicable and consistent with Agency statutes and existing legislative regulations, the objectivity of such information disseminated by the Agency by applying the following . . . principles . . . :

> (A) The substance of the information is accurate, reliable and unbiased. This involves the use of:
>
> > (i) the best available science and supporting studies conducted in accordance with sound and objective scientific practices, including, when available, peer reviewed science and supporting studies; and

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[34] *See Control of Air Pollution from Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards*, 79 Fed. Reg. 23414, 23528-29 (Apr. 28, 2014) (hereinafter Tier 3 Rule) (noting that an E30 fuel "could help manufacturers who wish to raise compression ratios to improve vehicle efficiency as a step toward complying with the 2017 and later light-duty greenhouse gas and CAFE standards. This in turn could help provide a market incentive to increase ethanol use beyond E10"); Derek A. Splitter & James P. Szybist, *Experimental Investigation of Spark-Ignited Combustion with High-Octane Biofuels and EGR. 1. Engine Load Range and Downsize Downspeed Opportunity*, Energy & Fuels (revised Dec. 21, 2013) ("The unique properties of midlevel alcohol-gasoline blends were shown to be the enabling technology toward higher engine efficiency, leading to feasible near-term increases invehicle efficiency and reductions in CO2."); *id.* ("If a lower carbon renewable fuel can be used with higher engine efficiency, this could enable simultaneous compliance with RFS II and CAFE.").

[35] Anderson et al., *supra* note 7, at 1033.

[36] Information Quality Guidelines, *supra* note 5, at 20.

[37] *Id.*

[38] *Id.* at 21.

(ii) data collected by accepted methods or best available methods (if the reliability of the method and the nature of the decision justifies the use of the data).[39]

For the reasons that follow, the EPAct study and the MOVES2014 model do not satisfy even the basic requirements of objectivity, utility, and integrity applicable to all EPA-disseminated information—much less the heightened standards of information quality for influential risk assessments.

III. THE EPACT STUDY SHOULD BE WITHDRAWN BECAUSE ITS DESIGN WAS FUNDAMENTALLY FLAWED AND ITS RESULTS ARE INACCURATE.

A. The EPAct Study's Design Was Not Objective.

To meet the Information Quality Guidelines' standard of objectivity, EPA-disseminated information must be "accurate, reliable, and unbiased."[40] From the beginning, the EPAct study was incapable of producing accurate and reliable data, because its design is fundamentally biased against ethanol. Emails obtained through the Freedom of Information Act (FOIA) show that EPA's matrix of test fuels fell short of its duty to ensure that its study was "conducted in accordance with sound and objective scientific practices."[41]

1. The EPAct Study's Design Was the Product of Financially Interested Third Parties and Arbitrary Choices.

The EPAct study's results are not only contrary to science; they are the result of EPA's path-dependent approach, its poor design choices and lack of expertise, and it's almost exclusive reliance on self-interested oil company consultants.

The intended design of EPA's fuel matrix deteriorated over time, as a result of EPA's poor planning and its overly ambitious goals.[42] EPA wanted to generate the data needed for a statistical model capable of predicting emissions for the majority of in-use fuels."[43] To generate this data, EPA designed the test fuels "to span the boundaries of in-use fuel properties."[44] But technical blending constraints, limited resources, and pressure from the oil industry, led EPA to use flawed test fuels that are not found in the real world.[45]

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[39] *Id.* at 22. Influential risk assessments must also be presented in a form that is "comprehensive, informative, and understandable." *Id.*

[40] *Id.* at 15.

[41] Information Quality Guidelines, *supra* note 5, at 22; *see* Exhibit A (select FOIA record excerpts).

[42] *See infra*, pp. 10–27.

[43] EPAct Final Report, *supra* note 2, at 14.

[44] *Id.*

[45] *See infra*, pp. 27–33.

a. The Oil Industry Influenced the EPAct Study's Design from the Beginning.

From the outset, EPA modeled the EPAct study's matrix of test fuels on prior studies conducted by CRC. In particular, EPA relied on CRC's E-67 study, a "match-blending" study that found ethanol increases emissions.[46] Like the CRC E-67 study, EPA's original fuel matrix ("Design #0-A"),[47] was limited to fuels with an ethanol content between 0 and 10%, and both the E0 and the E10 test fuels were confined to the same range of values for all the other studied fuel parameters.[48] Design #0-A had three levels of T50,[49] and two

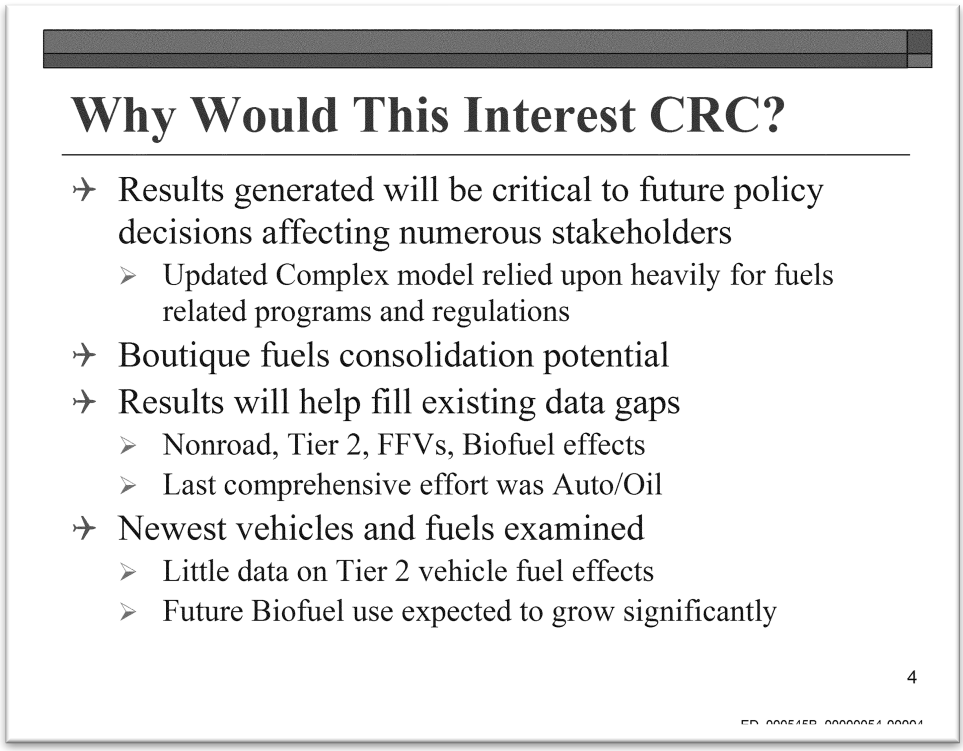

Figure 1. *See* Exhibit A, at A-76

[46] *See* Exhibit A, at A-87 (Michael Christianson, ASD, OTAQ, EPA, to Robert Mason, SwRI, EPA-RIF-001025 (June 25, 2007)) (emailing data and analysis from CRC E-67 to EPA's contract statistician for the EPAct study and stating that the CRC E-67 report "has a particularly useful diagram of the fuel matrix used in this study, and I refer to it constantly!" (citing Thomas Durbin, *Effects of Ethanol and Volatility Parameters on Exhaust Emissions*, CRC Project No. E-67 (2006)). The CRC E-67 study included three levels of ethanol (E0, E5.7, E10), three T50 temperatures (195°F, 215°F, and 235°F), and three T90 temperatures (295°F, 330°F, and 330°F) in a twelve fuel matrix. Durbin, *supra*, at 4.

[47] *See* EPAct/V2/E-89: Final Report on Program Design, App'x A: Re-Design of the Fuel Matrices for EPAct Program, A-4 (Apr. 2013) (hereinafter "EPAct Appendix A, Re-Design"). For purposes of this summary, Design #0–A is the 16-fuel matrix that EPA selected prior to the DOE expansion. Design #0-A is available at Exhibit A, at A-22, and Exhibit A, at A-20 (EPA, Expanded EPAct Program, EPA/DOE Collaboration, at 18 (Jan. 8, 2008)).

[48] The fuel matrix could therefore be visualized as a cube. *See* Exhibit A, at A-49 (EPA, EPAct Light Duty Fuel Effects Program, Experimental Design Proposals, Presentation to CRC, EPA-RIF-000320, at -000324 (Sept. 14, 2007)); CRC E-67, *supra* note 46, at 3.

[49] EPA included three T50 levels in order to establish "non-linear effects of T50 on emissions." *See* Exhibit A, at A-106 ("Response to Uihlein.doc", EPA-RIF-003014, *attached to* E-mail from Rafal Sobotowski ASD, OTAQ, EPA, to Rafal Sobotowski, EPA-RIF-003013 (Feb. 24, 2008)). *Cf.* EPA, EPAct/V2/E-89: Assessing the Effect of Five Gasoline Properties on Exhaust Emissions from Light-Duty Vehicles Certified to Tier 2 Standards: Final Report on Program Design and Data Collection 9 (Apr. 2013) (hereinafter EPAct Program

levels of T90, RVP, aromatics, and ethanol.[50]

While EPA would gradually revise its fuel matrix over several iterations, EPA retained the basic framework of Design #0-A—modeled after CRC's own study—as the base for the EPAct study's ultimate partial factorial design.[51]

EPA solicited funding and expertise from CRC, underscoring the importance of the study to CRC's petroleum members. EPA explained that the "[r]esults generated will be critical to future policy decisions," including those related to "[f]uture biofuel use," which was "expected to grow significantly," eating into the oil industry's market share.[52] *See* Figure 2.

Specifically, "the same fuel effects data" from the EPAct study would influence

- Annual renewable fuel blending obligations under the Renewable Fuel Standard (RFS),[53]
- efforts by EPA or the States to limit or expand the number of "boutique" fuels sold in the States,[54]
- "[p]otential state requests to rescind the ethanol RVP waiver,"[55]
- "State biofuel mandates,"[56]
- State implementation plans ("SIPs") for compliance with air quality standards,[57]

Design Report) ("To capture a non-linear impact, three or more treatment levels of a given parameter must be included in the study design.").

[50] Exhibit A, at A-50 (EPA, EPAct Light Duty Fuel Effects Program, Experimental Design Proposals, Presentation to CRC, EPA-RIF-000320, at -000325 (Sept. 14, 2007)). For both ethanol levels, the T50 levels were 195°F, 215°F and 235°F; the T90 levels were 300°F to 350°F. *Id.* at A-18 (EPA, Expanded EPAct Program, EPA/DOE Collaboration, at 16 (Jan. 8, 2008)).

[51] *Id.* at A-18 (EPA, Expanded EPAct Program, EPA/DOE Collaboration, at 16 (Jan. 8, 2008)).

[52] Exhibit A, at A-76 (John Koupal & Rick Rykowski, ASD, OTAQ, EPA, EPA Perspective on Fuel Effects Data Needs, Briefing for CRC Board, EPA-RIF-000775, at -000778).

[53] *Id.* at A-74, A-84 (-000776, -000793).

[54] *Id.* at A-74, A-81, A-82, A-83 (-000776, -000790, -000791, -000792).

[55] *Id.* at A-82 (-000791).

[56] *Id.*

[57] *Id.*

- EPA's Anti-Backsliding Analysis of the RFS,[58] and by extension
- EPA's regulations of mobile source air toxics ("MSAT"), and
- The potential "removal" of the "[o]xy[genate] mandate."

Such policies would depend on the air quality "impacts of fuel changes on emissions," including "[e]thanol—and its impact on T50, T90, [o]lefins, etc."[59] Without CRC's assistance on a new study, EPA said it had "no technical basis for providing" the "legislative and administrative recommendations" required of it.[60]

As a result of EPA's outreach, CRC played a critical role in the EPAct study's design. EPA's staff looked to CRC members to suggest "possible tweaks" in the design of the EPAct study's fuel matrix.[61] John Koupal, Director of Air Quality and Modeling at EPA, personally assured CRC members that EPA would "definitely" be "seeking their input to finalize, especially on the fuel matrix."[62] Rafal Sobotowski, EPA's project manager for the EPAct study, praised Lew Gibbs, a CRC consultant employed by Chevron, for his help in designing the EPAct study.[63] EPA's staff insisted on designing the EPAct study to "compl[e]ment[]" existing or pending CRC studies.[64] More than playing an advisory role, CRC was EPA's joint partner in a multi-study scientific venture.[65]

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[58] *Id.* at A-74, A-83 (-000776, -000792) (The anti-backsliding analysis will "serve as the basis for future fuel decisions by legislators and policy makers.").

[59] *Id.* at A-81 (-000790).

[60] *Id.*

[61] Exhibit A, at A-72 (E-mail from Aron Butler, ASD, OTAQ, EPA, to Michael Christianson, ASD, OTAQ, EPA, et al., EPA-RIF-000456 (June 4, 2007)) ("I know we are all looking forward to some feedback from CRC folks for possible tweaks, and thus this should be considered tentative.").

[62] *Id.* at A-72 (E-mail from John Koupal, Dir., Air Quality and Modeling Ctr., ASD, OTAQ, EPA, to Michael Christianson, ASD, OTAQ, EPA, et al., EPA-RED-000270 (June 7, 2007)) ("The CRC members are very eager to provide input to us . . . . I made it clear that . . . we are definitely seeking their input to finalize, especially on the fuel matrix."). EPA sought CRC input primarily because EPA did not know which fuels in its proposed matrix could be feasibly blended. *Id.* at A-86 (EPA, EPA's Gasoline Fuel Effects Testing Plans, Presentation to CRC Real World Grp., EPA-RIF-000822, -000824 (June 6, 2007)) ("Would like CRC input, esp. on fuel matrix, i.e., Can all the fuels on the matrix be blended?").

[63] *Id.* at A-100 (E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Lew Gibbs, Chevron Fellow, Senior Consulting Engineer, Chevron Products Co., EPA-RIF-002256 (Sept. 12, 2007)) ("I truly appreciate your feedback. It has been very helpful to the design of the EPAct program.").

[64] *Id.* at A-86 (EPA, EPA's Gasoline Fuel Effects Testing Plans, Presentation to CRC Real World Grp., EPA-RIF-000822, at -000824 (June 6, 2007)).

[65] *See*, *e.g.*, *id.* at A-60 (E-mail from John Koupal, Dir., Air Quality and Modeling Ctr., ASD, OTAQ, EPA, to Rafal Sobotowski, ASD, OTAQ, EPA, et al., EPA-RIF-000403, at -000406 (Apr. 4, 2008)) ("Chris Tennant and Brent Bailey of CRC would like to visit the lab next week to coordinate on our various projects, including E-69, E-70, E-77, ACES, and our EPAct work (missing anything?).").

By the end of the process, EPA had secretly consulted with a group of oil company employees about the test fuel parameters, despite the requirement of the Federal Advisory Committee Act and EPA's Scientific Advisory Policy that such committees be balanced,[66] that they be publicly announced[67] and that their meetings be open to the public.[68]

EPA sought advice on its test fuel parameters exclusively from companies that sell gasoline and the aromatic hydrocarbons in it that compete with ethanol as rival sources of octane. EPA's exclusive reliance on consultants with an incentive to generate results favorable to petroleum and disfavorable to ethanol violated the objectivity requirement of the Information Quality Guidelines.[69]

EPA's decision to involve Chevron and BP employees in the EPAct study's design and to exclude stakeholders from outside the oil industry also violated EPA's Scientific Integrity Policy, which requires all employees, including scientists and managers, to "[a]void conflicts of interest and ensure impartiality."[70] EPA's reliance on oil industry consultants was kept secret, in violation of the Scientific Integrity Policy's requirement that scientific findings, be "generated and disseminated in a timely and transparent manner."[71]

b. Higher Ethanol Content Prompted More Oil Industry Intervention.

EPA was initially unable to secure CRC funding for additional fuel testing, so EPA turned to the Department of Energy ("DOE") for money.[72] Through Wendy Clark, a scientist at DOE's National Renewable Energy Laboratory ("NREL") and former BP employee,[73]

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[66] 5 U.S.C. App'x 2, § 5(b)(2). "The term 'advisory committee' means any committee, board, commission, council, conference, panel, task force, or other similar group, or any subcommittee or other subgroup thereof . . . established or utilized by one or more agencies . . . in the interest of obtaining advice or recommendations for . . . one or more agencies or officers of the Federal Government." *Id.* § 3(2).

[67] *Id.* § 9(a).

[68] *Id.* § 10(a)(1); *accord* EPA, Scientific Integrity Policy 3, *available at* http://bit.ly/2cF7XVR.

[69] Information Quality Guidelines, *supra* note 5, at 3, 15, 22.

[70] EPA, Scientific Integrity Policy 3; *see also id.* ("Welcome differing views and opinion on scientific and technical matters as a legitimate and necessary part of the scientific process.").

[71] *Id.* at 4.

[72] *See* Exhibit A, at A-131 (E-mail from Joseph Somers, ASD, OTAQ, EPA, to Michael Christianson, ASD, OTAQ, EPA, et al., EPA-RIF-004517 (Dec. 25, 2007)).

[73] Wendy Clark was "a great champion of DOE's involvement in the EPAct program." *Id.* at A-132 (E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Joseph Somers, ASD, OTAQ, EPA, EPA-RIF-004518 (Dec. 5, 2007)). Wendy Clark worked at BP for sixteen years before joining NREL. *See* Alternative Energy for the Future, SAE, at http://bit.ly/24iFC0x.

EPA secured over $2 million in DOE funds for additional test fuels and particulate matter ("PM") testing in December 2007.[74]

DOE's money came with strings attached. EPA had to re-design its fuel matrix to include higher ethanol blends—E20 and E15—only weeks before fuel blending was scheduled to begin. Instead of re-assessing the original matrix, EPA initially decided to add an additional "DOE" fuel matrix on-top of its previous design, without changing the original set of fuels.[75]

The EPAct study's expansion to include higher ethanol blends generated renewed interest from stakeholders in the oil and automobile industries. On February 13, 2008, the Alliance of Automobile Manufacturers ("Auto Alliance") visited EPA's Office of Transportation and Air Quality ("OTAQ") in Ann Arbor and showed Rafal Sobotowski that a lower T50 of 150°F for the E10 and E15 blends was "well-justified" by recent survey data.[76] EPA therefore promised the Auto Alliance to re-design the matrix to include a lower T50 level.[77] This required raising the high RVP level from 9 psi to 10 psi for the entire fuel matrix.[78]

Bob Mason, a statistician for EPA's contractor, SwRI, re-designed the matrices, increasing the RVP level and adding a new set of test fuels with a T50 level as low as 150°F (Designs #0-C and 0–D).[79] Designs #0-C and 0-D had a G-efficiency of approximately 67%, and included eight E20 fuels, each with a T50 of 160°F, and only one E15 fuel, which had a T50 of 150°F.[80]

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[74] Exhibit A, at A-10 (E-mail from Joseph Somers, ASD, OTAQ, EPA, to Kathryn Sargeant, Deputy Dir., ASD, OTAQ, EPA, et al., at 1 (Jan. 8, 2008)). On top of the $2 million in initial funds, DOE later secured almost an additional $1 million in funds for EPAct testing. *See id.* at A-61 (E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Paul Machiele, Director, Fuels Ctr., ASD, OTAQ, EPA, et al., EPA-RIF-000407 (May 13, 2008)).

[75] *Id.* at A-102 (E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to John Koupal, Dir., Air Quality and Modeling Ctr., ASD, OTAQ, EPA, EPA-RIF-002320 (Oct. 17, 2007)) ("The matrix is designed in such a way that its E0/E10 portion can be treated as a separate entity.").

[76] *Id.* at A-106 ("Response to Uihlein.doc", EPA-RIF-003014, *attached to* E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Rafal Sobotowski, EPA-RIF-003013 (Feb. 24, 2008)) ("The T50 level of 150 F for E10 fuels was agreed upon in the course of discussions between the EPA and [Auto Alliance]. It is well justified by recent survey data which show significant numbers of E10 fuels with T50 at 150F and RVP~=10 psi.").

[77] *Id.* at A-54 (E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Ellen Shapiro, Dir. of Automotive Fuels, Alliance of Auto. Mfrs. & Aron Butler, ASD, OTAQ, EPA-RIF-000377 (Mar. 3, 2008)).

[78] *Id.* at A-54 (EPA, EPAct Light Duty Vehicle Fuel Effects Program, EPA-RIF-000378, -000380 (Mar. 3, 2008)); *id.* at A-23 (Rafal Sobotowski, ASD, OTAQ, EPA, to Paul Machiele, Dir., Fuels Ctr., ASD, OTAQ, EPA, EPA-RED-000203 (Feb. 4, 2008)) (discussing T50 and RVP issues arising in light of the DOE re-design).

[79] *See* Exhibit B, at B-3, B-4.

[80] Exhibit A, at A-108, A-109, A-110, A-111 ("Sobotowski Version 4b test matrix 2012-08.xls", EPA-RIF-004013, at -004013–16, *attached to* E-mail from Robert Mason, SwRI, to Rafal Sobotowski, ASD, OTAQ, EPA, EPA-RIF-004012 (Feb. 13, 2008)). For a description of the concept of G-efficiency, see EPAct Appendix A, Re-Design, *supra* note 47, at A-2 ("The efficiency value is a function of the number of points in a design, the number and types of factors in a model, and the maximum standard error for model prediction over the design points. The G-optimality criterion seeks to minimize the maximum standard error for prediction over the

EPA wanted to include E15 test fuels with a higher T50 than the 150°F level of Designs 0-C and 0-D.[81] But according to Bob Mason, the optimization program used to generate the fuel matrices would have to be "manipulated" to accept the E15/T50 combinations desired by EPA.[82]

The same day that the Auto Alliance visited EPA, EPA hosted a conference call with BP and Chevron employees "to resolve several outstanding issues related to this fuel matrix" including the "T50 ranges at the different ethanol content levels" and "RVP ranges at ethanol content/T50 combinations selected for the test fuels."[83] Based "on feedback" from that conversation with the oil industry, Bob Mason, the SwRI statistician, designed three new fuel matrices, manipulating the software to force the inclusion of E15 blends with a higher T50 of 190°F alongside the low T50 of 150°F.[84]

Mason's three additional designs were as follows:

- Design #0-E, with a G-efficiency of 65.6%, had five E20 test fuels and four "balanced" E15 test fuels, meaning that each level of any given parameter was represented an equal number of times—two E15 fuels had a T50 of 150°F and two had a T50 of 190°F; two had a high T90 and two had a low T90, two had high aromatics and two had low aromatics;[85]

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design points. Since a standard fractional design will have an efficiency of 100%, a large G-efficiency value indicates the design is good.").

[81] *See* Exhibit A, at A-107 (E-mail from Robert Mason, SwRI, to Rafal Sobotowski, ASD, OTAQ, EPA, EPA-RIF-004012 (Feb. 13, 2008)); *id.* at A-119 (E-mail from Robert Mason, SwRI, to Rafal Sobotowski, ASD, OTAQ, EPA, EPA-RIF-004084 (Feb. 15, 2008)); *id.* at A-120 ("25-trial matrix 2-14-08.xls", EPA-RIF-004085, *attached to* E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Robert Mason, SwRI, EPA-RIF-004084 (Feb. 15, 2008)).

[82] *Id.* at A-107 (E-mail from Robert Mason, SwRI, to Rafal Sobotowski, ASD, OTAQ, EPA, EPA-RIF-004012 (Feb. 13, 2008)) ("The optimization program either chose a fuel at (150,15) or at (190,15), but not runs could be generated that selected both of these points (since the program determined that both were not needed. If you want both of them in the fuel matrix, let me know and we will try to manipulate the program to accept both of them. One way to possibly do this is to initially add a cubic term for EtOH in the model, which might cause both points to be selected. We could then remove the cubic term, but keep both points and measure the G-efficiency of the result using the quadratic model.").

[83] *Id.* at A-112 (E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Frank S. Gerry, BP Products, et al., EPA-RIF-004017 (Feb. 12, 2008)) ("In order to resolve several outstanding issues related to this fuel matrix, we would like to propose a conference call between fuel experts from EPA, BP, and NREL to discuss" "T50 ranges at the different ethanol content levels" and "RVP ranges at ethanol content/T50 combinations selected for the test fuels."); *id.* at A-116 (E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Frank S. Gerry, BP Products, et al., EPA-RIF-004040 (Feb. 13, 2008)) ("The EPAct Fuel Matrix conference will take place today[.]").

[84] *Id.* at A-25 (E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Wendy Clark, NREL, DOE, et al., EPA-RED-000209 (Feb. 19, 2008)); *id.* at A-122 (E-mail from Robert Mason, SwRI, to Rafal Sobotowski, ASD, OTAQ, EPA, EPA-RIF-004087 (Feb. 15, 2008)).

[85] *See* Exhibit B, at B-5; Exhibit A, at A-123 ("25-trial matrix 2-14-08.xls", EPA-RIF-004088, *attached to* E-mail from Robert Mason, SwRI, to Rafal Sobotowski, ASD, OTAQ, EPA, EPA-RIF-004087 (Feb. 15, 2008)).

- Design #0-F, with a G-efficiency of 68.1%, had four balanced E20 fuels, and five E15 fuels—three out of five E15 fuels had a high T50 of 190°F, two had a high T90, and three had high aromatics; and[86]

- Design #0-G, with a G-efficiency of 68.3%, was like Design #0-F in that it had four balanced E20 fuels, and five E15 fuels, but three (instead of two) E15 fuels had a high T90.[87]

To choose among these three new designs, EPA again turned to the oil industry for advice, even asking BP and Chevron consultants which of these three designs they would "prefer to see tested" in the EPAct study.[88]

c. EPA Re-designed the Matrix To Address the Oil Industry's Concerns.

Some oil industry employees, however, were dissatisfied with some of the features of the three matrices (Designs #0-E, 0-F, and 0-G). Sobotowski (himself a former BP and Exxon employee) had asked Frank Gerry of BP to invite James (Jim) Uihlein, an employee of Chevron Products (and a former BP employee) to join the group discussion of the fuel matrix.[89] After several discussions with Sobotowski, Uihlein outlined possible design compromises in an e-mail to EPA and NREL.[90] Uihlein first suggested that EPA should renege on its promise to the Auto Alliance, by raising the low T50 level of all fuels to 160°F, "the lowest feasible E20 level," in order to address his concerns with the misaligned T50 levels

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The fuels for this design were balanced for all parameters except for RVP, because EPA determined that an RVP of 10 psi was the only level achievable for an E15 or E10 blend with a T50 of 150°F. *Id.* at A-115 (E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Frank Gerry, BP Products, et al., EPA-RIF-004019, -004020 (Feb. 12, 2008) ("You will notice that at T50 level of l50F, the RVP will likely be limited to a narrow range around 10 psi. That range will probably be similar for El5 at T50 of l50F. For El5 at T50 of 190F as well as for E20, we assumed RVP range of 6.65-10 psi.").

[86] *See* Exhibit B, at B-6.

[87] *See id.* at B-7.

[88] Exhibit A, at A-25 (E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Wendy Clark, NREL, DOE, et al., EPA-RED-000209 (Feb. 19, 2008)).

[89] *Id.* at A-116 (E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Frank S. Gerry, BP Products, et al., EPA-RIF-004040 (Feb 13, 2008)).

[90] *Id.* at A-103 (E-mail from James P. Uihlein, Chevron Products Co., to Rafal Sobotowski, ASD, OTAQ, EPA, et al., EPA-RIF-003001 (Feb. 22, 2008)) ("In the interest of documenting the trade-offs involved in selecting the fuels matrix, I've put together the following summary of a discussion between Rafal and myself. The focus was on options short of completely re-doing the matrix. There was agreement that whatever fuel matrix is selected, there will be compromises involved."). Uihlein's e-mail can fairly be read as recommending that Sobotowski rejected the Auto Alliance's proposal, and raise the T50 of E15 blends to 160°F. Chevron and CRC had already demonstrated to EPA that moving the T50 of E20 test fuels below the 160°F level was not possible. *See id.* at A-106 ("Response to Uihlein.doc", EPA-RIF-003014, *attached to* E-mail from Rafal Sobotowski ASD, OTAQ, EPA, to Rafal Sobotowski, EPA-RIF-003013 (Feb. 24, 2008)).

of the ethanol blends.[91] Uihlein also suggested that the gap between the T50 and T90 temperatures for some fuels was too extreme (up to 200°F), and not realistic for in-use fuels. In his view, blending these fuels would require "gymnastics" and would result in unrealistic "dumbbell" fuels—which vaporize in disproportionate volumes at extremely high and low temperatures.[92]

To "allay" Jim Uihlein's concern about "dumbbell" fuels, Sobotowski directed SwRI to re-design the fuel matrix once again, lowering the high T90 level slightly to 340°F.[93] SwRI's re-design resulted in the first two fuel matrices reported by SwRI in its official report:

- Design #1, with a G-efficiency of 72.6%, consisted of the same sixteen E0 and E10 test fuels as Designs #0-E, #0-F, and #0-G, but with a high T90 level of 340°F (instead of 350°F); and[94]

- Design #2, with a G-efficiency of 68.1%, consisted of the sixteen Design #1 test fuels plus nine E15 and E20 test fuels.[95] Design #2 was based on Design #0-F, and included four balanced E20 fuels (two with each level of T90, RVP, and aromatics), and five E15 fuels (three with a T50 of 190°F, and two with a T50 of 150°F).

Given the oil industry's influence over the original design, it is not surprising that the E15 fuels were imbalanced in favor of fuel properties that contribute to emissions:[96] one of the five E15 fuels (fuel #24) had high T50, high aromatics, and high T90, but there was no corresponding E15 fuel with a combination of low T50, low aromatics, and low T90.

d. EPA Re-designed its Fuel Matrix when It Proved Impossible To Blend.

During the summer of 2008, as EPA and its oil industry partners continued to design the test fuel matrix for Phase 3, time and money became overriding considerations for EPA,

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[91] *Id.* at A-103 (E-mail from James P. Uihlein, Chevron Products Co., to Rafal Sobotowski, ASD, OTAQ, EPA, et al., EPA-RIF-003001 (Feb. 22, 2008)).

[92] *Id.* at A-126 (E-mail from James P. Uihlein, Chevron Products Co., to Rafal Sobotowski, ASD, OTAQ, EPA, et al., EPA-RIF-004133 (Feb. 20, 2008)); *see also id.* at A-103 (E-mail from James P. Uihlein, Chevron Products Co., to Rafal Sobotowski, ASD, OTAQ, EPA, et al., EPA-RIF-003001 (Feb. 22, 2008)).

[93] *See id.* at A-106 ("Response to Uihlein.doc", EPA-RIF-003014, *attached to* E-mail from Rafal Sobotowski ASD, OTAQ, EPA, to Rafal Sobotowski, EPA-RIF-003013 (Feb. 24, 2008)). The EPAct study's test fuels still retained an extreme difference of 190°F between their T50 and the T90 temperatures. According to recent surveys, not a single fuel has these extreme characteristics. Alliance of Auto. Mfrs., 2014 Summer North American Fuel Survey.

[94] EPAct Appendix A, Re-Design, *supra* note 47, at A-4.

[95] *Id.* at A-6. The combined fuel matrix is reproduced in Exhibit B, at B-9.

[96] Fuels are balanced in a matrix if "each level of a factor occurs an equal number of times with each level of the other factors." Robert L. Mason et al., Statistical Design and Analysis of Experiments with Applications to Engineering and Science, at 252 (2nd ed. 2003).

further damaging the quality of the EPAct study's design.[97] EPA was unable to blend the E15 test fuels to specification, while maintaining a realistic distillation temperature curve.[98] By the end of the summer, following conversations with oil industry experts,[99] EPA recognized that it would be unable to blend the E15 test fuels in bulk.[100] EPA therefore decided to re-design the Phase 3 fuel matrix once again.[101]

EPA's Design #3 replaced two E20 fuels with two new E20 fuels, and added two additional E20 fuels, for a total of "six E20 fuels (in place of four)."[102] Design #3 also replaced two E15 fuels with two new E15 fuels, and dropped two E15 test fuels, for a total of "three E15 fuels (in place of five)."[103] G-efficiency was nominally raised to 68.7%, but the set of E15 test fuels got worse. They were deeply imbalanced—out of three E15 blends, two had a high T50, two had a high T90, and two had high aromatics—all properties associated with increased emissions.[104]

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[97] *Cf. id.* at 120 ("Occasionally efficiency becomes an overriding consideration and the project goals become secondary. If time or budgetary considerations lead to undue restrictions on the factors and levels that can be investigated, the project goals should be reevaluated relative to the available resources. This may lead to a decision to forego experimentation.").

[98] Exhibit A, at A-156 (E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Doug Lawson, NREL, DOE, EPA-RIF-012872 (Aug. 8, 2008)); *id.* at A-64 (E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Doug Lawson, NREL, DOE, EPA-RIF-000408, at -000409 (May 7, 2008)) ("Attempts to alter these distillation curves [in preliminary test fuels] failed.").

[99] *Id.* at A-33 (E-mail from Rafal Sobotowski ASD, OTAQ, EPA, to Sonia Bain, Analytical Services Supervisor, Refining Analytical and Development, Marathon Petroleum Co., EPA-RED-000744 (July 15, 2008)) (Thanking Sonia Bain for putting "the whole [reproducibility] issue in a perspective."). Part of the same e-mail chain, without Mr. Sobotowski's reply, appears unredacted at Exhibit A, at A-144 et seq. Reproducibility" is a technical ASTM term that refers to the greater variability that can occur when a sample is tested in different laboratories. Neil Ullman, *What are Repeatability and Reproducibility? Part 2,* ASTM Standardization News (May/June 2009), *available at* http://bit.ly/1VHw3Dw.

[100] Exhibit A, at A-155 (E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Doug Lawson, NREL, DOE, EPA-RIF-012872 (Aug. 8, 2008)) ("As you know, the blending of the first E15 fuel in the EPAct Program has caused a multitude of problems associated with the effect of ethanol on the shape of the distillation curve. It took us nearly two months to prepare the bulk blend of this fuel from the time the hand blend was approved. Based on this experience and on communications with members of the ASTM Subcommittee D02.08.0A, we have concluded that the EPAct fuel matrix should be redesigned to make it more robust and easier to develop.").

[101] *Id.*

[102] *Id.*

[103] *Id.*; *see also* EPAct Appendix A, Re-Design, *supra* note 47, at A-8.

[104] Exhibit A, at A-157 ("Designs of Feb and Aug 2008 EPAct Fuel Matrices.xls", EPA-RIF-012873, *attached to* E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Doug Lawson, NREL, DOE, EPA-RIF-012872 (Aug. 8, 2008)). The high T50 level for the E15 fuels at this point was 190°F, and the low level was 150°F, making the three-fuel average 177°F. Although this is higher than the average for premium summer E15 fuels, EPA would further increase the E15 average to above 200°F. *See infra*, note 135 and accompanying text.

e. EPA Delegated the Design of the EPAct Study to an Oil Industry Consultant.

EPA's re-designs of the test fuel matrix were not over. In April 2008, CRC executives Brent Bailey and Chris Tennant visited OTAQ in Ann Arbor to propose a matrix re-design.[105] CRC proposed adding two fuels with an intermediate T90 level of 325°F, in order to test possible "non-linear" effects of T90 in some of the "extreme" fuels—those with a wide gap between the T50 and T90 distillation temperatures.[106] EPA accepted this proposal, and SwRI re-designed the matrix accordingly under the supervision of Jim Uihlein from Chevron in late August 2008 (Design #4).[107]

CRC's re-design, Design #4, consisted of 30 fuels (as opposed to 25), including two CRC fuels with a T90 level of 325°F and the preliminary test fuels (which had also had a T90 of 325°F).[108] To pick the two new CRC fuels, SwRI designated several candidates through a complicated, five-step process.[109] Uihlein ultimately selected an E10 and E20 pair of fuels, both with high aromatic content (40%), even though (as he pointed out) a similar pair with balanced aromatic levels (15% and 40%) would have produced identical G-efficiency values.[110]

With CRC's re-design, G-efficiency fell from 68.7% to 64.1%.[111]

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[105] Exhibit A, at A-129 (E-mail from Chris Tennant, Deputy Dir., CRC, to John Koupal, Dir., Air Quality and Modeling Ctr., ASD, OTAQ, EPA, et al., EPA-RIF-004495 (Apr. 24, 2008)) ("Many of us have talked individually about our interest in this project and our interest in participating with some additions to the fuel matrix; after Brent and I visited with some of you in Ann Arbor last week, it sounds like we should try and speak collectively very soon.").

[106] *Id.* at A-66, A-67 (James P. Uihlein, Proposed CRC Addition to EPA Fuel Effects Study, CRC Emissions Committee Meeting, EPA-RIF-000411, at 000415–16 (May 22, 2008)).

[107] *Id.* at A-152, A-153 (E-mail from Robert Mason, SwRI, to James P. Uihlein, Chevron Products Co., EPA-RIF-012841, at -012843–44 (Aug. 21, 2008)) (proposing a new, complex re-design consisting of 6 steps). *See also* EPAct Appendix A, Re-Design, *supra* note 47, at A-8, A-9. Design #4 is also reproduced in Exhibit B, at B-10.

[108] Exhibit A, at A-152, A-153 (E-mail from Robert Mason, SwRI, to James P. Uihlein, Chevron Products Co., EPA-RIF-012841, at -012843–44 (Aug. 21, 2008)). The fuel pairs generated by the SwRI are available at Exhibit A, at A-150.

[109] *Id.* at A-153 (Robert Mason, SwRI, to James P. Uihlein, Chevron Products Co., EPA-RIF-012841, -012844 (Aug. 27, 2008)). SwRI did not add a squared aromatics term because G-efficiency would be too low for such a model. *Id.*

[110] *Id.* at A-150 (E-mail from James P. Uihlein, Chevron Products Co., to Rafal Sobotowski, ASD, OTAQ, EPA, EPA-RIF-012841 (Sept. 15, 2008)).

[111] EPAct Appendix A, Re-Design, *supra* note 47, at A-11.

f. EPA Abandoned Test Results and Test Fuels that Challenged Its Prior Assumptions About Ethanol's Emissions Effects.

EPA's results-driven methodology is evident from its handling of Phase 1 of the EPAct study in the spring and summer of 2008.[112] The Phase 1 pilot program was supposed to test three "representative" blends (one E0, one E10, and one E15 blend, labeled #17, #18, and #19, respectively), to generate data for the 2010 RFS rule.[113] Consistent with historic refinery practices, the aromatics levels of these three test fuels were lowest in the fuel with the most ethanol, and highest in the fuel with no ethanol.[114]

EPA tested these three fuels in 19 Tier 2 vehicles over the Unified Driving Cycle ("LA92").[115]

The final results for Phase 1 became available in September 2008. They showed that NO_X [nitrogen oxides], "CO [carbon monoxide], HC [hydrocarbons], and PM [particulate matter] all have significant decreases in emissions as ethanol levels increase from E0 to E10."[116]

EPA questioned these results because they went against the Agency's prior assumptions about ethanol's emissions effects, based on CRC's "match-blending" studies.[117]

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[112] Exhibit A, at A-142 (EPA, E0/E10 Results from Phase 1 of EPAct Program Preliminary, EPA-RIF-010696 (June 30, 2008)).

[113] *Id.* at A-135 (EPA, E0-E10-E15 Results from Phase 1 of EPAct Program, EPA-RIF-009068, at -009069 (Sept. 4, 2008)).

[114] *Id.* at A-136 (-009072).

[115] *Id.* at A-135 (EPA, E0-E10-E15 Results from Phase 1 of EPAct Program, EPA-RIF-009068, at -009069 (Sept. 4, 2008)); EPAct Program Design Report, *supra* note 49, at 42–43 (listing the 19 vehicles tested in Phase 1 and 2).

[116] *Id.* at A-137 (EPA, E0-E10-E15 Results from Phase 1 of EPAct Program, EPA-RIF-009068, at -009081 (Sept. 4, 2008)).

[117] EPA was strongly invested in the results of the CRC studies, which predict that ethanol increases NO_X. EPA assured CRC that the EPAct study's design "compl[e]ments recent and ongoing testing by CRC," including E-67 and E-74b. *Id.* at A-51 (John Koupal, Dir., Air Quality and Modeling Ctr., ASD, OTAQ, EPA, EPA's Plans for Fuel Effects Testing, FACA MOVES Review Workgroup, EPA-RIF-000335, at -000337 (Sept. 18, 2007)). To that end, prior to the preliminary program, EPA's EPAct study staff closely reviewed NO_X and HC emissions data from CRC E-67 and the ongoing E-74b study, and EPA's staff created NMHC and NO_X models for RVP, oxygen content, and olefins as fuel parameters based on EPA's extensive analysis of data from these two studies. *See*, *e.g.*, *id.* at A-96 (E-mail from Rafal Sobotowski, ASD, OTAQ, U.S EPA, to George Hoffman, ASD, OTAQ, EPA, EPA-RIF-001402 (June 29, 2007)) (asking EPA staff to create a predictive model based on these studies); *id.* at A-92 (Michael Christianson, ASD, OTAQ, EPA, Robert L Mason, SwRI, EPA-RIF-001290 (June 27, 2007)) (e-mailing extensive plots and data based on CRC E-67 data); *id.* at A-93 (Michael Christianson, ASD, OTAQ, EPA, to Rafal Sobotowski, ASD, OTAQ, EPA, EPA-RIF-001305 (June 27, 2007)) (forwarding EPA's analysis of E-74b). EPA also relied on the CRC E-74b and E-67 studies to determine how many vehicles would be required to resolve NO_X and HC emissions for E0, E10, and E20 fuels, because data from these two CRC studies "can be used to estimate ethanol effects on HC and NO_X emissions." *Id.* at A-98 (E-mail from Rafal Sobotowski, ASD, OTAQ, to Greg Janssen, ASD, OTAQ, EPA-RIF-001911 (Nov. 6, 2007)). EPA had access to E-74b data because it was closely involved in the design

EPA had expected to find that ethanol increased NO_X, because that is what CRC had found.[118] Accordingly, when preliminary Phase 1 results contradicted CRC's predictions, EPA considered "chang[ing] the program midstream" "[i]f we continue seeing no NO_X effect."[119] Among other strategies, EPA considered adding test fuels with more matched parameters to generate the desired anti-ethanol results.[120]

Instead, EPA decided to conduct additional Phase 1 testing using the Federal Test Procedure ("FTP")—the same test procedure used by CRC in E-74b and E-67[121]—in order to "magnify cold start impact" for ethanol fuels.[122] And CRC loaned EPA two vehicles thought to be more "sensitive" to ethanol's alleged NO_X effect.[123] Analyzing the preliminary data from interim testing of the E0 and E10 fuels, EPA tentatively concluded that the "test cycle was not (highly) influential on results."[124]

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of E-74b even while it was designing the EPAct study. *See, e.g.*, *id.* at A-97 (Chris Tennant, Deputy Dir., CRC, to Michael Christianson, ASD, OTAQ, EPA-RIF-001616 (Dec. 20, 2006)) (discussing the latest changes to the E-74b study and asking "[o]n a related topic, if memory serves me accurately you or one of your colleagues was working on a literature review relevant to the overall EPAct data needs discussion.").

[118] *See* Exhibit A, at A-29 (E-mail from Ed Nam, Dir., ASD, OTAQ, EPA, to Carl Scarbro, ASD, OTAQ, EPA, EPA-RED-000334 (June 1, 2008)) (comparing the results of the Phase 1 E10 fuel (fuel 18), with the results of CRC's E-67 study, which indicated that NO_x emissions should have increased for fuel 18); CRC E-67, *supra* note 46, at vii (finding E10 increased NO_X emissions relative to E0 except at the high T50 levels of 235°F); Sierra Research, *Effects of Vapor Pressure, Oxygen Content, and Temperature on CO Exhaust Emissions*, CRC Report No. E-74b, at 80 (2009) (finding E10 increased NO_X emissions "by approximately 10 percent in all FTP Bags and by larger amounts at higher oxygen contents."); Exhibit A, at A-139 (EPA, E0-E10-E15 Results from Phase 1 of EPAct Program, EPA-RIF-009068, at -009087 (Sept. 4, 2008)) (citing the results of CRC E-74b, which indicated an increase in NO_x emissions for Tier 2 vehicles).

[119] Exhibit A, at A-138 (EPA, E0-E10-E15 Results from Phase 1 of EPAct Program, EPA-RIF-009068, at -009082 (Sept. 4, 2008)).

[120] *Id.* ("If we continue seeing no NO_X effect, should we . . . [a]dd some tests with fuels that have exactly the same properties except for ethanol[?]").

[121] *Id.* at A-93 (Michael Christianson, ASD, OTAQ, EPA, to Rafal Sobotowski, ASD, OTAQ, EPA, EPA-RIF-001305 (June 27, 2007)) (emailing the FTP summary for CRC E-74b); CRC E-67, *supra* note 20, at 11 (explaining that the study used the FTP).

[122] Exhibit A, at A-138 (EPA, E0-E10-E15 Results from Phase 1 of EPAct Program, EPA-RIF-009068, at -009082 (Sept. 4, 2008)).

[123] *Id.*; After EPA's discussion about whether to "change the program midstream," CRC agreed to loan EPA two Tier 1 vehicles used in the E-74b study for interim FTP testing: A 1999 Honda Accord, and a 2001 Toyota Corolla. *Id.* at A-7 (Work Plan for Work Assignment 1-09, EP-C-07-028 (Nov. 17, 2008)). EPA expected these two CRC vehicles would be more "sensitive" to changes in ethanol content, because they had higher NO_X emissions. *See id.* at A-95 ("CRC E-74 Weekly Status Report 6.24.07.pdf", EPA-RIF-001319, at -001320, *attached to* E-mail from Michael Christianson, ASD, OTAQ, EPA, to Rafal Sobotowski ASD, OTAQ, EPA, EPA-RIF-001305 (June 27, 2007)). For lack of funding however, the two CRC vehicles were not tested prior to Phase 3. *See id.* at A-44 (EPAct/EISA Test Programs in ASD, 23rd Bi-Weekly Report, EPA-RED-001407, at -001408 (Mar. 12, 2009)) (reporting that the two CRC vehicles "will be tested after or during Phase 3 if funding is available.").

[124] Exhibit A, at A-41 (EPA, EPAct Program Update for Chet France, at EPA-RED-001207, at -001213 (Jan. 23, 2008)).

EPA had recently added the Phase 1 test fuels to the EPAct study's Phase 3 matrix in late August 2008.[125] But sometime after the preliminary results for Phase 1 became available in September 2008, EPA decided to drop the Phase 1 test fuels (then labeled #26, #27, and #28) from the Phase 3 fuel matrix.[126]

g. EPA Made Arbitrary, Eleventh-Hour Experimental Design Changes To Control Costs.

The test fuel matrix's G-efficiency fell even further to 51.6%, as EPA made a series of arbitrary changes to control costs.[127] Although EPA at first considered that only a design with G-efficiency above 60% would be satisfactory,[128] EPA later lowered its minimum standard to 50% in response to the deteriorating quality of its design.[129]

In November 2008, EPA reduced the maximum aromatic content to 35% in November 2008.[130]

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[125] EPAct Appendix A, Re-Design, *supra* note 47, at A-11; *see also* Exhibit A, at A-152, A-153 (E-mail from Robert Mason, SwRI, to James P. Uihlein, Chevron Products Co., EPA-RIF-012841, at -012843, -012844 (Aug. 21, 2008)). CRC's August re-design of the EPAct study is explained in more detail above. *See supra*, p. 1.

[126] EPAct Appendix A, Re-Design, *supra* note 47, at A-12 ("Fuels 26, 27 and 28 were removed from the matrix design #4."). A memorandum submitted in support of EPA's Tier 3 rule claims that while EPA's original intent was "to fold the data from" the pilot fuels into the Phase 3 dataset, EPA "decided against it for a number of reasons related to improvements made in vehicle handling and prep procedures . . . as well as . . . concerns related to fuel blending[.]" Aron Butler, ASD, OTAQ, EPA, Data Collected in EPAct Fuel Effects Study Pilot Phases, EPA-HQ-OAR-2011-0135 (Apr. 29, 2013).

[127] This diminished G-efficiency value does not fully capture the diminished objectivity and utility of the EPAct study, because it does not take into account the eleventh hour reduction of test fuels and vehicles due to funding shortfalls or the decision to omit the inaccurate Bag 3 (hot start) results. *See infra* at p. 28. Nor does it account for the radical over-simplification that comes with treating T50 and T90 as representative of all distillation temperatures in a study of ethanol blends or treating all aromatics alike. *See infra* at pp. 34–37.

[128] Exhibit A, at A-37 (EPA, Fuel Matrix Design Options, EPA-RED-001086, at -001087 (Jul. 18, 2007)) (">60% considered satisfactory").

[129] *Id.* at A-147 (E-mail from Robert L. Mason, SwRI, to James P. Uihlein, Chevron Products Co., EPA-RIF-012788 (Aug. 27, 2008)) ("It is useful to have a higher efficiency because that indicates that the design is close to having orthogonal effects. However, the efficiency is connected to the candidate set of fuels being considered so we need to be careful to compare efficiencies of designs that used the same candidate set of fuels in their construction. The value of 50% efficiency is a lower bound by many users on what is acceptable. Increased to 64% efficiency is a good return, but probably increasing beyond 80% or 90% is not that great an improvement.").

[130] *Id.* at A-70 ("Appendix 1 to EPAct Fuel Development Protocol_Detailed Test Fuel Specification_Version 9-22-2008.xls.", EPA-RIF-000443, *attached to* E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Kevin Whitney, Project Mgr., SwRI, EPA-RIF-000442 (Nov. 12, 2008)); EPAct Program Design Report, *supra* note 49, at 16.

In February 2009, Chet France, the Director of the Assessment and Standards Division at OTAQ, "emphasiz[ed] ethanol effects as a goal of the program."[131] And EPA staff decided that, if it had "whittle down" fuels for hydrocarbon speciation, it should emphasize ethanol and "not worry about T50/T90 effects."[132] As a result, EPA reduced the experiment to 12 fuels for speciated hydrocarbons as part of a "reduced design" that emphasized ethanol.[133]

That month, EPA arbitrarily raised the T50 of the E15 test fuels from 195°F to 220°F.[134] EPA then raised the lower T50 level for the E15 and E20 fuels, to 160 and 165°F respectively.[135] According to SwRI, the changes were necessary in order "match levels achievable with the available blending components,"[136] but EPA's report provided a different (and rather curt) explanation. EPA said it raised the high T50 level for the E15 test fuels after discovering that the "upper T50 limit for E15 fuels was as high as 220°F."[137] In other words, EPA raised the T50 of higher ethanol fuels as high as it would go after being instructed to "emphasize ethanol effects as a goal of the program."[138]

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[131] Exhibit A, at A-31, A-32 (E-mail from Catherine Yanca, to Rich Cook, & Joseph Somers, ASD, OTAQ, EPA, EPA-RED-000537, at -000537, –000538 (Feb. 24, 2009)).

[132] *Id.* at A-31 (E-mail from Rick Cook, ASD, OTAQ, EPA, to Catherine Yanca, EPA-RED-000537 (Feb. 25, 2009)).

[133] EPAct Program Design Report, *supra* note 49, at 65; *see also* Exhibit A, at A-42 (Proposed Speciation List, EPA-RED-001406 (Mar. 11, 2009)); *id.* at A-9 (EPAct Program Update for Chet France, Status and Budget (Mar. 2, 2009)) (proposing to reduce the scope of speciation even though the "data [was] necessary for [air quality] modeling and toxic emission factors.").

[134] Exhibit A, at A-42 (Proposed Speciation List, EPA-RED-001406 (Mar. 11, 2009)).

[135] *See infra* Exhibit B, at B-12. SwRI's Re-Design Appendix erroneously indicates that EPA increased the low T50 level for the E15 test fuels to 165°F. EPAct Appendix A, Re-Design, *supra* note 47, at A-8. But EPA's specifications show that it increased the low E15 level to 160°F, not 165°F. EPAct Program Design Report, *supra* note 49, at 16.

[136] EPAct Appendix A, Re-Design, *supra* note 47, at A-8.

[137] EPAct Program Design Report, *supra* note 49, at 16. EPA's decision was likely motivated by cost considerations, not design reasons. By adding lighter-end hydrocarbons, EPA would boil-off the ethanol components in the T40 range, which would make the E15 test fuels easier to blend and measure. *Id.* at 37 (showing how the "knee of distillation" for the EPAct study's E15 test fuels was in the T40 range, in contrast with other test fuels with a knee of distillation in the T50-T60 range). Jim Uihlein had already suggested to EPA that a "T50 of 190" would "be difficult to blend for the E15." Exhibit A, at A-103 (E-mail from James P. Uihlein, Chevron Products Co., to Rafal Sobotowski, ASD, OTAQ, EPA, et al., EPA-RIF-003001 (Feb. 22, 2008)). At that time, EPA decided to maintain the T50 temperature for the E15 test fuels at 190°F, believing the blender would have no problem blending these fuels. *Id.* at A-106 ("Response to Uihlein.doc", EPA-RIF-003014, *attached to* E-mail from Rafal Sobotowski ASD, OTAQ, EPA, to Rafal Sobotowski, EPA-RIF-003013, at -003014 (Feb. 24, 2008)) (stating that the blender "has blended some E15 fuels in recent months and does not see a problem in achieving T50 of 190F"). EPA's later decision to raise the T50 temperature to 220°F is likely a result of the blender's failure to blend these test fuels to specification.

[138] Exhibit A, at A-31 (E-mail from Catherine Yanca, to Rich Cook, & Joseph Somers, ASD, OTAQ, EPA, EPA-RED-000537, at -000537–38 (Feb. 24, 2009)). Although these last-minute, arbitrary changes by EPA were not part of a comprehensive re-design effort by SwRI, they are reported in SwRI's EPAct Appendix as Design #5. EPAct Appendix A, Re-Design, *supra* note 47, at A-13.

In any event, EPA's eleventh-hour changes raised the average T50 for the E15 test fuels to 220°F—higher than the average for the E10 test fuels (195°F), even though raising ethanol content naturally lowers the T50 of gasoline in the marketplace.[139] And EPA's changes lowered the G-efficiency of Design #5 to 51.6%,[140] lower than any of the previously proposed matrices and dangerously close to EPA's new "lower bound."[141]

EPA's last-minute changes were not limited to the fuel matrix. EPA also lowered the number of Phase 3 test vehicles to 10 from an initial fleet of 19,[142] eventually increasing the number to 15 vehicles a full thirty-seven weeks after vehicle testing had begun (Phase 3 testing took 60 weeks in total).[143] For hydrocarbon speciation, EPA also decided to use only 5 vehicles for Bags 2 and 3, with no replicate tests.[144] And Paul Machiele, the Director of EPA's Fuels Center, directed the EPAct study's test team to begin vehicle testing the fuels as they were available, without fully randomizing all the test fuels.[145] EPA began fully randomizing the test fuels only after twelve weeks of testing.[146]

EPA continued manipulating the design of the study, even after the results for Phase 3 were in. EPA, for example, omitted results for Bag 3 (hot start) emissions, "as review of results suggests that the models for Bag 3 may be less reliable than those in Bags 1 and 2."[147]

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[139] EPAct Appendix A, Re-Design, *supra* note 47, at A-13.

[140] *Id.*

[141] Exhibit A, at A-147 (E-mail from Robert L. Mason, SwRI, to James P. Uihlein, Chevron Products Co. EPA-RIF-012788 (Aug. 28, 2008)).

[142] *Id.* at A-35 (EPA, EPAct Program Update for Chet France, Status and Budget, EPA-RED-000899, at -000900 (Feb. 19, 200[9*]) (* The initial presentation slide is erroneously dated Feb. 19, 2008, but the presentation occurred on February 19, 2009.). EPA also considered eliminating one or two test fuels to control costs, but this change would have reduced G-efficiency below 50%, "the minimum acceptable limit." *Id.* at A-9 (EPAct Program Update for Chet France, Status and Budget (Mar. 2, 2009).

[143] *See* EPAct Program Design Report, *supra* note 49, at 51 ("Due to initial funding limitations, only ten vehicles were included in the original Phase 3 test plan. Two additional vehicles were added to the matrix in the 25th week of testing, and three additional vehicles were added in the 37th week of testing.").

[144] *Id.* at 65.

[145] Exhibit A, at A-143 (EPAct bi-weekly updated mtg, EPA-RIF-012086 (Aug. 8, 2008)) ("Paul says start w/ whatever handful of fuels we have on 11/1, then re-randomize as new fuels arrive"); EPAct Program Design Report, *supra* note 49, at 50–51 (explaining the EPAct study's incomplete randomization). Randomization "is a procedure whereby factor-level combinations are . . . assigned to a test sequence in such a way that every factor-level combination has an equal chance of being assigned to any experimental unit or position in the test sequence." Mason et al., *supra* note 96, at 142. Randomizing is important because it "affords protection from bias by tending to average the bias effects over all levels of the factors of an experiment." *Id.* at 141.

[146] EPAct Program Design Report, *supra* note 49, at 51.

[147] EPAct Final Report, *supra* note 2, at 3.

h. EPA Allowed Biased Market Actors To Measure the Properties of the Test Fuels.

The EPAct study's objectivity is also suspect in that the entities responsible for measuring the properties of the test fuels, including T50, T90, ethanol, and aromatics content were mostly oil companies.[148] In the "round robin" fuel testing process, the testing companies were allowed to see how their data compared with the other companies' before it was finalized.[149] This created the possibility of uncorrected mistakes or even collusion between the various testing companies who could adjust their own data to match the others'. And the risk of mistakes is not merely hypothetical: "EPA and NREL identified [unspecified] results [that] were obviously in error and requested retesting by the respective laboratories."[150] Contrary to EPA's information integrity policy,[151] the Agency has not made the erroneous fuel testing data public. This is significant, because the accuracy of the entire EPAct study and, by extension, the MOVES2014 model, depends on accurate identification of the test fuel properties.

i. CRC Bought EPA's Test Vehicles So that EPA Could Complete the EPAct Study.

EPA concluded Phase 3 of the EPAct study on June 2010,[152] more than a year after EPA's target end date.[153] EPA was too late to use the EPAct study's flawed Phase 3 data for the 2010 Renewable Fuel Standard Rule, but EPA planned to use the EPAct study's flawed data to update its vehicular emissions model, MOVES, and satisfy other statutory requirements.[154]

Due to EPA's delays, the vehicle leases expired before EPA could conclude testing. To ensure the EPAct study could reach its (flawed) conclusions, CRC purchased the "test vehicles and made them available to the test program for the remainder of its duration" at no

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[148] *See* EPAct Program Design Report, *supra* note 49, at 26 ("BP, Chevron, ConocoPhillips, EPA, ExxonMobil, Marathon, PAC (distillation equipment manufacturer) and Shell").

[149] *Id.* at 29.

[150] *Id.* at 30.

[151] *See* Information Quality Guidelines, *supra* note 5, at 13.

[152] *Id.* at 7 ("Phase 3 data collection was completed in June 2010").

[153] *See* Exhibit A, at A-142 (EPA, E0/E10 Results from Phase 1 of EPAct Program, Preliminary, EPA-RIF-010696, at -010708 (June 30, 2008) (showing that EPA intended to conclude Phase 3 in early March 2009)).

[154] *Id.* at A-2 (Rich Cook, ASD, OTAQ, EPA, Emissions from Tier 2 Vehicles Running on Ethanol/Gasoline Blends, Presentation for ATRA, at 16 (March 10, 2011)).

charge to EPA.[155] EPA's acceptance of these vehicles was an unlawful "augmentation" of the Agency's appropriated budget.[156]

2. The EPAct Study's Test Fuel Properties Were Inconsistent with the Range of Fuel Properties Found in the Market.

Although the EPAct study was intended to "provide the basis for generation of updated fuel effects models representing the gasoline vehicle fleet at the time of the study,"[157] EPA expressly declined to use real-world fuels in the study.[158] This omission is hard to fathom for a study intended to "provid[e] a basis for the development of statistical models capable of predicting emissions for the majority of *in-use fuels*."[159]

At the very least, the EPAct study should have included a reference case of splash-blended gasoline-ethanol fuels actually used in the marketplace. Instead, it included only fuels artificially match-blended to predetermined parameters,[160] even though refiners have no economic, regulatory, or environmental reason to artificially elevate T50 when blending ethanol into fuel.[161]

Even worse, the test fuels contradict EPA's own prescription that "the properties of the test fuels are assigned to span the ranges of in-use fuel properties."[162] Although EPA said this was that "[a] critical feature of the study design,"[163] the test fuels have key properties,

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[155] EPAct Program Design Report, *supra* note 49, at 5.

[156] *See* 2 GAO, *Principles of Federal Appropriations Law*, at 6-223 (3d ed. 2004) ("[A]cceptance of a gift of money or other property by an agency lacking statutory authority to do so is an improper augmentation"); *see also Story v. Snyder*, 184 F.2d 454, 456 (D.C. Cir. 1950) ("gifts to the United States which involve any duty, burden, or condition, or are made dependent upon some future performance by the United States, are not accepted by the Government unless by the express authority of Congress"). In addition, EPA appears to have violated regulations requiring agencies to report gifts to the General Services Administration. *See, e.g.*, 41 C.F.R. § 102.36.405.

[157] EPAct Final Report, *supra* note 2, at 1.

[158] *See* EPA, Air Toxic Emissions from On-road Vehicles in MOVES2014, at 19 (Dec. 2014) (hereinafter Air Toxics in MOVES2014) ("The properties of the test fuels were not assigned to represent in-use fuels, but rather to allow development of statistical models that would enable estimation of relative differences in emissions across the ranges of fuel properties expected in commercially available summer fuels in the U.S.").

[159] EPAct Final Report, *supra* note 2, at 1 (emphasis added).

[160] EPA and its consultants removed the three test fuels that had characteristics of splash-blended market fuels (relatively low T50 and low aromatics). *See supra* p. 18.

[161] Anderson et al., *supra* note 7, at 1034 ("[M]inimal modifications to the blendstock should be required assuming that future specifications for E15 and higher blends are carried over from existing E10 specifications.").

[162] EPAct Final Report, *supra* note 2, at 1.

[163] *Id.*

including octane ratings, distillation temperatures, and aromatics levels, that exceed the range found in the market.

a. The Test Fuels' Octane Levels Were Skewed High.

Octane—a critical measure of a fuel's resistance to premature combustion— was not among the fuel parameters that were matched in the EPAct study. Indeed, octane could not have been matched given the EPAct study's methodology. In order to achieve the arbitrary T50 and T90 parameters, the study's designers added *more* high-boiling-point, high-octane hydrocarbons to the test fuels whose distillation temperatures would naturally be lowered by the addition of ethanol. But this is the opposite of what occurs in the market. Real fuel refiners add *less* of these costly hydrocarbons, not more, to blendstocks designed for ethanol blending, "taking advantage of ethanol's octane value."[164]

Because it ignored this well-known real-world refinery practice to satisfy its arbitrary match-blending methodology, the EPAct study's test fuels contained unrealistically high levels of octane. All of the E10 test fuels, for example, had octane ratings in the range of 90.6 to 94.7 AKI—far above the combined market average of

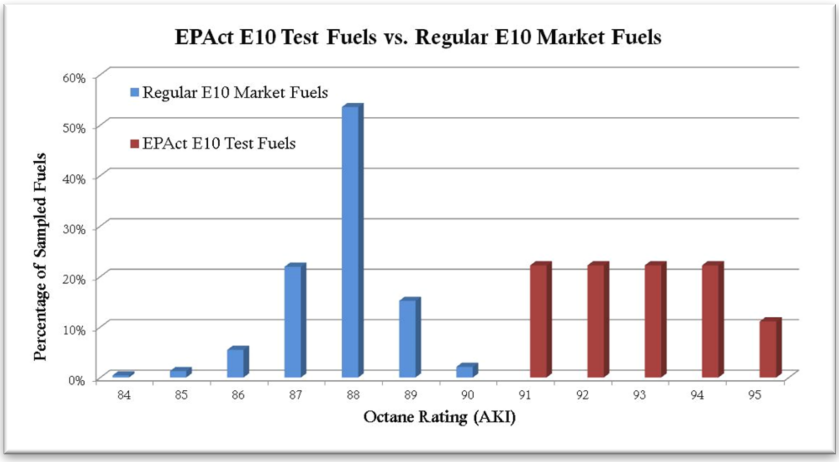

Figure 2. *See* Exhibit D, at D-2.

[164] Control of Air Pollution from Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards Final Rule: Regulatory Impact Analysis, at 3-3 (Mar. 2014) (hereinafter Tier 3 RIA); *see also* Draft Regulatory Impact Analysis: Tier 3 Motor Vehicle Emission and Fuel Standards (Mar. 2013), at 3-2 ("[T]he [Alliance of Automobile Manufacturers summer fuel] survey does tell us one important thing about octane—refiners are doing their best not to give it away. We anticipate that this trend will continue into the future as E15 replaces E10."). Thus, as the ethanol content of gasoline rose from 0 to 10%, the octane level of the pre-ethanol blendstock fell accordingly. *See* Tier 3 RIA, *supra*, at 3-3 ("[T]he average octane of finished regular grade gasoline has remained constant between 87-88 AKI over the past decade . . . despite the increasing blend of ethanol. . . ."); *id.* ("[I]t is evident that many refiners have backed off on octane production at the refinery by reducing levels of aromatics and olefins."); Exhibit C, at C-4. Today's gasoline begins with a blendstock roughly 2 to 2.5 octane points lower than the final gasoline; it receives those 2 to 2.5 octane points when it is eventually blended with the most cost-efficient source of octane, ethanol. *See* David S. Hirshfeld et al., *Refining Economics of U.S. Gasoline: Octane Ratings and Ethanol Content*, 48 Envt'l Sci. & Tech. 11064, 11065 (Aug. 21, 2014).

88.3 AKI.[165] *See* Figure 2. The test fuels' octane ratings are closer to (though on average they still exceed) the octane ratings of premium fuel,[166] which represents just 10% of all fuel sales.[167]

These octane ratings did not span the range found in the market. Indeed, the octane ratings of some test fuels exceeded the highest ratings found in any market fuel—regular or premium.[168] No test fuel approached the low end of the octane range of market fuel—84.20 AKI.

The test fuels' high octane ratings are unrealistic. Barring some regulatory action to establish a minimum octane rating, increasing the ethanol content of gasoline beyond E10 should only further reduce the octane levels of the blendstock as refiners respond to economic incentives to produce lower volumes of the high-boiling-point hydrocarbons used to raise octane levels in the absence of ethanol.[169] *See* Figure 3.

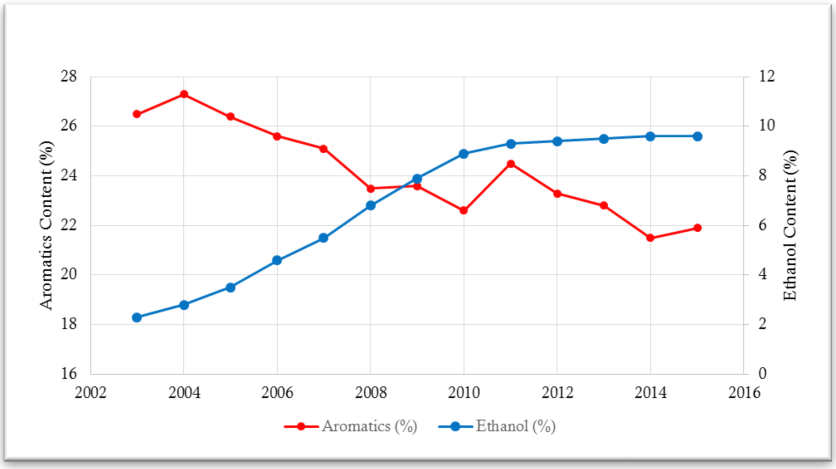

Figure 3. *See* Exhibit C, at C-4.

As Anderson et al. points out, widespread adoption of a high-octane fuel, whether by market forces or by an exercise of EPA's authority to set a minimum octane requirement to reduce air toxics,[170] would allow for innovations in engine design with corresponding

[165] *See* Exhibit D, at D-1. This value is weight-adjusted to account for varying sales of regular and premium fuel.

[166] *See id.* at D-3.

[167] *See id.* at D-1, n.2.

[168] *See id.* at D-1. Some test fuels had octane ratings as high as 103 RON [research octane number). Anderson et al., *supra* note 7, at 1036.

[169] *See* Hirshfeld et al., *supra* note 164, at 11067.

[170] *See* Clean Air Act § 202(*l*), 42 U.S.C. § 7521(*l*).

improvements in fuel efficiency and reductions in emissions.[171] But the EPAct study does not account for these benefits, even though it makes use of high octane fuels.[172]

b. The Distillation Temperature Range of the Test Fuels Exceeded that of Market Fuel.

Although the EPAct test fuels were intended to "cover[] typical market ranges of ethanol, T50, T90, aromatics, and RVP,"[173] the range of T50 values in EPAct test fuels (165–240°F) is significantly higher than the observed range of T50 values for E10 market fuel (154.8–226.5°F)[174] and for splash-blended E15 using commercial blendstocks (155–206°F).[175] This is the result of the EPAct study's designers' decision to raise the "T50 of E15 fuel 26 and all E20 fuels . . . to 165°F from 150°F and 160°F, respectively," and to raise the "T50 of E15 fuels 27 and 29 . . . from 190°F to 220°F."[176] In the market, when ethanol is blended into gasoline, T50 drops because ethanol's boiling point is lower than the other octane additives it replaces. The EPAct study designers did the opposite, raising T50 in higher ethanol blends through the addition of high-distillate hydrocarbons to compensate for ethanol's downward effect on T50.

In addition, the EPAct study's final boiling point ("FBP") was unusually low. The average FBP in the EPAct study was 369.1°F, and the highest FBP temperature was 384.7°F.[177] In the market, by contrast, the average FBP is 396°F—higher then the highest FBP found in the EPAct study's test fuels—and some market fuels have a FBP as high as 436°F.[178] The test fuels' unusually low FBP further demonstrates that the EPAct study's fuel properties did not span the range of market fuels.

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[171] Anderson et al., *supra* note 7, at 1036; *accord* Tier 3 Rule, 79 Fed. Reg. at 23528-29 (noting that a midlevel ethanol blend like E30 "could help manufacturers who wish to raise compression ratios to improve vehicle efficiency as a step toward complying with the 2017 and later light-duty greenhouse gas and CAFE standards").

[172] *Id.*

[173] Final Report, *supra* note 2, at 76.

[174] Texas Fuel Survey (June 2014), June2014_GasolineDataReport_NoDHAData.xlsx, http://www.tceq.texas.gov/assets/public/implementation/air/am/contracts/reports/mob/5821199776FY1420-20140815-ergi-summer_2014_fuels_DataFiles.zip, *accompanying* Diane Preusse et al., Eastern Research Group, Inc., 2014 Summer Fuel Field Study: Final Report (Aug. 15, 2014).

[175] EPA said the "upper T50 limit for E15 fuels was as high as 220°F." EPAct Program Design Report, *supra* note 49, at 16. But an API study demonstrates that commercial E15 fuels have a range of 155°F to 206°F. American Petroleum Institute, Determination of the Potential Property Ranges of Mid-Level Ethanol Blends: Final Report 21 (Apr. 23, 2010).

[176] EPAct Appendix A, Re-Design, *supra* note 47, at A-12.

[177] EPAct Program Design Report, *supra* note 49, at 31–32.

[178] Alliance of Auto. Mfrs., 2014 Summer North American Fuel Survey.

c. The EPAct Study's E15 Test Fuels With High T50 Exceeded ASTM's Driveability Index.

Out of the three E15 fuels in the final test fuels matrix of the EPAct study, one of them could not legally be sold in the market, because it exceeded the ASTM driveability index (DI) maximum of 1250, according to the formula then in effect.[179] Test fuel 27 has a DI value of 1255.[180] The high T50 value of this fuel (221.5°F) is responsible for the excessive DI value. A T50 value of 183°F or lower would remedy the problem, and that would be the effect of simply splash-blending additional ethanol into an existing gasoline blendstock.

The EPAct study's reliance on fuels that could not legally be sold demonstrates that the Study is not objective and casts doubt on the accuracy of its results. Elevating these distillation temperatures increased emissions from higher ethanol fuels without an objective scientific basis.

d. The Test Fuels' Aromatics Levels Were Skewed High.

The aromatics levels of the EPAct test fuels also fell short of the study's aspiration to "span the ranges of in-use fuel properties."[181] Each test fuel included between 14.1% and 35.8% aromatics.[182] But the market includes fuels with aromatics levels as low as 3.9%. Because the aromatics levels in the test fuel matrix are skewed high, the average aromatics content of the EPAct test fuels was much

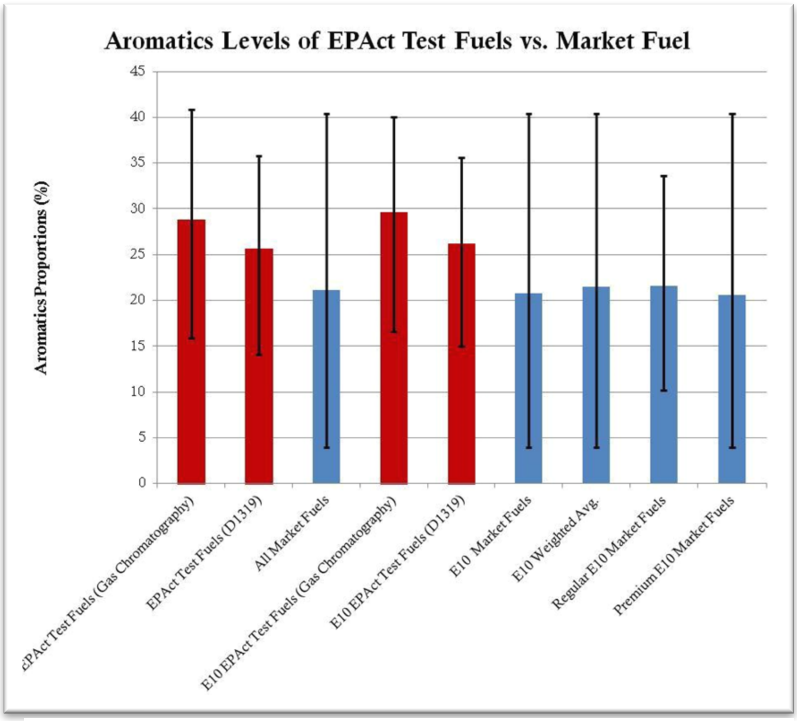

Figure 4. *See* Exhibit C, at C-3.

[179] ASTM, Standard Specification for Automotive Spark-Ignition Engine Fuel, D4814-10b, at 2, Table 1. Moreover, using the most up to date DI for E15 blends, two out of three E15 test fuels, test fuels 27 and 28, violated the ASTM standard. *See* Exhibit E, at E-2. Test fuels 27 and 28 had a DI value of 1360 and 1307, respectively. *Id.*

[180] *See* Exhibit E, at E-1.

[181] EPAct Final Report, *supra* note 2, at 1.

[182] *See* Exhibit C, at C-3. These aromatics volumes were calculated according to the D1319 method.

higher (25.6%) than the market average (21.1%).[183] *See* Figure 4.

The omission of fuels with truly low levels of aromatics undermines the objectivity and utility of the results. Higher ethanol blends, like the E20 fuels in the EPAct study, would have aromatics levels even lower than can be found in the market today. History shows that as ethanol levels rise, refiners reduce reformer intensity and aromatics content to take advantage of ethanol's high octane value.[184]

Making matters worse, EPA's own analysis of the test fuels using the highly sensitive method of gas chromatography revealed that the test fuels' aromatics levels significantly exceeded the levels for which they were designed.[185] As re-designed, the EPAct study's high-aromatics test fuels were to be composed of 35% aromatics.[186] But when analyzed by gas chromatography (GC),[187] some of the high-T90 test fuels revealed aromatics levels approaching or exceeding 40%.[188] Likewise, some of the low-aromatics test fuels, which were intended to have 15% aromatics, actually had more than 20% aromatics.[189] This inconsistency between the study's design and its execution and between actual aromatics levels of the high-T90 and low-T90 test fuels undermines the objectivity of the study and the accuracy and integrity of its results.

Critical to the EPAct study's findings about ethanol, the test fuel matrix does not include a single E15 fuel with low T90 and low aromatics. Former fuel 28 (in Design #4), which possessed those characteristics (22.6% aromatics and a T90 of 325°F) was removed from the study in the final revisions to the fuel matrix.[190] The remaining three E15 test fuels had characteristics associated with pollution. Two out of the three had high aromatics (35%), two out of the three had high T50 (220°F), and two out of the three had high T90 (340°F).[191] The EPAct study's disproportionate association of E15 with pollution-producing aromatics contributes to the EPAct study's erroneous link between ethanol and emissions.

The EPAct study's failure to use ethanol blends with typical octane ratings, distillation temperatures, and aromatics levels had a profound effect on its results. The Final Report admits ethanol's emissions profile would have been much more favorable, if EPA had followed ordinary refinery practices for producing fuel for blending with ethanol: "if typical

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[183] *See* Exhibit C, at C-3.

[184] *See id.* at C-4; *see also supra* note 164 and accompanying text.

[185] *See* Exhibit C, at C-1.

[186] EPAct Appendix A, Re-Design, *supra* note 47, at A-13.

[187] The lower levels of aromatics reported by the EPAct study were measured according to D1319, which is less accurate than GC. *Cf.* EPAct Final Report, *supra* note 2, at 23, tbl. 4.

[188] *See* EPAct/V2/E-89 detailed fuel properties, http://bit.ly/2icji2m.

[189] *Id.*

[190] EPAct Appendix A, Re-Design, *supra* note 47, at A-13.

[191] *Id.*

collateral fuel changes (lower T50 and aromatics) are accounted for, we might project that blending ethanol would tend to reduce [total hydrocarbon (THC)], [non-methane hydrocarbon (NMHC),] and [non-methane organic gas (NMOG)] emissions (highlighting the important sensitivities of these other fuel parameters.)"[192] Unfortunately this critical caveat about the study's design is not reflected in its reported results or in the emissions factors of the MOVES2014 model on which the states must now base their Implementation Plans.[193]

3. The EPAct Study Failed To Control for Confounding Variables.

The EPAct's designers recognized that "consideration of single coefficients in isolation can easily result in misleading conclusions."[194] Unfortunately, the EPAct study and the MOVES2014 model derived from it both neglect this warning. The EPAct Final Report concludes that "[o]ther factors being equal, increasing ethanol is associated with an increase in emissions, as indicated by the positive ethanol coefficients in most models, both for running and start emissions."[195]

Critically, the EPAct study makes no serious effort to disentangle these "other factors" in its reported results. Indeed, disentangling them would be impossible because some of the studied parameters, like octane, distillation temperatures, driveability, and aromatics fall outside the range found in the market, as described above.[196]

Even worse, the EPAct study left uncontrolled some of the most important fuel parameters, like octane, T70, aromatics speciation, density, saturate content, and olefin content. The EPAct study failed to account for the significant effect these parameters have on emissions. Thus, even if EPA had been able to accurately match its selected properties, a study limited to EPA's five chosen parameters would still have been unable to produce accurate results.

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[192] EPAct Final Report, *supra* note 2, at 232; *see also id.* at 231 ("[S]ince blending ethanol into gasoline also affects many other fuel properties, and given that ethanol is blending in [sic] into gasolines in different ways that affect the collateral property changes differently, it is difficult to interpret trends across the body of literature without more information on multiple fuel property changes.").

[193] According to the MOVES2014 model, ethanol increases pollution even when the other parameters associated with emissions decrease. *See* Exhibit F, at F-11 to F-12, tables 2–4 (fuel parameter inputs); *id.* at F-28 ¶ 32(a) (results summary).

[194] EPAct Final Report, *supra* note 2, at 3; *see id.* ("[I]n interpreting or applying the models, *it is critical to consider the effects of all five fuel properties in conjunction with each other*.").

[195] *Id.* at 7. This gives rise to a serious "risk that the EPAct model will be applied or interpreted incorrectly, leading to incorrect conclusions about fuel property effects on emissions." Anderson et al., *supra* note 7, at 1034. Even if it were possible to reverse-engineer an accurate allocation of emissions effects among the fuel parameters studied—and for reasons discussed above at 27–33 it is not—the EPAct study's misleading conclusions violate the Information Quality Guidelines' requirement that information "be[] presented in an accurate, *clear*, *complete*, and *unbiased* manner." Information Quality Guidelines, *supra* note 5, at 15; *see also id.* at 22 (requiring influential risk assessments to be presented in a manner that is "consistent with the purpose of the information" and "comprehensive, *informative*, and *understandable*").

[196] *See supra* pp. 27–33.

a. The EPAct Study Did Not Control for Octane.

When refiners blend fuel, they do not match the parameters that were controlled in the EPAct study, but they *do* match one key parameter that the EPAct study did not control—octane.[197]

The EPAct study does not account for the varying (and unrealistic) octane levels of the test fuels, because octane is not one of the studied parameters. This is an important omission, because the octane additives that EPA used to match the target distillation temperatures all contribute to pollution. The uncontrolled and disparate octane levels of the test fuels therefore confound the results of the study.

b. The EPAct Study Did Not Control for Distillation Temperatures Other than T50 and T90.

The study fails to control for differences in the full range of the test fuels' distillation temperatures (other than the T50 and T90 boiling points). T50 and T90 are arbitrary distillation temperatures that do not fully capture the distillation profile of a blended fuel. And matching the T50 and T90 of different test fuels with varying ethanol concentrations does not guarantee that all of the fuels will have the same distillation temperature profile. Indeed, that is not feasible due to ethanol's near-azeotropic effect, which affects distillation temperatures in a nonlinear fashion. The higher the ethanol content, the more (or higher distillate) the hydrocarbons required to match T50 and T90.

Anderson et al. demonstrated that two different EPAct test fuels with the same T50 and T90 can have very different distillation profiles, because "matching T50 and T90 for ethanol-gasoline blends does not ensure that the region in between will also be matched."[198] The T50 of ethanol blends can only be elevated by adding high-distillate hydrocarbons to the fuel.[199] This artificially raises the T60-T80 range of those fuels significantly higher than for test fuel with less ethanol.[200]

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[197] *See supra* pp. 28–30.

[198] Anderson et al., *supra* note 7, at 1031.

[199] *Id.* at 1032 ("[M]atching the T50 and T90 of the ethanol-containing fuels requires that their BOBs contain a greater proportion of heavier (higher boiling point) hydrocarbons than the corresponding E0 fuels.").

[200] *Id.* ASTM, the private standard setting organization for gasoline, has acknowledged that "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." ASTM, Standard Specification for Automotive Spark-Ignition Engine Fuel, D4814-16e, at 16. In other words, elevated T60 to T80 temperatues are due in part to high levels of aromatics.

In a recent paper, EPA responds that, unmatched T60–T80 distillation temperatures represent "represent[] an exception rather than the rule."[201] Not so. Within every set of EPAct test fuels with matched T50 and T90, and varying ethanol concentrations, the boiling points of one or more higher-ethanol fuels exceeded those of one or more lower-ethanol fuels for the entire T60–T80 range.[202] *See, e.g.*, Figure 5. For two of the E10 test fuels (Fuels 10 and 12), the T70 values exceeded the highest levels reported in the national market fuel survey conducted by the Auto Alliance in 2006 (270°F).[203] Two E15 test fuels (Fuels 26 and 27) and three E20 test fuels (Fuels 23, 25, and 31) also have T70 values above that level.[204]

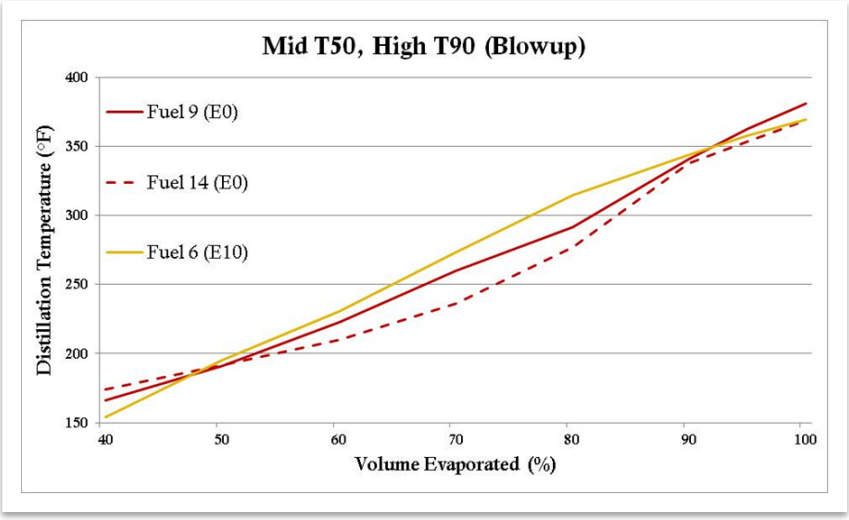

Figure 5. *See* Exhibit G, at G-4.

This uncontrolled T60–T80 bubble confounds the reported emissions effects, attributing to ethanol the effects of aromatics used to match T50 and T90. Anderson et al. predicted that these "higher T60, T70, and T80 values will likely have an adverse impact on tailpipe emissions (similar in magnitude as the T50 and T90 impacts), even though T50 and T90 are the same."[205] That is because the high-distillate hydrocarbons themselves—and the higher temperatures required to vaporize them—increase pollution.[206] It is no coincidence that the two E10 fuels with the highest T70 values also produced the highest levels of PM emissions in the EPAct study.[207]

A subsequent study confirmed that EPA's exclusion of T70 as a controlled parameter in the EPAct study skewed the results against ethanol. "[I]f T70 is added to the Bag 1 [cold-start] EPAct model and used in EPA's MOVES2014 emission inventory model, increased

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[201] Aron Butler et al., *Influence of Fuel PMI Index and Ethanol Content on Particulate Emissions from Light-Duty Vehicles*, SAE Tech. Paper 2015-01-1072, at 2.

[202] *See* Exhibit G.

[203] 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 3.

[204] *See* EPAct Program Design Report, *supra* note 49, at 32.

[205] *See* Anderson et al., *supra* note 7, at 1031.

[206] *See id.* at 1032 ("The addition of these hydrocarbons with lower volatility (and poorer fuel vaporization and air-fuel mixing) can reasonably be concluded to be the underlying cause of the increased emissions.").

[207] Darlington et al., *supra* note 203, at 3.

ethanol levels beyond E10 are predicted to reduce PM from on-road motor vehicles in the U.S."[208] The EPAct study reached the opposite conclusion, because it ignored T70.

c. The EPAct Study Did Not Control for Differences in Aromatics Species.

EPA has previously acknowledged that "aromatics do not appear to be created equally in terms of the potential impact on vehicle PM emissions."[209] Specifically, the Agency has cited "a growing number of studies showing the influence of higher-boiling aromatic compounds on particulate matter (PM) emissions from gasoline vehicles."[210]

Nevertheless, the EPAct study's match-blending methodology treats all aromatics alike for purposes of achieving the 15% and 35% aromatics levels of the test fuels. This had an ineradicable confounding effect on the results of the study, because high-boiling-point aromatics were included in the various test fuels in varying proportions based on their respective ethanol levels. EPA admits that "[a]s a practical matter of meeting the distillation targets, the proportions had to be adjusted to include more C7 and C8 aromatics for fuels with a combination of low T90 and high aromatics."[211]

As a result, fuels with higher ethanol content generally had higher doses of PM-causing high-distillate aromatic and saturated hydrocarbons in order to equal the T50 and T90 of lower ethanol blends. This phenomenon is not speculative. Anderson et al. used the EPAct study's reported test fuel hydrocarbon speciation data to demonstrate that the blendstocks modified for higher ethanol blends have higher Particulate Matter Index (PMI) values—a measure of a fuel's expected PM emissions—than blendstocks prepared for lower ethanol levels.[212] This trend is inconsistent with conditions in the real world, where high- and low-distillate aromatics appear in relatively consistent proportions throughout the fuel pool.[213] Even worse, the EPAct study's disproportionate levels of high-distillate hydrocarbons were not accounted for in the study's results, and the increased PM emissions they caused were therefore wrongly attributed to ethanol.[214]

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[208] *Id.* at 1.

[209] Tier 3 RIA, *supra* note 164, at 3-10.

[210] *Id.* at 3-9; *see id.* ("A study published by the Japan Petroleum Energy Center (JPEC) found that PM mass emissions from a light-duty gasoline vehicle increased with increasing carbon number of aromatics in the gasoline. Honda has published a "PM Index" that correlates PM emissions to the double bond equivalent (DBE) and vapor pressure (V.P) of the fuel components. . . . According to this model, gasoline containing a large fraction of low-volatility compounds with high DBE values is expected to produce greater PM emissions.").

[211] EPAct Program Design Report, *supra* note 49, at 14.

[212] *See* Anderson et al., *supra* note 7, at 1033.

[213] Tier 3 RIA, *supra* note 164, at 3-8 ("[T]he relative proportions of the molecular species by carbon number [are] relatively consistent across [a national survey of fuel] samples.").

[214] Anderson et al., *supra* note 7, at 1033 ("[T]he PMI values of the gasoline blendstocks increase significantly with increasing ethanol content in the finished fuels due to the addition of high-boiling-point

d. The EPAct Study Did Not Control for Density.

In the market, ethanol displaces higher density octane additives. Thus, refiners historically have lowered the density of the gasoline blendstock as the volume of ethanol to be blended into that gasoline has risen.[215] The EPAct test fuels invert this market trend: test fuels with more ethanol were generally more dense, not less. *See* Figure 6. This demonstrates the lengths to which EPA and its consultants had to go to achieve their arbitrarily matched fuel parameters—adding high-density fuel components to cancel out ethanol's beneficial reduction of T50 and T90.

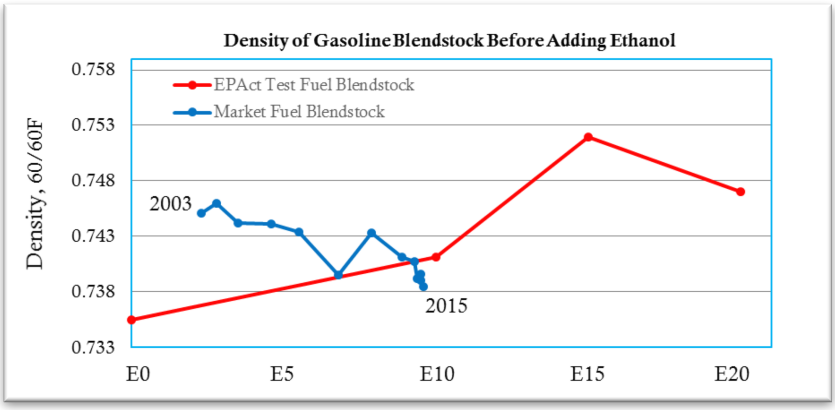

Figure 6. *See* Exhibit H, at H-1.

Because density is not one of the five parameters EPA chose to study, the EPAct study did not control for the relationship between density and emissions. But higher density fuel components contribute to emissions, so density is a confounding variable whose omission compromises the accuracy and utility of the EPAct study.

e. The EPAct Study Did Not control for Saturate or Olefin Content.

In order to match the EPAct test fuels' predetermined T50 and T90 values while also matching their aromatics content, EPA and its consultants had to adjust the saturate content of the fuel. High-distillate saturates contribute to pollution, but the EPAct study did not control for the saturate content of the test fuels. Because the test fuels contain different volumes of saturates, these uncontrolled properties confound the results of the study.

The EPAct study also failed to control for olefin content as a fuel parameter, despite the fact that olefin content is correlated with NO_X cold start emissions and 1,3-butadiene emissions in modern vehicles.[216] In the market, refiners lower olefin levels in the blendstock

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hydrocarbons to match the distillation parameters. This trend is expected to lead to significantly increased PM emissions, which, . . . have been erroneously attributed to increased ethanol content rather than to greater amounts of high-boiling-point hydrocarbons added to the blendstock.").

[215] *See* Exhibit H, at H-1.

[216] Maryam Hajbabaei et al., *Impact of Olefin Content on Criteria and Toxic Emissions from Modern Gasoline Vehicles*, 107 Fuel 671, 673 (2013).

when adding ethanol, reducing 1,3-butadiene and NO_X cold start emissions.[217] The EPAct study's failure to control for olefins as a fuel parameter ignores this beneficial effect of blending ethanol, generating incomplete results that are biased against ethanol.

f. The EPAct Study Did Not Account for the Cumulative Degenerative Effect of Multiple Tests Using Detergent-Free Test Fuels and the Confounding Effect of Disproportionately Delayed Testing of Ethanol Blends.

Market fuels contain detergents that reduce pollution-causing engine build-up on fuel injectors.[218] The EPAct test fuels did not contain such detergents. As a result, some of the test vehicles developed engine build-up that increased emissions for reasons unrelated to the five tested fuel parameters.

That build-up from the use of detergent-free fuels resulted in a bias against ethanol. EPA failed to randomize the test fuel runs, on average, tested ethanol blends later in the testing schedule—after pollution-generating carbon deposits from previous tests had already accumulated. The ethanol effects that the EPAct study purported to measure were therefore confounded with the gradual build-up caused by a lack of detergent in the test fuels.[219]

The resulting bias against ethanol is significant. The effects of the carbon deposits were so pronounced that when CRC used nine EPAct study vehicles in a subsequent study, most of them "had higher emissions then expected" based on the initial EPAct study tests.[220] To remedy the effect of the detergent-free EPAct study test fuels, CRC had to run the vehicles on a full tank of a fuel containing a high-detergent "additive package" plus "a bottle of fuel injector clean-up additive," then change the oil, and run each vehicle for 2,000 more miles on a high-detergent fuel.[221]

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[217] Tier 3 RIA, *supra* note 164, at 3-3 (observing that in response to higher levels of ethanol "it is evident that many refiners have backed off on octane production at the refinery by reducing levels of aromatics and olefins.").

[218] The Clean Air Act prohibits selling fuels without detergents. 42 U.S.C. § 7545(l).

[219] E0 blends were tested much earlier, on average, than E10, E15, and E20 fuels. *See* Exhibit J, at J-1 (showing that 10% of E0 tests were conducted before any ethanol blends were tested; by the time half of E0 tests were conducted, only 27%, 34%, and 22% of the E10, E15, and E20 tests had been conducted; and the ethanol blends did not reach parity with the E0 fuels until 60% of tests had been conducted).

[220] Christopher J. Tennant et al., *Exhaust Emissions of Average Fuel Composition*, CRC Project No. E-98/A-80, at 12 (2014).

[221] *Id.*

4. The Fuels Selected for Speciation Were Biased Against Ethanol.

The EPAct study measured speciated hydrocarbon emissions, as well as some alcohol and carbonyl emissions, using only a limited subset of 12 fuels.[222] This list of 12 fuels was intentionally hand-picked by EPA staff to "emphasize ethanol effects as a goal of the program."[223] Unsurprisingly, the subset of test fuels is biased against ethanol: Out of the three E20 and two E15 test fuels selected for speciation, not a single one of them combines low T50, low T90, and low aromatics (factors associated with low emissions).[224] By contrast, one E0 (Fuel 7) has all of these characteristics.[225] Moreover, out of the four E10 test fuels selected for speciation, one of them (Fuel 10) had the highest T70 value (290°F) of all of the study's test fuels,[226] exceeding the maximum level found in the market by 20°F.[227] And with only one exception, the 12 fuels have a low RVP value (7 psi), which raises tailpipe emissions.[228] The resulting bias is of great consequence, because the EPAct study relies on this subset of 12 fuels alone to predict 1,3-butadiene and benzene emissions, as well as running emissions for ethane, ethanol, and formaldehyde.[229]

5. The Selection of Air Toxic Pollutants To Be Measured Was Biased Against Ethanol.

The EPAct study measured only a small subset of the many dangerous emissions from aromatics. The study measured benzene and 1,3-butadiene, but neglected—for example—ultra-fine particles (UFPs), polycyclic aromatic hydrocarbons (PAHs), and black carbon. These pollutants are much more dangerous than others EPA measured, and all of them are reduced by the addition of ethanol to gasoline.[230] These are the pollutants that matter, but EPA ignored them.

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[222] EPAct Program Design Report, *supra* note 49, at 65–66. Bag 1 (cold start) alcohol and carbonyl emissions were speciated using all test fuels, but Bag 2 (running emissions) and 3 (hot start emissions) alcohol and carbonyl emissions were speciated using only the subset of 12 test fuels. *Id.* at 65.

[223] Exhibit A, at A-31, A-32 (E-mail from Catherine Yanca, to Rich Cook, & Joseph Somers, ASD, OTAQ, EPA, EPA-RED-000537, at -000537, –000538 (Feb. 24, 2009)); *see also supra* p. 27.

[224] EPAct Program Design Report, *supra* note 49, at 66.

[225] *Id.*

[226] Darlington, *supra* note 203, at 3; EPAct Program Design Report, *supra* note 49, at 31–32.

[227] Darlington, *supra* note 203, at 3. The highest T70 temperature found in the Auto Alliance's 2014 summer fuel survey was 272°F. Alliance of Auto. Mfrs., 2014 Summer North American Fuel Survey.

[228] EPAct Program Design Report, *supra* note 49, at 66.

[229] EPAct Final Report, *supra* note 2, at 9.

[230] *See, e.g.*, M.A. Costagliola et al., *Combustion Efficiency and Engine Out Emissions of a S.I. Engine Fueled with Alcohol/Gasoline Blends*, Applied Energy 1, 7, 9 & fig. 17 (2012) (finding "reduction of toxic equivalents [of the carcinogenic PAH benzo(a)pyrene (B(a)p)] when moving from gasoline to alcohol blends," including a 50% to 70% reduction for splash blended E10, E20, and E30 as compared to E0, with even better results for E85, and a 30% PN reduction for splash-blended E10, with PN emissions further "decreas[ing] almost an order of magnitude when moving from gasoline to E85."); Maria Muñoz et al., *Bioethanol Blending Reduces Nanoparticle,*

Even if the study's results were accurate—and they are not—its selective measurement conflicts with the Information Quality Guidelines' requirement that information be "presented in a[] . . . *complete* and *unbiased* manner"[231] and that influential risk assessments be presented in a manner that is "consistent with the purpose of the information" and "*comprehensive* [and] *informative*."[232]

B. The EPAct Study's Results Are Demonstrably Inaccurate.

The flaws in the design of the EPAct study are manifest in its erroneous results. The EPAct study attributes to ethanol increased emissions of various pollutants that numerous studies have shown ethanol to reduce, and the EPAct study claims that lowering T50 below a certain level increases emissions. All these claims are refuted by prior studies.

1. The EPAct Study Erroneously Reports that Ethanol Increases Particulate Matter (PM) Emissions.

The entire PM formation potential of gasoline comes from aromatics.[233] Ethanol, by contrast, does not produce $PM_{2.5}$, as EPA's own investigations have concluded.[234] Instead, ethanol reduces PM. "[T]he reduction of PM emissions with the additional of ethanol . . . has been demonstrated in many studies and is supported by fundamental combustion chemistry considerations."[235]

PAH, and Alkyl- and Nitro-PAH Emissions and the Genotoxic Potential of Exhaust from a Gasoline Direct Injection Flex-Fuel Vehicle, 50 Environ. Sci. & Tech. 11853, 11857, 11859 (2016) (finding that "[u]sing only 10% ethanol is sufficient to reduce PAHs and nitro-PAHs in a range of 67–96%" and PN by 77% compared to a commercial E0 in a GDI vehicle); Georgios Karavalakis et al., *Assessing the Impacts of Ethanol and Isobutanol on Gaseous and Particulate Emissions from Flexible Fuel Vehicles*, 48 Envtl. Sci. & Technol. 14016, 14020 (2014) (finding that ethanol reduces toluene and xylenes in both PFI and GDI Tier 2 vehicles); *id.* at 14021, S16 (finding that "the use of higher ethanol blends . . . resulted in sharp, statistically significant reductions in soot emissions relative to E10 for both" GDI and PFI Tier 2 vehicles); *id.* at 14022 (finding that the reduction in PN with higher ethanol blends "was particularly noticeable, with higher oxygen content in the fuel probably being the main contributing factor for the PN decrease by supressing soot formation"); Dabrina A. Dutcher et al., *Emissions from Ethanol- Gasoline Blends: A Single Particle Perspective*, 2 Atmosphere 195 (2011) (finding that a splash-blended E20 reduces black carbon and PAHs relative to a commercial E0 fuel).

[231] Information Quality Guidelines, *supra* note 5, at 15 (emphasis added).

[232] *Id.* at 22.

[233] *See* 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."), *available at* http://www.unc.edu/courses/2007fall/envr/416/001/OdumScience97.pdf.

[234] *See* Tier 3 RIA, *supra* note 164, at 7-72.

[235] Anderson et al., *supra* note 7, at 1031 & nn.1, 13, 14, 15, 16, 17 (citing ten "particularly well documented" studies); *see, e.g.*, Karavalakis et al., *supra* note 230, at 14021 (finding PM emission reductions of 61% and 59% for E51 and E83 blends relative to E10 in GDI and PFI vehicles over the LA92 cycle). Ethanol's PM and particle number ("PN") reducing effects are becoming increasingly important as more GDI vehicles are produced. *See, e.g.*, Andreas Janssen et al., *The Role of High Octane Fuels in Future Mobility: A Technical Review*, 25th Aachen Colloquium Automobile and Engine Technology 6 (2016) (testing splash-blended fuels in

EPA itself has acknowledged that "[d]ue to the high octane quality of ethanol, it greatly reduces the need for and levels of other high-octane components such as aromatics," so that "it is important to assess the effect of these reductions on ambient PM."[236]

Instead of meaningfully assessing ethanol's potential to displace aromatics and therefore reduce PM, the EPAct study did the opposite—unnecessarily *increasing* aromatics along with ethanol to hold certain arbitrary distillation temperatures constant. In light of the well-known effects of these substances on emissions, EPA's decision to artificially fix the T50 and T90 of the test fuels looks like a pretext for adding high-distillate aromatics. The EPAct study reports a causal relationship between higher ethanol content and increased PM emissions,[237] but this can only be explained as a function of the match-blended test fuels that contained additional high distillate aromatic and saturated hydrocarbons to compensate for ethanol's effect on T50.[238]

Even the EPAct study's own flawed data itself disproves its conclusion about ethanol's effect on PM emissions. If EPA had simply added T70 (alongside T50 and T90) as a parameter in its model—without any change to the content of its test fuels—EPA would have found that ethanol lowers PM emissions, using exactly the same data that EPAct study misinterpreted to prove the opposite.[239]

2. The EPAct Study Erroneously Reports that Ethanol Increases Nitrogen Oxide (NO_X) Emissions.

According to the EPAct study, increased ethanol content is correlated with increased emissions of NO_X.[240] This is misleading and inconsistent with studies based on more realistic assumptions about the content of gasoline-ethanol blends. When ethanol is simply splash-

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a modified high compression GDI engine at steady-state and finding that PM and PN emissions "can be significantly reduced in Ethanol splash blends"); Muñoz et al., *supra* note 230, at 11857 (finding that PN emissions fall by 77 to 97% in a GDI vehicle when using E10 and E85 instead of E0); John M. Storey et al., *Ethanol Blend Effects nn Direct Injection Spark-Ignition Gasoline Vehicle Particulate Matter Emissions*, 3 SAE Int. J. Fuels Lubr. 650, 653 (2010) (E20 reduced PM by 30% relative to E0 over FTP, and 42% over more aggressive US06, in a GDI vehicle); *id.* at 656 (E20 decreases PN by 80% to 90% relative to E0, in a GDI vehicle); John M. Storey et al., *Exhaust Particle Characterization for Lean and Stoichiometric DI Vehicles Operating on Ethanol-Gasoline Blends*, SAE Tech. Paper 2012-01-0437 (showing PM and PN reductions with the addition of ethanol in a GDI engine).

[236] Tier 3 RIA, *supra* note 164, at 7-72.

[237] *See* EPAct Final Report, *supra* note 2, at 4–6.

[238] Notably, Phase 1 of the EPAct study, in which the test fuels' aromatics content decreased with the addition of ethanol, found "significant decreases in [PM] emissions as ethanol levels increase from E0 to E10." Appendix A, at A-137 (EPA, E0-E10-E15 Results from Phase 1 of EPAct Program, EPA-RIF-009068, at -009081 (Sept. 4, 2008)).

[239] Darlington et al., *supra* note 203, at 1 ("[I]f T70 is added to the Bag 1 EPAct model and used in EPA's MOVES2014 emisison inventory model, increased ethanol levels beyond E10 are predicted to reduce PM from on-road motor vehicles in the U.S.").

[240] *See id.* at 4-6, 231–32.

blended into ordinary gasoline, it lowers NO_X emissions.[241] Even Phase 1 of the EPAct study witnessed a "significant decrease [in NO_X emissions] from E0 to E10 . . . for starts."[242] (And ethanol enables new engine technologies that radically reduce NO_X.[243]) The contrary conclusion of the EPAct study is the inevitable result of adding high-distillate hydrocarbons to take advantage of ethanol's favorable effect on the T50 and T90 of blended fuel—an addition that does not happen in the real world, because the high-distillate hydrocarbons are much more expensive than ethanol. Indeed, the Final Report admits that aromatics are to blame for the NO_X emissions attributed to ethanol: "the models also suggest that reductions in NO_X could occur with corresponding reductions in aromatics, particularly for start emissions, for which the aromatics coefficient is larger than that for ethanol."[244] Corresponding reductions in aromatics are precisely what happens in the real world, when ethanol is blended into gasoline.[245]

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[241] *See* Carolyn Hubbard et al., *Ethanol and Air Quality: Influence of Fuel Ethanol Content on Emissions and Fuel Economy of Flexible Fuel Vehicles*, 48 Environ. Sci. & Tech. 861, at 863–64 (2014) (finding a 50% decrease in NO_X emissions when ethanol content increases from E0 to E20 in a Tier 2, PFI vehicle); Mustafa Canakci et al., *Impact of Alcohol-Gasoline Fuel Blends on the Exhaust Emission of a Spark Ignition Engine*, 52 Renewable Energy, 111–17 (2013) (finding decreases in NO_X emissions of 13.5% and 15.5%, depending on speed, when ethanol content is increased from 0% to 10%, respectively, in a gasoline engine (used in the Honda Civic) with a 10.4:1 compression ratio); Hosuk H. Jung et al., *Effect of Ethanol on Part Load Thermal Efficiency and CO_2 Emissions of SI Engines*, 2013-01-1634, 6 SAE Int'l J. of Engines 456 (2013) (finding a 25% to 45% decrease in NO_X emissions, depending on speed and load, from E85 relative to E0, for an engine with a 9.5:1 compression ratio); M. Matti Maricq, et al., *The Impact of Ethanol Fuel Blends on PM Emissions from a Light-Duty GDI Vehicle*, 46 Aerosol Sci. & Tech. 576, 580 (2011) (finding decreases in NO_X emissions of "about 20%" when the ethanol content of fuel is increased from 0% to 17% or higher, in a turbocharged GDI engine); M. Bahattin Celik et al., *Experimental Determination of Suitable Ethanol-Gasoline Blend Rate at High Compression Ratio for Gasoline Engine*, 28 Applied Thermal Engineering 396 (2008) (finding a 33% decrease in NO_X emissions from E50 relative to E0 in a single-cylinder engine at stoichiometric fuel conditions, with a compression ratio of 6:1); Koichi Nakata et al*., The Effect of Ethanol Fuel on a Spark Ignition Engine,* SAE Technical Paper 2006-01-3380 (finding a 25% decrease in NO_X emissions from E50 relative to E0 in an engine (used in the Toyota Corolla) with a compression ratio of 13:1); *see also* Robert A. Stein & Rod Harris, *Effect of Ethanol on NO_X Emissions of Vehicles with SI Engines* ("NO_X emissions typically decrease or are unaffected with increasing ethanol content.").

[242] Appendix A, at A-137 (EPA, E0-E10-E15 Results from Phase 1 of EPAct Program, EPA-RIF-009068, at -009081 (Sept. 4, 2008)). That is why EPA considered "changing the program midstream," *id.* at A-138, and ultimately eliminated the Phase 1 test fuels from the final test fuel matrix. *See supra* note 126 and accompanying text.

[243] *See* Matthew Brusstar (EPA) & Marco Bakenhus, *Economical, High-Efficiency Engine Technologies for Alcohol Fuels* (2005) ("Alcohol-fueled engines that instead use high levels of EGR to modulate load have demonstrated efficiency gains of greater than 10% over throttled engines, while at the same time giving considerably lower NO_X emissions. Engine out NO_X levels of well below 1.0 g/kW-hr and peak efficiency around 42% can be achieved in this manner for DI, lean stratified-charge methanol engines and similar improvements in PFI lean burn methanol engines." (citations omitted)) (presented at ISAF XV International Symposium on Alcohol Fuels, Sept. 28, 2005), http://www.epa.gov/otaq/presentations/epa-fev-isaf-no55.pdf.

[244] EPAct Final Report, *supra* note 2, at 232.

[245] *See supra* note 164, and accompanying text; Exhibit C, at C-4.

3. The EPAct Study Erroneously Reports that Ethanol Increases Total Hydrocarbon (THC), Non-Methane Organic Gas (NMOG), and Non-Methane Hydrocarbons (NMHC).

"Numerous studies in which ethanol was splash-blended with a fixed gasoline blendstock have demonstrated reductions of vehicle exhaust emissions, particularly . . . non-methane hydrocarbons (NMHC)."[246] Total hydrocarbon (THC) and non-methane organic gas (NMOG) are also reduced by the addition of ethanol to gasoline from E0 through E30.[247]

But the EPAct study concludes that "ethanol content would be associated with increases in emissions" of all these pollutants "if the remaining fuel properties could be kept constant while increasing the ethanol level."[248] The EPAct study admits that this condition is important: "[I]f typical collateral fuel changes (lower T50 and aromatics) are accounted for, we might project that blending ethanol would tend to reduce THC, NMHC and NMOG emissions (highlighting the important sensitivities to these other fuel parameters)."[249]

What the EPAct study does not make clear is that to keep all other fuel properties "constant" while adding ethanol is not only unnecessary (and ultimately impossible), but also the opposite of what happens in the real world. Harmful levels of high-distillate aromatics are needed even to approximate holding all other fuel properties constant. That condition is never satisfied in the real world because adding redundant octane additives to match arbitrary distillation parameters would be economically wasteful and highly polluting. The EPAct study's conditional conclusion is therefore deceptive.

4. The EPAct Study Erroneously Reports that Ethanol Increases Formaldehyde Emissions.

The best available evidence does not support the EPAct study's prediction that low and mid-level ethanol blends increase formaldehyde emissions.[250]

Prior studies conducted in the 1990s found that increasing gasoline's ethanol content has no significant effect on formaldehyde emissions.[251] Even the CRC E-67 study, which EPA

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[246] Anderson et al., *supra* note 7, at 1031; *see also* Hubbard et al., *supra* note 241, at 863–64 (finding THC, NMHC, and NMOG decrease significantly from E0 to E30 in PFI engine).

[247] *See* Hubbard et al., *supra* note 241, at 863 & fig. 3 ("The emission of THC and NMOG exhibit a clear minimum around E20–E40, 25–35% lower than for E0 and E80.").

[248] EPAct Final Report, *supra* note 2, at 5–6.

[249] *Id.* at 232.

[250] *See* EPAct Final Report, *supra* 2, at 10–11 (showing that increasing ethanol increases bag 1 and bag 2 formaldehyde emissions).

[251] *See* Georgios Karavalakis et al., *Impacts of Ethanol Fuel Level on Emissions of Regulated and Unregulated Pollutants from a Fleet of Gasoline Light-Duty Vehicles*, 93 Fuel 549, 554 (2012) (citing several studies from the 1990s and concluding that "previous studies . . . have shown no or inconsistent changes with formaldehyde emissions as function of ethanol content").

used to develop the EPAct study's fuel matrix,[252] found that "neither ethanol nor the interaction between T50 and ethanol was marginally significant" for formaldehyde emissions.[253] More recent studies have confirmed that mid-level ethanol blends do not increase formaldehyde emissions in modern vehicles.[254] The EPAct study predicts the opposite effect, contradicting the best available science.

The EPAct study's prediction that ethanol increases formaldehyde emissions is particularly inaccurate as applied to GDI vehicles. Two studies by Oak Ridge National Laboratory have found that in GDI engines, mid-level ethanol blends reduce formaldehyde emissions.[255]

5. The EPAct Study Erroneously Reports that Lowering T50 Below a Certain Level Causes Emissions To Rise.

One of the clearest indications of the inaccuracy of the EPAct study and its bias against ethanol is the study's conclusion about the emissions effects of T50—the temperature at which 50% of a fuel's contents will vaporize. According to the EPAct study, Bag 1 PM emissions tend to rise as T50 rises above 185°F *and* as T50 *falls* below 185°F.[256] This reported effect of T50 is illogical: PM is primarily emitted by high-distillate aromatics responsible for raising T90—not lowering T50.[257] And it is well established that lowering T50 *lowers* emissions.[258]

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[252] *See supra* p. 11.

[253] Thomas D. Durbin et al., *Effects of Fuel Ethanol Content and Volatility on Regulated and Unregulated Exhaust Emissions from the Latest Technology Gasoline Vehicles*, 41 Envtl. Sci. Technol. 4059, 4062 (2007) (finding that E10 had no effect on formaldehyde emissions relative to E0 in a study of twelve model year 2001 to 2003 PFI vehicles). The CRC E-67 study did find that increasing T50 increases formaldehyde emissions. *Id.* (finding that increasing the T50 temperature from 195°F to 235°F increased formaldehyde emissions by 23%). Because adding ethanol to gasoline decreases T50, the study therefore suggests that ethanol reduces formaldehyde emissions.

[254] *See* Hubbard et al., *supra* note 241, Supplemental Information, at S-6, S-7 (2014) (finding no clear trend for formaldehyde emissions from E0 to E55 in a Tier 2 PFI vehicle); *see also* Keith Knoll et al., *Effects of Mid-Level Ethanol Blends on Conventional Vehicle Emissions*, SAE Tech. Paper 2009-01-2723 (showing that E10 increases formaldehyde relative to E0, but finding no effect for E15 or E20 relative to E10).

[255] John M. Storey et al., *Novel Characterization of GDI Engine Exhaust for Gasoline and Mid-Level Gasoline Alcohol Blends*, 7 SAE Int'l J. Fuels Lubr. 571, 578–79 (2014) (finding that a splash-blended E30 fuel reduces formaldehyde exhaust concentration, from approximately 4,500 micrograms/cubic meter to 800 micrograms/cubic meter); John M. Storey et al., *Ethanol Blend Effects On Direct Injection Spark-Ignition Gasoline Vehicle Particulate Matter Emissions*, *supra* note 235, at 653 (showing that splash-blended ethanol fuels significantly decrease Bag 1 formaldehyde emissions).

[256] Anderson et al., *supra* note 7, at 1035.

[257] *See id.* ("Lack of dependence of PM on T50 is the expected result from an engine perspective, since PM emissions primarily originate from fuel components with high DBE [double-bond equivalency] values (e.g. aromatics) and high boiling points (e.g. the T90 region and above in the distillation curve.").

[258] *See* CRC E-67, *supra* note 46, at 1 ("The reduction of T50 and T90 and the corresponding reduction of heavy fuel hydrocarbon compounds have generally been found to reduce exhaust hydrocarbon emissions.").

The EPAct study's conclusion is especially puzzling because, as Anderson, et al., points out, the EPAct test vehicles themselves did not actually exhibit the modeled trend of increased PM emissions below a T50 of 185°F.[259]

Whatever their origin, the EPAct study's reported correlation between PM emissions and *lowering* T50 below 185°F is detrimental to ethanol, because ethanol lowers T50.[260]

C. The EPAct Study Was Inadequately Peer Reviewed.

Although EPA subjected the EPAct study to peer review when it was completed, this review came too late to correct the fundamental design flaws of the study.

EPA should not have waited until the EPAct study was complete to subject it to peer review. "Peer review is not restricted to the penultimate version of work products; in fact, peer review at the planning stage can often be extremely beneficial."[261]

IV. THE MOVES2014 MODEL SHOULD BE WITHDRAWN BECAUSE IT REPLICATES THE EPACT STUDY'S FLAWS AND ERRONEOUSLY MODELS ETHANOL'S EMISSIONS EFFECTS.

A. MOVES2014 Incorporates the EPAct Study's Erroneous Conclusions about the Tailpipe Emissions Effects of Ethanol and T50.

All of the defects in the EPAct study, described above, are reflected in the MOVES2014 model, which incorporates the EPAct fuel effects data in a vehicular emissions model used by State regulators in the development of their SIPs and in their conformity and hot-spot analyses.[262]

In particular, the EPAct study's spurious findings about ethanol's effect on emissions of $PM_{2.5}$ and NO_X are reflected in MOVES2014's emissions factors. The model predicts increased tailpipe emissions of PM and NO_X in higher ethanol blends, even when other parameters associated with emissions, like T50 and aromatics, are reduced.[263]

These predictions are not based in reality. In 2016, scientists from Wyle and Volpe, a part of 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

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[259] *See* Anderson et al., *supra* note 7, at 1035.

[260] *See id.* at 1029; Robert A. Stein, et al., *An Overview of the Effects of Ethanol-Gasoline Blends on SI Engine Performance, Fuel Efficiency, and Emissions*, 6 SAE Int'l J. Engines 1, 5 (2013).

[261] Information Quality Guidelines, *supra* note 5, at 11 (citing Peer Review and Peer Involvement at the U.S. Environmental Protection Agency (June 7, 1994), http://www.epa.gov.osp.spc.perevmem.htm.

[262] Air Toxics in MOVES2014, *supra* note 158, at 18–25, 34–40.

[263] *See* Exhibit F, at F-28, ¶ 32(a).

found ethanol fuel blend emissions trends that appear in many cases to be different than the predictions of the MOVES2014 model."[264]

In addition, MOVES2014 reflects the EPAct study's nonsensical finding that *lowering* T50 *below* 185°F increases emissions, even though *raising* T50 *above* 185°F has the same effect.[265] This phenomenon is unexplained by the materials accompanying either the EPAct study or the MOVES2014 model, and it is inconsistent with real-world emissions effects.[266]

B. MOVES2014 Reflects Erroneous Assumptions about Ethanol's Evaporative Emissions Effects.

The MOVES2014 fuel adjustment predicts that blending any amount of ethanol into gasoline (E5 through E85) more than doubles permeation emissions[267]—a subset of evaporative emissions that contribute significantly to the total modeled emissions of VOCs.[268] Specifically, the model predicts that ethanol raises permeation rates 113.8% in models year 2001 and newer vehicles, and 107.3% for model years 1997 to 2000.[269]

EPA developed this fuel adjustment factor for ethanol using data from four CRC studies funded by the oil industry[270]: E-65,[271] E-65-3,[272] E-77-2,[273] and E-77-2b.[274] These studies

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[264] 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.*

[265] *See supra* at 36-37.

[266] *See* Anderson et al., *supra* note 7, at 1035.

[267] EPA, Evaporative Emissions from On-road Vehicles in MOVES2014, EPA-420-R-14-014, at 13 (Sept. 2014) (hereinafter Evaporative Emissions in MOVES2014). "Permeation emissions are specific hydrocarbon compounds that escape through micro-pores in pipes, fittings, fuel tanks, and other vehicle components (typically made of plastic or rubber)." *Id.* at 15.

[268] *See* Exhibit F, at F-14, F-15. Of the four evaporative emissions processes modeled by MOVES2014, permeation accounts for the largest increase in evaporative emissions due to ethanol. EPA, Renewable Fuel Standard Program (RFS2), Regulatory Impact Analysis, EPA-420-R-10-006, at 508 (Feb. 2010).

[269] Evaporative Emissions in MOVES2014, *supra* note 267, at 16.

[270] EPA, MOVES2010, Development of Evaporative Emissions Calculations for the Motor Vehicle Emissions Simulator MOVES2010, Final Report, at 10 (Sept. 2012). The MOVES ethanol fuel adjustment to the base permeation rate is unchanged between MOVES2010 and MOVES2014. *Compare id.* at 11, *with* Evaporative Emissions in MOVES2014, *supra* note 267, at 16.

[271] Harold M. Haskew et al., *Fuel Permeation from Automotive Systems*, Final Report, CRC Project No. E-65, at 3 (2004) (hereinafter CRC E-65).

[272] Harold M. Haskew et al., *Fuel Permeation from Automotive Systems: E0, E6, E10, E20, and E85*, Final Report, CRC Project No. E-65-3, at 3 (2006) (hereinafter CRC E-65-3).

[273] Harold M. Haskew et al., *Enhanced Evaporative Emissions Vehicles*, CRC Project No. E-77-2 (2010) (hereinafter CRC E-77-2).

[274] Harold M. Haskew et al., *Evaporative Emissions from In-Use Vehicles: Test Fleet Expansion*, CRC Project No. E-77-2b, Final Report, EPA-420-R-10-025 (2010) (hereinafter CRC E-77-2b).

are flawed because their test fuels were biased against ethanol. And, as CRC itself has reported, EPA's ethanol fuel adjustment factor is not even consistent with the studies' results.

1. EPA Relied on Four Biased CRC Studies to Calculate the Ethanol "Fuel Adjustment" to MOVES2014's Permeation Rates.

The MOVES2014 model fails to satisfy EPA's information quality standards because the four CRC studies on which it relied to develop the model's ethanol "fuel adjustment" for permeation emissions were biased against ethanol. In at least three of the studies, higher ethanol test fuels were loaded with disproportionately high levels of aromatics, which unrealistically elevated permeation emissions in the higher ethanol fuels.

a. CRC E-65

CRC E-65 was published in 2004, as a joint effort by the California Air Resources Board and CRC (funded by CRC), to investigate the permeation emissions effects of ethanol and MTBE in gasoline.[275]

CRC E-65 ran ten test vehicles on just three fuels: one with 11% MTBE, one with 5.7% ethanol, and a California Phase 2 reformulated gasoline with no MTBE or ethanol.[276] All fuels were match-blended to the extent feasible for RVP, T10, T50, and T90.[277] In addition, the olefin content of the ethanol test fuel was raised from 0.5% to 5.8% to make it more like the non-ethanol gasoline test fuel.[278] One member of the E-65 committee suggested that CRC's last-minute effort to match olefin content and its lengthy storage of the ethanol test fuel may have raised the mass and reactivity of permeation emissions and elevated peroxide levels in the ethanol test fuel, further biasing the results against ethanol.[279]

Not surprisingly, the ethanol test fuel with artificially elevated vapor pressure and olefin content exhibited the highest evaporative permeation emissions in 9 out of 10 test vehicles.[280] Although this effect was caused by all of the fuel components added to achieve the

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[275] CRC E-65, *supra* note 271.

[276] *Id.* at 21; *see* Robert E. Reynolds, Issues Related to Permeation Emissions, Prepared on Behalf of the Renewable Fuels Association, at 3 (Sept. 29, 2004) ("[T]he [sample limitations] call for caution when applying results across the entire vehicle population.").

[277] CRC E-65, *supra* note 271, at 21.

[278] Reynolds, *supra* note 276, at 8.

[279] The ethanol fuel's artificially "matched" olefin content would tend to increase peroxide levels in the ethanol fuel, damaging "the fuel system elastomers" and producing "permeation levels higher than that which would be experienced in real world use." Reynolds, *supra* note 276, at 9. Peroxide formation, though never measured, was likely exacerbated by much longer fuel storage periods than is typical in the marketplace—149 days or more for the ethanol blend, compared to a normal market storage period of about 10 to 20 days. *Id.* 9–10.

[280] On average, vehicles tested on Fuel A emitted 2.16 g/day, vehicles tested in Fuel B emitted 3.56 g/day, and vehicles tested on Fuel C emitted 2.45 g/day. *See* CRC E-65, *supra* note 271, at 39, Table 8.

targeted fuel parameters, EPA unreasonably interpreted the results as evidence that ethanol raises permeation emissions.

b. CRC E-65-3

CRC E-65-3's objective was to test permeation emissions in newer vehicles using a variety of different ethanol blends.[281]

The study tested five vehicles running on six test fuels: one E0, two E5.7 fuels with different aromatics compositions, one E10, one E20, and one E85.[282] All the ethanol blends except the E85 test fuel had higher levels of aromatics than the E0 fuel.[283] This characteristic of the E-65-3 test fuels makes them unrealistic, because refiners lower aromatics content to compensate for the addition of ethanol.[284] And it biased the results against ethanol, because aromatics are known to increase permeation emissions.[285] Furthermore, all but the E85 and the E5.7 test fuel with the highest total volume of aromatics also had higher BTEX levels (high volatility C6 to C8 aromatics) than the E0 fuel.[286] Octane and density increased with increasing ethanol content[287] —contrary to historic trends.[288]

As a result of this unrealistic correlation between ethanol content on the one hand and aromatics, octane, and density on the other, CRC E-65-3 blamed ethanol for the permeation effects of aromatics. With the exception of the E85 test fuel in the flex-fuel test vehicle, all of the ethanol blends produced higher permeation emissions than the E0 test fuel in all test vehicles.[289] In a statistical analysis performed by Jim Uihlein, then an employee at BP, CRC concluded from this evidence that ethanol increases permeation emissions.[290]

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[281] CRC E-65-3, *supra* note 272, at 3.

[282] *Id.* at 10. "[T]he small size, and the limited testing conducted, suggest some caution in evaluating these observed differences." CRC E-65-3, *supra* note 272, at 31.

[283] *Id.*

[284] *See supra* note 164 and accompanying text.

[285] Indeed, both "theory and experimental data . . . shows that permeation increases exponentially with fuel aromatic content." Sam R. Reddy, *Understanding Fuel Effects on Hydrocarbon Permeation through Vehicle Fuel System Maters*, SAE Technical Paper 2007-01-4089, at 1. One General Motors study predicts that for "every 10% increase in aromatics, the permeation rate increases by a factor of 1.35 (35% increase)." *Id.*

[286] *Id.* at 10.

[287] *Id.* at 11. The study at least nominally controlled for "peroxide number." *Id.*

[288] *See supra* pp. 28–30, 37.

[289] CRC E-65-3, *supra* note 272, at 18–20 (diurnal), 29–30 (steady state).

[290] *Id.* at 46.

Based on a comparison of the two E10 test fuels with different aromatics levels,[291] Uihlein also found no statistically significant effect of aromatics on permeation.[292] Uihlein neglected the significant proportional difference in the aromatic species of the two E5.7 test fuels. It was the fuel with lower aromatics overall that had the highest levels of high volatility aromatics, which are known to contribute disproportionately to permeation emissions.[293] In the E5.7 with the highest total volume of aromatics, by contrast, the aromatics were heavily concentrated in the less volatile C9+ range, thereby masking the permeation effects of aromatics.[294] Moreover, the E5.7 test fuel with low total aromatics also had significantly higher levels of low-molecular-weight paraffin species such as pentane,[295] which are known to permeate at faster rates.[296] Because CRC E-65-3 treated all species of aromatics and paraffins as equivalent, it erroneously concluded that aromatics had no effect on permeation emissions.

c. CRC E-77-2

CRC-E-77-2 tested eight vehicles running on five test fuels at three ethanol and RVP levels:[297] one E20 fuel with an RVP of 8.5 psi, two E0 fuels with varying RVP levels (7 psi and 10 psi), and two E10 fuels with varying RVP levels (7 and 10 psi). The fuels were borrowed from an unrelated CRC program, so they were not designed to study ethanol's effect on permeation.[298]

The fuels varied in their aromatic composition. Contrary to historic trends,[299] the E10 fuel had a higher volume of aromatics (24.8%) than the E0 fuel (23.9%) and the E20 fuel

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[291] *Id.*

[292] *Id.*

[293] BTEX permeate at significantly faster rates because of their high solubility in plastic fuel tank materials and their small molecular size. Michele De Gennaro et al., *Data-driven Analysis of the Effectiveness of Evaporative Emissions Control Systems of Passenger Cars in Real World Use Condition: Time and Spatial Mapping*, 129 Atmospheric Env't 277, 278 (2016) (arguing that "hydrocarbons like aromatics can also be found in evaporative emissions in significant concentrations" with the main sources being the "permeation of fuel components through the plastic material of the fuel system."); Reddy, *supra* note 285, at 5 (noting that toluene significantly increased permeation emissions); *see also* Dan D. Koo, *Modified Permeation Coefficients for Benzene, Toluene, Ethylbenzene, and Xylene (BTEX) Estimation through Polyethylene Pipe*, 5 Int'l J. of Emerging Tech. & Advanced Engineering 427 (Apr. 2014). Indeed, consistent with both theory and data, C6 to C8 aromatics (along with pentane) dominated hydrocarbon permeation emissions in CRC E-65-3. CRC E-65-3, *supra* note 272, at 32–36.

[294] *Id.* at 10.

[295] The low-aromatics E5.7 fuel had 17.4% pentane (C5), 17.5% hexane (C6), and 8.0% heptane (C7). *Id.* at 12. The high-aromatics E5.7 fuel had 10.6% pentane, 13.1% hexane, and 6.1% heptane. *Id.*

[296] *See*, *e.g.*, Reddy, *supra* note 285, at 5 ("The permeation rates of pentanes were the highest and they were nearly the same for pentane (normal-pentane) and cyclopentane.").

[297] *Id.* at 4.

[298] *Id.* at 3.

[299] *See supra* note 164 and accompanying text.

(21.8).[300] The concentration of benzene, one of the most permeable species of aromatics,[301] was highest in the test fuels containing ethanol—1.06% for the E10 fuel and 0.97% for the E20 fuel, but only 0.89% for the E0 fuel.[302]

As a result of the study's unrealistic fuel blending and its failure to control for aromatics content, CRC concluded that "[a]dding ethanol to the fuel increased permeation," and RVP had no discernible effect."[303] This is inconsistent with "both theory and experimental data," which "show[] that permeation increases exponentially with fuel aromatic content [and] increases linearly with fuel RVP."[304] Moreover, ethanol, by itself, "permeate[s] at a much lower rate than gasoline . . . due to [its] low solubility" in plastic fuel tank materials.[305] Thus, CRC's use of ethanol blends with artificially elevated aromatics content introduced a systematic bias against ethanol, rendering the CRC E-77-2 study's results unreliable.

The CRC E-77-2 study's diurnal results also contain aberrant data that skewed the results against ethanol. In particular, the diurnal emissions of the E10 10 psi fuel were dominated by a single vehicle, the 2004 Ford Escape, certified according to the less stringent "enhanced" emissions standard.[306] While running on the E10, 10 psi test fuel, the Ford Escape emitted 0.492 grams on day one, 0.839 grams on day two, and a startling 11.374 grams on day three—23 times more than on day one.[307] As a result, average diurnal emissions for the E10, 10 psi fuel on the Ford Escape were 4.237 g/day, significantly higher than average for the other four "enhanced" emissions vehicles tested by the study (which averaged 1.256 g/day), and significantly exceeding federal Tier 2 requirements for model year 2004 vehicles.[308] The CRC E-77-2 study did not venture an explanation for the aberrant behavior of the Ford Escape.

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[300] *Id.* at 39.

[301] Koo, *supra* note 293, at 428.

[302] *Id.* The benzene levels in the fuels were also significantly above the 0.6% market averages observed by EPA in its Tier 3 rule analysis and the 0.62% average required by EPA in its 2007 MSAT Rule. Tier 3 RIA, *supra* note 164, at 3-10; Control of Hazardous Air Pollutants, 72 Fed. Reg. 8428 (Feb. 26, 2007). Other aromatic species are not individually reported in the fuel inspection results, and were left uncontrolled. Paraffins were also left uncontrolled.

[303] *Id.* at viii. CRC cautioned, however, that "the small size and limited number of tests precluded making statements about trends in emissions with statistical confidence." *Id.* at vii.

[304] Reddy, *supra* note 285, at 1.

[305] *Id.* at 9.

[306] *Id.* at 25, 40.

[307] *Id.* at 25, 40.

[308] The Tier 2 standard for 2004 required 0.95 g/test for a three day diurnal and hot soak test. Because the applicable 3 day diurnal value is the largest daily value, the Ford Escape's would have emitted 11.374 g/test, significantly above the standard even before adding hot soak emissions. 40 C.F.R. § 86.1811-04(e).

The full extent of EPA's reliance on these test results is unknown, because the Agency has not explained in any detail how it performed its fuel adjustment.[309] But EPA's report says that the Agency used the diurnal test results for E10 fuels in the CRC E-77-2 study, which includes these aberrant test results.[310] Because this data does not represent normal emissions, MOVES2014's modeling of ethanol's effect on permeation emissions is erroneous.

d. CRC E-77-2b

CRC E-77-2b was a CRC partnership with EPA, aimed at expanding the data available from E-77-2.[311] It tested the same E0 and E10 test fuels as the prior study in a fleet of eight test vehicles consisting of five Tier 1 vehicles, two "near zero" vehicles, and one vehicle certified to the newer, more stringent "zero" evaporative emissions standard.[312]

As with CRC E-77-2, CRC E-77-2b's "enhanced" emissions vehicles showed increasing permeation rates with increasing volatility and ethanol levels.[313] But also consistent with the prior study, test vehicles certified to the more stringent "near-zero" and "zero" emissions standard "did not indicate the same trend[.]"[314] CRC suggested that this could be because of "permeation control materials used in the newer vehicles."[315]

Consistent with other permeation studies, the speciation results for CRC E-77-2b show that BTEX, as well as low-molecular-weight paraffins, permeated at much higher rates than other hydrocarbons.[316]

But the CRC E-77-2b study entirely ignored this. Like other CRC studies, the E-77-2b study focused on the effect of ethanol and RVP on permeation emissions to the exclusion of other relevant factors, like paraffin or aromatic species. The CRC E-77-2b study therefore confounded the effect of ethanol with the effect of aromatics and other fuel components.

As in CRC E-77-2, aberrant data biased the diurnal emissions results against ethanol. For the E10, 10 psi test fuel, diurnal emissions increased dramatically from day 1 to day 3 in the Nissan Altima. That test vehicle's emissions rose from 2.8 grams on day 1, to 31 grams on day 2, and to 43 grams on day 3—fifteen times higher than on day 1.[317] This amount of permeation is well outside the range observed in Tier 1 vehicles—even Tier 1 vehicles

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[309] *See infra* p. 52.

[310] *See* Evaporative Emissions in MOVES2014, *supra* note 267, at 15.

[311] CRC E-77-2b, *supra* note 274, at 6.

[312] *Id.* at C-1.

[313] *Id.* at 8. Two Tier 1 vehicles, a 2000 Chevrolet Malibu and a 2000 Mitsubishi Galant, were diagnosed with leaks and removed from the general analysis. *Id.* at 15.

[314] *Id.*

[315] *Id.*

[316] *Id.* at Appendix E.

[317] *Id.* at 7, Table 4 (vehicle 206b); *see also id.* at D-5.

diagnosed with leaks—[318] and significantly exceeds Tier 1 standards.[319] As a result of these extreme values, "[t]he averages for the 10 psi E10 fuel [were] highly dominated by" the Nissan Altima.[320]

These results are unlikely to represent the actual emissions behavior of E10 or RVP. When the same vehicle was tested with a 7 psi E10 fuel, diurnal emissions were 11 times lower.[321] And when the same vehicle was tested with an E20, 9 psi RVP fuel, diurnal emissions were 14 times lower.[322]

Although the full extent of EPA's reliance on these aberrant test results is unclear, EPA says it relied on E10 diurnal emissions data from the CRC E-77-2b study to calculate its MOVES2014 fuel adjustment.[323] Because this data does not represent real world emissions behavior, the MOVES2014 model's fuel adjustment for ethanol's permeation emissions is inaccurate.

2. EPA's Ethanol Fuel Adjustment for Permeation Emissions Is Not Objective or Useful, Because the CRC Studies are Systematically Biased Against Ethanol.

In sum, EPA's reliance on the CRC studies to develop its ethanol fuel adjustment for permeation emissions fails the agency's objectivity and utility standards for at least two reasons:

First, all four studies are systematically biased against ethanol because they include ethanol test fuels with artificially elevated volumes of aromatics and other fuel components that contribute to permeation emissions. In particular, the ethanol test fuels in CRC studies E-65-3, E-77-2, and E-77-2b consistently have higher volumes of aromatics and a significantly higher BTEX content than non-ethanol fuels, [324] contrary to market trends.[325] This introduces

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[318] *Id*. at 26–27.

[319] *See* Control of Air Pollution From New Motor Vehicles and New Motor Vehicle Engines: Evaporative Emission Regulations for Gasoline- and Methanol-Fueled Light-Duty Vehicles, Light-Duty Trucks and Heavy-Duty Vehicles, 58 Fed. Reg. 16002, 16004 (Mar. 24, 1993) ("Two evaporative emission standards must be met for a vehicle to pass the three-diurnal evaporative emission test. First, a vehicle must emit no more than a total of 2 grams of hydrocarbon . . . measured during the 24-hour cycle with the highest emissions from the diurnal emission test, plus that measured during the one-hour hot soak test. Second, the vehicle must meet a running loss test standard of 0.05 g/mi (0.03 g/km).").

[320] CRC E-77-2b, *supra* note 274, at 12.

[321] *Id.* at 7.

[322] *See* CRC Report E-77-2c, Study to Determine Evaporative Emissions Breakdown Including Permeation Effects and Diurnal Emissions, Using E20 Fuels on Aging Enhanced Evaporative Emissions Certified Vehicles, at 21 (Dec. 2010).

[323] *See* Evaporative Emissions in MOVES2014, *supra* note 267, at 15.

[324] *See supra* pp. 48–52.

[325] *See supra* note 164 and accompanying text.

a significant systematic bias against ethanol in these studies, because "permeation increases exponentially with fuel aromatic content" and BTEX in particular.[326]

Second, and relatedly, the four CRC studies are biased against ethanol because they fail to control for confounding variables. With the occasional exception of RVP, the CRC studies focus systematically on the effect of a single factor (ethanol), without adequately testing other fuel properties (or interactions of multiple properties) that are known to increase permeation emissions. For instance, highly volatile aromatics, like benzene,[327] and smaller molecular-size paraffins, like pentane, can contribute significantly to permeation.[328] Because the CRC studies focus on ethanol without controlling for other significant factors and aberrant vehicle data, the CRC studies confound the effect of ethanol content with the effects of other fuel or vehicle properties.

Because of these biases, the CRC studies are not objective, and EPA should not have used them to calculate ethanol's effect on permeation emissions.

3. The MOVES2014 Model's Fuel Adjustment Is Not Supported by the CRC Studies EPA Purports to Rely On.

Setting aside the flaws in the four CRC studies EPA used to develop its model, the evaporative emissions modeling of MOVES2014 is fundamentally flawed. The ethanol fuel adjustment for permeation emissions is not objective because it is inconsistent with the CRC studies from which EPA derived it.

a. The CRC Studies Do Not Support a Fuel Adjustment for E85 Blends.

The MOVES2014 model's fuel adjustment predicts that E85 (like all other gasoline-ethanol blends) more than doubles permeation emissions, but the CRC studies EPA relied on do not support this prediction.

Only one of these CRC studies, E-65-3, tested an E85 blend,[329] and that study demonstrated the opposite of what EPA's model predicts: The E85 test fuel emitted 28% less pollution through permeation than the E0 test fuel did.[330] EPA's fuel adjustment, which treats E85 as badly as other ethanol blends, is therefore unsupported by evidence.

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[326] Reddy, *supra* note 285, at 1.

[327] Koo, *supra* note 261, at 430–31; *see also* De Gennaro et al., *supra* note 293, at 278.

[328] Reddy, *supra* note 285, at 5.

[329] CRC E-65-3, *supra* note 272, at 3.

[330] The E85 test fuel emitted an average of 128 mg/day, while the E0 test fuel emitted an average of 177 mg/day. *Id.* at 23.

b. CRC Data Does Not Support EPA's Fuel Adjustment for Ethanol in "Near Zero" Emissions Vehicles.

The CRC data relied on by EPA does not support the MOVES2014 model's fuel adjustment for ethanol's permeation emissions in "near zero" certified vehicles, which were required to achieve "[s]ignificant improvements in permeation performance" relative to older vehicles.[331] The combined CRC dataset includes only five "near-zero" certified vehicles (one in CRC E-65-3, two in CRC E-77-2, and two in E77-2b).

The MOVES2014 model, however, simply assumes that the permeation rates of "near zero" (Tier 2) emissions vehicles should have the same ethanol fuel adjustment as older Tier 1 vehicles.[332] This assumption is highly consequential, because "near zero" (Tier 2) emissions vehicles constitute a major fraction of the in-use vehicle fleet.[333] But EPA's assumption is not supported by evidence.

To the contrary, the "near zero" emissions vehicle tested in CRC E-65-3 had a much more muted response to the fuels with higher ethanol content (and higher aromatics) than the older, "enhanced" emissions vehicles tested in the study.[334] Likewise, in CRC E-77-2 and CRC E-77-2b, "the small sample of 'near zero' emission vehicles did not exhibit the same trend" of increasing permeation rates with increasing ethanol content and increasing RVP that was observed in older, "enhanced" emissions vehicles.[335]

c. The CRC Studies Do Not Support MOVES2014's Prediction that Permeation Emissions Increase or Remain Constant in New Model Year Vehicles.

The four CRC studies, demonstrate that model year 2001 to 2015 vehicles have much lower permeation emission rates than earlier vehicles.[336] Indeed, from just model year 1999 to 2003 (even before "near zero" and Tier 2 standards further tightened evaporative emissions controls), there were significant reductions in evaporative emissions from light-duty vehicles.[337]

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[331] CRC E-65-3, *supra* note 272, at 6.

[332] Evaporative Emissions in MOVES2014, *supra* note 267, at 15.

[333] Indeed, by 2013, over 50 passenger car models were already certified to California's partial zero emissions standards (equivalent to Tier 3 federal evaporative standards), which are expected to profoundly transform permeation control technologies. Tier 3 RIA, *supra* note 164, at 1-55, 1-63.

[334] *Id.* at 46.

[335] CRC E-77-2b, *supra* note 274, at 8.

[336] *See*, *e.g.*, *id.* at 7–8 (showing data for CRC E-77-2 and E-77-2b enhanced and near zero emissions vehicles).

[337] Yanbo Pang et al., *Trends in the Emissions of Volatile Organic Compounds (VOCs) from Light-Duty Gasoline Vehicles Tested on Chassis Dynamometers in Southern California*, 83 Atmospheric Env't 127, 130 (2014) (reductions of more than 95% for most species).

The MOVES2014 model, however, counterfactually predicts that newer vehicles (model years 2001 to 2015) produce more evaporative emissions than older vehicles (model years 1999 to 2000) when fueled with gasoline-ethanol blends.[338] In MOVES2014, all vehicles produced between 1999 and 2015 have the same base permeation rate of 0.010 g/hour.[339] The ethanol fuel adjustment, however, is greater for model year 2001 to 2015 vehicles than for model year 1999 to 2000 vehicles.[340] This results in the nonsensical prediction that newer vehicles emit more pollution despite the more stringent standards that govern them.

CRC itself recently concluded that MOVES2014 "significantly over-estimate[s] permeation" from model year 2004 and newer vehicles,[341] in part because the same CRC studies EPA relied on show that newer vehicles are "less sensitive to the increase in permeation due to ethanol" than EPA assumed.[342] Because EPA's modeling contradicts the evidence it is supposed to be based on, MOVES2014's ethanol fuel adjustment for permeation emissions is not objective.

C. The MOVES2014 Model's Default Fuel Parameters Are Inconsistent with Market Fuel, and State Regulators May Not Replace Them.

As explained above, the MOVES2014 model is fundamentally flawed as a result of the confounding variables in the underlying EPAct study. But setting aside these defects in objectivity, the MOVES2014 model itself fails to meet the Information Quality Guidelines' utility standard, because it is not "useful[] . . . to its intended users"[343]—the State regulators who must use MOVES2014 in their SIPs.

States are at the mercy of MOVES2014's default fuel parameters.[344] But the defaults are inconsistent with known data about the fuel actually sold throughout the country. As

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[338] Evaporative Emissions in MOVES2014, *supra* note 267, at 14–16 (adjusting the base permeation rates for the ethanol adjustment factor yields 0.02138 and 0.02073 g/hour, respectively).

[339] *Id.* at 16.

[340] *Id.*

[341] Sierra Research, *Review of EPA's MOVES2014 Model*, CRC Project No. E-101, at 34 (Aug. 11, 2016) (hereinafter CRC E-101). CRC found that the MOVES2014 permeation rates "omit key recent test data and significantly over-estimate permeation from Tier 2 certified vehicles (i.e., near-zero standards)," *id.* at 32; *see id.* at 34 ("Both the base [permeation] rate and the ethanol increment are less, and the net impact would be significantly reduced permeation emissions from the current fleet commencing with the model 2004 year.").

[342] *Id.* at 32.

[343] *Id.*

[344] EPA's guidance allows substitution of the State's own parameters only "where precise local volumetric fuel property information is available." EPA, MOVES2014 and MOVES2014a Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity 45, ¶ 4.9.1 (Nov. 2015). EPA will not countenance "single or yearly station samples." *Id.* This rules out the industry-standard *North American Fuel Survey* by the Alliance of Automobile Manufacturers. And fuels that are not yet sold locally (such as higher ethanol blends) or that are no longer in general use (such as E0) cannot possibly meet this standard. For those, the States must use EPA's "Fuels Wizard," which is based not on retail

Department of Transportation scientists concluded, the default fuel parameters "likely do not have the same attributes" as real-world fuels.[345] This renders the model inaccurate and useless.

MOVES2014's default T50 values, for example, are generally higher than those of real-world fuel in corresponding counties.[346] But this basic discrepancy masks an even more fundamental error in the model's default parameters: In the real world, reformulated gasoline (RFG) tends to have a *higher* T50 boiling point than conventional (non-RFG) gasoline.[347] This is because the lower vapor pressure (RVP) required in RFG demands the addition of low-volatility, high-boiling-point hydrocarbons. But the MOVES2014 defaults reverse this relationship without explanation. The model assumes that RFG has significantly *lower* T50 than conventional fuels,[348]—the exact opposite of what occurs in the real world.[349] *See* Figure 7.

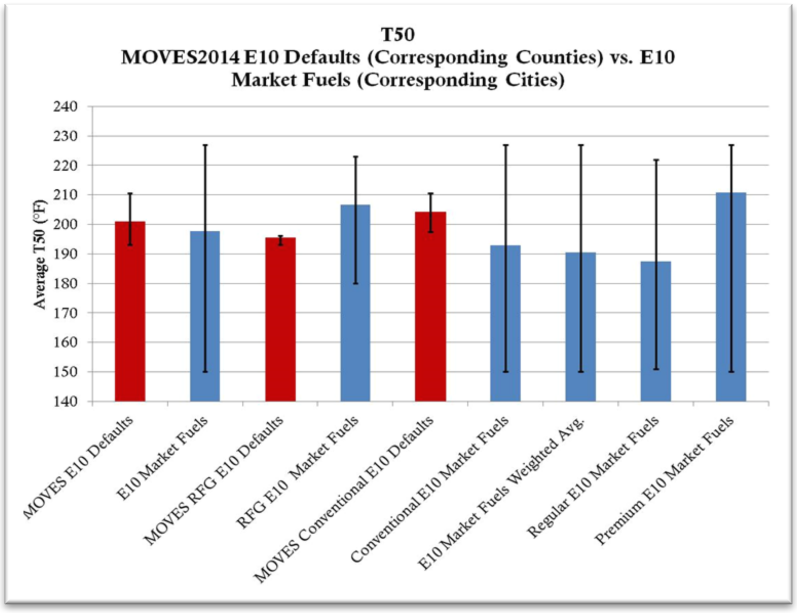

Figure 7. *See* Exhibit I, at I-1.

In the case of T90, the average MOVES2014 defaults (327.3°F) are significantly *higher* than the corresponding market averages for both RFG (314.9°F) and conventional gasoline (317.7°F).[350] *See* Figure 8.

samples but on undisclosed "refinery modeling" data. *See* MOVES2014 for Experienced Users 16, slide 32 (Sept. 2014), *available at* http://bit.ly/2k583y7.

[345] Wayson et al., *supra* note 264, at 10.

[346] *See* Exhibit I, at I-1.

[347] *See id.*

[348] *See id.*

[349] Market survey data reports an average T50 for RFG of 206.7°F, but the MOVES2014 default T50 values for the corresponding counties average a much *lower* 195.5°F. *See id.* For conventional gasoline the difference is reversed: In the market, conventional gasoline has an average T50 of 192.9°F, but the model defaults average a much *higher* 204.4°F. *Id.*

[350] *See id.*

This mismatch between real-world fuel parameters and MOVES2014's assumptions undermines the reliability of its results. Accurate fuel parameters are essential to the proper functioning of MOVES2014. The model cannot provide accurate results unless "the accompanying changes in fuel properties with increasing ethanol content . . . are properly taken into account in the model (e.g. reduced T50, T90, and aromatics)."[351] As with the EPAct study, "consideration of single coefficients in isolation can easily result in misleading conclusions."[352]

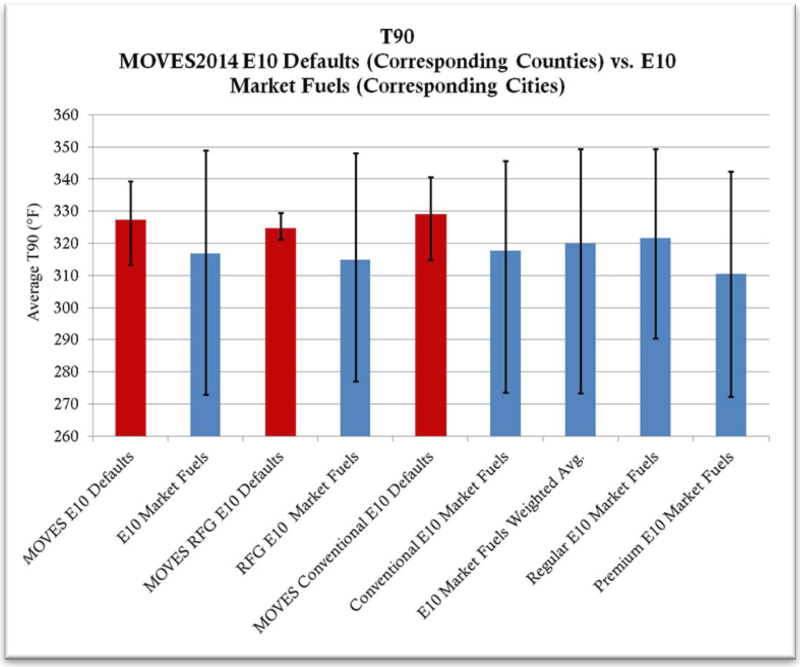

Figure 8. *See* Exhibit I, at I-2.

EPA has not explained how it derived its default fuel parameter inputs,[353] and it has not made the underlying data available to the public.

D. EPA Failed To Make the MOVES2014 Model and EPAct Study Available to the Science Advisory Board.

Under the Science Advisory Board statute, "[for] any proposed criteria document, standard, limitation, or regulation, [EPA] shall make available to the [Science Advisory] Board such proposed criteria document, standard, limitation, or regulation, together with relevant scientific and technical information in the possession of the Environmental Protection Agency on which the proposed action is based."[354] EPA's Information Quality

[351] Anderson et al., *supra* note 7, at 1034.

[352] EPAct Final Report, *supra* note 2, at 3; *see id.* ("[I]n interpreting or applying the models, *it is critical to consider the effects of all five fuel properties in conjunction with each other*.").

[353] *Cf.* Email from Jarrod Brown, EPA, to Tom Darlington (after Aug. 1, 2014), Doc. 207, Administrative Record, *Kansas v. EPA*, No. 14-1267 (D.C. Cir.) ("Most of the fuel data used in MOVES2014 comes from a combination of Auto Alliance survey data and batch fuel quality reports from our refinery compliance process.").

[354] 42 U.S.C. § 4365(c)(1).

Guidelines say that this mandatory review by the Science Advisory Board "ensures the quality of information we disseminate."[355]

EPA's Official Release of the MOVES2014 model[356] is a regulation imposing immediate legal obligations on the States. EPA therefore should have "ma[d]e available to the [Science Advisory] Board" ("SAB") a *proposed* Official Release of the MOVES2014 model as well as the underlying EPAct study.

EPA's obligation to provide MOVES2014 to the Science Advisory Board was triggered by its "consultation with [the Department of Transportation (DOT)]" about the proper length of the grace period before MOVES2014 is required for transportation conformity.[357] Consistent with EPA's previously expressed intentions on the subject, EPA and DOT jointly considered the significance of "the effects of the new emissions model" when they decided on a two-year grace period.[358] That consultation required DOT to have access to the model.[359]

Under § 4365(c)(1), EPA was required to give the Science Advisory Board the "proposed . . . regulation [*i.e.,* the Official Release], together with relevant scientific and technical information in the possession of [EPA] on which the proposed action is based." 42 U.S.C. § 4365(c)(1). In the case of MOVES2014, the "relevant scientific and technical information" includes the model itself, the EPAct study on which the model is based, and all related reports and data.

CONCLUSION

For the foregoing reasons, Petitioners respectfully request that EPA cease disseminating erroneous data from the EPAct study and MOVES2014 model. The agency should immediately withdraw the EPAct study and lock the MOVES2014 model's ethanol parameter at 10% to prevent spurious comparisons between fuels with different levels of ethanol content, until a replacement model can be developed.

EPA should promulgate the corrected vehicular emissions model following public notice and an opportunity for comment, and review by the Science Advisory Board. Before promulgating a corrected model, EPA should undertake a new study of fuel effects on vehicular emissions based on splash-blending of ethanol into existing gasoline blendstock following notice and an opportunity for comment on the design of the proposed study.

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[355] Information Quality Guidelines, *supra* note 5, at 19.

[356] 79 Fed. Reg. 60343 (Oct. 7, 2014).

[357] *Id.* at 60345.

[358] *Id.* (quoting 58 Fed. Reg. 62211); *see also* 40 C.F.R. § 93.111(b) ("EPA will consult with DOT to establish a grace period . . . depend[ing] on the degree of change in the model.").

[359] DOT also necessarily reviewed the model in connection with the "DOT training" on MOVES2014 that must precede the model's use in transportation conformity analyses. App. 437 (79 Fed. Reg. at 60345).