

Comments On

**EPA's Proposal to Update the Air Quality Standards for Ground-Level Ozone
Docket ID#: EPA-HQ-OAR-2008-0699**

**Submitted By
The Urban Air Initiative**

March 17, 2015

Urban Air Initiative Comments to EPA Ground Level Ozone Rule

UAI appreciates this opportunity to comment on EPA's proposal to strengthen the National Ambient Air Quality Standards (NAAQS) for ground level ozone, as set forth on November 25, 2014. As summarized here and developed more fully in the appendices, these comments argue that:

1. EPA's proposed rule should be strengthened to better meet the criteria set forth in Executive Order 13563—a regulatory system that will “protect public health, welfare, safety, and our environment while promoting economic growth, innovation, competitiveness, and job creation”.
2. EPA's proposed rule requires heavy manufacturers, power plants, and agriculture operations to reduce smog in ground-level ambient air. However, this rule should do more to address the primary cause of ground level ozone in urban areas, where the vast majority of Americans live, work, and commute: gasoline exhaust, more specifically the combustion byproducts of aromatic hydrocarbons used to enhance gasoline octane ratings.
3. EO 13563 stipulates that EPA's regulatory system “must be based on the best available science”. However, EPA requires states to base their state implementation plans (SIPs) for ozone control on its recently released MOVES2014 model, which has serious deficiencies, and relies upon flawed data. In addition, EPA's Community Multi-scale Air Quality (CMAQ) model substantially under-predicts a primary contributor to ground level ozone, secondary organic aerosols (SOAs). Finally, EPA's 2007 Mobile Source Air Toxics (MSAT) Rule relied upon erroneous and outdated assumptions that transposed the octane enhancement effect of aromatics vs. ethanol, resulting in the wrong policy outcome. Eight years later, EPA has not yet corrected this huge error.
4. EPA and other health experts have identified fine particulate matter (PM_{2.5}) and ozone as the nation's most serious health threats. In urban areas, gasoline aromatic hydrocarbons are the predominant source of both pollutants. Congress directed EPA to reduce aromatics to the greatest degree achievable in Sec. 202 (l) of the 1990 Clean Air Act Amendments (sometimes referred to as the MSAT provision). However, this ozone NAAQS does nothing to reduce gasoline aromatic content, which is the primary cause of ozone-forming, PM_{2.5}, and air toxics emissions, and thus fails to adequately protect the public health and welfare.
5. Vehicle hardware technology, including three-way catalytic converters, is not capable of capturing the primary precursors to ground level ozone and PM_{2.5}. Changes in gasoline composition, specifically reductions in aromatic hydrocarbons, are necessary to reduce emissions of SOAs, fine and ultrafine particulate matter, and highly reactive toxics such as BETX and polycyclic aromatic hydrocarbons (PAHs).
6. A recent study by California's Office of Environmental Health Hazards Assessment confirmed that children's lung function capacity has improved significantly over the past twenty years, during which time Federal and California law has required refiners to reduce gasoline aromatic content, and encouraged the use of high-octane ethanol as a replacement.
7. Controlling gasoline aromatic hydrocarbons would provide simultaneous environmental and health co-benefits, including substantial reductions in carbon (both at refineries and out the vehicle tailpipe), mobile source air toxics (MSATs), and permeation losses/evaporative emissions.
8. Recent studies confirm that mid-level ethanol blends ranging from 25 to 30 percent by volume would significantly improve fuel quality and could reduce aromatic content by 60%, thereby substantially reducing the largest urban source of ozone-forming pollution. According to DOE's Oak Ridge National Labs and other experts, this would also benefit regulated parties to comply with the GHG – CAFE, Tier 3, RFS2, and MSAT rules.

About the Urban Air Initiative

The Urban Air Initiative is a non-profit entity dedicated to research and education in the area of fuel quality and its relationship to mobile source emissions, especially in urban areas. The climate and public health impacts of mobile source (traffic) pollution—in the U.S. and globally—are of great importance to policymakers, industries, and the billions of people that are regularly exposed to harmful pollutants in their homes, schools, and vehicles. Among the most vulnerable are infants and children. The Urban Air Initiative believes that protecting our children’s health and well-being is the most important investment society can make to build a better future.

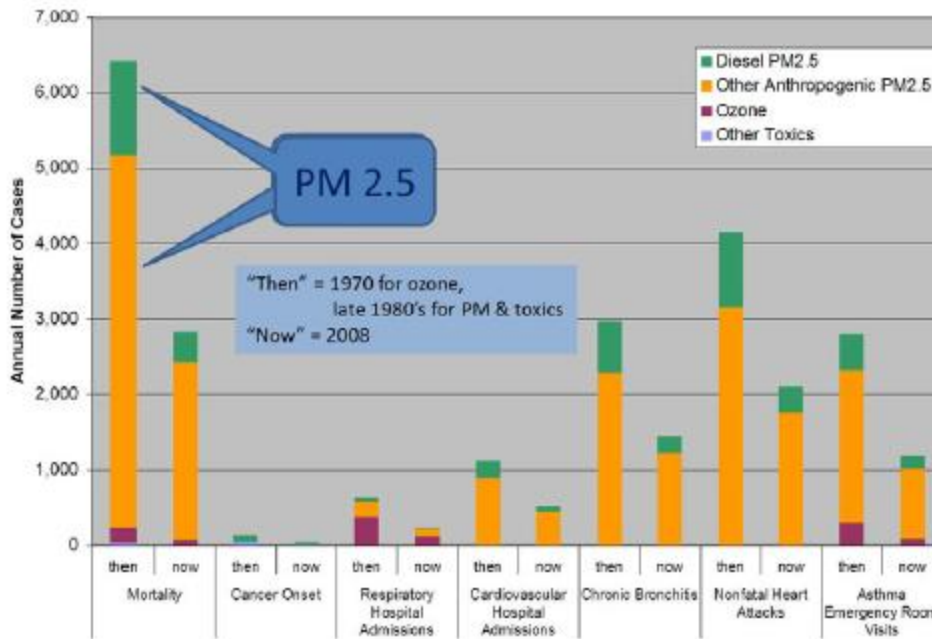
Executive Order 13563. On September 2, 2011, Cass R. Sunstein, Administrator of OMB’s Office of Information and Regulatory Affairs, wrote then-EPA Administrator Lisa Jackson instructing the Agency to reconsider its proposed ozone NAAQS rulemaking. Sunstein based the President’s instruction for reconsideration on several criteria: 1) “must be based on best available science”; 2) “must promote predictability and reduce uncertainty”; and 3) must “protect public health, welfare, safety, and our environment while promoting economic growth, innovation, competitiveness, and job creation”.

Unfortunately, as written, this rule does not meet these tests. It would impose a disproportionate economic burden on industries, agricultural operations, and small businesses that in fact contribute less to the formation of ground level ozone than does a source that the rule appears to overlook: gasoline exhaust.

The (626 page) [Proposed Rule](#) proposes a new ozone standard within the range of 65 to 70 parts per billion—not as stringent as the 60ppb level, but still severe enough to bring new parts of the country into non-attainment. The (575 page) [Regulatory Impact Analysis](#) notes that even rural states like South Dakota and Nebraska have ozone levels within a 65 to 70 ppb range. (2-8, fig. 2-3), and recognizes that “some states will incur costs both designing State Implementation Plans (SIPs) for and implementing new control strategies to meet final revised standards.” (7-1)

Ozone and PM_{2.5} Are Nation’s Primary Health Threats, but PM_{2.5} Dominates. In its “Strategic Plan for Understanding the Public Health Effects of Air Pollution”, the Health Effects Institute (HEI) stated that “*ozone and PM pose the greatest potential risks to public health*”. However, PM_{2.5} health effects are much larger than those of ground level ozone. In its 2011 report to Congress on the cost – benefit of the 1990 Clean Air Act Amendments, EPA stated that 90% or more of the \$2.2 trillion in projected cost savings would come from reductions in PM_{2.5}. This relationship is illustrated by the following chart from the Bay Area Air Quality Management District:

Figure 1-4 Bay Area Air Pollution Health Burden: Past & Present



Estimated contribution of PM, ozone, and key air toxics to health endpoints among Bay Area residents, based on Bay Area air pollution data for year 2008.

For Both Urban Ozone and PM_{2.5}, the Predominant Precursors Are Gasoline Aromatic Hydrocarbons.

Serendipitously, the primary urban source of the orange section that dominates the bar chart above, “Other Anthropogenic PM_{2.5}” is also the primary source of urban ground level ozone. Unfortunately, EPA’s models do not recognize the predominant role that gasoline aromatics play in the formation of urban SOAs, which comprise a very large fraction of urban PM, and which are also a major contributor to ground level ozone. EPA has said for some years now that it intends to correct this oversight in its Community Multi-scale Air Quality (CMAQ) model, but it has not yet done so.

A 2013 study by the Harvard Center for Risk Analysis found that up to \$50 billion per year in social costs are attributable to gasoline aromatics. The Harvard study considered only premature mortalities (as opposed to morbidity) caused by PM_{2.5} secondary organic aerosols (SOAs). In other words, Harvard did not attempt to quantify the even greater health costs (morbidity) associated with SOA-bound polycyclic aromatic hydrocarbons (PAHs), the highly potent combustion byproducts of aromatics.

Harvard study excerpts:

- *“Modeled aromatic SOA concentrations from CMAQ fall short of ambient measurements by approximately a factor of two nationwide...Assuming that the contribution of SOA precursors originating from aromatic hydrocarbons in gasoline is higher in urban areas increases these estimates to 5100 predicted premature mortalities nationwide...associated with total social costs of \$37.9B”. p. 3*
- *“...particulates from vehicular emissions of aromatic hydrocarbons demonstrate a sizeable public health burden. The results provide a baseline from which to evaluate potential public health impacts of changes in gasoline composition.” P. 3*

- *"Evidence is growing that aromatics in gasoline exhaust are among the most efficient secondary organic matter precursors. In general, air quality models do not adequately capture these increased yields or potential interactions, although improvements have been made." P. 4*
- *"In the United States, gasoline-powered vehicles are the largest source of aromatic hydrocarbons to the atmosphere...Therefore, it has been suggested that removal of aromatics could reduce SOA concentrations and yield a substantial public health benefit...a number of studies have noted that gas-phase vehicle emissions lead to a substantial fraction of observed SOA. For example, a source apportionment study of SOA formation during a severe photochemical smog event in Los Angeles found that gasoline engines represented the single-largest anthropogenic source of SOA." P. 4*
- *"Source-specific speciation reveals that the U.S. emissions of aromatic hydrocarbons are 3.6 million tons per year, of which 69% are from gasoline-powered vehicles as shown in Table 3." P. 8*
- *"In addition to premature mortality, which dominates monetized estimates of total social cost, exposures to SOA from aromatics in gasoline are associated with other health outcomes, including exacerbation of asthma, upper respiratory symptoms, lost work days, and hospital emergency room visits." P. 9*
- *"A recent study in Los Angeles found that gasoline emissions dominated SOA formation, accounting for nearly 90% of total aerosol formation, and the ratio of SOA to primary organic aerosol was approximately a factor of three...Anthropogenic SOA have been shown to enhance biogenic SOA formation." P. 9*
<http://www.ehjournal.net/content/12/1/19/abstract>

A 2011 study by Shang Liu et al. confirmed that SOA components accounted for 80% to 90% of fine particle organic matter, and that gasoline exhaust was the predominant source.¹ Appendix II of the EFC – UAI comments to CARB’s Low Carbon Fuels Standard (attached in the appendices) identifies a number of recent studies on the adverse health effects of aromatics and their combustion byproducts.

Along with VOCs/SVOCs, SOAs react with NOx to help form ground level ozone. A 2013 Manufacturers of Emissions Control Association 2013 study noted that PM control strategies fall into three general categories, which include fuel-based strategies (e.g., reducing sulfur levels and changing other fuel properties), engine-based strategies, and strategies based on reducing emissions after combustion has taken place but before they leave the tailpipe (including technologies like particulate filters). Gasoline aromatic hydrocarbons are the predominant urban source of both SVOCs and SOAs. A well-designed fuel-based strategy would therefore prioritize gasoline aromatics controls to ensure the most cost effective reductions in ozone-forming emissions.

- P. 42: *"First, gasoline PM tends to be smaller in size and more volatile than diesel PM... the largest portion of gasoline PM is organic carbon, which includes the numerous PAH compounds present in the exhaust and are associated with carcinogenic risk."*
- P. 50: *"This reduces the formation of secondary organic aerosol particles and volatile organic compounds (VOC) that contribute to the formation of ground level ozone and smog."*
http://www.meca.org/resources/MECA_UFP_White_Paper_0713_Final.pdf

¹ "Secondary organic aerosol formation from fossil fuel sources contribute majority of summertime organic mass at Bakersfield", Shang Liu et al., contact: lmrussell@ucsd.edu.

Ethanol Does Not Produce SOAs. In EPA's Tier 3 Regulatory Impact Analysis, at 7-64, the Agency confirmed that its Office of Research and Development investigated whether ethanol had SOA-forming potential, and concluded that "As expected, no SOA was produced." <http://www.epa.gov/otaq/documents/tier3/420d13002.pdf>

Light-duty vehicle three-way catalysts (TWC) do not effectively reduce SOA precursors, aromatics, and particle-borne PAHs. A 2013 study by Robinson – Maricq et al. study, "Secondary organic aerosol formation exceeds primary particulate matter emissions for light-duty gasoline vehicles"² noted that light duty vehicle (LDV) "Catalysts are optimized to reduce emissions of regulated pollutants (NO_x, NMOG, and CO), not SOA precursors."

- 23175: "Therefore, the contribution of light duty gasoline vehicle exhaust to ambient PM levels is likely dominated by secondary PM production (SOA and nitrate)."
- "Over the time scale of these experiments, the mixture of organic vapors emitted by newer vehicles appear to be more efficient (higher yielding) in producing SOA than the emissions from older vehicles. About 30% of the non-methane organic gas emissions from the new vehicles could not be speciated, and the majority of the SOA formed from these vehicles appears to be associated with these unspciated organics."
- 23176: " Numerous reports have shown that the secondary fraction of fine organic PM (secondary organic aerosol, SOA) dominates primary organic aerosol (POA), even in urban areas with substantial fresh PO emissions...However, chemical transport models systematically underpredict SOA levels...Motor vehicle emissions contribute to both POA and SOA concentrations."
- "Although much is known about primary emissions from light-duty gasoline vehicles (LDGVs), there are few published reports on SOA formation from LGDVs (Nordin et al., 2013)..."
- "LDGVs emit a complex mixture of organic gases, some of which are known SOA precursors, such as single-ring aromatics."
- 23196: "In fact, SOA formation from LDGV exhaust will likely exceed its direct contribution to ambient PM, especially for newer vehicles...there was no evidence that SOA production was completed after 3h of photo-oxidation (i.e., SOA was still being produced at the end of the experiments). Other studies have shown that SOA production downwind of urban areas may persist for 48h..."
- "Although tightening regulations have significantly reduced emissions of regulated primary pollutants (for example, Fig. 2 highlights the dramatic reductions in NMOG emissions...), the same may not be true for PM. In fact, Fig. 8 suggests that for LDGVs manufactured over the last twenty years...there may not have been much reduction in their contribution to ambient PM. This is not surprising...changes to engine control/aftertreatment from LEV1 to LEV2 were not aimed at reducing PM (or the non-volatile particles – EC). Some fraction of semivolatile particles may be removed by the catalyst (note the downward trend in POA emissions in Fig.2b), but the efficiency is not well understood."

² <http://www.atmos-chem-phys-discuss.net/13/23173/2013/acpd-13-23173-2013-print.pdf>

- 23197: 23198: *“...in the United States there are substantially more LDGVs than HDDVs.”*
- 23199: *“...SOA production could not be fully explained by speciated (traditional) SOA precursors. However, about 30% of the NMOG emissions from LEV1 and LEV2 vehicles could not be speciated. These unspeciated emissions appear to be important SOA precursors, likely forming the majority of the SOA in experiments performed with LEV1 and LEV2 vehicles. Given the unexpected finding that the gas-phase emissions from newer, LEV2 vehicles are more efficient at producing SOA than emissions from older, pre-LEV vehicles, future studies elucidating the nature of these precursors are needed to advance the development of next-generation SOA models and emission control strategies.”*

EPA’s CMAQ Model Does Not Meet the “Best Available Science” Test. EPA has publicly admitted for some time that its CMAQ models substantially under-reported the prediction of SOAs from mobile sources.³ In its April 2007 final rule on fine particles, EPA stated that “[a]romatic compounds such as toluene, xylene, and trimethyl benzene are considered to be the most significant anthropogenic SOA precursors and have been estimated to be responsible for 50 to 70 percent of SOA in some airsheds.”⁴ The OMB scores mobile source PM emission reductions orders of magnitude higher than those from stationary sources.⁵ Carbonaceous particle reduction has been shown to achieve the highest dollar per ton in health benefits, and the mobile source pollutants occur where most of the people live.⁶ Thus, it is vitally important that EPA ensures that its modeling is more capable of recognizing and accounting for the substantial contributions that traffic-related pollution—particularly that which originates from toluene and the Aromatic Group Compounds—makes to urban ozone and PM inventories.

In a 2010 study, EPA Office of Research and Development experts confirmed that anthropogenic pollution, especially mobile source primary carbonaceous particulate matter and NO_x emissions, “facilitate transformation of naturally emitted VOCs to the particle phase.” EPA’s modeling predicted that reducing mobile source emissions could help to reduce biogenic SOA emissions in the eastern U.S. by as much as 50% or more.⁷ However, it does not appear that new science is reflected in the proposed ozone rule.

EPA’s MOVES2014 Model Does Not Meet the “Best Available Science” Test. On March 6, 2015, the states of Kansas and Nebraska were joined by the Energy Future Coalition (EFC) and UAI in petitioning

³ EPA has said it would adjust its models to correct for their substantial under-prediction of secondary organic aerosols (SOAs) from mobile sources http://www.cmu.edu/news/archive/2007/March/march1_soot.shtml.

⁴ “Clean Air Fine Particle Implementation Final Rule,” 40 CFR Part, 51; April 25, 2007; p. 20593

⁵ See OMB 2003 Report to Congress on Cost and Benefits of Federal Regulations, Sept. 2003. OMB noted that “mobile source tailpipe emissions are located in urban areas at ground level (with limited dispersal) while electric utilities emit NO_x from tall stacks located in rural areas with substantial geographic dispersal.”

⁶ “The influence of location, source, and emission type in estimates of the human health benefits of reducing a ton of air pollution,” Fann et al., EPA Office of Air Quality Planning & Standards, Air Qual Atmos Health (2009) 2: 169-6. “[C]arbonaceous particles tend to be emitted in close proximity to population centers. In fact, area source and mobile source particle emissions, in particular, show the highest \$/ton, suggesting that the emissions and population centers exposed are co-located.”

⁷ “To What Extent Can Biogenic SOA Be Controlled?,” Carlton, Prakash, et al., U.S. Environmental Protection Agency, Office of Research and Development, Research Triangle Park, NC, 2010, p. 8.

the EPA under the Information Quality Act to withdraw its Motor Vehicle Emissions Simulator Model (MOVES2014) and the EPA study upon which it is based.⁸

In releasing the model, EPA instructed the states that: "MOVES2014 should be used in ozone, CO, PM, and NO₂ SIP development as expeditiously as possible, as there is no grace period for the use of MOVES2014 in SIPs. The Clean Air Act requires that SIP inventories and control measures be based on the most current information and applicable models that are available when a SIP is developed.

Unfortunately, the MOVES2014 model is fatally flawed, and should not be used. It fails to accurately represent the emissions effects of real-world gasoline, and would mislead state regulators and cause them to forgo the most cost effective steps for controlling both ground level ozone and PM_{2.5}—encouraging the use of higher ethanol blends like E30.

The key concept obscured by the MOVES2014 model is that blending ethanol into ordinary gasoline reduces harmful emissions when gasoline combusts in an engine. Ethanol does this both by diluting the most harmful gasoline components (e.g., aromatic hydrocarbons) with its own clean octane, and by improving combustion properties of the fuel. In the real world, ethanol is simply added to gasoline blendstock, which thus produces this salutary effect.

However, the EPA study's designers—which included a Chevron consultant—went to extraordinary lengths to do just the opposite. They artificially reversed the beneficial ethanol blending effects by dumping in more of the most polluting fuel additives—high-boiling-point hydrocarbons, e.g., aromatics—though not required to do so by any law or private standard. In fact, as a recent GM – Ford SAE study confirmed, there is no technical, economic, or regulatory reason for adding these “high boilers” in the presence of ethanol. Perversely, the EPA study unfairly and erroneously attributes to ethanol the emissions effects of the hydrocarbons used to elevate the targeted distillation temperatures.

Thus, the new MOVES2014 model—which the States are required to use in developing their state implementation plans—poses a very real danger to those who live in our largest cities, and/or near congested roadways. Unless EPA corrects the model, it will force the States to adopt those same mistaken conclusions about ethanol's contribution to air pollution when they make decisions on how to comply with EPA's air quality standards. Instead of states encouraging the use of more ethanol, they may very well feel compelled to prohibit the use of a clean-burning product that does not contribute to the formation of ground level ozone and PM_{2.5}. As a result, gasoline aromatic content will not be reduced, and both ground level ozone and fine particulate emissions will increase.

Research Confirms Significant Lung Function Improvement in Children Over Past 20 Years, During Which Time California Gasoline Ethanol Content Increased Tenfold. A recent study by scientists from the California Office of Environmental Health Hazards Assessment (OEHHA) and USC found that reduced emissions of PM_{2.5} and NO_x have resulted in significant improvement in lung function and lung growth in children over the past 20 years. A December 18, 2014 white paper by the Renewable Fuels Association (RFA) noted that assertions that increased ethanol use would increase ozone-forming and PM_{2.5} emissions are contradicted by EPA's own air sensor data. At the same time as ethanol-blended

⁸ Request for Correction of Information submitted on behalf of Kansas, Nebraska, the Energy Future Coalition and Urban Air Initiative Concerning EPA's EPA/V2E-89 Fuel Effects Study and MOVES2014, Docket ID Nos. EPA—420-R-13-002, FRL—9917-26-OAR, by Boyden Gray & Associates PLLC, March 6, 2015.

gasoline use has dramatically increased, “Ozone concentrations have fallen 33% since 1980, while PM_{2.5} is down 34% since 2000”.⁹

The OEHHA study noted that “In California, nitrogen dioxide, PM_{2.5}, and PM₁₀ are mainly found in motor vehicle emissions, and researchers said that stricter emission standards in the state have likely contributed to the decline in these pollutants.”

[Peter Thorne, PhD](#), professor and head of occupational and environmental health at the University of Iowa, College of Public Health in Iowa City, who was not affiliated with the study, said this study “provides convincing evidence that reducing ambient air pollutants such as nitrogen dioxide and fine particulate matter improves lung function growth during adolescence.”

Interestingly, the study concluded that changes in ozone levels were not associated with health benefits. http://www.medpagetoday.com/Pediatrics/GeneralPediatrics/50321?xid=nl_mpt_DHE_2015-03-05

Facilitating the Use of Mid-Level Ethanol Blends could reduce Gasoline Aromatic Content by 60%.

The attached August 2014 article by MathPro, Ford, GM, and Chrysler experts is entitled “*Refining Economics of U.S. Gasoline: Octane Ratings and Ethanol Content*”. Because ethanol has unique and superior octane boosting properties, and is lower cost than gasoline aromatic hydrocarbons, the U.S. could achieve billions of dollars per year in lower transportation costs, reduced carbon and ozone-forming pollution emissions, and reduced health costs via a nationwide Clean Octane program. Among other things, ethanol’s superior octane properties would allow refineries to turn down or idle their energy intensive reformers, which the Hirshfeld et al. study says would reduce refinery CO₂ emissions by 10%, and crude oil use by 8% (this does NOT include the crude oil savings from ethanol’s displacement effect, which would amount to an additional 20 – 30% reduction).

Table 2 in the Hirshfeld paper, p. 11068, reports the results of the MathPro linear program (LP) analysis which found that producing a 98 RON gasoline using E10 would require 28.6% aromatics (E0 would require even more aromatics), while 98 RON with E30, for example would require only 11.8% aromatics. This 60% reduction in aromatics would translate into commensurate, more likely even larger reductions in highly reactive tailpipe air toxics and ozone-forming SOA emissions from the light duty vehicles that dominate the U.S. transportation fleet.

This is clearly a substantial reduction in aromatics, but Hirshfeld et al. admit it is understated due to ethanol’s unique octane enhancement effects: “*However different BOB compositions can have second-order effects yielding higher RON than predicted by this approach. Combining the synergistic ethanol blending effects reported by Anderson [Ford Motor] et al. with the BOB RON values in Figure 2 yields higher finished gasoline RON values for all fuels in the study, with larger effects for E20 and E30 fuels than for E10. A key implication is that higher-octane blends would be more attractive than shown here, because they would require lower-RON BOBs.*” That would translate into lower aromatics content than the 11.8% in the table, to where the BOB would be approaching the amount of naturally-occurring aromatics (owing to the crude oil itself, as opposed to that produced by the reformer).

⁹ “Response to PNAS Article: ‘Life Cycle Air Quality Impacts of Conventional and Alternative Light-Duty Transportation in the United States’, Renewable Fuels Association, December 18, 2014.

This landmark study—conducted by a reputable consulting firm frequently used by the EPA, and experts from three auto manufacturers—shows how realistic it would be for EPA to achieve substantial and cost effective reductions in gasoline aromatics.

Aromatics, Permeation/Evaporative Emissions, & EPA’s MOVES2014 Model. In explaining the results of its MOVES2014 model, EPA erroneously claims that ethanol is responsible for a “two-fold increase in permeation”. Since permeation is the primary contributor to evaporative emissions, EPA’s models show that using more ethanol results in more evaporative emissions. Consequently, EPA’s model suggests that ethanol use increases the formation of ground-level ozone. Unless EPA corrects the MOVES2014 model (as formally requested by EFC and UAI), state regulators will conclude that higher level ethanol blends such as E30 will INCREASE ozone levels, even though E30’s RVP is lower than E10, and the highly reactive tailpipe VOC emissions are substantially less.

Unfortunately, EPA once again blames ethanol for emissions that are attributable to the aromatic compounds. A 2007 Society of Automotive Engineering (SAE) paper by General Motors scientists (SAE 2007-01-4089) states that permeation is the main remaining source of evaporative emissions, and that “Permeation increases exponentially with fuel aromatic content.” Reporting on testing of its Viton elastomer materials, DuPont says that “Aromatics play a major role in the effect a fuel has on elastomers”.

Appendix B of a 2001 California Air Resources Board report posed the question: “*Could Lower Aromatics Reduce the Permeation Increase? Neat ethanol is sometimes shipped in high-density polyethylene (HDPE) drums, and permeation is effectively zero. If aromatics are added to the ethanol, the permeation rate suddenly increases, as HDPE is very soluble in aromatics. California’s RFG3 fuel requirements allow up to 25% aromatics under the flat limits. (See Table in Appendix A) This is more than enough to create the start of the permeation. The question is: “Could the permeation increase caused by ethanol if lower aromatic content fuels were offered?”*”

A 2006 CRC study found that permeation decreased by 50% with E85 compared to E0 (gasoline containing no ethanol). As with RVP, ethanol’s peak permeation impact occurs prior to 10 percent. However, unlike RVP, ethanol has a mole fraction of 50% by E30 so permeation drops very quickly compared to the slower RVP reduction.

EPA Precedent Recognized Ethanol’s Evaporative Emissions are Much Less Reactive than Tailpipe VOCs Caused by Aromatics’ Incomplete Combustion. In the spring of 2000, then-EPA Administrator Carol Browner granted the Chicago – Milwaukee RFG region an RVP waiver for E10 blends which EPA justified on the basis of ethanol’s reductions in the highly reactive VOC tailpipe emissions, which more than offset ethanol’s slight increase in less reactive evaporative emissions.
http://articles.chicagotribune.com/2000-04-14/news/0004140089_1_ethanol-corn-based-additive-mtbe

Gasoline Aromatic Hydrocarbon Controls Would Enable Substantial Health and Climate Co-Benefits In Addition to Ozone and PM_{2.5} Emissions Reductions. Reducing gasoline aromatic hydrocarbon levels would substantially reduce the transportation sector’s carbon footprint, and mitigate serious impacts on public health by reducing ground level ozone formation, fine and ultrafine particulate matter emissions, as well as a wide range of potent MSATs, especially BETX and PAHs. In comments submitted to the California Air Resources Board (CARB) on its Low Carbon Fuel Standard, the EFC and UAI noted that automakers are expected to require gasoline for decades. Automakers say that they will require low carbon, high octane gasoline to power higher compression advanced engines to meet strict fuel efficiency

and carbon reduction requirements.¹⁰ Replacing aromatic hydrocarbons with high octane ethanol would help to achieve a myriad of important public policy goals, with substantial climate and health co-benefits, while saving motorists money at the pump.

Higher Ethanol Blends Program Would Help EPA Comply with a Number of Important Rulemakings.

The attached 2013 Oak Ridge National Labs study is noteworthy not just because of the unqualifiedly favorable conclusions about ethanol's efficiency potential that the Department of Energy scientists draw, but because they explicitly tie together Tier 3, the RFS, and CAFE. The study finds that "midlevel ethanol blends—such as E30" are "the enabling technology" for "near-term increases in vehicle efficiency and reductions in CO₂," such that they "could enable simultaneous compliance with RFS II and CAFE" and even "set the sustainable transportation trajectory to extend beyond the requirements set by RFS II and CAFE legislation." The study explicitly notes that the certification fuel that determines CAFE and greenhouse gas emissions compliance "is currently up for debate," and cites the EPA's Tier 3 rulemaking.

Unfortunately, the EPA failed to enable automakers to take advantage of E30's significant benefits in its final Tier 3 rule, which is why EFC and UAI petitioned the DC Circuit Court to vacate EPA's unworkable E30 test fuel provisions.¹¹

EPA also missed a major opportunity in its final 2007 MSAT rule, when it failed to regulate benzene-related aromatic compounds as Congress directed it to do in Sec. 202 (l). Inexplicably, EPA rested its decision largely upon an economic model that used wildly outdated and/or fallacious assumptions, including \$19 crude oil, and an octane equivalence ratio of two gallons of ethanol to displace one gallon of toluene. In fact, the opposite is true: one gallon of ethanol provides the same octane boost as do two gallons of toluene. Ethanol's superior octane properties were confirmed in the MathPro et al. study cited earlier, and EPA's refusal to recognize the proper relationships is another clear example of its failure to use best available science in designing its regulatory policies with regard to cleaner gasoline.

In its 2007 MSAT Final Rule, EPA observed that "[t]here may be compelling reasons to consider aromatics control in the future, especially regarding reduction in secondary PM_{2.5} emissions, to the extent that evidence supports a role for aromatics in secondary PM_{2.5} emissions."¹² Since that time, EPA inexplicably has failed to take advantage of the tremendous benefits aromatics control would bring to public health and the environment, and to automakers and consumers.

As Oak Ridge and others have observed, EPA would find it much easier to comply with a number of its regulatory obligations—including the GHG – CAFE, Tier 3, RFS2, and MSAT requirements—if it implemented a nationwide Clean Octane program. Just as it did with the successful transition from leaded to unleaded gasoline, EPA could significantly improve the public health and welfare by encouraging the displacement of toxic aromatic compounds by ethanol's safe, clean-burning octane. Substantial reductions in ozone-forming pollution would be just one of the many benefits. UAI respectfully urges EPA to credit states for using mobile source controls in their SIPs, and assist them by taking the necessary steps to reduce gasoline aromatic hydrocarbons by 60% or more, thereby substantially reducing the primary source of urban ozone-forming emissions.

¹⁰ California Air Resources Board, "Proposed Re-Adoption of the Low Carbon Fuel Standard", Comments submitted by the Energy Future Coalition and Urban Air Initiative, February 17, 2015.

¹¹ Energy Future Coalition et al. v. Environmental Protection Agency, United States Court of Appeals for the District of Columbia Circuit, No. 14-1123, oral argument scheduled for March 20, 2015.

¹² Supra, 2007 MSAT Final Rule, p. 8479

