February 13, 2012

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Secretary of Transportation
U.S. Department of Transportation
1200 New Jersey Avenue SE
Washington, DC 20590

Honorable Lisa Jackson
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue NW
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Subject: NHTSA-2010-0131 and EPA–HQ–OAR–2010– 0799, Proposed Rule, 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy

Secretary LaHood and Administrator Jackson:

We appreciate the opportunity to comment on this proposed rule that many believe will shape the U.S. transportation fuels sector for decades to come, and significantly impact the nation's economy, environment, public health, and energy security. These comments are being submitted on behalf of an ad hoc coalition[1] made up of non-profit trade organizations and other stakeholders who support expanded use of clean-burning biofuels and other forms of "Clean Octane"[2] in the U.S. transportation fuels sector to reduce the nation's dependence on petroleum and reduce harmful emissions to improve our nation's air quality.

RECOMMENDED ACTIONS. The Agencies have proposed a rule with multiple, and potentially competing, objectives. Increasing fuel efficiency and reducing transportation sector petroleum use and carbon emissions, without compromising urban air quality, requires a balanced approach to both fuels and vehicles. In order to enable the most cost effective compliance with these important objectives, we respectfully recommend the following changes to the rule as it now stands:

1. Provide automakers with sufficient incentives to commit to aggressive flex fuel vehicle (FFV) production schedules post-MY2016, with robust credit trading mechanisms among vehicle classes and among the manufacturers themselves. FFV incentives should be on par with those provided by the Agencies to other fuel options incented by this rule, such as electric, CNG, and fuel cell-powered vehicles.
2. Properly credit ultra-low emissions, high octane, low sulfur ethanol blends' (E30+ blends) higher octane; power density; reduced carbon; and RVP control benefits in calculating both Petroleum Equivalency Factor (PEF) and carbon reduction credits.
3. Acknowledge the importance of octane in achieving both fuel efficiency and carbon/criteria pollutant reduction, and E30+ blends' unique ability to transform an 84 sub-octane gasoline blend-stock into a high-quality, clean-burning 94 octane (AKI) finished fuel.
4. Give full weight to E30+ blends' ability to substantially reduce both PM and PM2.5 emissions, including the associated toxic PAHQ emissions, and thus fairly credit their ability to protect against unintended urban air quality impacts.
5. Update the CMAQ model to ensure full capture of the benefits derived from the significant reductions in urban PM2.5 secondary organic aerosol (SOA) that will occur due to the reductions in gasoline "Aromatic Group Compounds"[3] made possible by E30+ blends' substitution (especially significant for OMB cost – benefit analysis purposes, see discussion on p. 6 and Attachment D).

[1] Coalition members include the American Coalition for Ethanol; Clean Fuels Development Coalition; Growth Energy; and the Nebraska Ethanol Board.
[2] Examples of Clean Octane include compressed natural gas (CNG) and intermediate level ethanol blends (e.g., E30+).
[3] Aromatic Group Compounds, commonly known as "aromatics", are derived from crude oil and used to enhance gasoline octane ratings. They span the gasoline distillation curve spectrum, from lower boiling compounds (benzene, toluene) to higher boiling compounds (e.g., multi-substituted alkyl aromatics, MSAAs). In addition to their octane characteristics, Aromatic Group Compounds are typically low volatility, high double bond equivalent (DBE) gasoline components. Their molecular structure makes them difficult to combust, and thus they disproportionately

6. Recognize ethanol's cost advantages compared to gasoline Aromatic Group Compounds, and the sufficiency of E30+ ethanol supplies over the term of this rulemaking to both reduce Aromatics Group Compounds, and increase U.S. gasoline octane levels, while helping to reduce automakers' costs of compliance (see Attachment J).
7. Develop commercially practicable methods to measure actual usage of E30+ blends post-MY 2019, whether it be on-board diagnostic reporting, or other predictable, and transparent, macro-accounting procedures.

BACKGROUND. Since the enactment of the 1990 Clean Air Act Amendments (1990 CAAA), U.S. policymakers have recognized that U.S. transportation fuels policy should strive to preserve a careful balance between vehicles and the fuels that power them, as they are synergistic pieces of an integrated system. Requiring automakers (original equipment manufacturers, or OEMs) to improve vehicle hardware and engine technologies without at the same time requiring fuel providers to improve fuel quality would be bad policy, and could result in adverse unintended consequences that will ultimately undermine the important objectives of this rule. In particular, failure to upgrade fuel standards to replace Aromatic Group Compounds with Clean Octane alternatives will compromise the nation's petroleum use and carbon reduction goals, potentially resulting in increased ambient particulate matter (PM2.5, a currently regulated pollutant whose constituents include ultrafine particulates, or UFPs). We believe it is of paramount importance for the Agencies to ensure that the final rule properly recognizes intermediate ethanol blends' ability to enhance gasoline octane levels, and significantly reduce emissions of carbon and criteria pollutants. In order to take advantage of ethanol's unique qualities, the Agencies must revise their proposed rule to incent the manufacture of FFVs after MY2016 and require fuel quality improvements as Congress intended. This will be the best way to maximize cost effective compliance with both fuel efficiency and carbon reduction goals, enable the introduction of higher octane in-use fuels, prevent adverse urban air quality impacts, and protect the public health and welfare as new engine technologies come to market.

It is especially important to note that, in order to provide an accurate picture of the final rule's health and welfare impacts, the Agencies cannot evaluate emissions results based only on certification fuels and laboratory testing procedures such as the FTP and US06 methods. When real-world fuels containing on average 25% Aromatic Group Compounds are combusted under real-world driving conditions (e.g., stop-start, acceleration and high speeds, heavy loads, etc.), tailpipe emissions of harmful ambient particulate matter increase significantly, as the Aromatic Group Compounds' extraordinary resistance to complete combustion ultimately stymies the best efforts of the vehicles' catalytic converter. Even more worrisome is the fact that some of the more important new advanced engine technologies (e.g., gasoline direct injection) will make these emissions even worse if fuel quality is not improved.

CONGRESSIONAL INTENT IS CLEAR: FUEL PROVIDERS MUST SHARE COMPLIANCE BURDEN WITH VEHICLE MANUFACTURERS. The EPA is relying on statutory authorities contained in the 1990 CAAA to support its proposed actions in this rulemaking. Since the 1990 CAAA were enacted with overwhelming bipartisan support in the Congress, and signed into law by President George H.W. Bush, the EPA has been required to maintain a careful balance between vehicles and fuels. *Congressional Record* floor debates in both the Senate and House of Representatives are testimony to just how strongly lawmakers in both parties felt about the importance of periodic upgrades in fuel quality standards to keep pace with changing vehicle technology.

One example can be found in the Senate colloquy on the 1990 CAAA conference report,[4] in which Senator David Durenberger (R-MN) stated: "Over the 20 year history of the Clean Air Act most of the regulatory history has focused on the vehicle itself. . . .But it is possible to accomplish much more pollution reduction by focusing on the fuel." (S16921) The Senator went on to observe that "[a]romatic compounds include benzene, toluene, and xylene. All three are air toxics listed in Title III of the bill…Aromatics have a higher carbon content than the rest of gasoline, so gasoline high in aromatics contributes more to global warming." (S16922) Moreover, Senator Tom Daschle (D-SD), the primary author of the 1990 CAAA reformulated gasoline (RFG) amendment—commonly

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contribute to a wide range of emissions, including VOCs, MSATs, and particulate matter, especially in urban areas near congested roadways.

[4]Conference Report to the 1990 CAAA, Congressional Record, October 27th, 1990, Vol. 136, No. 150

called the "Clean Octane" provision—observed that the RFG language stipulates that "such regulations shall require the greatest reduction in…emissions of toxic air pollutants…achievable through reformulation of conventional gasoline, taking into consideration the cost…and any non-air quality and other air-quality related health and environmental impacts and energy requirements." Importantly, Senator Daschle also pointed out that "**[p]roper implementation of this authority will require the Administrator to…determine whether additional measures would increase emissions reductions and are achievable."** (S16923)

Congress most certainly did not intend for EPA to reduce one non-health pollutant (CO_2) while inadvertently increasing emissions of one of the nation's more dangerous health pollutants (PM 2.5). As will be demonstrated below, extensive scientific evidence provides ample basis to "reasonably anticipate" that particulate emissions from Aromatic Group Compounds represent a serious health threat today, and one that is almost certain to get worse unless new fuel quality standards that complement new engine technologies are imposed.

OEMs NEED CLEANER FUELS IN ORDER TO FULLY AND COST EFFECTIVELY COMPLY WITH THE RULE. To meet the aggressive targets established by this rule, OEMs will employ advanced engine technologies that would benefit from and require fuel quality improvements in order to meet the fuel efficiency and lower carbon goals without worsening other forms of pollution and contributing to air quality backsliding. The OEMs will bundle multiple advanced engine technologies to meet the stricter targets. Notably, the Agencies project that for spark ignition (SI) engines, gasoline direct injection (GDI) will be an especially important compliance tool, and they expect the OEMs to rapidly adopt it, projecting 85% penetration by 2016, and 100% by 2020 and beyond. However, as will be discussed more below, absent fuel composition changes, experts warn that for all of its mileage efficiency and carbon reduction benefits, GDI technology is expected to result in substantial increases in urban ambient particulate matter, especially the highly pathogenic PM2.5 that includes UFPs.[5] Unfortunately, if regulators ultimately decide to deal with that problem by requiring the OEMs to install filters and traps on SIDI engines (as is now done with diesel engines), adverse consequences are likely to ensue. Engine efficiencies and costs to consumers will be compromised. The Agencies will limit the ability of the OEMs to utilize engineering expertise to develop the optimal solution to reach the goals of this regulation. Experts warn that gasoline UFPs are so much smaller than diesel PM, use of filters will be ineffective, cost prohibitive, and counterproductive, leading to increased carbon emissions and reduced engine efficiency.[6] In short, failure to synchronize fuel composition changes with advanced engine technologies could negate many of the positive outcomes this rule is designed to achieve.

THE CRITICAL IMPORTANCE OF OCTANE. For SI gasoline-powered engines, octane is an extremely important fuel property to help the OEMs achieve both efficiency improvement and pollution reduction. NHTSA requested comment on whether higher octane fuels "may be necessary if certain advanced fuel economy-improving technologies are required by stringent CAFE standards" (p. 75335).

In a recent letter to EPA Administrator Jackson, the Alliance of Automobile Manufacturers has suggested increasing gasoline octane levels: "…[T]o help achieve future requirements for the reduction of greenhouse gas emissions, we also recommend increasing the minimum market gasoline octane rating, commensurate with increased use of ethanol."[7] The Auto Alliance also has recently stressed how important it is for regulators to recognize the differences between the various octane sources and the importance of ensuring fuel quality, in addition to controlling vehicle hardware and calibration effects. In comments submitted in September 2010 to California EPA on its LEV III certification fuel hearing, the Alliance noted that, "[a] Total Aromatics limit alone in the cert fuel spec does not preclude the blending of relatively high molecular weight aromatics that can lead to increased HC and PM emissions."[8]

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[5] See Health Effects Institute (Boston, MA) 2011 Fall Newsletter, p. 1. HEI warns that "[u]ltrafine particles'…small size and high surface area might make [them] especially toxic when inhaled. Concern has heightened recently, given evidence that emissions of ultrafine particles might increase with greater use of gasoline direct-injection engines and other changes in fuels and technology."
[6] See Delphi Powertrain International 2011 SAE paper, Attachment C.
[7] See Attachment A.
[8] See Attachment C for details.

While EPA did not specifically request comment on the matter of octane, it is our understanding that EPA assumes that the standard for SI engine fuel will be 87 octane (R + M/2), and that engine compression will be capped at 10.5:1. We believe this assumption unnecessarily inhibits fuel quality and engine design improvements that could be made available by both fuel providers and the OEMs, and that it could adversely impact the nation's petroleum dependence, carbon footprint, and health and welfare goals. Today, Aromatic Group Compounds constitute approximately 25% of an average gallon of U.S. gasoline, which refiners synthesize from crude oil to increase octane ratings. They are the most toxic, energy inefficient, carbon-intensive, and costly components in gasoline, and we believe that the goals of this rulemaking cannot be fully and efficiently met unless they are steadily reduced over time. As will be discussed further below, it is entirely realistic to reduce Aromatic Group Compounds in the U.S. gasoline pool while simultaneously increasing average octane levels over the life of this rulemaking.

NOT ALL OCTANE IS CREATED EQUAL. As we have seen, Congress recognized in the 1990 CAAA that there are very important differences between "Dirty Octane" (the Aromatic Group Compounds) and Clean Octane substitutes. That is why the Clean Octane amendments passed with such overwhelming margins in both the Senate (Daschle – Dole – Harkin floor amendment passed 69 – 30) and the House of Representatives. These large bipartisan majorities explicitly directed the EPA Administrator to reduce Aromatic Group Compounds in gasoline as technologies advanced to do so. We believe this rulemaking, as a complement to the expected Tier 3 rulemaking, is an appropriate vehicle for the Agencies to adhere to legislative intent and ensure that fuel providers bear their fair share of the compliance burden in meeting the nation's petroleum use, carbon reduction, and health and welfare goals.

Consider the many shortcomings of Aromatic Group Compounds:

- Gasoline and finished product yield losses at the refinery due to the energy intensive requirements of the catalytic reformer
- High cost component which escalates as crude oil prices increase
- High carbon intensity component
- Incomplete combustion properties exacerbate wide range of tailpipe emissions
- Primary source of urban ambient particulate matter [9]
- Primary source of urban polycyclic aromatic hydrocarbons (PAHs) and quinones (oxidative derivatives of Aromatic Group Compounds)[10] that coat the UFP particles in PM2.5
- Major culprit in combustion chamber deposits , which over time reduce vehicle efficiency and increase carbon and other harmful tailpipe emissions

In short, Aromatic Group Compounds are expensive to manufacture, and their costs escalate as crude oil prices rise. Aromatic Group Compounds would be even less cost competitive compared to Clean Octane alternatives if appropriate actions were taken to level the playing field, and Aromatic Group Compounds' true social costs were fully considered (under current policy, these costs are not borne by petroleum refiners as they should be, but rather by taxpayers and other industries in the form of higher health care spending and lost productivity, etc.). This is true

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[9] As will be discussed in more detail below, the Agencies have stated their intention to incorporate more detailed findings in the final rule from new science and model improvements. For example, the EPA says it will use its updated CMAQv.5.0 model to "…analyze the impact of the standards on PM2.5, ozone, and selected air toxics." This is potentially significant because EPA has known for years that its CMAQ model was substantially under-reporting the formation of mobile source PM2.5 secondary organic aerosols (SOAs). In urban areas, PM2.5 SOAs primarily originate from mobile sources, most importantly from toluene within the Aromatic Group Compounds. It must be assumed that incorporation of these new findings will also require NHTSA to make adjustments to its draft EIS, which gives insufficient attention to mobile source PM2.5, particularly the future health and welfare costs which will be imposed by increases in gasoline-derived particulate matter emissions, and will most severely impact the nation's highly vulnerable urban population. New science suggests that the particulate bound toxics can be found at elevated levels up to 2,500 meters from congested roadways, thus exposing a vast majority of Americans to these deadly pollutants.

[10] A quinone is a class of organic compounds that is formally "derived from aromatic compounds such as benzene or naphthalene."

even though budgetary pressures are forcing an end to tax incentives and other forms of public sector support for alternative fuel technologies. Examples of commercially available and cost-competitive Clean Octane alternatives to the Aromatic Group Compounds include:

- Compressed natural gas (CNG), especially in centrally fueled fleets
- Biofuels, especially intermediate ethanol blends (e.g., E30+)[11]

It should be emphasized that opening the door for these Clean Octane alternatives does not require the Agencies to "pick winners"; the marketplace can and will do that. However, it will be important for the Agencies to ensure parity among the competing alternatives and equitable treatment in the final rule. Properly done, the final rule will send market-based signals to the OEMs and private sector capital providers to build out the next generation of vehicles and fuels, depending upon cost, technology adoption rates, and consumer preferences. Each of these Clean Octane alternatives will require modifications to next generation vehicles (e.g., the relatively straightforward production of flex fuel vehicles capable of using E30+ blends). Each will also require changes in the fuel distribution system, ranging from relatively expensive modifications in the case of CNG, to relatively less costly flex fuel dispensers required for E30+ blends. However, as the successful Brazilian experience has demonstrated, none of these challenges are insurmountable. They have been accepted elsewhere on a large-scale basis by industry and consumers alike, and well within the time frame envisioned by this rule.

THE AGENCIES HAVE REQUESTED COMMENT ON A NUMBER OF IMPORTANT ISSUES. We commend the Agencies for requesting comment on a number of key issues that deserve careful consideration for shaping the final rule. Since we note that the Agencies project a fleet-wide penetration rate of only 1% for plug-in and electric vehicles (PHEVs and EVs) by 2021, and 7% for hybrid electric vehicles (HEVs), we believe that liquid fuel- propelled spark-ignition vehicles will continue to dominate the U.S. transportation fuels sector for many years, perhaps decades. A 2010 National Research Council (NRC) study was cited in a GM/Coskata paper as concluding that "PHEVs will have little impact on oil consumption before 2030 because there will not be enough of them in the fleet. More substantial reductions could be achieved by 2050 but will reduce oil consumption only slightly more than can be achieved by just the hybrid vehicles (HEVs)."[12] Therefore, we will focus our comments on the important role we believe E30+ blends can play in down-sized GDI vehicles with bundled advanced technology packages. (The page numbers below identify where in the rulemaking the captioned issue is raised by the Agencies.)

- P. 75335, IMPORTANCE OF OCTANE. As mentioned previously, we believe that octane should play an extremely important role in meeting the nation's transportation fuels sector goals between now and 2025 and beyond. There are critical differences between the Aromatic Group Compounds (Dirty Octane) and Clean Octane alternatives, involving a range of considerations including legal/statutory authority, technical/performance, and environmental/health criteria. In the process of finalizing this rule, we strongly recommend that the agencies avail themselves of the extensive body of third party scientific literature, including recent Society of Automotive Engineers (SAE) and other credible work that has been done on performance and emissions effects of E30+ blends compared to the different types of in-use gasoline.[13] Well respected experts such as Honda Motors, Delphi Powertrain, Oak Ridge National Laboratories, and Southwest Research Institute have published findings that contradict many of the conventionally accepted assumptions about higher ethanol blends' performance based on testing that has historically been conducted primarily by petroleum interests or affiliated entities. In particular, E30+ blends can help the OEMs more cost effectively comply with the new fuel efficiency rules, reduce transportation fuel carbon intensity and CO_2eq tailpipe emissions, improve advanced engine design performance, and achieve significant reductions in harmful pollutants.

- P. 75112, USE OF UPDATED CMAQ MODEL IN FINAL RULEMAKING FOR PM2.5, OZONE, AND AIR TOXICS. We commend the EPA for its stated intention to use the updated CMAQ model to "estimate the formation and fate of oxidant precursors, primary and secondary PM concentrations and deposition, and air toxics." It is imperative that EPA uses the best possible science in making these decisions, as they will

[11] See Attachment B for a chart comparing USGC spot toluene vs. spot ethanol prices for the period 2008 – 2011.
[12] "Ethanol – the primary renewable liquid fuel," Datta et al., J Chem Technol Biotechnol 2011; 86: 473-480.
[13] See Attachment C for a summary of some of the most important of these studies.

have significant impact on OMB's cost – benefit analyses. EPA has publicly admitted for some time that the earlier versions of its CMAQ models substantially under-reported the prediction of SOAs from mobile sources.[14] 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."[15] The OMB scores mobile source PM emission reductions orders of magnitude higher than those from stationary sources.[16] 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.[17] Thus, it is vitally important that EPA is now applying modeling 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 PM inventories. We also note that the EPA's October 19, 2011, announcement of the completion of its CMAQ 5.0 model means that it will be better able to measure localized pollution impacts, such as those that occur near congested roadways.[18] As a 2007 Tufts University study[19] and others have warned, EPA's regional modeling approach has seriously masked the true health costs of gasoline Aromatic Group Compounds and their primary role in urban PM emissions. 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 PM2.5 emissions, to the extent that evidence supports a role for aromatics in secondary PM2.5 emissions."[20] **In a 2010 study, EPA Office of Research and Development experts confirmed that anthropogenic pollution, especially mobile source primary carbonaceous particulate matter and NOx 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.**[21] This rulemaking provides EPA an opportunity to recognize the significant role played by gasoline exhaust, not just diesel exhaust, and the dominant role that Aromatic Group Compounds play in gasoline emissions. A May 2010 UCLA study noted that "several polycyclic aromatic hydrocarbons (PAHs) are toxic to living organisms, and engine exhaust emissions constitute a major source in urban areas…We focus this report on our estimates of vapor-phase naphthalene (NAP) from gasoline and diesel engines emissions…**taking into consideration that SI engines constitute 96% of the estimated 28 million California vehicle fleet, and that the NAP content in regular and premium gasoline ranges from 69 up to 2,600 ppm since 1999, reduction of NAP from SI fuels may constitute an effective means of reducing the emissions of a major SOA-forming precursor to the atmosphere of large urban centers."**[22]

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[14] EPA is adjusting 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.

[15] "Clean Air Fine Particle Implementation Final Rule," 40 CFR Part, 51; April 25, 2007; p. 20593

[16] 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 NOx from tall stacks located in rural areas with substantial geographic dispersal."

[17] "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 qulatiy Planning & Standards, Air Qual Atmos Health (2009) 2: 169-176. "…[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."

[18] http://www.epa.gov/nerl/documents/CMAQFactSheet.pdf

[19] See 2007 Tufts University study http://www.ehjournal.net/content/6/1/23

[20] Supra, p. 8479

[21] "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. (See Attachment D for a more extensive discussion.)

[22] "Reducing Polycyclic Aromatic Hydrocarbons (PAH) Content of Fuels: An Avenue to Reduce SOA Formation in Urban Centers?," Antonio Miguel, UCLA, presented to the American Association for Aerosol Research, May 16, 2010.

- P. 75112, OTHER HEALTH AND ENVIRONMENTAL IMPACTS ASSOCIATED WITH ADVANCEMENTS IN VEHICLE GHG REDUCTION TECHNOLOGIES. We strongly urge the Agencies to recognize the substantial body of evidence that links gasoline Aromatic Group Compounds to increasing levels of urban PM (PM2.5, which includes the UFPs), which are coated with highly toxic polycyclic aromatic hydrocarbons and quinones (PAHQs). Attachment E summarizes and provides cites for just a few of the leading epidemiological and related studies that provide alarming evidence linking gasoline Aromatic Group Compound combustion products to premature births and infant mortality, a wide range of cancers, asthma and other respiratory diseases, cardiovascular and heart conditions, and even brain disorders and autism. Many of the same PAHs found in secondhand cigarette smoke are found in gasoline exhaust (see cites 10, 11, and 12 of Attachment E), and for the tens of millions of Americans who live within 300 – 2,500 meters of congested roadways, there is no escape from the particle-bound toxics that originate from incomplete combustion of Aromatic Group Compounds.[23] As previously discussed, experts warn that advanced engine designs needed for automakers to comply with tighter fuel efficiency rules could lead to a significant increase in the UFP fraction of PM2.5 emissions unless fuel composition is upgraded to replace the toxic octane components of Aromatic Group Compounds with Clean Octane components.[24]
- VEHICLE FILTERS INEFFECTIVE FOR GASOLINE'S SMALLER PARTICLES. A number of recent studies have concluded that requiring the OEMs to fit gasoline-powered vehicles with filters or traps, as they have done with diesel engines, would be cost prohibitive, ineffective, and counterproductive. For example, according to the Delphi Powertrain International 2011 SAE study, ". . . the number size distributions show for homogeneous gasoline engines compared to Diesel engines typically a higher number of particles at smaller sizes…**the typically smaller particles generated by gasoline engines require a finer filter characteristic…which consistently leads to a negative impact on performance, fuel consumption, and CO2 emissions."** For that reason, we firmly believe that the most cost effective, and technologically efficient, solution to these undesirable tradeoffs is to upgrade fuel standards to significantly reduce Aromatic Group Compounds, which are the primary source of the PM2.5 and particle-bound toxics.
- P. 75104, ULTRAFINE PARTICLES' PM AND AIR TOXIC HEALTH EFFECTS. We believe it is critically important for the Agencies to recognize the direct connection between the UFP fraction of PM2.5 and the deadly toxics that coat them: the polycyclic aromatic hydrocarbons + quinones (PAHQs). Two of the nation's leading UFP authorities released a 2009 study finding that **"[u]rban UFP contain a higher content per unit mass of polycyclic aromatic hydrocarbons, which are relevant organic constituents since they can induce oxidative stress…in human tissues after conversion to quinones…"**[25] Over the past decade, advancing science and measurement techniques have established that the PAHQs—which experts say are carcinogenic, cytotoxic, and genotoxic—"hitchhike" on the tiny particles, which carry them to the bloodstream and throughout the body to the organs.[26] PAHQs are combustion byproducts and derivatives of Aromatic Group Compounds (see Attachment C for the discussion in the 2010 Honda SAE paper), and could be inadvertently and substantially increased by this rulemaking in the absence of fuel composition changes.

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[23] "In their research, the investigators focused on a class of cancer-causing culprits found in cigarette smoke called polycyclic aromatic hydrocarbons (PAHs)…The velocity of the cancer-causing process surprised the research team. **They said the speed with which the potentially lethal DNA assault began was comparable to having injected the PAH directly into an individual's bloodstream."**The PAHs found in cigarette smoke are the same as the PAHs that can coat UFPs, which lodge deeply into humans' lungs, and are carried to the organs by the bloodstream. http://envirocancer.cornell.edu/Factsheet/general/fs41.pah.cfm

[24] http://pubs.healtheffects.org/getfile.php?u=668; http://papers.sae.org/2010-01-2115/

[25] http://www.particleandfibretoxicology.com/content/6/1/24/ref, p. 5

[26] UCLA/USC researchers called PAH, etc., coating of UFPs a "Cellular energy crisis: particulate hitchhikers damage mitochondria". They said that "one of the body's most important processes—energy production in the cell—can be significantly disrupted by exposure to UFPs…the team isolated organic 'hitchhiker' substances such as PAHs and quinones that had attached to the particle cores". http://www.thefreelibrary.com/Cellular+energy+crisis%3a+particulate+hitchhikers+damage+mitochondria-a0134257218

- P. 75107, ACETALDEHYDE. We note that EPA states it is currently "conducting a reassessment of cancer risk from inhalation exposure to acetaldehyde," which is the only hazardous air pollutant associated with increased use of E30+ blends. Attachment F provides preliminary details on acetaldehyde's extremely low ranking in terms of Inhalation Risk Factor (IRF), as reported by DOE, CARB, and other experts (1, 3 butadiene = 100; formaldehyde = 4.6; benzene = 3.0; acetaldehyde = 0.8). We will be submitting a more detailed analysis on this subject for the Tier 3 rulemaking, but, in the meantime, we respectfully request that the Agencies take this information into account as they finalize this rule.[27]

- P. 75109, EXPOSURE AND HEALTH EFFECTS ASSOCIATED WITH TRAFFIC-RELATED AIR POLLUTION. We strongly urge the Agencies to update their database and assumptions with regard to how far mobile source air pollutants can travel at elevated levels. The Agencies, both EPA in the rulemaking, and NHTSA in its EIS, assume populations are exposed only 300 – 500 meters from congested roadways. (Even at this limited range, the Agencies note that 48 million people would be subjected to these elevated pollutant levels.) However, **more recent studies (such as 2009 CARB, UCLA, and University of Southern California research) show that mobile source-generated PAHs can be found at elevated levels as far away as 2,500 meters, or more than 1.5 miles.** The report states that these findings have "significant exposure implications, since most people are in their homes during the hours before sunrise, and outdoor pollutants penetrate into indoor environments."[28] This means that the vast majority of Americans are exposed to pathogenic PAHs and other particle-bound toxics that this rulemaking does not consider. As the 2007 Tufts University study warned, this oversight represents a major deficiency in transportation fuels regulatory policy, especially since vehicle GHG reduction technologies expected to come into widespread use as a result of this rule are likely to increase these pollutants dramatically.[29]

- P.75112, ESTIMATED COST AND ECONOMIC BENEFITS. As referenced in Attachment B, the 2008 – 2011 cost comparison of USGC spot toluene prices (a reference marker for Aromatic Group Compound pricing in general) and USGC ethanol prices shows that toluene prices have exceeded ethanol prices by an average of approximately $.70/ gallon over the three-year period, and more than $.80 per gallon over the past two years. (Q3 and Q4 in 2008 saw a precipitous drop in crude oil prices, from approximately $140 per barrel at its peak to $70+ per barrel at year-end. This global recession-induced plunge in oil prices had a direct, and aberrational, price depression effect on Aromatic Group Compounds.) **As a March 2010 United Kingdom Department for Environment, Food, and Rural Affairs report confirmed, world corn prices also dropped precipitously during this period, in line with oil and other raw commodities, even though U.S. ethanol production actually increased, a relationship that clearly refutes the much-publicized but fallacious "food vs. fuel" attacks.[30]** The cost advantages of ethanol's Clean Octane

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[27] Attachment F, "Putting Ethanol's Acetaldehyde Emissions Into Proper Context"

[28] A May 2009 UCLA/CARB study found "peak levels of ultrafine particles (UFP) immediately adjacent to the freeway, but we found high concentrations persisted for up to 1.5 miles downwind of the freeway during the pre-sunrise hours." Other pollutants, including "particle-bound polycyclic aromatic hydrocarbons, also extended far from the freeway during the pre-sunrise hours," which is a time when most people are in their homes.http://www.ph.ucla..edu/pr/newsitem061009.html

[29] "The most susceptible (and overlooked) population in the U.S. subject to serious health effects from air pollution may be those who live very near major regional transportation routes, especially highways. **Policies that have been technology based and regional in orientation do not efficiently address the very large exposure and health gradients suffered by these populations. This is problematic because even regions that EPA has deemed to be in regional PM "attainment" still include very large numbers of near highway residents who currently are not protected. There is a need for more research, but also a need to begin to explore policy options that would protect the exposed population."** (Emphasis added.) 2007 Tufts University study http://www.ehjournal.net/content/6/1/23

[30] March 2010 UK Department for Environment, Food, & Rural Affairs report, pp. 59 – 61: "…there has been no decline in maize (corn) use for ethanol—indeed it is projected to rise by 32% from 2007/8 to 2008/9…Despite this trend, world maize prices fell from $300/tonne in June 2008 to around $170/tonne in March 2009—this fall in spite of an estimated decrease in world maize production…Ethanol production continued to increase until August and then stayed at that level until the end of the year. Monthly US maize prices reached their peak in June 2008…In December 2008, the price was 45% below its peak level." CONCLUSION: "The fact that production of biofuels has remained steady since mid-2008,

compared to the Aromatic Group Compound's Dirty Octane, while impressive enough, pales in comparison to the enormous health benefits as well as reduced petroleum and carbon footprint benefits that would be achieved. Attachment F explains the basis of the table that extrapolates from EPA and Energy Future Coalition sources, and suggests that a gradual phase-down in Aromatic Group Compounds could save the public and private sectors more than $400 billion per year by 2025.[31] In the final rule, we strongly urge the Agencies to take all of its these critically important cost-benefit factors into account, especially as the EPA reassesses its PM2.5 SOA apportionment due to mobile sources based upon its new CMAQ modeling results.

- P. 74878, PETROLEUM EQUIVALENCY FACTOR FOR E30+ BLENDS. The Agencies state in footnote #56 that EPA is required to calculate fuel economy using DOE's Petroleum Equivalency Factor (PEF). We are concerned that DOE's simplistic approach to ethanol's PEF based only on energy density comparisons (e.g., dividing gasoline's 115,000 BTUs into ethanol's 76,000 BTUs) significantly and incorrectly penalizes ethanol when it comes to both petroleum displacement and, by extension, carbon reduction credit calculations. It is important that the Agencies recognize at least three distinct facts about ethanol's unique octane enhancement properties: 1) it has an octane rating as high, or higher, than Aromatic Group Compounds, which means that ethanol can reduce the catalytic reformer's significant gasoline and other product yield losses sufficiently to entirely offset its lower energy density (confirmed by the 2008 NREL/McKinsey linear program study cited below);[32] 2) its power density, chemical octane, superior octane sensitivity, and charge cooling effects help to further compensate for its energy density (BTU) shortcomings;[33] and 3) as ethanol volumes increase in the future in response to market-based signals, OEMs can optimize advanced engine designs for higher compression ratios and other modifications to take even greater advantage of ethanol's unique performance benefits. Taken together, these benefits result in a greater than 1:1 displacement effect from E30+ blend substitution for Aromatic Group Compounds. Another important factor that must be considered in any recalculation of ethanol's PEF is for the Agencies to recognize that as ethanol concentration increases, e.g., E30+ blends, depending upon base gasoline properties, ethanol's naturally lower Reid Vapor Pressure (RVP)[34] begins to take over, which allows refiners and blenders to more easily control for RVP (one of EPA's targets in the anticipated Tier 3 rulemaking). In any case, E30+ blends significantly reduce a wide range of tailpipe emissions, including NOx, CO, VOCs, weighted average MSATs, and PM/PN that far outweigh any evaporative emission increases.[35]

- ENSURE FULL-SCOPE COST-BENEFIT ACCOUNTING FOR REPLACING DIRTY OCTANE WITH CLEAN OCTANE. To our knowledge, the last time EPA did a cost-benefit analysis of reducing Aromatic Group Compounds was in the 2007 MSAT rulemaking. At that time, EPA's model used crude oil price assumptions of approximately $20 a barrel, which is of course 80% lower than current prices, making the analysis of little value. (Aromatics prices are tied directly to crude oil costs. As crude oil costs have soared in recent years, Aromatics Group Compound costs have also escalated rapidly.) Another major assumption that skewed the 2007 analysis against the potential of E30+ blends to replace Aromatic Group

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whilst prices of the food commodities used directly for biofuels have fallen dramatically (between June 2008 and December 2008, maize prices fell by 45%) suggest that biofuels were not the key driver, even in those feedstocks used directly in biofuel production."

[31] Attachment G sets forth a range of PM, carbon, toxics, and oil import savings achieved by a Clean Octane substitution program, projected to exceed $400 billion per year by 2025.
[32] http://www.nrel.gov/analysis/pdfs/44517.pdf, pp. 17 – 19. Specifically, as shown by the McKinsey linear program models, E30+ blends would provide sufficient octane clout to reduce refinery gasoline yield loss by approximately 9.9%, which effectively negates the mileage penalty predicted for E30+ blends. (The Agencies assume that E85 blends will result in 27% lower mileage, based on BTU calculations, although real-world mileage losses have been shown to be considerably lower. E30+ blends' mileage performance (assuming no engine optimization) should thus be approximately one-third of that, or 9 – 10% lower. See also Footnote #30.)
[33] See Attachment C.
[34] When not blended with gasoline, ethanol has an RVP of slightly more than two pounds.
[35] See Attachment C, particularly the Delphi and ORNL studies

Compounds was EPA's adherence to conventional wisdom as far as penalizing ethanol for its energy density and RVP properties. This resulted in EPA assuming that it took approximately 1.6 barrels of ethanol to replace 1.0 barrels of aromatics. In fact, E30+ blends' superior octane enhancement effects, and the RVP control tendencies of higher blends—coupled with the offsets that should be credited to them for their substantial tailpipe emissions reductions—should result in E30+ blends being credited for **at least** a one for one displacement of Aromatic Group Compounds.[36] In addition to the enormous health cost savings, there are at least two other costs-benefit considerations worth mentioning. The first is to recognize that commercial technologies exist to upgrade Aromatic Group Compounds and divert them from the gasoline pool to the value-added petrochemical market.[37] The second consideration anticipates a predictable defense from refiners as to why the gasoline Aromatic Group Compounds cannot be reduced, whatever their costs or health risks: the catalytic reformer is not only the source of aromatics, but also provides off-gas hydrogen used for other operations, such as diesel fuel desulfurization. We believe that the best response to this specious argument can be found in the previously mentioned 2008 NREL/McKinsey linear program study of U.S. refiners, which specifically addressed the issue: "The [Linear Programming] model also calculated the input costs for each scenario to account for changes in inputs (e.g., as the reformer and isomerization unit throughputs are reduced, additional hydrogen will have to be purchased)…**We also verified that increases in the inputs required, specifically hydrogen, could be met without driving up the prices of the inputs**." (Emphasis added.)[38]

- P. 75103, GHG – CAFE RULEMAKING CAN/SHOULD COMPLEMENT TIER 3 RULEMAKING. We note EPA's statement that for this analysis, they assume "…no effect on volumes of ethanol and other renewable fuels because they are mandated under the Renewable Fuels Standard (RFS2)…However, as a consequence of the fixed volume of renewable fuels mandated in the RFS2 rulemaking and the decreasing petroleum consumption predicted here, we anticipate that this proposal would in fact increase the fraction of U.S. fuel supply that is made up by renewable fuels. **Although we are not modeling this effect in our analysis of this proposal, the Tier 3 rulemaking will make more refined assumptions about future fuel properties, including (in a final Tier 3 rule) accounting for the impacts of the LD GHG rule."** Inasmuch as EPA wants to reduce gasoline sulfur content, achieve RVP control, and establish a pathway to reducing PM emissions from gasoline-powered vehicles, it makes sense for EPA to also strive for "increasing the fraction of U.S. fuel supply that is made up by renewable fuels."[39] However, we would point out that moving U.S. ethanol production and use to the next level faces many challenges, most of which will not be solved by simple reliance on RFS2 (the volume targets of certain categories of which can be, and often are, significantly reduced by EPA edict due to supply shortfalls). Private sector capital investment has dried up due to uncertainty driven largely by Blend Wall constraints and elimination of longstanding public sector support for new entrants. Now that the ethanol industry's tax incentives and other support has ended, what is most needed is regulatory policy that sends market-based, technology-neutral signals to investors that Clean Octane alternatives can compete on a level playing field with the entrenched, higher cost, higher carbon intensity, and highly toxic Aromatic Group Compounds. This is what the Congress intended in the 1990 CAAA, and it is what would be best for the nation's economy,

[36] For the reasons set forth in Footnote #25 above, we would respectfully suggest that now might be an excellent time for EPA to re-run the 2007 MSAT cost-benefit model using more current EIA oil price projections, and recognizing the 1:1 displacement factor for ethanol and Aromatic Group Compounds.

[37] See Attachment H for a discussion of commercially available technologies that are commonly used to convert Aromatic Group Compounds to higher value petrochemical building blocks.

[38] "2.4.2 Findings: As the percentage ethanol with which the CBOB will be blended increases, the share of naphtha in the CBOB increases, while the share of isomerate and reformate decreases…Overall, we found that refiners producing fossil gasoline for…**E20 blending, the fossil gasoline yield goes up by…6.7 percent…we found that gasoline prices at the pump could fall to…2 to 5 cents… (Footnote 27: The increased gasoline yield is the result of reduced throughput in the reformer. A secondary effect of backing down the reformer is reduced production of hydrogen, which is required for desulfurization of diesel. For most refineries, this will not be a problem as they typically have access to hydrogen produced from natural gas.)"** pp. 18-19. http://www.nrel.gov/analysis/pdfs/44517.pdf

[39] See p. 75103 of this rulemaking

energy security, environment, and public health and welfare. We strongly recommend that EPA fully consider the substantial benefits E30+ blends would bring in terms of: 1) reducing gasoline sulfur levels (a combination of refinery adjustments and the sheer dilution benefits of replacing Aromatic Group Compounds with 30+% low sulfur ethanol; 2) helping to control RVP, while achieving major reductions in a host of tailpipe emissions; and 3) substantially reducing PM, and especially PM2.5, and their associated PAHQ toxic emissions, even as the use of GDI engine technologies increases in the future. For the OEMs, and the entire nation, to extract full benefit from the use of these high-performance, low carbon intensity E30+ blends, it is imperative that the OEMs are properly incented to manufacture FFVs after MY2016. While FFV cost differentials will be considerably lower than CNG alternative vehicles and/or EVs/PHEVs, the OEMs must receive fair and balanced treatment if they are to make the level of commitment needed to ensure that American motorists are able to exercise "consumer choice" at the pump. This means that, over time, all vehicles should be capable of running on no less than E30+ blends, i.e., all FFVS. In the future, as more volumes of ethanol enter the marketplace—from a diverse range of sources, feedstocks, and technologies—the OEMs will be able to achieve even greater mileage efficiencies, performance enhancements, and carbon, PM, toxics, etc. reductions by committing to higher compression engines and other forms of optimization. They will not be able to make such a transition, however, unless FFVs are replacing older legacy vehicles as the fleet turns over.

- P. 74878, FAILURE TO EXTEND PARITY TREATMENT TO FFVs. Regrettably, we note that the Agencies fail to treat ethanol's many Clean Octane benefits equitably compared to other alternatives, and to offer the OEMs parity treatment as it relates to incentives to manufacture FFVs compared to other types of vehicles. The Agencies state: "To facilitate market penetration of the most advanced vehicle technologies as rapidly as possible, EPA is proposing an incentive multiplier for compliance purposes of all elec**tric** vehicles (EVs), plug-in hybrid electric vehicles (PHEVs), and fuel cell vehicles (FCVs) sold in MYs 2017 through 2021." (The Agencies are relying on at least one questionable assumption to justify the EV incentives, in that they have elected to assume no upstream carbon emissions from electricity generating units.)[40] CNG vehicles are also being incented in this manner. However, in stark contrast, EPA proposes no such incentive multiplier for FFVs, even as it also proposes to eliminate the Usage Factor for all FFVs after MY2016. Consequently, the OEMs have no incentive to manufacture FFVs in the future, which will effectively cap the ethanol industry at its current levels, and thus unnecessarily, and unwisely, prevent the realization of the enormous economic, environmental/health, and energy security benefits that would accrue from an aggressive E30+ Clean Octane program.

- P. 75126, CO_2 REDUCTION BENEFITS AND THE SOCIAL COST OF CARBON. The expanded use of E30+ blends between now and 2025 would achieve substantial reductions in mobile source carbon emissions. EPA has confirmed that Aromatic Group Compounds are 20% more carbon intensive than gasoline itself, and that based on their molecular formulas, ethanol's carbon share (% mass) is approximately 40% less than Aromatic Group Compounds.[41] In addition, an accurate assessment of the carbon reduction impacts of a Clean Octane fuel reformulation program would have to recognize that the combustion of Aromatic Group Compounds emit orders of magnitude more carbon (see Southern California Particle Center chart, Attachment I). In its December 7, 2011 Technical Support document on

[40] A stark example of this unbalanced treatment is the EPA's provision of an advanced technology vehicle incentive in the form of a 0 g/mile compliance value for MYs 2017 and later electric operation. This 0 g/mile assumption was retained despite opposition from some quarters during the run-up to the proposed rule. In the September 2010 Interim Joint Technical Assessment Report for this rulemaking, the Agencies noted that "[s]ome environmental and public interest groups expressed concern that the 0 g/mi value does not adequately capture upstream emissions from the charging of electric vehicles, and believe an upstream emissions factor should be included." Pp.5-6. In contrast, the ethanol industry has been subjected to rigorous upstream and downstream lifecycle analyses, including applying international Indirect Land Use penalties, while other fuels, such as tar sands and oil shale, have been exempted from such considerations.

[41] See "Final Rule for Mandatory Reporting of Greenhouse Gases," Technical Support Document, Climate Change Division, U.S. EPA, September 15, 2009, pp. 15, 32.
http://www.epa.gov/climatechange/emissions/downloads09/documents/SubpartMMPr

PM, CARB provided reinforcement for this assertion: "…[B]ased upon the SPN-EC correlation observed in this study, it is likely that the inclusion of a strict SPN standard would lead to reductions in EC (i.e., BC) emissions."[42] In a recent paper on BC properties, Sierra Nevada Research Institute noted that PAH isomers are a major source of urban BC (EPA's draft 2011 Report to Congress on Black Carbon stated that mobile sources are the source of approximately 60% of BC emissions in the U.S.), and that automobiles are a major source of PAH isomers.[43] As noted above, the Agencies are proposing to generously incent manufacturers to build FCVs, even though their commercialization is still many years away, because they can utilize hydrogen, which is a fuel that contains no carbon, and therefore would theoretically have no CO_2eq emissions. Using the same logic, the Agencies should be eager to incent the manufacture of FFVs, which can be mass produced today, and which are required to enable increased use of a fuel which contains at least 40% less carbon than the compounds it replaces, and which is available in large quantities today.[44] By facilitating the widespread availability of FFVs, the Agencies can remove one of the most formidable barriers to E30+ blends' commercialization. Increased use of such blends would help the OEMs by reducing compliance costs in meeting the rulemaking's 2025 goal of 163 g/mile of CO_2eq emissions, due to a combination of their lower carbon molecular composition, as well as their ability to substantially reduce high carbon intensity combustion byproducts . We believe that this rulemaking fails to properly identify, and credit, E30+ blends' cumulative carbon effect. The leading alternatives to the Aromatic Group Compounds all have a much lower carbon intensity index than the high carbon content they would displace, as suggested by the estimates in the table below.

Cost-Effective Alternatives to Aromatic Group Compounds	**Carbon Intensity Index vs. Gasoline**	**Carbon Intensity Index vs. Aromatic Group Compounds***
Corn ethanol [1]	21%[1] - 59%[2]	41 - 79%
Sugar cane ethanol [1]	61%	81%
Cellulosic ethanol [1]	72 – 130%	92 – 150%
Electric vehicles	25% – 100% (electricity source)	45 – 120%
CNG [3]	25%	45%
Bonus Credit: Avoidance of filters [4]	++	+++

*Calculations do not take into consideration the higher carbon intensity of PM2.5 and UFPs, which would be additive

[1] EPA RFS2 Final Rule Lifecycle GHG Analysis, February 2010

[2] Improvements in Life Cycle Energy Efficiency and Greenhouse Gas Emissions of Corn-Ethanol, *Journal of Industrial Ecology*, *Volume 13*, *Issue 1*, pages 58–74, February 2009

[3] EPA 420-F-00-033

[4] Experts warn that filters/traps to reduce gasoline particle matter, which is orders of magnitude smaller than diesel PM, would be extremely cost prohibitive, and would interfere with fuel efficiency and carbon reduction goals (see Attachment C, 2011 Delphi Powertrain International SAE paper)

- P. 75070, TECHNOLOGY PENETRATION AND ADOPTION RATES. We have already noted that a range of experts—the NRC, the Agencies, and the OEMs themselves—predict that technology adoption challenges will limit the penetration of EVs, PHEVs, HEVs, and FCVs well into the future. Meeting this rule's important objectives will require primary reliance on liquid fuels to power mostly SI engines,

[42] http://www.arb.ca.gov/regact/2012/leviiighg2012/levappp.pdf, p. 126

[43] "Black Carbon's Properties and Role in the Environment: A Comprehensive Review", Shrestha et al., *Sustainability* 2010, 2, 204-320;doi:10.330-/su2010294, p. 5.

[44] Some experts have argued that next-generation cellulosic ethanol's reduced carbon footprints closely resemble the net carbon reduction benefits that have been attributed to the use of hydrogen in fuel cell-powered vehicles.

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wable-liquidfuel+JCTI

equipped with advanced engine technologies. Many of the SI engine technology advancements are expected to be adopted rapidly. For instance, the Agencies project that GDI advances will be incorporated into 85% of new vehicles by 2016, and 100% by 2020 and beyond. Properly incentivized, the OEMs could make most of their light duty fleet flex-fuel capable within a comparable time frame, as the technology is readily available, and the costs are relatively low. There are at least two separate considerations involved here. The first consideration: whether or not the final rule properly recognizes the value of E30+ blends in meeting the petroleum and carbon reduction goals, and therefore sufficiently incents the OEMs by way of Incentive Multipliers and/or Utility Factors to produce the FFVs needed to use the fuel. The second consideration: whether the OEMs realistically expect that sufficient volumes of ethanol will be made available in the coming years to make it worth their while to produce such vehicles, especially since by MY2019 they must demonstrate that the ethanol is actually being used for their credits to be earned? Recognizing that current U.S. ethanol production capacity already stands at one million barrels per day (bpd), we believe that this second question can be answered affirmatively. Using U.S. Energy Information Administration (EIA) numbers, we can paint the following picture of U.S. transportation fuel demand by 2025:

1. 2009, 245 million LDVs on U.S. roads
2. Based upon VMTs, each vehicle averages approximately 12,000 miles/year, and 22.5 mpg
3. Prior to the Great Recession, fleet turnover averaged 7%/yr. (e.g., entire fleet turns over every 14 years)
4. Assume only 5.5% replacement rate going forward, with fleet growth only 1%/year, effective 2013
5. Implies average new vehicles sales of 16.4 million vehicles/year
6. Assume new vehicles hit the 49.6 mpg target by 2025
7. Means that total U.S. LDV fleet would be 276 million vehicles, with an average fuel economy of 36 mpg
8. Equals 2.6 million bpd reduction in U.S. motor fuel consumption

If the EIA assumptions are anywhere near correct, the U.S. transportation fleet crude oil demand picture is in for a major transformation over the next 10 – 15 years. EIA numbers for 2010 show U.S. gasoline consumption at just short of 9 million bpd, which includes ethanol's 900,000 bpd. Adjusting the 2.6 mmbpd figure downward to net out diesel use yields a net reduction in mogas (motor gasoline) usage of approximately 2 mmbpd. That would make 2025 U.S. gasoline demand only 7 mmbpd, of which 1 mmbpd would be comprised of U.S. corn ethanol (capacity already in place), leaving a net total of approximately 6 million bpd of U.S. gasoline demand in 2025.

That means if the goal is to have a flex-fuel transportation system in place by 2025 that would accommodate a national average of E30+ blends, the U.S. would require only 2.1 million bpd of ethanol. This translates into an increase in ethanol supplies of only slightly more than double 2012's 1 million bpd of ethanol production capacity over a period of 13 years. To put this into perspective, the U.S. ethanol industry tripled its production capacity between 2005—the year RFS1 was signed into law—and 2011, or in only six years. Even with the recent elimination of ethanol tax incentives and import duty protections, the market-based signals of a properly drawn rule would unleash the private sector energies of scientists, investors, and feedstock producers to tap into a wide range of sources, technologies, and feedstocks.[45]

The table in Attachment J provides a snapshot of how market-based regulatory signals could successfully balance a gradual reduction in gasoline Aromatic Group Compounds levels with a gradual ramp-up in ethanol levels, until the U.S. has reached a sustainable "equilibrium" of nationwide E30+ blends in 2025.

[45] See Attachment J, "Primary Underlying Assumptions of a Nationwide E30+ Clean Octane Program: 2012 – 2025" for a table that lays out the key market drivers and inter-relationships that could enable a successful rollout of a nationwide program over the term of this rulemaking.

The graph attached to the table shows how U.S. fuel providers can actually REDUCE (Aromatic Group Compounds), REPLACE (with E30+ blends), and INCREASE (the U.S. transportation sector octane pool in the process). Such an outcome is achievable, so long as the Agencies adequately incent FFV manufacture in this rulemaking, and require higher quality fuel standards here and in the upcoming Tier 3 rule.

The primary assumptions are set out in the Key Market Driver Criteria column. They include the following:

- The fuel efficiency rules will reduce U.S. mogas consumption to 7 mmbpd by 2025
- This means that by 2025, U.S. ethanol use must reach approximately 2.1 mmpbd, or slightly more than double current production capacity of 1 mmbpd over the next 13 years
- That 84 sub-octane blend-stocks average approximately 10 volume % Aromatic Group Compounds
- That E30+ blends, when added to 84 sub-octane gasoline, result in a high quality finished gasoline of approximately 100 RON (for GDI engines)
- That ethanol will displace Aromatic Group Compounds on a one to one, gallon for gallon, basis, based upon its ability to reduce gasoline yield loss at the refinery; the RVP control benefits of higher levels of ethanol in E30+; the de minimus mileage penalty that could occur with E30+ blends (vs. E85), even before the OEMs are able to employ optimization techniques, such as increased compression; and the additional miscellaneous benefits of ethanol's increased power density, chemical octane response, and charge cooling effects.

Finally, we are also confident that the nation's fuel distribution infrastructure can keep pace with the FFV manufacturing schedule and the expansion of next-generation ethanol production. Based upon typical turnover rates for the nation's gasoline dispensers, if flex fuel dispensers were as a matter of course substituted as the obsolescent dispensers are phased out (such as has been proposed by Senate Energy and Natural Resources Committee Chairman Bingaman), the entire U.S. fleet and fuel dispenser system could be flex-fuel compatible by 2025. Consumers would be empowered to save billions of dollars on their fuel purchases by having the freedom to select which blend of gasoline and ethanol best suited their preferences, depending upon cost considerations, environmental impacts, and energy security concerns. Especially when compared to the formidable infrastructure and logistical challenges of some of the other alternatives, such as electric and CNG vehicles, transitioning to an ethanol flex fuel system can be done smoothly, cost effectively, and well within the time frame envisioned by the rule.

CONCLUSION. We respectfully urge the Agencies to make every effort to ensure that the final GHG – CAFE rule does not—in its pursuit of important petroleum and carbon reduction goals—inadvertently create air quality impacts that compromise the public health and welfare, especially that of our most vulnerable citizens living in our largest cities. Congressional intent in the 1990 CAAA is unmistakably clear: the U.S. transportation fuels sector must be managed as a synergistic whole, with vehicles and fuels carefully balanced and periodically aligned as the science advances and technological opportunities present themselves. This rule will shape the U.S. transportation fuels sector for decades to come and has the potential to make dramatic contributions to the nation's economic, energy security, environmental, and health and welfare goals. Failure to act now to match improved fuel standards with improved vehicle technologies will unnecessarily expose an entire generation of Americans to increased emissions, especially particle-bound toxics, substantially increase the nation's health care costs, and represent a missed opportunity of enormous proportions. In order to open the door to take full advantage of the many benefits of E30+ Clean Octane blends, it is imperative that the Agencies extend equal treatment to FFVs compared to electric, fuel cell, and CNG vehicles. The OEMs must be adequately incented to manufacture FFVs in the future. If they do not, ethanol use will be effectively capped at current levels, and the enormous benefits of a nationwide Clean Octane program will never be realized.