U.S. Environmental Protection Agency
Air and Radiation Docket and Information Center
Docket ID No. EPA-HQ-OAR-2013-0479
Mailcode: 28822T
1200 Pennsylvania Avenue, NW.,
Washington, DC 20460

Dear Administrator McCarthy:

The Environmental and Energy Study Institute and the Clean Fuels Development Coalition respectfully submit the following comments regarding the U.S. Environmental Protection Agency's Notice of Proposed Rulemaking in *Federal Register* Vol. 78, No. 230 dated November 29, 2013, regarding the proposed fuel reduction, "Standards for the Renewable Fuel Standard Program".

The Environmental and Energy Study Institute (EESI) is an independent, non-profit organization, dedicated to promoting an environmentally and economically sustainable society. EESI seeks to advance a transition to a low-carbon economy through energy efficiency and renewable energy, including sustainable biomass energy. Founded by a bipartisan Congressional caucus in 1984, EESI is governed by a diverse Board of Directors comprised of environmental, business, academic, and former political leaders, serving as a trusted source of credible, non-partisan information on energy and environment solutions for policy makers.

The Clean Fuels Development Coalition (CFDC) is a non-profit organization established in 1988 to support the development of alternative fuels that can reduce US dependence on imported oil, stimulate the economy, and improve public health by reducing harmful emissions from petroleum. The CFDC has a broad base of members and supporters from the agriculture, biofuels, automotive, and technology sectors. CFDC has been involved in virtually every major policy program affecting biofuels at both the state and federal level for the past 25 years. CFDC representatives served on the original regulatory negotiating committee for the mobile source provisions of the Clean Air Act Amendments of 1990 that established the oxygenated fuels and reformulated gasoline programs. CFDC was also involved in the transition to the Renewable Fuel Standard that created broad demand for biofuels like ethanol and biodiesel. EESI and CFDC strongly support keeping the full volumetric requirements of the RFS regulation.

In the proposed rule, the EPA asserts that there is inadequate domestic supply of biofuels that, together with the "blend wall", warrant a total reduction in the Renewable Fuel Standard (RFS). However, achievable solutions to the arbitrary limits of the volumetric requirements in the "blend wall" as well as growing production of advanced fuels show that the full volumetric requirement is the best step forward for the RFS and the biofuels industry. Not only does the full volumetric requirement support complementary EPA policies, it helps to protect the health and safety of humans and the environment. Additionally, there is evidence that some of the predictive models used by the EPA de-emphasize the contribution of gasoline aromatics to particulate matter (PM) and other harmful pollutants. Alternatively, biofuels are a clean burning, non-toxic fuel additive. Maintaining the full volumetric requirement of the RFS is critical not only to a growing and advanced technology, but to human and environmental health.

The myths surrounding biofuels are pernicious, despite the fact that in a few short years, the RFS has already achieved tremendous success. The RFS is meeting many of its goals; improving energy

security, stimulating rural economies, and reducing greenhouse gases and toxic aromatics from transportation fuel. Between 2005 and 2012, ethanol has risen from 1 to 10 percent of gasoline supplies and reduced our dependence on imported petroleum in the same time period.[1] The RFS has created 100,000 direct jobs, and has saved families an average of $1200 at the pump.[1] Most importantly, biofuels provide a healthier alternative to petroleum, both for humans and the environment. Reducing the total volumetric requirements for 2014 under the RFS, from 18.15 Bgal to 15.21 Bgal, would have a chilling effect on the nation's biofuels industry and the investment community for advanced biofuels, an industry that is providing clean, homegrown fuel to Americans.

Additionally, the RFS is providing the incentive for the development of advanced cellulosic biofuels, which could provide regionally appropriate, homegrown fuels in every area of this country. The proposed reduction of the advanced biofuels category by 1.55 Bgal would be especially damaging to this nascent industry that has grown because of the consistent regulatory support provided by the RFS. The industry met the 2013 advanced biofuels target, and is set to produce even more in 2014. Additionally, several commercial scale plants are currently under construction, and advanced biofuels will soon achieve new applications, such as jet fuel.[2,3] There are currently 160 commercial-scale, advanced biofuel projects planned, under construction or recently completed, representing nearly $5 billion in private investment and billions in public investment since 2007.[4] All of these projects are due to Congress' long-term, bipartisan commitment to renewable fuels. The advanced biofuels industry views the RFS as the single most important investment and driver in the industry. These advanced technologies cannot be divorced from first-generation ethanol. Rather, advanced biofuels are building on the success of first generation biofuels, but will only continue on this path if the RFS is maintained.

Overcoming the "Blend Wall"

To provide a true fuel choice to consumers, EPA has a responsibility to overcome any barriers that are present in any potential E10 blend wall. In the proposed rulemaking, EPA states that,

> "a decrease in total gasoline consumption since EISA was enacted in 2007, coupled with limitations in the number and geographic distribution of retail stations that offer higher ethanol blends such as E85 and the number of FFVs that have access to E85 … combine to place significant restrictions on the volume of ethanol that can be supplied to and consumed in the transportation sector".

EPA has known about the existence of the potential for an E10 blend wall since the RFS1 was enacted in 2003, and the "blend wall" should not be the basis for a volumetric reduction of the RFS. The Department of Energy (DOE) has carefully examined the effects of E15 and E20 on legacy vehicles and found that it is safe to use in these vehicles.[5] Eighty percent of vehicles on the road today are able to use E15 fuels, with the EPA approving E15 in use of 2001 model year vehicles and beyond.[6] Commonly cited issues of misfueling, costly vehicle modifications and limited fuel availability can also be addressed with continued aggressive infrastructure investment for FlexFuel Vehicles (FFV) and blender pumps.[6] Solutions to the "blend wall" are available to us today; 15 percent ethanol blends have been approved for 80 percent of the cars on the road, and millions of FFVs can run on E85. General Motors estimates that there are now 20 million FFVs in the United States. FlexFuel Vehicles are available in dozens of makes and models, and if deployed co currently with hybrid and plug-in technologies, could be a win-win for manufacturers and consumers, achieving miles per gallon ratings of up to 500 mpg.[7] FlexFuel manufacturing credits provided a pathway that was immensely successful in getting FFVs on the road.

With full deployment of FFV and plug-in hybrid technology in vehicles, we could significantly reduce our dependence on unhealthy petroleum.

We also need to give FFV owners the opportunity to buy E85. Out of more than 100,000 retail gas stations in the United States, there are only about 2,400 that sell E85.[8] Increased deployment of blender pumps would give consumers flexibility at the pump as well as allow for the continued safe operation of smaller and legacy engines; blender pumps are a proven technology that is already widely used to mix mid-grade gasoline on-site. The Clean Fuels Development Coalition and the Flex Fuel Awareness Campaign estimate that there are approximately 750,000 dispensing pumps in the US and that approximately 10 percent of those pumps are routinely replaced each year as they wear out. Transitioning to a flex-pump system represents a modest incremental cost that would make a rapid transition to a full flex system feasible in conjunction with the schedule of the RFS. These measures, combined with consumer education and biofuels deployment in new sectors can move us beyond the "blend wall" towards a sustainable market of mid-blend fuels.

The petroleum industry has argued that the RFS is a matter of consumer choice, citing low consumer interest in mid and higher blends. However, as an obligated party, it is their responsibility to create interest and product acceptance. To say there is no consumer interest in these higher blends when they make it difficult or impossible for consumers to access them, is a self-fulfilling statement. And yet, consumers may be ready to buy higher blends of ethanol. In recent months, ethanol has been roughly 30 percent less expensive than gasoline, making it cheaper than gasoline on an energy equivalent basis. This price gap has opened a new opportunity for fuel retailers to market higher ethanol blends (E85 and E15) and pass on the savings to consumers. Encouragingly, according to a recent public opinion poll, more than 80 percent say they would like to have the choice to buy higher E15 and E85 blends at their local gas stations.[9] A recent uptick in the projected demand for gasoline shows that the blend wall is a movable target, at best.[10] Unfortunately, a poor job has been done in presenting consumers with true choice regarding their fuels. Congress should act to hold auto manufacturers, gasoline-powered equipment manufacturers, and fuel distributors free of liability for the use and mis-use of properly labeled E15 fuel in properly labeled equipment. Moving forward, auto manufacturers and fuel distributors should be required to make all vehicles and fueling equipment compatible with higher blends of ethanol, up to E85. Furthermore, there is enormous growth potential in the renewable fuel market, with advances in drop-in fuels, advanced biodiesel and efficiencies in agriculture in a remarkably short period of time since the 2007 Energy Independence and Security Act. The so-called "blend wall" is a convenient argument against the full volume of the 2014 RVO, but it holds little weight when looking at the full picture and the immense progress that is being made.

RFS Has Reduced our Unhealthy Dependence on Petroleum

The RFS already reduced our dependence on unhealthy and environmentally destructive petroleum. Between 2008 and 2012, the United States consumed more than 59 billion gallons of renewable ethanol and 2.7 billion gallons of renewable biodiesel, which equals four months of US gasoline consumption.[11] Splash blending of ethanol with gasoline reduces the total load of mutagenic, carcinogenic and teratogenic compounds from gasoline such as polycyclic aromatic hydrocarbons, commonly referred to as PAHs or aromatics, as well as particulate matter ($PM_{2.5}$ and PM_{10}), ultrafine particulate matter (UFP), secondary organic aerosols (SOA), carbon monoxide (CO), ozone and other harmful compounds. Paradoxically, the effects of these toxins will not decrease with increased fuel efficiency. Ford engineers have found that without improved fuel quality, advanced engine technologies

such as direct injection will increase emissions of aromatics and PM due to incomplete fuel volatilization in these systems.[12] Fortunately, a better oxygenator is already available. Researchers at Ford Motor Company have demonstrated that blends of E30 and higher reduce PM emissions (both in mass and particle number) by up to 45 percent, and reduce NOx by 10 to 20 percent.[14] Hence, volumetric reduction in the RFS would lead to a needless increase in premature deaths as well as asthma, heart disease and an entire constellation of diseases that are now being linked to the toxic additives in our fuel supply.

Gasoline also significantly contributes to greenhouse gas emissions (GHG), the driving force of anthropogenic climate change. To date, the RFS has prevented an additional 205 metric tons of CO2 from being emitted from vehicles, equivalent to removing 39 million cars from the road.[1] Additionally, the RFS is supporting other federal policies that will reduce our carbon dioxide (CO2) and toxic emissions: the CAFE standards, the reformulated gasoline (RFG) specification and EPA's proposed Tier III standards. High octane fuel is crucial to the success of these policies. For instance, as miles per gallon increase under the new CAFE standards, more efficient fuel will be needed. Automakers have long pushed for higher octane regular fuels, to ensure that direct injection technologies operate properly, as well as allowing for manufacturers to more easily comply with more stringent CAFE standards.[13] Widespread use of higher-octane fuels also will assist in overcoming the so-called blend wall.[13] Direct fuel-injection technology demands high-octane fuels, which can be easily provided by E30.[14] These mid-level ethanol blends would provide "ridiculous power and good fuel economy", according to William Woebkenberg, senior engineer for fuels policy at Mercedes-Benz.[15] The auto industry is eager for high octane fuels and recognizes the value of biofuels. In a 2012 presentation, a Chrysler representative stated, "ethanol offers low carbon content and less GHG emissions....and offers most expedient and least expensive means to lessen CO2 for liquid fuels." This sentiment is echoed by other American automakers,

- General Motors, 2012: "Ethanol can be used to produce new, higher octane fuels that can be used more efficiently...using ethanol to increase octane of fuels could be a cost effective means to reduce GHG."
- Ford, 2012: "While additional work is needed to quantify and optimize the costs and benefits, ... it appears that substantial societal benefits may be associated with capitalizing on the inherent high octane rating of ethanol for future high octane needs."
- Ford, 2012: "At equivalent part load conditions, E85 exhibits fundamental benefits in thermal efficiency and CO2 emissions compared to E0 gasoline of about 4% and 7% respectively. These fundamental benefits should be included in the analysis of the fuel economy and CO2 implications of increased ethanol content in future ethanol-gasoline blend fuels."

Biofuels provide a clean alternative to toxic, petroleum-based fuel oxygenates such as benzene, toluene, ethylbenzene and xylene (BTEX) that are currently in our gasoline. The EPA has the authority, and the obligation, to enforce Section 202 of the 1990 Clean Air Act Amendments, to reduce "mobile source air toxics" to "the greatest degree … achievable," and in particular to reduce the toxins emitted by gasoline aromatic compounds (BTEX).

Clean Fuel, Healthy Air

Corn ethanol and advanced biofuels provide a clean alternative to toxic aromatic compounds that are used to boost octane in gasoline. When BTEX was chosen as an alternative to lead, in order to provide the same octane-boosting qualities, its dangers were already well established.[16] In 1989, when the removal of lead from gasoline was being considered in Congress, the *Congressional Record* was filled with warnings about the parallels between BTEX and lead. There was early concern about aromatic additives in gasoline. In 1987, Senator Tom Daschle wrote to Vice President Bush to express his and many other's concerns about the negative health effects of aromatics and BTEX, writing,

> "given the mounting scientific evidence linking rising gasoline aromatic levels and the increased risk of human exposure to highly carcinogenic benzene, I believe the federal government should initiate a coordinated effort to reduce the dangers from gasoline spills and auto emissions, and that this effort should include the promotion of the use of environmentally safe ethanol as an alternative means of octane enhancement."[17]

Senator Daschle, along with Senators Dole and Harkin introduced the "Clean Octane" amendment S. 1630, to the 1990 CAAA, which passed along with the other 1990 CAA amendments. The Clean Octane amendment calls for the use of "benign additives to replace the toxic aromatics that are now used to boost octane in gasoline." Over 20 years later, this intent has not been fulfilled. While we have succeeded in removing some of the benzene added to gasoline, it still contains at least 20 percent by volume of other aromatics, such as toluene, ethylbenzene and xylene, which are converted to benzene, an aromatic compound, upon combustion. Research has also indicated a positive relationship between gasoline aromatic content in the formation of Secondary Organic Aerosols (SOA), an ultrafine particulate matter. Researchers at the Harvard School of Public Health demonstrated that the aromatics blended into gasoline are particularly efficient at forming SOA. [18] These ultrafine particulates (commonly referred to as $PM_{2.5}$) arise from the incomplete combustion of gasoline aromatics (BTEX) and contain a mixture of soot, ash, and unburned fuel and lubricant.[12]

While we have spent considerable effort reducing diesel emissions, gasoline still represents the majority of fuel usage in the United States. There has been much focus on the role of diesel fuel and its elevated content of nitrogen oxides (NOx), PM, and sulfur dioxide (SO2) as compared to gasoline, and yet gasoline contains more CO and aromatics by volume, due to its higher fuel volatility.[19] Gasoline is responsible for a staggering 69 percent of aromatic emissions, while in comparison diesel use is responsible for one percent of aromatic emissions.[18] Additionally, light-duty gasoline vehicles have been found to contribute 40 percent of the total tailpipe emissions of PM in California.[20] The scientific research on the health effects of aromatics and their formation of SOA, PM, UFP and PAHs has been mounting in recent years.[16] Ultrafine particles, which are coated in polycyclic aromatic hydrocarbons (PAHs), penetrate deeply into human lungs and make their way into the bloodstream.[16] Urban areas are subject to particularly high aromatic exposures, due to both the volume of vehicles on the road but also the close proximity of most major population centers to aromatic-dependent refineries. These risks are especially high for our nation's children and research has repeatedly shown that fetuses and children are the most vulnerable to the toxins in our fuels. [21]

- Researchers have estimated that $PM_{2.5}$ is responsible for a calculated mean of 3,800 premature mortalities in the continental United States. When accounting for the higher toxic load in urban areas, premature mortalities were predicted at over 5,000 premature deaths per year. These unnecessary deaths are estimated to cost society anywhere from $13.6B to $34.9B.[18] Although these numbers represent only 1.4 percent

of the 130,000 premature mortalities due to all sources of $PM_{2.5}$, the proportion of mortality due to gasoline is expected to rise as other laws to clean our air are implemented; therefore these numbers represent a growing public health problem.[18]

- The aromatics contained in fuel are linked to infant mortality, low birth weight, lung function issues, respiratory diseases, asthma, developmental disorders as well as cancer.[21]
- Recently, researchers have found a connection between increased levels of air pollutants (particulate matter, nitrogen oxides and ozone) and increased autistic disorder risk. Among 408 children studied, those who were exposed (either as children or in utero) to increased air pollution were more likely to meet the criteria for autism or autism spectrum disorder. [22] Researchers at UCLA found an association between traffic related air pollution and increased risk of autism disorder. The researchers studied the connection between fetal exposure to PM, ozone, and NO and found a 12 to 15 percent increase in odds of autism disorder due to increased exposure to ozone and $PM_{2.5}$. They also found a 3 to 9 percent increase in the odds of developing autism disorder from elevated exposure to NO and NO_x.[23] Currently, the autism spectrum disorder affects 1 out of 88 children in the United States.[22]
- Several studies have linked fetal PAH exposure and developmental disorders and developmental delay.[24,21] Researchers at the National Institutes of Health found elevated levels of PAHs in umbilical cord white blood cells in children born to non-smoking women in New York City.[24] Fetal PAH exposure and increased attention problems and other behavioral problems were also correlated.[24] Societal impacts from increased childhood development disorders are numerous. Among children 6 to 17 years of age, 11.5 percent have been diagnosed with learning disabilities, 8.8 percent are diagnosed with attention-deficit/hyperactivity disorder, and 6.3 percent are diagnosed with behavioral problems, representing over 25 percent of our nation's children. Additionally, diagnosis rates are thought to be lower than actual rates. These children have higher incidences of low-self-esteem, depression, anxiety, as compared with their peers. Their parents face increased difficulties in the areas of childcare, employment and relationships with their children.[25]
- Asthma and aromatic exposure have been linked by several studies. Over the last 30 years, asthma rates have increased in the developed world; in the inner city, childhood asthma rates reach as high as 25 percent.[21]

Increased Biofuels, decreased Greenhouse Gases

In addition to being healthier for individuals, biofuels are healthier than fossil fuels for our planet. Gasoline and diesel use in transportation and industry account for roughly 48 percent of US greenhouse gases (GHG), the primary driver of climate change.[26] Despite falling demand for fuels domestically, CO2 emissions are projected to rise 0.85 percent between 2010 and 2020.[27] Alternatively, corn-based ethanol reduces GHG emissions by 18 to 28 percent on a per-gallon basis, and cellulosic ethanol would reduce GHG emissions by up to 87 percent.[28] Not only do biofuels reduce GHG emissions, they reduce the emission of particulate matter (or black carbon), and SOA, both of which are potent GHGs.

Although there have been some indirect land use change (ILUC) issues attributed to corn-ethanol, these issues have been overblown. While some marginal agricultural lands have been converted to corn production, unfortunately resulting in some nitrogen and phosphate fertilizer runoff as well as increased GHG emissions, RFS is only one among many contributing factors in the demand for agricultural land. Strengthening agricultural conservation programs, not rolling back the RFS, could resolve these issues. It is also worth noting that the agricultural sector has made great efficiency gains, and is producing corn and other feedstocks on less land and using less water and inputs than when the RFS was first enacted. Corn that is converted to ethanol represents less than 6 percent of all harvested cropland in the US. The production of corn has become much more efficient, decreasing GHG emissions by 36, land use by 30 percent, soil erosion by 67 percent irrigation by 53 percent and energy use by 43 percent (per bushel).[29] Additionally, some studies indicate that corn growth on existing agricultural lands increases soil health, by returning carbon to the soil and the addition of organic matter to the soil.[30]

Corn ethanol has already met the 20 percent GHG reduction target mandated by the RFS, a target that was set for 2022. Currently, corn ethanol is reaching 50 percent less GHG emissions as compared to gasoline.[31] Of course, corn-starch based ethanol is only the first generation of biofuels. Next generation, advanced, cellulosic, and algae biofuels offer much greater potential for reducing costs, life cycle GHG emissions, land use, resource inputs, and environmental impacts. For example, Argonne analysis estimates that the life cycle GHG emissions from using corn stover to make cellulosic biofuel will be 96 percent less than gasoline; switch grass, 88 percent less; and miscanthus, 108 percent less.[32] These advanced biofuels are critical to moving the country away from its dependence on petroleum and to clean, renewable fuels for our cars, trucks, planes and ships.

Limitations of EPA Models to Predict Particulate Emissions

According to the EPAct E-89 study, an increase in ethanol volume in fuels results in an increase in emissions, both in the running and starting of the engine.[33] The parameters of this study should be carefully re-examined to answer the question, how exactly, the addition of ethanol in blends of 10 percent or higher will result in the increase of harmful aromatics. The answer may lie in the fuel blending practices; notably, a set octane was not used in the EPAct E-89 study.[34] Reformulated Blendstock for Oxygenate Blending (RBOB) allows the refiner to produce a sub-octane RBOB, since the required 2 percent oxygen will be added downstream with ethanol blending - known as match blending.[34] T90 is defined as the point at which 90 percent of the fuel vaporizes, usually over 400°F. This portion of the fuel contains the greatest fraction of ultra-fine particulates. RBOB fuels contain a higher percentage T90, since ethanol creates the ability to offload more of these toxins to the consumer market. Conversely, ethanol is below T50, with a boiling point of 173°F. Splash blending is adding ethanol to the final gasoline product that is already at the desired 87 octane level. Researchers at the Urban Air Initiative used the Honda Predictive Model Index (PMI), to calculate particulate emissions for E0, E10, E15, and E20. Their results showed that splash blending ethanol from E0 to E20 resulted in a 0.3 reduction in fine particulates.[34] The effect of match blending versus splash blending is a major parameter in any emissions testing and needs to be accounted for in any predictive model. Additionally, if refiners were required to perform splash blending, they would not be allowed to add heavy, low-value refinery fractions to gasoline prior to ethanol blending. Splash blending results in improved fuel quality.

The EPA Community Multi-scale Air Quality Model (CMAQ), is used by agencies world-wide to estimate the impact of potential regulations on air quality.[35] Despite the great successes of CMAQ in

meeting the EPA's National Ambient Air Quality Standards (NAAQs), independent research suggests the model's algorithms in CMAQv5.0 for estimating concentrations of SOA lead to under-estimation of the concentration of $PM_{2.5}$, particularly in the summer months.[18,36] For instance, researchers at the Harvard School of Public Health measured concentrations of $PM_{2.5}$ in 77 samples during the summer of 2006 in Cincinnati. They recorded concentrations of $PM_{2.5}$ as high as 0.41 µgC/m^3 (micrograms Carbon per meter cubed), with a median concentration of 0.14 µgC/m^3. In contrast, the CMAQv5.0 model for the same area and time calculated a maximum value of 0.13 µgC/m^3 and a median value of 0.052 µgC/m^3.[18]

The point is, there is a healthy alternative to aromatic additives to gasoline, namely biofuels. Splash blending of ethanol has allowed us to reduce the toxic load of aromatics and their secondary compounds from the fuel supply. Mid-level blends would further reduce individuals' needless exposure to toxic chemicals. Therefore, it is vitally important that the RFS levels remain and increase, not decrease, in 2014 and beyond. For the health of our citizens, especially developing children, RFS has provided critical reduction of toxic aromatics. Additionally, RFS is helping to reduce GHG and lessen our dependence on petroleum. The RFS is critical and effective policy. EPA's proposed action is causing a chilling effect on the investment community and the biofuels industry overall, just as advanced biofuels are growing, and as many new technologies, feedstock and facilities are coming on line. EESI and CFDC encourage EPA to re-evaluate the rollback of the 2014 RVO for the health of our citizens and our environment.

Sincerely,

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