U.S. Environmental Protection Agency

Air and Radiation Docket and Information Center

Docket ID No. EPA-HQ-OAR-2008-0699

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1200 Pennsylvania Avenue, NW.,

Washington, DC 20460

March 17, 2015

RE: COMMENTS ON THE PROPOSED UPDATES TO THE AIR QUALITY STANDARDS FOR GROUND-LEVEL OZONE

Docket ID No. EPA-HQ-OAR-2008-0699

Dear Administrator McCarthy:

The Environmental and Energy Study Institute respectfully submits the following comments regarding the U.S. Environmental Protection Agency's Notice of Proposed Rulemaking in Federal Register Vol. 79, No. 242 dated December 17, 2014, "National Ambient Air Quality Standards for Ozone."

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 the transition to a low-carbon economy through energy efficiency, wisely built infrastructure and a diverse portfolio of renewable energy. Founded by a bipartisan Congressional caucus in 1984, EESI is governed by a diverse Board of Directors comprised of environmental, business, and academic leaders, including former Members of Congress.

EESI applauds the efforts of EPA and the Obama administration to deal with air pollutants and greenhouse gases. Acting on climate change, perhaps the greatest threat society faces, is a moral imperative. Lowering the greenhouse gases that are precursors to ozone will also protect public health. According to the United Nations Intergovernmental Panel on Climate Change (IPCC) and the United States National Climate Assessment (NCA), climate change will negatively impact public health, food and water security, national security, and community stability. Reducing ozone precursors goes hand in hand with addressing greenhouse gases and has multiple co-benefits, most significantly, improved public health through cleaner air.

In reducing the 8 hour standard for ozone to 65 to 70 parts per billion (ppb), vulnerable populations such as children and the elderly will be further protected from the negative respiratory, developmental and associated health effects of ozone. However, while the proposed ozone standard will require manufacturers, agriculture and power plants to reduce ozone precursors, **the proposal leaves out the largest contributor to ground level ozone in urban areas, gasoline exhaust**.

Introduction

Thanks to EPA action, toxic emissions such as mercury and lead have been greatly reduced in the last 20 years. Yet, still more action is needed to address the toxicity of petroleum products, and the secondary compounds they form, such as ozone. Worldwide, air pollution is still the cause of 7 million deaths per year, according to the World Health Organization. Gasoline tailpipe emissions of both fine ($PM_{2.5}$) and ultra-fine particles (UFP) and the compounds they carry have been linked to higher incidence rates of developmental disorders such as autism and ADHD, as well as cardio-pulmonary effects and certain cancers.

According to EPA, In the United States alone, there are 45 million people living, working or attending school within 300 feet of a major road, airport, or railroad. At the same time, there is growing evidence of the negative health impacts of living and working near busy roadways. A larger portion of Americans live and work closer to busy roadways and intersections than to agricultural production areas, power plants, and manufacturing sectors. Therefore, **the contribution to ozone from vehicle tailpipes must not be ignored if the greatest public benefit is to be realized from further reductions in ozone**.

EESI argues, as do several other non-profits, including the Urban Air Initiative, the Clean Fuels Development Coalition and the Energy Future Coalition that including gasoline tailpipe emissions in an ozone rule can realize much greater reductions in ozone and further protection of human health and welfare. While only 25 to 30 percent of the total volume of gasoline, gasoline aromatics contribute outsized effects to both ozone and $PM_{2.5}$ relative to other fuel constituents. **Controlling the volume of gasoline aromatics in gasoline will greatly reduce carbon, secondary organic aerosols (SOA), polycyclic aromatic hydrocarbons (PAHs), and other ozone precursors.**

And while the oil and gas industry have insisted on using a petroleum additive to provide octane to gasoline, other alternatives are now available. The Department of Energy's Oak Ridge National Laboratory as well as others have found that **a mid-level ethanol blend would provide a low cost option for several EPA regulations** including Greenhouse gases (GHG), Corporate Average Fuel Economy (CAFÉ), Tier 3 emission standards, and Mobile Source Air Toxics (MSAT) rules. Mid-level and higher blends of ethanol have already been shown to reduce air toxics in California over the past twenty years, a time period in which ethanol content of gasoline increased by tenfold.

The proposed rules do not address the connection between tailpipe emissions and ozone. At the same time, **EESI is highly concerned that EPA's own models**, including the Community Multi-Scale Air Quality (CMAQ) Model and the MOVES2014 model **either under-predict, or mischaracterize contributors to ozone**, especially, secondary organic aerosols (SOA).

Gasoline Aromatic Hydrocarbons Have Outsized Impact on Ozone, $PM_{2.5}$ Health Risks

Aromatics are used to provide octane in gasoline, and are comprised of benzene, toluene, ethylbenzene, and xylene (commonly known as the BTEX complex). **The role the BTEX complex plays in ozone formation has long been known**, but its role in developmental disorders and other health effects has been more recently investigated. Despite being known carcinogens, these compounds form approximately 25 to 30 percent of every gallon of gasoline. The burning of these aromatics causes the formation of secondary organic aerosols (SOA). These small particulates carry other toxic emissions, such as polycyclic aromatic hydrocarbons (PAHs), through the lungs and into the bloodstream. The Energy Future Coalition (EFC) and Urban Air Institute (UAI) report that, according to the National Emissions Inventory, a majority of aromatic hydrocarbon emissions are from gasoline vehicles. Just as $PM_{2.5}$ was a growing area of concern 20 years ago, UFP exposure is a growing area of concern for public health researchers. Unlike larger particles, these ultrafine particles may stay airborne for weeks at a time, allowing them to travel long distances and penetrate vehicles and buildings. Indeed, they are so small that they are able to pass the blood barrier and carry with them a toxic payload of PAHs, metals, and other products of incomplete gasoline combustion.

Most recently, researchers have found that autism spectrum disorder (ASD) risk is 50 percent higher for those with the highest fine particulate matter ($PM_{2.5}$) exposure during pregnancy; the risk for developmental disorders such as ASD, as well as asthma, cardio-pulmonary effects and various cancers is also now correlated to living and working in close proximity to roadways.[1] Developing fetuses are particularly vulnerable -- PAHs have been found in the cord blood of pregnant women living near congested roadways in New York City. Researchers have even found high levels of these gasoline tailpipe emissions at intersections in residential neighborhoods.

Since passage of the Clean Air Act Amendments in 1990, the link between the combustion products of the BTEX complex and other developmental disorders has more clearly been established. A growing body of research has linked PAHs to developmental disorders such as autism and ADHD[2], cardio-pulmonary effects, and various cancers. PAHs are carried into the bloodstream by the UFP emitted at the tailpipe. Indeed, research concerning the health effects of UFP is so concerning, that EPA scientists held a "Workshop on Ultrafine Particles" in Research Triangle, North Carolina, just this February. At the workshop, researchers from around the world presented evidence on the health effects of UFP, including the link between these small particles and the thickening of arterial walls and stimulus of the central nervous system, which is responsible for heart and brain functioning. These presentations also raised the larger question of whether or not these particles should be regulated by EPA as a criteria air pollutant**. And while ozone is still a significant health risk, the EPA has stated that the vast majority – 90 percent – of the cost savings of the Clean Air Act Amendments of 1990 come from a reduction in $PM_{2.5}$.**

EPA's Own Models Under-predict or Mischaracterize Air Emissions from Mobile Sources

EESI, along with groups such as the Urban Air Initiative, the Energy Future Coalition, as well as the state of Nebraska and the State of Kansas are highly concerned with the underlying studies used to build the

[1] Air Pollution and ASDs: Homing In on an Environmental Risk Factor, Environmental Health Perspectives, vol. 23, number 3, March 2015.
[2] F. Perera et al., Early-Life Exposure to Polycyclic Aromatic Hydrocarbons and ADHD Behavior Problems, Plos One, Nov. 2014

2014 MOVES model. EPA requires state regulators to use the model to craft state implementation plans (SIPs) for ozone. However, there is significant evidence that the underlying studies used to build the model seriously mischaracterize the emissions from using ethanol-blended fuels. According to auto engineers from Ford and GM, when ethanol is "splash-blended" with gasoline, as it is at the refinery, it lowers the overall toxicity of emissions.[3] Yet, EPA's studies were conducted using a method called "match blending," which artificially controls certain fuel parameters, and is not reflective of what happens at refineries. The net result is that ethanol is labeled as worse for ozone and other emissions than gasoline. **The perverse effect of widespread use of this model would be to instead increase the most toxic portion of gasoline, gasoline aromatics**, instead of relying on clean forms of octane**.**

According to the Harvard Center for Risk Analysis, there is also growing evidence that gasoline aromatics are easily converted to SOA in a running engine.[4] The researchers also found that CMAQ may be under-predicting SOA, stating "modeled aromatic SOA concentrations from CMAQ fall short of ambient measurements by approximately a factor of two nationwide." The societal cost associated with this portion of SOA not currently measured by EPA is estimated to be $37.9 billion. These costs do not even include the health impacts associated with PAH-bound SOA. Therefore, as EPA considers lowering ozone limits, with arguably large costs associated with attainment, **the tools used to quantify air emissions must also be accurate.**

Vehicle Technology Is Not Sufficient to Address Ozone Precursors – Fuel Quality Must Be Addressed

Emissions control methods broadly fall into three categories: fuel composition, engine composition, and post-combustion control strategies. EPA should be commended for its robust measures taken to improve engine performance and tailpipe control technologies, as well as diesel fuel composition in the past decade. **It is now time to address gasoline quality. Just as we 'got the lead out,' it is time to address the use of the toxic BTEX complex.** And while increasing use of electric vehicles will also lower emissions, the U.S. Energy Information Administration predicts that combustion powered engines will still be 95 percent of the international car market by 2040. The contribution of gasoline composition to air quality cannot continue to be ignored, nor will it go away with new combustion engine technologies.

As the automotive industry complies with higher CAFÉ and Tier 3 standards, auto engineers are turning towards gasoline direct injection (GDI) technologies. While these technologies have much greater fuel efficiency, research has shown that they may actually increase the number and dispersal of particles emitted. Research from Carnegie Mellon University and the California Air Resources Board finds control technologies such as catalysts are not designed to reduce PM and other SOA precursors. While "tightening regulations have significantly reduced emissions of regulated primary pollutants [NOx,

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[3] J. Andersen et. al, Issues with T50 and T90 as Match Criteria for Ethanol-Gasoline Blends. SAE International Journal of Fuels and Lubricants, vol. 7, no. 3. Nov. 2014.

[4] K. von Stackelberg et. al, Public health impacts of secondary particulate formation from aromatic hydrocarbons in gasoline. Environmental Health, vol. 12, no. 19.

NMOG, CO] … the same may not be true for PM." Moreover, while catalysts may remove a portion of these particles, "changes to engine control … were not aimed at reducing PM."[5]

Use of Mid-Level and Higher Ethanol Blends Have Enormous Potential to Improve Air Quality

According to engineers at MathPro, Ford, GM and Chrysler, widespread use of mid-level blends have tremendous opportunity to reduce both carbon and ozone precursors. For example, the researchers found that **shifting from a blend of E10 to E30 would reduce aromatic use by a staggering 60 percent at refineries, while still producing a high octane blend at 98 RON.[6]** This would translate into large reductions in tailpipe emissions of air toxics, including ozone precursors, at significantly lower cost, since gasoline aromatics are the most expensive portion of the fuel.

Additionally, automakers have asked EPA to approve high-octane fuels, noting that they would make it significantly easier for the manufacturers to comply with more stringent miles per gallon (MPG) standards. Mid-level ethanol blends would provide "ridiculous power and good fuel economy", according to William Woebkenberg, senior engineer for fuels policy at Mercedes-Benz.[7] 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.

Going forward, more efficient engines will require higher-octane fuels. Today, there are two available sources of octane – aromatic hydrocarbons or ethanol. Increasing the amount of aromatics would increase tailpipe emissions of ozone precursors. Conversely, ethanol is both cheaper and a cleaner provider of octane. EPA has recognized this fact, and in their Tier 3 Regulatory Impact Analysis, the agency confirmed that ethanol has no potential to form secondary aerosols.[8]

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 and higher blends of ethanol would further reduce individuals' needless exposure to toxic chemicals, by replacing the gasoline aromatics with renewable clean octane as well as improving the combustion of the fuel. **For the health of our citizens, especially developing children, EPA must consider the contribution of gasoline tailpipe emissions to ozone formation.** The role that the continuum of ethanol blends, E15, E30 and up to E85, should also be considered as a compliance

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[5] T.D. Gordon et al., Secondary organic aerosol formation exceeds primary particulate matter emissions for light-duty gasoline vehicles. Atmospheric Chemistry and Physics, Sept. 2013.
[6] D. Hirshfeld, et al., Refining Economics of U.S. Gasoline: Octane Ratings and Ethanol Content. Environmental Science & Technology, vol. 48, no. 19, Aug. 2014.

[7] Wald, M. Squeezing More from Ethanol. New York Times, May 3, 2013.
[8] U.S. EPA, Draft Regulatory Impact Analysis: Tier 3 Motor Vehicle Emission and Fuel Standards. EPA-420-D-13-002, Mar. 2013.

strategy in the reduction of toxic tailpipe emissions. And, of course, this has the added benefit of yielding very large reductions in GHGs as well.

Sincerely,

Carol Werner

Executive Director

Environmental and Energy Study Institute