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Fighting for Air

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Testimony of A. Blakeman Early
Presented on behalf of
The American Lung Association
Before the
Senate Environment and
Public Works Committee
Subcommittee on Clean Air and Nuclear Safety

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Chairman Carper, members of the Subcommittee my name is A. Blakeman Early. I am grateful to be able to appear before you on behalf of the American Lung Association to discuss the Renewable Fuel Standard (RFS) and our concerns about the premature approval of the use of mid-level ethanol in our nation's gasoline supply.

The American Lung Association sees serious limitations in recent studies looking at the impact of the use of mid-level ethanol—that is, ethanol in the range of 12 to 40 percent or higher in gasoline mixture—on vehicles in use and, most critically, on the levels of ozone precursors emitted by those vehicles. We urge that the U.S. Environmental Protection Agency (EPA) take no action to authorize the use of these blends until the impact of these fuels can be fully reviewed in independent, peer-reviewed studies. We have these specific concerns: the effect of mid-level ethanol blends on ozone and other pollutants is not known; the effect of ethanol on Tier II and older vehicles is potentially harmful; and severely limited evidence has been used to argue that the impact of these blends poses no problems.

Background

When Congress deliberated and adopted the Energy Independence and Security Act, many accepted the aggressive increase in annual volumes of renewable fuel required to sold on the assumption that ultimately the gasoline blend of 85 percent ethanol known as E-85 use would proliferate along with the flexible fuel vehicles (FFVs) that use it. While the production and distribution of E-85 ramped up, ethanol would be sold in lower ratios as ten percent ethanol, or E-10. In addition, bio-diesel and other renewable fuels would grow in share and contribute to meeting the RFS goals. There was broad consensus that E-85 was the best way to use ethanol for three reasons: FFVs must certify to the same emissions standards as gasoline; E-85 is lower in evaporative emissions than gasoline; and, from a volume perspective, every gallon of E-85 consumes eight times more ethanol than E-10.

However, there were recognized limitations on the lower blends of ethanol. As a general matter, placing ethanol in gasoline in lower amounts (10-20 percent) causes tailpipe emissions of hydrocarbons (HC) and carbon monoxide (CO) to go down and

nitrogen oxides (NO_X) to go up. While reducing carbon monoxide is a clear benefit, there is mixed result for ozone, as it lowers tailpipe emissions of one precursor—hydrocarbons—and increases another –nitrogen oxides. Furthermore, evaporative emissions of hydrocarbons due to volatility or permeation go up. These trends are affected significantly by fuel formulation and vehicle technology. As a result of California Cleaner Burning Gasoline and Reformulated Gasoline requirements, evaporation of ethanol-containing gasoline where such fuels are used is well controlled – permeation is not. Nevertheless, since evaporation generates greater HC emissions in conventional gasoline containing ethanol, EPA estimates the biggest impact of ethanol in gasoline is in areas that still use conventional gasoline.

The shift in technology will help over time. With the introduction of Tier II vehicles, both tailpipe and evaporative/permeation emission will be reduced by new technologies to control problems, especially with the use of FFVs.

The Ethanol Industry Has Shifted Focus Away From E-85

Today, it has become clear the ethanol industry's strategy for selling ethanol has changed. Their energy and emphasis appears to have shifted to promoting mid-level volumes (E-12 and higher) as the main means of selling ethanol. While the ethanol industry has not abandoned E-85, most of the money and public discussion appears to be invested in the obtaining approval for use of E-12, E-13, E-15 or E-20. To be sure, the ethanol industry is still pressing the automobile companies to maximize production of FFVs, more than the auto companies want to, but that appears to be because FFVs have few if any problems using E-15, or E-20, E-30, or even E-40.

Unfortunately, this shift in strategy also involves using mid-level ethanol in vehicle and other engines that were not designed and certified on mid-level ethanol. We do not know whether Tier II vehicles, first introduced in 2004 can use these fuels without durability, emissions or other problems. Older vehicles without Tier II technology are more vulnerable to durability degradation and adverse emissions effects of mid-level ethanol.

We need to "Look before we Leap" to Mid-level Ethanol

Much remains to be known about the impact of these mid-level blends. In particular, we need to understand how these blends would affect ozone, the most widespread air pollutant in the nation. We must better understand the affect these blends may have on emissions, on the durability of the emissions control systems, especially on the catalysts themselves, and on other engines that use the gasoline.

As we move forward to adopt strategies to reduce our dependence on foreign oil, promote clean energy, and bolster the farm economy, we must make smart choices that also reduce

air pollution. We cannot ask our children, our elders, our family members who struggle to breathe because of their lung diseases—we cannot ask the most at risk people among us to continue to breathe unhealthy air because of our mistakes in policy decisions on fuel.

We cannot risk increasing air pollution

The American Lung Association is concerned with any policy decisions that risk increasing ozone anywhere in the U.S. The federal government, the states and local governments have fought for decades to cut the precursor emissions to reduce ozone. Still, ozone remains the most widespread air pollutant—and among the most dangerous. Recent research has revealed new insights into how they can harm the body. All in all, the evidence shows that the risks are greater than we once thought.

The most recent and disturbing new research shows that ozone pollution can kill. Let me repeat that: ozone can kill. The National Research Council recently confirmed that the available evidence shows that high ozone days increase the risk of dying early.[1] And most recently, a new study published last month in the *New England Journal of Medicine* found that breathing ozone day-in-and-day-out—that means even when we don't have a "high" ozone day—increases the risk of dying from respiratory causes[2]. That troubling new evidence underscores the need for us to clean up ozone pollution now.

Five groups of people are especially vulnerable to the effects of breathing ozone:

- children and teens;
- anyone 65 and older;
- people who work or exercise outdoors;
- people with existing lung diseases, such as asthma and chronic obstructive pulmonary disease (also known as COPD, which includes emphysema and chronic bronchitis); and
- "responders" who are otherwise healthy but for some reason react more strongly to ozone.

New evidence published last year found that some segments of the population may face higher risks from dying prematurely because of ozone pollution, including communities with high unemployment or high public transit use and African Americans/Blacks.[3]

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[1] Committee on Estimating Mortality Risk Reduction Benefits from Decreasing Tropospheric Ozone Exposure, National Research Council. *Estimating Mortality Risk Reduction and Economic Benefits from Controlling Ozone Air Pollution*, 2008. Available at www.nap.edu/catalog/12198.html.

[2] Jerrett M, Burnett RT, Pope III, CA, Ito K, Thurston G, Krewski D, Shi Y, Calle E, Thun M. Long-Term Ozone Exposure and Mortality. *N Engl J Med* 2009; 360: 1085-1095.

[3] Bell ML, Dominici F. Effect Modification by Community Characteristics on the Short-term Effects of Ozone Exposure and Mortality in 98 US Communities. *Am J Epidemiol* 2008; 167: 986-997.

The impact of even short-term exposure to ozone on healthy adults showed up in a study of lifeguards on the beach in Galveston, Texas. In a study published last year, researchers measured the ability of these healthy young adults at the beginning of their shift and then again at the end. They found that the airways of many lifeguards had greater obstruction when ozone levels were high, even when the levels were well below the national standards. Because of this research, Galveston became the first city in the nation to install an air quality warning flag system on the beach.[4]

Evidence on Mid-Level Ethanol is Severely Limited

With such risks at stake, we need to know much, much more about the impact of mid-level ethanol blends. The lack of well-done research evidence may surprise you.

Only one scientifically-based study has been done on tailpipe emissions from today's cars operating on E-15 or E-20. No testing has been done on E-12 or E-13 on cars or small engines. Most of the recent testing has focused on motor vehicle operability, materials compatibility, and to a lesser extent, tailpipe emissions.

The public statements we have read from Growth Energy tend to conflate the testing of mid-level ethanol in all three categories, which has the effect of inflating the amount of vehicle tailpipe emissions testing that has been done. While the statements imply that 100 vehicles have been the subject of testing (in the last two years), available evidence shows that only 16 non-FFV vehicles have been subject to testing primarily designed to measure the impact on emissions. The U.S. Department of Energy (DOE) completed that study, and has just finalized its report on the 16 vehicles[5]. An additional study, conducted by Minnesota State University and the University of North Dakota looked at both fuel economy and emissions in three 2007 vehicles. However, this study was funded by the ethanol industry and was not peer reviewed.[6]

The DOE study understates the problem

The only well-conducted, peer reviewed study of emissions has recently been completed by the Department of Energy (DOE). However, the DOE study raises a number of troubling concerns about the conclusions it reaches.

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[4] Thaller EI, Petronell SA, Hochman D, Howard S, Chhikara RS, Brooks EG. Moderate Increases in Ambient $PM_{2.5}$ and Ozone Are Associated With Lung Function Decreases in Beach Lifeguards. *J Occcp Eviron Med* 2008; 50: 202-211.

[5] U.S. Department of Energy, Oak Ridge National Laboratory. *Effects of Intermediate Blends on Legacy Vehicles and Small Non-Road Engines, Report 1,* Updated. NREL/TP-540-43543, February, 2009.

[6] Minnesota State University, Minnesota Center for Automotive, and University of North Dakota. *Optimal Ethanol Blend-Level Investigation*, Energy & Environmental Research Center, 2007-EERC-11-02, November, 2007.

The DOE study applies a flawed test to find "significant" emissions increases

DOE reports no "significant" increase in regulated emissions from 16 vehicles tested. However, DOE applies a statistical measure requiring 90-95% confidence for emissions changes after averaging emissions across all vehicles. The use of a statistical measure is inappropriate in this case. Increases in emissions would have had to occur in 13 of 16 vehicles to meet DOE's 95 percent certainty analytical criteria. In their analysis, reductions in emissions of some vehicles were allowed to "offset" increases in others. Of course, we don't breathe air pollution "on average." Much depends on the vehicle fleet mix in a given area, not the mix in the national fleet.[7]

The DOE study reports 56 percent NO_x emissions increase from vehicles to be "insignificant"

The Executive Summary fails to report that nine of 16 vehicles (56 percent) using E-20 had an increase of NO_x emissions, six with increases that reached 25 percent or higher. Six vehicles had increase emissions of NO_x using E-15, four of them of 25 percent or more. Since the magnitude of these increases were off set by decreases in other vehicles, DOE deemed these findings statistically insignificant.[8] We find it hard to understand how DOE could come to that conclusion with results showing that over half—or even one quarter—of the vehicles increased their emissions.

The DOE study found higher catalyst temperatures with mid-level ethanol operated in wide open throttle (WOT) mode—a potential risk to 116 million on-road vehicles

The DOE study found seven of 13 vehicles experienced catalyst temperatures averaging 30 degrees C when operated in "wide open throttle", or WOT, mode with E-20 and average temperature increases of 25 degrees C using E-15 compared to operation with E-0. These vehicles were tested at ambient temperatures of 75 degrees F and not "summertime" conditions. Two of these vehicles were model year 2007vehicles.

According to DOE, 116 million vehicles are registered across the U.S. that are pre-Tier II (model year 2003 or older) which may be vulnerable to higher temperatures in wide-open throttle mode.

It is important to note that engines do not operate with throttles wide open except under very heavy load conditions, such as pulling a trailer up hill. Some smaller vehicles engines may operate at full throttle up steep inclines. It is therefore difficult to estimate the significance of the DOE findings, making further study all the more critical.

[7] U.S. DOE, 2009. p. 2-6.
[8] U.S. DOE, 2009. Table 3.1, p. 3-4.

The DOE conducted no testing for catalyst durability

Auto companies are required to certify that emissions control systems—principally catalysts—will operate for 120,000 miles. This is accomplished through a process that artificially ages engine systems by running for many hours. **There has been no testing of the impact of ethanol on vehicle engines and emissions systems over their useful life (120,000 miles).**

One study, done in Australia, raises a red flag on this issue. It appears that when pre-Tier II vehicles—model year 2003 and earlier—are operated in wide open throttle mode, the computer does not adjust carburetion to account for the oxygen added to the air-fuel mixture provided by the presence of ethanol in the fuel. As a result, **during acceleration, exhaust temperatures can rise**, as the DOE study found, **damaging the catalyst and engine**.

In this 2004 study of Australian vehicles using E-20, two of five vehicles exhibited the problem and damage to the catalyst after artificial "aging" of only 50,000 miles. One vehicle had 200 percent increase in HC emissions and 500 percent increase in NO_x emissions. The other experienced a 20 percent increase in HC emissions and 150 percent increase in NO_x emissions.[9] This study has several limitations. This study was not peer reviewed, it used Australian vehicles, nor does it necessarily include the same Tier I technology used in the U.S. It does demonstrate that **engine and catalyst durability could be a problem with mid-level grades of ethanol**. Before we risk the engines of 116 million pre-2004 vehicles on the road today, we need to make certain.

Degradation of catalyst efficiency can have a major impact on emissions. For example, if the presence of ethanol increases NO_x emissions 10 percent, AND catalyst efficiency has been reduced 10 percent (from 90 percent to 80 percent) NO_x emissions will rise 100 percent-- not just 10 percent

DOE overstates findings on small non-road engines (SNREs)

There has been almost NO testing on mid-level ethanol used in non-road engines. Even the California Air Resources Board has been unable to estimate non-road emissions increases (mostly evaporative) attributable to increases of ethanol in gasoline (including E-10). While DOE did conduct a "scoping" of Small Non-Road Engines (SNREs), even this part of the study raised many questions.

[9] Orbital Engine Company. *Market Barriers to the Uptake of Biofuels Study Testing Gasoline Containing 20% Ethanol(E20), Phase 2B Final Report to the Department of the Environment and Heritage.*, May 2004, p. 3. Available online at http://www.environment.gov.au/atmosphere/fuelquality/publications/biofuels-2004/index.html.

The Executive Summary reports that while emissions of NO_x went up, HC emissions went down and regulated emissions (combined HC+NO_x) decreased in "most cases". While this statement is true of engines tested when they were new, the DOE durability testing on small engines was dismal. One of four classes of engines (Class IV) could not be operated long enough to test durability. Of the remaining seven engines, all seven when operated on E-0 after durability testing with E-10, E-15, or E-20 experienced emissions increases. Five of seven experienced HC+NO_x increases of 90 to 150 percent.[10] Since the SNRE testing also found a significant exhaust temperature increase in many small engines, these findings are consistent with a potential durability degradation problem as discussed above with vehicle engines.

We need more scientifically-based testing of mid-level ethanol (E-12 or higher) to assure protection of public health

Recently Growth Energy and a number of ethanol companies submitted a "waiver" request to EPA to authorize E-15. Of the seven tests submitted to support the request, only the DOE test and one other were peer-reviewed. The other five lacked proper test protocols and fuel controls and were not peer reviewed. Furthermore, only one was designed primarily to measure emissions. Growth Energy also called for EPA to administratively authorize E-12 or E-13 while submitting no test data. EPA cannot base such an important decision, potentially affecting millions of cars and small engines on such flimsy or non-existent data.

We need to make decisions about additional ethanol use with full understanding of the impacts on our health and our vehicles and engines. Too much is at stake. Clearly, the path forward is to do the needed testing and see under what circumstances and how more ethanol could be used in our gasoline. Based on the current information, E-85 is the safest path forward if we are to use ethanol in our fleet. . Applying a greater effort to provide ethanol in these markets could consume an additional billions gallons of ethanol and avoid the "blend wall" long enough to conduct needed testing. I suspect these markets have not been reached largely to the lower profitability of supplying them
Allowing the use of an ethanol fuel that ends up degrading the nation's automobiles and small engines is not an acceptable alternative

Thank you for the opportunity to present these concerns.

[10] Orbital Engine Company, 2004. Tables 3.8-3.12, pp. 3-24 – 3-28.