



## **NRDC Statement on New Study of Ethanol (E85) Impact on Air Quality**

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NRDC believes there should be no rush to judgment on the impacts of ethanol used as high blends (E85, 85% ethanol, and 15% gasoline) on air quality based on a new study by Mark Z. Jacobson of Stanford University.

We urge Dr. Jacobson to join with NRDC, air pollution regulators, and scientists to clear the air regarding his statement that concludes that E85, “a high blend of ethanol poses an equal *or greater* risk to public health than gasoline.” This conclusion is at odds with previous studies and emission data from modern vehicles running on E85, and even appears to be at odds with the conclusion from his own study.

NRDC recommends the following to clarify the results of this paper and the air quality impacts of ethanol used as high blends:

- First, NRDC recommends that a team of leading vehicle emission experts review the existing data on emissions from E85. Based on this review, if the panel believes the emission scenarios in Dr. Jacobson’s study are incorrect and/or additional sensitivity runs are necessary, air pollution regulators should re-run the air pollution model to develop a broader scientific consensus of the impacts on air quality.
- Second, based on the results from the above work, we urge the CARB, US EPA, automakers and the ethanol industry to commit to additional testing of E85 vehicles if warranted. If such testing results indicate a need, we call upon CARB and US EPA to immediately set tighter emission standards on E85 vehicles to protect public health.

We look forward to working with Dr. Jacobson and vehicle emission experts to clarify and improve the quality of information being provided to policymakers and the public on this important issue of the pollution impacts of E85.

**NRDC Comments on Mark Z. Jacobson's  
"Effect of Ethanol (E85) Versus Gasoline Vehicles on Cancer and Mortality  
in the United States,"  
J. Air & Waste Management Assoc., Revised Feb 19, 2007**

***Study Overstates Potential Air Pollution Impact of Ethanol (E85)***

For E85 ethanol to pose a greater risk to public health than gasoline a series of puzzling assumptions have to be true that either are or appear to be contrary to conclusions reached by other scientists, air regulators, and emission experts. Considering the uncertainty in these assumptions, the study does not demonstrate a conclusive difference in the public health impacts between E85 and gasoline.

***Study finding conflicts with findings by US EPA, US DOE and NREL that found that E85 can reduce emissions of smog-forming chemicals.***

Dr. Jacobson fails to explain why his results differ from the published conclusions by scientists at US EPA, US DOE, and NREL. In a study published in the *Journal of Air & Waste Management Association*, researchers at the US EPA and US DOE found that a flex fuel vehicle running on E85 lowers the smog-forming potential of its emissions.<sup>1</sup> Scientists at the National Renewable Energy Laboratory (NREL) reached the same conclusion.<sup>2</sup> These studies were based on testing of actual vehicles.

***Study's assumption that E85 emissions are substantially different is incorrect.***

There are three key reasons that the study's emission rate assumptions are incorrect:

- First, the law requires vehicles that can run on E85, called flexible fuel vehicles (FFVs), meet the same pollution standards for smog and soot-forming pollutants as gasoline cars. Despite this fact, the study assumes dramatic changes in emission levels from the use of E85, a 30% decrease in NOx and a 22% increase in hydrocarbons.<sup>3</sup> Certification data from modern FFVs show that these vehicles meet the same pollution standards regardless of what fuel they run on.<sup>4</sup>
- Second, the study greatly exaggerates emission impacts by assuming that 100% use of E85 is possible by 2020, a virtual impossibility. It is physically impossible for that much ethanol to be available or for all of the vehicles to transform into FFVs by 2020. Currently ethanol displaces less than 5% of our gasoline fuel supply. To achieve 100% displacement would require well over 200 billion gallons of ethanol compared to today's roughly 5 billion. Under a

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<sup>1</sup> Black, Tejad and Gurevich, "Alternative Fuel Motor Vehicle Tailpipe and Evaporative Emissions Composition and Ozone Potential," *J. Air & Waste Management Assoc.*, 48: 578-591.

<sup>2</sup> Kelly et al., "Federal Test Procedure Emission Results from Ethanol Variable-Fuel Vehicle Chevrolet Lumina," Society of Automotive Engineers, International Spring Fuels and Lubricants Meeting, Dearborn, MI, May 6-8, 1996.

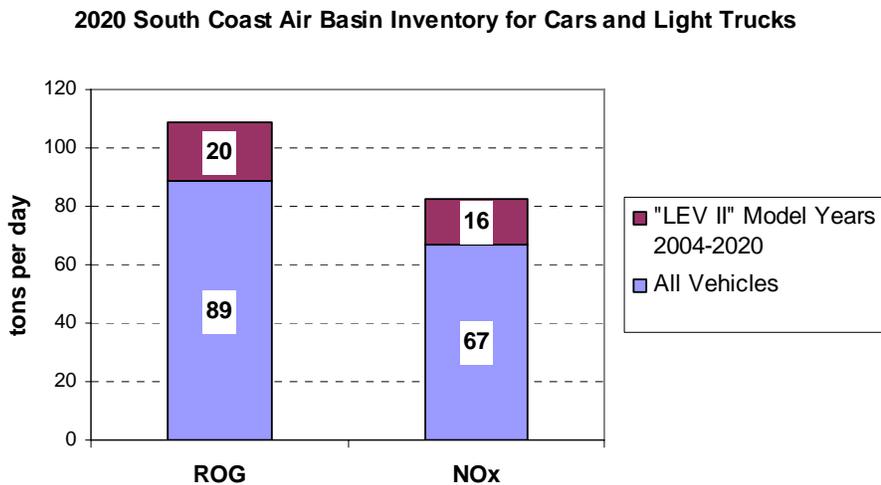
<sup>3</sup> Measured as total organic gases (TOG).

<sup>4</sup> See CARB website at <http://www.arb.ca.gov/msprog/onroad/cert/cert.php> for complete set of emission certification data for FFVs and conventional gasoline cars. Certification data can be found under "Executive Order Listings" on this page.

more likely penetration scenario, E85 would displace about 10% of the gasoline supply by 2020.

- Third, the study further magnifies small differences by ignoring the fact that most emission from cars is due to older vehicles that would be incapable of running on E85. By 2020, CARB estimates that less than 25% of the on-road passenger vehicle NOx and hydrocarbons emissions are from cars 16 years and newer (see Figure 1).<sup>5</sup> This mistake alone exaggerates the emission impacts by a factor of about four.

**Figure 1.** Emissions from older vehicles that would not be able to run on E85 dominate the 2020 emissions inventory. Study exaggerates emission changes by applying emission reductions to the emissions from a fleet of older cars that cannot be run on E85 and are certified to meet older, dirtier emission standards. Cars starting in model year 2004 must meet the stricter LEV II pollution standards. Source: EMFAC2002 V2.2

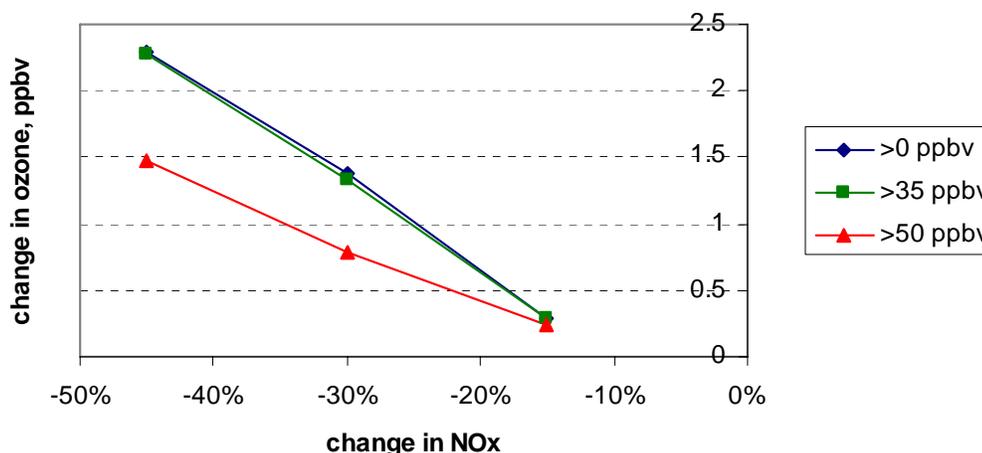


***Study's findings are primarily driven by assumed decrease in NOx.***

Sensitivity runs by the author make it clear that the changes in the Los Angeles region smog levels are almost entirely driven by his assumption of a 30% NOx decrease (see Figure 2). The small changes in ozone levels appear to be primarily driven by assumption of large changes in NOx. Simple extrapolation of the fairly linear trend shows that there would likely be no change in ozone levels if the author assumed a less than 10% reduction in NOx emissions, a scenario which was not included in the paper. For the primary scenario, the author assumed a very large 30% decrease in NOx.

<sup>5</sup> Starting in model year 2004, new cars are certified to the more stringent LEV II standards. According to CARB, LEV II vehicles are approximately 80% cleaner than an average 1998 car. <http://www.arb.ca.gov/msprog/levprog/levii/factsht.htm>

**Figure 2.** Small changes in ozone levels are driven by assumption of large changes in NOx. Simple extrapolation of the fairly linear trend shows that there would likely be no change in ozone levels if the author assumed a less than 10% reduction in NOx emissions, a scenario which apparently was not run. For the primary scenario, the author assumed a very large 30% decrease in NOx. Source: Table 5 of ES&T journal article.



The study fails to acknowledge that, despite the potential for ozone to increase under certain conditions of NOx decreases, under most circumstances reducing NOx will reduce smog and that the California strategy for the last 25 years to meet ozone and soot (PM2.5) ambient air quality standards has been built around reducing both NOx and hydrocarbons concurrently. Though undesirable, this effect (sometimes known as the “weekend effect”) is well known and has been well studied by CARB.<sup>6</sup> However since it’s impossible to meet clean air standards with hydrocarbons reductions alone, air quality regulators have adopted a strategy to reduce both at the same time. According to CARB:

A strategy of concurrent reductions of the major precursors of ozone, VOCs and NOX, has been used for more than twenty-five years to reduce ozone levels in California’s ambient air. Concurrent reductions of VOCs and NOX have been very successful at reducing the high ozone levels in southern California. From the mid-1970s into the 21st century, the ozone control strategy implemented in the South Coast Air Basin (SoCAB) included reductions of both VOC emissions and NOX emissions. Early NOX reductions were achieved by statewide controls on emissions from motor vehicles combined with local controls on emissions from industrial sources, such as power plants and cement kilns.<sup>7</sup>

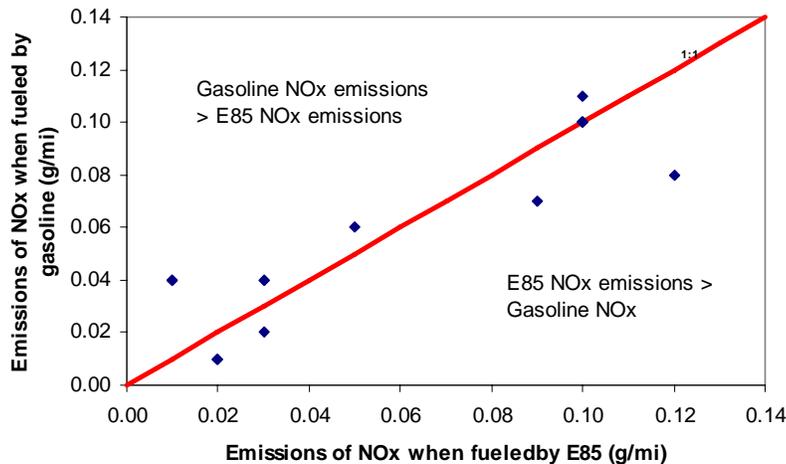
Even if reducing NOx was a bad idea, emissions data from modern FFVs clearly shows that there is no discernible pattern of differences in NOx emissions when an FFV is running on E85 versus gasoline (see Figure 3).

<sup>6</sup> See <http://www.arb.ca.gov/aqd/weekendeffect/weekendeffect.htm>.

<sup>7</sup> CARB, “The Ozone Weekend Effect in California,” staff report, June 30, 2003. [http://www.arb.ca.gov/aqd/weekendeffect/we\\_sr-final.htm](http://www.arb.ca.gov/aqd/weekendeffect/we_sr-final.htm)

**Figure 3.** Data from the California Air Resources Board demonstrates that there is no consistent pattern in whether a FFV emits more or less when fueled on E85 versus gasoline. It should be noted that even if there is a difference in these test results, the manufacturer is legally liable for ensuring that the emissions remain under the emission standards for 120,000 miles.

Source: CARB certification database, <http://www.arb.ca.gov/msprog/onroad/cert/cert.php>



***Study ignores the potential global warming pollution reductions from E85 and the smog impact of rising temperatures caused by global warming.***

Dr. Jacobson dismisses the substantial potential for E85 to reduce global warming pollution, despite the fact that most researchers agree that when produced from cellulosic feedstocks (e.g., switchgrass, agricultural waste, etc.) ethanol has the potential to dramatically cut global warming pollution. According to a study published in *Science* magazine by Professors Farrell and Kammen at UC Berkeley, cellulosic ethanol can reduce greenhouse gases by up to 90% compared to gasoline.<sup>8</sup>

Dr. Jacobson fails to account for the fact that rising temperatures due to global warming are predicted to increase smog levels in the US, including California. According to the latest Intergovernmental Panel on Climate Change report by the world’s leading experts on global warming, the US can expect “increased frequency of cardio-respiratory diseases due to higher concentrations of ground level ozone related to climate change.”<sup>9</sup>

### ***Conclusion***

The author’s comments surrounding the release of his study overstate what the study actually shows. An accurate summary would be that this study shows that use of high blend ethanol is unlikely to significantly improve air quality compared to use of gasoline.

<sup>8</sup> Farrell et al, “Ethanol Can Contribute to Climate and Energy Goals”, *Science*, 2006. <http://rael.berkeley.edu/ebamm/FarrellEthanolScience012706.pdf>

<sup>9</sup> See IPCC, *Fourth Assessment Report: Summary for Policymakers*, 2006. [http://www.net.org/documents/IPCC\\_SPM6avr07.pdf](http://www.net.org/documents/IPCC_SPM6avr07.pdf)