Review of "Effects of Ethanol (E85) Versus Gasoline Vehicles on Cancer and Mortality in the United States" authored by Mark Z. Jacobson

by
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While the model used in this study by Mark Z. Jacobson is very extensive and sophisticated, the quality of the results from any modeling study always dependant on the quality of the inputs used for the model. In the present case, these inputs are questionable, mainly due to the time projection out to 2020. The California Air Resources Board (CARB) is currently struggling with an emissions inventory to be used in air quality models that will attempt to predict 2010; yet Professor Jacobson is attempting to predict 2020. Furthermore, the differences in air quality predicted for 2020 between ethanol and gasoline fuels are much smaller than the differences expected in California for just gasoline vehicles in the four years between now and 2010. Thus, even the base gasoline predictions are uncertain for a year so far in the future as 2020, let alone the potential emissions using E85.

As a group of sensitivity simulations, future expected trends in various emissions categories might be a useful addition to a study comparing gasoline with E85. However, this reviewer believes a more convincing comparison would be based on a simulation of a near term year (e.g. 2006 or 2010) using the latest current gasoline emissions and a compilation of currently available E85 emissions data. To be sure, as discussed below, this would still be a "fictional" exercise because so few vehicles now can use E85, but it would be based on the best emissions estimates currently available. Even though a total use of E85 might be assumed in one of these near-term scenarios, the results could be used to provide an approximation to the impact of any level of E85 utilization. Trying to project 14 years into the future for all emissions adds too many uncertainties due to changes in gasoline and ethanol technology, let alone potential differences between them.

Currently only about 1 percent of vehicles are capable of using E85 nationwide. Thus, any vehicles remaining on the road in 2020 would need to be retrofitted. All new vehicles sold between now and then would have to be either flex-fuel capable between gasoline and E85 (or perhaps even dedicated E85) or they too would have to be retrofitted. There really is a paucity of data now on the emissions of existing E85-capable vehicles. Also new emissions-technology improvements and catalyst formulations are being developed every year. Rapid developing technologies are a major source of uncertainty for the emissions for each fuel themselves, let alone the differences between gasoline and E85 by 2020. Given such uncertainties and the fact that this study by Professor Jacobson showed results that actually were very small (less than 2 ppb

ozone) impacts, it is reasonable to state that zero impact could be considered to be within the range of uncertainty for this study.

Another problem with this futuristic modeling study is that the methodology used to assemble existing data on E85 emissions is not described in sufficient detail to assess the robustness of that methodology or the range of data variability. As an example, one study well known to this reviewer is the study by the Auto/Oil Air Quality Improvement Research Program released in July 1995, as Technical Bulletin No. 16 entitled "Exhaust Emissions of E85 Ethanol Fuel and Gasoline in Flexible/Variable Fuel Vehicles." In that study three flex-fuel vehicles were tested on gasoline and E85 fuels. Only one of the three had been certified to the emissions standards of the time (the other two were prototypes). The certified vehicle showed favorable comparisons for E85, but the two prototypes did not. Notably, the certified vehicle showed results that appear to be different than those used by Professor Jacobson. Thus, there must be a range of variation in emissions data between E85 and gasoline that suggests that he could have run his model for both the worst and the most favorable (for E85) sides of that range of variation and thereby address the sensitivity to some of the uncertainty inherent due to the technologies available even today.

An interesting feature of the results from that Auto/Oil study was that as much as 40 percent of the emissions using E85 appeared to come from the 15 percent of the fuel which was not ethanol. Thus, the quality of the gasoline used can play a role in the emissions. Another possibility suggested by that 1995 study was that future flex-fueled vehicles might use higher ethanol concentrations (e.g. E95) with the non-ethanol content used to address any additive needs (e.g. cold-starting, lubrication, denaturant, etc.) that may not be gasoline. In Brazil there are apparently flex-fueled vehicles that can use E100.

Finally, the results of this study by Professor Jacobson do show that most of the air quality “problems” he identified stem from acetaldehyde that is either emitted directly or results from excessive ethanol emissions. If these problems were found to be serious enough, then regulations could quickly be put into place that would require vehicles using E85 (or higher ethanol content fuels) must meet more stringent ethanol and acetaldehyde emissions standards before they could be certified for sale. This reviewer believes that the present study does not show such problems to be serious enough at this time to require changing the existing regulations due to the uncertainties apparent in this study, the long time frame used in the study, and the current rapid changes in vehicle emissions technology.