

Thomas L. Darlington

Statement before Assembly Agriculture Committee

February 3, 2005

Chairman Ott, members of the Committee, thank you for this opportunity to provide comments on Assembly Bill 15. My name is Tom Darlington. I am President of Air Improvement Resource, Inc., a company in Michigan that specializes in evaluating the emission impacts of mobile source control programs such as changes to fuels, vehicle emission standards, and engine emission standards.

Marathon Ashland Petroleum has retained me for the limited purpose of providing the Committee an overview of the preliminary findings of a study by the Southeast Michigan Council of Governments. The preliminary findings of that study relevant to AB 15 are that blending conventional fuel with 10 percent ethanol, as would be required under AB 15, will increase emissions of volatile organic compounds (called VOCs) and oxides of nitrogen (or NOx). VOCs and NOx form ozone and are the primary targets for controlling ozone in Wisconsin's nonattainment areas.

I have approximately 24 years experience evaluating emission impacts from mobile sources. The first nine years I worked at the Environmental Protection Agency. This was followed by a year at Detroit Diesel Corporation, 5 years with General Motors, and the last ten years with Air Improvement Resource.

During the last ten years, my company has evaluated the emission changes of many different gasoline changes, including low sulfur gasoline, changes in fuel volatility and distillation index, reformulated gasoline, and the impacts of various oxygen

compounds like MTBE and ethanol. We perform work for a variety of automobile and engine manufacturers, associations, the Federal Government, oil companies, the Environmental Protection Agency, and various state governments. We also perform work for the Canadian government.

Most recently, my company was retained to conduct a major study of different fuels in the Southeast Michigan area. This study examined the benefits of reformulated gasoline, further reductions in fuel volatility, lower sulfur fuel, and a range of ethanol “market shares” from 0% to 100%. What I mean by market shares is the percentage of gallons of gasoline sold at the pump that has ethanol in it.

This study was conducted for the Southeast Michigan Council of Governments, or SEMCOG. SEMCOG is the regional planner in Southeast Michigan and I’ve been told it plays a similar planning role to that performed in Wisconsin by the Southeast Wisconsin Regional Planning Commission. The purpose to the study is to help policy-makers assess emission reductions options to meet the EPA 8-hour ozone standard. Like eastern Wisconsin, the southeast Michigan area is designated an ozone nonattainment area by the EPA. Even though there are differences in gasoline composition between Michigan and Wisconsin, the key findings of the SEMCOG study are relevant to Wisconsin.

The SEMCOG fuels study was funded by SEMCOG, the Alliance of Automobile Manufacturers, and the American Petroleum Institute. All stakeholders actively reviewed each step of the study. We also took care to obtain EPA’s input on the study along the way. The study is 95 percent complete, and the final report should be out in a couple of weeks. Since I have been incorporating comments into the draft study for the past six weeks, I do not expect the relevant findings to change from what I will present to you

today. The results, however, are still considered “draft.” While I have every reason to believe that SEMCOG, the automobile manufacturers, and the petroleum industry agree with the draft results, I am not representing SEMCOG, the Alliance of Automobile Manufacturers, or the American Petroleum Institute today.

**Many studies have been conducted on the emission impacts of ethanol. What is unique about the draft SEMCOG study that Wisconsin should consider?**

Emissions of VOCs from fuels come from three sources: evaporation, vehicle exhaust, and permeation. Evaporation refers to the “breathing losses” from the fuel tank as the fuel is heated during the day. Vehicle exhaust emissions are tailpipe emissions or other emissions resulting from the incomplete combustion. Permeation is included in the standard computer models, but the increase in permeation VOC emissions due to the use of ethanol is not. The inclusion of increased permeation emissions due to ethanol is an important factor that distinguishes SEMCOG’s study.

In September of 2004, the Coordinating Research Council, a research group funded by auto and oil companies, published results of a year-and-a half of testing on the impacts of ethanol blends on fuel system permeation. Permeation is the migration of fuel through the walls of plastic fuel systems components. For example, some automotive fuel tanks made in the 1990s were made from high-density polyethylene. Ethanol in fuel basically opens up passages in the polyethylene so that fuel can migrate to the outer wall of the tank and evaporative. This process is permeation. This study found that ethanol increases permeation hydrocarbon emissions from on-road vehicles compared to gasoline that does not contain ethanol.

The ethanol permeation factor is not included in any of the standard computer programs that estimate emissions, and the SEMCOG study is the first study that we are aware of that takes this factor into account. Given the fact permeation occurs virtually everywhere gasoline with ethanol is found in, on-road and off-road vehicles, lawnmowers, garden tractors, and portable containers, the omission of increased permeation emissions due to ethanol is a flaw with standard emission estimate protocols.

The second item that is unique with regard to the SEMCOG study is that it accounts for the increase in NOx emissions with ethanol blends. Extensive testing and analysis of 1988-1995 model year cars and light duty trucks show that NOx emissions increase when ethanol blends are used. Both the California Air Resources Board and the Environmental Protection Agency agree on this fact. This NOx effect, however, is also not included in the standard EPA computer model used to estimate the emission impacts of ethanol for on-road vehicles.

It is my understanding that Wisconsin's DNR will testify today to the effect mandating use of ethanol as proposed in AB 15 would have only a marginal adverse impact on VOC and NOx emissions. If so, this can likely be explained by their use of standard emissions models which do not account for the permeation effects and to incorporate recent studies showing increases in NOx emissions. Although policies such as emission estimate models sometimes lag evolving science, it is my experience these gaps eventually closed. Thus, I and many others experts in the field believe federal and state ozone policies will eventually have to address the known increases in VOC and NOx emissions demonstrated in the SEMCOG study.

It is also important to note, however, that the SEMCOG study does not ignore the benefits of ethanol, for example the reduction in carbon monoxide emissions on older vehicles. The study makes every attempt to include all known factors that have an effect on emissions.

**What are the key results from the draft SEMCOG study that are relevant to this Bill and Wisconsin's Ozone Policies?**

The VOC and NOx benefits estimated in the study for the gasoline options are shown in the attached Figures ES-1 and ES-2. Estimates are shown using two different models to predict exhaust emission changes - the EPA Complex Model, and the California Predictive Model. Results from the two models should not be averaged. They should instead be viewed as the range of likely benefits. These figures show emission changes in tons per day that are specific to the SEMCOG regions, not Wisconsin. Nonetheless, the relative changes between the bars can be used.

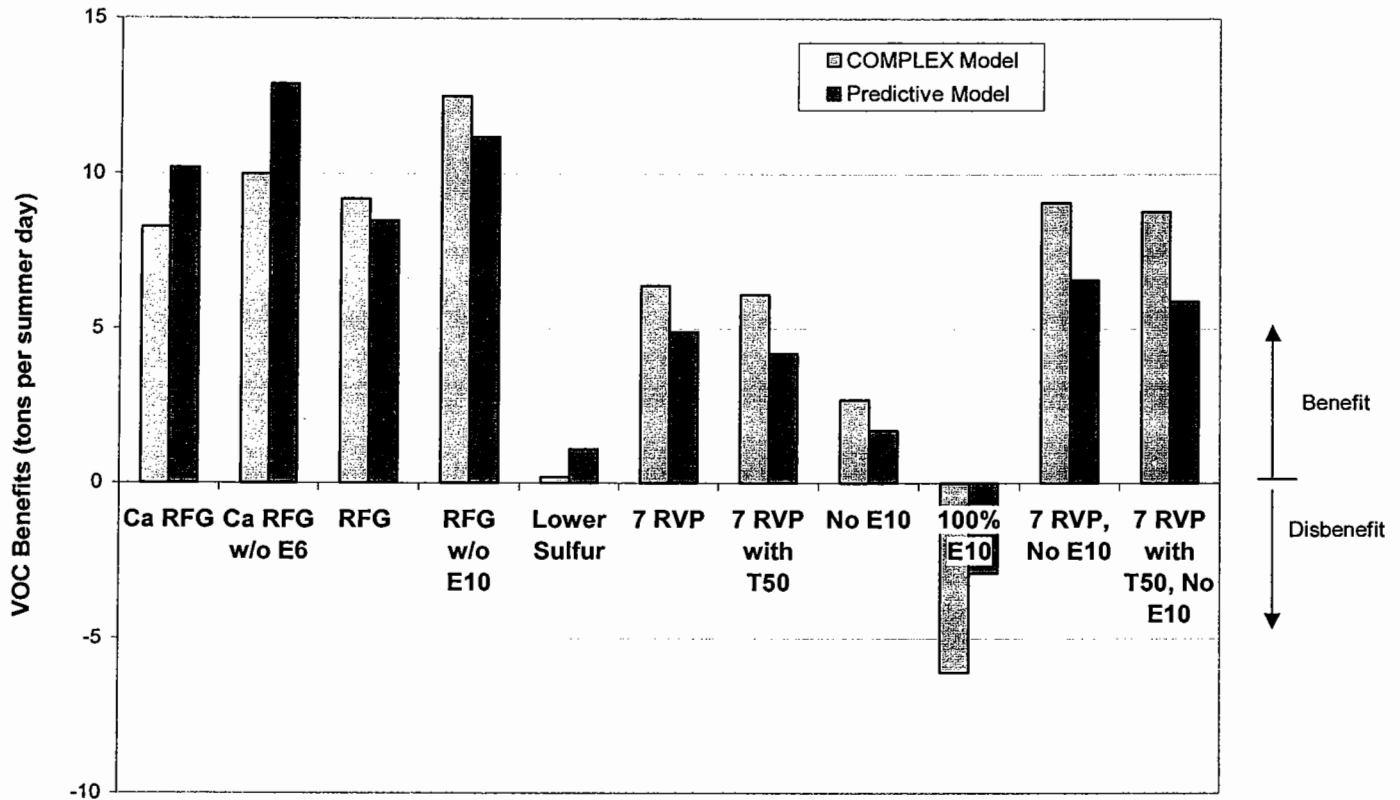
The RFG noted in third columns from the left is the same gasoline mandated for the six-county nonattainment area in Southeast Wisconsin. The E10 noted in the third column from the right is same gasoline that would be required under AB 15. The key findings and observations on VOC emissions relative to the current discussion on AB 15 is that increasing the ethanol market share to 100% (100% E10 option) would result in significant VOC emission increases due to increased permeation.

The key finding on NOx emissions is that for the 100% E10 option (i.e. all Southeast Michigan gasoline would be 10% ethanol) is that the Predictive Model shows a significant NOx disbenefit.

Another factor that could make the situation worse in nonattainment areas is NOx transport from outside these areas. NOx transport refers to NOx which comes into the region from areas outside of the region. If NOx increases from other areas outside of nonattainment area due to ethanol use, this could also make the ability to attain the 8-hour ozone standard more difficult. Although to a lesser extent, VOC emissions will also be transported from attainment areas to nonattainment areas.

This concludes my remarks, but I would be happy to address any questions you may have. Thank you very much.

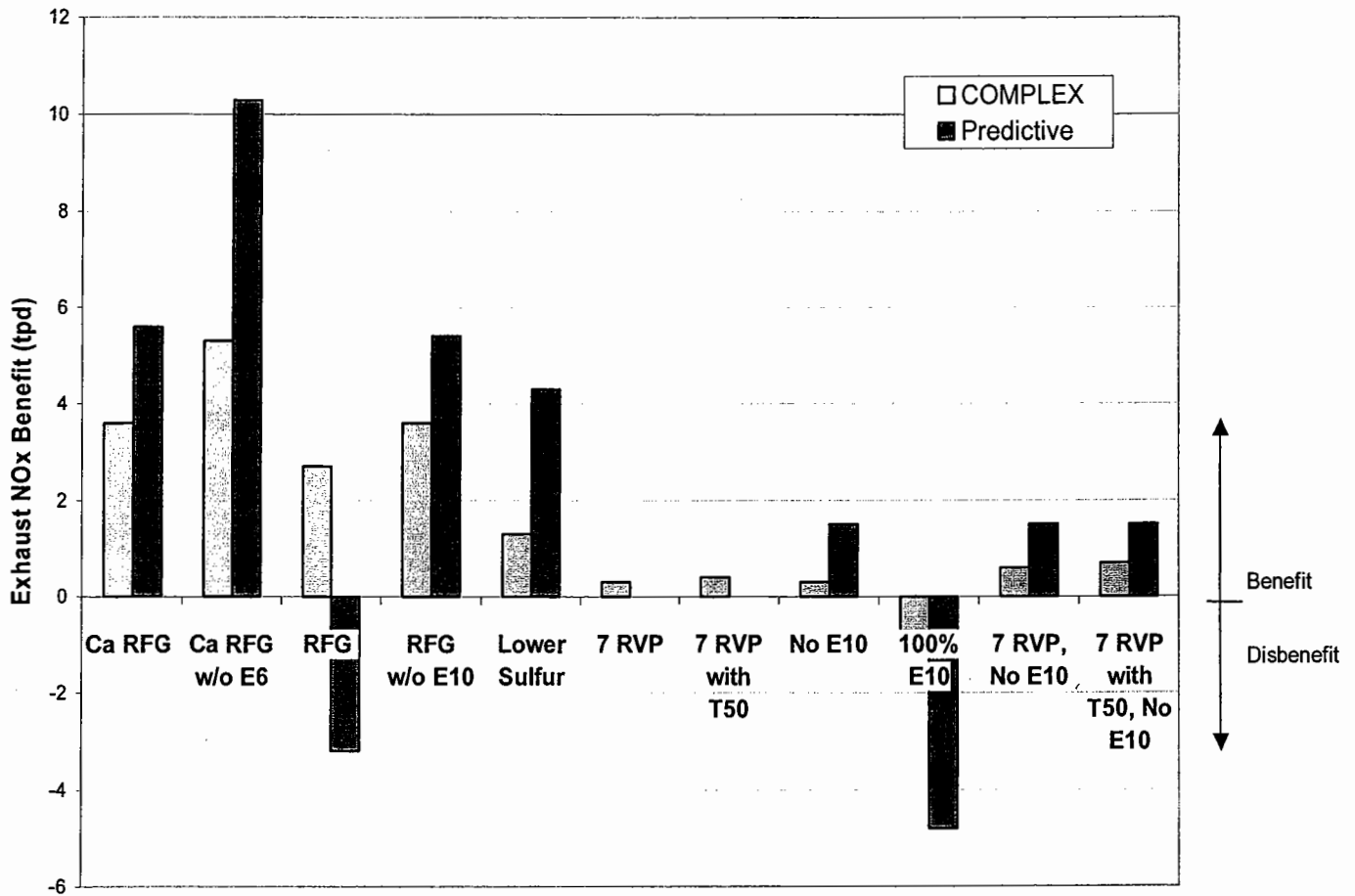
**Figure ES-1. Net VOC Benefits in 2007 - All Sources  
(tons per summer day)**



Notes for Figure ES-1

1. Includes all exhaust and evaporative effects, including ethanol permeation, where applicable.
2. Includes both on-road and off-road sources.
3. E6 and E10 refer to the volume percent of ethanol in the gasoline. E6 denotes a 6% ethanol concentration; E10 denotes a 10% concentration. 100% E10 denotes 100% market share of E10 fuel.
4. 7 RVP with T50 is a low volatility sensitivity case in which T50 is assumed to increase by 3°F as a result of the lower RVP.
5. The reduction benefit of lower volatility fuels is expected to be higher than shown above because the NONROAD model does not currently account for the evaporative benefit of lower volatility fuels for off-road vehicles and equipment.

**Figure ES-2. Net NOx Exhaust Benefits in 2007 - All Sources**  
(tons per summer day)



Note: Figure ES-2 includes both on-road and off-road sources.