Regulation of Fuels and Fuel Additives: Renewable Fuel Standard Program

Summary and Analysis of Comments

Chapter 10
Environmental Impacts

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

EPA United States Environmental Protection Agency

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10 ENVIRONMENTAL IMPACTS

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What We Proposed:

The comments in this section largely correspond to Section VIII of the preamble to the proposed rule, but are targeted at the environmental and emissions impacts of the use of renewable fuels. A summary of the comments received, as well as our response to those comments, are located below.

10.1 Effect of Renewable Fuel Use on Emissions from Gasoline-Fueled Motor Vehicles and Equipment

10.1.1 Restrictions on Gasoline Handling During Distribution

What Commenters Said:

We received a couple of comments regarding the way that gasoline handling practices are currently regulated. We also received a comment on the flexibility granted States to implement fuel control measures which result in the need to segregate their gasoline from that being distributed in neighboring areas.

BlueFire Ethanol suggested that EPA slightly relax its restrictions on mixing ethanol and non-ethanol gasoline blends in order to enhance distributors' ability to use ethanol in the gasoline pool. They provide a number of reasons to justify this relaxation: 1) the relaxation of such mixing for reformulated gasoline per Section 1513 of the Energy Act, 2) the fact that increased Reid vapor pressure (RVP) levels do not appreciably increase reactive volatile organic compound (VOC) emissions, 3) the 2% VOC performance adjustment granted Midwest reformulated gasoline (RFG) blended with ethanol. BlueFire Ethanol also stated that the impacts of increased commingling will be inconsequential as ethanol blends become the dominant fuel in an area. They suggested that EPA could, alternatively, temporarily require a slightly lower overall RVP (or volatility constraint) to account for this impact, so ethanol can be blended downstream with no concern.

The New York State Department of Environmental Conservation (NYDEC) suggested that EPA: 1) explore the benefits to the distribution system (and the possibility of enabling improved criteria pollutant and toxic air pollutant control) of restricting octane, by eliminating mid-grade gasoline or capping the octane of premium; 2) evaluate the impact on the distribution system of State Implementation Plan (SIP) related fuel controls compared to other business and regulatory practices that increase the number of gasoline formulations distributed; and 3) determine whether other simplifications to gasoline marketing could preserve or enhance environmental benefits at reduced cost.

Letters:

BlueFire Ethanol OAR-2005-0161-0200, -0224
New York State Department of Environmental Conservation (NYDEC) OAR-2005-0161-0169

Our Response:

The comment by BlueFire Ethanol to relax the commingling restrictions on ethanol containing fuels is outside the scope of the RFS rule. However, since several of the emission impacts estimated in the RFS rule analyses bear upon BlueFire Ethanol's recommendation, we will address these aspects of their comments here.

First, per Section 1513 of EPAct, Congress directed EPA to allow the limited mixing of ethanol containing RFG with other RFG twice during the VOC-control period (i.e., summer) for a limited amount of time to facilitate the use of ethanol and non-ethanol containing RFG. EPA recently conducted a rulemaking implementing this and several other provisions of EPAct which addressed the use of oxygenates in gasoline (71 FR 8973, February 22, 2006). Section 1513 explicitly refers to reformulated gasoline. Congress did not extend this allowance to conventional gasoline. Section 1513 explicitly refers to the continued application of the volatility controls for conventional gasoline described in Section 211(h) of the Clean Air Act (CAA). Section 211(h) allows ethanol-gasoline blends to have an RVP of 1.0 psi higher than applicable to non-ethanol gasoline if the ethanol content is 10 vol%. No RVP allowance is granted ethanol blends containing less ethanol. As commingling of ethanol and non-ethanol blends would generally dilute the ethanol content of the 10 vol% ethanol blend to less than 10 vol%, the 1.0 psi RVP allowance would not apply to the commingled mixture. Thus, the provisions of Section 211(h) continue to prohibit commingling of ethanol and non-ethanol conventional gasoline blends. BlueFire Ethanol's reference to Section 1513 of the Energy Act does not support its recommendation.

Second, BlueFire Ethanol stated that increased RVP does not increase emissions of reactive VOCs. They offer no support for this statement. As indicated in Table 3.1-20 of Chapter 3 of the Final Regulatory Impact Analysis (RIA), RVP continues to affect non-exhaust VOC emissions from onroad vehicles well out in to the future (a 1.0 psi increase in RVP increases emissions 12%). This impact of RVP is also supported by the most recent test programs conducted by EPA which support the MOBILE6.2 estimates of evaporative emissions.[1] Mixing ethanol and non-ethanol containing gasoline during distribution will increase the RVP of the non-ethanol fuel by 1.0 psi and affects every user of that fuel. In contrast, the commingling that occurs in vehicle fuel tanks is a function of fuel purchasing patterns and generally is projected in Chapter 3 of the Final RIA to not exceed 0.3 psi RVP, even for a worse-case local fuel supply of 50% ethanol containing gasoline and 50% non-ethanol containing gasoline.

Third, EPA did grant RFG sold in the Chicago and Milwaukee RFG areas an adjustment to the applicable VOC performance standard which is equivalent to an RVP increase of 0.2 psi.

[1] For example, "Evaluating Resting Loss and Diurnal Evaporative Emissions Using RTD Tests," U.S. EPA, M6.EVP.001, EPA420-R-01-018, April 2001. Other similar studies can be found at the EPA website for the MOBILE6.2 onroad emission inventory model, http://epa.gov/otaq/models/mobile6/m6tech.htm.

This adjustment was due, however, to further reductions in carbon monoxide (CO) emissions which occur with the use of a 10 vol% ethanol RFG compared to the CO emission reduction achieved by an 11 vol% methyl tertiary butyl ether (MTBE) RFG and not a reduction in or elimination of VOC reactivity, as suggested by BlueFire Ethanol. BlueFire states that reductions in VOC emissions from newer vehicles will justify even greater adjustments in the future. However, CO emissions, and the reduction in CO emissions due to ethanol use, are also decreasing. Thus, it is not clear whether the magnitude of such an adjustment to RFG VOC performance will increase or decrease in the future. BlueFire Ethanol does not provide any specific information pertaining to this analysis, which again is outside the scope of the RFS rule.

Fourth, as discussed in Chapter 2 of the Final RIA, we expect that the use of ethanol blends will be very geographically focused, with ethanol blend use dominating some areas and being quite low in others. This approach tends to reduce the cost of distributing the finished gasoline in both types of areas. In areas where ethanol use is essentially 100% or zero, commingling of ethanol-containing and non-ethanol containing fuels is moot. It is only in the so-called border areas that the issue is relevant. To date, we are not aware of the prohibition on commingling causing any practical or economic difficulty with respect to ethanol blending. In fact, as described in Chapter 2 of the Final RIA, ethanol use in gasoline is increasing dramatically in the presence of such prohibitions. Except in a few local areas, ethanol blending in conventional gasoline is allowed to have an RVP level 1.0 psi higher than the standard applicable to non-ethanol gasoline. This differs from summertime RFG, where both ethanol and non-ethanol blends must meet the same RVP level. Thus, there is not a large difference in the incentive to blend ethanol in summer or winter conventional gasoline. Because of this, we do not observe large shifts in ethanol use by season occurring with all fuel suppliers at the same time. The need to manage any shifts between ethanol and non-ethanol blends in the distribution system likely has more to do with preventing water contamination as with RVP control.

BlueFire Ethanol provided no information which indicates that a change to the commingling prohibition would increase ethanol blending. Thus, it is not clear that any benefits would accrue from such a change. Emissions would clearly increase. Thus, even if such an action were within the scope of this rule, there appears to be no justification for taking this action at this time.

BlueFire Ethanol also suggested that, if increased commingling would increase RVP, EPA could compensate for it by reducing the applicable RVP standards. Again, such an action is outside the scope of this rule. However, reducing the RVP standards would increase the cost of gasoline and reduce its supply.[2] Again, no information is provided demonstrating that allowing increased commingling during fuel distribution would reduce costs or increase fuel supply to compensate. Thus, we do not believe that this course of action would be appropriate at this time.

The actions recommended by NYDEC are outside the scope of the RFS rule. In addition, it is not clear what benefits would accrue from restricting octane, as suggested in their first point listed above. The impact of SIP-related fuel controls on gasoline distribution was recently addressed in a Report to Congress required by Section 1541 of the Energy Act. EPA, along with

[2] EPA White Paper, "Study of Unique Gasoline Fuel Blends ("Boutique Fuels"), Effects on Fuel Supply and Distribution and Potential Improvements," EPA420-P-01-004, October 2001.

the Department of Energy (DOE), will also be conducting a more extensive analysis of such impacts in another Report to Congress required by Section 1509 of the Energy Act and due in 2008. The same is true regarding the impact of simplifications to gasoline marketing.

10.1.2 Effect of Ethanol Blending on Gasoline Fuel Quality

10.1.2.1 General

What Commenters Said:

NYDEC suggested that EPA improve its estimate of the impact of ethanol blending on gasoline quality by conducting a detailed analysis of the gasoline quality data. E.g.:

1) Conduct refinery analysis on a refinery by refinery basis, or by grouping refineries by a combination of region and similar product output (per batch reports). Consider imports and blending-only refineries;
2) Extend analysis beyond summer regular grade gasoline;
3) Analysis of EPA's batch report database (inc. gasoline properties) should play a key role in evaluating the potential for, and technical and economic impacts of, more environmentally protective gasoline formulation;
4) Evaluate the compositional changes resulting from the addition of ethanol to gasoline or gasoline blendstocks at loading facilities; and
5) Evaluation of changes in gasoline composition associated with increased use in ethanol should be comprehensive (e.g., do not assume gasoline aromatics will be reduced because increased use of ethanol will provide sufficient octane). The catalytic reformer, a major source of high octane aromatics, also plays a role in producing petrochemical feedstocks and in producing hydrogen needed to produce low sulfur gasoline, and ultra low sulfur diesel fuel.

Letters:
New York State Department of Environmental Conservation (NYDEC) OAR-2005-0161-0169

Our Response:

EPA has analyzed the fuel quality data collected from refiners and importers and used it to calibrate the refinery modeling which is described in Chapter 7 of the Final RIA. We also updated our estimates of the impact of ethanol blending on gasoline quality using this refinery modeling, as described in Chapter 2 of the Final RIA.

It is difficult to use the refiner and importer data directly to estimate the impact of ethanol blending on gasoline quality. First, while it is possible to compare the quality of gasoline produced by different refiners or importer, the differences in the fuel quality of those refiners blending ethanol and those which do not cannot be automatically attributed to the effect of ethanol blending. Second, even in those cases where a specific refiner changed their ethanol blending habits, the change in fuel quality cannot be automatically attributed to the change in

ethanol blending. The relative production volumes of various types of gasoline (e.g., RFG, low RVP gasoline, etc.) might have also changed. It may be possible to find specific situations where these other changes did not occur and therefore, attribute all of the change in fuel quality to the change in ethanol blending. However, this would involve a considerable amount of time and resources, which were not available within the timeframe of this rule. We believe that our refinery modeling performed for the final rule (and discussed in Chapter 7 of the Final RIA) appropriately characterizes the changes in gasoline quality with ethanol use.

10.1.2.2 Effect of Commingling Ethanol and Non-Ethanol Blends on In-Use RVP Levels

What Commenters Said:

Emission estimates for a particular area often use the average fuel properties of all the gasoline or diesel fuel sold in that area. In most cases, this is sufficiently precise to capture the effect of fuel quality on emissions. However, when ethanol is blended into gasoline, or when ethanol and non-ethanol gasoline blends are mixed, the RVP of the fuel mixture is not the simple volumetric average of the two original fuels. As discussed in the Appendix to Chapter 2 of the Final RIA, just a small amount of ethanol tends to increase RVP by roughly 1.0 RVP, while 10 vol% increases RVP to the same degree. While mixing ethanol and non-ethanol blends during distribution is generally prohibited, such mixing occurs in vehicle fuel tanks when drivers refuel with different fuels. The result in an increase in RVP over and above the volumetric average of the RVP of the fuels sold in that area. This RVP increase is commonly referred to as the commingling impact. Several commenters addressed EPA's estimate that the use of ethanol in less than 100% of the gasoline in an area would increase the RVP in vehicle fuel tanks by 0.1 psi over the simple volumetrically weighted average RVP based on the market share of ethanol blends and pure gasoline in that area. Concern was also expressed about how the areas where this 0.1 RVP commingling impact applied were determined.

The Renewable Fuels Association (RFA) and the Renewable Energy Action Project (REAP) commented that it is unclear how EPA decided to apply the 0.1 psi RVP bump to account for commingling, and how the 0.1 psi figure was reached. REAP noted that the California Air Resources Board (CARB) has argued that the commingling effect is less than 0.1 psi RVP. RFA noted that the draft Regulatory Impact Analysis (DRIA) picked several states where commingling is expected, but it believes that this exercise is almost impossible. RFA recommended a more substantial analysis of the commingling issue and the reasons for settling on 0.1 psi RVP adjustment to remedy uncertainty, and recommended that EPA's analysis consider the trends in the market in its analysis on commingling.

Letters:
Renewable Energy Action Project (REAP) OAR-2005-0161-0204
Renewable Fuels Association (RFA) OAR-2005-0161-0192, -0228 (hearing)

Our Response:

EPA reviewed the description of the methodology used to estimate the commingling impact in the Notice of Proposed Rulemaking (NPRM). We have expanded this description in order to aid the reader in understanding the methodology (see the Appendix to Chapter 2 of the Final RIA). Our methodology considers all the available studies of fuel mixing in vehicle fuel tanks, including a recent survey conducted by CARB. We found more commingling than that estimated by CARB due to what we believe is an improved understanding of the brand loyalty of fuel purchasers. Understanding brand loyalty is a critical factor in estimating commingling, as fuel sold from refueling outlets carrying the same brand of gasoline tend to sell the same fuel (i.e., ethanol or non-ethanol containing). Our methodology differs from that used by CARB in that we distinguish between fuel sold at so-called "branded" stations and "un-branded" stations. The CARB survey data indicated much lower brand loyalty for the vehicle operators refueling at the latter group of stations. The proportion of unbranded (versus branded) fuel stations surveyed by CARB was lower than the proportion of unbranded stations existing nationwide. Thus, considering separate estimates for brand loyalty at branded and unbranded stations decreased the average level of brand loyalty and increased the frequency of commingling.

Our updated commingling model indicates that as little as a 10% market share for ethanol blends increases the average RVP across all vehicles' fuel tanks by 0.1 psi RVP over the average RVP of all the fuel sold in the area. The same is true if the market share of non-ethanol gasoline is as little as 10% (the remainder being ethanol blends). A 30/70 mix of the two types of fuels increases commingling to 0.23-0.24 psi RVP. The highest level of commingling occurs at a 50/50 split, where commingling reaches 0.27 psi RVP. As described in Chapter 2 of the RIA, it is impossible to predict exactly where ethanol and non-ethanol blended fuel will be sold. Since the RFS applies on a national average basis, there is no regulatory incentive for ethanol blending to change dramatically at a county or state line. We have generally made the assumption that ethanol blending will be either zero or 100% in a given state (with a further urban/rural distinction in some states). This clearly underestimates the impact of commingling, as commingling is zero for either of these two situations. Any deviation from either 0% or 100% will result in an increase in RVP.

For the NPRM, we determined two types of situations where commingling was likely to be significant. One was a state or subsection of a state (e.g., an RFG area in a state) where the ethanol market share was positive, but not 100%. The other was a state on the "border" between zero ethanol use and 100% ethanol blend market penetration. While we assumed that ethanol use went from 100% to zero at the state line, practically speaking, a "border" area will always exist between areas where ethanol use predominates and those where it is minimal. There is unlikely to be a "bright line" between these two areas. This is evidenced by current ethanol use patterns. Despite sufficient ethanol use to convert the fuel supply of entire Midwestern states to 10 vol% ethanol blends, we do not see this happening. Instead, we find numerous states with significant, but not 100% use of ethanol blends. The fraction of gasoline represented by low level ethanol blends for Midwestern states is shown below in Table 10-1, as estimated in Chapter 2 of the RIA.

Table 10-1. Level of Ethanol Blend Use in 2004	
State	(Fraction of total gasoline sales)
ILLINOIS	0.54
INDIANA	0.40
MICHIGAN	0.16
OHIO	0.37
WISCONSIN	0.25
IOWA	0.71
KANSAS	0.29
MINNESOTA	1.00
MISSOURI	0.18
NEBRASKA	0.45
NORTH DAKOTA	0.30
SOUTH DAKOTA	0.55

As can be seen, only Minnesota shows 100% use of ethanol blends, which is due to their mandate. Otherwise, ethanol use tends to spread into adjacent states (e.g., Missouri, Michigan) before reaching 100% market penetration in high producing states (e.g., Iowa, Illinois). Thus, our estimate that the market penetration of ethanol use will not change from 100% to zero between States is reasonable.

Still, there was the need for judgment to estimate where the use of ethanol blends would be substantial but less than 100%. For the FRM, we have adjusted our approach to estimating commingling. As described in Chapter 2 of the Final RIA, we are now relying on refinery modeling to predict the level of ethanol use in RFG and conventional gasoline at the Petroleum Administration District for Defense (PADD) level. This has resulted in more areas with significant, but less than 100% ethanol blend use. Thus, we have simply based our estimate of the RVP commingling impact on the local mix of fuels being sold in each area. The specific commingling impact is based on our updated commingling model, which is described in the Appendix to Chapter 2 of the Final RIA. The net result of this change is the application of a commingling impact to fewer areas. However, in many cases, the commingling impact is larger than 0.1 psi. This approach is still likely to underestimate the impact of commingling in the "border" areas of ethanol use. However, it avoids the possibility that commingling is being over-estimated.

10.1.2.3 RVP and Distillation Temperatures

What Commenters Said:

RFA commented that it has concerns regarding some of the assumptions used by EPA in its analysis, such as (a) the distillation temperature drops used in DRIA Table 2.2-4 (based on four cities) and the RVP increase used, which may overstate the effects of T50 and RVP in Table 2.2-5.

Letters:
Renewable Fuels Association (RFA) OAR-2005-0161-0192, -0228 (hearing)

Our Response:

Regarding the impact of ethanol blending on T50 and RVP, EPA did not assume these effects. The impact of ethanol blending on T50 levels was based on an analysis of fuel survey data collected by the Alliance of Automobile Manufacturers (Alliance). While there are several limitations involved in the methodology used to derive these impacts (which were fully described in the Draft RIA), RFA did not present any data with which to modify this effect.

Since the time of the NPRM, EPA has conducted refinery modeling which provides an alternative estimate of the effect of ethanol blending on T50, as well as other properties of gasoline. This refinery modeling indicates a smaller effect of ethanol on T50. Due to the limitations involved in the analysis of the Alliance survey data, we believe that the refinery modeling likely provides a better indication of the impact of ethanol on gasoline properties. Thus, the T50 impacts shown in Table 2.2-4 of the Draft RIA have been replaced with revised estimates in Table 2.3-11 of the Final RIA.

Regarding the impact of ethanol blending on RVP, this impact was also not assumed, but based on an analysis of the Alliance survey data. In this case, we took extra steps to ensure that the impact (1.0 psi RVP) was not over-estimated due to the different numbers of fuel samples taken in different cities and an unequal number of gasoline and ethanol-gasoline blend samples. Given that current federal law allows ethanol blends to have an RVP of 1.0 psi higher than the RVP standard applicable to non-ethanol blends, our estimate that ethanol blending increases RVP by 1.0 psi appears quite reasonable and justifiable. Thus, this 1.0 psi impact was maintained for the final rulemaking analysis.

10.1.3 Onroad Motor Vehicles Emissions from Low Level Ethanol Blends

10.1.3.1 Exhaust Emissions

What Commenters Said:

Several commenters addressed EPA's approach to estimating the impact of ethanol use on exhaust emissions from motor vehicles. Some supported our approach and the resultant findings, while others disagreed.

ExxonMobil commented that the conclusions on increased oxides of nitrogen (NO_x) emissions are consistent with testing conducted by ExxonMobil and others, and the conclusion on VOCs is consistent with concerns that have long been expressed by ExxonMobil, Toyota, and others regarding the potential for increased permeation of VOCs with ethanol blends. The commenter also stated that offsetting the increases in NO_x and VOC emissions are some

reductions in toxics due to the dilution benefit of ethanol blending (with the notable exception of a very significant increase in acetaldehyde emissions).

RFA and REAP questioned that national NO_x emission inventories will increase. The commenters also noted that the Coordinated Research Council (CRC) E-67 report (2006), which was cited in the DRIA, looked at the existing NO_x/ethanol data and concluded that "[t]he results in the literature show some tendency for NO_x emissions to increase with greater ethanol levels, but this trend is not consistent or statistically significant over a wide range of studies."

RFA also noted that many NO_x emissions data sets are available on the CARB website, and that these data sets confirm the directional uncertainties of the tailpipe NO_x response to ethanol. The commenter encouraged EPA to better discuss the uncertainties of the ethanol/NO_x issue, stating that it is hesitant to call the emissions responses projected by the EPA Predictive Model definitive. The commenter stated that, while it may be the right vehicle to improve upon many of the assumptions made in 2001 (the last time the EPA Complex Model was updated), it believes there is substantial uncertainty about the NO_x response to ethanol. The commenter does not believe that this uncertainty is corrected by the EPA Predictive Model, and stated that it should be better reflected in the RIA.

REAP also commented that the wide (and often directional) range of vehicular NO_x responses to ethanol content is a problem and nothing in the CRC analysis or any other recent analyses changes this reality. REAP suggested that the projected NO_x inventory impacts should be more clearly noted as highly uncertain, and that a better approach might be to establish (percentage based) ranges in the modeling analysis and the inventory analysis, so that the uncertainties and ranges in the actual data are reflected in the analysis. The commenter stated that the DRIA leaves the unmistakable impression that the use of ethanol comes with NO_x liability, which it believes is a questionable conclusion that could jeopardize fuels diversification efforts at the state level.

NYDEC commented that it believes that the tools and data available to EPA to measure the emissions effects of renewable fuels, such as ethanol in gasoline, are outdated, incomplete, and inadequate. The commenter stated that it strongly supports EPA in its desire to provide newer and more relevant data, and stated that it desires to work with EPA and other stakeholders to achieve these goals. The commenter also noted that EPA's analysis suggested that there will be increases in overall emissions of several key pollutants, particularly VOCs and NO_x. The commenter stated that it is concerned by these increases, especially given the uncertainty in the available tools discussed above, and the fact that EPA has neglected any increases that may have happened in regions where ethanol has already become a significant gasoline constituent. The commenter urged EPA to explore ways to mitigate these emissions increases.

NYDEC suggested the following for EPA test programs:

1) Properties of test fuels be within the normal range of the property, including near the midpoint, rather than outliers;
2) Do not limit test cycles of light duty vehicles to the Federal Test Procedure (FTP). Very low speeds (New York City Cycle), aggressive acceleration (US06), and sustained high speeds (80 mph cruise) should all be equal parts of the test suite;

3) Greater research emphasis is necessary on vehicle emissions at lower temperatures – particulate matter (PM) formation does not require high temperatures. Toxic chemicals tend to accumulate in cold air because the chemical reactions that remove them from the atmosphere slow down and meteorological conditions that prevent dispersion of toxic chemicals are more common in winter;
4) Evaluate tailpipe and evaporative benzene emissions versus the benzene content of gasoline and the content of known benzene precursors in gasoline including cyclohexane, and aromatics such as toluene;
5) Compare emissions performance of 7.0 psi RVP conventional gasoline (CG) to current RFG requirements;
6) Consider alternative measures of volatility to RVP. In particular, Distillation Index (DI) and some measure of front end distillation may (either singly or in combination with RVP) improve the predictability of volatility effects on emissions;
7) Partial combustion products of oxygenated compounds such as alcohols cannot be measured by the standard hydrocarbon testing instrument - the Flame Ionization Detector (FID). All partial combustion products must be measured, including aldehydes, ketones and alcohols;
8) Testing of toxic emissions is necessary to facilitate an increase in toxics control. This may be accomplished by some combination of: weighting toxics by potency rather than molecular weight, expanding the list of compounds controlled, and promulgating emissions caps for individual toxics such as benzene;
9) Testing should be conducted to evaluate fine PM emissions from gasoline light duty vehicles and nonroad equipment; and
10) Further evaluation of the combustion chamber deposit forming potential of ethanol blended gasoline should be conducted, and the emissions impact of this effect evaluated.

Marathon and API commented that EPA should better characterize the uncertainty associated with its estimates of the impacts of the RFS program on emissions and air quality. The commenters stated that they do not disagree with EPA's assessment, but noted that the conclusions are supported by models and assumptions that contain numerous elements of uncertainty that merit more testing and research. The commenters noted that areas of uncertainty include the use of old/limited data for estimating effects of fuel property changes, especially for vehicles in advanced emission controls. The commenters agree with the EPA's observation that that existing models (such as the Complex Model, the Predictive Model and MOBILE6.2) for evaluating fuel factor effects are based on technology that is more representative of the 1990s than of the present or oncoming decade. They believe that there is a need to update these models with information from fuel factor effect test programs on newer technology vehicles such as those contained in recent reports of the CRC relating to the effects of ethanol and gasoline volatility on exhaust emissions and the effects of ethanol on permeation emissions.

Letters:
American Petroleum Institute (API) OAR-2005-0161-0185
ExxonMobil Refining & Supply Co. OAR-2005-0161-0197
Marathon Petroleum Company (MPC) OAR-2005-0161-0175
New York State Department of Environmental Conservation (NYDEC) OAR-2005-0161-0169

Renewable Energy Action Project (REAP) OAR-2005-0161-0204
Renewable Fuels Association (RFA) OAR-2005-0161-0192, -0228 (hearing)

Our Response:

The first observation to make about the above comments is their overall inconsistency. Some comments indicate that the emission impacts made in the NPRM are consistent with the existing studies of the impact of ethanol on vehicle emissions, while others say that the existing studies are inconclusive or even directionally inconsistent. None of the commenters pointed to any specific study or analysis to support their position. Therefore, it is not a simple task to compare the basis of one commenter's position to that of another.

A couple of commenters point to: 1) analyses conducted by CARB in the past, 2) studies presented at CARB's website and 3) the fact that CARB is updating their fuel-emission models. First, CARB's current fuel-emission model (the Version 3 of the CARB Predictive Model) projects that oxygen content significantly increases NO_x emissions. This effect is small between 0 and 2 wt% oxygen (roughly a 2% increase in NO_x emissions), but accelerates as oxygen increases above 2 wt%. At 3.5 wt% oxygen, that of E10, NO_x emissions are predicted to increase by another 4% over a 2 wt% oxygen fuel, for a total NO_x emission increase of 6% relative to a non-oxygenated fuel.[3] Thus, the current CARB model for determining compliance with their Clean Burning Gasoline requirements clearly directionally supports our emission projections in the NPRM. In fact, the CARB Predictive Model more strongly supports our sensitivity analysis which projects a larger increase in NO_x emissions than the primary analysis, which projects a smaller increase in NO_x emissions.

Second, regarding studies posted on CARB's website, several of these studies now include a comparison of non-oxygenated and oxygenated fuels. Some show an increase in NO_x emissions for ethanol blends, one shows a decrease, while still others are inconclusive. A number of these studies show that MTBE blending reduces NO_x emissions and ethanol appears to increase NO_x emissions relative to MTBE. We describe and present the results of these studies in detail in Chapter 3 of the Final RIA. We reevaluate the assumptions which form the basis for our primary and sensitivity analyses on the basis of these studies, as well.

Third, until CARB completes any planned revisions to their gasoline regulations, the outcome of any revision is unclear. Thus, there is no way to take this potential action into account in the analysis of the RFS rule.

Thus, as presented in Chapter 3 of the Final RIA, we feel that the directional trends presented in our analysis are the best possible conclusions that could be drawn given the available data. In the future, our MOVES emissions model will be better equipped to deal with the impact of uncertainty in emissions estimates.

[3] Other fuel properties used in this example calculation: 10 ppm sulfur, 7 RVP, 25 vol% aromatics, 5 vol% olefins, T50 or 190 F, and T90 of 330 F), all set to be flat limits, summer fuel. Oxygen's increase in NOx emissions is essentially independent of any assumption of how T50 changes with the addition of oxygenate (e.g., ethanol) to the fuel.

Several commenters cite a recent CRC E-67 report that states that: "[t]he results in the literature show some tendency for NOx emissions to increase with greater ethanol levels, but this trend is not consistent or statistically significant over a wide range of studies." We reviewed this report and found that this statement was based on a review of a number of emission studies, some of which tested Tier 0 vehicles, other tested Tier 1 vehicles and still others tested low-emission vehicles (LEVs), etc. In some cases, oxygen type or content was the only change in fuel quality, while in other cases, other fuel parameters changed as well. Thus, it is not surprising that an inconsistency in the results would occur. At least two studies involving LEV and cleaner vehicles have been published since the time of the CRC study. In Chapter 3 of the Final RIA, we evaluate five studies which measured the effect of a change in oxygenate type and content on the exhaust emissions from late model year vehicles. We evaluate the results of each study individually. We also combine the results in a non-quantitative fashion by presenting the results of each study side-by-side in terms of whether it showed a particular change in oxygenate type or content to increase or decrease the emissions of a particular pollutant to a statistically significant degree.

In addition to the analyses described in Chapter 3 of the Final RIA, we made several attempts to model the combined data from the five studies of LEV and cleaner vehicles. Table 10-2 summarizes the breadth of each study in terms of the number and type of fuels and the number of LEV and cleaner vehicles tested.

Table 10-2. Description of Fuel Effects Studies of LEV and Cleaner Vehicles

	Vehicles Tested	Fuels Tested				
		No Oxygen	Ethanol Blends		MTBE Blends	
			~6 vol%	~10 vol%	~5 vol%	~11 vol%
AAM-AIAM	10	1	---	1	---	1
ExxonMobil	5	1	1	1	---	1
Toyota	9	--	---	1	---	1
Mexican Petroleum Institute	7	1	1	---	1	1
CRC E-67	12	3	1	2		---

In the majority of cases, the differences in the fuels tested were restricted to oxygen and paraffin content. Other properties, such as aromatics, olefins, sulfur and distillation temperatures, were held constant. In most cases, RVP was also held constant. However, in some cases, the RVP of the ethanol blends were roughly 0.5 psi higher. In general, the fuels were more typical of California RFG than conventional gasoline, having relatively low levels of aromatics and olefins. Two of the above studies, those performed by the Mexican Petroleum Institute and CRC, tested many more fuels than those listed. We only included those fuel pairs where oxygenate type and content was the primary or only difference. Also, the study by the Mexican Petroleum Institute included many vehicles not indicative of LEV and later vehicles. We only included data from those vehicles with emissions like those required by the LEV standards. The reader is referred to Section 3.1.1.1 of the Final RIA for the details of both the vehicle and fuel selection.

Combining the data from the five studies produced a database with 310 distinct tests. We applied two mixed models to the logarithm of the emission data in order to estimate the effect of oxygenate type and content on emissions. Both models assigned each vehicle a random vehicle term. One model applied included separate fuel terms for MTBE content and ethanol content (i.e., volume percent). Both linear and squared fuel terms were allowed. A stepwise process was applied which removed the squared terms if they were not statistically significant at a 90% confidence level. The linear term was retained if the squared term was significant. The other model did not distinguish between oxygenate type, but only included oxygen content terms (again linear and squared). In both models, the fuel term was treated as a covariate. The modeling was performed using the Univariate function in SPSS, version 10.1.3.

Assigning the vehicle codes was straightforward for all but the CRC study, as the fuels in the other four studies could all be related to each other in terms of a change in only oxygenate type or content. However, the data in the CRC study required further segregation, since the data selected from this study included three distinct pairs of matched fuels (A/B, D/E, and F/G) The "base", non-oxygenated fuels for the three pairs differed in terms of distillation properties (i.e., T50 and T90). We did not want this difference to affect the predicted impact of oxygenate on emissions, since the models did not include the effect of distillation temperatures. Thus, each vehicle was assigned a different code depending on which of the three pairs of fuels was used in that test. This essentially created three separate studies where the "base" emission level of each vehicle could change freely.

We modeled the effect of oxygenate on emissions of four pollutants. All five studies measured CO and NO_x emissions. However, four of the five studies measured total hydrocarbon (THC) emissions and four out of five measured non-methane hydrocarbon (NMHC) emissions. (Three studies measured emissions of both types of hydrocarbons.) Thus, we modeled both THC and NMHC emissions. As will be seen below, the statistical models for both pollutants were very similar. Thus, including or excluding either of the two studies which did not measure the other pollutant appears to have little effect on the results.

The final MTBE/ethanol models are summarized in Table 10-3.

Table 10-3. Combined LEV+ Emissions Vs. MTBE and Ethanol Content

Terms	THC		NMHC		CO	NO_x
	Non-Linear	Linear	Non-Linear	Linear	Linear	Linear
MTBE (vol%)	0.03476	-0.006858	0.04096	-0.007684	-0.01604	-0.00932
MTBE * MTBE	-0.003861	----	-0.000445	----	N.S.	N.S
EtOH (vol%)	-0.003993	-0.004064	-0.00434	-0.004445	-0.02198	0.003883
EtOH * EtOH	N.S.	----	N.S.	----	N.S.	N.S.

The statistical analyses of THC and NMHC emissions found the effect of MTBE to be non-linear. All except one of the MTBE blends contained roughly 11 vol% MTBE. The exception was a 5.5 vol% MTBE blend tested by the Mexican Petroleum Institute. Given this, we also generated a second set of THC and NMHC models which only included linear fuel

terms. These are also shown in the second column under "THC" and "NMHC" headings in Table 10-3. The effect of a typical 11 vol% MTBE blend on THC and NMHC emissions using the two sets of models will be compared below.

The final oxygen content models are summarized in Table 10-4.

Table 10-4. Combined LEV+ Emissions Vs. Oxygen Content

Terms	THC	NMHC	CO	NO_x
Oxygen (wt%)	-0.01046	-0.01134	-0.05963	-0.05542
Oxygen * Oxygen	N.S.	N.S.	N.S.	0.01812

As shown in Table 10-4, the oxygen squared term was only statistically significant with respect to NO_x emissions. Unlike the case with MTBE contents, the oxygen content of the fuels tested were much more evenly distributed between 1.0 and 3.5 wt%.

Table 10-5 presents the predicted emission impacts for three fuels relative to a non-oxygenated gasoline: an 11 vol% MTBE blend containing 2.0 wt% oxygen, a 5.7 vol% ethanol blend containing 2.0 wt% oxygen and a 10 vol% ethanol blend containing 3.5 wt% oxygen.

Table 10-5. Predicted Emission Impacts of Typical MTBE and Ethanol Blends

	THC	NMHC	CO	NO_x
11 vol% MTBE blend				
MTBE-Ethanol Model	-8.5%	-8.8%	-17.6%	-10.6%
MTBE-Ethanol Model (linear)	-7.5%	-8.4%	-----	-----
Oxygen Content Model	-2.1%	-2.3%	-11.9%	-3.8%
5.7 vol% Ethanol Blend				
MTBE-Ethanol Model	-2.3%	-2.5%	-12.5%	2.2%
MTBE-Ethanol Model (linear)	-2.3%	-2.5%	-----	-----
Oxygen Content Model	-2.1%	-2.3%	-11.9%	-3.8%
10 vol% Ethanol Blend				
MTBE-Ethanol Model	-4.0%	-4.3%	-22.0%	3.9%
MTBE-Ethanol Model (linear)	-4.1%	-4.5%	-----	-----
Oxygen Content Model	-3.7%	-4.0%	-20.9%	2.8%

The first observation from Table 10-5 is that the linear and non-linear models for MTBE blends predict very similar THC and NMHC emission impacts for an 11 vol% MTBE blend. This is not surprising, since all but one of the MTBE blends in the five studies was close to this level. Thus, it is not material which model is used as long as the primary focus is on fuel with a MTBE content of 11 vol%.

Second, the MTBE-ethanol and Oxygen models predict very different emission impacts for the 11 vol% MTBE blend, but similar impacts for the two ethanol blends, with the exception of the NO_x emission impact for the 5.7 vol% ethanol blend. The reason for the dissimilar impacts for the MTBE blend is the fact that the MTBE-ethanol model predicts very different

emission impacts for MTBE and ethanol at common levels of oxygen content. When treated as a separate factor, MTBE reduces the emissions of all four pollutants more than ethanol. When combined with ethanol in terms of oxygen content, the effect of MTBE on THC, NMHC and CO emissions are brought in line with those of a 5.7 vol% ethanol blend when ethanol is treated as a separate factor. For NO_x emissions, the effect of 2.0 wt% oxygen is intermediate between that predicted for an 11 vol% MTBE blend and a 5.7 vol% ethanol blend by the MTBE-ethanol model.

We are not aware of an obvious explanation for the differences between the two models, particularly for MTBE blends. Based on this limited dataset, MTBE appears to have properties which affect emissions beyond its oxygen content. This is particularly true for NO_x emissions, where MTBE blending reduces NO_x emissions and ethanol addition at either 5.7 or 10 vol% increases NOx emissions. This issue deserves further study.

As noted above, the fuels tested in the five test programs were more similar to California or Federal RFG than to typical conventional gasoline. Thus, these preliminary findings apply more to the removal of MTBE and use of ethanol in RFG areas than in conventional gasoline areas. In particular, when ethanol is added to conventional gasoline, other parameters tend to change significantly (e.g., aromatics and T50 decrease, RVP increases, etc.). These ancillary changes are not reflected in the test fuels of the five LEV and later vehicle studies. Thus, the predictions of the two models developed above should not be simplistically applied to represent the effect of blending ethanol into conventional gasoline.

Regarding NYDEC's comments concerning uncertainty in the effect of oxygenate and other fuel parameters on emissions, the comments basically support the statements made in the proposal that additional testing is needed. EPA has been working diligently to develop a comprehensive set of emission test programs to address the gaps in our understanding of fuel-emission interactions. We have already engaged several organizations, such as CRC, to collaborate on such testing. We hope to begin the first of several test programs this year to begin to address this problem. We will consider NYDEC's detailed suggestions regarding the specifics of these test programs as we finalize our testing plans.

A couple of commenters asked EPA to better characterize the uncertainty in our emission and air quality estimates. EPA generally agrees that a more robust and statistical estimate of the potential uncertainty in the emission and air quality implications of increased use of ethanol is desirable. However, due to limited data and the aggressive timeline for the RFS rule promulgation, we are not able to conduct such an analysis in the context of this rule. Also, the RFS rule itself does not depend on our current estimates of the emission and air quality impacts. It may be possible to develop such an estimate of the uncertainty in the fuel-emission effects in the Report to Congress on the emission and air quality impacts of all the fuel-related provisions of the Energy Act. A draft of this report is required by section 1506 of the Act to be published in 2009.

10.1.3.2 Non-Exhaust Emissions

What Commenters Said:

RFA commented that it has concerns regarding EPA's assumption that tank temperatures follow ambient without considering lower temperatures for vehicles parked in the shade or garages. RFA also stated that it is concerned that EPA is over-estimating permeation emissions from E10. The commenter noted that CRC has released a second "interim" report on permeation emissions from E10 which confirms that permeation emissions do not increase (on a mass emissions basis) when increasing ethanol content from 6 to 10 percent, and the reactivity of the "permeate" is lower for ethanol blends in comparison to non-ethanol blends. The commenter also noted that, at the same time, there are greater benefits related to reducing exhaust emissions, such as CO emissions, with the 10 percent blend. RFA encouraged EPA to clarify which emissions estimates are being used in the final report. The commenter noted that several analyses conducted in the last few years, including AIR, Inc. analyses, assumed that permeation emissions increase when going from the 2005 CRC test case (E6) to E10, when in fact this assumption is incorrect. The commenter believes this will be particularly important to state-level interpretations of the available data with regard to permeation.

Letters:
Renewable Fuels Association (RFA) OAR-2005-0161-0192, -0228 (hearing)

Our Response:

In estimating permeation emissions, EPA assumed that fuel in parked vehicles was at ambient temperature in order to estimate the increase in permeation emissions from ethanol blends. An increase in fuel temperature due to driving was added to the ambient temperature, as fuel heats up due to fuel recirculating from the engine compartment, hot cooling air flowing underneath the vehicle and heat transfer from the hot exhaust system.

Focusing on the fuel temperature of parked cars, absent radiant heat, fuel temperatures tend to lag ambient temperature by a few degrees due to the heat capacity of the fuel. The peak fuel temperature will be a few degrees below the peak ambient temperature and the minimum fuel temperature will be a few degrees above the minimum ambient temperature. The average fuel temperature will be very close to the average ambient temperature. Permeation emissions increase exponentially with temperature, however. Thus, increasing the difference between the minimum and maximum temperatures, while holding the average temperature constant, will increase the average permeation emission rate.

We evaluated the potential of this assumption to over-estimate the increase in permeation emissions associated with ethanol blends. For a typical summer day with minimum and maximum temperatures of 72 °F and 96 °F, respectively, we estimated permeation emissions with no lag between fuel and ambient temperature and for the situation where the and maximum fuel temperatures differed from the ambient by 3 °F. The ratio of permeation emissions in the latter case to those in the former case was 0.984. This indicates that ignoring the lag in time of fuel tank temperature relative to ambient temperatures is likely over-estimating emissions on the order of 1.6%. Thus, the potential error associated with this simplifying assumption appears to be quite small.

In addition, there are at least two factors which counter the lag of fuel temperature relative to ambient temperature. First, there is the radiant heat that RFA mentions in their comments. Some vehicles are parked in the sun and this can heat up the fuel up to and above the ambient temperature. This effect can be even larger for vehicles which have been parked in a spot which had previously been baking in sunlight, as the underlying pavement can be well above the ambient temperature.

Second, initially after being driven, fuel temperatures are well above ambient. The fuel temperature then cools to the ambient temperature. Both the heating of the fuel during driving and the cooling down to ambient is accounted for separately by the fuel temperature adjustment due to driving described in the RIA. However, at the point in time when the fuel reaches the ambient temperature, the lag between fuel and ambient temperature is zero, not a few degrees as assumed above.

Thus, any over-estimation of fuel temperature due to our assumption that the fuel temperature tracks the ambient temperature is less than 1.6%, or very small. We therefore continue to utilize this assumption in the FRM analysis.

Regarding the effect of increasing ethanol content on permeation emissions, our estimate of the impact of a 10 vol% ethanol blend on permeation was assumed to be the same as that for a 6 vol% ethanol blend. Therefore, our estimate of permeation emissions is consistent with the CRC E-65 Phase 3 study cited in the comment.

10.1.4 Onroad Motor Vehicles Emissions from High Level Ethanol Blends (E85)

What Commenters Said:

A number of commenters noted that the amount of data available on the emissions from flexible-fueled vehicles (FFVs) using E85 was very limited. They suggested that EPA quantify the uncertainty in its emission projections for E85 use.

Marathon does not disagree with EPA's assessment of the emission impacts of E85 use, but indicated that there are numerous elements of uncertainty in the estimates that merit more testing and research

API believes there is a need for more test data to evaluate the emissions effects of E85 in FFVs, as current projections of E85 show its usage to be very small compared to E10. The commenter noted that while this indicates that the overall emissions impacts of FFVs fueled with E85 will be small, this expectation is based on extremely limited published information available on the emissions characteristics of modern technology FFVs. The commenter stated that available data relate to tests performed on FFVs produced in the early and mid-1990s and standard EPA emissions certification tests and suggest that E85 will increase non-methane organic gas (NMOG) and acetaldehyde emissions while having mixed effects on other criteria pollutants and air toxics. The commenter stated that, to the extent that FFV penetration and

usage increases in the future, whether by market incentives or other means, it will be important to for EPA to collect more data to better characterize the emissions implications associated with fueling these vehicles on E85 blends.

Letters:
American Petroleum Institute (API) OAR-2005-0161-0185
Marathon Petroleum Company (MPC) OAR-2005-0161-0175

Our Response:

Available test data on FFVs is limited and additional testing is needed. This will become more and more important as the market share of FFVs increases over the next decade, especially if the use of E85 fuel becomes more common. EPA is currently working to address this issue by including FFVs in the planning of future test programs. Some limited testing of FFVs is currently in process to support a Mobile Source Air Toxics (MSAT) rulemaking. This testing however is targeted at primarily air toxic emissions at colder temperature operation (20° F) while using winter grade E70. For a better emission assessment, future FFV test programs will require expanded testing including additional "off-cycle" areas of operation and even different ethanol content blends possible in the field.

The limited amount of test data available for FFVs operating on E85 and ethanol blends between E0 and E85 prevents a straightforward statistical estimate of the uncertainty in the emission impact of FFV emissions when operating on E85 compared to E0. The additional test data which we plan to obtain in the near future should help address this problem. EPA also plans to explicitly include estimates of uncertainty in its MOVES emission inventory model. Since the RFS rule does not depend directly on the emission impacts projected here, it is reasonable to focus current efforts on obtaining more data and delay further quantification of uncertainty to the MOVES model and to later emission studies of fuel effects, such as that required by section 1506 of the Energy Act.

10.1.5 Nonroad Equipment Emissions from Low Level Ethanol Blends

What Commenters Said:

API and Marathon commented that EPA failed to conduct a sensitivity analysis for emissions from non-road vehicles. API commented that EPA projections of emissions inventories for mobile sources provided in the nonroad diesel rulemaking suggest that the non-road sector will account for an increasingly larger proportion of the total in the future. API recommended that EPA perform a nonroad sensitivity analysis to obtain a preliminary measure of the uncertainty associated with the contribution of the non-road sector to future mobile source emissions inventories.

The RFA also commented that it has concerns regarding some of the assumptions used by EPA in its analysis, such as the use of a 0.1 psi RVP increase to assess commingling for non-

road emissions where non-road equipment is normally fueled from cans that are empty or almost empty.

Letters:
American Petroleum Institute (API) OAR-2005-0161-0185
Marathon Petroleum Company (MPC) OAR-2005-0161-0175
Renewable Fuels Association (RFA) OAR-2005-0161-0192, -0228 (hearing)

Our Response:

A nonroad sensitivity analysis would better characterize the potential implications of the RFS program on nonroad emissions. However, due to limited data and the aggressive timeline for the RFS rule promulgation, we were not able to conduct such an analysis. It is not possible to estimate the uncertainty in the fuel-emission effects of late model nonroad equipment if no such testing has yet been performed. To estimate a range for the fuel-emission effects of late model equipment on the fuel-emission effects of older models implies a relationship between the two effects that can only be determined through testing. Furthermore, no data were submitted to EPA that would permit more refined nonroad inventory estimations. Despite the lack of better data, the efforts to quantify the impacts on emissions and air quality are merely intended to be illustrative, and were not developed to determine appropriate costs and benefits of particular environmental standards. EPA intends to obtain more updated data on nonroad emissions for the Report to Congress required by Section 1506 of the Energy Act, a draft of which is due to be published in 2009. EPA also plans to explicitly include estimates of uncertainty in its MOVES emission inventory model in areas where the data are sufficient to permit this.

RFA's assumption or intuition that portable fuel tanks are normally empty or near empty when refilled is reasonable for most portable fuel tanks in residential use. However, this is not as obvious for tanks in commercial service, where they might be refilled at the beginning of the day regardless of their current fill level. The same is true for fuel tanks located on the nonroad equipment in either residential or commercial service. It seems reasonable to assume that operators fill their tank at the beginning of use. It is unlikely that the tank just reached empty at the end of the previous use. Thus, significant commingling is likely to occur in the equipment fuel tank. This commingling could be greater or less than that estimated for onroad vehicles. Absent studies which specifically measured commingling in nonroad equipment fuel tanks, it is more reasonable to assume that this commingling is the same as that occurring with onroad vehicles than to assume it is zero. Therefore, we have not changed this aspect of the NPRM analysis for the FRM.

10.2 Diesel Vehicle Emissions from Biodiesel

What Commenters Said:

Most commenters reiterated statements contained in the preamble to the rule by stating that much of the data used in estimating biodiesel emission effects was limited or old and may no longer be reliable in characterizing emission impacts in the 2012 fleet.

Many of the commenters, including the National Biodiesel Board (NBB), National Renewable Energy Laboratory (NREL), Biodiesel Industries of Greater Dallas and Fort Worth (BIGDFW) and REAP, claimed that based on the most recent biodiesel emissions test data, B20 has no impact on NO_x emissions. Some of them cited the report on this subject issued by the National Renewable Energy Laboratory in October 2006. The Biodiesel Coalition of Texas argued the EPA should "make it clear to states that biodiesel does not significantly – if at all – increase NO_x emissions". Galveston Bay Biodiesel urged the EPA to "update the final RFS rule to include the most recent biodiesel emissions test data that best represents emissions from real world driving scenarios."

The NBB, NREL, BIGDFW, Baker Commodities, Galveston Bay Biodiesel, Griffin Industries and REAP, commended the EPA for and/or urged the EPA to continue working with other stakeholders in order to ensure that the most up-to-date and reliable information is included in the final rule.

In addition, NREL claimed in their comments that EPA's assessment of newer test data was not based on all the available sources, that one of the data sources used by the EPA was of inadequate quality and that a single engine model dominated EPA's 2002 assessment of the biodiesel effect on exhaust emissions of diesel engines. They also reiterated another statement contained in the preamble to the RFS rule by saying that "additional data on a set of engines and vehicles that are more representative of the in-use, on-highway fleet are required to come to a definitive conclusion."

NREL commended EPA's Office of Transportation and Air Quality for addressing the important issue of biodiesel impacts on emissions in the rule.

Letters:
Baker Commodities OAR-2005-0161-0003 through -0006, -0173
Biodiesel Coalition of Texas (BCOT) OAR-2005-0161-0186
Biodiesel Industries of Greater Dallas and Fort Worth (BIGDFW) OAR-2005-0161-0211
Engine Manufacturers Association (EMA) OAR-2005-0161-0177
Galveston Bay Biodiesel (BioSelect) OAR-2005-0161-0206
Griffin Industries OAR-2005-0161-0189
National Biodiesel Board (NBB) OAR-2005-0161-0212
National Renewable Energy Laboratory (NREL) OAR-2005-0161-0179
Renewable Energy Action Project (REAP) OAR-2005-0161-0204

Our Response:

As mentioned in the preamble to the proposal, the estimates of emission impacts used in this rule were based on the best available test data, but the test engines and vehicles were not representative of the in-use fleet. Consequently, these estimates must be viewed as preliminary.

In order to resolve the biodiesel NO_x issue, the EPA has launched a program to comprehensively analyze all available test data relevant to this issue. This includes data which

was analyzed in the 2002 draft EPA study, subsequent data which was analyzed for the draft RFS rule and a number of new sources of data which have become available since the time of the RFS proposal. We have sought and will continue to seek input on this issue from various stakeholders, including NREL. In addition to updating the database, this effort will include detailed data quality checks, investigation of specific engine effects and weighting of test data based on the contribution of the various vehicle and engine categories to the NO_x inventory.

This expanded analysis is in progress but was not ready in time for the final rule. In addition, in order to expand the database to better characterize any emission impacts for the in-use fleet going forward - as already stated in VIII of the preamble - we are planning significant new testing with broad stakeholder participation and support. According to our current estimates, such a study will require about two years to complete. It will be conducted according to best industry practices using statistical design of experiment methodologies and include state-of-the-art and advanced diesel engine technologies. We hope to incorporate the data from such additional testing into the analyses for other studies required by the Energy Act in 2008 and 2009, and into a subsequent rule to set the RFS program standard for 2013 and later.

10.3 Engine Manufacturer's Responsibility Related to Biodiesel Use

What Commenters Said:

The Engine Manufacturers Association (EMA) requested an assurance from EPA that "the use of biodiesel will not increase the engine manufacturer's responsibility or liability for emissions compliance, warranty coverage, or recall liability resulting from the use of such fuel".

Letters:
Engine Manufacturers Association (EMA) OAR-2005-0161-0177

Our Response:

Section 211(f)(1) of the Clean Air Act prohibits the introduction of motor fuels or additives that are not substantially similar to the fuels that were used to certify these vehicles. EPA has promulgated an interpretive rule which defines the term "substantially similar" for gasoline (56 FR 5352, February 11, 1991). Although it is the case that no analogous interpretive rule has been promulgated for diesel fuel, EPA retains the authority under the Clean Air Act to prohibit fuel components that the Agency believes are clearly not substantially similar to certification fuels. In fact, in the past EPA has refused to register for use materials that were clearly not substantially similar to diesel fuel or fuel additives. In the past, EPA has relied on compositional and physical property similarities and, especially, on similarity in emissions, when compared to certification fuel, to determine whether a material is or is not substantially similar to a certification fuel or additive. Unfortunately, in a number of situations related to diesel fuel, insufficient data exist to determine whether some fuels or additives combined at various levels are or are not substantially similar to certification fuels. Biodiesel blends are a good example. As mentioned above, the EPA is coordinating with other parties, both governmental and non-governmental to launch a program to answer questions about the emissions effects of biodiesel at

various blend levels. With respect to the "substantially similar" definition for diesel fuel, the Agency is carefully studying the issue and will decide when sufficient data exist to begin such a rulemaking. In short, we agree with the concerns of EMA and plan to address these concerns in the future as reliable data becomes available.

10.4 Emissions from Ethanol Production Facilities

What Commenters Said:

The Northeast States for Coordinated Air Use Management (NESCAUM) commented on the stationary source emissions implications from establishing increased ethanol production capacity. They expressed concern that a substantial portion of these emissions may be subject to less stringent controls in light of EPA's recent increase of the thresholds for triggering prevention of significant deterioration (PSD) requirements for ethanol production facilities. Prior to the rule change, corn milling facilities that produced fuel and emitted 100 tons or more pollutants per year were subject to PSD permitting program requirements. By comparison, corn milling facilities that produced food grade products did not trigger PSD until they emitted 250 tons or more pollutants per year. The new rule established the same emissions limits under the PSD program – 250 tons per year – regardless of whether the ethanol end product is to be used for fuel production or food grade ethanol. NESCAUM urged EPA to consider the entire emissions picture (stationary and mobile) when promulgating regulations.

Letters:
Northeast States for Coordinated Air Use Management (NESCAUM) OAR-2005-0161-0187

Our Response:

In the NPRM, we based our estimates of the emissions from ethanol production facilities on DOE's GREET model, version 1.6. Since the time of the NPRM, DOE has published version 1.7 of GREET. We updated our estimate of ethanol plant emissions for the FRM with those from GREET1.7. In addition, we have obtained from the States estimates of emissions for a number of current ethanol plants. We present these State estimates as an alternative estimate of emissions from ethanol production from both current and future ethanol plants. These estimates are is described in Chapter 3 of the Final RIA. The inclusion of the State emission data for existing plants in our estimate of emissions from future ethanol plants should enhance the consistency of the projected emission impacts of increased ethanol use with EPA's proposed emission standards applicable to future ethanol plants (71 FR 12240, March 9, 2006, Prevention of Significant Deterioration, Nonattainment New Source Review, and Title V: Treatment of Corn Milling Facilities Under the ''Major Emitting Facility'' Definition). In addition to estimating the emissions from ethanol and other renewable fuel production plants, we desired to estimate the impact of such facilities on ambient pollutant levels, such as ozone. Unfortunately, the time and resources available to conduct this rule did not allow the application of sophisticated air quality dispersion models, such as Community Multiscale Air Quality Model (CMAQ). The Ozone Response Surface Model (RSM), which is used to estimate the ozone impacts of changes in

mobile source emissions is not designed to estimate the impact of individual point sources, particularly in rural areas of the kind where most ethanol plants are located.

Further regulation of the emissions from these and other fuel production facilities is outside of the boundaries of the RFS rule. Emissions from renewable fuel production are not specifically addressed in the Energy Act. EPA will continue to regulate these emissions under its authority provided by the Clean Air Act and other relevant statutes.

10.5 Emission Inventory Modeling Procedures

What Commenters Said:

The Missouri Department of Natural Resources (MDNR) commented that EPA based inventory results on model runs for June and July, and therefore did not take into account summer-to-winter fuel changes. The commenter also noted that the model used for the local and regional VOC and NO_x impacts in July assumed MTBE-containing reformulated gasoline (RFG). The commenter indicated that EPA admits that most refiners have stopped using MTBE this year due to liability issues, and that EPA should explore the impact this difference would have on modeling results.

The commenter stated that it is not clear what areas EPA focused on in performing the evaluation for local and regional VOC and NO_x Emission Impacts in July; and added that vehicles travel between the attainment and nonattainment areas so it stands to reason that EPA should investigate this issue.

Letters:
Missouri Department of Natural Resources (MDNR) OAR-2005-0161-0217

Our Response:

EPA based modeling on fuel properties for January and July, not June and July as indicated in the comments from the MDNR. EPA's methodology using one summer and one winter month is described in Section 4.1.2 of the Draft RIA and Section 4.1.2 of the Final RIA. As described in both places, we ran the National Mobile Inventory Model (NMIM) for January and July, then multiplied the results from each month by six to obtain annual emissions estimates.

Regarding MTBE in RFG, EPA did not include MTBE in its projections of future fuel quality, as we assumed complete phase-out of MTBE by 2012. Only the base case included MTBE. Fuel quality in the base case represented fuel properties that existed in 2004, at which time MTBE was present in some counties. In order to eliminate the impact of factors extraneous to the RFS rule, such as changes in the vehicle fleet and Tier 2 sulfur controls, we compared emissions under two RFS fuel cases to the base case fuel properties as if the fuel properties that existed in 2004 continued into the future unchanged.

When estimating the impact of increased ethanol use on local and regional emissions, we focused on areas where ethanol use changed significantly. Since the increase in ethanol use varies geographically, and in fact doesn't change in many areas of the country, presenting impacts which are averaged across the entire nation is not indicative of the impact in the vast majority of local areas. This is described in Section 4.1.3.3 of the Final RIA.

It is not feasible to model the travel of vehicles between attainment and non-attainment areas in a national analysis. This level of precision can only be achieved in a local air quality analysis (e.g., a SIP) or regional analysis where such impacts are expected to be critical. An example of the latter was the comparison of the air quality benefits of the National Low Emission Vehicle rule versus the adoption of California Low Emission Vehicle standards by the NESCAUM states. In this case, travel to the NESCAUM states by vehicles purchased outside of NESCAUM was a key factor in the emission comparison. In the case of the RFS rule and an increase in the use of ethanol, such inter-state travel is not a critical issue.

10.6 Ambient Air Quality Impacts

What Commenters Said:

Several commenters mentioned that EPA could expand its analysis of the air quality impacts of renewable fuel use beyond that described in the NPRM. Some wanted additional scenarios evaluated. Others wanted to see the impacts of several pollutants combined into a single, more comprehensive estimate of the impact of renewable fuel use.

MDNR pointed out that EPA used predictive models that were developed in 2000 using Tier 0 vehicle emissions data, and that EPA assumes that adding ethanol to gasoline does not effect exhaust emissions from Tier 1 and later vehicles. The commenter stated that although EPA did a sensitivity study to account for the findings of Tier 1 and later vehicles having higher emissions rates than expected, it would have been more informative if EPA had run the model under both cases and determined which version was the more conservative estimate overall.

REAP commented that it believes that the DRIA could benefit from a further analysis (perhaps an additional sub-section) of the cumulative air quality impacts of ethanol and biodiesel. REAP is concerned that the attributes of ethanol and biodiesel get somewhat lost amidst uncertain claims about segregated pollutant increases. The commenter noted that ozone attainment is a major regulatory issue; however, it believes that PM emissions are probably a greater threat to public health, and fuels diversification may be the single-most important thing that can be done to curb pollution (including greenhouse gases (GHGs)) from the transportation sector in the long term. The commenter stated that the DRIA, like most air quality analyses, gravitated toward the pollutants that could increase (NO_x, VOC) even if the net impact on attainment and public health is negligible. The commenter noted that this issue is not just one of aesthetics, as the inventory projections in the DRIA are already being considered by states drafting their SIPs (notwithstanding the uncertainty of those figures).

RFA encouraged EPA to better emphasize the cumulative "air quality" and public health benefits of blending ethanol, including carbon dioxide, VOC emissions and particulate matter (PM). As currently drafted, the commenter believes that the potential health benefits of reducing PM emissions and petroleum dependence are obscured by very small estimated NO_x and VOC inventory increases that result in little impact on NAAQS attainment.

Letters:
Missouri Department of Natural Resources (MDNR) OAR-2005-0161-0217
Renewable Energy Action Project (REAP) OAR-2005-0161-0204
Renewable Fuels Association (RFA) OAR-2005-0161-0192, -0228 (hearing)

Our Response:

As MNDR points out, EPA developed two sets of emission impacts based on how Tier 1 and later vehicles respond to changes in fuel quality. However, as described in Chapters 4 and 5 of the Draft RIA, EPA did estimate the nationwide emissions impact and ozone impact of both sets of emission changes. As shown in Table 5.1-2 of both the Draft RIA and Final RIA, the sensitivity analysis, which assumed that Tier 1 and later vehicles responded to fuel changes like Tier 0 vehicles, produced the higher ozone impacts. In addition, in Chapter 3 of the Final RIA, we evaluate a number of studies which evaluate the impact of fuel quality on LEV and cleaner vehicles. These studies are not yet sufficient to confidently predict the emission impacts of fuel quality for these vehicles. However, they do confirm the appropriateness of the range of emission impacts provided by the primary and sensitivity analyses.

REAP suggests that EPA provide an overall impact of renewable fuels across the variety of emissions and ambient pollutants affected. EPA did attempt this for pollutants affecting ozone, as the Ozone RSM addresses changes in both VOC and NO_x emissions. This avoids a focus on just one pollutant, for example NO_x, as mentioned by REAP. The Ozone RSM is not able to account for changes in CO emissions and VOC reactivity, as described in Section 10.6.1 below. However, more sophisticated ozone models could not be applied to this rule analysis due to the limited amount of time available to establish the rule.

Comparing the impacts of changes in the ambient concentration of different pollutants is a complex task. The most appropriate way to do so is by quantifying the changes in human health endpoints or even better, monetizing these effects and comparing the net benefits of each change. The deadline for promulgating the RFS rule did not allow the development and application of benefit models to this rule. Even if we could have applied such models to this rule, the uncertainties in many of the emission effects would have made any conclusions which could have been drawn highly suspect. This is particularly true for PM. We agree that controlling ambient PM levels (both due to primary emissions and secondary, atmospheric formation) is very important to public health and is, therefore, a high agency priority. However, as discussed in the proposal, very little testing of PM emissions from gasoline vehicles has been performed, particularly testing aimed at evaluating the impact of fuel quality. As described in the proposal, we are currently planning additional test programs to address these data needs over the next 2 to 3 years. We hope to be able to more confidently quantify the impact of increased

ethanol use on PM emissions and secondary PM for the Report to Congress required by section 1506 of the Energy Act.

Regarding biodiesel, the impact of biodiesel on emissions is very small. As indicated in Table 4.2-1 of the Draft RIA, at that time biodiesel was estimated to only affect the nationwide emissions of VOC, NO_x, CO and PM by a few hundred tons per year. As described in Section 4.2 of the Final RIA, we believe that the available data on the impact of biodiesel on emissions from later model diesel engines is insufficient for us to quantify the impact at this time. We and other interested parties are embarking on a test program to address this lack.

10.6.1 Ozone

10.6.1.1 Factors Not Considered in EPA's Ozone Analysis

What Commenters Said:

Several commenters desired to see a more extensive analysis of the impact of renewable fuel use on ambient ozone levels. This included measuring the change in ambient ozone levels associated with past changes in fuel quality to including changes in CO emissions and VOC reactivity in our ozone modeling.

REAP commented that the final analysis should consider using air quality monitoring data in estimating the air quality impact of increased ethanol use. The commenter noted that it completed a brief analysis in March 2006 of air quality monitoring data in the several states that switched from MTBE to ethanol blends in January 2004 (report entitled "Clearing the Air with Ethanol"). The commenter stated that, in general, ozone exceedance days trend downward (at a greater rate than with MTBE) after the introduction of E10 into states such as New York, Connecticut, and California. The commenter stated that while this trend should not be traced definitively to ethanol blending, it believes that this "real world" data is relevant and useful for the purpose of creating an air quality profile for biofuels based on the full weight of evidence. The commenter stated that this also further underscores the uncertainties inherent with trying to predict (i.e., model) emissions responses to relatively small changes in fuel composition. The commenter stated that air quality monitoring data draws into question some of the tonnage estimations (especially with regard to NO_x and VOC) made by various regulatory models. The commenter suggested that these monitoring results be disclosed and discussed in the ethanol analysis.

REAP and RFA commented that analyzing the use of ethanol with "predictive models" isolates pollutants, and creates results that vary depending on the assumptions made and the scenarios tested. The commenters noted that air quality liabilities have not been seen in several states that have switched from MTBE to ethanol blends over the past three years—in all cases, a flattening ozone exceedance curve started re-trending downward after ethanol use. The commenters stated that they believe the uncertainties of trying to model pollutant responses to changes in fuel content are not well reflected in the exact figures contained in the DRIA tables,

nor the textual analysis of the approach. The commenters encouraged EPA to "fill out" the air quality profile of ethanol by discussing air quality monitoring and by better emphasizing the inherent uncertainties of "predictive" modeling.

RFA recommended that EPA add a section to the DRIA that analyzes the results of the "predictive" modeling and the Ozone RSM analysis cumulatively, in the context of establishing the "ozone forming potential" of ethanol blends. The commenter stated that ozone-forming potential analysis is common, and could better incorporate: (1) the uncertainties involved with modeling, especially with regard to NO_x; (2) the "real world" air quality monitoring results observed in MTBE ban areas; (3) the undercounting of CO emissions by MOBILE 6.2 and the omission of CO emissions in the Ozone RMA, and its possible effects; (4) VOC reactivity (including lower permeate reactivity for ethanol); and (5) uncertainties about commingling and regional ethanol use. REAP suggested that the discussion incorporate some of the issues identified (but not addressed) in the report, such as NO_x uncertainty, CO impacts, and the different reactivities of non-exhaust emissions.

RFA believes that the DRIA's analysis of CO is insufficient. While the DRIA models and inventories the potential impacts of increased ethanol use on CO emissions, the document does not sufficiently discuss the interconnectedness of CO emissions with other pollutants and ground level ozone concentrations. The commenter offered the following examples: (1) the DRIA does not discuss (except in side reference) the increasing role of CO as an ozone precursor, with the potential to offset increases in VOC emissions, (2) many of the inventory increases projected in the DRIA are the result of the one-pound RVP allowance. The commenter also stated that the DRIA does not caveat the emissions increases traced to the RVP allowance, even though the RVP allowance is directly related to CO. The commenter believes that the failure of the DRIA to conduct an in-depth analysis of the interconnectedness of CO, VOC and ozone compounds this problem; there should be a more robust discussion of the RVP allowance, and any emissions impacts stemming from it must be considered within the context of CO emissions reductions.

API and Marathon commented that uncertainty in the level of future ethanol usage will influence ozone impacts. These commenters said the EPA noted that the ozone analysis did not include consideration of the impacts of CO reduction from ethanol usage nor did it include consideration of the impact of ethanol on changes in the types of compounds comprising VOC emissions – factors which might ameliorate the projected ozone increases resulting from the proposed program.

Letters:
American Petroleum Institute (API) OAR-2005-0161-0185
Marathon Petroleum Company (MPC) OAR-2005-0161-0175
Renewable Energy Action Project (REAP) OAR-2005-0161-0204
Renewable Fuels Association (RFA) OAR-2005-0161-0192, -0228 (hearing)

Our Response:

As discussed in Chapter 3 of the Final RIA, ethanol use tends to reduce CO emissions. It also reduces exhaust VOC emissions from older vehicles and may from newer vehicles. If not

mitigated by removing light hydrocarbons from the blend's gasoline blendstock, ethanol blending also increases gasoline RVP and, thus, evaporative VOC emissions. The increase in non-exhaust VOC emissions tends to be greater than the reduction in exhaust VOC emissions. However, this is a function of the vintage of the vehicle fleet and other factors such as ambient temperature, the presence of an inspection and maintenance program, etc. These exhaust and non-exhaust emission impacts affect ozone in opposite directions. The net impact of reduced CO emissions and generally increased VOC emissions will depend on the relative sizes of the changes in emissions and their relative ozone reactivity. The emission impacts will depend on the characteristics of the local motor vehicle and nonroad equipment fleets. The latter will depend on local meteorological conditions and the relative amounts of ambient pollutants present. Therefore, the relative impact of ethanol use on ozone formation will tend to vary over time and from place to place.

In June 2001, EPA estimated the impact of ethanol's impact on CO emissions on ozone in the Lake Michigan area for the 2007 timeframe[4]. EPA was petitioned to relax the VOC emission performance standard applicable to RFG sold in this area due to the additional CO emission reduction achieved by RFG containing 10 vol% ethanol compared to RFG containing 11 vol% MTBE. EPA found that the ozone reduction due to reduced CO emissions due to the additional 1.5 wt% oxygen of the ethanol blend was equivalent to the ozone impact of an increase in RVP of about 0.3 psi. This is significant.

There are a number of reasons why this analysis, however, cannot be simply applied in this RFS rule analysis. First, except for the effect of ethanol on CO emissions, the emission modeling was performed using MOBILE5.b, the precursor to MOBILE6.2[5]. The VOC, CO and NO_x emission projections of MOBILE5.b differ significantly from those of MOBILE6.2. Second, the effect of ethanol on permeation emissions was not included, as this issue was just emerging at that time. Third, the analysis ignored the impact of additional oxygen on NOx emissions, as RFG sold in the Lake Michigan area already contained 10 vol% ethanol. Thus, the baseline for the analysis was not a complete comparison of all the effects of ethanol blending on ozone forming emissions and ozone itself, but only the effect of additional oxygen on CO emissions and its VOC emission equivalency. Fifth, the base RVP from which the increase in RVP was evaluated was that typical for RFG, 6.8-6.9 psi. While appropriate for RFG, this is not appropriate for the effect of an RVP increase for conventional gasoline. Evaporative VOC emissions vary non-linearly with RVP, with the increase in VOC emissions per psi RVP increasing at higher levels of RVP.[6] Thus, using a higher base RVP level would reduce the increase in RVP which would produce the same change in non-exhaust VOC emissions as a 0.3 psi increase from 6.8-6.9 RVP. Finally, the equivalency of reduced CO emissions and increased VOC emissions was based on ozone modeling of the Lake Michigan area with its specific mix of ambient pollutants, temperature, wind patterns, etc. Thus, the results of this analysis cannot be extrapolated to other geographic areas.

[4] 66 FR 37158, July 17, 2001

[5] VOC Adjustment Rule: Response to Comments, U.S. EPA, EPA420-R-01-017, June 2001.

[6] RFA also comments that the National Research Council (NRC) believes that MOBILE6.2 underestimates CO emissions. However, NRC's comments about the under-estimation of CO emissions pertains to an earlier version of MOBILE, MOBILE5b, not MOBILE6.2. EPA considered the NRC comments when developing MOBILE6.2.

The analysis performed for the RFS rule updates the 2001 analysis in several ways. It utilizes MOBILE6.2 instead of MOBILE5b to estimate baseline emissions, as well as the EPA Predictive Models to estimate the impact of fuel quality on emissions. It includes the effect of ethanol on permeation emissions. It advances the timeframe of analysis from 2007 to 2012 and beyond. The emissions analysis considers the effect of ethanol on all emissions, including NOx. However, as described in the Chapter 3 of the RIA, significant uncertainty exists regarding the impact of ethanol on emissions from both newer vehicles and nonroad engines. This adds to our inability to quantify this relationship in the RIA to this rule. It is not possible to quantify the impact of changes in the ozone reactivity of VOC emissions and CO emissions on ozone without a sophisticated atmospheric model. The time available to implement the RFS rule did not allow for the use of such models, nor did the RFS rule depend on a more precise estimate of the impact of increased ethanol use on ambient ozone levels. Thus, we cannot estimate the "cumulative" effect of ethanol use on ozone including these changes at this time. States considering changes to their SIPs will have access to these models and will use them as they consider the impact of increased ethanol use on ambient ozone levels in the future. The changes in mass emissions of VOC, CO and NO_x described in the RIA to this rule will be an important, but not complete, input to such modeling.

In order to better reflect the uncertainty in the effect of oxygenates on all emissions from Tier 1 and later vehicles, we included an alternative estimate of the impact of oxygenate on CO emissions in our sensitivity analysis (see Section 3.1.1.1.9.1 of the Final RIA). In the NPRM, we did not include a second estimate of the impact of ethanol on CO emissions from Tier 1 and later vehicles for two reasons. One, no Predictive Model is available which addresses CO emissions. Two, MOBILE6.2 includes an effect of ethanol on CO emission from these vehicles, at least for high emitters. However, since the sensitivity analysis assumes that ethanol affects the exhaust VOC and NO_x emissions from all Tier 1 and later vehicles, not just high emitters, we have extended the MOBILE6.2 CO emission effect for normal emitting Tier 0 vehicles to normal emitting Tier 1 and later vehicles. This effect is an 13.8% reduction for a 10 vol% ethanol blend. The projection that ethanol use reduces CO emissions from Tier 1 and later vehicles is also supported by the results of five test programs involving LEV and later vehicles. The results of these test programs are discussed in Section 3.1.1.1 of the Final RIA.

Both commenters also refer to the use of air quality monitoring results observed in MTBE ban areas as a way to estimate the impact of the many factors related to increased ethanol use on ambient ozone levels, in particular a recent study by REAP.[7] It is rarely possible to directly observe a change in ambient ozone concentration and attribute it to a single factor. This is due to the fact that ozone is a strong function of ambient conditions, such as temperature and wind speed and direction, and of the mixing of emissions from an extremely wide set of emission sources. All of these factors change daily, seasonally and annually. This is evidenced by the large variability in ozone exceedances cited in the REAP study, which is summarized in Table 10-6 below.

[7] Better Environmental Solutions and Renewable Energy Action Project, "Clearing the Air with Ethanol, a review of the real world impact from fuels blended with ethanol," March 2006.

Table 10-6. Number of Violations of the 8-Hour Ozone NAAQS City in REAP Study

	Eastern Wisconsin	South Coast Air Basin*	New York	Connecticut
1989	756	231		
1990	676	161		
1991	638	160		
1992	592	172		
1993	579	160		
1994	544	148		
1995	589	122		
1996	604	119		
1997	617	120		
1998	580	92	14	25
1999	600	92	20	33
2000	575	93	7	15
2001	506	92	17	26
2002	506	94	28	36
2003		110	15	14
2004		89	1	6
2005		80	10	20

* *Approximate (read off of graph in REAP report)*

Whether one finds an increase or a decrease in ambient ozone levels after a certain year often depends on which years are included in the comparison. For example, REAP finds that the number of ozone NAAQS violations decreased from 1994-2002 compared to 1989 to 1993. However, from the figures shown in Table 1, this finding is strongly influenced by the inclusion of the year 1989 in the "pre-ethanol" period and years 2000-2002 in the "post-ethanol" period. Likewise, for the South Coast, REAP compares ozone violations in 2004-2005 (post-ethanol) to those in 2003 (pre-ethanol), ignoring the earlier lower numbers of violations from 1998-2002.

An even greater problem is that ozone levels are generally decreasing over time due to emission controls being implemented by EPA and the States. Thus, any comparison of "earlier" ozone levels to "later" ozone levels will generally show a decrease. However, this decrease cannot be simply attributed to any one cause, such as ethanol use.

As mentioned above, ambient ozone data such as that cited by REAP can be used to discern the effect of a sudden and dramatic change in fuel quality, as such a change usually effects the emissions from all the vehicles in the fleet. However, at minimum, such a study must account for hourly or daily changes in meteorological factors (e.g., wind speed and direction, temperature, etc.) and the possibility of a gradual trend in ozone occurring over time from other emission controls. Once these other effects are properly accounted for, the effect of including or excluding certain calendar years usually becomes small and the effect of ethanol may be more confidently estimated. Since the REAP study does not account for any of these factors and chooses its years for comparison in a highly subjective fashion, its results cannot be used with any confidence here.

We believe that it is still too early to utilize changes in ambient ozone over time to estimate the effect of the change from MTBE to ethanol on ozone in those areas where MTBE was removed in the 2004 timeframe. Only two years of ambient ozone data are available following the change (complete 2006 data are not yet available). More data are necessary to overcome the variability in ambient ozone levels and provide the statistical confidence needed to separate the fuel effect from other factors.

One particular problem affecting the estimation of the ozone effect of a change from MTBE to ethanol is that the change occurred in the 2004-2006 timeframe. The implementation of the Federal Tier 2 sulfur standards applicable to all gasoline occurred at the same time. RFG prior to 2004 tended to have lower sulfur levels compared to conventional gasoline, particularly in the summer. However, the sulfur content of summer RFG still declined from roughly 100-150 ppm prior to 2004 to 30 ppm by 2006. The effect of the two nearly simultaneous fuel changes makes it very difficult to separate using only ambient air quality data. This problem obviously affects the above REAP analyses in New York and Connecticut.

Given the problems with the REAP analysis described above, we disagree with REAP that the available air quality data calls into question the emission modeling results presented in the NPRM.

10.6.1.2 Ozone Transport and Ozone Impact in Western U.S.

What Commenters Said:

MDNR commented that, in performing the evaluation, EPA used a metamodel to estimate the changes in ozone from the use of 7.2 billion gallons of ethanol. The commenter noted that the model EPA used only covered the eastern 37 states, thus the commenter does not believe that these results are representative for a nationwide program that will impact all 48 contiguous states. The commenter further stated that it believes the ozone metamodeling done by EPA for the ozone impact analysis is too narrow in its scope, and assumptions were made that are not likely to reflect the actual affects of this increase in ethanol use. The commenter pointed out that EPA claims that 7.2 billion gallons of ethanol would only increase ozone values by 0.250 parts per billion and that two different runs were used with "different VOC and NO_x reductions". The commenter stated that earlier results for VOC and NO_x impacts showed potential increases in NOx and possibly VOCs as well, and that EPA then picked from these two runs whichever one they felt "best matched VOC and NO_x reductions for that county." The commenter stated that the model does not account for ozone transport by using this method of choosing between two different model simulations for the emissions of each county individually. The commenter noted that most areas of the country with ozone problems face significant impact from ozone transport, therefore, failing to take ozone transport into account may underestimate the effects of the RFS. The commenter stated that, from EPA county by county results, EPA claims that most of the ozone increase will occur in attainment areas.

MDNR also said it would have been more informative if EPA had estimated the effects of attainment areas using more ethanol on areas that are nonattainment or maintenance that may not see an increase in ethanol usage. The commenter also stated that it had concerns about EPA's model assumptions and the validity of estimates of ozone increase, particularly in nonattainment and maintenance areas. MDNR commented that EPA assumed that there is no ozone impact on areas that do not experience a significant change in ethanol use (50% market share ethanol change). MDNR recommended that EPA provide rationale for their assumption that areas with a less than 50% market change will not see any changes in ozone values, especially if areas surrounding them dramatically increase their ethanol usage.

Letters:
Missouri Department of Natural Resources (MDNR) OAR-2005-0161-0217

Our Response:

The commenter is correct that our ozone impact projections only address the easternmost 37 states of the U.S. This is a limitation of the Ozone RSM. As discussed above, the time available in which to conduct this rule did not allow the application of more sophisticated dispersion models which can be applied the western states. We will consider doing so in support of the Report to Congress required by Section 1506 of the Energy Act, a draft of which is due to be published in 2009. This notwithstanding, the ozone impacts due to increased ethanol use predicted for the eastern states average 0.06-0.14 ppb across the entire area and 0.15-0.32 ppb in those areas where ethanol use changed significantly. We do not expect that the impacts in western states will differ dramatically from these impacts. Analyses being conducted by western States in support of State Implementation Plans will be able to utilize sophisticated dispersion models which will more accurately predict the impact of ethanol use on ozone and other pollutants.

The limitations of the Ozone RSM prevent us from estimating the impact of emission and ozone transport between different areas as precisely as possible with sophisticated atmospheric dispersion models. However, our specific application of the Ozone RSM does incorporate at least some of the effect of emission and ozone transport for most counties at roughly the same degree of accuracy that the model estimates the impact of local emissions. For example, each run of the Ozone RSM included an estimate of the change in VOC and NO_x emissions for both attainment and non-attainment areas. The predicted ozone impact in each specific county is the sum of the ozone impact due to:

1) the change in VOC emissions in all attainment areas, plus
2) the change in NO_x emissions in all attainment areas, plus
3) change in VOC emissions in all non-attainment areas, plus
4) change in NO_x emissions in all non-attainment areas.

Each county's predicted ozone impact includes the effect of changes in VOC and NO_x emissions in that county plus the impact of emissions and ozone formed in upwind counties. The issue is how well the model is able to represent the ozone impact of both sets of emissions. The greatest limitation of the Ozone RSM is that only one percentage change can be modeled at a time for each of the above four pollutant-location combinations. (Distinct emission changes can

be input for onroad and nonroad emission sources in each run of the Ozone RSM.) Thus, if VOC emissions from onroad vehicles increase by 0-7% across the range of attainment counties, only one increase in VOC emissions can be run in the model. In our particular situation, numerous counties experienced no change in emissions, since ethanol and MTBE use was not predicted to change. Thus, there was a distinct bi-modal distribution in the projected emission changes across the two types of counties. Each distribution consisted of a large number of counties with no change in emissions and a number with changes falling within a relatively tight range. The choice was: 1) to model the average of the emissions change in those counties experiencing the change in emissions, and assume that ozone did not change in counties where emissions did not change, or 2) to model the average change in emissions across all counties. In the latter case, the emission impacts modeled would not have matched the changes in emissions in either those counties where ethanol use changed or did not change (i.e., they would be inaccurate for all counties). In the former case, the emission impacts modeled at least matched those occurring in the counties where ethanol use changed, which is the focus of the RFS rule (i.e., increasing the use of renewable fuels). Also, for these counties, at least the change in local emissions was modeled relatively accurately. Transport would not be accurately modeled in either case. That is the main reason why we eliminated the predicted ozone impact for counties where no change in ethanol use is expected to occur. Still, some estimate of ozone transport is included in the predictions.

In reality, this approach to the modeling still likely provided a reasonable estimate of ozone transport for many counties. There are two reasons for this. One, ethanol use is expected to vary regionally, not locally. (An exception could be across boundaries between RFG and other areas.) In this case, the counties adjacent to those counties whose ozone impacts were assumed to be zero would also be expected to experience little change in ethanol use and thus, emissions. Thus, not only would the impact of local emission changes be small, but the impact of transport would also be small.

Two, the estimates of the ozone impact for roughly 80-90% of the country were derived from the Ozone RSM runs which assumed that non-attainment areas utilized RFG and attainment areas utilized conventional gasoline subject to the 9 RVP standard. Given the regional orientation of ethanol use, both local emission impacts and ozone transport should be reasonably estimated for these counties. The only exception are attainment areas downwind of counties with low RVP fuel, since our projections would have assumed that the upwind areas had RFG and not low RVP fuel. This is the primary limitation of the approach used to model ozone for this rule and could not be avoided.

In those cases where a specific county did not experience a significant change in ethanol content and an upwind county did, our approach will not reflect either the emissions or ozone transport from the upwind area on the downwind county. This is because the Ozone RSM requires that the same percentage change in emissions be applied to all attainment areas and a second percentage change in emissions to all non-attainment areas. Since some attainment and non-attainment areas had no change in emissions since ethanol use did not change, the impact of local emission changes due to the application of the change in emissions occurring elsewhere in the country was clearly inappropriate. There is no simple way to separate the impact of the local

emission change from the impact of transport. This is simply one of the limitations of the Ozone RSM.

Since ethanol use may increase in attainment areas upwind of ozone non-attainment areas, the impact of this situation on ozone in the downwind, non-attainment areas is of interest. This type of impact is best addressed through the use of more local ozone models and not national models, like the Ozone RSM. However, we estimate the impact of ozone transport from attainment areas to non-attainment areas through some additional runs of the Ozone RSM in Section 5.1.1 of the Final RIA.

10.6.1.3 Impact of the 9.6 Billion Gallon Ethanol Use Case on Ozone

What Commenters Said:

API and Marathon stated that the EPA only focused on a 7.5 billion gallon renewable fuels scenario in a 37-state eastern area of the US. They commented that the projected ozone impacts will likely be larger and more widespread if the EPA includes the 9.9 billion gallon scenario (which was covered in the emissions inventory assessment) as well as those western regions of the US which are likely to see expanded ethanol usage.

Letters:
American Petroleum Institute (API) OAR-2005-0161-0185
Marathon Petroleum Company (MPC) OAR-2005-0161-0175

Our Response:

We estimate the ozone impact of both the 7.2 billion gallon per year ethanol case (or its updated equivalent) and the 9.6 billion gallon per ethanol case in Section 5.1.1 of the Final RIA.

10.6.1.4 Use of the Ozone RSM to Predict Ozone Impacts

What Commenters Said:

Environmental Defense commented that it believes EPA's air quality impact analysis is seriously deficient for purposes of informing the public about the impacts of increased renewable fuel use. The commenter stated that EPA's analysis of nationwide emissions implications of increased renewable fuel use indicates the potential for substantial increases in emissions of nitrogen oxides and volatile organic compounds under some scenarios. The commenter urged EPA to provide a careful and thorough analysis of the air quality impacts of these potential changes. The commenter noted that the Clean Air Scientific Advisory Committee (CASAC) recently recommended to the Agency that to protect human health, the national ambient air quality standard for ozone should be lowered to somewhere between 60 and 70 ppb on an eight-hour average basis, from the current 84 ppb limit. Regardless of EPA's response to this recommendation, CASAC's action clearly indicates a consensus among health scientists that

ozone concentrations are harmful at levels significantly below the current standard. The commenter believes that this means that attention needs to be paid to ozone levels across much of the country, not only in existing nonattainment areas.

Environmental Defense stated that the air quality impacts analysis presented in the proposal utilizes an inadequate "screening" model, the Ozone RSM, which entirely omits the western United States. The commenter further stated that this is unacceptable, as the renewable fuels standard is a national program, not a regional one. The commenter noted that the RSM does not reflect changes to the composition of volatile organic compound emissions, which is a significant issue when ethanol blends displace conventional gasoline. The RSM also neglects the impact of reductions in carbon monoxide which may offset the disbenefit of increased VOC emissions. The commenter stated that it believes EPA's two-step approach to applying the RSM is incapable of accurately assessing the combined impacts of long-range transport and local emissions changes; and that some of these limitations may lead to "conservative" overestimation of ozone increases from renewable fuels use, but the net effect is not clear, particularly if local impacts rather than national averages are considered.

Environmental Defense urged EPA to use the tools it has at its disposal for examining the nationwide air quality impacts of trends in renewable fuels use. The commenter specifically noted that EPA should consider using the CMAQ for a continental-scale analysis; significant insight could also be provided by using the nested grid capabilities available with CMAQ to apply higher resolution for areas expected to see significant use of ethanol-conventional gasoline blends.

Letters:
Environmental Defense OAR-2005-0161-0172, -0223

Our Response:

The RIA describes the uncertainty which currently exists regarding the impact of ethanol use on emissions from motor vehicles and nonroad engines, particularly for newer models. These uncertainties necessarily affect any estimate of the impact of renewable fuel use on ambient ozone levels. We believe that the Ozone RSM provides a general indication of the types of ozone impacts that we can expect to occur in areas where ethanol use increases substantially. These impacts are not large. Also, increased ethanol use is expected to decrease the ozone reactivity of VOC emissions on a per mass basis and CO emissions. Both of these changes directionally reduce the projected ozone impacts in areas which are VOC limited and the Ozone RSM cannot account for these changes.

EPA plans to conduct additional testing of late model year vehicles and engines to improve our estimate of the impact of fuel quality on emissions over the next few years. We also hope to be able to apply more sophisticated air quality models to estimate the net impact of all these emission changes on ambient ozone and PM for the comprehensive study of all the fuel-related provisions of the Energy Act, a draft of which is due to be published in 2009. The specific requirements of the RFS are not affected by the ozone impact of increased ethanol use.

Therefore, there is no reason to delay the RFS rulemaking until more sophisticated ozone modeling results are available.

10.6.1.5 Basis for Ozone Impact of Increased Use of Renewable Fuels

What Commenters Said:

MDNR pointed out that EPA assumed ethanol usage would continue to increase regardless of the rule, leading to the conclusion that the RFS rule would not impact renewable fuel use directly. They also pointed out that EPA recognized significant uncertainty as to the effect of ethanol on emissions from both motor vehicles and nonroad equipment, particularly from the latest models equipped with the most advanced emissions controls, but still made the claim that ozone levels will increase minimally.

Letters:
Missouri Department of Natural Resources (MDNR) OAR-2005-0161-0217

Our Response:

Modeling efforts were somewhat limited given the unique conditions under which the rule is promulgated. Because the volumes of fuel required under the RFS program were mandated by Congress, and because we expect market forces alone to drive renewable fuel consumption beyond mandated volumes, the standards finalized in this rule are not influenced by the analysis of the environmental impacts.

Normally EPA considers various regulatory options based on considerations like air quality impacts, health impacts, and monetary costs and benefits. Here, however, EPA's primary responsibility is to provide the guidance for a renewable fuel credit trading program. The efforts to quantify the impacts on emissions and air quality are merely intended to be illustrative, and were not developed to determine appropriate costs and benefits of particular environmental standards. We acknowledge the uncertainty in our modeling efforts, but point out that this is our best estimate of the magnitude and directionality of RFS program impacts given the data available.

The difference between environmental impacts of not promulgating a rule and promulgating the RFS mandate are zero, since the ethanol use is expected to increase regardless of regulations. In our attempt to estimate future emissions regardless of regulations, EPA recognizes the need for better data on the impacts of renewable fuels on vehicle emissions and recognizes the need for more refined modeling to better characterize the effects of increased use of renewable fuels. More testing and research are clearly needed, but EPA analyses were limited due to time and resource constraints associated with the rulemaking.

10.6.1.6 Ozone Reactivity of Permeation Emissions

What Commenters Said:

REAP and RFA commented on how the impact of ethanol use on permeation emissions was handled in the NPRM. REAP noted that permeation emissions do not increase when going from E6 to E10. Both commenters pointed out that the impacts of permeation should be "corrected" for the lower reactivity of permeation emissions for ethanol-blends, as most of the VOC inventory increase attributed to ethanol in the NPRM stems from permeation. RFA also noted that permeation emissions from on-road vehicles decrease substantially over time, due to superior evaporative emissions controls in newer vehicles. The commenter stated that recent analysis suggests that the relative impact of on-road permeation on VOC inventories in the 2012 to 2015 time frame is quite small.

Letters:
Renewable Energy Action Project (REAP) OAR-2005-0161-0204
Renewable Fuels Association (RFA) OAR-2005-0161-0192, -0228 (hearing)

Our Response:

The results of the CRC E-65 Phase 1 study show the ozone reactivity of the permeation emissions to be lower with than without ethanol on a per mass basis. This occurs because ethanol itself has a lower than average ozone reactivity under the ambient conditions assumed in the CRC report. The ozone reactivity of exhaust and evaporative emissions on a per mass basis from vehicles using ethanol blends can also often be lower than emissions from vehicles fueled with non-ethanol gasoline. EPA points this out in Section 5.1.1 of both the Draft RIA and the Final RIA.

Sophisticated atmospheric models, like CMAQ, account for the relative reactivity of the various components of VOC emissions and adjust their prediction of ambient ozone levels accordingly. If the local area in question is "VOC-limited", a reduction in the mass-specific ozone reactivity is likely to reduce ambient ozone levels to some degree. However, the exact effect of the change in ozone reactivity on ambient ozone can vary dramatically depending on atmospheric conditions (e.g., the other VOCs present, the concentration of NO_x, the temperature, the level of ultraviolet radiation, etc.). Ozone reactivity scales, such as the maximum reactivity and maximum ozone scales developed by CARB can be a useful regulatory tool to encourage actions which might reduce the ozone reactivity of VOC emissions in an effort to reduce ozone. However, they provide an indication of the relative reactivity of various VOCs only for the conditions specified. These conditions may or may not be relevant to ozone formation in a specific local area. For example, the relative reactivity of CO and VOCs typically emitted from gasoline vehicles varies even between the two sets of conditions evaluated by CARB (maximum reactivity and maximum ozone). Also, if the area is "NO_x-limited", then a reduction in the mass-specific ozone reactivity is unlikely to affect ambient ozone levels at all. Neither will a change in the mass of VOC emitted.

Due to the time constraints placed on this rulemaking by the need to quickly implement RFS, EPA was not able to utilize a model like CMAQ to estimate the impact of increased ethanol use on ambient ozone levels. The uncertainties in the effect of ethanol on emissions from a

number of classes of vehicles and engines also limit the increased value of ozone projections made using such sophisticated atmospheric models. The simpler Ozone RSM utilized here does not account for changes in ozone reactivity, as described in Section 5.1.1 of the Final RIA. Lower ozone reactivity of VOC emissions from utilizing ethanol blends would tend to lower ambient ozone in VOC limited areas, as would a reduction in CO emissions. These changes could either reduce some of the ozone increases presented in Section 5.1.1. of the Final RIA, or possibly convert an increase to a decrease. In the case of permeation emissions, the impact of ethanol use on the mass of permeation emissions is much larger than the impact on ozone reactivity, even for the conditions considered by the CARB reactivity scales. Ethanol use appears to increase permeation emissions by roughly a factor of 3-4, while reducing the ozone reactivity per mass of VOC emitted by only 25%. Thus, the analysis presented in the FRM is accounting for the larger of the two impacts. Also, REAP's statement that most of the VOC inventory increase attributed to ethanol in the DRIA stems from permeation is not correct. Between 12% and 39% of the net VOC emission increase estimated to occur with increased ethanol use under the four ethanol use scenarios is due to an increase in permeation emissions. In terms of non-exhaust VOC emissions, these percentages would be even smaller.

As the RFS does not depend on the predicted ozone impact of increased ethanol use, it is not essential to this rule that a more accurate estimate of the ozone impact be made. The projected ozone increases are relatively small even without considering lower ozone reactivity or CO emissions. States considering the impact of increased ethanol use on future ozone levels will utilize more sophisticated models which account for a change in ozone reactivity of VOC emissions and CO emissions.

Until we can employ these more sophisticated models, it is possible to combine the impacts of ethanol use on the total mass of VOC and NOx emissions into a single estimate of ozone impact. However, we cannot estimate the impacts of changes in the ozone reactivity of VOC emissions, nor in CO emissions.

10.6.1.7 Ozone Reactivity of CO Emissions

What Commenters Said:

REAP commented that the impacts of carbon monoxide (CO) emissions are not adequately discussed or analyzed in the DRIA. The commenter noted that the DRIA identified CO as an ozone precursor, but did not attempt to quantify this impact, either with regard to predicted ozone impacts, or as an offset to VOC. The commenter stated that recent studies demonstrate that CO can be the equivalent of up to half the mobile-related contribution of VOC in some areas, and new data shows substantial CO reductions from ethanol in new cars. Yet, the commenter noted, CO was not analyzed as a VOC offset in the DRIA, and was not taken into account in the Ozone RSM analysis. The commenter believes, therefore, that the ozone profiles are not as accurate as they could be, given the precedence for taking CO into account as an ozone precursor. The commenter encouraged EPA to conduct a comprehensive analysis of CO for the final analysis, in order to properly project the potential ozone impacts of E10.

Letters:
Renewable Energy Action Project (REAP) OAR-2005-0161-0204

Our Response:

The discussion of the ozone reactivity of permeation emissions in the previous section is also relevant here. CO has clearly been determined to be an ozone precursor in the atmosphere. A reduction in CO emissions will tend to reduce ambient ozone levels. However, the effect will not be the same in all areas of the country, nor on all days of the year. Some areas, those which are NO_x-limited, will not experience any effect. CARB's reactivity scales only apply under very specific conditions, which may or may not match those of areas outside of California. Thus, they are not applicable for use in a national analysis such as this one. CO emissions from motor vehicles have also been decreasing steadily over time through the use of more advanced emission controls. Thus, estimates of the impact of CO emission reductions made in the past may not be accurate for the future.

As the RFS does not depend on the predicted ozone impact of increased ethanol use, it is not essential to this rule that a more accurate estimate of the ozone impact be made. The projected ozone increases are relatively small even without considering lower ozone reactivity or CO emissions. States considering the impact of increased ethanol use on future ozone levels will utilize more sophisticated models which account for a change in ozone reactivity of VOC emissions and CO emissions.

Until we can employ these more sophisticated models, it is possible to combine the impacts of ethanol use on the total mass of VOC and NOx emissions into a single estimate of ozone impact. However, we cannot estimate the impacts of changes in the ozone reactivity of VOC emissions, nor in CO emissions.

10.6.1.8 Issues Related to State Implementation Plans

What Commenters Said:

The Biodiesel Industries of Greater Dallas Fort Worth (BIGDFW) noted that in Texas, the use of biodiesel will be illegal after December 31, 2006, because the Texas Commission of Environmental Quality (TCEQ) has focused on a potential 2% NO_x increase for B20, cited in: 1) EPA's 2002 Draft Technical Report: A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions, October 2002 and 2) EPA Notice of proposed rulemaking: Regulation of Fuels and Fuel Additives: Renewable Fuels Standard Program, September 7, 2006. BIGDFW and Griffin Industries stated that Texas, as well as many other states, will make decisions to restrict renewables based on emissions estimates contained in the final RFS regulation. The commenters requested that EPA clarify its position on the effect biodiesel use will have relative to current and future ozone control plans for the 8 hour ozone standard, since many states are making ozone control plan choices that could severely damage the RFS program. The commenters believe that it would harm the RFS program nationwide if renewable fuels were banned based on an incomplete analysis of EPA data and conclusions, especially when EPA is

currently evaluating newer data that are more representative of the real emission effects of renewable fuels. BIGDFW also stated in it its comments that if TCEQ continues on its proposed course of action and bans biodiesel due to potential NO_x emissions cited in EPA's reports, it will be the first time that a renewable fuel required under the Energy Policy Act has been banned in any state.

BioSelect commented that it believes EPA should affirmatively take the position that using renewable fuels will not impact the SIP process. The commenter noted that an EPA draft report released in 2002 suggested that biodiesel may increase NO_x emissions; the commenter believes that this report is causing some concerns that biodiesel use could jeopardize SIPs. BioSelect believes that SIPs should not be affected by emissions profiles published in RFS because subsequent technical reports have concluded that NO_x emissions from biodiesel blends are insignificant. The commenter further stated that emissions from biodiesel are insignificant given the small market penetration of biodiesel into the transportation fuel market. The commenter also noted that California has a specialized California Air Resources Board (CARB) diesel program and has been awarded full SIP credits – such clarification would provide states assurance that there would be no consequences to their SIPs.

NBB commented that it is concerned that the inclusion of biodiesel NOx emission impacts in a final rule could result in negative consequences for industry in certain regions of the country. The commenter's concern is that states may utilize the information to restrict the sales and use of renewables. The commenter noted that industry encourages EPA to continue working with NREL to further evaluate biodiesel's NO_x emission profile in order to ensure the most up-to-date and reliable information is included in the final rule; as well as provide guidance in the preamble to the final rule outlining the liberty states have in utilizing emissions data when making decisions regarding their ozone control plans.

The New York Department of Environmental Conservation commented that the magnitude of the projected increases in VOC and NO_x emissions as a result of increase ethanol use depends on the actual amount of ethanol blended into gasoline and where the blending occurs. The commenter stated that EPA should hold harmless state SIPs from this increase. The commenter suggested the following potential mitigation measures:

- EPA should require certification test fuel to contain 10% ethanol.
- Evaporative emissions test fuel needs to contain 10% ethanol with an RVP of 10 psi.
- Evaporative emissions in many ozone nonattainment areas could be reduced by lowering the maximum RVP for conventional gasoline to 7.8 in all nonattainment areas not subject to RFG.
- More widespread use of Stage I and II controls to reduce evaporative emissions; toxic exposure to gasoline delivery truck drivers and motorists refueling their vehicles would also be reduced by this measure.
- EPA needs to conduct further testing of the short and long term emissions performance of E85 capable vehicles, and define and promulgate standardized certification procedures for vehicles using E85 (since states are acting to increase the commercial availability of E85).
- Analysis should be conducted on the technical feasibility of further gasoline benzene reduction, and further reduction of benzene precursors.

- Increasing the stringency of ozone precursor control of RFG should be evaluated.
- The emissions impact of stringent olefin control, including per gallon caps, should be evaluated.
- The emissions impacts of stringent aromatics control, including per gallon caps, should be evaluated.

Letters:
Biodiesel Industries of Greater Dallas Fort Worth (BIGDFW) OAR-2005-0161-0211
Galveston Bay Biodiesel (BioSelect) OAR-2005-0161-0206
Griffin Industries OAR-2005-0161-0189
National Biodiesel Board (NBB) OAR-2005-0161-0212
New York State Department of Environmental Conservation (NYDEC) OAR-2005-0161-0169

Our Response:

The purpose of the RFS rule is to establish standards for renewable fuel use nationwide and a framework for ensuring this use occurs. EPA is also to estimate as best as possible, given applicable resource and time constraints, the environmental and economic impacts of increased renewable fuel use. The environmental impacts may include an increase of one type of emission or another. Section 1501 of the Energy Act does not direct EPA to eliminate any negative impacts related to renewable fuel use, nor to adjust the provisions of other relevant statutes and regulations so that such impacts would become moot. In addition to the analyses contained in the RFS rule, section 1506 of the Energy Act directs EPA to perform a comprehensive analysis of the impacts of all fuels and fuel additives used as a result of the Energy Act. Thus, Congress was clearly looking for a thorough analysis of all of the relevant environmental impacts related to renewable fuel use.

States have numerous responsibilities under the Clean Air Act and other federal statutes. In fulfilling their duties under these statutes they must consider the environmental impacts of renewable fuel use. In some cases, they may need to take action to counter a negative impact. One example would be the removal of the 1 psi RVP waiver generally applicable to gasoline containing 10 vol% ethanol in order to avoid increasing non-exhaust VOC emissions and authorized by section 1501 of the Energy Act.

At the same time, as discussed extensively in Chapter 3 of the Final RIA, there currently exists significant uncertainty in the impact of several renewable fuels on emissions from motor vehicles and nonroad equipment, particularly those of more recent vintage. In the Final RIA, we have enhanced the discussion of uncertainty, particularly with respect to biodiesel. We no longer make any quantitative inventory predictions of the impact of biodiesel on the diesel emission inventory. Instead, we, along with several other stakeholders, have embarked on a test program in order to fill the gaps existing in the available data. We believe that this approach provides an appropriate balance between our responsibilities to address the environmental impact of renewable fuels and doing so only to the degree that current scientific knowledge allows.

NYDEC suggests a number of actions which directionally would reduce the impact of renewable fuels on emissions (e.g., requiring vehicle certification on ethanol containing fuel). These actions are outside of the scope of the RFS rule. EPA will consider such actions as it fulfills its Congressional mandates under the Clean Air Act in future rulemakings.

10.6.2 Particulate Matter (PM)

What Commenters Said:

MDNR commented that in the proposal, EPA stated that was not able to project the effect that increased ethanol use will have on levels of directly emitted PM. The commenter further noted that the preamble stated that there are no estimates available for secondary PM either, because the formation of secondary PM is highly complex and the science is still evolving. The commenter stated that EPA has no way of determining the effect increased ethanol usage will have on PM emissions; and this "unknown" presents planning challenges to states dealing with PM nonattainment issues.

Letters:
Missouri Department of Natural Resources (MDNR) OAR-2005-0161-0217

Our Response:

We are unable at this time to predict the impact of ethanol use on either directly emitted or secondary PM. As described in Section 5.2 of the Final RIA, EPA is planning to conduct significant testing of late model year vehicles and equipment to improve our estimate of the impact of fuel quality on emissions. This testing will include PM emissions. As also described in the FRM, EPA has been conducting smog chamber experiments to identify and quantify the production of secondary PM in the atmosphere from gaseous VOC emissions, especially those emitted from gasoline fueled vehicles. The results of these experiments are being incorporated into EPA's CAMx modeling system so that the impact of gasoline vehicle emissions on ambient PM levels can be better predicted.

10.7 Water Quality Impacts

What Commenters Said:

Marathon commented that it believes that EPA's assessment of environmental impacts does not consider all environmental impacts and is therefore incomplete, especially with respect to water quality impacts.

Letters:
Marathon Petroleum Company (MPC) OAR-2005-0161-0175

Our Response:

Section X of the preamble to the final rule describes our approach to estimating the water quality impacts of increased use of renewable fuels.