ARB STAFF RESPONSES TO COMMENTS RAISING SIGNIFICANT ENVIRONMENTAL ISSUES REGARDING THE AMENDMENTS TO THE PHASE 3 CALIFORNIA REFORMULATED GASOLINE REGULATIONS

April 22, 2008

INTRODUCTION

This document is an attachment to Executive Order R-08-003, and written to compile responses to comments raising significant environmental impacts regarding the Amendments to the Phase 3 California Reformulated Gasoline Regulations. The following comments and responses are copied from the Final Statement of Reasons for the proposed regulation.

COMMENTS AND RESPONSES

COMMENTS PRESENTED PRIOR TO OR AT THE HEARING

1. Implementation Timing

1. **Comment:** Current requirements for CaRFG3 ethanol blending and the use of the fuel in motor vehicles produce significant evaporative permeation emissions. According to the ARB staff report, permeation was responsible for 29 tons per day of smog-forming emissions in 2005. Any delay in implementing new fuels regulations would allow the continued release of harmful air pollution. Therefore, ARB should implement and enforce new requirements that account for these emissions as soon as possible.

While mitigation is needed today, ARB does not require full mitigation of permeation emissions until 2010 and complete compliance with new fuel formulation requirements until 2012. ARB expects that some refiners can blend ethanol using the proposed Predictive Model today, but has given more than four years of lead time for those refiners that require equipment modifications. Since permeation emissions are already polluting today's air, further extension of the compliance date is unacceptable. (BH, JS, LT, PM)

Agency Response: After discussions with producers, importers, and other stakeholders, staff believes that we have set forth an aggressive, yet fair and reasonable implementation schedule that allows for earlier implementation and also gives producers reasonable time and flexibility to make any refinery modifications, if needed, to meet the regulations. The implementation schedule also takes into consideration the potential impact of the amendments on fuel supply in California. There is an option for producers to apply for a one year extension for the AERP. Producers would have to justify the need for this

extension, and this extension would have to be approved by the Executive Officer. An extension of the AERP does not allow refiners to come into compliance a year later; it allows them the use of the AERP as a flexibility option to mitigate permeation emissions while refinery modifications are completed. Permeation emissions will still be mitigated if a one year extension is granted, but instead of being mitigated strictly through fuel formulation changes, it will be mitigated through the AERP.

2. Sulfur Cap

2. **Comment:** The proposed sulfur cap limit of 20 ppm is an important step forward over the existing specification. We appreciate ARB opening up this rulemaking to adjust this important parameter. However, the AQMD strongly recommends that sulfur levels be further tightened to 10 ppm. This lower sulfur level would fully align California gasoline requirements with those of numbers governments around the world. We know with certainty that a maximum sulfur fuel level of 10 ppm at retail dispensing sites is very feasible, as the average levels today are 9 to 11 ppm. Now that the California average fuel quality exceeds the ARB's proposed sulfur cap by a large margin, it is very reasonable – and in fact most responsible – to adjust this level downward as a matter of state policy. Japan has already implemented this standard in use, and it has been adopted by European Union countries. California should not concede any ground with respect to its world leadership on gasoline specifications. (BRW)

Agency Response: Sulfur levels in CaRFG3 currently average about 10 ppmw, with 95 percent of production being below 18 ppmw. Staff believes that producers will significantly further reduce the sulfur content of California gasoline to certify gasoline if the proposed revisions are adopted. However, staff believes that although sulfur levels will be well below 20 ppmw, lowering the cap to 10 ppmw would have an adverse effect on production by limiting flexibility, especially during the non-regulatory RVP season. Staff believes that setting the sulfur cap at 20 ppmw sufficiently prevents excessive sulfur in CaRFG while providing adequate flexibility for producers.

3. **Comment:** "Regarding the sulfur cap, we do strongly support the staff's recommendation as far as it goes. We certainly could not propose any relaxation of the 20 ppm. But we recommend that you take the next additional opportunity for emission reductions, mainly to tighten that 20 ppm sulfur cap down to 10 parts per million. That reduction is an essential enabler of higher fuel efficiency vehicles. The average level of sulfur today is 9 to 11 ppm, so there is already a large compliance margin in the marketplace." (PW)

Agency Response: See response to comment #2.

4. **Comment:** Regarding specification changes, ARB has proposed only to lower the sulfur cap from 30 ppm to 20 ppm. Frankly, we were very surprised at this decision, because we were expecting ARB to instead propose capping sulfur at 10 ppm (considered "ultra-low" sulfur). This is the best time for California to adopt ultra-low sulfur gasoline (ULSG): Europe is doing it, Japan is doing it, and even California refiners are doing it, today. In fact, the refiners have been doing it for several years. According to the Alliance's North American Summer Fuel Survey, with samples taken from retail locations in San Francisco and Los Angeles, the average sulfur levels from the two cities combined was less than 10 ppm in 2003, 2005 and 2006. Reducing the cap to 20 ppm isn't even a stretch; since 2004, 100% of the survey's samples have been below 20 ppm. The average sulfur levels have hovered around 10 ppm since 2000, with some years slightly above that level and some years below it. We suspect the federal implementation of the national Tier 2 sulfur regulation is making lower sulfur easier for California refiners to produce because more low sulfur gasoline product is now available from outside the state. In any case, keeping the sulfur cap where it is now, at 30 ppm, as requested by the oil industry, just makes no sense at all.

Capping sulfur at 10 ppm would be important not just from an emissions perspective but also to enable improved fuel economy. We all know lower sulfur means consistently lower tailpipe emissions and enables new diesel technology, but some may be unaware that ULSG would enable lean burn gasoline engines. These engines, which are significantly more fuel efficient than conventional spark ignited engines, have been on the market for several years in Europe and Japan, where ULSG is required. However, due to higher engine-out NOx emissions, lean-burn gasoline engines require the same type of advanced NOx controls as diesel engines to meet California's stringent emission standards. These control technologies are highly sensitive to sulfur, which is the main reason why the country now has ultra-low sulfur diesel fuel. Gasoline sulfur would need to be reduced across the U.S. to fully enable this technology, but California could and should be leading the way and telling Washington to remove this key barrier to a promising new technology. (ELS)

Agency Response: As a result of the requirement to mitigate permeation, producers and importers will likely have to increase the use of ethanol in gasoline to offset hydrocarbon emissions. With the addition of ethanol, NOx emissions increase and the easiest way for producers to reduce NOx emissions is to lower sulfur in gasoline. ARB staff estimates that he sulfur levels in California gasoline are expected to be well below 10 ppm, as a result of the amendments, which is more than adequate for lean burn engines. Also see response to comment #2.

5. **Comment:** "I want to address the issue of enabling fuel efficiency which is one of our key reasons for recommending 10 ppm. I think it was a

misunderstanding by the staff in some comments we made. We need sulfur in the single digits. But we do not say that lean burn is enabled by up to 20 ppm sulfur. It's very similar to diesel technology. We need the ultra low sulfur levels.

I'd like to propose an alternative program to the extent that a regulatory cap cannot be put in. We think incentives will help reward the progressive refiners instead of penalizing them under a regulatory system. We want to suggest that they could – ARB could authorize a label for ultra clean gasoline in exchange for certifying under 10 ppm consistently that they would have to forgo some of that flexibility above 10 ppm, but we think they can do it. The data show that they're pretty much there." (ELS)

Agency Response: ARB will consider action on the suggested alternative program at a later date. See also responses to comments #2 and #4.

6. **Comment:** "I'm going to follow along with what Ellen Shapiro was talking about with lean burn gasoline injected engines. We are one of the industry leaders in this technology. And that is what we slightly disagree with staff a little bit. Lower sulfur will gain us new technology. It won't gain us tons in the model. It will gain us new technology."

"And I go along with what Ellen was just discussing about the proposing an ultra-low sulfur gasoline similar to what the auto makers now do with the top tier gasoline, to be able to propose that is a voluntary program for superior fuel.

This can be an example where ARB can lead the country into the future with a clean high technology fleets. This isn't something that we're going to be able to – even if California does have this lower sulfur gasoline, until it is adopted across the country, we will not enable to use these low lean burn engines to be able to get those NOx benefits. That will only be allowed in captive fleets for the time being. But we need to take a step forward into the future. And I hope this Board can look at this as a first step towards that future." (DNP)

Agency Response: See responses to comments #2 and #4.

7. **Comment:** If the ARB Board can't quite see its way forward to requiring ULSG across the state, we would propose it consider developing an incentive program to induce refiners to market the ULSG we know they can make. It might be something as simple as allowing these companies to use a label that declares their fuel to be "ultra-clean," in exchange for certifying their fuel will always meet the 10 ppm limit. In a state like California, this could provide just the market incentive that would make this fuel widely and predictably available. Perhaps industry itself can

devise a program that would encourage refiners to market ULSG. Such a program would convert the current race to a lowest common denominator, minimally compliant fuel to a race to sell the cleanest possible fuel, to the ultimate benefit of California citizens. (ELS)

Agency Response: See responses to comments #4, #6, and #7.

8. **Comment:** WSPA strongly opposes the staff proposal to lower the sulfur cap from 30 ppm to 20 ppm. There are no emissions benefits to be gained, and it will not make enforcement any easier. There is no evidence it will result in the introduction of advanced vehicles by the auto/truck manufacturers. Finally, there may be significant negative producibility consequences for this step. (GG)

Agency Response: Cap limits provide an upper limit for fuel properties for all compliance options and allow enforcement of the requirements through the gasoline distribution system. Sulfur levels in CaRFG3 currently average about 10 ppmw, with 95 percent of production being below 18 ppmw. Staff believes that producers will significantly further reduce the sulfur content of California gasoline to certify gasoline if the proposed revisions are adopted. With the recent implementation of the federal Tier II sulfur rules for gasoline, nationwide gasoline sulfur levels must average less than 20 ppmw with a cap of 80 ppmw. The implementation of the federal Tier II sulfur rules will significantly reduce the historical difference between sulfur levels in California and those seen outside the State.

Lowering the sulfur cap to 20 ppmw is not expected to significantly affect flexibility to make complying fuels but will increase the enforceability of the program and help to protect the sulfur-sensitive emissions control components. Staff believes that it will not be practical for producers to certify alternative formulations with sulfur levels above 20 ppmw. Staff believes that the sulfur cap should be set at the lowest level possible that does not significantly reduce production flexibility. From this perspective, the current cap of 30 ppmw is much higher than necessary.

In order to provide added flexibility to refiners, the 2007 CaRFG3 amendments include an option for the producers and importers to address the expected ongoing difficulties in meeting the very low sulfur content requirements. This option allows producers and importers to specifically offset a batch of gasoline that does not meet CaRFG3 standards due to an unintentionally high sulfur content. In this case, the producer or importer would be permitted to offset any increased emissions by producing a series of subsequent batches that are cleaner than the Phase 3 CaRFG standards. In no event could any batch exceed the cap limit for sulfur. This option would apply beginning December 31, 2009.

3. Vehicle Certification Fuel

9. **Comment:** Given the potential for an increase in permeation evaporative emissions from ethanol blended gasoline, there is cause to reexamine the regulations under which most vehicles sold in California today are certified using an MTBE containing fuel. The regulations should be changed to require certification on E10 as soon as possible. (JPU)

Agency Response: The current certification fuel is an MTBE blended fuel. Staff agrees that the certification fuel needs to be updated to reflect the fuel that is currently in-use in California. Staff will work with our Mobile Source Control Division, automobile manufacturers, and other stakeholders to establish a new appropriate certification fuel.

10. **Comment:** It is important to recognize that the PM {predictive model} reflects Tech 5 vehicles which have not been certified with in-use fuels since the phase out of MTBE. Instead, all new gasoline vehicles are allowed to certify with inherently cleaner Phase 2 gasoline rather than commercially dispensed ethanol-containing gasoline. The use of such a non-representative fuel represents a de facto relaxation of vehicle emission standards. For example, it is possible that higher catalyst loading and higher conversion efficiency formulations would be needed to certify Tech 5 and later vehicles on Phase 3 in-use fuel. The gross disparity between certification test fuel and the in-use fuel specification is a major weakness which directly affects the validity of the proposed update of the Predictive Model. Ideally, the certification test fuel would simply track whatever fuel formulation was authorized by the Predictive Model. In the absence of an immediate harmonization in this regard, the AQMD staff strongly recommend that the ARB Board direct staff to move expeditiously to update certification fuel specifications such that all new gasoline vehicles certify on in-use Phase 3 gasoline as soon as possible. (BRW)

Agency Response: See response to comment #9.

11. **Comment:** WSPA, among possibly others, is asking the ARB to require the use of ethanol in the test fuel used to certify new vehicles, so the fuel will more closely represent market quality fuel. Without taking a position on this issue today because it is outside the scope of this hearing, the Alliance notes that the request represents a much bigger challenge than many people understand or appreciate. In particular, changing the certification fuel would change not just the vehicle emission standards but also all the test protocols and regulations used to support those standards. This would impose an enormous burden on the ARB, not to mention our industry. Given the resources needed to simply examine this issue, the Board should view the proposal with great caution. (ELS)

Agency Response: See response to comment #9.

12. **Comment:** WSPA urges ARB to redefine the fuel that manufacturers of automobiles, off-road equipment and gasoline storage devices use for certifying their equipment to emissions standards. In general, certification fuel should represent the fuel that is being used by the consuming public. In this case, it is critical that equipment pass the relevant standards with gasoline containing ethanol. Much of the need for this current rulemaking came about because ethanol was not part of the certification fuel in the past. WSPA recommends the Board direct ARB staff to evaluate and take appropriate action on this issue.

In addition, ARB should continue to test whether fuel containing ethanol has different emissions performance than fuel without ethanol. (GG)

Agency Response: See response to comment #9.

13. **Comment:** "Lastly, just want to turn to the question of certification fuel harmonization to underscore its very important relevance. As you I'm sure know, gasoline vehicles today are allowed to certify on cleaner Phase II gasoline, even though MTBE has been fully phased out and is no longer available. That represents in fact a de facto relaxation of the standards. And we consider that a major weakness of the current predictive model.

So we recommend that the staff be directed by your Board, as I think they reflected in their request, that they be directed as soon as possible to bring a harmonization recommendation." (PW)

Agency Response: See response to comment #9.

14. **Comment:** "Finally, we also support the previous statements about the need for fixing the certification fuel. Eight years ago, this Board approved the regulations that phased out MTBE from the fuel, and yet today we still see the bulk of the cars that are being sold in California are certified using an MTBE containing fuel." (JPU)

Agency Response: See response to comment #9.

15. **Comment:** "I'd also like to look to regarding E10 and cert fuel, I'd like to agree with Mr. Cackette. You know, as you know, ARB standards are the most stringent in the world on vehicles. And we do it by mandating E10 as a cert fuel, it will effectively tighten the current emission standards. And again, I agree that we need to carefully evaluate the procedures." (DNP)

Agency Response: See response to comment #9.

4. Exhaust Model

16. **Comment:** We are concerned that the proposed model does not reflect the best available science. We disagree with staff's decision to exclude the bulk of the available data on the sulfur impact on emissions for the most recent vehicle technology class. This decision has the greatest impact on the proposed NO_X model, greatly increasing the predicted sensitivity of NO_X emissions to changes in sulfur content. The practical impact is that the NO_X increase observed for E10 can be offset by decreasing sulfur to very low levels; however, this offset depends on the modeled NO_X impact to truly represent what actually occurs in the vehicle fleet. We are concerned that the proposed model over-predicts the benefits of low sulfur fuels and that NO_X increases will result in the real world. (JPU)

Agency Response: In the CaRFG3 Predictive Model, the emissions response of Tech 5 vehicles to sulfur was based on a limited data set. The modeled emissions response to changing sulfur concentrations for the Tech 5 vehicles was based on the two studies available at that time: "AAMA/AIAM Study on the Effects of Fuel Sulfur on Low Emission Vehicle Criteria Pollutants (1997)" and "CRC Sulfur/LEV Program (CRC E-42, 1997)". In the current update, two more sulfur studies have been added to the Predictive Model database: "Sulfur Oxygen Vehicle Emissions Test Program (AAM/AIAM, 2001)" and "The Effect of Fuel Sulfur on NH3 and Other Emissions from 2000-2001 Model Year Vehicles (CRC E-60, 2003)."

Staff believes these two later studies are much more relevant to both the actual California vehicle mix and in-use fuels and is, therefore, proposing to only use these two studies to estimate the average Tech 5 vehicle response to changes in fuel sulfur concentrations in 2015. Our rationale is based on several considerations. Staff believes that using all four datasets to calculate the Tech 5 portion of the Predictive Model would significantly over represent the LEV I and earlier vehicle emissions control technologies.

Staff has addressed the Tech 5 NOx-sulfur response in great detail in the Initial Statement of Reasons, pages 23-27.

17. **Comment:** In the ISOR, ARB presented its rationale for including data from two studies in the determination of the Tech 5 NOx-sulfur response while excluding data from two other studies. WSPA continues to disagree with staff's decision. WSPA is also very disappointed that our submissions to ARB on this subject (two workshop presentations, a statistical workgroup presentation, a private presentation to ARB, and private teleconference conversations with ARB) were not included in the staff report. (GG)

Agency Response: The information on the Tech 5 NOx-sulfur response presented by WSPA at the two workshops and the statistical workgroup were carefully studied and analyzed by ARB staff. Although WSPA pointed out interesting facts in the omitted studies, ultimately ARB staff disagreed with their assessment on a technical basis. Please also see response to comment #27.

18. **Comment:** As WSPA has indicated in workshop presentations, there are several examples of exhaust model responses that are not the result of data used in developing the model, but rather an artifact of a quadratic function being extrapolated beyond the range of the data. In these cases, the model response should be held constant beyond the range of the data in order to avoid the inclusion of such inappropriate responses in the model. (GG)

Agency Response: Staff agrees that in earlier drafts of the Predictive Model that this was true. The latest version of the model, which was included in the 45-day notice package, was refined to account for those effects.

5. Evaporative Model

19. **Comment:** The "Procedures for Using the Predictive Model" (ISOR, Appendix A-2) provide the option to choose whether or not the evaporative and CO models are used. However, the impact of ethanol on permeation emissions is included only in the evaporative model. Therefore, making the evaporative model optional constitutes a serious loophole relative to ensuring that permeation emissions are offset within the model. This option should be removed.

However, it should be noted the above change will require other changes to make the Predictive Model compatible with the non-RVP control season. In the current regulations, the option to use the evaporative model exists only during the RVP control season. Therefore, the evaporative model was eliminated from the non-RVP control season by default. Making the evaporative model mandatory for the RVP control season will require specific language directing blenders to not use the evaporative model during the non-RVP control season.

Finally, it should be noted the spreadsheet version of the Predictive Model includes the evaporative model in both summer and winter calculations. It is therefore inconsistent with both the existing proposal and the changes recommended above. While WSPA recognizes that the spreadsheet is not an official part of the rulemaking package, we urge ARB to make it consistent with the regulatory package to avoid confusion among the various stakeholders who seek to evaluate the new model. (GG)

Agency Response: The “Procedures for Using the Predictive Model” has been updated such that the evaporative model is no longer optional during the RVP regulatory control period and is now required. The evaporative model also is now optional outside of the RVP regulatory control period. The Predictive Model spreadsheet was also updated to reflect those changes. This updated Predictive Model was released during the 15-day comment period for public review.

6. Offsetting Emissions Associate with Higher Sulfur Levels

20. **Comment:** BP disagrees with the Western States Petroleum Association (WSPA) support of ARB’s proposed Section 2265.1 “Offsetting Emissions Associated with Higher Sulfur Levels”. This amendment provides a new, additional, and likely unneeded "flexibility" for batches of CARB gasoline that have too high of a sulfur content to certify due to some “unexpected problem".

We consider the added flexibility both “free” and “secret”, and recommend it be deleted for the following reasons:

- To our knowledge, the added flexibility was not originally requested by the oil industry, and
- It will allow the sale of gasoline that would otherwise be considered noncompliant, and
- It reduces the enforceability of the rules, and
- It does nothing to encourage fuel providers to make the necessary investment and operational changes to avoid the use of this flexibility – one reason why we consider it “free”, and
- It provides no opportunity for the public to be informed of the use of the provision – why we consider it a “secret”, and
- It will likely be "gamed" and misused since there is no way to determine whether the higher sulfur level was unexpected or not, and
- It will increase emissions of at least SO2 and secondary particulates upon its immediate use, and
- There is no limit on how high the sulfur is allowed to go, and
- It will penalize those that have or will make the necessary investments to prevent such “unexpected problems”. (DAS)

Agency Response: Regardless of who requested this provision, staff believes it is practical, reasonable, and necessary. At low sulfur levels, the compliance margin for refiners is small, and slight unexpected deviations in the refinery process could result in a non-compliant batch due to slightly elevated sulfur. Staff anticipates that it will be very difficult to blend a slightly higher than needed sulfur level batch to a compliant blend using the existing sulfur averaging provisions because it becomes increasingly more and more difficult to average out sulfur when the levels are very near the bottom of the range. Therefore, for a

producer that experiences a problem with the sulfur content when blending a particular batch of gasoline, staff decided to add a compliance option that would permit that producer to use an averaging option that is based on emissions.

Without such a flexibility provision, such batches would likely need to be shipped out-of-state at significant expense and reduction in supplies of available product in California. Unlike most other fuel properties governed by the CaRFG3 rules, increases in sulfur levels in individual batches do not result in immediate emission increases in vehicles using the batch. Sulfur degrades catalyst performance, but the effect is reversible. Given this situation, staff believe it is reasonable to infrequently allow batches with slightly higher sulfur levels to be used, so long as the emission impacts of the higher sulfur batch are fully mitigated in the near future through subsequent batches. While one batch may have a slightly elevated level of sulfur, that increase would be fully offset by a subsequent batch. Thus, the net effect would be a combination of compliant blends, resulting in no net increase in SO2 and secondary particulates.

In order to maintain the enforceability of the regulations, staff has included significant notification requirements. These requirements will ensure that staff is apprised of who is blending fuels with elevated sulfur levels, how much is being blended, the impacts of the elevated sulfur level, and whether the elevated sulfur has been fully offset. In addition, since staff is notified of the date and time of the completion of physical transfer from the production facility or the import facility within 24 hours after the completion of the physical transfer, staff has the ability to check and track the batches for enforcement purposes.

This option is not expected to be used routinely. Any elevated sulfur in one batch must be fully offset in subsequent batch(es), and the net effect is no increase in sulfur. Therefore, public notice of the use of this option is not necessary.

Although it is feasible that the emissions offsetting provision could be “gamed”, it is highly unlikely. While refiners could potentially make multiple non-compliant batches and have to have many different offsetting batches, staff believes that the recordkeeping and the constant changes in refinery production to offset high sulfur batches would be cost ineffective. Therefore, it would be more efficient for all refiners to be compliant without having to use the emissions offsetting provision.

While this option allows for elevated levels of sulfur in certain situations, in no event could any batch exceed the cap limit for sulfur. Thus, there is a limit to how high the sulfur is allowed to go.

This option does not penalize those companies who have made investments to prevent elevated levels of sulfur in gasoline because at such low sulfur levels, minor deviations in the refinery process could easily result in unacceptable sulfur levels. These minor deviations are unforseen and could arise even if

investments toward facility modifications were made. As a result, this option is available to all refineries, regardless of whether they made any such investments.

21. **Comment:** "You've heard today that due to the model changes that the rule includes some new flexibility, a new 90-day averaging period for unexpected programs that come up in the refineries.

BP differs from the rest of the industry in that we don't think this flexibility is really needed. And more importantly, it diverges from policies that past Boards have taken when giving refineries additional flexibility by requiring them to pay some additional cost. And I'll get into that later. I might add that to our best knowledge the oil industry didn't originally request this flexibility, but it came from staff.

Currently, the rule does have a 90-day averaging period in it that refiners can take advantage of. It also has a variance provision in it that we can take advantage of for such situations. And they are both designed to deal with unexpected problems.

The important difference is that the current flexibility comes with a cost. In the case of a variance, you have to pay 15 cents a gallon. In the case of an averaging provision, the current one, you have to actually meet a lower set of specifications. It's a tighter specification for the fuels. This new flexibility that's being proposed doesn't contain any of that. There is no fee. There is no public reporting, no public hearing. And for the averaging, it doesn't require the refine to a lower set of limits."

"In the past, earlier Boards decided that before they gave refineries this flexibility they needed to have, charge them a cost. And especially for averaging, with averaging, it's harder to enforce an averaging standard. So you're less certain you're going to actually get the emission reductions that you would otherwise get if you didn't use that averaging. And so because of their emphasis on making sure they get those environmental qualities they require and the current averaging standard requires you to meet a lower emission limit. For sulfur, it's actually 25 percent lower. So previous Boards said we really want to make sure if we're going to give these people flexibility, we want to make sure to get the emission reductions.

So in summary, our solution would be that you delete this new flexibility. But if you think it's necessary, we think you should follow the practice of previous Boards and assign some cost to this new flexibility so that we'll ensure that the environmental benefits will be achieved." (DAS)

Agency Response: See response to comment #20. The Board has not always required refiners to pay a fee for additional flexibility. For example, the history of the gasoline regulations reveals that ARB allowed early compliance with the CaRFG3 standards before December 31, 2003 (California Code of Regulations, Title 13, section 2261(b)(3)), optional compliance with the averaging limits (Cal. Code Regs., tit. 13, section 2262.3(c)), phase-in of the MTBE prohibitions (Cal. Code Regs., tit. 13, section 2262.6(b)), alternative test methods (Cal. Code Regs., tit. 13, section 2263(c)), combination of notifications (Cal. Code Regs., tit. 13, section 2263.7), optional compliance with the PM alternative specifications (Cal. Code Regs., tit. 13, section 2265), optional compliance with test-certified alternative gasoline formulations (Cal. Code Regs., tit. 13, section 2266), exemptions for test programs (Cal. Code Regs., tit. 13, section 2267), optional standards for small refiners (Cal. Code Regs., tit. 13, section 2272), and various protocols without the requirement that the refiner pay a fee to ARB.

Much like the current averaging provision, this option requires that the refiner offset a batch of gasoline that does not meet CaRFG3 standards due to an unintentionally high sulfur content. In this case, the producer or importer would be permitted to offset any increased emissions by producing a series of subsequent batches that are cleaner than the Phase 3 CaRFG standards. Both the averaging provision and the sulfur offsetting provision result in no net detrimental effect to the environment. Hence, no public reporting or public hearing is required. However, the variance provision is substantially distinguishable from the sulfur offsetting provision. For the variance, any exceedance is not offset. There are or could be net detrimental environmental effects. There are fees, public notices and hearings, and public participation. With the sulfur offsetting option, the refiner must offset the effects of any elevated sulfur with subsequent batches. There are no net detrimental environmental effects, fees, public notices and hearings, and public participation.

While the current averaging provision might cause an additional enforceability risk, that risk is mitigated by imposing strict notification, reporting, and recordkeeping requirements. Likewise, any enforceability risk associated with the sulfur offsetting provision is mitigated by similar strict notification, reporting, and recordkeeping requirements.

22. **Comment:** If ARB believes that added flexibility is needed, ARB is encouraged to consider two alternative approaches that would not produce most of the above negative impacts. They are:

- Increase the current Averaging Limit for sulfur from its current 15 ppm to something closer to the 20 ppm Flat Limit and/or
- Reduce the variance fee for this specific situation from the current 15 cents per gallon (cpg).

Besides reblending the batch of gasoline, the existing rules already provide for dealing with "unexpected problems". One is the current averaging provisions that allow the fuel properties to be averaged over 90 days, but require the fuel producer to meet a stricter set of averaging fuel specifications. For example, the sulfur averaging limit is 15 ppm while the so-called Flat Limit is 20 ppm thereby requiring the producer to pay for the use of increased flexibility. The proposed additional flexibility in Section 2265.1 requires no such payment – it is "free".

The permeation changes to the predictive model will make it more difficult to use the existing averaging provisions, but not impossible. By reducing the "price" of using the current averaging provisions by increasing the sulfur limit for the averaging option, it will provide refiners greater flexibility, but not make it "free". Therefore, BP suggests ARB consider increasing the averaging limit above 15 ppm as a more effective alternative to providing additional flexibility in limited circumstances.

The second option currently allowed is a variance for unexpected problems that are caused by factors outside of the producer's control. With a variance the producer is charged a flat 15 cpg which is used to offset the increased emissions allowed under the variance. The current variance process can be completed quickly and includes a public notice and hearing. In comparison, the proposed added flexibility is given free with no public notice or hearing for unexpected problems that are much more under the producer's control than those situations covered by a variance (e.g. earthquake). To increase refiner's flexibility BP would suggest ARB consider initially reduce the variance fee for limited and specified situations. This would then ensure the added flexibility is not "free" and allows for public notice and comment. (DAS)

Agency Response: Pursuant to Health and Safety Code section 43013.1(b)(1), the ARB must ensure that CaRFG3 maintains or improves upon the emissions and air quality benefits achieved by CaRFG2. Increasing the sulfur Averaging Limit or allowing variances (without offsets) would be in direct violation of Health and Safety Code section 43013.1(b)(1). It would allow backsliding from the air quality benefits achieved by CaRFG2.

In terms of reducing the variance fee, ARB is committed to cleaner air for California. Staff believes that reducing the variance fee might encourage producers to produce non-compliant gasoline if the fee is lowered enough. This is not an option. ARB would like to see cleaner air through strict yet fair reformulated gasoline regulations. Staff feels that we have achieved this through this regulation. See also response to comment #30.

23. **Comment:** "We also encourage the Board to include T-50 as a trigger for what emissions averaging similar to the treatment that's currently being

given for sulfur due to sensitivity for T-50 in an E10 type of environment." (JPU)

Agency Response: Staff will consider this at a future rulemaking. This issue was not within the scope of the hearing notice to enable action on this item.

7. Permeation

24. **Comment:** With regard to permeation emissions, it is central to recognize that such HC emissions are exponentially– not just linearly - related to temperature. The maximum temperature assumed in the PM methodology is therefore a defining parameter and effectively establishes the degree of stringency required by the PM model. ARB staff proposes a temperature profile with a peak temperature of only 87°F for the Los Angeles County portion of the ozone planning inventory used in the model. This temperature assumption is used despite the fact that last year the South Coast Air Basin experienced the highest number of consecutive days above 100 degrees on record. While we appreciate that the staff had limited time and resources to make adjustments on a statewide basis to reflect worse case higher temperature conditions, it is clear that an undercount of HC permeation emissions exists for Los Angeles County due to the disproportionate effect of the cooler coastal sub-region compared to the San Fernando and San Gabriel Valleys.

Although the staff note that the average temperature used in the California 8-hour ozone profile is 3 degrees higher than the default inventory, this does not fully account for the full permeation impacts from the use of Phase 3 gasoline. Maximum temperature days do not typically achieve the highest ozone levels. However, high temperature conditions in the high 90's to over 100 also directly impact ozone concentrations before the Basin's inversion layer is broken by especially high temperatures, especially in the more urbanized portion of the Basin. ARB's permeation emission rate assumptions reflect temperature profiles which occur on the highest ozone day.

As ARB staff has acknowledged, this is certainly not the highest emission rate scenario. As a matter of public health policy, we believe that ARB is obligated to address the full range of possible adverse ozone air quality effects and not solely the peak ozone meteorological day. A more robust temperature assumption is crucial in order that the PM adequately meet the full range of real world scenarios anticipated under SB 989. Temperatures significantly above 87°F should there fore be modeled to ensure that the maximum emissions condition is fully mitigated under the PM, rather than just the peak ozone modeling scenario. To ensure that permeation emissions are fully accounted for in the PM inventory, the AQMD staff therefore recommends that ARB adjust the Los Angeles

County portion of the statewide inventory used in the PM model by raising its maximum temperature to at least 95 degrees. (BRW)

Agency Response: The South Coast air basin temperature profile covers not only the inland areas, but also the coastal areas. This temperature reflects the average temperature in all those areas. The EMFAC2007 model is designed to show a temperature profile across the entire South Coast Air Basin of which Los Angeles County is one region. While on some hotter days the peak temperature of 87 degrees used in the model might be low compared to the actual temperature in Los Angeles County, it will most likely be higher than the actual temperature in the coastal regions.

25. **Comment:** "I just want to say quickly we know very clearly that permeation is an exponential function relative to temperature, not linear; that the staff have proposed a maximum temperature of 87 degrees for the L.A. County portion. If we applied the temperatures they assumed for Fresno, for example, today, there would be a significant shortfall in the inventory. Similarly, in Los Angeles, last year, we had the highest number of consecutive days above 100 degrees. 87 degrees is not a realistic appropriate temperature.

We appreciate the hard work the staff have done and understand some of the complexities of the modeling inventory. But we do seriously recommend that you consider – in fact, we recommend that you adjust the temperature exogenously for L.A. County to at least 95 degrees to address that fundamental under-count of permeation emissions." (PW)

Agency Response: See response to comment #24.

26. **Comment:** The proposed equations for evaporative benzene emissions do not include the impact of permeation on benzene emissions. The equations are composed of an estimate of the total hydrocarbon evaporative emissions for each process in mg/mi, multiplied by an estimate of benzene emissions as a fraction of the total hydrocarbons. Both of these components appear to be direct carry-overs from the previous Predictive Model. In the absence of new data, this is appropriate for the component that deals with the benzene fraction. However, the component that deals with g/mi hydrocarbon emissions has not been updated to include the impact of ethanol on permeation and is thus inconsistent with the evaporative models used elsewhere. WSPA recommends this inconsistency be removed to ensure that the impact of permeation on benzene emissions is characterized accurately. (GG)

Agency Response: The final version of the 2007 Predictive Model includes the impact of permeation on benzene emissions. The equations used to estimate evaporative benzene emissions are consistent with the rest of the hydrocarbon

evaporative models elsewhere. Staff has also updated the benzene fraction of the total hydrocarbon emissions. This updated Predictive Model was released during the 15-day comment period for public review.

8. Inventory Year

27. **Comment:** A key policy decision embodied in the proposed update to the predictive model is the choice of inventory year from which to calculate the mitigation obligations needed to meet the SB 989 criteria. The SCAQMD staff strongly believes that the 2010 inventory year is the appropriate baseline from which to implement requirements, rather than the proposed 2015 Inventory year. First, it must be noted that at least five years of unmitigated HC emission increases have occurred already. By moving the inventory baseline year back to 2010, there would be more underlying equity, as the majority of the unmitigated emissions will occur during the current decade. Second, since the Alternative Emissions Reduction Plan (AERP) goes into effect in 2010, it is logical to establish the same year as the Predictive Model baseline year. Using the 2015 inventory for this portion of the PM is clearly inconsistent with the 2010 start date for the AERP. Third, full gasoline compliance commences in 2012. The closest inventory year is therefore 2010, not 2015. Fourth, the start date for the implementation of the Low Carbon Fuel Standard (LCFS) is 2010. Aligning the Predictive Model inventory with the LCFS is therefore the most logical and direct policy. Ethanol blends of 10% are likely to be a key means of compliance with the LCFS, especially in the early years. Aligning the inventory year to the LCFS is especially appropriate since the LCFS standard is the major reason that E10 blends will be produced and such higher levels of ethanol blending are the immediate cause of the permeation issues at issue in this proceeding.

Lastly, the 2010 inventory is a much closer approximation to today's emissions. The 2015 inventory is inherently lower, and in effect provides a less stringent level of control. Given the air pollution public health emergency status of the South Coast Air Basin, ARB should take all feasible steps to expedite emission reductions, rather than delay them. From our perspective, the choice of the inventory date is a straight forward policy judgment which should be heavily weighted toward the near-term public health impacts of ozone exposure. SB 989 did not envision that there would be a 13 year lag between the phase out of MTBE (starting in 2002) and the full mitigation of ethanol-induced permeation emissions as implied by the use of a 2015 inventory year. For all of these reasons, the SCAQMD staff strongly recommends the use of the 2010 inventory rather than the current staff proposal of 2015. (BRW)

Agency Response: The proposed amendments will not be fully implemented until 2012. The very earliest the predictive model would be updated again would

be 2015. Even if the Predictive Model is updated at this earlier time frame, it would most likely take several years for full implementation to occur. The vehicle fleet would be represented by a 2010 inventory all the way up until 2019. That is a nine year difference between the inventory and the actual on-road fleet. There would be a great discrepancy between the estimated emissions and the actual on-road emissions. The 2015 inventory provides a better emissions estimate throughout the entire time range, as it is a central year. Whereas, the 2010 estimate more closely estimates the earlier years more accurately and the latter years very poorly.

28. **Comment:** "We would strongly recommend that you use a 2010 inventory and not 2015. There are several reasons for that. The last five years, we have seen unmitigated – fully unmitigated hydrocarbon permeation emissions. So we've already accrued that disbenefit." (PW)

"The start date of the low carbon fuel standard as you know is in 2010, not 2015. The 2010 inventory is much more closely approximate to the current inventory. So given the public health emergency status of the South Coast air basin – and I use that phrase very carefully, because our Board just several weeks ago adopted formally an emergency petition to the Governor and to the President to declare the South Coast air basin an air pollution emergency.

For that reason, we think a strict inventory year is a very important opportunity to expedite emission controls. When SB 989 was adopted, there was not any expectation at that time there be in effect a 13-year lag implied by this 2015 inventory portion of this question." (PW)

Agency Response: See response to comment #27.

9. Ozone Reactivity

29. **Comment:** Although the ARB's latest proposed PM ozone reactivity adjustments reflect the best science available at this time, it would be very constructive for ARB to conduct additional air quality modeling and atmospheric sampling to update the state's MIR factors for ethanol and other species where appropriate. This is especially important in light of the likely transition from E5.7 to E10 blends driven by the intersection of the updated Predictive Model and the upcoming Low Carbon Fuel Standard. An updated MIR assessment is also important to help address concerns raised by certain researchers about the potential for ethanol emissions to convert to acetaldehyde in the atmosphere over multiple day ozone episodes. Because the Carter factors essentially are derived from a single day EKMA box model assessment, there may be multi-day carryover effects associated with added ethanol reactivity which are under-accounted for in the current version of the PM analysis. (BRW)

Agency Response: ARB staff determined that the current Board-approved MIR factors were more than adequate for this rulemaking and determined that additional air quality modeling and atmospheric sampling were not necessary at his time. ARB staff works closely with the Reactivity Science Advisory Committee on updating California's MIR factors and will consider action on this item during the next update of the MIR factors.

10. Increase Flexibility of Biofuel Use

30. **Comment:** On April 25, 2006, Governor Schwarzenegger provided guidance to ARB staff to maximize flexibility in the CaRFG3 regulation to utilize biofuels. The order (Executive Order S-06-06) stated, "the California Air Resources Board is urged to consider as part of its rulemaking the most flexible possible use of biofuels through its Rulemaking to Update the Predictive Model and Specification for Reformulated Gasoline, while preserving the full environmental benefits of California's Reformulated Gasoline Programs." Several months later, Governor Schwarzenegger announced a plan to reduce California petroleum dependence, during which he directly referenced the intent of S-06-06 to "maintain current [biofuel] levels while enabling production and consumption growth." Governor Schwarzenegger's Executive Order is not mentioned in the ISOR as an organizing principle for conducting the rulemaking. The ISOR does not identify measures it considered in the context of S-06-06. In addition, getting to 10 percent ethanol blends (E10) is a widely recognized first step to meeting the Governor's low carbon fuel standard (LCFS) requirements. The ability for the state to get to E10 blends depends, first and foremost, on the CaRFG3 regulation, and more specifically, on the Predictive Model. Yet this state policy goal is not identified in the ISOR as a driver for the amendments recommended by the state board.

REAP believes that ARB staff could go farther with regard to meeting the goals set forth by Governor Schwarzenegger.

During the rulemaking process, there was very little (if any) discussion about flexibility in the context of S-06-06. For example, we are not aware of any serious discussions about a minimum oxygen content requirement that would have maintained current levels of ethanol in gasoline (~6 percent). Also, there was no sub-committee group gathered to consider how to maximize flexibility in the regulation while protecting air quality. The California gasoline regulation is often referred to as one that facilitates market flexibility, with the implication being that ARB prefers not to require specific fuel recipes. However, beneath the exterior the regulation does enforce a framework of fuel controls for several fuel components such as sulfur, distillation temperature, aromatics, benzene, etc. While California

clearly enforces a fuel regulation that is totally different and technically more advanced than other states, it is useful to note that Minnesota jumpstarted its fuel ethanol industry by enforcing a minimum oxygen requirement. California may prefer to diversify the fuels market via a carbon metric (re: the proposed LCFS). But at this point the LCFS is a concept, and could take years to develop and enforce. (BC)

REAP recommends delaying final implementation until ARB staff considers a wider set of strategies to increase flexibility in the regulation. A "flexibility working group" could be pulled together in a relatively short time frame, as there are experts already working on these issues. (BC)

Agency Response: One of the principal purposes of the 2007 CaRFG3 amendments was to fulfill the requirements of SB 989, i.e., to ensure the Phase 3 CaRFG regulations preserve the emissions and air quality benefits of the Phase 2 CaRFG program. To this end, emissions associated with permeation must be fully mitigated and an AERP is an alternative option to accomplish this. Therefore, Executive Order S-06-06 is not mentioned in the Staff Report and provisions to accomplish the goals of S-06-06 are not included in the 2007 CaRFG3 amendments. Executive Order S-06-06 is not within the scope of this rulemaking.

Staff incorporated the maximum flexibility possible to include the widest range of ethanol use in CaRFG possible. Staff also added the alternative emissions reduction plan and the emissions averaging provisions to provide producers additional flexibility to blend higher levels of ethanol in CaRFG. In addition to the amendments, staff suggested additional modifications to the original proposal in response to comments received since the Staff Report was published. These modifications were released for a 15 day public comment period. The most significant modification was adding flexibility for early blending of higher levels of ethanol before 2010. Two early ethanol blending options were provided. The first option is called an ethanol emissions reduction plan that would have refiners mitigate emissions associated with increased ethanol use through alternative measures. This option was generally patterned after the AERP. The second option allows a refiner to add more ethanol into California Reformulated Gasoline Blendstocks for Oxygenate Blending (CARBOB) than the common carrier pipeline specifications (5.7% ethanol) allow.

The 2007 CaRFG3 amendments were intended to implement H&SC section 43013.1 and are independent from the future LCSF. However, if there are any inconsistencies between the two programs, ARB will rectify them.

The Phase 2 California Reformulated Gasoline (CaRFG2) regulations, approved in 1992, set specifications for eight fuel properties: sulfur, aromatics, oxygen, benzene, 50 percent distillation temperature, 90 percent distillation temperature, olefins, and Reid vapor pressure. To comply with the oxygen content

requirement, producers chose to use MTBE. Soon after CaRFG2 implementation, the presence of MTBE in groundwater began to be reported. An investigation and public hearings were conducted resulting in the issuance of Executive Order D-5-99 on March 25, 1999. The Executive Order directed the phase-out of MTBE in California's gasoline.

During the December 1999 hearing, the Board recognized that permeation emissions from the use of ethanol in gasoline may be an issue and directed the staff to investigate the effects, with the understanding that additional modifications to the CaRFG3 regulations may be required. The modifications would be required in order to ensure that regulations adopted pursuant to Executive Order D-5-99 maintain or improve upon emissions and air quality benefits achieved by the CaRFG2 regulations as of January 1, 1999 (Health and Safety Code [H&SC] section 43013.1). H&SC section 43013.1 (SB 989) was approved by the Governor in October 1999.

Based on meetings with producers, pipeline distributors, CEC staff, and other stakeholders, ARB staff learned that some producers can already produce complying gasoline and some producers can make complying gasoline by the December 31, 2009 deadline with slight to no refinery modifications and virtually no change in production volumes. Without refinery modifications, staff estimates that production could decrease four to seven percent. With the refinery modifications, staff estimates that production could increase 3 to 10 percent. For the producers that could not make complying gasoline by December 31, 2009 without significant production loss, staff was able to determine it would take up to four years to complete refinery modifications necessary to offset production loss that could come from meeting the requirements of these amendments. These refinery modifications include permitting, engineering, resources, and construction.

The ARB has longstanding legislative authority to "endeavor to achieve the maximum degree of emission reduction possible from vehicular and other mobile sources in order to accomplish the attainment of the state standards at the earliest practicable date." (Health and Safety Code [H&SC] section 43018(a).) As such, it is the Board's responsibility to determine the most effective approach to achieving this mandate. Relative to methyl tertiary-butyl ether (MTBE), ethanol increases oxides of nitrogen emissions as well as permeation emissions. The 2007 CaRFG3 amendments require refiners to mitigate permeation emissions beginning January 1, 2010, with an option for an alternative emissions reduction plan (AERP) that sunsets December 31, 2011. This action recognizes the need to expeditiously mitigate the permeation emissions and allows refiners adequate time to make necessary refinery modifications. It should also be noted that the 2007 CaRFG3 amendments allow a one year extension to the AERP.

Moreover, the CaRFG2 program is a major component of the California State Implementation Plan (SIP), which is a comprehensive strategy designed to attain

federal air quality standards as quickly as possible. The implementation schedule of the updated Predictive Model (with the use of an AERP) facilitates expeditious attainment of those standards.

The CEC and MathPro, Inc., CEC's consultant, both concluded refiners will need to make modifications to their refineries to meet requirements of amendments. The Math Pro modeling report estimated that the modifications would take approximately 45 to 59 months to complete. ARB staff estimated that the refinery modifications could take up to 48 moths and allowed for a 12 moth extension to the AERP (the use of alternative emission mitigations), if conditions were necessary. Some refiners could already meet the amended regulations or would be able to meet the standard by December 31, 2009. Therefore, in order to obtain maximum feasible reductions as expeditiously as possible, requiring producers and importers that produce gasoline to use the revised Predictive Model starting December 31, 2009 (allowing for the use of alternative emission mitigations) and requiring the production of CaRFG compliant fuel with the revised Predictive Model by December 11, 2011 are appropriate.

ARB has not established a precedent for a four-year compliance period. WSPA prepared a summary showing 12.5 – 51 months for various CaRFG rulemakings. Therefore, the commenter is incorrect in stating that the historical lead time for the petroleum industry is four years. To adopt a four-year implementation period here based on any perceived historical lead time, as opposed to a technical basis, would be arbitrary and capricious. As discussed above, some producers can already produce complying gasoline, others can use the AERP to comply in a cost-effective manner, and full compliance by 2012 is technologically feasible.

The commenter further suggests that the common-carrier pipeline future ethanol content requirements should be determined. However, any future changes to the common-carrier pipeline specifications are speculative and cannot be relied upon for the development of the current amendments.

The AERP is a flexibility option to ensure that emission increases caused by the addition of ethanol to gasoline are mitigated completely and expeditiously-consistent with State law requirements (Health and Safety Code section 43013.1(b)(1)). Health and Safety Code section 43013.1 requires that CaRFG3 preserve the emission benefits of CaRFG2. These benefits include emission reductions for pollutants, including precursors, identified in the State Implementation Plan for ozone, and emission reductions in potency-weighted air toxics compounds. The intent of the AERP is to serve as a flexibility option for producers that choose to incorporate it to offset some of the loss of production while refinery modifications are being made to offset losses in production. Producers are not required to use an AERP to come into compliance with the new regulatory requirements. There are several options that producers can choose to come into compliance with the 2007 CaRFG3 regulations without using the AERP. Another option would be to use the Predictive Model to adjust the eight regulated fuel properties to offset the permeation emissions and make a

complying blend. In addition, the 2007 CaRFG3 amendments do not require ethanol use in gasoline. Producers have the option of putting from zero to ten percent by volume oxygen in gasoline. A fully compliant non-oxygenated gasoline blend is a viable option for producers. As the AERP is an option intended to offset emissions associated with permeation due to the use of ethanol in gasoline, an AERP is not necessary, and therefore not a penalty, for fuel blends that don't include ethanol.

The implementation period is necessary to achieve the maximum degree of emission reduction possible in order to accomplish the attainment of the state standards at the earliest practicable date and fulfill the requirements of H&SC section 43018(a). The ARB does not have authority to provide incentive funding to offset emissions associated with permeation from the use of ethanol in gasoline. Absent statutory authority, ARB may not offer "carrot approaches." Several individuals/organizations unsuccessfully attempted to gain new legislation in the 2007 Legislative regular session that provides for alternative funds to mitigate any emissions increases associated with the introduction of higher blends of ethanol up to 10 percent by volume, the alternative emissions reduction plan option, or both, including provisions to enable refiners and importers to take advantage of the amended CaRFG3 rules to introduce higher ethanol blends as early as feasible.

Based on meetings with producers, pipeline distributors, CEC staff, and other stakeholders, staff learned that most producers can meet the changes in regulations with only limited reduction in production. However, to offset this reduction in production some producers would have to do refinery modifications. In these meetings, many producers indicated that the refinery modifications would take approximately four years. Therefore, staff set a full implementation date of December 31, 2011 with a provision that producers could apply for a one year extension of the AERP if there were some unexpected circumstances that prevented them from coming into compliance by that date.

11. Dual Model Approach

31. **Comment:** Early in the public workshop process, RFA presented a Dual Model approach to more accurately represent the response of the vehicle fleet to fuel properties. However, the staff seemed to reject the concept due to a misunderstanding of the response of higher emitters to changes in fuel properties compared to low emitters, and a narrow focus on the effects of ethanol on NOx emissions.

RFA feels that the Dual Model proposal has not been given adequate consideration, and has prepared the attached report entitled "The Case for a Dual Tech 4 Model Within the California Predictive Model" that fully describes the Dual Model and why the authors believe that such a model would be more technically correct for all vehicles, and would

simultaneously provide greater flexibility for the oil industry to meet the Predictive Model requirements. (GH)

Agency Response: During the workshop process, several stakeholders requested that the staff consider dividing the Tech 4 dataset into a higher and lower emitter group to be modeled separately, and presented the results of an analysis of dividing the datasets. The basic concept was that a Tech 4 NOx model would provide an overall higher statistical fit if the dataset were divided into two distinct vehicle groups. The cut point would be at 0.6 times the NOx emissions standard and each portion modeled separately. Proponents believe that this approach produces a much lower response of NOx to oxygen content and it would require less adjustment to other fuel properties to be able to increase the amount of ethanol into CARFG.

Staff discussed this issue with the ARB's vehicle experts and consulted representatives of the Alliance of Automobile Manufacturers and the Association of International Automobile Manufacturers. These discussions focused on determining if there was some physical design factor in vehicle emission control systems that change how they respond to fuel property changes at the levels indicated by the stakeholder analysis. Staff learned that while many manufacturers do calibrate their emission control systems to emit at levels below the actual standard, there is no physical response differences between vehicles emitting just below 0.6 times the standard and those emitting just above 0.6 times the standard. This was important because the alternative statistical method did not produce consistent results at other cut points. Lacking a technical reason for using the suggested 0.6, staff was concerned that the result was more the product of a statistical anomaly than a meaningful point that defines vehicle emission performance. Staff also is concerned that the rational for the cutoff point of 0.6, applied specifically to NOx to produce an optimal statistical model, is not applicable to hydrocarbons and CO. The cutoff points that maximize the likelihood function for THC and CO are 1.0 and 1.6 times their tailpipe standard, respectively.

Staff also consulted with Dr. David Rocke of the University of California, Davis to provide comments and guidance regarding the validity of the Tech 4 NOx modeling approach proposed by the stakeholders. He concurred with staff that while the alternative approach might provide some improvement in statistical performance, other factors should be considered. In this case, it is essential that emissions modeling be consistent with sound engineering judgment and good science and have a sound basis relative to vehicle control system design and combustion chemistry. Relying on statistics as the sole guide to model construction could lead to misleading results. As a result, staff believes the suggested alternative is not appropriate and the approach taken to model Tech 4 vehicles in the previous Predictive Model modeling efforts should be maintained. This current approach was subject to independent scientific peer reviewed by

appointees from the University of California in 1994 and 1999 and found to be reasonable and scientifically supportable.

32. **Comment:** Early in the public workshop process, REAP took interest in the Dual Model approach recommended then by Dr. Jonathan Cohen from ICF International, and now by a wider set of experts (recently resubmitted by the Renewable Fuels Association as "The Case for a Dual Tech 4 Model Within the California Predictive Model"). The Dual Model approach was first discussed with ARB as far back as 1999. This approach would increase regulatory flexibility for refiners to utilize E10 while protecting air quality.

During the course of more than a dozen public workshops, ARB staff made a commitment to provide a formal, technical and written response to the Cohen report in advance of the release of the ISOR, so that the technical arguments could be reviewed and discussed in a workshop setting. This commitment was made in part because the Dual Model proposal appeared to more accurately represent the response of the vehicle fleet to fuel property changes on a statistical basis. ARB did not furnish this response (significantly) prior to the ISOR, and the response it did submit (prepared by Dr. David M. Rocke of the University of California, Davis) includes very little technical analysis (the entire letter is ~ 2 pages). The critical question was whether there is an engineering justification for splitting the Model (a vehicle question), yet a vehicle expert was not retained by the state to look at the issue (an engineering justification <u>for</u> the Dual Model was submitted to ARB by Gary Herwick of Transportation Fuels Consulting, Inc.).

Given that stakeholders have not been given a chance to review ARB's technical position with regard to the issues detailed in Dr. Rocke's response, REAP recommends delaying final implementation until ARB staff provides a more thorough analysis of the work submitted by ICF International, Gary Herwick and Tom Darlington (AIR, Inc.), which could be conducted as part of the "flexibility working group" referenced above. (BC)

Agency Response: Staff not only consulted with Dr. David Rocke of the University of California, Davis to provide comments and guidance regarding the validity of the Tech 4 NOx modeling approach proposed by the stakeholders, but also consulted with representatives of the Alliance of Automobile Manufacturers and the Association of International Automobile Manufacturers in regards to this approach. ARB staff believes it has provided enough detail and analysis to provide adequate grounds for rejection the dual model approach proposal. See also response to comment #31.

33. **Comment:** "The dual model proposed by RFA models Tech 4 vehicles – that is, 1986 to 1995 higher emitters – differently than normal vehicles that are complying with the applicable standards." (GH)

"What we learned from the analysis that is the dual model is not only a more accurate model that preserves the emission benefits of the California reformulated gasoline program, but it also would provide increased refining flexibility and help enable 10 percent ethanol. We believe the increase in refining flexibility provided by the dual model would result in increased fuel supply by facilitating the blending of 10 percent ethanol sooner. The staff proposal would make it more difficult to blend 10 percent ethanol and might even keep it at either 5.7 percent or at 7.7 percent." (GH)

"Several important changes have been proposed such as a lower sulfur cap, revising the sulfur NOx, curb, and the dual model. All of these deserve further consideration.

We would recommend allowing additional time to properly consider these changes, perhaps an extra couple or three months, another workshop, before the Board gets the opportunity to approve. Making the model as accurate as possible is in everyone's best interest to preserve the benefits of the RFG program." (GH)

Agency Response: Staff did a complete analysis of the dual model approach and consulted with Dr. David Rocke of the University of California, Davis to provide comments and guidance regarding the validity of the approach. Staff did not feel any more time was necessary to analyze the dual model approach. See also responses to comments #31 and #32.

12. Off Road Emissions

34. **Comment:** Currently, ARB's obligation to comply with Section 43013.1(b)(1) remains open because ARB has determined that CaRFG3 emissions from on and off-road sources exceed those from CaRFG2. Extensive studies have established that evaporative permeation emissions increase significantly with CaRFG3 when used in on-road vehicles. Off-road vehicles such as pleasure craft and lawnmowers also result in increased emissions when using CaRFG3. According to initial estimates by ARB, off-road vehicles will emit over 10 tons per day of evaporative reactive organic gases (ROG) in the South Coast Air Basin in 2010, surpassing on-road evaporative emissions in that year. ARB's staff report estimates that off-road evaporative emissions could be as high as 39 tons per day statewide and may only be partially offset by reductions in exhaust hydrocarbon emissions with the addition of more ethanol. Until all on-road and off-road emissions and air quality benefits of CaRFG2 are achieved,

ARB's obligations specified in Section 43013.1(b)(1) remain unfulfilled. Again, we urge you to resist any attempts by fuel providers to shift their current responsibilities under the law to public funds or programs.

We urge staff to move quickly to collect necessary data and propose further amendments to CaRFG3 and/or initiate other ARB regulations to fully mitigate the impacts of ethanol on off-road sources. ARB staff should return to the Board with a proposal for mitigation actions no later than 18 months from the June 14, 2007 board hearing. (BH, JS, LT, PM)

Agency Response: To improve the data and enable the design of an effective off-road mitigation strategy, staff is developing an emissions test program to provide enough information to reasonably quantify the impacts of ethanol on the emissions from off-road sources. This will allow a mitigation program, if appropriate, to be developed. Different off-road categories likely have different ethanol permeation rates. Staff is proposing to significantly expand the existing database of evaporative and exhaust emissions data for the off-road equipment. Impacts on permeation due to ethanol blending, engine exhaust emissions, changes due to increased oxygenates, and benefits of catalysts on reducing engine emissions will be studied.

The proposed program will be conducted in two phases. The first phase will be conducted at a Southwest Research Institute with a report made available within a year. The second phase will be conducted in-house by ARB staff and is expected to be completed in a longer time frame (2-3 years). This project will expand the number and types of engines being tested.

The suggested 18 month time period is very ambitious. Staff feels that such an ambitious time frame could impact the quality of the research necessary to do a complete and thorough investigation into off-road emissions. While staff agrees that it is important to quantify and mitigate off-road emissions as soon as possible, we also believe that it is important to take the time to ensure that the test program is thorough.

13. Alternative Emissions Reduction Program

35. **Comment:** We urge you to insure that the AERP is a temporary measure that is narrowly prescribed to only apply in limited situations and not a general compliance method. We support ARB's recommendation that the proposed AERP sunset on December 31, 2011. The AERP should provide refiners only temporary relief from meeting the full fuel formulation requirements of the proposed Predictive Model while refinery modifications are made.

We agree that emission reductions sought under the AERP must come from sources

related to the combustion of gasoline. The reductions should be quantifiable, verifiable and in excess of reductions created from different sources, required under other programs or part of on-going business practices. Furthermore, the emission reductions should occur in the same region in which the producer would normally distribute fuel. Banking of emission reductions under the AERP should be prohibited. (BH, JS, LT, PM)

Agency Response: The AERP provides producers with a temporary option that allows them to obtain emission reductions from other sources while they make refinery modifications to meet the full implementation date. The AERP will be required to be quantifiable and verifiable. The AERP option was designed to ensure that emission reductions occur in the same region in which the producer would normally distribute the fuel. Banking of emission reductions under the AERP is not allowed.

36. **Comment:** If ARB wants to mitigate the effects of permeation by reducing other sources of emissions, it should be the subject of a separate program and rulemaking, not part of the RFG regulations. The obligation to address ethanol permeation should be shared by not only our industry but the ethanol production industry and the automotive industry, so perhaps all parties could engage in the development of a program to reduce permeation emissions. WSPA is willing to work with ARB staff to define such a separate alternative program. (GG)

Agency Response: The mitigation of permeation by reducing other sources of emissions is a flexibility option that was incorporated into the regulation, i.e., as part of the AERP. As the AERP is an alternative to a fully compliant fuel formulation, inclusion in the CaRFG3 regulations is appropriate. The flexibility option is a temporary option that sunsets at the end of 2011 and is not intended to be a permanent part of the CaRFG3 regulations. Regulations to reduce other sources' emissions not associated with the fuel formulation have been and will continue to be handled separately. However, where the AERP is integrally tied to the fuel formulation as it is here, it is proper to include them in the CaRFG3 regulations.

The automotive industry is held to strict standards to reduce evaporative emissions. ARB staff will be reviewing these standards and pushing forward to reduce evaporative emissions from vehicles even further. The reduction of evaporative emissions from vehicles is wholly dependent upon the vehicle fleet turnover. The newer cars are equipped to reduce evaporative emissions better than older cars. Forcing the automotive industry to retrofit the older cars would be cost ineffective.

Producers have the option of putting from zero to ten percent by volume oxygen in gasoline. Producers can control the amount of emissions from their blends by

adjusting their fuel formulations. Producers have the option of incorporating or not incorporating ethanol into their gasoline during this transition period. A fully compliant non-oxygenated gasoline blend is a viable option for producers.

As part of the 15-day changes, the Board directed staff to allow third party AERPs. Under the third party AERP provisions, the ethanol production industry and the automotive industry can enter into an AERP allowing fuel producers to offset their emissions associated with permeation.

37. **Comment:** "Second, we recommend the AERP which is designed in our opinion as really a penalty for companies that can't comply with the two-year implementation date. That it's not really a fair mechanism and that it be replaced with language that would allow for the development of an alternative mechanism for achieving these emission reductions. And we recommend that because we are all involved in what we think are very productive discussions in the Legislature on this topic. And we're hopeful that will be a better mechanism for us to utilize offsetting the ethanol permeation." (CR)

Agency Response: The Phase 2 California Reformulated Gasoline (CaRFG2) regulations, approved in 1992, set specifications for eight fuel properties: sulfur, aromatics, oxygen, benzene, 50 percent distillation temperature, 90 percent distillation temperature, olefins, and Reid vapor pressure. To comply with the oxygen content requirement, producers chose to use MTBE. Soon after CaRFG2 implementation, the presence of MTBE in groundwater began to be reported. An investigation and public hearings were conducted resulting in the issuance of Executive Order D-5-99 on March 25, 1999. The Executive Order directed the phase-out of MTBE in California's gasoline.

During the December 1999 hearing, the Board recognized that permeation emissions from the use of ethanol in gasoline may be an issue and directed the staff to investigate the effects, with the understanding that additional modifications to the CaRFG3 regulations may be required. The modifications would be required in order to ensure that regulations adopted pursuant to Executive Order D-5-99 maintain or improve upon emissions and air quality benefits achieved by the CaRFG2 regulations as of January 1, 1999 (Health and Safety Code [H&SC] section 43013.1). H&SC section 43013.1 (SB 989) was approved by the Governor in October 1999.

Based on meetings with producers, pipeline distributors, CEC staff, and other stakeholders, ARB staff learned that some producers can already produce complying gasoline and some producers can make complying gasoline by the December 31, 2009 deadline with slight to no refinery modifications and virtually no change in production volumes. Without refinery modifications, staff estimates that production could decrease four to seven percent. With the refinery modifications, staff estimates that production could increase 3 to 10 percent. For

the producers that could not make complying gasoline by December 31, 2009 without significant production loss, staff was able to determine it would take up to four years to complete refinery modifications necessary to offset production loss that could come from meeting the requirements of these amendments. These refinery modifications include permitting, engineering, resources, and construction.

The ARB has longstanding legislative authority to "endeavor to achieve the maximum degree of emission reduction possible from vehicular and other mobile sources in order to accomplish the attainment of the state standards at the earliest practicable date." (Health and Safety Code [H&SC] section 43018(a).) As such, it is the Board's responsibility to determine the most effective approach to achieving this mandate. Relative to methyl tertiary-butyl ether (MTBE), ethanol increases oxides of nitrogen emissions as well as permeation emissions. The 2007 CaRFG3 amendments require refiners to mitigate permeation emissions beginning January 1, 2010, with an option for an alternative emissions reduction plan (AERP) that sunsets December 31, 2011. This action recognizes the need to expeditiously mitigate the permeation emissions and allows refiners adequate time to make necessary refinery modifications. It should also be noted that the 2007 CaRFG3 amendments allow a one year extension to the AERP.

Moreover, the CaRFG2 program is a major component of the California State Implementation Plan (SIP), which is a comprehensive strategy designed to attain federal air quality standards as quickly as possible. The implementation schedule of the updated Predictive Model (with the use of an AERP) facilitates expeditious attainment of those standards.

The CEC and MathPro, Inc., CEC's consultant, both concluded refiners will need to make modifications to their refineries to meet requirements of amendments. The Math Pro modeling report estimated that the modifications would take approximately 45 to 59 months to complete. ARB staff estimated that the refinery modifications could take up to 48 moths and allowed for a 12 moth extension to the AERP (the use of alternative emission mitigations), if conditions were necessary. Some refiners could already meet the amended regulations or would be able to meet the standard by December 31, 2009. Therefore, in order to obtain maximum feasible reductions as expeditiously as possible, requiring producers and importers that produce gasoline to use the revised Predictive Model starting December 31, 2009 (allowing for the use of alternative emission mitigations) and requiring the production of CaRFG compliant fuel with the revised Predictive Model by December 11, 2011 are appropriate.

ARB has not established a precedent for a four-year compliance period. WSPA prepared a summary showing 12.5 – 51 months for various CaRFG rulemakings. Therefore, the commenter is incorrect in stating that the historical lead time for the petroleum industry is four years. To adopt a four-year implementation period here based on any perceived historical lead time, as opposed to a technical basis, would be arbitrary and capricious. As discussed above, some producers

can already produce complying gasoline, others can use the AERP to comply in a cost-effective manner, and full compliance by 2012 is technologically feasible.

The commenter further suggests that the common-carrier pipeline future ethanol content requirements should be determined. However, any future changes to the common-carrier pipeline specifications are speculative and cannot be relied upon for the development of the current amendments.

The AERP is a flexibility option to ensure that emission increases caused by the addition of ethanol to gasoline are mitigated completely and expeditiously-consistent with State law requirements (Health and Safety Code section 43013.1(b)(1)). Health and Safety Code section 43013.1 requires that CaRFG3 preserve the emission benefits of CaRFG2. These benefits include emission reductions for pollutants, including precursors, identified in the State Implementation Plan for ozone, and emission reductions in potency-weighted air toxics compounds. The intent of the AERP is to serve as a flexibility option for producers that choose to incorporate it to offset some of the loss of production while refinery modifications are being made to offset losses in production. Producers are not required to use an AERP to come into compliance with the new regulatory requirements. There are several options that producers can choose to come into compliance with the 2007 CaRFG3 regulations without using the AERP. Another option would be to use the Predictive Model to adjust the eight regulated fuel properties to offset the permeation emissions and make a complying blend. In addition, the 2007 CaRFG3 amendments do not require ethanol use in gasoline. Producers have the option of putting from zero to ten percent by volume oxygen in gasoline. A fully compliant non-oxygenated gasoline blend is a viable option for producers. As the AERP is an option intended to offset emissions associated with permeation due to the use of ethanol in gasoline, an AERP is not necessary, and therefore not a penalty, for fuel blends that don't include ethanol.

The implementation period is necessary to achieve the maximum degree of emission reduction possible in order to accomplish the attainment of the state standards at the earliest practicable date and fulfill the requirements of H&SC section 43018(a). The ARB does not have authority to provide incentive funding to offset emissions associated with permeation from the use of ethanol in gasoline. Absent statutory authority, ARB may not offer "carrot approaches." Several individuals/organizations unsuccessfully attempted to gain new legislation in the 2007 Legislative regular session that provides for alternative funds to mitigate any emissions increases associated with the introduction of higher blends of ethanol up to 10 percent by volume, the alternative emissions reduction plan option, or both, including provisions to enable refiners and importers to take advantage of the amended CaRFG3 rules to introduce higher ethanol blends as early as feasible.

The AERP is a flexibility option incorporated as part of the amendments to the CaRFG3 regulations. The AERP was designed to provide producers an alternative way to offset emissions from permeation while refinery modifications are being made to allow the production of fully compliant fuel formulations. Producers have the option of not using it. ARB staff believe in providing producers as much flexibility as possible and removing the AERP would reduce flexibility.

16. Multimedia Evaluation

38. **Comment:** Health and Safety Code Section 43830.8 requires that ARB may not adopt any regulation that establishes a specification for motor vehicle fuel unless that regulation and a multimedia evaluation are reviewed by the California Environmental Policy Council. ARB claims in the ISOR, page 52 the "proposed amendments do not change specifications of CaRFG3 gasoline" and thus do not trigger the multimedia evaluation.

The characterization that the "proposed amendments do not change specifications" is not accurate. Currently, the regulations stipulate that the primary means of compliance in CaRFG3 are the (flat) specifications listed in Section 2262 of the regulations. Use of the Predictive Model and the vehicle test option are identified as alternative methods of compliance. This will change under the new regulations. The (flat) specifications can only be used in combination with an AERP, which will sunset on 12/31/11. As a result, the primary means of compliance with the regulations will no longer be available, and the Predictive Model will become the only means of compliance. This change has occurred because significant new requirements to offset permeation emissions due to ethanol have been added to the Predictive Model, but the specifications (i.e. flat and average limits) have not been changed to reflect these additional requirements.

WSPA believes the multimedia evaluation is required because:

1) the existing (flat and average) specifications will no longer be a valid compliance option for CaRFG3, and,

2) the new specifications represented in the Predictive Model are significantly more stringent than the current specifications. (GG)

Agency Response: Historically, use of the Predictive Model and the vehicle test options did not trigger the requirement for a multi-media evaluation even though refiners could, and probably did, use different formulations for their respective Predictive Model formulations and vehicle test formulations. The multi-media evaluation was not required for these options because the Predictive Model and

vehicle test options are not “specification[s] for motor vehicle fuels.” (H&SC section 43730.8(a).)

The Predictive Model is a set of mathematical equations that relate emission rates of exhaust hydrocarbons, oxides of nitrogen (NOx), and combined exhaust toxic species to the values of the eight regulated gasoline properties. Emissions of each pollutant type are predicted by equations formulated separately for vehicles of different technology classes. The CaRFG3 Predictive Model constrains exhaust emissions of NOX, VOCs, and cancer-potency-weighted toxic air contaminants (that is, acetaldehyde, benzene, 1,3-butadiene, and formaldehyde), and evaporative emissions of VOCs and benzene. Thus, numerous different fuel formulations are possible, but each is manufactured to have similar emissions through the adjustment of various fuel properties, such as sulfur content, aromatic content, etc.

Under the emission testing option, a gasoline producer applies for certification of an alternative gasoline formulation found through emission testing to result in emissions equivalent to gasoline meeting the CaRFG2 flat limits. The test fuel is compared directly to the reference fuel which meets the CaRFG2 flat limits. The comparison is made by testing a group of vehicles, in vehicle categories that reflect the on-road fleet mix, on both the test and the reference fuel. To be certified, a test fuel must result in exhaust emissions of carbon monoxide, oxides of nitrogen, non-methane organic gases (NMOG) on a mass basis, NMOG on an ozone-forming potential basis and the potency-weighted sum of toxic pollutants that do not individually exceed the emissions of the same pollutants when the reference fuel is used. Like the Predictive Model option, numerous different fuel formulations are possible. Whether validated by the Predictive Model or by emission testing, no alternative limit may exceed the cap limit for the property.

The proposed amendments do not change the flat or averaging specifications of CaRFG3 gasoline and will not require a gasoline ingredient to be added or removed beyond what is already used to produce gasoline for sale in California. The amendments only change the certification criteria and the range of fuels likely to be produced fall into the range covered by the multimedia evaluation done in 1999.

17. Ethanol Flexibility

39. **Comment:** Flexibility for gasoline producers to vary the amount of ethanol they add to gasoline is beneficial since it allows the industry to respond to shifts in supply and demand in a timely manner. Currently there is a substantial barrier to such flexibility in Section 2266.5(f)(1)(C) which virtually prohibits changes in ethanol content. We believe significant flexibility could be added without environmental harm by making the following modifications to the regulations.

1. Eliminate 2266.5(f)(1)(C)(1). This requirement is too vague to be useful.

2. Modify 2266.5(f)(1)(C)(2) to limit changes in oxygen content to 1.4 mass % oxygen. This would allow up to a 4% change in ethanol content at any one time. For example, a blender could change from 6% ethanol to 10% ethanol in one step by following these procedures.

3. Modify 2266.5(f)(1)(C)(3) to require a volume addition of at least three times the heel, not four times the heel. The original requirement is too burdensome and the difference between three and four is not large enough to make a difference.

4. Eliminate 2266.5(f)(1)(C)(4). This requires CARBOB to have a sulfur level of less than 12 ppm. The level of sulfur in a complying CARBOB is irrelevant and should not be included. If the CARBOB passes the Predictive Model test, then any level of sulfur should be acceptable. Concerns about excess emissions caused by mixing CARBOBs will not be addressed by this step, but by controlling the size of the heel as in subparagraph (3). (GG)

Agency Response: The CaRFG3 regulations in effect prior to the adoption of section 2266.5(f)(1)(C) prohibited the blending of CARBOB that is downstream from a production or import facility with other CARBOB, gasoline, blendstock or oxygenate. (2266.5(h)). Downstream CARBOB could only be combined with other CARBOB that has been designed to have the same type and amount (or range of amounts) of oxygenate added and with the type and amount of oxygenate for which it is designed. Generally, when ethanol is added to gasoline, the RVP of the gasoline is increased, and this will result in increased evaporative emissions. Two CARBOBs that are to be blended with different amounts of ethanol cannot be mixed because it becomes difficult to determine the appropriate amount of ethanol to add to the resulting blend of CARBOBs; consequently, the final blend may not comply with the regulations, resulting in increased emissions.

The regulations also recognize that there could be operational business reasons for mixing CARBOB with California gasoline or other CARBOB during a changeover in service of a storage tank. Consequently, section 2266.5(f)(2) allows the Executive Officer to enter into a written protocol with any person to identify conditions under which such mixing would be permitted. However, to simplify the transition from one gasoline oxygen content to another, it is preferable to have the regulations identify the conditions under which the mixing of two products will always be permitted. Staff conducted an analysis and determined that the regulations could be modified to allow transitions at the storage tank under specific conditions and constraints that would preserve

emissions benefits. Therefore, staff narrowly defined those situations in which mixing of different CARBOBs would be allowed. Elimination or modification of 2266.5(f)(1)(C)1-4 would result in uncontrolled mixing of different CARBOBs and ultimately, increases in emissions.

Specifically, 2266.5(f)(1)(C)1 allows the mixing of different CARBOBs if the change in service of the tank is for legitimate operational reasons and is not for the purpose of combining the different types of CARBOB. Deletion of this provision would allow refiners and producers to mix different CARBOBs for any reason. As 2266.5(f)(1)(C) was intended to "permit the mixing of CARBOBs designed for different oxygen levels as part of a change of service of a terminal tank," (ISOR released on September 29, 2000, page 18) deletion would thwart the purposes of this provision. Staff disagrees that this provision is too vague. Throughout the 2000 rulemaking on follow up amendments to the CaRFG3 regulations, there were no questions or comments on the vagueness of 2266.5(f)(1)(C) (see Final Statement of Reasons, Public Hearing To Consider Follow-Up Amendments To The California Phase 3 Reformulated Gasoline Regulations, Public Hearing Date: November 16, 2000.

The Initial Statement of Reasons (ISOR) which was issued when this rule was originally adopted in 2000 states, "The staff is proposing amendments that would permit the mixing of CARBOBs designed for different oxygen levels as part of a change of service of a terminal tank, as long as certain conditions are met… Staff has conducted an emissions analysis indicating no significant emission increases in these circumstances."

With respect to 2266.5(f)(1)(C)2, which provides, "The initial and new CARBOBs are designated for blending with different amounts (or ranges of amounts) of oxygen, and the change in oxygen content will not exceed 1.1 weight percent of the oxygenated gasoline blend," staff believes that allowing 1.4 wt% oxygen content would result in an emission increase.

With respect to 2266.5(f)(1)(C)3, which provides, "The volume of the new CARBOB that is added to the tank is at least four times as large as the volume of the initial CARBOB in the tank," staff believes that allowing a volume addition of at least three times the heel will also result in an emission increase. In the 2000 rulemaking, staff originally proposed a 9 to 1 dilution. Following a comment on the restrictiveness of this requirement, staff then performed additional analyses and found that the tank heel requirement of 10 percent can be changed to 20 percent (4 to 1 dilution) for a transition from a CARBOB formulated for one oxygen content to a CARBOB formulated for another oxygen content, without adverse emissions impacts. A further dilution would result in an emission increase.

Finally, 2266.5(f)(1)(C)4 provides, "The sulfur content of the new CARBOB added to the tank is no more than 12 parts per million." Staff disagrees with the

recommendation that this limit be eliminated and further disagrees with the notion that the level of sulfur in CARBOB is irrelevant and any level of sulfur should be acceptable. In this rulemaking, staff proposed decreasing the sulfur cap limit to 21 ppmw for CARBOB beginning December 31, 2009 to improve enforceability of the CaRFG3 program and to help protect the performance of the vehicles' sulfur-sensitive emission control components. Likewise, the sulfur limit of the new type of CARBOB being added to a storage tank will improve enforceability of the CaRFG3 program and facilitate newer engine technology by protecting the performance of sulfur-sensitive emission control components.

18. Ethanol Specifications

40. **Comment:** The specification for ethanol is an important component of the overall regulatory package and ARB has, when necessary, adopted a specification that is more stringent than ASTM. In particular, WSPA believes that the current sulfur specification for ethanol - 10 ppm - is too high. ARB believes that future sulfur concentrations in gasoline will be lower than they are today and will approach zero in many cases. If this is the case, then sulfur in ethanol could raise the gasoline sulfur level significantly. We believe that the specification for ethanol sulfur should be consistent with the lowest levels of sulfur needed for gasoline blends. The exact level should be the subject of discussion between ARB, ethanol suppliers and refiners. WSPA recommends that the Board instruct ARB staff to evaluate ethanol specifications and take appropriate action on this item. (GG)

Agency Response: ARB will consider future action on this item. This item was not covered in the hearing notice and did not fall within the scope of this rulemaking.

19. Regulation Modifications

41. **Comment:** The current regulations contain a number of provisions that are not relevant and are not likely to be used in the future. WSPA recommends the regulatory language be revised to take into account how the regulations are used. Specifics are described below.

1. Eliminate vehicle testing option

The current regulations allow a fuel producer to certify a blend composition by conducting a vehicle test program. Initially, it was felt this was a viable option for producers considering unusual or novel blends not described by the Predictive Model. This option is expensive and complicated. As refiners have gained experience with the various versions of the Predictive Model, it is commonly accepted as a good representation of the relationship between fuel quality and emissions.

Alternative formulations are unlikely to be successfully approved through a vehicle test program.

To the best of our knowledge the vehicle option has never been used and we believe it is highly unlikely to be used in the future. WSPA proposes its elimination from the regulations.

2. The Predictive Model is the only compliance option

The regulations, as currently written, implicitly suggest that complying gasoline can be made by meeting the flat or average limit specifications. This is not the case in the summer. Since gasoline meeting the limits has excess permeation emissions in the summer, the only way to produce complying summertime gasoline is by using the Predictive Model. Thus, the Predictive Model is the single most important piece of the regulations and should be recognized as such.

In the winter, when the evaporative part of the Predictive Model is not active and permeation emissions are not considered, it is possible to make a complying gasoline by using the flat and average limits. However, we believe that even in the winter, most, if not all, gasoline blends are made using the Predictive Model. (GG)

Agency Response: Staff is committed to providing the maximum amount of flexibility for producers. The vehicle testing option is one such flexibility provision. Although it has yet to be used, staff sees no advantage to eliminating this provision from the regulation. In fact, eliminating this flexibility could be considered a potential negative impact to supply and production of CaRFG3 in California. Elimination of the vehicle testing option was not covered in the hearing notice and does not fall within the scope of this rulemaking.

Staff agrees that the Predictive Model is a very important component of the CaRFG3 regulations. However, staff disagrees that complying gasoline could not be made using the flat or averaging specifications. Staff explicitly allowed the use of flat or averaging limits, with the caveat that emissions associated with permeation must be offset. The proposed amendment to 2262.3(b) provides, "Notwithstanding section 2265.5(a), a producer or an importer that produces gasoline and that has elected to be subject to the flat limits specified in section 2262 shall offset its emissions associated with permeation by complying with sections 2265.5(b) – (i). An importer that does not produce gasoline shall not sell, offer for sale, supply, or offer for supply California gasoline if the gasoline creates emissions associated with permeation." Furthermore, the proposed amendment to 2262.3(c) provides, "Notwithstanding section 2265.5(a), a producer or an importer that produces gasoline and that has elected to be subject to an averaging limit specified in section 2262 shall offset its emissions associated with permeation by complying with sections 2265.5(b) – (i). An importer that does not

produce gasoline shall not sell, offer for sale, supply, or offer for supply California gasoline if the gasoline creates emissions associated with permeation."

On pages 30-34 of the Initial Statement of Reasons, released April 27, 2007, staff provided detailed analyses for two AERP examples. In the first example, staff calculated the amount of mitigation required and the associated AERP costs if a producer uses the flat limits for their fuel formulation and does not choose to mitigate any increased permeation emissions through an alternative fuel formulation. In the second example, staff calculated the mitigation requirement and AERP costs for the situation where a producer chooses to mitigate some of the increased emissions using an alternative fuel formulation. In both examples, the percent change in ozone forming potential is an output from the Predictive Model. This is variable and is dependent on the fuel formulation entered into the Predictive Model. Moreover, the percent change in NOx is also an output from the Predictive Model. This too is variable and is dependent on the fuel formulation entered into the Predictive Model.

COMMENTS RECEIVED DURING THE 15-DAY COMMENT PERIOD

20. Regulation Modifications

42. **Comment:** We are disappointed that producers and oxygenate blenders were not given a more straightforward option to offset emissions resulting from early ethanol blending using non-fuel measures. Similar in concept to the Carl Moyer program, such an option would give parties that do not have the ability to mitigate the emissions impact using their fuel formulation another avenue to blend increased volumes of ethanol into current CARBOBs while maintaining or improving emissions benefits. (JPU)

Agency Response: Staff provided two alternatives to increase ethanol blending. Staff did not include the suggested option that relied on a Carl Moyer-type program. Such a program would be implemented by the California air pollution control districts (air districts).

There are several reasons why such a provision was not considered. First, the option would require the specification of a specific dollar amount per ton of emissions emitted. The actual amount of emissions could be quantified. However, concerning the dollar amount, staff was unable to reach any specific consensus between the air districts and the industry representatives that would use the option. Costs ranged between $2,500 and $24,000 per ton of emissions. Consensus was important because the option is voluntary; too low and the air districts would not support and too high and the industry would not use. In addition, the California Air Pollution Control Officers Association raised other policy issues and concerns. These air district concerns included: (1) The need to

require 1.5 tons of emissions reductions for every one ton of emissions to ensure that actual emission reductions are achieved; (2) The need to have a higher cost effectiveness value; (3) Concern, based on recent information, that the program may lead to increases in greenhouse gases; and (4) The need to have a greater level of protection for assuring that the wholeness of the NOx offsets be achieved. Due to these complexities, the staff chose not to include this option.

21. Ethanol Emissions Reduction Plan (EERP)

43. **Comment:** Can offsetting emissions with lower-emitting batches of gasoline be used as an option for an EERP or AERP similar to the permissible option of "offsetting emissions with lower emitting diesel fuel batches" listed in 2265.5(b)(6)? If no, why not? (CR)

Agency Response: Section 2265.5(b)(6) provides, "AERPs may include, but are not limited to: (A) Vehicle scrappage, (B) Offsetting emissions with lower emitting diesel fuel batches, (C) Incentive grants for cleaner-than-required engines, equipment and other sources of pollution providing early or extra emission reductions." This list was not intended to be limiting, but rather, to provide some common examples of offsetting mechanisms. A lower-emitting batch of gasoline may be used as an option provided it meets the requirements of section 2265.5.

23. Alternative Emission Reduction Plan (AERP)

44. **Comment:** Regarding the proposed Alternative Emission Reduction Plan ("AERP") for refiners that cannot meet the new standard within the first two years (now only approximately 20 months) they are forced to use the AERP in order to stay in compliance. As a result, not only do refiners have to pay the costs and provide the resources associated with making the refining modifications to be in compliance, but they will also have to pay the AERP penalty and oversee the complex AERP program development, CARB approval, and execution for their facilities. Accordingly, the AERP has the potential to punitively impact refiners for fuel blend deficiencies (permeation) not of their making and beyond their control. (DWS)

Agency Response: This comment does not pertain to the 15 day changes.

The Phase 2 California Reformulated Gasoline (CaRFG2) regulations, approved in 1992, set specifications for eight fuel properties: sulfur, aromatics, oxygen, benzene, 50 percent distillation temperature, 90 percent distillation temperature, olefins, and Reid vapor pressure. To comply with the oxygen content requirement, producers chose to use MTBE. Soon after CaRFG2 implementation, the presence of MTBE in groundwater began to be reported. An investigation and public hearings were conducted resulting in the issuance of

Executive Order D-5-99 on March 25, 1999. The Executive Order directed the phase-out of MTBE in California's gasoline.

During the December 1999 hearing, the Board recognized that permeation emissions from the use of ethanol in gasoline may be an issue and directed the staff to investigate the effects, with the understanding that additional modifications to the CaRFG3 regulations may be required. The modifications would be required in order to ensure that regulations adopted pursuant to Executive Order D-5-99 maintain or improve upon emissions and air quality benefits achieved by the CaRFG2 regulations as of January 1, 1999 (Health and Safety Code [H&SC] section 43013.1). H&SC section 43013.1 (SB 989) was approved by the Governor in October 1999.

Based on meetings with producers, pipeline distributors, CEC staff, and other stakeholders, ARB staff learned that some producers can already produce complying gasoline and some producers can make complying gasoline by the December 31, 2009 deadline with slight to no refinery modifications and virtually no change in production volumes. Without refinery modifications, staff estimates that production could decrease four to seven percent. With the refinery modifications, staff estimates that production could increase 3 to 10 percent. For the producers that could not make complying gasoline by December 31, 2009 without significant production loss, staff was able to determine it would take up to four years to complete refinery modifications necessary to offset production loss that could come from meeting the requirements of these amendments. These refinery modifications include permitting, engineering, resources, and construction.

The ARB has longstanding legislative authority to "endeavor to achieve the maximum degree of emission reduction possible from vehicular and other mobile sources in order to accomplish the attainment of the state standards at the earliest practicable date." (Health and Safety Code [H&SC] section 43018(a).) As such, it is the Board's responsibility to determine the most effective approach to achieving this mandate. Relative to methyl tertiary-butyl ether (MTBE), ethanol increases oxides of nitrogen emissions as well as permeation emissions. The 2007 CaRFG3 amendments require refiners to mitigate permeation emissions beginning January 1, 2010, with an option for an alternative emissions reduction plan (AERP) that sunsets December 31, 2011. This action recognizes the need to expeditiously mitigate the permeation emissions and allows refiners adequate time to make necessary refinery modifications. It should also be noted that the 2007 CaRFG3 amendments allow a one year extension to the AERP.

Moreover, the CaRFG2 program is a major component of the California State Implementation Plan (SIP), which is a comprehensive strategy designed to attain federal air quality standards as quickly as possible. The implementation schedule of the updated Predictive Model (with the use of an AERP) facilitates expeditious attainment of those standards.

The CEC and MathPro, Inc., CEC's consultant, both concluded refiners will need to make modifications to their refineries to meet requirements of amendments. The Math Pro modeling report estimated that the modifications would take approximately 45 to 59 months to complete. ARB staff estimated that the refinery modifications could take up to 48 moths and allowed for a 12 moth extension to the AERP (the use of alternative emission mitigations), if conditions were necessary. Some refiners could already meet the amended regulations or would be able to meet the standard by December 31, 2009. Therefore, in order to obtain maximum feasible reductions as expeditiously as possible, requiring producers and importers that produce gasoline to use the revised Predictive Model starting December 31, 2009 (allowing for the use of alternative emission mitigations) and requiring the production of CaRFG compliant fuel with the revised Predictive Model by December 11, 2011 are appropriate.

ARB has not established a precedent for a four-year compliance period. WSPA prepared a summary showing 12.5 – 51 months for various CaRFG rulemakings. Therefore, the commenter is incorrect in stating that the historical lead time for the petroleum industry is four years. To adopt a four-year implementation period here based on any perceived historical lead time, as opposed to a technical basis, would be arbitrary and capricious. As discussed above, some producers can already produce complying gasoline, others can use the AERP to comply in a cost-effective manner, and full compliance by 2012 is technologically feasible.

The commenter further suggests that the common-carrier pipeline future ethanol content requirements should be determined. However, any future changes to the common-carrier pipeline specifications are speculative and cannot be relied upon for the development of the current amendments.

The AERP is a flexibility option to ensure that emission increases caused by the addition of ethanol to gasoline are mitigated completely and expeditiously-consistent with State law requirements (Health and Safety Code section 43013.1(b)(1)). Health and Safety Code section 43013.1 requires that CaRFG3 preserve the emission benefits of CaRFG2. These benefits include emission reductions for pollutants, including precursors, identified in the State Implementation Plan for ozone, and emission reductions in potency-weighted air toxics compounds. The intent of the AERP is to serve as a flexibility option for producers that choose to incorporate it to offset some of the loss of production while refinery modifications are being made to offset losses in production. Producers are not required to use an AERP to come into compliance with the new regulatory requirements. There are several options that producers can choose to come into compliance with the 2007 CaRFG3 regulations without using the AERP. Another option would be to use the Predictive Model to adjust the eight regulated fuel properties to offset the permeation emissions and make a complying blend. In addition, the 2007 CaRFG3 amendments do not require ethanol use in gasoline. Producers have the option of putting from zero to ten percent by volume oxygen in gasoline. A fully compliant non-oxygenated

gasoline blend is a viable option for producers. As the AERP is an option intended to offset emissions associated with permeation due to the use of ethanol in gasoline, an AERP is not necessary, and therefore not a penalty, for fuel blends that don't include ethanol.

The implementation period is necessary to achieve the maximum degree of emission reduction possible in order to accomplish the attainment of the state standards at the earliest practicable date and fulfill the requirements of H&SC section 43018(a). The ARB does not have authority to provide incentive funding to offset emissions associated with permeation from the use of ethanol in gasoline. Absent statutory authority, ARB may not offer "carrot approaches." Several individuals/organizations unsuccessfully attempted to gain new legislation in the 2007 Legislative regular session that provides for alternative funds to mitigate any emissions increases associated with the introduction of higher blends of ethanol up to 10 percent by volume, the alternative emissions reduction plan option, or both, including provisions to enable refiners and importers to take advantage of the amended CaRFG3 rules to introduce higher ethanol blends as early as feasible.

Based on meetings with producers, pipeline distributors, CEC staff, and other stakeholders, staff learned that most producers can meet the changes in regulations with only limited reduction in production. However, to offset this reduction in production some producers would have to do refinery modifications. In these meetings, many producers indicated that the refinery modifications would take approximately four years. Therefore, staff set a full implementation date of December 31, 2011 with a provision that producers could apply for a one year extension of the AERP if there were some unexpected circumstances that prevented them from coming into compliance by that date.

25. Need for Higher Offset Ratio

45. **Comment:** CARB staff is proposing in Section 2265.5 that the Alternative Emission Reduction Plan (AERP) require equivalent or better emission reduction benefits for NOx, total ozone forming potential, and potency-weighted toxics. Given that there are inherent uncertainties in the modeling and inventory associated with these emissions; in addition, the impact of higher ethanol blends use of off-road sources is not reflected in the current version of the Predictive Model, the AQMD staff recommends that an offset ratio of 1.5:1 for each of these emission categories be required to ensure that the emission impacts of added ethanol blending are mitigated to the fullest extent possible. We recognize that staff are attempting to gain additional information in these area. However, given the timelines incorporated in the current proposal and the urgent need to expedite emission reductions in the South Coast Air Basin, we consider an offset ration of 1.5:1 to be the most direct, effective and fair reconciliation

of these concerns at this time. These reductions should also be achieved on a contemporaneous basis. (BRW)

Agency Response: This comment does not pertain to the 15 day changes. However, with all models, there are some uncertainties and the impacts of ethanol blends on off-road sources are unknown. In order to have the most complete model possible, staff has incorporated all known relevant emission data into the Predictive Model. The Predictive Model is designed to offset known emissions gleaned through testing. ARB is attempting to offset known emissions, rather than the speculated amount of emissions, such as those that may occur from off-road sources. ARB is currently undertaking an off-road emission test program to quantify these emissions. Until those emissions are quantified, to attempt to mitigate more than is required by the law would be arbitrary and capricious.

26. Tighter and More Expedited Sulfur Limit

46. **Comment:** It was noted at the June 2007 hearing that 5 ppm sulfur levels are needed to achieve full flexibility and emission benefits associated with the revised Phase 3 gasoline requirements**.** In order to ensure that the 5 ppm level is attained in use, the AQMD staff urge CARB to set a sulfur cap limit at a level no higher than 10 ppm. Such a lower limit is necessary to enable advanced fuel efficiency technologies such as lean NOx catalyst technology. In addition, such a standard would align California gasoline sulfur requirements with Japan and the European Union, and ensure that the maximum potential emission reductions are achieved from gasoline. It should also be noted that under the CARB proposed sulfur cap California's gasoline sulfur limits would still be less stringent than the 15 ppm sulfur limit imposed on diesel fuel. (BRW)

Agency Response: This comment does not pertain to the 15 day changes. See also response to comment # 2.

47. **Comment:** With respect to the timeframe, CARB staff is proposing that the sulfur cap limit of 20 ppm be phased in by December 31, 2011 rather than February 14, 2009 as originally provided in the June 2007 staff recommendation.[1] This delay of over 2 ½ years is unnecessary, given the readily available excess gasoline desulphurization capacity already in place in California refineries. While this relaxation provides additional flexibility to refiners, it is unwarranted in the face of critical need to supply the cleanest gasoline possible as soon as possible. Given the clear benefits associated with lower sulfur levels, we urge CARB to retain the original proposed deadline of February 14, 2009 for its most stringent sulfur limit. We also believe that a 10 ppm sulfur limit is achievable in that

[1] Staff Report, Initial Statement of Reasons (ISOR), Appendix A, Proposed CARFG3 Regulations Including Predictive Model Procedures, April 27, 2007, pg A-7.

time frame, and further recommend that the expedited schedule reflect such a limit. (BRW)

Agency Response: While ARB does recognize the clear benefits associated with lower sulfur levels, after meeting with individual refiners, staff made a determination that many of the modifications being made to the refineries to come into compliance with the amendments to the CaRFG3 regulations were directly related to lowering sulfur. Many of these modifications were deemed to take from two to four years. Therefore, staff decided that the December 31, 2011 for the phase in of the sulfur cap limit was more appropriate.

27. Greenhouse Gas Impacts

48. **Comment:** The evolution to E10 in California – the largest gasoline market in the U.S. – will accelerate the pressure for increased corn-based ethanol production. The natural acreage devoted to corn production increased from 80 million acres to 93 million from just 2006 to 2007. Additional corn ethanol demand pressures may in fact result in INCREASED greenhouse gas emissions, according to some researchers.[2] Certain key assumptions made by CARB staff regarding the GHG efficacy of corn-based ethanol are coming under tighter scrutiny from a number of researchers. Nobel Prize winning chemist Dr. Paul Crutzen, for example, has published an important paper which challenges the key GHG parametric assumption which drives the current belief that there is a slight GHG benefit association with corn-based ethanol.[3] Dr. Crutzen's analysis, which became available in August after the June hearing, indicates that four percent – rather than two percent – of nitrogen applied as fertilizer converts to nitrous oxide (N_20) in the atmosphere. As a result of the updated "land use" effect on a potent GHG emission sources, the assumed net benefit associated with corn-based ethanol blends becomes a net increase in GHGs once this impact on nitrous oxide emissions is better estimated. We therefore recommend that proposed Section 2261(b)(5)(C) include a provision that the GHG assessment underlying the program is to be annually updated to ensure that the incremental impacts of the Ethanol Emission Reduction Plan (EERP) and the Alternative Emissions Reduction Plan (AERP) do not exacerbate GHGs on a full life cycle basis. (BRW)

Agency Response: The United States Congress recently enacted the Energy Independence and Security Act of 2007 (2007 Energy Act).[4] The 2007 Energy Act requires a rapid expansion of use of renewable fuels. Based on the Act, the

[2] Timothy Searchinger, "Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change", Science Magazine, February 29, 2008.
[3] Dr. Paul Crutzen, Mosler, Smith and Winiwarter, "N_20 Release from Agro Biofuel Production Negates Global Warming Reduction by Replacing Fossil Fuels", Atmospheric Chemistry and Physics Discussions, 7, 11911-11205, August, 2007.
[4] PUBLIC LAW 110–140—DEC. 19, 2007, 121 STAT. 1493

U.S. Environmental Protection Agency now requires that fuel producers must increase their use of renewable fuels, generally ethanol, from a required average content in gasoline of 4.0% to 7.76% by volume in calendar year 2008.[5] Current California gasoline contains about 5.7% ethanol. In addition, ARB staff estimates that the required renewable fuel volumes in the 2007 Energy Act will necessitate a nationwide average of 9% ethanol in gasoline in 2009, and 10% in 2010.

The 2007 Energy Act requires substantial expanded production of advanced biofuels, such as ethanol derived from cellulosic material. However, compliance dates with these requirements are several years in the future, and it is expected that virtually all of the near term increased use of renewable fuel is likely to be accomplished through the use of ethanol derived from corn.

There are several impacts of this new legislation that are relevant to the current rulemaking and to the consideration of early blending options.

First, fuel producers now have a much greater obligation under federal law to use greater amounts of renewable fuels in the 2008 to 2009 timeframe. In fact, certain California fuel producers have indicated that they need an early blending option in order to comply with their obligations under the new federal requirements for increased use of renewable fuels.

Second, at the time the Board acted in June 2007 it was thought that, because national ethanol volumes far exceeded the minimum renewable fuel volume requirements of the 2005 Energy Act, additional early use in California would result in a net increase in ethanol use. However, much higher nationwide volume requirements have been established in the 2007 Energy Act and are now in place. Staff believes it is unlikely that a near term increase in ethanol use in California will have any impact on the amount of corn-based ethanol produced and consumed in the U.S. market.

Consideration of Greenhouse Gas Benefits of Crop-Derived Biofuels

During its consideration of the proposed amendments, the Board received testimony that flexibility to allow early blending of higher levels of ethanol would produce greenhouse gas (GHG) emission benefits. This premise appeared reasonable at that time. It was consistent with ongoing work at the Board and the California Energy Commission that suggested a GHG benefit when gasoline was replaced with ethanol derived from corn under most circumstances. However, our past assessments of the lifecycle GHG emissions attributable to current biofuel production did not account for indirect land use impacts, and new information suggests that these impacts are likely to be significant.

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[5] United States Environmental Protection Agency, "Revised Renewable Fuel Standard for 2008, Issued Pursuant to Section 211(o) of the Clean Air Act as Amended by the Energy Independence and Security Act of 2007," [FRL-8528-9], Federal Register, Vol. 73, No. 31, February 14, 2008.

For example, articles recently published in Science magazine have questioned the net greenhouse gas emissions benefits of using ethanol derived from corn.[6] In general, the assessments point to indirect land use changes and increased greenhouse gas generation as a result of past and future reliance on crop-based biofuels. However, several individuals and organizations have challenged the assumptions and conclusions in the Science articles.[7] At present, there is no reliable quantification of the lifecycle greenhouse gas emissions resulting from the increased use of biofuels.

The ARB's CaRFG3 regulations do not currently address or regulate greenhouse gas emissions. Staff is currently in the process of developing a low carbon fuel standard (LCFS) for California. As part of the LCFS effort, ARB staff is carefully evaluating these studies and other data to determine and quantify the GHG emission impacts of a wide range of transportation fuels. The LCFS will be developed in consultation with top national and international experts on the issue. The ARB staff intends to consider emissions relating to both direct and indirect land use, extraction, production, refining, and transport in the LCFS effort to ensure an accurate accounting and mitigation of the potential impacts, if any, compared to fuels sold today.

Further work is needed to determine the land use consequences and greenhouse gas emissions attributable to increased use of corn-based ethanol. At this time staff believes it is premature to conclude that increased ethanol use in California would produce greenhouse gas benefits.

Conclusions on Impact of Early Blending on California GHG Emissions

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[6] Searchinger, T., R. Heimlich, R.A. Houghton, F. Dong, A. Elobeid, J. Fabiosa, S. Tokgoz, D. Hayes, and T.H. Yu, 2008, "Use of U.S. Croplands for Biofuels Increases Greenhouse Gases through Emissions from Land Use Change," Sciencexpress, available at www.sciencexpress.org, February. 7, 2008

Department of Energy, "New Studies Portray Unbalanced Perspective on Biofuels: DOE Committed to Environmentally Sound Biofuels Development," available at http://www1.eere.energy.gov/biomass/printable_versions/news_detail.html?news_id=11574, February 14, 2008.

[7] Wang, M., and Z. Haq, 2008, "Response to February 7, 2008 Sciencexpress Article," Letter to Science, available at http://www.transportation.anl.gov/media_center/news_stories/20080214_response.html, February 14, 2008

Mueller, S., 2008, "Sensitivity of Presented GHG Land Use Change Calculations," Comments to the Air Resources Board, available at http://www.arb.ca.gov/lists/lcfs-lifecycle-ws/9-erc_luc_comments.pdf, February 6, 2008

Based on the uncertainty of current GHG impact assessments and the impact of the 2007 Energy Act, staff believes it is inappropriate at this time to assume that GHG emissions will either increase or decrease with early blending of ethanol. First, because of the increased volume requirements for ethanol on the federal level, increased ethanol blending in California in the next two years will likely have no impact on the emissions of greenhouse gases because the national level of production and use is unlikely to change with greater blending in California. Second, due to uncertainty in estimating the net lifecycle GHG impacts of crop based biofuels, staff believes that more data is needed be any such effect could be quantified. As part of the LCFS, the ARB staff will propose appropriate regulations to ensure that progress is made to move quickly to low carbon fuels.

28. Hydrocarbon Permeation Emissions

49. **Comment:** CARB is assuming that permeation emissions do not increase as a result of increasing ethanol content from 5.7% to 10% in gasoline. There is very little data available on this key assumption. The changes being proposed allow for a 75% increase in ethanol blend levels in gasoline. Rather than assume the best possible outcome, it would be far more prudent to assume that there may be some increase. Even if the increase is relatively small in percentage terms, given the 16^{+} billion gallons of annual gasoline consumption statewide, it is very possible that permeation emissions impact of these upcoming modifications could be meaningful. CARB staff acknowledged that the fundamental chemical/materials mechanisms governing permeation are still not well understood. A categorical assumption of no additional impact on permeation HCs from an increase from 5.7 to 10 percent ethanol blend level is directly analogous to the erroneous assumption on permeation emissions back in 2003.

The Coordinating Research Council (CRC) study E65-3, which was primarily intended to assess permeation emissions from PZEVs and E85 indicated that for two of the vehicles tested in the study, total permeation emissions increased by 4% and 38% respectively as the ethanol portion increased from E6 to E10.[8] Figure 34 of this study indicates that there is in fact a non-linear positive relationship between ethanol content and permeation rates. AQMD staff strongly recommends that CARB obtain additional permeation emissions data from both older and newer car segments to further understand the impacts of permeation emissions. We further recommend that in the interim, CARB reevaluate its assumption of no increase in permeation emissions above 6% ethanol and, at al minimum, the Predictive Model should reflect some small increase in

[8] Coordinating Research Council, E65-3, Figures 26 and 27, http://www.crcao.com/reports/recentstudies2006/E-65-3/CRC%20E-65-3%20Final%20Report.pdf

permeation HC between E6 and E10 rather than zero percent increase. (BRW)

Agency Response: In the CRC E65-3 study, under section B in Conclusions and Findings, the report states, "Diurnal permeation rates do not appear to increase between E6 and E10." More particularly, the study found the average diurnal permeation rate increased 347 mg/day (from 177 to 524 mg/day) when the E6 fuel was substituted for the base non-ethanol E0 fuel. In comparison, the study also found the average diurnal permeation rate increased 307 mg/day (from 177 to 484 mg/day) when the E10 fuel was substituted for the base non-ethanol E0 fuel. ARB staff analyzed the data and reviewed the CRC E65-3 study and agreed with the conclusions set forth in the report.

29. Biofuel Concerns

50. **Comment:** Biofuels are causing food and water shortages, rapid food cost inflation, and are speeding global warming.

Oil price increases have not shrunk the human food supply, but biofuel production has! The more biofuels we produce, the less food we have to eat, because we grow biofuel crops, even switchgrass, using the same land, water, fertilizer, farm equipment, and labor we use to grow food. The world is running out of wheat because too many wheat farmers have switched to growing corn for ethanol production. The USDA states that by May US wheat supplies will be lower than any time since 1948.

The FAO states global food prices rose 40% in 2007. When America foolishly turns its food into fuel, we raise food prices worldwide which gives other countries a financial incentive to burn down rainforests in order to grow more food. It takes 9,000 gallons of water to create just 1 gallon of biodiesel, so biofuel production aggravates water shortages.

The twisted logic of biofuel advocates has been that we should gladly starve the world today by turning our food into fuel, but in a few years the world can eat again because we will soon make biofuels out of easy to grow inedible cellulose crops instead of food. Three agricultural economists with insider knowledge from Iowa State University have published a study which states that ethanol made from cellulose will never be affordable. Federal tax credits would have to be raised from the current $.51 per gallon for corn ethanol to $1.55 per gallon for cellulosic ethanol. That means no ethanol from switchgrass, wood chips, or crop waste will ever be sellable.
http://www.card.iastate.edu/publications/DBS/PDFFiles/08wp460.pdf

This comes on top of the recent Princeton University study published in the journal SCIENCE that concludes that all current and proposed future

biofuels, even switchgrass, are far worse for the environment and global warming than using ordinary gasoline.
http://www.sciencemag.org/cgi/content/abstract/1151861

Nitrogen fertilizers used to grow anything unleash nitrous oxide, a greenhouse gas 296 times more powerful than carbon dioxide. Farming contributes more to global warming each year than all land, sea, and air transportation combined, so farming should only be used for essential food productions.

The global destruction caused by biofuels makes no sense strategically because by 2015 it is estimated that oil from shale will cost only $30 a barrel to manufacture, and there is far more oil potential in American shale than in the entire Middle East before drilling began in 1980.

The "energy independence" argument for biofuels is a hoax because American biodiesel made out of soybeans costs the equivalent of making regular diesel out of oil at $232 a barrel. Making ethanol from corn costs the equivalent of oil at $81 a barrel and uses 28% more fossil fuels than gasoline.

MORE BIOFUEL FACTS –
http://home.att.net/~meditation/bio-fuel-hoax.html (CC)

Agency Response: ARB is currently working on these issues under the Low Carbon Fuels Standard. This item was not covered in the 15-day package and did not fall within the scope of this regulation. Please also see response to comment #48.

PEER REVIEWER'S COMMENTS

51. **Comment:** One general observation is that the environmental impact of gasoline formulation is analyzed entirely in terms of the ozone forming potential of vehicular emissions. There is hardly any mention of the fact that gasoline vehicles are a source of primary organic carbon (OC) [*Schauer et al.*, 1996], and that some VOC species in vehicle exhaust, notably aromatics, are precursors of secondary organic aerosol (SOA) formation [*Odum et al.*, 1997]. In addition there is an increased recognition in the community that SOA formation has been quantitatively underestimated [*Robinson et al.*, 2007]. With regard to SOA, I would say that the science is not good enough to predict how a change in gasoline formulation would change the SOA forming potential of vehicular emissions. Nevertheless, our understanding of SOA formation processes is expected to improve significantly over the next few years and CARB may want to follow these developments closely and incorporate the findings into future gasoline (and Diesel) formulation programs. (JDG)

Agency Response: Currently, the Predictive Model does not account for SOA formation. At the present time, not enough information exists to incorporate SOA formation into the model. As more information becomes available, staff will consider incorporating SOA formation into the model. This issue was not covered in the hearing notice and does not fall within the scope of this rulemaking.

52. **Comment:** My major comment on the report relates to the apparently limited consideration of greenhouse gas emissions. My recommendation is to initiate a study to more thoroughly evaluate the impact of California reformulated gasoline regulations in general on greenhouse gas emissions. This study should consider not only emissions from on-road motor vehicles, but also from refinery operations, gasoline imports (emissions at the refineries producing the gasoline for import), and ethanol production. In order to truly estimate the impact of California reformulated gasoline regulations on greenhouse gas emissions, the study will also need to estimate emissions prior to the original introduction of the regulations." (DDG)

Agency Response: Greenhouse gas emissions will be covered in more detail under the upcoming Low Carbon Fuels Standard. This issue was not covered in the hearing notice and does not fall within the scope of this rulemaking.

53. **Comment:** As indicated in the previous comments, the new regulations all appear to be very reasonable, and the implementation plan allows flexibility for producers to comply in a cost effective manner depending on their particular circumstances. My main suggestion is a more through study of the impact of CaRFG regulations on greenhouse gas emissions. As stated in the General Comments section of this letter, the study should be comprehensive, and not only look at the small incremental changes brought about by these proposed regulations. (DDG)

Agency Response: See response to comment #48.

This comment does not pertain to the 15 day changes. However, during the development of this rulemaking, staff met individually with stakeholders, including Kinder Morgan, the nonproprietary pipeline operator, to determine the impacts of the amendments on pipeline fungibility. Staff determined that many of the refiners have different approaches to how they will deal with the amendments when the go into effect after 2009. Staff believes there is sufficient flexibility in the regulations to address any unforeseen problems with fungibility. Also, as part of our implementation efforts, staff will continue to monitor the situation through surveys and other actions as appropriate. ARB staff is committed to working the CEC on the fungibility study and will continue to monitor pipeline fungibilty. ARB staff is prepared to make recommendations to the Board as needed.

54. **Comment:** Implicit in the ARB approach is that the Predictive Model accurately represents the changes in emissions from the existing vehicle fleet with changes in fuel composition that are within the limits of the CaRFG3 standard. In fact, the regulations use the model output in a deterministic fashion to decide whether the fuel composition is acceptable. However, the model predictions are uncertain. This unaccounted-for uncertainty means that the Predictive Model may imposes unnecessary, arbitrary constraints on fuel producers. It may mean that the CaRFG3 regulations are not achieving the anticipated air quality improvements. Addressing these concerns requires a thorough assessment of the uncertainties in the Predictive Model predictions. The goal is to not paralyze ourselves with uncertainty analysis, but to identify critical knowledge gaps and, most importantly, improve the effectiveness of regulations.

There is very little information in the report and associated appendices that address uncertainty. This is a major shortcoming of the report. The report did provide very limited goodness of fit information, but only for certain submodels and for certain pollutants (for example some goodness of fit information was given in the SAS output files for the Tech 5 CO model reproduced in Appendix D). The report noticeably did not provide confidence intervals for any of the models or discuss potential uncertainties. There were no plots or other materials that evaluated the model against actual data. In order for the Predictive Model to be a credible tool for technical analysis, the report must do a better job discussing and quantifying the uncertainties in model predictions. (AR)

At a minimum, the ARB needs to assess the uncertainty in the predictions of the existing model in its current form with the existing dataset. Ideally this would account for both the uncertainty in the underlying data and the quality of the statistical fit. Evaluating the uncertainty of the existing data set may be difficult because it requires information from the original studies. This uncertainty exists on at least two dimensions: one is the uncertainty in the actual measurements (e.g. what was the uncertainty in the emission monitor) and the second is whether or not the data are even suitable for the task at hand (this second issue is discussed in more detail later in this review).

A first step would be to simply evaluate the quality of the fit. This should be done in a number of ways. First, confidence intervals need to derived and reported for each model over the full range of its application. Deriving confidence intervals for non-linear models can be challenging so the model should also be fit using randomly selected subsets of the data and its predictions tested against the balance of the dataset. These exercises will provide substantial insight into the model performance. They may

suggest changes to how the model results are used in the context of the regulations. For example, a better approach might be to write specification that the producers must produce gasoline within certainty confidence limits defined by the model. In this way the regulations will better reflect the true accuracy of the model predictions. (AR)

In summary, I strongly support the concept of using a Predictive Model to provide fuel producers flexibility in developing fuel formulations to meet the CaRFG3 standard. However, in order for the regulations to be effective, the model uncertainties must be quantified. This is a major shortcoming of the existing model. Once these uncertainties are better characterized, then regulators and stakeholders can more effectively decide how this tool can be used appropriately to improve air quality in California. (AR)

Agency Response: The Predictive Model was independently reviewed by Dr. David Rocke of University of California at Davis. After careful review of the statistics involved in the Predictive Model, Dr. Rocke agreed with the statistical approach used by staff and determined that the uncertainty in the model was not a significant problem. Dr. Rocke's independent review is included in the appendices of the Initial Statement of Reasons.

55. **Comment:** The second issue involves the underlying structure of the model, specifically whether the model deals adequately with high emitting vehicles. The current model bins vehicles by model year/technology class, but it does not directly address the issue of high emitters. Model year/technology class is a reasonable approach because vehicle age is known and there are clear trends in increasing emissions with age. However, model year/age does not capture high emitters as has been amply demonstrated by on-road vehicle testing; high emitters occur in all age groups / model years. See, for example, the classic paper by Beaton et al. (Science, 1995, vol 268, page 991); although this paper is now dated, more recent studies show basically the trends (http://www.feat.biochem.du.edu/). Therefore, if the goal of the Predictive Model is to accurately represent how the emissions of the in-use vehicle fleet will change with changes in gasoline formulation, then the model must pay special attention to predicting the emissions from high-emitting vehicles correctly because they dominate overall fleet emissions. Given this context, a model based on simply binning vehicles by model year likely does not accurately predict effects of reformulated gas on the actual vehicle fleet.

Better accounting for high emitting vehicles will likely require developing new submodels specifically for these vehicles. This would likely involve modifying the basic structure of the model, by for example binning the data by emission rate in addition to model year. (This issue was raised by

Jonathan Cohen in his comments on the Predictive Model reproduced in Appendix D). Once high emitting sub-models have been developed, existing data on the fraction of the vehicle fleet that is high emitters can be used to estimate feet average emission rate. This sort of data is available from on-road vehicle testing studies and is already used in models such as EMFAC. Although these changes would increase the complexity of the Predictive Model, this additional complexity is justified scientifically given the dominant role of high emitting vehicles.

There are valid technical reasons to bin vehicles by emissions as opposed to simply by year. High emitting vehicles are physically different from low emitting vehicles – their engines and/or emission control systems are not functioning properly. For example, their catalytic converter may be poisoned or fuel control system has failed. If the vehicles are inspected the problem can be determined and fixed. In fact, a modern vehicle with a failed emission control system is likely more similar to a vehicle from an earlier era, even potential an uncontrolled vehicle from the 60s or 70s, than one in its technology category. Therefore, it seems appropriate to treat these vehicles separately in the model. Of course vehicle emission rates are a continuum of values and defining a boundary between normal and high emitting vehicles is inevitably somewhat arbitrary. However, I would argue that binning by emission rate maybe more meaningful than binning vehicles by model year. For example, model year is not a perfect indicator of control technology, as it is common for manufacturers to sell vehicles that meet future emissions standards years in advance because of other considerations in the vehicle development cycle." (AR)

At a minimum the report needs to do a better job of discussing high emitters. This would likely require more clearly defining the objectives of the model. It would also be useful to better define the CaRFG3 program vis a vis reducing emissions from high emitters versus other possible outcomes. (AR)

Agency Response: The Predictive Model is designed on vehicles operating in normal condition. Staff believes it is unnecessary to make a model based on high emitters because the SMOG program is designed to minimize the number of high emitters that are on the road. In addition, staff brought forth the high emitter issue to Dr. David Rocke of the University of California of Davis during his independent review of staff's work. He agreed with staffs handling of high emitters in the model. His review of staff's work was incorporated into the appendices of the Initial Statement of Reasons.

56. **Comment:** Other issues include whether the data are truly representative. For example, does the data adequately represent the in-use fleet? The age distribution of vehicles in the database listed in Table 1 on page D-37 of Appendix D suggests that they do not. Therefore, to

develop a predictive model would likely require more vehicle testing. Older vehicles would have to be retested using the new fuel blends. Also, a lot of data are likely needed for new vehicles. Efforts need to be made to ensure that testing accurately captures the variations in vehicle type, age, high emitter, etc. within the fleet. This will potentially require substantial resources; however, costs for this testing would likely be relatively minor compared to the other costs stated in the report for the CaRFG3 program. Whether such testing is a good investment is a policy decision. Are the benefits of improving the performance of the Predictive Model in the context of the CaRFG3 regulations and the overall California strategy to reduce vehicle emissions worth it? At a minimum, the report needs to have a more thorough discussion of the suitability of the existing data for this application. (AR)

Agency Response: Acquiring more data and retesting data will improve the accuracy of the model. However, test programs are often time consuming and very expensive. Constant testing and updating of the fleet data would make the model dynamic. Producers need a consistent model to make the necessary refinery investments to supply California. Constant changes to the model would negatively affect the supply of gasoline to California. Staff and Dr. David Rocke of the University of California at Davis, who did an independent review of staff's work, agree that the vehicle data currently being used in the Predictive Model provide a very good representation of the in-use fleet.