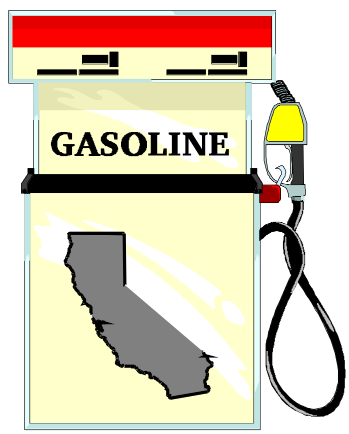
California Environmental Protection Agency

Air Resources Board

Proposed Follow-up Amendments to the California Phase 3 Reformulated Gasoline Regulations

Proposed Amendments to the California Reformulated Gasoline Regulations Including Denatured Ethanol Specifications, Small Refiner Provisions, CARBOB Model, and Other Changes

STAFF REPORT: INITIAL STATEMENT OF REASONS



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State of California
California Environmental Protection Agency
AIR RESOURCES BOARD
Stationary Source Division

STAFF REPORT: INITIAL STATEMENT OF REASONS
PROPOSED AMENDMENTS TO THE CALIFORNIA
PHASE 3 GASOLINE REGULATIONS

Public Hearing to Consider Amendments to the California Reformulated Gasoline Regulations, Including Denatured Ethanol Specifications, Small Refiner Provisions, CARBOB Model, and Other Changes

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Executive Summary

A. Introduction

The Air Resources Board approved the Phase 3 Reformulated Gasoline (CaRFG3) regulations at a hearing on December 9, 1999. The regulations prohibit California gasoline produced with the use of methyl tertiary-butyl ether (MTBE) starting December 31, 2002, establish CaRFG3 standards, and make various other changes. At the conclusion of the hearing, the Board adopted Resolution 99-39, in which it approved the originally proposed amendments with several modifications. A number of items that could not be addressed in December were deferred until this Board hearing.

The primary items addressed in this rulemaking include amendments to accommodate the blending of ethanol in CaRFG3, new regulations to assure consistent quality of fuel grade ethanol, proposed changes to the diesel fuel regulations to provide for offsets of the emissions associated with the small refiner CaRFG3 standards, and amendments that specify how refiners and gasoline distribution system proprietors can transition from distributing gasoline produced for one ethanol content level to a gasoline produced for another ethanol content level. Some other changes include improving the stated enforcement reproducibility of the Reid vapor pressure (RVP) test method when certain automated instruments are used.

B. Background

What were the Governor's Directives? The December 9, 1999 rulemaking was in response to Governor Davis' March 25, 1999 Executive Order D-5-99, in which he found that, on balance, there is a significant risk to the environment from using MTBE in gasoline in California. He made this finding on the basis of a University of California report (the U.C. Report) and other public input that concluded there are significant risks and costs associated with water contamination due to the use of MTBE. MTBE is highly soluble in water and will transfer faster and travel farther and more easily than other gasoline constituents such as benzene when gasoline leaks from underground storage tanks or pipelines. The Executive Order directed the California Energy Commission (CEC) to issue a timetable for the removal of MTBE from gasoline at the earliest possible date, but not later than December 31, 2002. The CEC subsequently determined that December 31, 2002 was in fact the earliest feasible time. The Executive Order also directed the ARB by December 1999 to adopt CaRFG3 regulations that will provide additional flexibility to refineries to lower or eliminate the use of oxygenates while maintaining current emissions and air quality benefits and ensuring compliance with the State Implementation Plan (SIP).

At the December 1999 public hearing, the Board approved the CaRFG3 regulations via Resolution 99-39. However, in Resolution 99-39, the Board recognized with the approval of the CaRFG3 regulations that there were items that still needed to be investigated further to fully and effectively implement the CaRFG3 regulations. As a result, in Resolution 99-39, the Board directed ARB staff to return to the Board with further amendments to the CaRFG3 regulations to address the remaining items. These included:

- Provisions to facilitate production and shipping of ethanol blendstocks (CARBOB);
- Specifications for denatured ethanol for blending in CaRFG3;
- Amendments to the ARB's diesel fuel regulations to incorporate a mechanism for small refiners to fully mitigate any increased emissions associated with the CaRFG3 small refiner provisions.

The Board directed that the proposed amendments not include changes to the CaRFG3 flat, averaging or cap limits or the Predictive Model.

How Were the Proposed Amendments Developed? To develop staff's proposed regulatory amendments, ARB staff conducted six public workshops over the past six months with representatives from the oil, automobile, ethanol industry, and other key stakeholders. Also, over the past six months, ARB staff has held numerous meetings with representatives from Western States Petroleum Association, individual refiners including small refiner Kern Oil Company, vehicle manufacturers, fuel suppliers, environmental organizations, the ethanol industry, marketing associations, and other organizations. Many of these meetings were held jointly with the staff of the California Energy Commission.

Items Deferred to Future. In Resolution 99-39, the Board directed ARB staff over the next few years to further evaluate and as appropriate develop recommendations to address potential emission increases that would result from the use of ethanol in gasoline due to material permeability and commingling of varying levels of ethanol in the gasoline distribution system. Staff was also directed to further evaluate the practicality of the allowable MTBE residual limits in the CaRFG3 regulations. The Board additionally directed staff to examine the potential to further lowering CaRFG3 sulfur levels in the future.

The Board also directed ARB staff in Resolution 99-39 to examine a number of critical issues regarding the future implementation of the CaRFG3 regulations. Staff was directed to evaluate whether the fully implemented CaRFG3 regulations maintain the CaRFG2 air quality benefits and the effective CaRFG2 Driveability Index (DI) level. Staff was also directed to monitor refiner progress in complying with the CaRFG3 regulations and to assist local governments in addressing potential impacts from diesel truck emissions. These issues are not dealt within this proposal. Staff will return to the Board periodically on these items.

The following sections of the Executive Summary present a brief summary and discussion of the staff s proposed regulatory amendments. The text of the proposed regulatory amendments are contained in Appendix A.

C. Denatured Ethanol Specifications

The staff's originally proposed CaRFG3 amendments included proposed specifications for denatured ethanol used as an additive to California gasoline. At the December 9, 1999 hearing, ethanol producers commented that some of the proposed specifications were too stringent in light of ethanol production processes and the characteristics of denaturants now being used. The Board decided to eliminate the proposed specifications as a part of that rulemaking, and directed staff to work with interested parties and come back with a proposal for consideration by the Board at a later hearing.

Following discussions with interested parties over the last year, we are proposing limits on the sulfur, benzene, olefins, and aromatics content in denatured ethanol used as an additive in CaRFG3. Refiners could establish more stringent alternative limits, typically for use in proprietary systems.

The staff is proposing that the sulfur limit be enforced by testing the denatured ethanol, but for the other properties enforcement would be through testing the denaturant and calculating the concentrations in the denatured ethanol. This approach would require product transfer documents with a description of ethanol and denaturant properties. Table 1 lists the proposed specifications for denatured ethanol and denaturants.

Table 1
Proposed Specifications for Denatured Ethanol and Denaturants

Property	Specifications for Denatured Ethanol	Specifications for Denaturants
Sulfur, ppm	10	--
Benzene, vol.%	0.06	1.1%
Olefin, vol.%	0.50	10%
Aromatics, vol.%	1.7	35%
Others	ASTM D 4806	--

The staff’s goal in developing the proposed specifications for denatured ethanol was to find the appropriate balance between ensuring that the cleanest ethanol possible is supplied for use in CaRFG3 distributed through common tankage without significantly limiting the supply of ethanol for those markets. Refiners which distribute fuel directly from refineries or through proprietary pipeline systems would be able to establish their own more stringent ethanol specifications.

D. CARBOB Provisions

The U.S. Environmental Protection Agency (U.S. EPA) structured the federal RFG regulations to allow refiners to ship non-oxygenated gasoline from the refinery that does not comply with the federal RFG standards if it is specially formulated to be combined with oxygenate "downstream" from the refinery and the resulting blend will meet all of the federal RFG standards. This allows entities wishing to oxygenate gasoline downstream from the refinery to take advantage of the contribution oxygenates can make in meeting the federal RFG standards. U.S. EPA calls the specially formulated product "Reformulated Gasoline Blendstock for Oxygen Blending," or "RBOB." In its 1995 rulemaking, the ARB amended the CaRFG2 regulations to incorporate a similar approach, allowing refiners to supply a non-oxygenated blendstock called "California reformulated gasoline blendstock for oxygen blending," or "CARBOB."

At the December 1999 hearing, the staff proposed some changes to the CARBOB regulations and was aware of additional CARBOB issues that needed to be addressed. However, the remaining issues required more time and discussions with affected parties before specific regulatory proposals could be made. The staff was directed to address these issues this year so that fuel producers and distributors would have sufficient time to make any necessary distribution system changes prior to December 31, 2002. The amendments will also facilitate the early introduction of CaRFG3, made without MTBE.

The staff is proposing adoption of a CARBOB model as an alternative to the current requirement to hand blend ethanol into CARBOB in determining the finished gasoline properties for evaluating compliance with CaRFG3 specifications. The staff is also proposing mechanisms under which gasoline suppliers may conduct a transition between finished gasoline and CARBOB, or between CARBOB intended for one ethanol content level and a CARBOB intended for another ethanol content level.

Why a CARBOB Model? The staff is proposing amendments to the CaRFG3 regulation to provide for a CARBOB model that would allow a refiner to certify a CARBOB blend that, when mixed with the specified ethanol content, is fully compliant with the CaRFG3 specifications. This provision would increase the flexibility for a refiner to produce complying CARBOB blends. The refiner would not have to hold a batch of fuel until it collects a sample, hand-blends ethanol into the sample, and then analyzes the sample to demonstrate compliance with the CaRFG3 specifications.

Development of the CARBOB Model. A CARBOB dataset was used as the basis for constructing a statistical model to predict finished fuel properties from the CARBOB properties and the expected quantity of ethanol to be blended. The linear regression procedure available from the SAS Institute Inc. was used in the model development. The basic terms included in the model are RVP, T90, T50, and ethanol content.

Use of the CARBOB Model. The CARBOB model is used in tandem with the CaRFG3 Predictive Model. The properties of the CARBOB gasoline are entered into the CARBOB model, which then calculates the expected properties for the finished blend. These finished blend properties are then entered into the CaRFG3 Predictive Model to see if they give CARBOB properties that would lead to a certifiable fuel. Details on the use of the CARBOB model are provided in Appendix B, the "Procedures for Using the California Model for California Reformulated Gasoline Blendstocks for Oxygenate Blending (CARBOB)."

E. CARBOB Tank Transition Requirements

The current CaRFG regulations generally prohibit the blending of CARBOB that is downstream from its production or import facility with other CARBOB, gasoline, blendstock or oxygenate.

The current regulations also recognize that there could be legitimate operational business reasons for mixing CARBOB with California gasoline or with other types of CARBOB during a changeover in service of a storage tank. Consequently Section 2266.5(f)(2), title 13, California Code of Regulations (CCR) allows the Executive Officer to enter into a written protocol with any person to identify conditions under which such mixing might be permitted. However, to simplify the transition from one gasoline oxygen content to another some modifications to the regulations are necessary. Staff conducted an analysis and determined that the regulations could be amended to allow transitions at the storage tank under specific conditions and constraints.

The staff is proposing options to provide flexibility on how gasoline suppliers would transition from distributing CARBOB intended for one ethanol content to another ethanol content. Specifically, staff is proposing conditions that would allow the mixing of CARBOBs intended for varying ethanol content in a manner that would not result in increased emissions. However, the mixing of nonoxygenated RFG with oxygenated RFG is more complex and would not be allowed during the RVP (summertime) control periods without a protocol between the Executive Officer and the supplier.

F. Small Refiner Provisions

The Board adopted small refiner CaRFG3 standards to provide flexibility to a small refiner provided that the small refiner fully offset the excess emissions of NOx, hydrocarbons and potency-weighted toxics by marketing a cleaner diesel fuel. The Board directed the ARB staff to propose amendments to the ARB's diesel fuel regulations to incorporate a mechanism for the small refiner to fully mitigate any increase in emissions from the small refiner provisions in the CaRFG3 regulations. The small refiner will be able to produce gasoline subject to the small refiner CaRFG3 standards only after the offset provisions are in place. A small refiner would be allowed this flexibility only if it produced CaRFG2 fuel in 1998 and 1999.

Small refiners are now allowed to produce diesel fuel meeting a 20 volume percent aromatic hydrocarbon content limit, while large refiners are required to meet a 10 volume percent aromatic hydrocarbon content standard. Both large and small refiners can certify alternative diesel formulations that are shown to be equivalent to their respective standard. Small refiners are also restricted to a volume cap on the total annual quantity of diesel fuel they could market subject to the small refiner standards. However, small refiners can increase their diesel production by complying with the large refiner 10 percent aromatic hydrocarbon content provisions.

The staff is proposing three options for small refiners to use in offsetting the small refiner CaRFG3 emissions. First, a small refiner can reduce the small refiner exempt volume cap to offset emissions. Second, the small refiner can produce a “cleaner” small refiner diesel fuel. Third, the small refiner can increase its exempt volume by producing an even “cleaner” small refiner diesel fuel that will result in no net increase in emissions from gasoline or diesel fuel it produces, if the small refiner also foregoes its right to market nonvehicular high sulfur diesel fuel in California and makes available a reasonable quantity of diesel fuel meeting a 30 ppm sulfur limit. None of the proposed options would prevent the small refiner from producing as much “large refiner” diesel as it chooses.

With any of these approaches, it is assumed that if the small refiner does not produce the maximum amount of small refiner diesel fuel, extra emissions benefits would be gained because the small refiner diesel would be replaced by cleaner large refiner diesel fuel. The reason staff is proposing three options is to provide the small refiner with greater flexibility in choosing how to comply with both the diesel fuel mitigation and CaRFG3 regulations, and to avoid the need in the future to make additional regulatory adjustments as other changes may occur.

G. Other Changes

The staff is also proposing a number of other changes. One change would provide that, when the RVP of a gasoline sample is determined using a specified automated instrument, the staff-determined reproducibility for that instrument will be used for enforcement purposes rather than the larger reproducibility of ASTM D323-58, the base method in the regulations. Both the staff and refiners have successfully been using automated instruments to determine RVP for a number of years. Some of the other changes are to update the designation for the test method for MTBE, ethanol and oxygen content, and authorization of protocols that will allow multiple averaging banks for operationally distinct products at a refinery or import facility.

H. Impacts of the Staff Proposal

What are the Emission Impacts of the Proposed Amendments? Staff's proposal was developed to provide greater flexibility to refiners and gasoline distribution system proprietors to comply with the CaRFG3 regulations while continuing to preserve the CaRFG2 air quality benefits and to preserve the additional emission reductions estimated from the CaRFG3 regulations which can be applied towards the SIP. As a result, staff's proposal is emissions-neutral.

What are the Costs of the Proposed Amendments? With the greater regulatory flexibility provided by these proposed amendments, refiners and gasoline distribution system proprietors should be able to reduce costs to comply with the CaRFG3 regulations.

Staff's proposed ethanol denaturant specifications may exclude some suppliers of ethanol to the California market, which could affect supply and potentially gasoline prices in California. However, the Renewable Fuels Association (RFA) survey supports the conclusion that there should be an adequate number of ethanol suppliers for the California market that can comply with the proposed ethanol denaturant specifications. As a result, the potential impacts on supply and cost should be very small. Further, this potential impact is further limited by the fact that denaturant can only be added up to a five percent maximum to comply with federal requirements.

What is the Cost-Effectiveness of the Proposed Amendments? Staff's proposal allows those entities subject to the CaRFG3 regulations new options which could enable them to more easily implement the CaRFG3 requirements. Staff's proposal is emissions neutral as it affects the CaRFG3 regulations. Therefore, with no emissions impact or expected increase in costs there is no cost-effectiveness to calculate for these proposed amendments.

What are the Environmental Impacts of the Proposed Amendments? Staff's proposal is emissions neutral as it affects the CaRFG3 regulations. No significant environmental effects from staff's proposal are expected regarding water and air quality and greenhouse gases.

I. Recommendation

The staff recommends that the Board adopt the proposed amendments to the Board's CaRFG3 and diesel fuel regulations as contained in Appendix A, and the "Procedures for Using the California Model for California Reformulated Gasoline Blendstocks for Oxygenate Blending (CARBOB)" as contained in Appendix B, with the recognition that staff may propose some modifications to their proposal based on information and comments obtained subsequent to the release of the Staff Report and prior to the Board hearing in November 2000. Specifically, discussions are continuing with CENCO Refining Company which is asking for temporary relief from complying with the CaRFG3 regulation.

I. Introduction

The Air Resources Board approved the Phase 3 Reformulated Gasoline (CaRFG3) regulations at a hearing on December 9, 1999. The regulations prohibit California gasoline produced with the use of methyl tertiary-butyl ether (MTBE) starting December 31, 2002, establish CaRFG3 standards, and make various other changes. At the conclusion of the hearing, the Board adopted Resolution 99-39, in which it approved the CaRFG3 regulations with future actions required because a number of items could not be appropriately addressed in December.

A. Why the CaRFG3 regulations?

The CaRFG3 rulemaking was in response to Governor Davis' March 25, 1999 Executive Order D-5-99, in which he found that, on balance, there is a significant risk to the environment from using MTBE in gasoline in California. He made this finding on the basis of a University of California report (the U.C. Report) and other public input that concluded there are significant risks and costs associated with water contamination due to the use of MTBE. MTBE is highly soluble in water and will transfer faster and travel farther and more easily than other gasoline constituents such as benzene when gasoline leaks from underground storage tanks or pipelines. The Executive Order directed the California Energy Commission (CEC) to issue a timetable for the removal of MTBE from gasoline at the earliest possible date, but not later than December 31, 2002. The CEC subsequently determined that December 31, 2002 was in fact the earliest feasible time. The Executive Order also directed the ARB by December 1999 to adopt CaRFG3 regulations that will provide additional flexibility in lowering or removing the oxygen content requirement while maintaining current emissions and air quality benefits and ensuring compliance with the State Implementation Plan (SIP).

B. ARB Staff's Proposal

The ARB staff returns to the Board in this proposed rulemaking with further amendments to the CaRFG3 regulations to request the Board's consideration of:

- Provisions to facilitate production and shipping of ethanol blendstocks (CARBOB);
- Specifications for denatured ethanol for blending in CaRFG3;
- Amendments to the ARB's diesel fuel regulations to incorporate a mechanism for small refiners to fully mitigate any increased emissions associated with the CaRFG3 small refiner provisions approved herein.
- Some other changes staff are proposing include lowering the enforcement reproducibility of the RVP test method and minor changes to update test methods ASTM D4815-94 and D4815-94a to the current version.

The Board directed that the proposed amendments not include changes to the CaRFG3 flat, averaging or cap limits or the Predictive Model. The following chapters in this report present staff's proposals.

C. The Process

The process ARB staff used to develop the proposed regulatory amendments included hosting six public workshops between February and September, 2000 and holding numerous individual meetings with representatives from the oil, automobile, and ethanol industries as well as numerous other key stakeholders over the past six months.

D. Other Future Activities

At the December 1999 public hearing in Resolution 99-39, the Board also directed ARB staff to investigate a number of other CaRFG3 related items and to report back to the Board. Those items are identified below as the Board's direction to ARB staff to:

- Evaluate potential increases in hydrocarbon emissions from materials permeability associated with the use of ethanol in gasoline and provide the Board with an update and report to the Board on the results of permeability testing.

- Further evaluate the expected real-world emissions impact in 2003 and beyond of the commingling of CaRFG3 containing ethanol with CaRFG3 not containing ethanol and report the findings to the Board with any appropriate recommendations.

- Further evaluate the practicality of the allowable MTBE residual limits for CaRFG3 and report back to the Board with a recommendation on whether the limit should be revised.

- Evaluate whether CaRFG3 regulations maintain CaRFG2 air quality benefits and report to the Board by 2004 on the results of the evaluation along with appropriate recommendations.

- Evaluate the CaRFG3 Driveability Index (DI) and report back to the Board by 2004 with the results and any appropriate recommendations.

- Evaluate potential to further lower CaRFG3 sulfur levels in the future and report back to the Board.

- Monitor refiner progress to comply with CaRFG3 regulations and assist local governments to address potential impacts from diesel truck emissions.

II. Proposed Specifications for Denatured Ethanol

Because of the physical properties of ethanol, the majority of ethanol used in California gasoline will be blended into the delivery tank truck at the terminal by an oxygenate blender rather than added at the refinery. The CaRFG regulations allow a refiner to ship from its refinery a non-oxygenated gasoline blendstock called "CARBOB," which is designed to comply with the applicable CaRFG refinery limits after its is blended with ethanol or another designated oxygenate. CARBOB stands for "California reformulated blendstock for oxygenate blending." The regulations require that refiners sample each final blend of CARBOB, hand-blend in the specified amount of ethanol, analyze the oxygenated sample to determine the level of each of the properties subject to CaRFG standards, and retain the test results.

Since most gasoline in California is shipped through common pipelines, the ethanol will be blended into the non-oxygenated base fuel at a point that is beyond the control of the refiner who originally certified the fuel. Therefore, to ensure the integrity of the original certification and to preserve the emission characteristics of the oxygenated gasoline, it is necessary to limit the concentration of the compounds controlled in gasoline by the CaRFG3 regulations and in the ethanol used to provide the desired oxygen content. These compounds are sulfur, olefins, aromatics, and benzene. The concentration of sulfur must be controlled in the denatured ethanol since sulfur occurs in both the base ethanol and in the material used to denature the ethanol. However, the others can be controlled by limiting their concentrations in the denaturant. These proposed limits are presented in Table II-1.

Table II-1
Proposed Specifications for Denatured Ethanol and Denaturants

Property	Specifications for Denatured Ethanol	Specifications for Denaturants
Sulfur, ppm	10	--
Benzene, vol.%	0.06	1.1
Olefin, vol.%	0.50	10
Aromatics, vol.%	1.7	35
Others	ASTM D 4806	--

A. Background

With the phase-out of MTBE, ethanol will most likely become the only oxygenate used in California. Part of the original staff proposal for the CaRFG3 regulations was a new section 2262.9, Title 13, CCR, which established a set of specifications for denatured ethanol intended for use in California gasoline. Because of concerns about water contamination, gasoline with ethanol has historically not been shipped through the common pipeline system. Instead, the ethanol is expected to be added to gasoline downstream at the distribution terminal.

Since ethanol is typically not added to the base gasoline until truck loading at the terminal, a set of denatured ethanol standards would provide predictable specifications that could be taken into account when refiners are producing CARBOB. The standards could also enable refiners to maximize the potential contribution that ethanol can make towards complying gasoline.

In the original CaRFG3 rulemaking, the staff proposed that the following standards be set for denatured ethanol intended for use in motor vehicles: 1 ppmw sulfur, 1 volume percent aromatics, 0.1 volume percent benzene, and 0.1 volume percent olefins. At the December 9, 1999 hearing, representatives of the ethanol industry commented that some of the proposed specifications were too stringent in light of ethanol production processes and the characteristics of denaturants now being used. The Board decided to postpone action on the proposed ethanol specifications as a part of the CaRFG3 rulemaking, and directed staff to work with stakeholders and come back with a proposal for consideration by the Board.

Beginning in March 2000, ARB staff held monthly workshops to discuss this and other issues with stakeholders. As a result of these workshops and individual meetings and discussions, the Renewable Fuels Association (RFA) conducted a survey to obtain information on the manufacture, properties and specification of denatured fuel ethanol. Based on information from the RFA study, discussion with interested stakeholders, and further analysis, the staff is proposing specifications for denatured ethanol, and for denaturants, in this rulemaking.

B. RFA's Ethanol Producers Survey

The RFA conducted a survey of ethanol producers within its membership. The objective of the survey was to obtain information regarding the sulfur content in denatured ethanol and certain hydrocarbons in the denaturants. The survey included forty-three companies that operated ethanol production facilities. Of the facilities surveyed, the RFA received data from twenty-seven that have a total production capacity of 1.42 billion gallons per year. The data covers production capacity representing 81 percent of the fuel ethanol production capacity in the United States. Table II-2 lists the results of RFA's survey.

Table II-2
Results of RFA's Ethanol Producer Survey

Property	Average	Range
Sulfur content of undenatured Ethanol	2.9 ppm	1 – 11 ppm
Sulfur content of denatured Ethanol	8.7 ppm	2.1 – 27.2 ppm
Sulfur content of the denaturant	127 .7 ppm	9.1 – 733.9 ppm
Benzene content of the denaturant	0.63 vol. %	0.01 –1.94 vol. %
Olefin content of the denaturant	0.55 vol. %	0.02 –2.1 vol. %
Aromatic content of the denaturant	1.33 vol. %	0.05 – 6.6 vol. %

The survey data represent only one sample from each reporting producer. It is not known how much variation would occur in the reported values over an annual production period. In addition, the uncertainty in the reported sulfur results is unknown because the repeatability and reproducibility for the method used to determine sulfur levels in ethanol have not been determined. Currently, nearly 100% of the denaturants used are natural gasoline. Natural gasoline is a condensate from natural gas production. The RFA proposed that for flexibility, the benzene, olefin, and aromatics limits in fuel ethanol should be set to allow for the possibility of using CaRFG3 gasoline as a denaturant. The RFA proposed specifications for fuel ethanol intended for use to produce CARFG3 gasoline. Table II-3 lists the limits for sulfur benzene, olefins, and aromatics in fuel ethanol proposed by RFA.

Table II-3
RFA's Proposed Specifications for Fuel Ethanol

Property	Maximum Limit
Sulfur	15 ppm mass
Benzene	0.10 vol.%
Olefins	0.50 vol.%
Aromatics	1.70 vol.%

Since there are no benzene, olefins, or aromatics in undenatured ethanol and a maximum 4.8% denaturant addition level, back calculating for these compounds in the denaturant yields levels very close to the Phase 3 RFG cap limits with the exception of benzene. Based on the benzene limit proposed by the RFA, a back calculation for benzene resulted in a value greater than the CARFG3 cap limit for benzene. Ethanol denatured with a denaturant containing benzene at the CaRFG3 cap limit of 1.10 vol.% should result in a benzene content of no greater than 0.06 vol.%. The RFA survey showed that the average benzene content in the denaturants used by ethanol producers is 0.63 volume percent. This would result in a benzene content of 0.03 volume percent in the denatured ethanol.

C. ASTM Specifications for Denatured Ethanol

The current specifications of the American Society of Testing and Materials (ASTM) for "denatured fuel ethanol for blending with gasolines for use as automotive spark-ignition engine fuel" are contained in ASTM D4806-98. These specifications require that the only denaturants used for fuel ethanol may be natural gasoline, gasoline components, or unleaded gasoline at a minimum concentration of two parts per 100 parts by volume of fuel ethanol (2.0 vol.%). The use of hydrocarbons with an end point higher than 437 ^{o}F are prohibited. The denaturant may be included as part of the 10 volume percent denatured fuel ethanol blended with a gasoline if they do not exceed five parts per 100 parts by volume of fuel ethanol (4.8 vol.%). The use of methanol, pyroles, turpentine, ketones and tars are prohibited. Denatured ethanol must conform to the performance requirements list in Table II-4 at the time of blending with a gasoline.

Table II-4
Performance Requirements for Denatured Fuel Ethanol
(ATSM D 4806)

Property	Specification
Ethanol, volume %, min.	92.1
Methanol, volume %, max.	0.5
Solvent-washed gum, mg/100 ml, max.	1
Water Content, volume %, maxim	1
Denaturant content, volume %, min.—max.	1.96 – 4.76
Inorganic chloride content, mass ppm (mg/l), max	40 (32)
Copper content, mg/kg, max.	0.1
Acidity (as acetic acid), mass % (mg/l) max.	0.007 (56)
Appearance	Visibility free of suspended or precipitated contaminants (clear and bright)

D. Proposed Test Methods and Specifications for Denatured Ethanol

Test Methods. The test method (ASTM D 5453-93) to measure sulfur in liquid hydrocarbons can be used to determine the sulfur content in ethanol. However, at this time precision for repeatability and reproducibly have not been determined for the use of this method for total sulfur content in ethanol. To facilitate the use of ASTM 5453-93 as a test method for sulfur in ethanol the staff of the ARB's Monitoring & Laboratory Division (MLD) is coordinating a round robin series of tests between participating laboratories to evaluate ASTM D5453-93 for determining the sulfur content in denatured ethanol. It is anticipated that the ASTM D5453-93 test method will be suitable to accurately measure the sulfur content in ethanol. The ARB staff is accordingly proposing that ASTM D5453-93 be the test method specified for determining the sulfur content of denatured ethanol.

There are no comparable test methods applicable to measure benzene, olefins, and aromatics at the concentration levels of these compounds that are found in denatured ethanol. The staff proposes that the concentration of these compounds in denatured ethanol be calculated using the concentration of these compounds found in the denaturant. The test methods to be used for testing the denaturants are the ones specified in the CaRFG regulations for determining compliance with the CaRFG standards.

Proposed Specifications. The staff's goal in proposing the specifications for denatured ethanol is to find the appropriate balance between ensuring that the cleanest ethanol possible is supplied for use in CaRFG3 without significantly limiting the supply of ethanol. The ARB staff is proposing limits to the sulfur, benzene, olefins, and aromatics content in denatured ethanol used as an additive in CaRFG3. The sulfur limit would be enforced by testing the denatured ethanol. The benzene, olefins, and aromatics limits would be enforced by determining the concentrations of these compounds in the denaturant and multiplying the result by 0.048 to reflect the maximum denaturant content of the denatured ethanol.

Table II-5 lists the staff's proposed specifications for denatured ethanol. It also lists separate standards that would apply to denaturants represented as suitable for fuel ethanol. In addition, denatured ethanol must meet all of the performance requirements specified in ASTM 4806.

Table II-5
Proposed Specifications for Denatured Ethanol and Denaturants

Property	Specifications for Denatured Ethanol	Specifications for Denaturants
Sulfur, ppm	10	--
Benzene, vol.%	0.06	1.1%
Olefin, vol.%	0.50	10%
Aromatics, vol.%	1.7	35%
Others	ASTM D 4806-98	--

The staff is not proposing a limit on the sulfur content of the denaturant to provide more flexibility to ethanol producers. The proposed specifications would allow producers that produce undenatured ethanol with a very low sulfur content to use denaturants with a higher sulfur content. Assuming a denaturant with a sulfur content of 60 ppm (the interim CaRFG3 cap limit) and the sulfur levels normally found in undenatured ethanol, the addition of the denaturant will result in an increase in the sulfur content of the denatured ethanol by 1 ppm. Appendix C presents what the final sulfur content of denatured ethanol would be if a denaturants with 60 ppm of sulfur were used to denature the ethanol. In addition, if a producer can produce ethanol with low levels of sulfur, the producer can use denaturant with higher levels of sulfur and still meet the proposed limit of 10 ppm for denatured ethanol. For example, with ethanol that has a sulfur content of 3 ppm (the average reported in the RFA survey), the denaturant could have a sulfur content of 352 ppm and 150 ppm when it is added to ethanol at 2.0 vol.% and 4.8 % vol%, respectively. Data in Appendix C also demonstrate how the sulfur content of the denaturant used by ethanol producers could vary widely depending upon the sulfur content of the undenatured ethanol.

In addition to proposed specifications for the sulfur content, benzene content, olefin content, and aromatic content, the staff is proposing that denatured ethanol and denaturants meet the all of the specifications listed in ASTM D 4806-93.

E. Rationale for Proposed Specifications

The RFA survey data show that the sulfur content of denatured ethanol ranged from 1 ppm to 11 ppm with the average sulfur content at 2.9 ppm. Although there are no data on the distribution of the sulfur content from different producers, the available data suggest that at least half of the ethanol currently produced has a sulfur content below 3 ppm.

The CaRFG2 averaging limit for sulfur is 30 ppm. However, data collected by the CEC showed that the average sulfur content of gasolines produced in 1998 was much lower than the averaging limit. The CaRFG3 averaging limit for sulfur is 15 ppm. If the current trend continues, refiners would likely produce gasoline with sulfur contents well below 15 ppm. Gasolines produced to meet the CaRFG3 averaging limits could have sulfur contents of 10 ppm or lower. The use of denatured ethanol with sulfur content higher than that of 10 ppm in these cases would actually increase the sulfur content of the gasoline. Table II-6 shows how the sulfur content of the denatured ethanol can affect the sulfur content of the finished gasoline containing 5.7 volume percent ethanol.

Table II-6
Gasoline Sulfur Contents Resulting from Blending CARBOBs and 5.7 Volume Percent of Denatured Ethanol with Different Sulfur Levels

Sulfur Level of CARBOB	CaRFG3 with Denatured Ethanol with 10 ppm Sulfur	CaRFG3 with Denatured Ethanol with 15 ppm Sulfur
1	1.5	1.8
3	3.4	3.7
5	5.3	5.6
7	7.2	7.5
10	10.0	10.3
15	14.7	15.0

F. Rationale for Adopting the ASTM D 4806-98 Specifications

The ASTM D-4806-98 specifications are very important for the successful use of ethanol. The ASTM denaturant requirements limit the denaturant to gasoline and gasoline components with a maximum end point of 437°F. This assures that denaturants that are not compatible with vehicle components could not be used even though they are allowed by the Bureau of Alcohol, Tobacco and Firearms.

G. Rationale for Separate Standards for Products Represented as Appropriate for Use as a Denaturant in Fuel Ethanol

Although most of the ethanol used in California gasoline will probably be imported in denatured form, in some instances the denaturant will be added in the state. Since compliance with the denatured ethanol standards for benzene, olefins and aromatic hydrocarbon content will depend entirely on the composition and amount of the denaturant, it is appropriate to adopt denaturant standards for these properties. These will enable an ethanol producer or marketer to rely on the denaturant supplier to provide a product that results in compliance with the ethanol specifications.

H. Documentation Required for the Transfer of Denatured Fuel Ethanol

The proposed amendments include requirements that apply when a person transfers denatured ethanol intended for use as an additive in California gasoline. The person transferring the product would have to provide a document stating that the denatured ethanol complies with the ARB standards. Further, when the denatured ethanol is supplied from the California facility at which it was produced or imported, the supplier would have to furnish a document stating his or her name and address, the name and location of the facilities where the ethanol was produced and the denaturant added, and the name of the party who produced it and added the denaturant. This requirements would help assure refiners and others that the ethanol is in compliance and facilitate tracing back if there are problems associated with the denaturant.

III. CARBOB Model and Related Provisions

The staff is proposing amendments to the CaRFG regulations to provide for a CARBOB model that could be used to calculate the expected properties of the final oxygenated gasoline from the properties of the CARBOB itself. If the properties of the finished blend meet the criteria of the Predictive Model, then a refiner could elect to have CARBOB at the refinery directly subject to CARBOB limits, rather than being subject to the CaRFG limits after the ethanol has been hand blended into the CARBOB. This could provide refiners with operational advantages. Staff is also proposing various other amendments to make the CARBOB regulation work more effectively and efficiently.

A. Background

The U.S. EPA structured the federal RFG regulations to allow refiners to ship non-oxygenated gasoline from the refinery without complying with the federal RFG standards if it is specially formulated to be combined with oxygenate “downstream" from the refinery and the resulting blend will meet all of the federal RFG standards. This allows entities wishing to oxygenate gasoline downstream from the refinery to take advantage of the contribution oxygenates can make in meeting the federal RFG standards. U.S. EPA calls the specially formulated product “Reformulated Gasoline Blendstock for Oxygen Blending,” or “RBOB.” In a 1995 rulemaking, the ARB amended the CaRFG2 regulations to incorporate a similar approach, allowing refiners to supply a non-oxygenated blendstock called “California reformulated gasoline blendstock for oxygen blending,” or “CARBOB.”

At the December 1999 hearing, the staff proposed some changes to the existing CARBOB regulations and was aware of additional CARBOB issues that needed to be addressed. However, the remaining issues required more time and discussion with interested parties before they could be resolved. The staff committed to address these issues this year so that fuel producers and distributors would have sufficient time to make any necessary distribution system changes prior to December 31, 2002.

The staff is proposing further amendments to the CaRFG regulations to assure the practical and effective implementation of the CARBOB provisions and to facilitate the blending of ethanol in gasoline.

B. Existing CaRFG and CARBOB Requirements

Background. When gasoline is mixed with ethanol, certain characteristics of the resulting blend make it infeasible to be transported through pipeline systems. For example, if there is water in the system the ethanol will separate from the gasoline into the water. This could lead to contamination of the gasoline or corrosion in the distribution system. Because of this, ethanol is typically added at the terminal, either in a stationary blend tank or by “splash blending” the ethanol and the non-oxygenated gasoline in the cargo tank truck that will deliver the oxygenated gasoline to service stations and other outlets. Adding the ethanol affects the properties of the resulting gasoline blend in various ways. Since denatured ethanol typically has very low levels of the compounds for which the ARB has adopted CaRFG specifications (sulfur, benzene, aromatics and olefins), adding the ethanol to gasoline may reduce the concentration of these compounds in the resulting blend by simple dilution. The addition of ethanol to a base hydrocarbon gasoline has a non-linear effect on the Reid vapor pressure (RVP), the 50 percent distillation point (T50) and, 90 percent distillation point (T90). Adding 5-10 percent ethanol will increase the RVP of the resulting blend by approximately 1.2 psi, and it will also depress T50 and, to a lesser extent, T90.

Current Requirements. The current CARBOB provisions require the producer of a batch of CARBOB to take a representative sample, add the appropriate level of oxygenate, and test the resulting blend to determine compliance with all of the properties covered by the CaRFG standards. The producer must notify the ARB about the batch of CARBOB before it is transferred from the refinery. Whenever the CARBOB is transferred, it must be accompanied by a document identifying the oxygenate type or types and amount or range of amounts that must be added before the CARBOB is supplied from the final distribution facility. Like the federal regulations, the CARBOB provisions prohibit combining CARBOB that has been shipped from the refinery with any other CARBOB, gasoline, blendstock or oxygenate, except for the oxygenate for which the CARBOB was designed, or other CARBOB for which the refiner has designated the same type and amount or range of oxygenate.

C. Development of the Model for the Certification of a Gasoline Blend Prior To The Addition of Ethanol (CARBOB Model)

The staff is proposing amendments that would establish a new “CARBOB model” which would be used in connection with limits directly applicable to the CARBOB being supplied from a production or import facility. The CARBOB model would serve as a preprocessor for the Predictive Model. The refiner’s proposed CARBOB properties would be used to calculate the expected properties of the finished oxygenated blend. These finished blend properties would then be entered into the Predictive Model to see if the CARBOB properties result in a qualifying fuel. If the finished blend properties do qualify, then the refiner electing the CARBOB model option could compare the test results of the CARBOB directly against the CARBOB limits, rather than go through the step of hand blending ethanol to produce a finished blend.

CARBOB Model Dataset. To develop the CARBOB model, it was necessary to assemble a dataset of fuel properties before the ethanol was added to the blend and after the ethanol was blended. The amount of ethanol added is also a necessary value to have. Sierra Research Inc. in Sacramento, California was contracted by the Western States Petroleum Association (WSPA) to collect and assemble all the available information into a computer readable datafile. This data is available through the ARB web page. For sulfur, benzene, aromatics, and olefins the resulting fuel property could be calculated by scaling the initial fuel property by the amount of denatured ethanol to be added and the concentration of the specific fuel property in the denatured ethanol. After a preliminary analysis, it was found that the important properties for predicting an effect on RVP, T50, and T90 are RVP, T50, T90, and the volume of ethanol. To that end, the assembled dataset only contains the amount of denatured ethanol added and the values for RVP, T50, and T90, both before and after the blending of the ethanol. Table III-1 presents a summary of the dataset assembled for the construction of the CARBOB model.

Table III-1
Summary of CARBOB Dataset

	Minimum	Mean	Maximum
RVP Before (psi.)	5.3	8.2	15.4
T50 Before, ºF	160	210	253
T90 Before, ºF	278	325	368
Ethanol (vol%)	4.6	7.4	15
RVP After, (psi.)	6.0	9.2	16.0
T50 After, ºF	140	196	250
T90 After, ºF	275	321	362

Model Development. The CARBOB dataset was used as the basis for constructing a statistical model to predict finished fuel properties from the CARBOB properties and the expected quantity of ethanol to be blended. The linear regression procedure available from the SAS Institute Inc. was used in the model development. An automated stepwise model selection procedure was used to generate a candidate model. The stepwise procedure, at each step tests each term not already in the model to see if including the term will make the model better. In this case, the most significant term meeting the 95 percent significance level was added at each step and the coefficients were recalculated. If an included term ceased to be significant at the 95 percent level after a new term was added, it was then removed and the coefficients for the regression model were recalculated.

The pool of candidate terms included the first order terms: RVP, T50, T90, and the amount of ethanol to be blended. Also, included were all second order terms that could be created from the four first order terms. The stepwise procedure starts with all first order terms forced into the model. Then the second order terms are entered by the stepwise procedure. Once the stepwise procedure has stopped and there are no more statistically significant terms not added to the model, then any first order term that is not significant at the 95 percent level and not part of a second order term is removed from the model and the regression coefficients are then recalculated.

During the model development, it was found some models fit better over some ranges of the independent variable than others. The RVP model was found to be very close to being linear over the range where the base RVP was less than or equal to 9.0 psi and the ethanol blend amounts were between 4 percent by volume and 10 percent by volume. The T90 model was fit across all the data. The T50 model as constructed by partitioning the data set into two parts and fitting different models to each part. The two partitions were based on ethanol between 4 percent by volume and 9 percent by volume and ethanol between 9 percent by volume and 10 percent by volume. Table III-2 presents the list of terms included in each model. Details of each model are provided in Appendix D.

Table III-2
Terms Included as Part of Each Statistical Model

Variable Modeled	First Order Terms	Second Order Terms
RVP	RVP	None
T90	T90, T50, Etoh	None
T50 (4% ≥ Ethanol < 9%)	RVP, T90, T50, Ethanol	Etoh*Etoh, RVP*Etoh, T50*Etoh, T90*Etoh, RVP*T90
T50 (9% ≥ Ethanol < 10%)	RVP, T90, T50	T50*T50, T50*RVP, T90*RVP

D. Use of the CARBOB Model

Proposed amendments to the CARBOB regulation (section 2266.5, title 13, CCR) would allow producers and importers to elect to have the CARBOB model used in determining whether a final blend designated as CARBOB complies with the standards applicable to gasoline when it is supplied from the production or import facility. In doing so, they would use the new "Procedures for Using the California Model for California Reformulated Gasoline Blendstock for Oxygenate Blending (CARBOB)" as shown in Appendix B.

A producer of importer using the CARBOB model option would select a single volume of ethanol to be added, and an oxygen content range to serve as the oxygen input for the Predictive Model. Staff is proposing that the oxygen content range be permitted to be no greater than 0.4 wt.% when the CARBOB model is used. This is analogous to the approach in the current Predictive Model procedures. Under those procedures, where a refiner selects an oxygen range of 1.8-2.2 wt.%, one Predictive Model evaluation is conducted, with an oxygen content of 2.0 wt.%. Similarly, selection of an oxygen range of 2.5-2.9 wt.% results in one Predictive Model evaluation with oxygen set at 2.7 wt.%. These are the two most commonly expected ranges to be specified, because of the tax structure for ethanol blending. To obtain optimal tax benefits, the refiner would be expected to specify either 5.7 vol.% or 2.7 vol.% ethanol, which typically translates to 2.0 or 2.7 wt.% oxygen, so it is appropriate to use the single mid-range value. Where a wider oxygen content range is identified, however, the Predictive Model procedures require that two sets of specifications must pass the Predictive Model – one with the minimum amount of oxygen and one with the maximum amount. Limiting the oxygen range to 0.4

wt.% when the CARBOB Model is used will avoid a situation where the oxygenate value used in the CARBOB Model to identify the CARBOB limits does not closely reflect the amount of oxygen that may ultimately be added to the CARBOB downstream.

Amendments to the sampling and testing requirements in the CARBOB regulation would provide that a refiner selecting the CARBOB model would directly analyze the sample of CARBOB rather than going through the step of hand blending the ethanol into the CARBOB and then analyzing the oxygenated blend. Refiners see this as the primary advantage of the CARBOB model mechanism, because the analysis can be conducted more quickly and a protocol for in-line blending could theoretically be established under the appropriate circumstances.

Notification requirements. A producer or importer supplying CARBOB from its production or import facility has been required to notify the executive officer of specified information before it starts physical transfer of the final blend of CARBOB, and at least 12 hours before physical transfer is completed or the final blend is commingled. Where the producer is using the CARBOB model, the notification would have to include a statement of that election and each of the CARBOB alternative specifications that apply to the final blend. The notice would also include the information that is required when the Predictive Model is being used, i.e. the Predictive Model alternative specifications. The proposed amendments would provide that once the producer has provided notice regarding a final blend of CARBOB, the reported properties will continue to apply to subsequent shipments of CARBOB or gasoline until the producer provides a superceding notification. This is similar to the provisions that have applied to final blends of CaRFG being supplied from the refinery, and assures that there is a clear compliance option that applies to each batch of gasoline or CARBOB being shipped from the refinery.

Compliance determinations by ARB inspectors. The proposed amendments provide that where a refiner has elected to use the CARBOB model, ARB inspectors still would have the option to demonstrate a violation by taking a sample of the CARBOB, hand blending in the appropriate amount of ethanol, and testing the blended product against the applicable CaRFG flat or averaging standards. Refiners have argued strenuously that such a provision substantially reduces the usefulness of the CARBOB model, and could cause refiners not to use the mechanism at all. Staff believes the requirement provides a backup mechanism if serious shortcomings with the CARBOB model become apparent. However, it is the staff’s intent during initial implementation of the amendments that, where a refiner has elected to use the CARBOB model, violations will only be pursued where tests show that the CARBOB limits have been exceeded. Staff anticipates that it will also conduct tests based on hand blending during implementation, to augment the database for evaluating the effectiveness of the CARBOB model. Staff also anticipates that refiners will participate in a testing program to expand the available data for further verifying the CARBOB model. If significant shortcomings of the CARBOB model, staff expects to work with refiners and other interested parties to make sure that a vigorous enforcement program is maintained for shipments of CARBOB.

The existing regulations prohibit the supply of CARBOB from a production facility where the sulfur, benzene, olefin and aromatic hydrocarbon content of the CARBOB would necessarily result in a sulfur, benzene, olefin or aromatic hydrocarbon content value in the blended gasoline which exceeds the applicable limit for that property. For example, where the oxygenate will make up 5.4 percent of the oxygenated blend, the measured CARBOB properties for sulfur, benzene, olefins, and aromatics could be diluted to 94.6 percent of the original concentration (assuming the denatured ethanol contains none of any of those compound). This is calculated by multiplying the concentrations of sulfur, benzene, olefins, and aromatics 0.946. Any CARBOB found to be out of compliance under this mathematical adjustment would necessarily be out of compliance after the minimum designated amount of oxygenate is added, since for these four properties the only effects adding the oxygenate is expected to have are dilution and the possible introduction of impurities. This provides ARB inspectors with a useful compliance tool and would be retained where the producer or importer has not elected to use the CARBOB model.

E. Cap Limits for Downstream CARBOB

Under the existing regulations, the only way that ARB inspectors can determine whether CARBOB at terminals meets the CaRFG2 or CaRFG3 cap limits is by hand blending the ethanol and analyzing the resulting blend. Staff is proposing amendments that would establish cap limits that would apply directly to the CARBOB, so hand blending would not be necessary. Table III-3 presents the proposed CARBOB cap limits as calculated using the CARBOB model and the existing CaRFG3 cap limits. There would be three sets of CARBOB cap limits, applicable to the ethanol ranges that would encompass the three levels of ethanol most likely to be used because of the tax structure for ethanol blending. The ranges would start with 2.0 vol.% ethanol, because by that point the RVP response has become flat.

In the CARBOB model, the RVP, T50, and T90 of the final blend are a function of the RVP, T50, and T90 of the CARBOB fuel and of the ethanol content. CARBOB cap limits for T50 and T90 are a function of the target ethanol concentration and the possible range of values for the other properties in the CARBOB model. The RVP of the final blend is only a function of the initial RVP of the CARBOB blend. It should be noted that the RVP portion of the CARBOB model is only applicable between 4 and 10 percent ethanol content.

Table III-3
CARBOB Cap Limits
Calculated by the CARBOB Model

Property	CARBOB Cap Limits					
	2.0 - 5.8 vol.% Ethanol Range		5.9 – 7.8 vol.% Ethanol Range		7.9 - 10 vol.% Ethanol Range	
	CaRFG2	CaRFG3	CaRFG2	CaRFG3	CaRFG2	CaRFG3
RVP[1], psi	5.78	5.99	5.78	5.99	5.78	5.99
Sulfur[2], ppmw	85	63 / 31	86	64 / 32	89	66 / 32
Benzene, vol%	1.27	1.16	1.30	1.19	1.33	1.22
Aromatics, vol%	31.7	37.0	32.4	37.8	33.1	38.7
Olefins, vol%	10.6	10.6	10.8	10.8	11.1	11.1
T50, °F	226	226	228	228	226	226
T90, °F	333	333	334	334	335	335

1. The Reid vapor pressure standards apply only during the warmer weather months identified in section 2262.4.
2. The CaRFG Phase 3 CARBOB cap limits for sulfur are phased in starting December 31, 2002, and December 31, 2004, in accordance with section 2261(b)(1)(A).

F. Other Changes Pertaining to CARBOB

<u>Level of oxygenate used in hand blending</u>. The current CARBOB regulation provides that when hand blending is conducted to convert a sample of CARBOB into finished gasoline, the smallest amount of oxygenate is to be added where an oxygen range has been specified. This was because adding the smallest amount of oxygenate would provide the minimum amount of dilution possible. Staff is proposing revised language that would call for 5.7 vol.% ethanol when an oxygen range of 1.8-2.2 wt.% is specified, and 7.7 vol.% ethanol when the oxygen range is 2.5-2.9 wt.%. This makes the approach more consistent with the features of the Predictive Model procedures discussed in III.D. above.

<u>Properties of the ethanol used in hand blending</u>. The existing CARBOB regulation provides that the oxygenate used for hand blending at the refinery be representative of the oxygenate that will ultimately be added at the terminal or elsewhere. It requires a refiner planning to produce CARBOB to enter into a protocol with the Executive Officer on how representativeness will be assured. One of the advantages of adopting specifications for denatured ethanol is that they can be used to set the specifications for ethanol used in hand blending at the refinery. The proposed amendments eliminate the "representativeness" and protocol requirements, and substitute the following specifications for the ethanol used in refinery hand blending: a sulfur content of 3-10 ppm, a benzene content of 0-0.06 vol.%, an olefins content of 0-005 vol.%, and an aromatic hydrocarbons content of 0-1.70 vol.%. The minimum sulfur level is required because denatured ethanol will normally have some amount of sulfur.

Designating "cleaner" specifications for the denatured ethanol used in blending. The amendments also permit a refiner to designate a "cleaner" set of denatured ethanol specifications for the ethanol that will ultimately be added at the terminal. In this case, there is a mechanism for those specifications to be reflected in the ethanol used for hand blending at the refinery. There are also provisions that would assure that the ultimate oxygenate blender knows what specifications the ethanol ultimately added must meet.

Alternative means for determining whether are final blend of CARBOB complies with the standards for California gasoline. Along with hand blending and the option of the CARBOB Model, the amendments authorize a producer or importer to enter into a protocol with the Executive Officer identifying a different way of determining compliance for CARBOB. Such a protocol would only be permitted if the Executive Officer reasonably determines that its application will be no less stringent or enforceable than application of the express regulatory provisions.

IV. Transition from Gasoline with One Ethanol Content to Another

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. Also proposed are amendments allowing the mixing of CARBOB and CaRFG in such tanks, as long as conditions are met including a prohibition to the RVP standards. Staff has conducted an emissions analysis indicating no significant emission increases in these circumstances.

A. Background

The current CaRFG regulations prohibit the blending of CARBOB that is downstream from its production or import facility with other CARBOB, gasoline, blendstock or oxygenate. (2266.5(h).) Downstream CARBOB may 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. Once the CARBOB has been oxygenated and converted to CaRFG, there are no restrictions on blending it with other CaRFG, as long as the blend continues to comply with the cap limits.

When ethanol is added to gasoline, the RVP of the gasoline is increased, and this will result in increased evaporative emissions. Also, two CARBOB's that are to be blended with different ethanol contents cannot be mixed because it becomes difficult to determine the appropriate amount of ethanol to add; consequently, the final blend may not comply with the regulations.

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.

B. Staff Analysis

The primary objectives of the staff's analysis were to determine any potential adverse effect on emissions with a refinery transitioning from a CARBOB designed for one level of ethanol to another level of ethanol or to non-oxygenated RFG. The staff analysis also identified the types of transitions where the RVP cap limit could be exceeded. The properties of the blends were calculated for each turnover of the terminal tank, service station tank, and vehicle tank, and the changes were evaluated using the CaRFG3 Predictive Model to estimate the effect on emissions. Staff's analysis addressed only RVP and evaporative and exhaust emissions, other constraints, such as minimum octane requirements, will need be considered by refiners.

Changing the amount of ethanol added at a terminal leads to changes in products at the service station tanks and in the vehicle tanks. The term “transition” refers to sufficient tank turnovers such that the gasoline used at the vehicle meets the predictive model requirements. When a refiner is changing from one product to another, we refer to the limit applicable to the new product as the "target" properties. Table IV-1 summarizes the possible transitions

Table IV-1
Possible Transitions

Possible Transitions at the Terminal	Corresponding Transitions at Service Station or Vehicle Tank
Zero Oxygen RFG to CARBOB	Zero Oxygen RFG to Ethanol Fuel
CARBOB to Zero Oxygen RFG	Ethanol Fuel to Zero Oxygen RFG
CARBOB (A) to CARBOB (B)	Ethanol Fuel (A) to Ethanol fuel (B)

Note: A and B are the ethanol volume concentrations for which the CARBOBs were designed.

A transition at the terminal is complete when the target fuel or CARBOB properties are attained. The fuels properties after each tank turnover were calculated until the gasoline in the vehicle tank met the CaRFG3 predictive model requirements for a complying gasoline. This process generally required more than one terminal tank turnover before sufficient mixing occurred downstream so that the predicted emissions would not increase. In some cases, the blends downstream of the refinery would not meet the CaRFG predictive model requirements.

In conducting the analysis, the staff made several assumptions. The staff evaluated the effect on emissions at three different heel amounts at the terminal tank (10 percent, 25 percent and 50 percent) for six gasolines. It was assumed that the service station tank had an average heel of 20 percent and the vehicle tank had an average heel of 25 percent. The analysis only varied the terminal tank heel amount because that is the only tank turnover that can be practically controlled by the supplier. Also, it was assumed that the properties of the CaRFG that would be produced at the terminal, prior to the transition, were the same as the properties of the heel at the service station and vehicle tank.

It was also assumed that the terminal tank would undergo one turnover per week, the service station tank two turnovers per week, and the vehicle tank one turnover per week. The analysis also assumed that in each week, half of the vehicles would refuel with the mixture resulting from the first turnover at the station while the remaining half of the vehicles would refuel with the mixture resulting from the second turnover at the station.

The increase in emissions was calculated by averaging the total emissions exceeding the Predictive Model standard for each fuel blend in a four week period. Appendix E contains a detailed description of the fuels and methodology used to calculate the effect on emissions.

C. Effect on Emissions

The staff's analysis showed that the emissions impact of the tank transitions depended on at least three factors:

- the relative magnitude of the fuel remaining in the terminal tank (the heel) at each tank turnover,
- whether the oxygen content increased or decreased with the transition, and
- the CaRFG properties

The detailed results of the staff analysis are contained in Appendix E. A summary is presented in Table IV-2 and discussed below under four types of terminal tank transitions:

- from CARBOB to CARBOB with increasing oxygen content,
- from CARBOB to CARBOB with decreasing oxygen content,
- from non-oxygenated fuel to CARBOB, and
- from CARBOB to non-oxygenated fuel.

Terminal Tank Transitions From CARBOB to CARBOB With Increasing Oxygen Content. These transitions at the terminal result in service station and vehicle tank transitions from an ethanol fuel of one oxygen content to an ethanol fuel with a higher oxygen content. These transitions could increase NOx emissions from the vehicle tailpipe. However, the adverse emissions impacts can be minimized by controlling the tank heel at each turnover and by changing the properties of the target fuel at the first terminal tank turnover. The staff's analysis shows that emissions increases can be prevented if the following is done:

- the terminal tank heel is not allowed to exceed 10 percent during any of the tank turnovers required to complete the transition, and
- the sulfur content of the target fuel is reduced for at least the first turnover.

Transitions From CARBOB to CARBOB With Decreasing Oxygen Content. This transition at the terminal results in a transition at the service station and vehicle from an ethanol fuel of one oxygen content to an ethanol fuel with a lower oxygen content. These transitions can increase total hydrocarbon emissions from the vehicle. Emissions increases can be prevented if the following is done:

- the terminal tank heel is not allowed to exceed 10 percent during any of the tank turnovers required to complete the transition, and
- the sulfur content of the target fuel is reduced for at least the first turnover.

<u>Transitions From Non-Oxygenated Fuel to CARBOB</u>. The transition from non-oxygenated CaRFG to a CARBOB (designed to be blended with ethanol) at the terminal causes commingling of non-oxygenated CaRFG and CaRFG with ethanol at the service station and in the vehicle tank. The staff's analysis indicates that for the three terminal heels investigated, there would be an increase in evaporative hydrocarbon emissions and an increase in RVP above the cap limit. This would not be a problem, however, if the combined product is only supplied from the terminal when it is not subject to the seasonal RVP standard.

<u>Transitions From CARBOB to Non-Oxygenated Fuel</u>. A transition from a CARBOB (originally intended for ethanol to be added) and non-oxygenated CaRFG at the terminal causes commingling of non-oxygenated and ethanol fuels in the service station tank and the vehicle tank. The staff's analysis predicts that for all three possible terminal transitions and for all three terminal tank heels investigated, there would be an increase in evaporative hydrocarbon emissions and an increase in RVP above the cap limit. Again, this would not be a problem if the combined product is only supplied from the terminal when it is not subject to the seasonal RVP standard.

D. Staff Recommendations

In light of this analysis, the staff is proposing adoption of new subsections 2266.5(f)(1)(C) and (D), identifying situations in which – without the need for a protocol – parties would be permitted to mix different CARBOBs and CARBOB with nonoxygenated CaRFG downstream from the refinery or import facility, as part of a change in service of a storage tank.

First, the mixing of two different CARBOBs designed for different oxygen levels in a storage tank at a terminal or bulk plant would be permitted where the party combining the products can demonstrate that the following conditions are met:

1. The ratio of the initial CARBOB remaining in the storage tank to the new CARBOB added to the tank is 1 to 9 or less;
2. The sulfur content on the new CARBOB added to the tank in the first turnover of the transition is no more than 12 ppm sulfur;
3. The change in ethanol content will not exceed 3 percent of the oxygenated gasoline blend; and
4. The change in service is for legitimate operational reasons and is not for the purpose of combining the different types of CARBOB.

Second, the changing from CaRFG to CARBOB, or from CARBOB to CaRFG, as the product stored in a storage tank at a terminal or bulk plant would be permitted where the party combining the products can demonstrate that the following conditions are met:

1. If CARBOB is being added to CaRFG, the ratio of the initial CARBOB remaining in the storage tank to the new CARBOB added to the tank is 1 to 9 or less;
2. The resulting blend of product in the tank is supplied from the terminal or bulk plant during a time that it is not subject to the RVP standards;
3. The change in service is for legitimate operational reasons and is not for the purpose of combining the different types of CARBOB.

Under either of these scenarios, the party doing the mixing would be required to notify the ARB prior to commencement of the mixing. As long as the conditions are met, the product in the storage tank after the fuel is mixed will be treated as the new type of product.

Table IV-2
Staff Recommendations for Tank Transitions to Change Ethanol Content of CaRFG3 and Mitigation of Emissions Impact

Transition From	Potential Emission Impact	Conditions to Prevent Emissions Increases
CARBOB to CARBOB (increasing oxygen by no more than 3%)	NOx increase	1. Sulfur of target fuel to be no more than 12 ppmw for 1st tank turnover of the transition. 2. Heel at terminal not to exceed 10% for each tank turnover during the transition
CARBOB to CARBOB (decreasing oxygen by no more than 3%)	HC increase	1. Sulfur of target fuel to be no more than 12 ppmw for 1st tank turnover of the transition. 2. Heel at terminal not to exceed 10% for each tank turnover during the transition
Non-Oxygenated to Oxygenated RFG	HC increase and likely RVP violation downstream of refinery	None known for summer. Allow transition during non-RVP season
Oxygenated RFG to Non-Oxygenated	HC increase and possible RVP violation downstream of refinery	None known for summer. Allow transition during non-RVP season.

V. Small Refiner Offset Provisions

A. Background

In approving the CaRFG3 regulations in December 1999, the Board found it not economically feasible for small refiners that had been producing CaRFG2 to phase out MTBE and meet the CaRFG3 specifications. Because of the disparate costs, and preexisting investments made to comply with CaRFG2, the Board adopted less stringent CaRFG3 standards for small refiners provided that any increased emissions would be offset by changes to the small refiner diesel fuel specifications or production. Table V-1 compares the CaRFG3 specifications for small refiners and large refiners. The flat limits for benzene, aromatics, T50, and T90 were relaxed. These changes result in increases of hydrocarbon, NOx and toxic emissions that have to be offset. The Board did not change the CaRFG3 cap limits for small refiners so that the small refiner provisions will not adversely affect downstream enforcement.

Table V-1
The California Reformulated Gasoline Phase 3 Standards

Property	Flat Limits		Cap Limits
	Small Refiner	Large Refiner	All Refiners
RVP[1], psi	7.00 or 6.90[2]	7.00 or 6.90[2]	6.40 -7.20
Sulfur, ppmw	20	20	60-30[3]
Benzene, vol%	1.0	0.80	1.10
Aromatics, vol%	35.0	25.0	35.0
Olefins, vol%	6.0	6.0	10.0
T50., ºF	220	213	220
T90, ºF	312	305	330
Oxygen, wt%	1.8 – 2.2	1.8 - 2.2	0[4]-3.5[5]

1. The Reid vapor pressure standards apply only during the warmer weather months identified in section 2262.4.
2. The 6.90 psi standard applies only when a producer or importer is using the evaporative emissions model element of the CaRFG Phase 3 Predictive Model.
3. The CaRFG Phase 3 sulfur content cap limits of 60 and 30 parts per million are phased in starting December 31, 2002, and December 31, 2004, respectively, in accordance with section 2261(b)(1)(A)
4. The 1.8 percent by weight minimum oxygen content cap only applies during specified winter months in the areas identified in section 2262.5(a).
5. If the gasoline contains more than 3.5 percent by weight oxygen but no more than 10 volume percent ethanol, the maximum oxygen content cap is 3.7 percent by weight.

The current CaRFG3 regulations identify the pounds of excess emissions that must be offset per barrel of gasoline subject to the small refiner CaRFG3 flat limits – 0.0206 pounds of exhaust hydrocarbons per barrel, 0.0322 pounds of NOx per barrel, and the potency-weighted toxic emissions equivalent of 0.0105 pounds of benzene per barrel.

B. Proposed Small Refiner Mechanism to Offset Emissions Increases

The staff is proposing modifications to the small refiner provisions of the diesel fuel regulations to ensure that a small refiner utilizing the small refiner provision of the CaRFG3 regulations will fully offset the emissions increase.

Small refiners are now allowed to produce diesel fuel meeting a 20 volume percent aromatic hydrocarbon content limit, while large refiners are required to meet a 10 volume percent aromatic hydrocarbon content standard. Both large and small refiners can certify alternative diesel formulations that are shown to be equivalent to their respective standards. Small refiners are also restricted to an annual volume cap on the total quantity of diesel fuel they can supply subject to the small refiner standard. Small refiners can increase their diesel production by complying with the large refiner 10 percent aromatic hydrocarbon content provisions.

The staff is proposing several options for small refiners to use in offsetting the small refiner CaRFG3 emissions. First, a small refiner can reduce its diesel fuel exempt volume cap to provide the needed offsets. Second, the small refiner can produce a "cleaner" small refiner diesel fuel. Third, the small refiner can increase their exempt volume by producing an even "cleaner" small refiner diesel fuel that will result in no net increase in emissions from gasoline or diesel fuel produced by them if they also forego their right to market high sulfur diesel fuel in California. Under each of the options, the small refiner would also have to make available up to 100 barrels per day of diesel fuel having a sulfur content not exceeding 30 ppm and an aromatic hydrocarbon content not exceeding 20 percent, to the extent there are buyers wishing to acquire that diesel fuel on commercially reasonable terms. None of the proposed options would prevent the small refiner from producing as much "large refiner" diesel as it chooses.

The staff is proposing several options to provide flexibility in meeting the regulations. Also, refinery operations are likely to change in the future and the regulations could become unnecessarily restrictive if only one option is provided.

Kern Oil and Refining Co. (Kern) is the only small refiner that qualifies for the CaRFG3 small refiner provisions at this time, because is the only small refiner that produced California gasoline subject to the CaRFG2 standards in 1998 and 1999. The exempt volume cap for Kern is currently 6,405 barrels per day for small refiner diesel fuel.

Under option one, Kern could reduce its small refiner exempt volume cap from 6405 bpd to 2,263 bpd, and sell or supply 100 bpd of diesel fuel with a sulfur content not exceeding 30 ppm. This would reduce the total amount of small refiner diesel sold in California.

With option two, Kern could keep its small refiner exempt volume cap at 6405 bpd and provide the offsets by reducing the aromatic hydrocarbon content of its small refiner diesel alternative formulation by 2 volume percent and increasing the cetane number by 0.7. Any small refiner diesel fuel it sells or supplies which is not designated as a certified alternative formulation must have an aromatic hydrocarbon content not exceeding 18 weight percent. Also, Kern would be required to sell or supply 100 bpd of diesel fuel with a sulfur content not exceeding 30 ppm.

With option three, Kern could give up the small refiner diesel exempt volume entirely in exchange for an exempt volume of a "cleaner" small refiner diesel fuel that is 125% higher than the current 6,405 bpd limit on the condition that they no longer market, in California, diesel fuel that does not meet the California motor vehicle diesel fuel requirements. For Kern, its exempt volume would be capped at 8,006 barrels per day and would be required to meet the following conditions:

- A reduced aromatic hydrocarbon content of 3.5 volume percent, a 0.5 number increase in cetane and an increase in additive of .02 percent for diesel fuel meeting a small refiner certified alternative diesel fuel formulation, or
- An aromatic hydrocarbon content not greater than 14 volume percent for small refiner diesel
- sell or supply 100 bpd of diesel fuel with a sulfur content not exceeding 30 ppm.

The staff calculations for Kern's situation are presented in Appendix F and demonstrate that either of the three options offset the emissions increase associated with the production of small refiner CaRFG3 and any increased emissions from increasing the diesel fuel exempt volume.

With any of these approaches, it is assumed that if the small refiner does not produce the maximum amount of small refiner diesel fuel extra emissions benefits would be gained because their small refiner diesel would be replaced by cleaner large refiner diesel fuel.

VI. Other Proposed Amendments

Staff is proposing several additional amendments to make the regulations work more effectively, provide additional flexibilities where feasible, and correct errors.

A. Reproducibility of RVP Test Method Using Automated Instruments

Until adoption of the Phase 1 CaRFG (CaRFG1) regulations, the sole test method designated for determining compliance with the ARB's standards for the RVP of gasoline was ASTM D 323-58, which had a stated reproducibility of 0.3 psi. The reproducibility of a particular test method represents the maximum difference between two single and independent test results obtained by different operators working in different laboratories on identical material that one would expect to occur in no more than in one case in twenty. When conducting tests to determine whether gasoline complies with an ARB standard, the Compliance Division only takes enforcement action when its test shows the gasoline exceeds the applicable standard plus the reproducibility. Thus, where the RVP standard is 7.00 psi and the test method reproducibility is 0.3 psi, the Compliance Division will only pursue a violation where the ARB's test results show an RVP exceeding 7.30 psi (staff also routinely notifies parties of test results exceeding the standard but within the range of reproducibilty, in order for the party to consider corrective actions in the future).

As part of the CaRFG1 rulemaking in 1990 – and at the request of industry – the ARB adopted an alternative method for measuring RVP, in order to accommodate testing with automated instruments. The test method was named the ARB's "Test Method for the Determination of the Reid Vapor Pressure Equivalent Using an Automated Pressure Testing Instrument," and was adopted as section 2297, title 13, CCR. The ARB method was based on ASTM Emergency Standard 15. The method identifies calibration equations for three different automated instruments: (1) Grabner Instruments Model CCA-VP (the laboratory Grabner), (2) Grabner Instruments Model CCA-VPS (the portable Grabner), and (3) the Stanhope-Seta Setavap model. In a round-robin testing process involving various laboratories including the ARB's and those of WSPA members, the ARB staff identified the following reproducibilities for the three instruments: 0.13 psi for the laboratory Grabner, 0.21 psi for the portable Grabner, and 0.32 psi for the Setavap. However, because ASTM D323-58 was still the regulatory base method, the Board adopted staff's recommendation for the regulation to state that, for compliance purposes, the reproducibility for all automated instruments would be treated as 0.3 psi. Attachment G contains the staff's 1990 report on the ARB test method using automated instruments, including the analysis supporting the instrument-specific reproducibilities identified above.

Since the early 1990's, Compliance Division inspectors have used the portable Grabner instrument for all RVP testing, with excellent results. The staff has issued advisories to the industry, announcing the instrument being used for testing each regulated gasoline property. Refiners and others have almost always used an automated instrument to analyze for RVP, achieving reproducibilities significantly better than is stated in the regulation. Staff is accordingly proposing that the RVP test method regulation be amended to eliminate the blanket 0.3 psi reproducibility value that had been based on the original D 323-58 method. Instead, the regulation would specify that, for each of the three instruments with assigned calibration equations, the reproducibility value will be the value identified in the staff's 1990 round-robin analysis and set forth in the preceding paragraph. Similarly, the lower repeatability values for the three instruments identified in the 1990 round-robin analysis would substitute for the regulation's current 0.20 psi repeatability value derived from the ASTM D323-58 test method.

After this amendment becomes effective, the ARB plans to continue testing with the portable Grabner instrument, and to apply the proposed 0.21 psi reproducibility value in taking enforcement action. This will enhance the ARB's RVP enforcement program at the same time that the RVP cap limit is being raised to 7.2 psi to accommodate the evaporative model for the CaRFG3 standards. The amendment will not reduce refiner flexibility because refiners are already conducting their own RVP tests with the automated instruments having better reproducibilities than has been stated in the test method regulation.

B. Other Changes

Exemption For Gasoline Used In Racing Vehicles. A proposed amendment to section 2261(f) corrects an oversight in the provision that exempts gasoline used only in racing vehicles from the ARB's gasoline regulations. This provision has reflected the ARB's longstanding interpretation that, since racing vehicles are exempted by Health and Safety Code section 43001(a) from the vehicular air pollution control statutes, fuel used in racing vehicles is exempt from the ARB's motor vehicle fuels regulations. The amendment adds the detergent additives regulation to the others covered by the exemption.

Winter Oxygenates Requirements At Low-Throughput Stations. Staff proposes an amendment to section 2262.5(e)(2), which authorizes a defense to the wintertime oxygenates requirements at the beginning of the winter season for low-throughput stations that have not received a gasoline delivery to a particular tank since 14 or more days before start of the season. The amendment would correct a misalignment of this provision with the elimination of October from the South Coast oxygenates season starting in 2003.

Test Method For Determining Oxygen, Ethanol And MTBE Content. The staff is proposing nonsubstantive amendments to sections 2263(b), 2273(b)(1) and 2273(d)(1) that will result in having the same test method version identified in all references to determining oxygen, MTBE and ethanol content. Each reference currently identifies the basic ASTM D4815 method, the Standard Test Method for Determination of MTBE, ETBE, TAME, DIPE, teriary-Amyl Alcohol and C1 to C4 Alcohols in Gasoline by Gas

Chromatography. However, while the method for determining oxygen content is identified as ASTM D4815-94, the method for determining MTBE and ethanol is identified as ASTM D4815-94a. The amendments would substitute uniform references to ASTM D4815-99, the most recent version of the method. This change would simply keep the test method designations current, and would eliminate the potentially confusing references to two different methods. The only differences between the three version of the method are editorial, so this change will have no substantive effect.

Protocol For Multiple Averaging Banks At Refinery Or Import Facility. A proposed amendment to section 2264(c) would allow a producer or importer to enter into a protocol with the Executive Officer allowing up to three separate averaging banks at a single production or import facility, applicable to operationally distinct products such as different grades of gasoline or oxygenated and unoxygenated. The averaging provisions currently require that the shipment of any "debit" batch of gasoline at the facility be offset by the shipment from the same facility of sufficient "credit" batches within specified time periods, and this has not permitted a protocol allowing multiple averaging banks to apply to a single facility. At least one refiner has indicated that the ability to have two or three simultaneous averaging banks at a facility for distinct products would provide additional useful flexibility. The Compliance Division has already entered into protocols that allow all shipments of one grade of gasoline to be subject to a particular set of Predictive Model flat limits while shipments of a different grade are subject to a different set of Predictive Model flat limits. As long as the different averaging banks are applied to clearly distinct product streams, compliance determinations for two or three banks should still be manageable. The offset requirements would apply independently to each bank. Once averaging is selected for a particular product, the refiner could change to a different compliance option only if all of the preexisting requirements for such a change were met for that product.

Staff proposes amendments to sections 2266.5(c)(2) and 2270(a)(3) regarding an importer's obligation to sample and test gasoline it has imported. Just as the flat and averaging CaRFG limits apply to each "final blend" that is supplied from a refinery, those limits also apply to each final blend that is supplied from the import facility. Regulatory requirements for sampling and testing each imported shipment would accordingly be amended so that they apply to each final blend of gasoline or CARBOB the importer has imported, rather than each shipment. This will make the batch that is sampled identical to the batch that is subject to the regulations.

Gasoline Sampling Procedures. An amendment is also proposed for the tap sampling element of the motor fuel sampling procedures in section 2296, which is ambiguous on the need for a cooling bath as part of the tap sampling. The amendment would insert a note which had been in the ASTM procedure from which the ARB's sampling procedure was derived. The note indicates that a cooling bath is to be used only if the RVP is over 16 psi.

VII. Economic Effects of the Proposed Amendments to the CaRFG3 Regulations

This chapter presents a summary of the staff analysis regarding the economic effects of the staff's proposal. Overall, the proposed changes to the CaRFG3 regulations are designed to provide clarity and enhance the flexibility of the current regulations. The staff does not anticipate there should be any adverse economic effect associated with the staff proposal.

A. Background

The primary issues that are to be addressed by this proposed rulemaking include amendments to accommodate the blending of ethanol in CaRFG3, new regulations to assure consistent quality of fuel grade ethanol, proposed changes to the diesel fuel regulations to offset the emissions from the small refiner provisions specified for CaRFG3, and amendments that specify how refiners are to transition from distributing gasoline produced for one ethanol content to a different ethanol content. Some other changes include lowering the enforcement reproducibility of the RVP test method when specified automatic instruments are used.

B. CARBOB Model

The CARBOB model will increase the flexibility for refiners to produce complying CaRFG3 gasoline. The CARBOB model will allow refiners to certify CARBOB blends without having to hand blend ethanol into the CARBOB and then send the sample to a laboratory to determine if the resulting blend is a complying fuel. This will decrease the time for a refiner to produce and ship CARBOB gasoline from the refinery. This increase in flexibility should not result in a negative economic impact.

C. Provisions to Switch from One CARBOB to Another or to a Non-oxygenated CaRFG

The current regulations impose restrictions on how one CARBOB and another may be combined downstream from the production or import facility. Downstream of a refinery, a CARBOB can only be commingled with other CARBOB that has been designed to have the same type and amount of oxygenate added. Once the CARBOB has been oxygenated and converted to CaRFG, there are no restrictions on blending it with other CaRFG, as long as the blend continues to comply with the cap limits. These restrictions limit the ability of gasoline distribution system proprietors to change the type of fuel in a storage tank.

The CARBOB tank transition provisions are intended to provide a mechanism for gasoline distribution system proprietors to transition their gasoline storage tanks from CARBOB blends requiring one level of ethanol to a different level of ethanol without having to pump the storage container dry prior to the introduction of a different CARBOB. These transitions include going from CARBOB to complying gasoline, and from complying gasoline to CARBOB, outside of the RVP season. Having to empty a storage container to comply with current regulations is time-consuming and expensive. Therefore, the staff’s proposal would result in an increase in flexibility and potential cost savings and not result in a negative economic impact.

D. Denatured Ethanol Specifications

The proposed denatured ethanol specifications will help ensure that when ethanol is blended with CARBOB at a gasoline terminal, the ethanol does not contribute to an exceedance of the applicable CaRFG3 limits for sulfur, benzene, aromatic, and olefin content. Suppliers will be able to specify alternative denatured ethanol specifications, most likely for use in proprietary systems. With the phase-out of MTBE from California gasoline, it is expected that by 2003, California would consume about one third of the existing United States ethanol production. Based on the results of the RFA survey, currently over half of all producers responding to their survey produce denatured ethanol that meets the proposed specification, and with careful selection of the denaturant, a significant portion of the remaining producers would be able to meet the proposed specifications for denatured ethanol.

For those few producers that currently do not meet the proposed specifications, they could use a denaturant with a lower sulfur content than they currently use. Given the small amount of denaturant that is added to ethanol, relatively small increases in the cost of the denaturant should have small impacts on the cost of the denatured ethanol. For example, an ethanol producer who wishes to meet the California specifications for denatured ethanol may need to purchase a denaturant that costs 10 cents per gallon more than its previous purchase price. At the ASTM upper limits of 4.8 percent volume denaturant, the added cost is less than a half cent per gallon (0.48 cent per gallon) of denatured ethanol. At the Bureau of Alcohol, Tobacco and Firearms lower limit for denaturant volume of 2 percent, the added cost is only 0.2 cents per gallon. This is significantly less that the expected transportation cost of about 10 to 15 cents per gallon when shipping ethanol to California. Therefore, the staff's proposal for denatured ethanol specifications should not have a significant negative economic impact.

E. Small Refiner Provisions

In Resolution 99-29, the ARB found that the cost of compliance with the CaRFG3 standards for small refiners now producing CaRFG2, and the additional capital expenditures to enable them to meet the CaRFG3 standards, would be substantially greater on a per-gallon basis than the comparable cost for large California refiners. Given the disparate costs and preexisting investments made to comply with the CaRFG2 standards, the ARB approved a set of alternative CaRFG3 flat limits for small refiners. The staff's proposal would put into place a mechanism for qualifying small refiners to fully mitigate any emissions increase associated with the small refiner CaRFG3 standards, and as such, are not expected to have a significant negative economic impact.

F. Other Changes

The staff's proposal to lower the enforcement reproducibility for the RVP test method when specified automated instruments are used should not result in a significant adverse economic method. Most if not all refiners are already using the same sorts of automated instruments as are used by ARB inspectors, and are presumably not supplying gasoline for which test results exceed the RVP standard, even if within the range of reproducibility.

G. Economic Effects on Small Business

Government Code section 11346.2(b)(4)(B) requires the ARB to describe any alternatives it has identified that would lessen any adverse impact on small business. In defining small business, Government Code section 11342(h) explicitly excludes refiners from the definition. Also, the definition includes only businesses that are independently owned and, if in retail trade, gross less than $2,000,000 per year.

The staff's proposed amendments to the CaRFG3 regulations are designed to assure the practical and effective implementation of the provisions on CARBOB and to provide a mechanism for small refiners to fully mitigate any increased emissions associated with the CaRFG3 small refiner provisions. These provisions are expected to increase the flexibility for refiners and gasoline distribution system proprietors to remove MTBE from California gasoline.

The current regulations prohibit the mixing of CARBOB designed for one level of ethanol with a CARBOB designed for another level of ethanol. This could be a significant burden to the smaller gasoline marketers and fuel distribution system proprietors. The staff proposal is designed to increase the flexibility for gasoline marketers and distribution system proprietors to make transitions from a CARBOB designed for one level of ethanol to a CARBOB designed for another level of ethanol. The staff proposal also includes provisions for transitioning between a complying CaRFG3 gasoline with ethanol and a non-oxygenated gasoline. These amendments are designed to provide clarity and enhance the flexibility of the current regulations, and as such, should not have a negative economic impact.

The remaining provisions are clean-up changes, clarifications, and small technical modifications to the current regulations. Therefore, the staff does not anticipate there should be any significant additional adverse economic effect upon small businesses associated with the staff proposal.

VIII. Environmental Effects of the Proposed Amendments to the CaRFG3 Regulations

This chapter presents a summary of the results of the analysis of the environmental effects of the staff's proposal.

A. Background on the Staff's Proposal and Existing Environmental Requirements

The staff's proposal will amend the CaRFG3 regulations to provide greater flexibility and guidance for refiners to produce and distribute gasoline meeting the CaRFG3 regulations without the use of MTBE. The changes include conditions that could allow CARBOBs intended for different oxygen contents to be mixed without increasing emissions. These proposed amendments are consistent with the Board's intent when the CaRFG3 Regulations were approved in December 1999. The proposed amendments do not effect the requirements specified in Senate Bill (SB) 989 or SB 529, nor do they present any issues that were not anticipated during the review by the Environmental Policy Council.

SB 989. Senate Bill 989 (Sher) was signed by the Governor on October 10, 1999. This legislation requires that the ARB ensure that the CaRFG3 regulations maintain or improve upon emissions and air quality benefits achieved by CaRFG2 as of January 1, 1999, and to provide additional flexibility to reduce or remove oxygen from motor vehicle fuel.

SB 529. Senate Bill 529 (Bowen) also was signed by the Governor on October 10, 1999. It established a mechanism for conducting environmental assessments of revisions to the ARB's CaRFG standards proposed before January 1, 2000, and was the mechanism used in connection with the December, 1999 CaRFG3 rulemaking.

California Environmental Policy Council Review. SB 529 also requires the California Environmental Policy Council (CEPC) to review the environmental assessments prepared on ARB's motor vehicle fuels regulations and to determine whether any significant environmental impacts would occur from regulatory amendments. Based on the CaRFG3 environmental assessments, the CEPC met on January 18, 2000, and determined that there will be not be a significant adverse environmental impact on public health or the environment, including any impact on air, water, or soil, that is likely to result from the change in gasoline that is expected to be implemented to meet the CaRFG3 regulations approved by the ARB. Further, it concluded that the CaRFG3 regulations will comply with all of the requirements of SB 989 and SB 529.

Below is additional discussion of potential individual environmental media effects regarding the staff's proposal and the modifications to the CaRFG3 regulations.

B. Effects on Water Quality

The staff's proposal would not change any of the CaRFG2 or CaRFG3 standards, and would not create changes to the CaRFG3 regulations that would have environmental impacts on water quality.

C. Effects on Air Quality

The staff’s proposal is designed to facilitate the transition to and production of CaRFG3 without affecting emissions. This proposal includes amendments to the CaRFG3 regulations to assure the practical and effective implementation of the provisions on CARBOB, including tank transitions from one ethanol content to another and a CARBOB model. This proposal also includes a mechanism for small refiners to fully mitigate any increased emissions associated with the CaRFG3 small refiner provisions. The staff proposal also includes other technical changes that do not materially effect emissions. As such, these provisions are not expected to result in any increase in emissions. The staff's proposal would not create a change to the intent of the CaRFG3 regulations when approved in 1999 and would have no effect regarding environmental impacts on air quality.

Use of CARBOB Model and Air Quality Impacts. The CARBOB model will increase the flexibility for refiners to produce CARBOB blends and complying CaRFG3 gasoline. The staff's proposal and modifications to the CaRFG3 regulations will have no net effect on emissions as refiners will still be required to meet the CaRFG3 specifications either by complying with specified CaRFG3 flat or averaging limits or through the use of the ARB Predictive Model. Therefore, the staff's proposal and additional regulatory flexibility provided in the CaRFG3 regulations will not have a negative effect on air quality.

Denatured Ethanol Specifications and Air Quality Impacts. The staff’s proposal for specifications for fuel grade denatured ethanol would provide greater predictability for refiners, oxygen blenders, and gasoline distribution system proprietors. The increased flexibility and predictability for the blending of ethanol would not have a negative environmental impact.

Small Refiner Provisions and Air Quality Impacts. The staff’s proposal would put into place a mechanism for small refiners to fully mitigate any emissions increase associated with the use of complying CaRFG3 made to the small refiner specifications, and as such, are not expected to have a negative environmental impact.

Tank Transition Provisions and Air Quality Impacts. The tank transition provisions are intended to provide a mechanism for gasoline distribution system proprietors to transition their gasoline storage tanks from CARBOB blends requiring one level of ethanol to a different level of ethanol without having pump all storage tanks dry prior to the introduction of a different CARBOB. These transitions include transitioning from CARBOB to non-oxygenated gasoline and from non-oxygenated gasoline to CARBOB blends outside the RVP season. The intent of staff’s proposal is to increase flexibility when transitions to different ethanol contents are needed without resulting in any increases in air emissions or other negative environmental impact.

D. Effects of the Staff's Proposal on Greenhouse Gas (GHG) Emissions

The staff's proposal is not expected to increase emissions of greenhouse gases that may contribute to global warming and do not effect the original finding that there is essentially no difference in GHG emissions between reformulated gasoline produced with MTBE versus gasoline blended with corn-derived ethanol.

E. Effects of Proposed CaRFG3 Regulations on Allowable Emissions

The proposed amendments to the CaRFG3 regulations will maintain the emissions benefits gained in the existing CaRFG2 program as required by SB 989 and the Governor's Executive D-5-99.   Therefore, there should be no increase in allowable emissions associated with the staff's proposal to amend the CaRFG3 regulations.

APPENDICES

Appendix A – Proposed Regulation Order -- Follow-up Amendments to the CaRFG3 Regulations

Appendix B – Procedures for Using the California Model for California Reformulated Gasoline Blendstocks for Oxygenate Blending (CARBOB)

Appendix C – Denatured Ethanol

Appendix D – Development of the CARBOB Model

Appendix E -- Effect of Transitions to Different Ethanol Contents

Appendix F -- Small Refiner Emissions Offsets

Appendix G -- RVP Test Method and Reproducibility

References

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American Society for Testing and Materials, D5453-00 Standard Test Method for Determination of Total Sulfur in Light Hydrocarbons, Motor Fuels and Oils By Ultraviolet Fluorescence, 2000.

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