SUMMARY OF BOARD ITEM

ITEM # 02-6-2: PUBLIC HEARING TO CONSIDER THE PROPOSED AMENDMENTS TO THE CALIFORNIA PHASE 3 REFORMULATED GASOLINE REGULATIONS

STAFF RECOMMENDATION: The staff recommends that the Air Resources Board (ARB) approve the proposed amendments to the California Phase 3 Reformulated Gasoline (CaRFG3) regulations. These amendments (a) postpone the prohibitions regarding Methyl Tertiary Butyl Ether (MTBE) and other oxygenates other than ethanol in CaRFG3 from December 31, 2002 to December 31, 2003, (b) postpone the imposition of CaRFG3 standards, from December 31, 2002 to December 31, 2003, and (c) make various minor changes to ensure that the regulations work effectively, provide additional flexibility where feasible, and make minor corrections.

DISCUSSION: In December 1999, the Board approved the CaRFG3 regulations that prohibited production of California gasoline with MTBE after December 31, 2002. These regulations also established CaRFG3 standards to become effective on the same date. The use of any oxygenate other than ethanol as a replacement for MTBE in California gasoline was also banned by these regulations unless a multimedia evaluation of the use of the oxygenate in California gasoline has been conducted, and the California Environmental Policy Council (CEPC) has determined that its use will not have a significant adverse impact on the public health or the environment. Because ethanol is the only oxygenate currently approved by the CaRFG3 regulations, the ban on MTBE is expected to result in the large-scale replacement of MTBE with ethanol to comply with current federal RFG oxygenate requirements.

On March 14, 2002, Governor Davis issued Executive Order D-52-02. This Executive Order directed the ARB to take the actions necessary to postpone for one year the prohibitions regarding the use of MTBE and other specified oxygenates in California gasoline. The Governor found that it is not possible to eliminate use of MTBE on January 1, 2003 without significantly risking disruption of the availability of gasoline in California. Such disruptions would substantially increase prices, harm California's economy and impose an unjustified burden on motorists.

Staff is proposing amendments to the CaRFG3 regulations consistent with the Governor's Executive Order D-52-02, along with a few other amendments designed to ensure that the regulations work effectively.

The proposed amendments will postpone the prohibition of the use of MTBE and other oxygenates other than ethanol in California gasoline supplied by refiners and importers from December 31, 2002 to December 31, 2003, with the downstream phase-in requirements also postponed by one year. Similarly, the schedule for reducing residual levels of MTBE in CaRFG3 would be postponed one year.

The amendments will also postpone the imposition of the CaRFG3 standards for gasoline properties for one year, from December 31, 2002 to December 31, 2003. With the proposed delay in the prohibition of the MTBE, it is appropriate to allow refiners to meet the CaRFG2 standards for an additional year for producing gasoline oxygenated with MTBE. However, individual refiners and importers will retain the ability to elect to have batches of gasoline subject to the CaRFG3 standards – including the prohibition of MTBE – prior to December 31, 2003.

Staff is proposing additional amendments to ensure that the regulations work effectively, provide additional flexibility where feasible, and make minor corrections. One set of amendments simplifies the testing provisions for determining whether gasoline blendstock designed for blending with ethanol will comply with the CaRFG standards after it is oxygenated. Another amendment would correct errors in the assignment of Reid vapor pressure regulatory control periods for the North Coast Air Basin and the North Central Coast Air Basin.

SUMMARY AND IMPACTS:

The postponement of the MTBE ban and the related CaRFG3 regulations should have no significant negative impacts on air quality. The additional benefits expected with the CaRFG3 program will be postponed by one year, and only to the extent that refiners choose not to elect into the CaRFG3 program early and remove MTBE from their gasoline prior to the mandated deadline.

The proposed one-year delay in the phase out of MTBE will postpone the evaporative emissions impact associated with gasoline containing ethanol to the extent that individual refiners continue to use MTBE to produce CaRFG and do not opt in to the CaRFG3 program early. The magnitude of the permeation emission impact is uncertain at this time.

To the extent the one-year postponement avoids gasoline supply shortages and price spikes, this could save motorists up to $30 million per day for the duration of the supply problem.

Refiners, ethanol producers and others who have made investments to comply with the current December 31, 2002 deadline may incur some costs. This impact would be reduced to the extent that producers of CaRFG elect to remove MTBE early.

Those companies that have not completed the conversion may experience an economic benefit as the delay allows the companies time to complete the infrastructure improvements and contingency provisions needed to ensure adequate supply and availability of gasoline after the MTBE phase-out.

Water districts could incur costs from additional contamination from continued use of MTBE. However, the impacts of the delay are expected to be small in comparison to the existing contamination.

Since Governor Davis issued his Executive Order, both Shell Oil and British Petroleum have publicly stated that they will voluntarily remove MTBE from their gasoline on the original schedule. It is likely that as other California refiners acquire sufficient quantities of ethanol and finish the necessary modifications to produce and distribute gasoline that is MTBE free there will be further announcements of gasoline being produced without the use of MTBE, thereby further reducing the potential for groundwater impacts.

TITLE 13. CALIFORNIA AIR RESOURCES BOARD

NOTICE OF PUBLIC HEARING TO CONSIDER AMENDMENTS TO THE CALIFORNIA REFORMULATED GASOLINE REGULATIONS TO POSTPONE IMPOSITION OF THE CaRFG3 STANDARDS AND THE PROHIBITION OF MTBE AND OXYGENATES OTHER THAN ETHANOL IN CALIFORNIA GASOLINE FROM DECEMBER 31, 2002 TO DECEMBER 31, 2003

The Air Resources Board (ARB or Board) will conduct a public hearing at the time and place noted below to consider amendments to the California Reformulated Gasoline (CaRFG) Regulations. The proposed amendments would postpone the prohibition of the use of methyl tertiary butyl ether (MTBE) and other oxygenates other than ethanol in California gasoline, postpone the imposition of the CaRFG3 standards, and make other changes.

Date	July 25, 2002
Time	9:00 a.m.
Place	California Environmental Protection Agency Air Resources Board Central Valley Auditorium 1001 "I" Street Sacramento, CA 95814

This item will be considered at a two-day meeting of the Board, which will commence at 9:00 a.m. on July 25, 2002, and may continue at 8:30 a.m. on July 26, 2002. This item may not be considered until July 26, 2002. Please consult the agenda for the meeting, which will be available at least 10 days before July 25, 2002, and posted on the ARB's website, to determine the day on which this item will be considered.

This facility is accessible to persons with disabilities. If accommodation is needed, please contact ARB's Clerk of the Board at (916) 322-5594, or Telecommunications Device for the Deaf (TDD) (916) 324-9531, or (800) 700-8326 for TDD calls from outside the Sacramento area, by July 11, 2002, to ensure accommodation.

INFORMATIVE DIGEST OF PROPOSED ACTION AND POLICY STATEMENT OVERVIEW

Sections Affected: Proposed amendments to sections 2261, 2262, 2262.4, 2262.5, 2262.6, 2262.9, and 2266.5, 2269, 2271, 2272, and 2296 of Title 13, California Code of Regulations (CCR).

Background

The ARB administers the Phase 2 CaRFG (CaRFG2) regulations, which have applied to all California gasoline since March 1996. The regulations establish standards for the following eight gasoline properties: sulfur, benzene, olefin, aromatic hydrocarbon, and oxygen contents, the 50 percent distillation temperature, (T50), the 90 percent distillation temperature, (T90), and summertime Reid vapor pressure (RVP).

The CaRFG regulations allow refiners to use a "Predictive Model" to specify alternative formulations. The Predictive Model is a set of mathematical equations that relate emissions rates of exhaust hydrocarbons, oxides of nitrogen (NOx), and potency weighted toxics for four toxic air contaminants (benzene, 1,3-butadiene, formaldehyde, and acetaldehyde) to the values of the eight regulated gasoline properties. An alternative gasoline formulation is acceptable if emissions of hydrocarbons, NOx, and potency-weighted toxics resulting from this formulation are no greater than emissions from gasoline having the specifications set forth in the CaRFG2 standards. Currently, most of the gasoline sold in California complies with the CaRFG2 regulations through the use of the Predictive Model.

Since 1995, most of the state's gasoline has contained about 11 percent MTBE, which, along with ethanol, is an oxygenate that is used to introduce oxygen into gasoline and to improve octane. The widespread use of MTBE has primarily resulted from two programs mandated by the federal Clean Air Act (CAA) – the federal reformulated gasoline (RFG) program administered directly by the U.S. Environmental Protection Agency (U.S. EPA), and the wintertime oxygenates program which is ultimately administered by ARB. In areas not subject to the federal RFG or the CO wintertime oxygen requirements, the Predictive Model may be used to reduce or eliminate oxygen in California gasoline.

One of the requirements for federal RFG is that it contain at least 2.0 weight % oxygen year-round in on-road vehicles in severe and extreme non-attainment areas for ozone. In 2002, the federal RFG requirements apply in San Diego County, the greater Los Angeles area (Los Angeles, Orange and Ventura Counties, and parts of Riverside and San Bernardino Counties), the greater Sacramento area (Sacramento County and parts of Yolo, Solano, Sutter, Placer, and El Dorado Counties), and the San Joaquin Valley Air Basin. Together, these areas account for about 80 percent of the gasoline sold in California. California has asked U.S. EPA to exercise its authority to waive the minimum oxygen requirement, but in June 2001 the agency denied the state's request. A lawsuit challenging the denial is currently pending in the U.S. Court of Appeals for the Ninth Circuit.

California's wintertime oxygenates requirements have resulted from requirements in the federal CAA that states mandate the use of oxygenated gasoline during the winter in most areas that are in nonattainment of the National Ambient Air Quality Standard (NAAQS) for carbon monoxide (CO). The use of oxygen in gasoline reduces emissions

of CO from the existing vehicle fleet, and ambient CO concentrations are the highest in the winter. As ambient CO concentrations have declined in California as a result of fleet turnover, the ARB has been able to eliminate the winter oxygen requirement in areas where it is no longer necessary for attainment and maintenance of the NAAQS for CO. At present, the ARB requires a wintertime minimum oxygen content of 1.8 wt.% only in Los Angeles, Orange, Riverside, San Bernardino, Ventura, and Imperial counties.

Several years ago, concerns began to increase about adverse environmental impacts from the use of MTBE in the state's gasoline. The main concern with the continued use of MTBE is the potential for contamination of California's groundwater, surface water, and drinking water systems. MTBE is very soluble in water and will transfer to groundwater faster, and will travel farther and more easily than other gasoline constituents when gasoline leaks from underground storage tanks or pipelines.

The California MTBE Public Health and Environmental Protection Act of 1997 directed the University of California (U.C.) to conduct research on the effects of MTBE. The legislation also required the Governor to take appropriate action based on the U.C. findings and information from public hearings conducted on the U.C. report. On March 25, 1999, Governor Davis signed 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. 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. It also directed the ARB 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).

At a December 9, 1999, hearing, the Board approved the CaRFG3 regulations consistent with the Governor's directive and the subsequent CEC recommendation that December 31, 2002 was the earliest feasible date for a ban on MTBE. The CaRFG3 regulations prohibited California gasoline produced with MTBE starting December 31, 2002, established CaRFG3 standards applicable the same date, established a CaRFG3 Predictive Model, and made various other changes. The CaRFG3 standards modify the specifications for 5 of the 8 gasoline properties regulated by CaRFG2, with the objective of providing additional flexibility in lowering or removing the oxygen content requirement while maintaining current emissions and air quality benefits.

The CaRFG3 regulations ban gasoline produced with the use of MTBE, for all California gasoline supplied from production and import facilities starting December 31, 2002. The prohibition is phased in for most deliveries of gasoline to retail outlets occurring after February 13, 2003, and to gasoline throughout the distribution system starting March 31, 2003. The regulations also established a three-stage schedule for reducing residual MTBE levels. The regulations require that the concentration of MTBE in

distributed CaRFG3 not exceed 0.3 percent, by volume, beginning December 31, 2002. This level is reduced to 0.15 percent by volume starting December 31, 2003 and 0.05 percent by volume starting December 31, 2004.

The CaRFG3 regulations also place a conditional ban, starting December 31, 2002, on the use of any oxygenate other than ethanol, as a replacement for MTBE in California gasoline. Such oxygenates may not be used to produce California gasoline unless a multimedia evaluation of the use of the oxygenate in California gasoline has been conducted, and the California Environmental Policy Council (CEPC) has determined that its use will not have a significant adverse impact on the public health or the environment.

The Proposed Amendments

Current information indicates that the timetable adopted in 2000 for removal of MTBE would not satisfy the directive of Executive Order D-5-99 that the timetable ensure adequate supply and availability of gasoline for California consumers. The results of a study commissioned by the CEC in 2001 show that phasing out MTBE from gasoline by the end of 2002 could result in a gasoline supply shortfall, which could in turn result in price levels that are 50 to 100 percent higher than normal. Further, there still exists uncertainty regarding the supply and availability of ethanol necessary to meet California's requirements.

On March 14, 2002, Governor Davis issued Executive Order D-52-02, which directed the ARB to take the necessary actions, by July 31, 2002, to postpone for one year the prohibitions of the use of MTBE and other specified oxygenates in California gasoline, and the related requirements for California Phase 3 reformulated gasoline. The Governor found that it is not possible to eliminate use of MTBE on January 1, 2003 without significantly risking disruption of the availability of gasoline in California. This would substantially increase prices, harm California's economy and impose an unjustified burden upon our motorists.

The ARB staff is proposing amendments to the CaRFG3 regulations consistent with the Governor's Executive Order D-52-02, along with a few other amendments designed to ensure that the regulations work effectively.

Prohibitions regarding MTBE and other oxygenates other than ethanol. The proposed amendments would postpone the prohibition of the use of MTBE and other oxygenates other than ethanol in California gasoline supplied by refiners and importers from December 31, 2002 to December 31, 2003, with the downstream phase-in requirements also postponed by one year. Similarly, the schedule for reducing residual levels of MTBE in CaRFG3 would be postponed one year. Starting December 31, 2003, California gasoline could not contain more than 0.30 volume percent MTBE. This residual limit of 0.15 volume percent MTBE would apply starting

December 31, 2004, with the 0.05 volume percent residual limit starting December 31, 2005.

Delaying imposition of the CaRFG3 standards. The amendments would also postpone the imposition of the CaRFG3 standards for gasoline properties for one year, from December 31, 2002 to December 31, 2003. With the proposed delay in the prohibition of the MTBE prohibition, it is appropriate to allow refiners to meet the CaRFG2 standards for an additional year for producing gasoline oxygenated with MTBE. However, individual refiners importers will retain the ability to elect to have batches of gasoline subject to the CaRFG3 standards – including the prohibition of MTBE – prior to December 31, 2003.

Other amendments. Staff is proposing additional amendments to ensure that the regulations work effectively, provide additional flexibility where feasible, and correct errors. One set of amendments simplify the testing provisions for determining whether gasoline blendstock designed for blending with ethanol will comply with the CaRFG standards after it is oxygenated. Another amendment would correct errors in the assignment of RVP regulatory control periods for the North Coast Air Basin and the North Central Coast Air Basin.

COMPARABLE FEDERAL REGULATIONS

As noted above, the U.S. EPA administers the federal RFG regulations, which currently apply to about 70 percent of California's gasoline and are contained in 40 CFR §§ 80.40 and following. The federal RFG regulations do not prohibit the use of MTBE.

AVAILABILITY OF DOCUMENTS AND AGENCY CONTACT PERSONS

The ARB staff has prepared a Staff Report: Initial Statement of Reasons (ISOR) for the proposed regulatory action, which includes a summary of the environmental and economic impacts of the proposal. The report is entitled "Proposed Amendments to the California Reformulated Gasoline Regulations Postponing Imposition of the CaRFG3 Standards and the Prohibition of MTBE and Oxygenates Other Than Ethanol in California Gasoline From December 31, 2002 to December 31, 2003.

Copies of the Staff Report and the full text of the proposed regulatory language, in underline and strikeout format to allow for comparison with the existing regulations, may be accessed on the ARB's web site listed below, or may be obtained from the Public Information Office, Air Resources Board, 1001 I Street, Environmental Resources Center, First Floor, Sacramento, CA 95814, (916) 322-2990 at least 45 days prior to the scheduled hearing (July 25, 2002).

Upon its completion, the Final Statement of Reasons (FSOR) will also be available and copies may be requested from the agency contact persons in this notice, or may be accessed on the ARB's web site listed below.

Inquiries concerning the substance of the proposed regulation may be directed to the designated agency contact persons, Mr. Steven Brisby, Manager, Fuels Section, (916) 322-6019, or Mr. Dean C. Simeroth, Chief, Criteria Pollutants Branch, Stationary Source Division, at (916) 322-6020.

Further, the agency representative and designated back-up contact persons to whom nonsubstantive inquiries concerning the proposed administrative action may be directed are Artavia Edwards, Manager, Board Administration & Regulatory Coordination Unit, (916) 322-6070, or Marie Kavan, Regulations Coordinator, (916) 322-6533. The Board staff has compiled a record for this rulemaking action, which includes all the information upon which the proposal is based. This material is available for inspection upon request to the contact persons.

If you are a person with a disability and desire to obtain this document in an alternative format, please contact the Air Resources Board ADA Coordinator at (916) 323-4916, or TDD (916) 324-9531, or (800) 700-8326 for TDD calls outside the Sacramento area.

This notice, the ISOR and all subsequent regulatory documents, including the FSOR, when completed, will be available on the ARB Internet site for this rulemaking at http://www.arb.ca.gov/regact/mtbepost/mtbepost.htm.

COSTS TO PUBLIC AGENCIES AND TO BUSINESSES AND PERSONS AFFECTED

The determinations of the Board's Executive Officer concerning the costs or savings necessarily incurred by public agencies and private persons and businesses in reasonable compliance with the proposed regulations are presented below.

In developing this regulatory proposal, the ARB staff evaluated the potential economic impacts on representative private persons or businesses. Delaying the phase-out of MTBE may impact a number of parties, including business and individual purchasers of gasoline, MTBE producers, ethanol producers, and refiners and others who have made investments to comply with the CaRFG3 standards by December 31, 2002.

The decision to delay the phase-out of MTBE is primarily predicated on the concern that the use of MTBE could not be eliminated by December 31, 2002 without significantly risking the disruption of the availability of gasoline in California. Such disruptions would substantially increase gasoline prices, harm California's economy, and impose an unjustified burden on individual and business motorists. Without the additional year directed by Governor Davis, it is likely that various segments of the transportation industry would not be ready to make the transition away from MTBE, precipitating gasoline supply problems and their associated price spikes. These increases would be expected to be larger than those experienced in the past. Previous supply problems have resulted in tightness of supply but not shortages. With an actual shortage of supply, prices could be expected to increase by 50 percent or more. The

benefit to individual and business motorists of avoided gasoline price spikes could be $30 million per day for the duration of the supply problem.

If a failure to postpone the MTBE prohibition were to result in a shortfall in gasoline supplies, it is likely that independent gasoline marketers would be disproportionately impacted. Independent marketers typically purchase gasoline on the unbranded market. Unbranded wholesale fuel is the portion of refinery production that would be impacted first if there is a shortfall in the market. A one-year postponement of the phase-out of MTBE and the related CaRFG3 standards would benefit independent marketers by allowing additional time to complete the infrastructure improvements and contingency provisions needed to ensure adequate supply and availability of gasoline after MTBE is prohibited.

California currently uses approximately 90,000 barrels per day of MTBE. Some California refiners operate small MTBE processing units that supply between 10,000 and 15,000 barrels per day of MTBE. The remaining demand is met from imports of MTBE from foreign and other domestic sources. A one-year postponement of the ban on MTBE would allow MTBE producers to continue to supply MTBE in California for up to an additional year. The amount will depend on decisions of refiners whether to continue to use MTBE to produce CaRFG or to elect to use ethanol early.

California refiners, product pipeline companies and terminal operators have completed a portion of the work necessary to accommodate the phase-out of MTBE. Delaying the phase-out of MTBE would mean that these businesses invested capital earlier than would be required, resulting in a potential delay in recovering their capital investment. This cost only applies to those companies who have completed the conversion and do not elect to phase out MTBE early. Those businesses that have not completed the conversion would experience an economic benefit from the proposed delay in the prohibition of MTBE.

Delaying the phase-out of MTBE by one year means that ethanol demand in California during 2003 may be significantly less than originally anticipated, resulting in excess capacity for ethanol producers who constructed or expanded plants in anticipation of the ban. This excess capacity may mean a temporary drop in profits during 2003 for ethanol producers, but this trend should be reversed once MTBE is phased out of use in the entire State by 2004. The size of this impact depends on whether other markets for the use of ethanol develop. Few ethanol producers are situated in California.

The Executive Officer has made an initial determination that the proposed regulatory action will not have a significant statewide adverse economic impact directly affecting businesses, including the ability of California businesses to compete with businesses in other states, or on representative private persons.

In accordance with Government Code section 11346.3, the Executive Officer has determined that the proposed regulatory action will not affect the creation or elimination

of jobs within the State of California, the creation of new businesses or elimination of existing businesses within the State of California, or the expansion of businesses currently doing business within the State of California. An assessment of the economic impacts of the proposed regulatory action can be found in the Staff Report (ISOR).

The Executive Officer has also determined, pursuant to Government Code section 11346.5(a)(3)(B), that the proposed regulatory action will affect small businesses. For the reasons discussed above, any impacts on the cost of gasoline to small businesses, and on independent oil marketers that are small businesses, are likely to be beneficial.

In accordance with Government Code sections 11346.3(c) and 11346.5(a)(11), the ARB's Executive Officer has found that the reporting requirements of the CaRFG regulations which apply to businesses are necessary for the health, safety, and welfare of the people of the State of California.

With regard to costs or savings necessarily incurred in reasonable compliance with the proposed amendments to the CaRFG regulations, the Executive Officer has determined that the proposed regulatory action will not create costs or savings, as defined in Government Code section 11346.5(a)(6), to any state agency or in federal funding to the state, costs or mandate to any local agency or school district whether or not reimbursable by the state pursuant to Part 7 (commencing with section 17500), Division 4, Title 2 of the Government Code, or other nondiscretionary savings to local agencies.

Like businesses and individuals, state and local agencies purchase gasoline for their motor vehicle fleets. As discussed above, the proposed amendments are expected to reduce the risk of gasoline supply shortages and price spikes that could occur if the MTBE prohibition is implemented on December 31, 2002 as currently scheduled. To the extent that changes in the price of gasoline resulting from the proposed amendments are considered costs or savings to state or local agencies, those agencies would likely experience a cost savings from the amendments. Given the many variables that will affect the price of gasoline in 2003, the amount of cost savings is unquantifiable.

Before taking final action on the proposed regulatory action, the Board must determine that no alternative considered by the agency or that has otherwise been identified and brought to the attention of the agency would be more effective in carrying out the purpose for which the action is proposed or would be as effective and less burdensome to affected private persons than the proposed action.

SUBMITTAL OF COMMENTS

The public may present comments relating to this matter orally or in writing at the hearing, and in writing or by e-mail before the hearing. To be considered by the Board,

written submissions not physically submitted at the hearing must be received **no later than 12:00 noon, July 24, 2002**, and addressed to the following:

Postal mail is to be sent to:

Clerk of the Board
Air Resources Board
1001 "I" Street, 23rd Floor
Sacramento, California 95814

Electronic mail is to be sent to: to: mtbepost@listserv.arb.ca.gov and received at the ARB **no later than 12:00 noon, July 24, 2002.**

Facsimile transmissions are to be transmitted to the Clerk of the Board at (916) 322-3928 and received at the ARB **no later than 12:00 noon, July 24, 2002.**

The Board requests but does not require that 30 copies of any written statement be submitted and that all written statements be filed at least 10 days prior to the hearing so that ARB staff and Board Members have time to fully consider each comment. The ARB encourages members of the public to bring to the attention of staff in advance of the hearing any suggestions for modification of the proposed regulatory action.

STATUTORY AUTHORITY AND REFERENCES

This regulatory action is proposed under that authority granted in sections 39600, 39601, 43013, 43013.1, 43018, 43101, and 43830, Health and Safety Code, and *Western Oil and Gas Ass'n.* v. *Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). This regulatory action is proposed to implement, interpret, and make specific sections 39000, 39001, 39002, 39003, 39010, 39500, 39515, 39516, 41511, 43000, 43013, 43013.1, 43016, 43018, 43021, 43101, 43830 and 43830.8, Health and Safety Code, and *Western Oil and Gas Ass'n.* v. *Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

HEARING PROCEDURES

The public hearing will be conducted in accordance with the California Administrative Procedure Act, Title 2, Division 3, Part 1, Chapter 3.5 (commencing with section 11340) of the Government Code.

Following the public hearing, the Board may adopt the regulatory language as originally proposed or with nonsubstantial or grammatical modifications. The Board may also adopt the proposed regulatory language with other modifications if the text as modified is sufficiently related to the originally proposed text that the public was adequately placed on notice that the regulatory language as modified could result from the

proposed regulatory action; in such event the full regulatory text with the modifications clearly indicated, will be made available to the public, for written comment, at least 15 days before it is adopted.

The public may request a copy of the modified regulatory text from the ARB's Public Information Office, Air Resources Board, 1001 "I" Street, Environmental Services Center, 1st Floor, Public Information Office, Sacramento, CA 95814, (916) 322-2990.

CALIFORNIA AIR RESOURCES BOARD

Michael P. Kenny
Executive Officer

Date: May 28, 2002

The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs see our Web –site at www.arb.ca.gov.

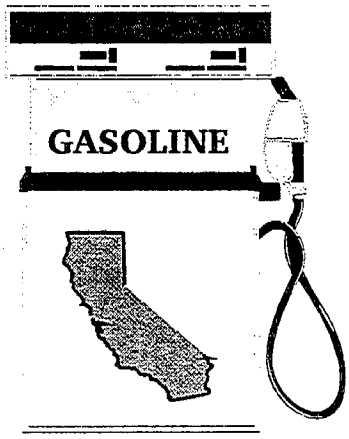
California Environmental Protection Agency

Air Resources Board

Proposed Amendments to the California Phase 3 Reformulated Gasoline Regulations

Proposed Amendments to the California Reformulated Gasoline Regulations Postponing Imposition of the CaRFG3 Standards and the Prohibition of MTBE and Oxygenates Other than Ethanol in California Gasoline from December 31, 2002 to December 31, 2003.

STAFF REPORT: INITIAL STATEMENT OF REASONS



Release Date: June 7, 2002

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 Postponing Imposition of the CaRFG3 Standards and the Prohibition of MTBE and Oxygenates Other than Ethanol in California Gasoline from December 31, 2002 to December 31, 2003.

Date of Release: June 7, 2002
Scheduled for Consideration: July 25, 2002

Location:

California Environmental Protection Agency
Central Valley Auditorium, Second Floor
1001 I Street
Sacramento, California 95814

Acknowledgments

This report was prepared with the assistance and support from the other divisions and offices of the Air Resources Board. In addition, we would like to acknowledge the assistance of staff of the State Water Resources Control Board and the California Energy Commission.

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APPENDICES

I. INTRODUCTION AND SUMMARY

A. Introduction

The Phase 3 Reformulated Gasoline (CaRFG3) regulations were adopted June 16, 2000 following a December 9, 1999 hearing by the Air Resources Board (ARB). The CaRFG3 regulations prohibit production of California gasoline, after December 31, 2002, with the use of Methyl Tertiary-Butyl Ether (MTBE), establish CaRFG3 standards, and establish a CaRFG3 Predictive Model. The Predictive Model provides refiners with flexibility to use alternative formulations while preserving the benefits of the program.

The CaRFG3 regulations were adopted in response to Governor Davis's March 25, 1999 Executive Order D-5-99 in which he found that, on balance, there is significant risk to the environment from using MTBE in gasoline in California. The Executive Order directed the ARB to adopt CaRFG3 regulations to phase out the use of MTBE in California gasoline by no later than December 31, 2002 and provide additional flexibility to producers of RFG in lowering or removing oxygen while preserving the existing air quality benefits of the CaRFG2 program.

This report is the initial statement of reasons to support proposed amendments to the CaRFG3 regulations adopted in 2000 regarding the effective date of the CaRFG3 regulations, the date of the prohibition of MTBE and oxygenates other than ethanol in California gasoline, and the handblend requirements of the California Reformulated Blendstock for Oxygenate Blending (CARBOB) provisions. The rulemaking is being conducted in response to Governor Davis's March 14, 2002 Executive Order D-52-02. Among other things, the Executive Order directed the ARB to take the necessary actions by July 31, 2002, to "postpone for one year the prohibitions of the use of MTBE and other specified oxygenates in California gasoline, and the related requirements for California Phase 3 reformulated gasoline."

B. Why Is MTBE Added to California Gasoline?

Since 1995, most of the state's gasoline has contained about 11 percent MTBE by volume. Such extensive use of MTBE is largely the result of the requirements of the 1990 Federal Clean Air Act Amendments for a federal reformulated gasoline program and for wintertime oxygenated gasoline programs to be adopted by states with areas in violation of the ambient air quality standard for carbon monoxide (CO). To meet the oxygenate requirements, MTBE became the refiners' oxygenate of choice because of its blending attributes which include its high octane rating, the fact that it dilutes undesirable gasoline components such as benzene, mixes well with gasoline, and is easily distributed in the state's pipeline system.

The federal reformulated gasoline (RFG) regulations adopted by the United States Environmental Protection Agency (U.S. EPA) have since 1995 required the year-round use of RFG containing 2.0-weight percent oxygen in severe and extreme ozone non-attainment areas. By the end of 2002, the federal RFG oxygen requirement will apply to about 80 percent of the gasoline sold in the state.

In response to the wintertime oxygenate requirement, the ARB in 1991 adopted a program that required that gasoline sold during the winter months in CO non-attainment areas contain an oxygenate. Originally, the ARB's wintertime oxygen requirement applied statewide. Currently, it applies only to Los Angeles, Orange, Riverside, San Bernardino, Ventura, and Imperial counties.

C. Why Is MTBE in Gasoline of Concern?

The main concern with the continued use of MTBE is the potential to contaminate California's ground and surface drinking water systems. Even relatively low levels of MTBE can give drinking water an unpleasant taste and odor, making the drinking water unusable. MTBE is very soluble in water and will transfer to groundwater faster, and will travel farther and more easily than other gasoline constituents such as benzene when gasoline leaks from underground storage tanks or pipelines.

With its increased use, MTBE has been found in many areas of the United States in groundwater in the vicinity of leaking underground storage tanks, in reservoirs which allow gasoline-powered watercraft, and to a lesser extent in drinking water supplies. In California, MTBE has been detected in some public drinking water supplies in diverse locations that include South Lake Tahoe, Santa Monica, Riverside, Anaheim, Los Angeles, San Francisco, Santa Clara, and San Diego. While only a small percentage of the State's community water supplies has been contaminated, in Santa Monica, about 75 percent of the drinking water wells are contaminated with MTBE and about one-third of the drinking water wells in the South Lake Tahoe Public Utility District are contaminated. A few drinking water wells in the Santa Clara Valley Water District and Sacramento have also been contaminated with MTBE. In addition, some drinking water wells have been closed down in communities as a protective measure to prevent MTBE from being drawn into the water supply system.

The California MTBE Public Health and Environmental Protection Act of 1997 directed the University of California to conduct research on the effects of MTBE. The University of California report was sent to the Governor in November 1998, and was peer reviewed by the Agency for Toxic Substances and Disease Registry, the United States Geological Survey, and other nationally recognized experts. After completion of the University of California report, two public hearings were held in February 1999. Subsequent to the hearings, the Governor issued Executive Order D-5-99 in which he found a "...significant risk to the environment from using MTBE in gasoline in California." The Executive Order directed appropriate state agencies to begin implementation of the phase out of MTBE from California gasoline.

D. What Were the Directives of the Governor's Executive Order D-5-99?

The Executive Order D-5-99 included a directive to the California Energy Commission (CEC) to develop, in consultation with the ARB, 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 the earliest feasible date. The Executive Order also directed the ARB to adopt the CaRFG3 regulations by December 1999. In addition, in the Executive Order, the Governor determined that California should request that the U.S. EPA grant

California a waiver from the year-round 2.0 percent by weight minimum oxygen mandate of the federal RFG program.

E. What Are the Present MTBE Prohibitions?

The ARB, in response to the Governor's Executive Order, approved the CaRFG3 regulations in December 1999 requiring the removal of MTBE from California gasoline by December 31, 2002. These regulations were the mechanism used to implement several provisions of the Governor's Executive Order. The CaRFG3 regulations provide producers of RFG with additional flexibility in removing MTBE, provide additional emissions and air quality benefits compared to the existing California Phase 2 Reformulated Gasoline (CaRFG2) program, and allow compliance with the California State Implementation Plan (SIP).

The CaRFG3 regulations prohibit the addition of MTBE and other oxygenates other than ethanol to California gasoline starting December 31, 2002, consistent with the Governor's 1999 directive and the CEC's recommendation. To address the question of trace amounts of MTBE that may be present as contamination, the regulations set limits for the allowable amount of residual MTBE that may be present in CaRFG3 in the distribution system. The CaRFG3 regulations were modified in 2000 to establish a California Reformulated Blendstocks for Oxygenate Blending (CARBOB) predictive model and specifications for denatured ethanol intended for blending into gasoline, and to identify conditions under which distributors could make transitions from one product to another.

Ethanol is the only oxygenate currently approved by the CaRFG3 regulations. Therefore, the ban on MTBE is expected to result in the large-scale replacement of MTBE with ethanol to comply with current federal RFG oxygenate requirements.

F. Why Are Amendments to the CaRFG3 Regulations Necessary?

1. CEC Study of Impact of MTBE Phase-out

Current information indicates that the existing timetable for removal of MTBE could conflict with the directive of Executive Order D-5-99 to ensure adequate supply and availability of gasoline for California consumers. The results of a study commissioned by the CEC in 2001 show that phasing out MTBE from gasoline by the end of 2002 is expected to reduce the ability of in-state refineries to produce sufficient fuel to meet demand, and that the availability of imported finished gasoline or blendstocks is uncertain. Therefore, there could be significant constraints on gasoline supply. This situation could lead to price levels that are 50 to 100 percent higher than normal. In addition, from the CEC contractor's study and from meetings with producers regarding CaRFG3 compliance plans, it is also apparent that some uncertainty exists regarding the difficulties of carrying out the large scale movement of ethanol necessary to meet California's requirements. It is estimated that California will need 750 to 900 million gallons of ethanol annually if MTBE is removed while the federal oxygenate requirement is still in effect. The logistics of moving such large volumes of ethanol have not been fully resolved, and there is a high probability that significant operational problems could occur in areas such as rail coordination, tank car unloading, marine receipts, and distribution of ethanol to gasoline truck terminals.

2. *Oxygenate Waiver Request*

To expedite the removal of MTBE from California gasoline and to lessen the impact on California consumers, the Governor, in April 1999, requested a waiver from the federal RFG oxygenate requirement. The U.S. EPA on June 12, 2001 denied California's request. This denial resulted in refiners being forced to continue to use an oxygenate thus giving them less flexibility in making CaRFG. With this loss of flexibility, the likelihood of the type of problems raised in the 2001 CEC contractor study, particularly with regard to supply and price of gasoline, becomes much greater. California is now pursuing a legal challenge of the U.S. EPA's decision in federal court.

3. *The Governor's Executive Order D-52-02*

In response to the problems identified above and the fact that there is significant risk that there would be a disruption in the availability of gasoline in California, on March 14, 2002, Governor Davis issued Executive Order D-52-02 which, among other things, directed the ARB to take the necessary actions, by July 31, 2002, to postpone for one year the prohibitions of the use of MTBE and other specified oxygenates in California gasoline, and the related requirements for California Phase 3 reformulated gasoline.

G. What Are the Proposed Amendments?

1. *Postpone Prohibition of MTBE in California Gasoline*

The staff is proposing that the Board amend the CaRFG3 gasoline regulations to extend the date on which the addition of MTBE to California gasoline is prohibited until December 31, 2003. This proposed amendment generally postpones the current MTBE prohibition date of December 31, 2002 by one year to comply with the directive of the Governor's Executive Order D-52-02.

2. *Revise the Schedule for Reducing Allowable Residual Levels of MTBE*

To be consistent with the proposed delay in phasing out the use of MTBE, staff is proposing that the Board adopt a revised schedule for reducing allowable residual levels of MTBE in CaRFG3 after the addition of MTBE is banned. Staff is proposing that the dates in the current schedule be postponed by one year to be consistent with the postponement of the current MTBE phase out date. Starting December 31, 2003, California gasoline could not contain more than 0.30 volume percent MTBE. This residual limit will be further reduced to 0.15 volume percent MTBE starting December 31, 2004, then to 0.05 volume percent starting December 31, 2005.

3. *Postpone Prohibition of non-MTBE Ethers and Alcohols Other than Ethanol*

The staff is also proposing that the Board postpone the prohibition of the use of non-MTBE ethers and alcohols other than ethanol in CaRFG3. The proposed amendment would prohibit the use of these oxygenates starting December 31, 2003 instead of December 31, 2002 to comply with the directive of the Governor's Executive Order D-52-02. The proposed delay would not change the provision that the prohibition would apply unless a multimedia evaluation of the use of the oxygenate in California gasoline has been conducted, and the California Environmental

Policy Council has determined that such use will not cause a significant adverse impact on public health or the environment.

4. Postpone the Imposition of the CaRFG3 Specifications

The staff is proposing that the Board postpone the imposition of the CaRFG3 limits for gasoline properties by one year to be consistent with the proposed one-year postponement of the MTBE phase out deadline. The CaRFG3 limits were necessary to increase a refiner's flexibility to make gasoline without MTBE while preserving the emissions benefits achieved by the CaRFG2 program. With the proposed delay in the imposition of the MTBE prohibition, the imposition of the CaRFG3 standards will not be necessary until the new date at which the MTBE prohibition becomes effective. This provision does not affect an individual refiner's ongoing ability to elect to use the CaRFG3 provisions to produce MTBE-free gasoline prior to December 31, 2003.

5. Other Changes

Staff is proposing a few additional amendments to ensure that the regulations work effectively, and to correct errors. The changes would simplify the testing provisions for determining whether a CaRFG complies when ethanol is the oxygenate. Also, changes are proposed to correct errors in the assignment of Reid vapor pressure (RVP) regulatory control periods for the North Coast Air Basin and the North Central Coast Air Basin.

H. What Alternatives Were Considered?

Two alternatives to the proposed one-year postponement of the MTBE phase out from California gasoline are: shortening the postponement period and maintaining the current deadline.

A postponement shorter than one year may not allow enough time to complete the infrastructure improvements and contingency provisions needed to ensure adequate supply and availability of gasoline after the MTBE phase out. A shorter postponement would also have the effect of introducing CaRFG3 during a period in which gasoline consumption is typically high, making the implementation of the program especially susceptible to the negative impacts of any constraints on the supply and availability of ethanol.

The current deadline is not satisfactory as more time is required to resolve the issues concerning adequacy of distribution and supply. With these issues resolved during the proposed one-year delay, there should be a significant reduction of the risk of disruption of gasoline supplies that could substantially increase prices, harm California's economy and impose an unjustified burden on California motorists.

I. Do the Proposed Amendments Satisfy the Commitments in the State Implementation Plan?

The CaRFG3 regulation was not one of the measures included in the 1994 SIP but it will provide benefits that help meet the SIP emission reduction obligations. Postponement of the CaRFG3 regulations by one year means that the emission benefits associated with the regulation would be lost during the one year delay. However, there would be no ongoing impact on the SIP unless the delay extends past 2004.

The year 2005 is the first milestone year for which the emission benefits of CaRFG3 have been credited toward ARB's SIP obligations. Because the CaRFG3 requirements were originally scheduled to go into effect on December 31, 2002, no emission reduction benefits from the regulation could be credited toward meeting ARB's 2002 milestone commitment. Consequently, because the CaRFG3 requirements will be fully implemented and the emission benefits will be fully realized by the end of 2004 under staff's proposal, there will be no SIP impact.

J. What are the environmental impacts of the proposed amendments?

1. Air Quality

The proposed amendment should have no significant negative impacts on air quality. Postponing the phase-out of MTBE and the related CaRFG3 regulations by one-year will maintain the benefits associated with the CaRFG2 program. The CaRFG3 program, relative to the CaRFG2 program, is expected to provide additional reductions in the emissions of hydrocarbons, oxides of nitrogen, and potency-weighted toxics of 0.1 percent, 2.3 percent, and 7.1 percent, respectively. Postponing the implementation of the CaRFG3 program by one year will postpone these additional benefits by one year. These additional benefits will be realized to the extent that refiners choose to elect into the CaRFG3 program to facilitate the removal of MTBE from their gasoline early.

There is some concern about the preservation of the emission benefits of CaRFG2 with a change from MTBE to ethanol during the delay of the MTBE phase out. To the extent that refiners choose to phase-out MTBE early, there may be an increase in emissions associated with the use of ethanol. Ethanol in gasoline can lead to an increase in evaporative emissions because of the potential for commingling of gasoline containing ethanol and non-ethanol gasoline in the vehicle fuel tank. Ethanol tends to increase the vapor pressure of any gasoline to which it is added. It is expected that refiners electing to use ethanol to replace MTBE will also elect to produce CaRFG3. This should not have a negative impact as the CaRFG3 regulations provide a Reid vapor pressure (RVP) offset of 0.1 psi designed to offset any increase in emissions associated with commingling.

Ethanol can also have an evaporative emissions impact due to permeation of ethanol through the soft fuel system components of motor vehicles. A delay in the phase out of MTBE will postpone this increase in emissions in so far as individual refiners chose not to remove MTBE and not opt in to the CaRFG3 program early. The magnitude of the permeation emissions impact remains somewhat uncertain at this time, but the ARB is co-funding a research study to investigate permeation emissions associated with ethanol in gasoline.

2. Water quality.

A one-year extension to complete the phase-out of MTBE from gasoline will likely result in some additional contamination of groundwater and surface water with MTBE. However, the magnitude of this impact is difficult to determine. Continued use of MTBE as a fuel oxygenate for an additional year may also add to the cleanup needs the state will face over the next decade, and could extend the risk of further closures of public drinking water supply.

It is not expected that the occurrence of leaks of gasoline containing MTBE in the proposed additional year would add significantly to the amount of existing contamination. For example, preliminary results of field tests currently being conducted by the State Water Resources Control Board (SWRCB) indicate that the strengthened underground storage tank (UST) requirements and enforcement have been very successful in reducing liquid releases of gasoline.

The SWRCB has also evaluated the potential for MTBE to enter groundwater through gasoline vapor leaks from underground piping and tanks. The SWRCB commissioned a tracer study to quantify the probability and environmental significance of releases from petroleum underground storage tank (UST) systems meeting the 1998 upgrade requirements. The largest tracer releases detected were estimated to have been associated with gasoline releases of 0.4 gallons per day (liquid equivalent), while the vast majority of releases are estimated to have been smaller than 0.04 gallons per day. The results are a significant improvement over a similar study performed before the implementation of the 1998 upgrade requirements that indicated that 35 percent of UST systems nationwide exhibited leak rates above 2.4 gallons per day. The SWRCB will continue to pursue research in this area to further evaluate impacts on groundwater.

With the one-year delay of the MTBE ban, other sources of MTBE releases will continue to have impacts on the water environment. These include deposition of MTBE from the air, surface spills, underground pipelines, above-ground storage tanks, marinas, watercraft, and vehicle accidents. Although the impact of these sources cannot be estimated at this time, historically their impact has been small compared to the impact from MTBE in gasoline leaks from underground storage tanks. Except to the extent that refiners elect to phase-out MTBE early, a delay in the phase out would result in another year of contamination at the present level.

K. What is the Cost of the Proposed Amendments?

Delaying the phase-out of MTBE by one year may impact a number of stakeholders. California motorists, MTBE producers and the Highway Trust Fund are expected to benefit from the delay. Ethanol producers and others who have made investments may incur some costs. Also, water districts could incur costs that would result from additional contamination from continued use of MTBE. This impact would be reduced to the extent that producers of CaRFG elect to remove MTBE early.

The proposed amendments will allow CaRFG2 to be produced for one additional year, thus allowing refiners, product pipeline companies, and others additional time to modify their facilities as needed to make CaRFG3 without risking disruptions in gasoline supply and the resulting increases in cost to the public. The benefit to California motorists of avoided price spikes could be 30 million dollars a day for the duration of the supply problem.

Other stakeholders that could benefit from the delay include MTBE producers and the federal Highway Trust Fund. MTBE producers may continue to supply MTBE to California for up to the proposed additional year. The amount of this benefit will depend on decisions of refiners to continue to use MTBE to produce CaRFG or to elect to use ethanol early. Currently more than 80 percent of California's MTBE demand is met through imports from foreign and domestic sources.

Gasoline blended with ethanol receives a $0.53 federal excise tax break for each gallon of ethanol used. This means that, the amount of money sent to the federal Highway Account from California will be decreased to the extent MTBE removed and ethanol in used. Delaying the phase-out of MTBE by one year means that some portion of this decline in revenue will be temporarily avoided.

Delaying the phase-out of MTBE means that refiners and product pipeline companies that invested capital earlier than would be required, may experience a delay in recovering their capital investment. This cost only applies to those companies who have completed the conversion and do not elect to phase out MTBE early. Those companies that have not completed the conversion can take advantage of the proposed delay.

Delaying the phase-out of MTBE by one year means that ethanol demand in California during 2003 may be significantly less than originally anticipated, resulting in excess capacity for ethanol producers. This overbuild of capacity may mean a temporary drop in profits during 2003 for ethanol producers but this trend should be reversed once MTBE is phased out of use in the entire State by 2004. Also, this is contingent upon the availability of other markets.

Delaying the phase-out of MTBE for another year may result in a few additional public water wells and leaking underground storage tanks (UST) sites that must be remediated for the presence of MTBE. The California State Water Resources Control Board estimates that the cost of replacing public water wells will range from 200,000 dollars to 1 million dollars per well, while the cost of cleanup of MTBE contaminated sites could range from 250,000 dollars to 3 million dollars per site depending on the extent of the contamination.

II. RECOMMENDATIONS.

The staff recommends that the Board adopt the proposed amendments to the California reformulated gasoline regulations, as contained in Appendix A. These amendments will change the effective dates in the CaRFG3 regulation to provide a one-year extension of the phase-out date for MTBE and other oxygenates other than ethanol.

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III. REFORMULATED GASOLINE PROGRAMS

The extensive use of MTBE in California gasoline at this time is largely the result of requirements of the Federal Clean Air Act Amendments for federal reformulated gasoline that contains oxygen year round and for state administered oxygenated gasoline programs in the wintertime. Neither the Clean Air Act nor the regulations adopted to implement the Act specify which oxygenate must be used. This choice is left to the producers. MTBE and ethanol are the two principal oxygenates used to meet both the federal RFG and wintertime oxygen content requirements. In California, MTBE became the refiners' oxygenate of choice because of its blending attributes which include its high octane rating, the fact that it dilutes undesirable gasoline components such as benzene, mixes well with gasoline, and is easily distributed in the state's pipeline system. Since 1995, most of the state's gasoline has contained about 11 percent MTBE.

A. Federal Reformulated Gasoline

The federal Clean Air Act (CAA) Amendments of 1990 directed the U.S. EPA to adopt federal RFG regulations, applicable starting January 1995. These regulations require the year-round use of RFG containing at least 2.0 weight percent oxygen in on-road vehicles in severe and extreme non-attainment areas for ozone. By the end of 2002, the federal RFG requirements will apply in San Diego County, the greater Los Angeles area (Los Angeles, Orange and Ventura Counties, and parts of Riverside and San Bernardino Counties), the greater Sacramento area (Sacramento County and parts of Yolo, Solano, Sutter, Placer, and El Dorado Counties), and the San Joaquin Valley Air Basin. Together, these areas account for about 80 percent of the gasoline sold in California.

B. California Wintertime Oxygen Requirement

In addition to the federal RFG program, the CAA amendments also required states to establish wintertime oxygenated fuel programs. This requirement generally applied to areas of the country that were in non-attainment of the National Ambient Air Quality Standard (NAAQS) for CO. Ambient CO concentrations are highest in the winter.

In 1991, ARB adopted a wintertime oxygenate requirement for gasoline to comply with federal law. Starting with the winter of 1992-1993, all California gasoline sold during the winter was required to contain 1.8 to 2.2 volume percent oxygen. The wintertime program was also incorporated into the Phase 2 CaRFG (CaRFG2) regulations effective in 1996.

Initially, the wintertime oxygenate requirement applied statewide because 80 percent of gasoline was consumed in CO non-attainment areas, and the distribution system could not efficiently accommodate oxygenated and non-oxygenated gasoline. However, as a result of its fuels and mobile source emissions reduction programs, California no longer has exceedances of either the State or federal ambient CO standard, except in a limited region in the Los Angeles area and in Calexico in Imperial County.

In 1998, ARB ended the wintertime oxygenate requirement for gasoline sold in areas that had demonstrated attainment of the ambient CO standard. At that time, the ARB continued the wintertime oxygen requirements until January 31, 2000 for the Lake Tahoe Air Basin and Fresno and Madera counties. In 1999, the ARB approved regulations rescinding the wintertime

oxygenate requirement in the Lake Tahoe Air Basin after January 1999, to facilitate the removal of MTBE from the gasoline sold in the Lake Tahoe region. The wintertime oxygen requirements remain unchanged in Los Angeles, Orange, Riverside, San Bernardino, Ventura, and Imperial counties.

C. California's Phase 2 Reformulated Gasoline Program

In November 1991, the Board approved the CaRFG2 regulations which became applicable beginning March 1, 1996. These regulations established standards for the following eight gasoline properties:

Reid vapor pressure (RVP)	the 50 percent distillation temperature (T50)
Sulfur	the 90 percent distillation temperature (T90)
Benzene	Olefin
Aromatic hydrocarbons	Oxygen

The CaRFG2 standards include three sets of limits. There are upper or "cap" limits for the eight regulated properties that apply to all gasoline throughout the distribution and marketing system. The "flat" and/or "averaging" limits apply to each batch of gasoline supplied from the production or import facility.

With the exception of RVP and oxygen content, the regulations provide producers and importers with three compliance options when supplying gasoline from the production or import facility. First, producers and importers may choose to comply with a flat limit applicable to all the gasoline, or they can meet a more stringent averaging limit. The averaging limits allow some flexibility as some batches of gasoline can be above or below the average specifications. There is no averaging option for RVP and oxygen standards.

The second compliance option allows a producer or importer to use the "CaRFG2 Predictive Model" to specify alternative flat and averaging limits that may be optimal for a particular refiner. The Predictive Model is a set of mathematical equations that relate emissions rates of exhaust hydrocarbons, NOx, and potency weighted toxics for four toxic air contaminants (benzene, 1,3-butadiene, formaldehyde, and acetaldehyde) to the values of the eight regulated gasoline properties. An alternative gasoline formulation is acceptable if emissions of hydrocarbons, NOx, and potency-weighted toxics resulting from this formulation are no greater than emissions from gasoline having the basic flat or averaging limits set forth in the CaRFG2 standards. The third compliance option allows certification of alternative formulations based on the results of vehicle emissions testing. Currently, most of the gasoline sold in California complies with the CaRFG2 regulations through the use of the Predictive Model.

Oxygen content is one of the gasoline properties used in the CaRFG2 Predictive Model. Oxygen is added to gasoline by blending in an oxygenate such as MTBE. The CaRFG2 regulations require a minimum oxygen content of 1.8 percent by weight, but a refiner may use the Predictive Model to reduce or eliminate oxygen, except when subject to wintertime oxygen requirements or the federal RFG requirements. Because of its blending characteristics MTBE became the oxygenate of choice by refiners producing CaRFG2.

IV. BAN OF THE USE OF MTBE IN CALIFORNIA

This section presents the background information relating to the CaRFG3 regulations and the phase-out of MTBE from gasoline.

A. Concern with the Use of MTBE

The widespread use of MTBE and leaks and spills associated with the distribution of gasoline have resulted in detectable MTBE levels in a number of drinking water wells and surface water resources. Even relatively low levels of MTBE can give drinking water an unpleasant taste and odor that renders the drinking water unusable.

The main concern with the continued use of MTBE is the potential to contaminate California's groundwater, surface water, and drinking water systems. MTBE is very soluble in water and will transfer to groundwater faster, and will travel farther and more easily than other gasoline constituents such as benzene when gasoline leaks from underground storage tanks or pipelines. Lawrence Livermore National Laboratory data show that MTBE is likely present at over 10,000 underground fuel tank sites in the state. While underground storage tanks were ordered replaced or upgraded by December 22, 1998, even upgraded storage tanks are not leak-proof and leaks from upgraded gasoline storage tanks in the state are expected in the future. However, these leaks should occur much less frequently and be much less severe than what was experienced prior to the upgrade program. Also, spillage during transfers of gasoline will continue to occur as a result of accidents and equipment failure.

The California MTBE Public Health and Environmental Protection Act of 1997 directed the University of California to conduct research on the effects of MTBE. The legislation also required the Governor to take appropriate action based on the U.C. findings and information from public hearings conducted on the U.C. report. The University of California report was sent to the Governor in November 1998, and was peer reviewed by the Agency for Toxic Substances and Disease Registry, the United States Geological Survey, and other nationally recognized experts. After completion of the University of California report, two public hearings were held in February 1999. The Governor then issued Executive Order D-5-99 based on the UC report, the peer review comments, and information from the public hearings,

B. The Governor's Executive Order D-5-99

On March 25, 1999, Governor Davis issued Executive Order D-5-99 in which he found that "on balance, there is significant risk to the environment from using MTBE in gasoline in California." Executive Order D-5-99 also directed specific action to be taken.

The Executive Order was implemented by State agencies including the ARB, the State Water Resources Control Board (SWRCB), Office of Environmental Health Hazard Assessment (OEHHA), California Energy Commission (CEC), and the Department of Health Services (DHS). The governor's Executive Order called for a number of steps to be taken to prohibit the use of MTBE, to evaluate the appropriate phase out period, and to investigate the environmental effects of alternative oxygenates. The Executive Order directed the CEC to develop a timetable

for removing MTBE from gasoline at the earliest possible date, but not later than December 31, 2002. The Governor further directed that steps be taken immediately to significantly reduce MTBE usage in the Lake Tahoe area and to require the labeling of gasoline pumps where CaRFG with MTBE is dispensed.

C. CEC's Response to the Directive of Executive Order D-5-99

The CEC determined that December 31, 2002 was the earliest feasible date that MTBE could be removed from RFG and that would comply with the Executive Order's directive to ensure adequate supply and availability of gasoline for California consumers. The CEC adopted their findings in the report, "Commission Findings: Timetable for the phase out of MTBE from California's Gasoline Supply" on June 28, 1999. A copy of the CEC analysis of the appropriate timetable to phase out the use of MTBE is in Appendix C.

The report identified several factors that would determine the feasibility of the December 31, 2002 phase-out date. The report described the refinery modifications needed to remove MTBE from the gasoline supply in California, including modifications to the gasoline distribution infrastructure. It also addressed the issues of the adequacy of ethanol supplies, project timelines, and other barriers to removing MTBE from gasoline prior to December 31, 2002. The CEC report (Appendix C) includes their findings on the factors that could affect the timetable for the phase out of MTBE.

D. California's Phase 3 Gasoline Standards

In response to Governor Davis's March 25, 1999 Executive Order D-5-99, the Board approved the CaRFG3 regulations at a hearing on December 9, 1999. The regulations included major amendments to the CaRFG2 regulations. The CaRFG3 regulations prohibit California gasoline produced with MTBE starting December 31, 2002, establish CaRFG3 standards applicable December 31 2002, establish a CaRFG3 Predictive Model, and make various other changes. The CaRFG3 regulations modified specifications for 5 of the 8 gasoline properties regulated by CaRFG2. The olefin standard did not change. Allowable levels of sulfur and benzene were reduced. At the same time, the aromatic hydrocarbon cap limit was increased and the flat limits and averaging limits for the two distillation temperature standards (T50 and T90) were relaxed. These changes were designed to comply with the Executive Order directive to provide additional flexibility in lowering or removing the oxygen content requirement while maintaining current emissions and air quality benefits. A copy of the Executive Order is in Appendix B.

a) Early Compliance with the CaRFG3 Standards

The CaRFG3 regulations include provisions allowing refiners to elect to produce gasoline subject to the Phase 3 RFG standards prior to the mandatory MTBE phase-out deadline of December 31, 2002. The regulations allow early compliance with the CaRFG3 standards by any producer or importer once one producer or importer has demonstrated to the satisfaction of the Executive Officer intent and ability to produce or import substantial quantities of one or more grades of gasoline complying with the CaRFG3 standards. On March 19, 2001, a refiner submitted a request for early CaRFG3 opt-in. On April 19, 2001, the Executive Officer issued Executive Order G-001-007, granting the refiner's request.

A refiner that elects to produce batches of CaRFG3 early is subject to the prohibitions on the use of MTBE and oxygenates other than ethanol in California gasoline that apply on December 31, 2002. Due to the need to maintain the fungibility of gasoline in the distribution system, the Executive Officer's approval of the early opt-in request automatically triggered changes in the CaRFG2 cap limits for RVP and aromatics to 7.20 psi and 35.0 volume percent respectively for gasoline downstream of the production or import facility.

b) MTBE Prohibitions of California's Phase 3 Gasoline Regulations

The CaRFG3 regulations ban gasoline produced with the use of MTBE, for all California gasoline supplied from production and import facilities starting December 31, 2002. The prohibition will be phased-in downstream from refineries according to a schedule similar to the one used to phase-in CaRFG2 in 1996. The regulations also establish a three-stage schedule for reducing allowable residual levels of MTBE to a final limit of 0.05 volume percent. Table 1 summarizes the current MTBE prohibitions of the CaRFG3 regulations, showing the MTBE levels that must not be exceeded during each phase of the timetable.

Table 1
Current Allowable Residual MTBE Levels

Allowable Residual MTBE Levels (volume percent)	Effective Date
0.30	Starting December 31, 2002
0.15	Starting December 31, 2003
0.05	Starting December 31, 2004

c) Prohibition of Oxygenates Other Than MTBE or Ethanol

The CaRFG3 regulations place a conditional ban, starting December 31, 2002, on the use of oxygenates other than MTBE or ethanol to produce California gasoline. Such oxygenates may not be used to produce California gasoline, unless a multimedia evaluation of the use of the oxygenate in California gasoline has been conducted, and the California Environmental Policy Council has determined that its use will not cause a significant adverse impact on pubic health or the environment. The current regulations do not specify residual limits for these oxygenates.

E. Local Regulations

On March 28, 2000, the Board of Supervisors of the County of El Dorado adopted an amendment to Title 8 of the El Dorado County Code to ban the sale of fuel containing MTBE in the Lake Tahoe Basin within El Dorado County. The ban became effective thirty days following adoption.

Some local agencies are implementing programs to restrict the use of MTBE and monitor the impact of MTBE on water resources. For example, since June 1994, the Los Angeles

Department of Water and Power has sampled for MTBE as part of its routine well-water monitoring. Also, the East Bay Municipal Utility District (EBMUD) allows only four cycle engines using MTBE-free gasoline in the San Pablo Reservoir. The EBMUD also proposes to ban all motor boat engines that discharge any fuel pollutants effective January 2003.

F. Actions by Other States

The use of MTBE in gasoline in other states has resulted in contamination of drinking water and ground water resources. These states have acted to protect their water supplies against contamination from MTBE by either substantially restricting or banning the use, sale or importation of fuels containing MTBE. Table 2 is a summary of the actions taken by 13 states to prohibit or reduce MTBE use in gasoline.

No state actually banned the use of MTBE prior to 1999. States either provided economic incentives to use ethanol or set oxygen specifications (3.5 weight percent) that could not be met with the use of MTBE.

Table 2

STATES OUTSIDE OF CALIFORNIA PROHIBITING OR REDUCING THE USE OF MTBE[1]

STATE	MTBE ACTION	DATE
Arizona	Ban	June 30, 2003 (180 days after CA)
Colorado	Phase out	May 1, 2002
Connecticut	Phase out	October 1, 2003
Illinois	Ban	July 24, 2004
Indiana	Ban	July 23, 2004
Iowa	Prohibit sale of gasoline with MTBE >2 volume %	2000
Kansas	Ban	July 1, 2004
Michigan	Prohibit use of MTBE	June 1, 2003
Minnesota	Prohibit sale of gasoline sale with MTBE >0.3 volume %	July 1, 2005
Nebraska	Prohibit sale of petroleum product with MTBE >1 volume %	2000
New York	Phase out	January 1, 2004
South Dakota	Prohibit sale of gasoline with MTBE >2 volume %	2000
Washington	Ban	December 31, 2003

1 NPRAonline: http://www.npradc.org/environmental/green-rm/archive/2001/5-11-01.html
Governor's Ethanol Coalition: www.ethanol-gec.org/summer2000/sum0004.htm
Illinois Corn: www.ilcorn.org/update/html

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V. RATIONALE FOR POSTPONING THE BAN ON THE USE OF MTBE IN CALIFORNIA

This section describes the rationale for postponing by one year the prohibition on using MTBE and other specified oxygenates in California gasoline and other related requirements for CaRFG3.

A. CEC Commissioned Study to Evaluate the Impact of the MTBE Phase-out

Both the ARB and CEC staffs have monitored the implementation of the CaRFG3 regulations. Since the CEC issued its June 1999 report in support of the feasibility of the ban of MTBE, new issues have been identified concerning the transition to MTBE-free gasoline by the December 31, 2002 deadline. A new CEC commissioned study evaluated the adequacy of California's gasoline supply and infrastructure to meet demand after MTBE is removed from California gasoline. The contractor reported their findings in the report, "MTBE phase out in California. California Energy Commission Consultant Report, Publication No. P600-02-008CR" dated March 2002. The study was primarily concerned with the availability and supply of gasoline and blending components that would be needed to make up for the anticipated net volume losses that result when ethanol is substituted for MTBE in the State's gasoline pool.

The study included the following findings:

- Implementation of the CaRFG3 standards as scheduled by January 1, 2003, with replacement by ethanol, could result in a gasoline supply shortfall of 5 to 10%. Such a shortfall could result in price levels that are 50 to 100% higher than normal.

- Large scale ethanol movements will be required to meet California's ethanol requirements which are estimated to be 750 to 900 million gallons annually if MTBE is removed while the federal oxygenate requirement is still in effect. The logistics of moving such large volumes of ethanol have not been resolved, and significant operational problems should be anticipated in areas such as rail coordination, tank car unloading, marine receipts, and distribution to gasoline truck terminals.

- A waiver from the federal requirement for oxygenates would improve flexibility for refiners after MTBE is phased out. The waiver would make the system less vulnerable to potential ethanol logistic problems.

B. Other Information

In addition to the CEC commissioned study, staffs of the ARB and CEC have analyzed the refiners' compliance plans and discussed the plans individually with the respective companies. These plans are required to be submitted by the CaRFG3 regulations. From this information, it appears that most capital modifications potentially could be completed on time for a December 31, 2002 phase-out of MTBE. However, the modifications would be completed just in time. There would be no time available to test the systems and take care of any problems that might be discovered, nor would there be time to fully develop contingency plans.

Also, only very limited information is available concerning how producers would respond to major incidents such as the loss of major processing units in refineries or delays in the distribution of ethanol within the state. With the use of ethanol, a delay in the delivery of ethanol to a terminal means that the terminal would have ample blendstocks that make up 94 percent of the volume of gasoline but no finished gasoline available for distribution to service stations. This is unlike CaRFG2 with MTBE, where all gasoline that arrives at a terminal can be delivered to service stations because the MTBE is typically added as part of the refining and blending process.

With only limited time to address these issues, the probability of substantial supply problems occurring is very high. Any significant supply problem could translate to increases in costs to consumers. Examples of this can be found in California in 1996 and 1999 and in the Chicago area (a federal RFG area) in 2000. Based on data from these time periods, it can be estimated that any significant reduction in supply could result in prices increasing up to 50 percent. For California, consuming about 40,000,000 gallons of gasoline a day, a supply disruption could mean consumers having to spend, conservatively, an extra 30,000,000 dollars per day for the duration of the supply disruption.

C. Oxygenate Waiver Issue

When the governor issued the Executive Order D-5-99 for the removal of MTBE, he identified the waiver from the federal RFG year-round oxygen requirement as an important element. Such a waiver would allow producers of CaRFG flexibility to minimize cost and increase production and flexibility with an actual increase in air quality benefits. A waiver would also enable refiners to respond more effectively to problems with ethanol supplies and refinery equipment.

In order to facilitate the removal of MTBE from California gasoline, on April 12, 1999, Governor Davis requested that the U.S. EPA grant California a waiver of the federal Clean Air Act requirement that gasoline sold in federal RFG areas contain two percent oxygen, year-round. With the federal oxygenate requirement in place, MTBE cannot be removed until there is sufficient production capability of ethanol in producing states, the ethanol infrastructure has been put into place and sufficient ethanol reserves built up within the state.

In 1999, both the National Research Council and the U.S. EPA's Blue Ribbon Panel on Oxygenate Use in Gasoline found that the Clean Air Act oxygen requirement should be removed for California. Between April 1999 and February 2000 the ARB staff supplied information in support of a wavier to the U.S. EPA staff.

On June 12, 2001, the U.S. EPA denied California's request for a waiver from the federal oxygen requirement based on its assessment that California had not met its burden of proof in making the required demonstration that maintaining the oxygen requirement would interfere with attainment of the national ambient air quality standard for ozone. It should be noted that the U.S. EPA did conclude that a waiver of the federal oxygenate requirement would result in significantly lower NOx emissions and a reduction in the cost of phasing out MTBE from California gasoline. On August 10, 2001, Governor Davis and the ARB filed a lawsuit challenging the U.S. EPA's denial of the waiver request. The lawsuit is currently pending.

Without a waiver of the federal oxygen requirement, California refiners will not have the additional flexibility to produce non-MTBE California reformulated gasoline more efficiently and at less cost. Flexibility that would lead to less volatility in gasoline prices was lost. Based on CEC cost estimates, retaining the oxygenate mandate will add on average about 3 cents per gallon to the cost of gasoline for California's consumers during times when ethanol supplies were generally adequate to meet demand. This cost would be much greater during periods when ethanol supplies were less than that needed to fully meet demand.

D. Underground Storage Tank Program

Senate Bill 989 (SB 989) (Stats. 1999, Ch. 812) – approved in California in October, 1999 – provides for a statewide program to continue to assess the existing problems of MTBE in groundwater and to provide for state and local programs to remediate the impacts in groundwater. Specifically, there are provisions for the study and assessment of MTBE leaks in groundwater from underground storage tanks (USTs), requirements for tank leak containment, annual UST inspections requirements, enforcement provisions related to UST and MTBE related leaks into groundwater, requirements for UST leak detection systems and monitoring, and statewide funding for UST petroleum leaks in groundwater remediation and cleanups. Further, there are SB 989 and other state and local provisions related to surface spills, underground pipelines, above-ground storage tanks, marinas, watercraft, and vehicle accidents. These state and local programs will continue over the next year to identify, remediate, prevent, and fund the cleanup of leaks related to petroleum USTs and other impacts related to MTBE leaks in water.

In 1998, when the University of California and Lawrence Livermore National Laboratory examined the problem of MTBE in ground water at service stations with underground liquid leaks, they estimated MTBE present at over 10,000 sites. This contamination has resulted in the closing of approximately 60 drinking water wells. Since that time, improvements in the underground storage tank program have been implemented.

UST facilities continue to represent the greatest potential source of future MTBE releases to water. The integrity of the UST systems in California has improved dramatically during recent years as old bare-steel single-walled tanks have been upgraded with corrosion protection and leak detection systems, or replaced with new double-contained systems. Preliminary results of field tests currently being conducted by the SWRCB indicate that this upgrade/replacement program has been very successful in reducing liquid releases, but approximately two out of three UST systems now in operation may be releasing gasoline vapors into the subsurface. This could create a localized source of groundwater contamination.

The SWRCB commissioned a tracer study to quantify the probability and environmental significance of releases from petroleum underground storage tank (UST) systems meeting the 1998 upgrade requirements. Randomly selected UST systems were tested using a sensitive commercial leak detection method. The largest tracer releases detected were estimated to have been associated with gasoline releases of 0.4 gallons per day (liquid equivalent), while the vast majority of releases are estimated to have been smaller than 0.04 gallons per day. None of the releases observed in the study would likely have been detected by leak detection systems meeting current performance standards of 0.1 gallons per hour (2.4 gallons per day). The results are a significant improvement over a similar study performed before the implementation of the

1998 upgrade requirements that indicated that 35 percent of UST systems nationwide exhibited leak rates above 2.4 gallons per day. The precise impact of the numerous small releases observed in this study on groundwater quality should be confirmed with more comprehensive modeling studies. A report documenting the findings of this study should be delivered to the SWRCB in June 2002.

Of greater risk to water quality than the vapor releases discussed above, are potential liquid MTBE releases from USTs. In particular, slow liquid releases from the remaining 5,000 or so single-walled USTs may be below the threshold of detection for monitoring devices. The leak detection rate is typically 0.2 gallons per hour for tanks and 0.1 gallons per hour for product piping. Annual releases of more than 1000 gallons of gasoline (containing more than 100 gallons of MTBE) could occur at an individual site without being detected from these single-walled systems and continue to go undetected.

Other sources of MTBE releases which can impact the water environment include: deposition from air, surface spills, underground pipelines, above-ground storage tanks, marinas, watercraft, and vehicle accidents. The impact from these sources cannot be estimated at this time.

E. The Governor's Executive Order D-52-02

On March 14, 2002, Governor Davis issued Executive Order D-52-02 (Appendix D), which directed the ARB to take the necessary actions, by July 31, 2002, to "postpone for one year the prohibitions of the use of MTBE and other specified oxygenates in California gasoline, and the related requirements for California Phase 3 reformulated gasoline." The Governor found that it was not possible to eliminate use of MTBE on January 1, 2003 without significantly risking disruption of the availability of gasoline in California. Such disruptions would substantially increase prices, harm California's economy and impose an unjustified burden on motorists.

The Executive Order includes directives to the ARB, CEC, SWRCB, and DHS to ensure the continuation of current efforts to eliminate the negative impacts of MTBE on the environment. The ARB and CEC were directed to work with the petroleum industry to ensure that MTBE-free gasoline meeting California standards continues to be supplied to the Lake Tahoe region and any other areas of California currently receiving MTBE-free gasoline. In addition, the SWRCB and DHS were directed to work with California drinking water providers to ensure that the providers continue to take all appropriate measures to prevent discharge of MTBE into surface water and reservoirs.

VI. PROPOSED AMENDMENTS

This chapter describes the proposed amendments to the CaRFG3 regulations. Staff is proposing amendments to title 13, CCR, section 2261, 2262, 2262.4, 2262.5, 2262.6, 2262.9, and 2266.5 to do the following:

- postpone for one year the prohibition on the use of MTBE in California gasoline,
- postpone for one year the prohibition on the use of non-MTBE ethers and alcohols other than ethanol in California gasoline,
- postpone for one year the imposition of CaRFG3 standards, and
- make various minor amendments.

The text of the proposed amendments is presented in Appendix A.

A. Prohibition of MTBE

The staff is proposing that the Board amend the CaRFG3 gasoline regulations to prohibit the use of MTBE in California gasoline starting December 31, 2003 instead of December 31, 2002 as currently required.

B. Prohibition of non-MTBE Ethers and Alcohols Other than Ethanol

The staff is also proposing that the Board postpone the prohibition of the use of non-MTBE ethers and alcohols other than ethanol in CaRFG3. The proposed amendment would prohibit the use of these oxygenates starting December 31, 2003 instead of December 31, 2002 to comply with the directive of the Governor's Executive Order D-52-02. As is currently the case, the prohibition would apply unless a multimedia evaluation of the use of the oxygenate in California gasoline has been conducted, and the California Environmental Policy Council has determined that such use will not cause a significant adverse impact on public health or the environment.

C. Schedule for Reducing Allowable Residual MTBE Levels

To be consistent with the proposed delay in phasing out the use of MTBE, staff is proposing that the Board adopt a revised schedule for reducing permitted residual levels of MTBE in CaRFG3 after the addition of MTBE is banned. Staff is proposing that the dates in the current schedule be postponed by one year to be consistent with the postponement of the current MTBE phase out date. The proposed amended schedule is summarized in Table 3. During the first year after the amended MTBE phase out date, starting December 31, 2003, California gasoline would be prohibited from containing more than 0.30 volume percent MTBE. This residual limit will be further reduced to 0.15 volume percent MTBE starting December 31, 2004, then to 0.05 volume percent starting December 31, 2005. As stated in the Initial Statement of Reasons for the CaRFG3 regulations, staff will continue to monitor the ability of refiners to meet these limits.

Table 3

Proposed Revisions to the Allowable Residual MTBE Levels

Allowable Residual MTBE Levels (volume percent)	Effective Date
0.30	Starting December 31, 2003
0.15	Starting December 31, 2004
0.05	Starting December 31, 2005

D. Imposition of CaRFG3 Standards

The staff is proposing that the Board postpone the imposition of the CaRFG3 limits for the gasoline properties by one year to be consistent with the proposed one-year postponement of the MTBE phase out deadline. The CaRFG3 limits were necessary to increase a refiner's flexibility in making gasoline without MTBE while preserving the emissions benefits achieved by the CaRFG2 program. With the proposed delay in the imposition of the MTBE prohibition, the imposition of the CaRFG3 standards will not be necessary until the new date at which the MTBE prohibition becomes effective.

The staff is not proposing any changes to the provisions that allow early compliance with the CaRFG3 standards. Under these provisions refiners are allowed to produce gasoline subject to the Phase 3 RFG standards prior to the proposed mandatory MTBE phase-out deadline of December 31, 2003.

E. Other Regulatory Changes

Staff is proposing additional amendments to ensure that the regulations work effectively, provide additional flexibility where feasible, and correct errors. These changes are described in Appendix E. One of the changes would simplify the testing provisions for determining whether a CaRFG complies when ethanol is the oxygenate. These are technical changes to improve the enforceability and consistency of the regulations; therefore the staff does not anticipate any adverse environmental or economic effects associated with the proposed amendments.

F. Consideration of Alternatives

Two alternatives to the proposed one-year postponement of the MTBE phase out from California gasoline are: shortening the postponement period and maintaining the current deadline.

Shortening the Postponement Period A postponement of less than one year was not considered acceptable as this would necessitate the introduction of CaRFG3 gasoline during those months of the year when gasoline consumption is typically high. Therefore, any constraints on the supply and availability of CaRFG3 or ethanol during this time would have significant negative impacts on the availability and cost of gasoline to California consumers. Also, constraints on supply are more likely during this time as the introduction of CaRFG3 would occur during the ozone

control period when the RVP standard applies. This is significant because the addition of ethanol to gasoline increases the RVP of the resulting blend. During the ozone RVP control season, more of the volatile compounds, such as pentanes, have to be removed to accommodate the addition of ethanol without causing a violation of the RVP standards. This has the effect of reducing the available volume of CaRFG3 at the time of maximum consumption. It is preferable for the transition to ethanol to occur during the non-RVP control season, when this is not a factor.

Maintaining the Current Deadline Maintaining the current deadline is not satisfactory as more time is required to address issues concerning the production, transportation, and distribution of CaRFG3 including ethanol. Without these issues resolved there would be a significant risk of disruption of the availability of gasoline that could substantially increase prices, harm California's economy and impose an unjustified burden on California motorists.

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VII. Environmental Impacts of the Proposed Amendments to the CaRFG3 Regulations

This chapter presents a summary of the analysis of the environmental effects of the proposed amendments. This analysis was prepared in consultation with SWRCB staff.

The current CaRFG3 regulation bans the addition of MTBE to gasoline after December 31, 2002 and restricts the use of an alternative oxygenate unless that oxygenate has undergone a multimedia review and been found acceptable by the California Environmental Policy Council (CEPC). This analysis will address the impact of the proposed amendments to postpone the imposition of the CaRFG3 standards and the prohibition of MTBE.

A. Effects of the Proposed CaRFG3 Amendments on Air Quality

1. Emissions Effects of Postponing the Implementation of the CaRFG3 Regulations

In the Final Statement of Reasons (FSOR) for the CaRFG3 Regulations, the ARB staff determined the expected emission benefits associated with the CaRFG3 regulations. This was to verify whether the CaRFG3 specifications would preserve the emissions benefits of the CaRFG2 program. The comparison demonstrated that gasoline expected to be produced to meet the CaRFG3 specifications would provide a small reduction in emissions when compared to gasoline produced to meet the CaRFG2 specifications. Table 4 presents the expected relative benefits of CaRFG3 program over the CaRFG2 program. The proposed amendments would maintain the benefits associated with the CaRFG2 program. Therefore, delaying the implementation of the CaRFG3 regulations by one year would only postpone the emission reductions achieved by the CaRFG3 regulations by one year, except to the extent that refiners elect to phase-out the use of MTBE early and produce CaRFG3.

Table 4. Benefits of CaRFG3 Relative to CaRFG2

Pollutant	Percent Change	Tons Per Day
Oxides of Nitrogen	-2.3	19
Exhaust Hydrocarbons	-0.1	Less than 1
Potency-Weighted Toxics	-7.2	N/A

2. Emissions Effects Associated with Commingling

When a gasoline containing ethanol is mixed with a non-ethanol gasoline, there is an increase in evaporative emissions. This effect is due to the RVP increase that occurs when ethanol is added to a non-ethanol gasoline. The federal RFG regulations prohibit the mixing of ethanol blended gasoline and non-ethanol blended gasoline in the distribution and marketing system from January 1 through September 15 to prevent RVP increases during the ozone season associated with commingling. However, neither the federal nor the CaRFG3 regulations restrict the mixing of ethanol-blended gasoline with non-ethanol-blended gasoline in the vehicle fuel tank. This can occur as consumers purchase different types of fuel when they fuel their vehicles.

To date, commingling has been a relatively small issue in California since a very large majority of CaRFG has been made with MTBE or without oxygenate and relatively little ethanol has been used. However, the proposed one-year delay could result in an emissions impact depending on the extent to which refiners elect to phase-out MTBE early. The commingling or mixing of a non-ethanol-blended fuel and an ethanol-blended fuel in vehicle tanks could increase, at least in areas where gasolines containing ethanol and non-oxygenated gasolines are both marketed.

However, an increase in commingling is not expected to result in an increase in evaporative emissions. It is expected that refiners electing to produce CaRFG with ethanol will take advantage of the flexibility provided by the CaRFG3 compliance option. Also, to compensate for the anticipated increase in evaporative emissions due to commingling, the CaRFG3 regulations reduced the ozone season RVP flat limit from 7.0 psi to 6.9 psi for gasoline produced using the evaporative element of the revised CaRFG3 Predictive Model. Due to uncertainty in the potential commingling impacts, the Board, in approving the CaRFG3 regulations, directed staff to further evaluate the magnitude of the potential real-world commingling impacts.

In 2001, staff performed both a field study and simulation modeling to carry out the Board's directive to assess the likely magnitude of commingling impacts associated with the switch to CaRFG3. Based on the field study and simulation model, staff estimated that the potential RVP increase due to commingling is less than 0.1 psi. The 0.1 psi RVP reduction provided for in the CaRFG3 Predictive Model adequately protects against an increase in evaporative emissions from gasoline powered motor vehicles due to commingling. Appendix F provides details of the staff's analysis.

3. *Emissions Effects Associated with Permeation*

The effect on permeation losses of blending ethanol with gasoline is an issue of concern. Permeation refers to the migration of organic molecules through any of the non-metallic materials used in the vehicle's fuel system. Studies have shown that ethanol preferentially permeates through the "soft" fuel system components used in motor vehicles when compared to other components of gasoline. One effect of the postponement of the imposition of the MTBE ban is the postponement of the large scale introduction of ethanol into California gasoline. The effect of the proposed amendment on the magnitude of the permeation emissions impact would depend on the extent to which refiners elect to phase out MTBE early and switch to the use of ethanol. However, the impact will be less than if the current date for the phase-out of MTBE is maintained.

The ethanol permeation effect can occur in any engine fuel system or fuel storage containers constructed of non-metallic materials similar to those found in vehicle fuel systems.

In June 2001, it was concluded that the use of ethanol in California gasoline would tend to increase evaporative emissions through the permeation of ethanol through the soft fuel system components. This conclusion was based on data gathered by a major vehicle manufacturer to estimate the emissions effect of gasoline containing ethanol on fuel systems. A delay in the phase out of MTBE will postpone this increase in emissions in so far as individual refiners chose not to remove MTBE and not opt in to the CaRFG3 program early.

The ARB is co-funding a Coordinating Research Council (CRC) research project to investigate the permeation emissions associated with ethanol in California gasoline. The results of this study should be available in early 2003.

B. Effects of the Proposed CaRFG3 Amendments on Water Quality

In very low concentrations, MTBE imparts an unpleasant taste and odor to water, rendering it unsuitable for drinking and other beneficial uses. Unlike petroleum-based components in fuel, MTBE moves rapidly through the soil into groundwater, is more persistent in the environment, and is more difficult to clean up. According to the DHS, MTBE has been measured above the state's 5 parts per billion drinking water standard for taste and odor in 41 (out of 9,905 sources sampled) surface and groundwater drinking water sources in the state. The fuel additive has forced the closure of public and private water supply wells in numerous communities, including Santa Monica, South Lake Tahoe, Sacramento County, and Cambria. Underground storage tanks (UST) have been the primary source of MTBE pollution. MTBE has been detected in groundwater at more than 4,600 UST sites.

Petroleum is stored at approximately 22,000 UST facilities in California. These facilities continue to represent the greatest potential source of future MTBE releases to water. The integrity of the UST systems in California has improved dramatically during recent years as old bare-steel single-walled tanks have been upgraded with corrosion protection and leak detection systems or replaced with new double-contained systems. Preliminary results of field tests currently being conducted by the SWRCB indicate that this upgrade/replacement program has been very successful in reducing liquid releases, but approximately two out of three UST systems now in operation are releasing gasoline vapors into the subsurface, creating a localized groundwater pollution source. The amount of MTBE released per year in gasoline vapors can not be precisely determined, but estimates provided by the SWRCB suggest that it is in the range of 3 to 30 gallons (as liquid equivalent) per day, statewide. Extending those estimates for one year would suggest that the equivalent of 1,000 to 10,000 gallons of liquid MTBE may be released from USTs in the vapor phase. This is equivalent to an average release per facility of between 0.4 and 4 gallons per year of gasoline containing MTBE at 10 volume percent. This is equivalent to 0.04 to 0.4 gallons per year of MTBE per facility.

Of greater risk to water quality than the vapor releases discussed above are potential liquid MTBE releases from USTs. In particular, slow liquid releases from the remaining 5,000 or so single-walled USTs may be below the threshold of detection for monitoring devices. The leak detection rate is typically 0.2 gallons per hour for tanks and 0.1 gallons per hour for product piping. Annual releases of more than 1000 gallons of gasoline (containing more than 100 gallons of MTBE) could occur at an individual site without being detected from these single-walled systems and continue to go undetected.

Other sources of MTBE releases which can impact the water environment include: deposition from air, surface spills, underground pipelines, above-ground storage tanks, marinas, watercraft, and vehicle accidents. The impact from these sources cannot be estimated.

A one-year extension to complete the phase-out of MTBE from gasoline could result in an incremental, but difficult to measure, increase in the water quality impacts highlighted above. Continued use of MTBE as a fuel oxygenate for an additional year could extend the risk of further closures of public drinking water supply. However, for the reasons discussed above, the expected impacts are expected to be small in comparison to the existing contamination.

C. Effects of the Proposed Amendments on Greenhouse Gas Emissions

The proposal to postpone for one year the prohibitions of the use of MTBE and other specified oxygenates in California gasoline, and the related requirements for CaRFG3, should result in no significant increase or decrease in greenhouse gas emissions over what would occur without the postponement.

D. Effects of the Proposed CaRFG3 Amendments on the State Implementation Plan

The 1994 SIP for ozone is California's master plan for achieving the federal ozone standard in six areas of the state by 2010. The SIP includes state measures to control emissions from motor vehicles and fuels, consumer products and pesticide usage, local measures for stationary and area sources, and federal measures for sources under exclusive or practical federal control. U.S. EPA approved the 1994 SIP in 1996. The South Coast Air Quality Management District revised its part of the Ozone SIP in 1997 and again in 1999. U.S. EPA approved the South Coast's 1999 Ozone SIP revision in 2000.

As ARB has implemented the SIP over the last eight years, some measures have delivered more reductions than anticipated, while other measures have delivered fewer reductions due to technical or economic concerns. In some cases, measures not originally envisioned in the 1994 SIP are providing benefits that help meet the SIP emission reduction obligations. The CaRFG3 regulation is one of the measures not originally included in the 1994 SIP that is providing needed emission reductions. Because ARB is relying on these reductions to meet its SIP obligations, delays in implementing the regulation have the potential to impact the SIP.

ARB staff is proposing to delay the CaRFG3 requirements by one year, from December 31, 2002 to December 31, 2003. While the small additional emission benefits associated with CaRFG3 gasoline would be lost during the one year delay, there would be no impact on the commitments made in the SIP unless the delay extends past 2004. ARB tracks its progress against its SIP commitments at three-year intervals (known as "milestone years") as well as in the attainment year. For the ozone SIP, milestone years are 2002, 2005, 2008, and 2010 (the South Coast's attainment year). 2005 is the first milestone year for which the emission benefits of CaRFG3 have been credited toward ARB's SIP obligations. Because the CaRFG3 requirements were originally scheduled to go into effect on December 31, 2002, no emission reduction benefits from the regulation could be credited toward meeting ARB's 2002 milestone commitment. Consequently, because the CaRFG3 requirements will be fully implemented and the emission benefits will be fully realized by the end of 2004 under staff's proposal, there will be no SIP impact.

E. Environmental Justice and Neighborhood Impacts

The primary environmental justice and neighborhood impacts of the proposed action would be potential additional contamination of ground water and drinking water. This is expected to be minimal as discussed above. An offsetting consideration is the potential for shortfalls in fuel supply and expected associated increases in fuel costs if the delay is not provided.

The proposed delay of the ban on MTBE will delay the impacts of the implementation of CaRFG3. (These impacts are discussed in Appendix G). The proposal does not change the provisions of the present CaRFG3 regulations that allow refiners to opt to remove MTBE before the phase out deadline. As discussed in Appendix G, actions by refiners to remove MTBE, whether early or by the final compliance date, are subject to full CEQA and permitting requirements.

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

This chapter presents a summary of the analysis of the economic effects of the proposed amendments. This analysis was prepared in consultation with CEC staff.

A. Evaluation of the Economic Impact of a Delay in the Removal of MTBE from CaRFG

Delaying the phase-out of MTBE by one year may impact a number of stakeholders. California motorists, MTBE producers and the Highway Trust Fund are expected to benefit from the delay. Ethanol producers and others who have made investments may incur some costs. Also, water districts could incur costs that would result from additional contamination from continued use of MTBE. This impact would be reduced to the extent that producers of CaRFG elect to remove MTBE early.

1. Savings for California Motorists

The decision to delay the phase-out of MTBE was primarily predicated on the concern that the use of MTBE could not be eliminated by January 2003 without significantly risking the disruption of the availability of gasoline in California. This would substantially increase prices, harm California's economy and impose an unjustified burden on motorists. If all the elements necessary for a successful transition away from MTBE are not in place, gasoline shortages could develop. Without the additional year directed by Governor Davis, it is likely that various segments of the transportation industry would not have been ready to make the transition away from MTBE, precipitating gasoline supply problems and their associated price spikes. These increases would be expected to be larger than experienced in the past. Previously, supply problems resulted in tightness in supply but not shortages. With an actual shortage in supply, prices could be expected to increase by 50 percent or more. The benefit for California motorists of avoided price spikes could be 30 million dollars a day for the duration of the supply problem.

2. Continued Profitability for MTBE Producers

California currently uses approximately 90 thousand barrels per day of MTBE[1]. Some of the California refiners operate small MTBE processing units that supply between 10 and 15 thousand barrels per day (TBD). The remaining demand is met from imports of MTBE from foreign and domestic sources. A delay allows MTBE producers to continue to supply MTBE to California for up to the proposed additional year. The amount will depend on decisions of refiners to continue to use MTBE to produce CaRFG or to elect to use ethanol early.

3. Avoided Loss for Federal Highway Trust Fund

The Federal government collects an excise tax from each gallon of motor vehicle fuel sold. These taxes are generally used to fund highway construction throughout the United States.

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[1] Average use by California refiners for 2001 obtained from the *Quarterly Reports Concerning MTBE Use in California Gasoline* located at: http://www.energy.ca.gov/mtbe/index.html.

Gasoline is assessed a federal excise tax of 18.4 cents per gallon. The majority of this tax (15.44 cents) is deposited directly into the Highway Account, the source of funding for highway projects. The remaining balance of the tax is used to fund the Mass Transit Account (2.86 cents) and the Leaking Underground Storage Tank Trust Fund (0.1 cents). But when gasoline is blended with ethanol the federal excise tax assessed each gallon of gasoline is decreased $ 0.53 for each gallon of ethanol used. This means that once MTBE is phased out of use in California, the amount of money sent to the Highway Account from California will decrease. Given an expected ethanol use of about 900 million gallons per year, a delay in the phase-out of MTBE by one year means that this decline in revenue, about $500 million, could be temporarily avoided. The actual decline in revenue would be determined by the extent that refiners elect to use ethanol and phase-out MTBE.

4. Impact on Refiners and Other Refining Related Industry Participants

California refiners, product pipeline companies and terminal operators have completed a portion of the work necessary to accommodate the phase-out of MTBE. Engineering, material and equipment purchases, and labor costs are some examples of expenses that could have been deferred, but not avoided. Delaying the phase-out of MTBE means that these companies invested capital earlier than would be required, temporarily stranding a portion of their investment capital. As a result, those firms that have already initiated their transition to Phase 3 RFG will incur an opportunity cost equivalent to one year's carrying charge on the prematurely invested capital. It has not been determined what portion of the total project costs for the transportation fuels industry has already been expended, but could have been deferred for a year. This cost only applies to those companies that have completed the conversion and do not elect to phase out MTBE early. At least one major producer has announced that it will proceed with the phase-out of MTBE. Those companies that have not completed the conversion may experience an economic benefit from the postponement of the MTBE phase out. The delay allows the companies time to test their systems and fully develop contingency plans to ensure continued production of gasoline.

If there is a short fall in supply, it is likely that the independent fuel marketers will likely first feel the impact. These independents typically purchase fuel from the unbranded market. Unbranded wholesale fuel is the portion of the refinery production that will be limited if there is a short fall in the market. Much of the major refiners' production goes to contracted marketers; this is the branded market. A one-year postponement of the phase-out of MTBE and the related CaRFG3 regulation will benefit the independent marketers by allowing enough time to complete the infrastructure improvements and contingency provisions needed to ensure adequate supply and availability of gasoline after the MTBE phase-out.

5. Excess Capacity for Ethanol Producers

The ethanol industry responded to the original announcement to phase-out MTBE in California by expanding ethanol production capacity throughout the United States over the last 2 years. A number of new ethanol facilities have been constructed and expansions of existing plants have been completed since 1999. Delaying the phase-out of MTBE by one year means that ethanol demand for California during 2003 may be significantly less than originally anticipated, resulting in excess capacity for ethanol producers. Overbuild of capacity usually results in a decrease in

price for the impacted commodity. This development is good for consumers (motorists) and bad for producers (ethanol industry). The estimated decrease in the 2003 market price for ethanol has not been calculated, due to a number of variables that cannot be quantified. Also, this impact depends on whether other markets for the use of ethanol develop. Other states are expressing interest in using ethanol in gasoline. Ethanol producers may experience a temporary drop in profits during 2003, which should be reversed once MTBE is phased out of use in the entire State by 2004.

B. 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. Thus, our analysis of the economic effects on small business is limited to the costs to certain gasoline retailers and jobbers, where a jobber is an individual or business that purchases wholesale gasoline and delivers and sells it to another party, usually a retailer or other end-user. Since the proposed delay continues the existing program, there should not be any increased costs.

A one-year postponement of the phase-out of MTBE and the related CaRFG3 regulation will likely benefit the independent marketers by allowing enough time to complete the infrastructure improvements and contingency provisions needed to ensure adequate supply and availability of gasoline after the MTBE phase-out.

C. Potential Increased Water Contamination Costs

The phase-out of MTBE in California was primarily the result of concern that California surface and groundwater resources would become contaminated from releases of MTBE into the environment due to leaking underground storage tanks. The presence of MTBE has already been detected in surface water resources and wells used as sources of drinking water. Delaying the phase-out of MTBE for another year may result in a few additional public water wells and leaking underground storage tanks (UST) sites that must be remediated for the presence of MTBE. The California State Water Resources Control Board estimates that the cost of replacing public water wells will range from 200,000 dollars to 1 million dollars per well, while the cost of cleanup of MTBE contaminated sites could range from 250,000 dollars to 3 million dollars per site depending on the extent of the contamination.

APPENDIX A

PROPOSED REGULATION ORDER

Amendments Pertaining to the California Phase 3 Gasoline (CaRFG3) Regulations Postponing Imposition of the CaRFG3 Standards and the Prohibition of MTBE and Oxygenates Other than Ethanol in California Gasoline from December 31, 2002 to December 31, 2003

PROPOSED REGULATION ORDER

AMENDMENTS TO THE CALIFORNIA REFORMULATEDGASOLINE REGULATIONS TO POSTPONE IMPOSITION OF THE CaRFG3 STANDARDS AND THE PROHIBITION OF MTBE AND OXYGENATES OTHER THAN ETHANOL IN CALIFORNIA GASOLINE FROM DECEMBER 31, 2002 TO DECEMBER 31, 2003

Note: The preexisting regulation text is set forth below in normal type. The proposed amendments are shown in underline to indicate additions and ~~strikeout~~ to indicate deletions. Subsection headings in italics and bold are to be italicized when printed in Barclays California Code of Regulations.

Amend title 13, California Code of Regulations, sections 2261, 2262, 2262.4, 2262.5, 2262.6, 2262.9, 2266.5, 2269, 2271, 2272, and 2296 to read as follows.

Section 2261. Applicability of Standards; Additional Standards.

(a) ***Applicability of the CaRFG Phase 2 Standards.***

(1) (A) Unless otherwise specifically provided, the CaRFG Phase 2 cap limit standards set forth in section 2262, and the CaRFG Phase 2 cap limit compliance requirements in sections 2262.3(a), 2262.4(a), and 2262.5(a) and (b),shall apply:

1. starting April 15, 1996 to all sales, supplies, offers or movements of California gasoline except for transactions directly involving:

   a. the fueling of motor vehicles at a retail outlet or bulk purchaser-consumer facility, or

   b. the delivery of gasoline from a bulk plant to a retail outlet or bulk purchaser-consumer facility, and

2. starting June 1, 1996 to all sales, supplies, offers or movements of California gasoline, including transactions directly involving the fueling of motor vehicles at a retail outlet or bulk purchaser-consumer facility.

(B) The remaining CaRFG Phase 2 standards and requirements contained in this subarticle shall apply to all sales, supplies, or offers of California gasoline occurring on or after March 1, 1996.

(2) The CaRFG Phase 2 cap limit standards in section 2262 shall not apply to transactions directly involving the fueling of motor vehicles at a retail outlet or bulk purchaser-consumer facility, where the person selling, offering, or supplying the gasoline demonstrates as an affirmative defense that the exceedance of the pertinent standard was

caused by gasoline delivered to the retail outlet or bulk purchaser-consumer facility prior to April 15, 1996, or delivered to the retail outlet or bulk purchaser-consumer facility directly from a bulk plant prior to June 1, 1996.

(b) ***Applicability of the CaRFG Phase 3 Standards.***

(1) (A) Unless otherwise specifically provided, the CaRFG Phase 3 cap limit standards set forth in section 2262, and the CaRFG Phase 3 cap limit compliance requirements in 2262.3(a), 2262.4(a), and 2262.5(a) and (b), shall apply starting December 31, ~~2002~~ 2003. The CaRFG Phase 3 benzene and sulfur content cap limit standards in section 2262, and the CaRFG Phase 3 benzene and sulfur content cap limit compliance requirements in 2262.3(a), shall apply:

1. starting December 31, ~~2002~~ 2003 (for the benzene content cap limit and the 60 parts per million sulfur content cap limit) and December 31, 2004 (for the 30 parts per million sulfur content cap limit), to all sales, supplies or offers of California gasoline from the production facility or import facility at which it was produced or imported.

2. starting February 14, ~~2003~~ 2004 (for the benzene content cap limit and the 60 parts per million sulfur content cap limit) and February 14, 2005 (for the 30 parts per million sulfur content cap limit) to all sales, supplies, offers or movements of California gasoline except for transactions directly involving:

   a. the fueling of motor vehicles at a retail outlet or bulk purchaser-consumer facility, or

   b. the delivery of gasoline from a bulk plant to a retail outlet or bulk purchaser-consumer facility, and

3. starting March 31, ~~2003~~ 2004 (for the benzene content cap limit and the 60 parts per million sulfur content cap limit) and March 31, 2005 (for the 30 parts per million sulfur content cap limit) to all sales, supplies, offers or movements of California gasoline, including transactions directly involving the fueling of motor vehicles at a retail outlet or bulk purchaser-consumer facility.

(B) The remaining CaRFG Phase 3 standards and compliance requirements contained in this subarticle shall apply to all sales, supplies, or offers of California gasoline occurring on or after December 31, ~~2002~~ 2003.

(2) The CaRFG Phase 3 benzene and sulfur content cap limit standards in section 2262 shall not apply to transactions directly involving the fueling of motor vehicles at a retail outlet or bulk purchaser-consumer facility, where the person selling, offering, or supplying the gasoline demonstrates as an affirmative defense that the exceedance of the pertinent

standard was caused by gasoline delivered to the retail outlet or bulk purchaser-consumer facility prior to February 14, ~~2003~~ 2004 (for the benzene content limit and the 60 parts per million sulfur content limit) or February 14, 2005 (for the 30 parts per million sulfur content limit) or delivered to the retail outlet or bulk purchaser-consumer facility directly from a bulk plant prior to March 31, ~~2003~~ 2004 (for the benzene content limit and the 60 parts per million sulfur content limit) or March 31, 2005 (for the 30 parts per million sulfur content limit).

(3) ***Early Compliance with the CaRFG Phase 3 Standards Before December 31, ~~2002~~ 2003.***

(A) Any producer or importer wishing to supply from its production or import facility, before December 31, ~~2002~~ 2003, any final blends of gasoline subject to the CaRFG Phase 3 standards instead of the CaRFG Phase 2 standards may notify the executive officer of its wish to do so. The notification shall include all of the following:

1. The approximate date by which it intends to begin supplying from its production or import facility gasoline complying with the CaRFG Phase 3 standards if permitted to do so;

2. A reasonably detailed demonstration of the producer's or importer's ability and plans to begin supplying from its production or import facility substantial quantities of one or more grades of gasoline meeting the CaRFG Phase 3 standards on or after the date specified;

(B)1. Within 15 days of receipt of a request under section 2261(b)(3)(A), the executive officer shall notify the producer or importer making the request either that the request is complete, or specifying what additional information is necessary to make the request complete.

2. Within 15 days of notifying the producer or importer that the request is complete, the executive officer shall either grant or deny the request. If the request is granted the executive officer shall specify the date on which producers and importers may start to supply from their production or import facilities final blends that comply with the CaRFG Phase 3 standards. The executive officer shall grant the request if he or she determines it is reasonably likely that the producer or importer making the request will start supplying substantial quantities of one or more grades of gasoline complying with the CaRFG Phase 3 standards reasonably soon after the date specified. If the executive officer denies the request, he or she shall provide the producer or importer with a written statement explaining the reason for denial.

3. Upon granting a request made under section 2261(b(3)(A), the executive officer shall notify interested parties of the date on which (i) producers and importers will

be permitted to start supplying final blends of gasoline complying with the CaRFG Phase 3 standards, and (ii) the CaRFG Phase 2 cap limits for RVP and aromatics will become 7.20 psi and 35.0 volume percent respectively for gasoline downstream of the production or import facility. This notification shall be made by posting the pertinent information on the state board's Internet site, providing electronic mail notification to all persons subscribing to the state board's Fuels-General Internet electronic mail list, and mailing notice to all persons registered as motor vehicle fuel distributors under Health and Safety Code section 43026.

4. With respect to all final blends supplied from a production or import facility from the day specified by the executive officer in granting a request made under section 2261(b)(3)(A) through December 30, ~~2002~~ 2003, any producer or importer may comply with the CaRFG Phase 3 standards that apply starting December 31, ~~2002~~ 2003 as an alternative to the CaRFG Phase 2 standards. Whenever a producer or importer is supplying a final blend subject to the CaRFG Phase 3 standards pursuant to this section 2261(b)(3)(B)4., any notification required by sections 2264.2 or 2265(a) shall indicate that the final blend is subject to the CaRFG Phase 3 standards. When it is sold or supplied from the production or import facility, any such final blend is subject to the prohibitions in section 2262.6(a)(1) and 2262.6(c) regarding California gasoline produced with the use of MTBE and oxygenates other than ethanol, but is not subject to the prohibition in section 2262.6(a)(2) imposing limits on the concentration of MTBE in California gasoline.

(c) California gasoline sold or supplied on or after March 1, 1996, is also subject to section 2253.4 (Lead/Phosphorus in Gasoline), section 2254 (Manganese Additive Content), and section 2257 (Required Additives in Gasoline). California gasoline that is supplied from a small refiner's California refinery prior to March 1, 1998, and that qualifies for treatment under section 2272(a), shall also be subject to section 2250 (Degree of Unsaturation of Gasoline) and section 2252 (Sulfur Content of Gasoline).

(d) The standards contained in this subarticle shall not apply to a sale, offer for sale, or supply of California gasoline to a refiner if: (1) the refiner further processes the gasoline at the refiner's refinery prior to any subsequent sale, offer for sale, or supply of the gasoline, and (2) in the case of standards applicable only to producers or importers, the refiner to whom the gasoline is sold or supplied is the producer of the gasoline pursuant to section 2260(a)(26)(B).

(e) The prohibitions in sections 2262.3(b) and (c), 2262.4(b), and 2262.5(c) shall not apply to gasoline which a producer or importer demonstrates was neither produced nor imported by the producer or importer.

(f) This subarticle 2, section 2253.4 (Lead/Phosphorus in Gasoline), section 2254 (Manganese Additive Content), and section 2257 (Required Additives in Gasoline) shall not apply to gasoline where the person selling, offering or supplying the gasoline demonstrates as an

affirmative defense that the person has taken reasonably prudent precautions to assure that the gasoline is used only in racing vehicles.

NOTE: Authority cited: sections 39600, 39601, 43013, 43013.1, 43018, and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n.* v. *Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). Reference: sections 39000, 39001, 39002, 39003, 39010, 39500, 39515, 39516, 41511, 43000, 43013, 43013.1, 43016, 43018, 43101, and 43830.8, Health and Safety Code; and *Western Oil and Gas Ass'n.* v. *Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

Section 2262. The California Reformulated Gasoline Phase 2 and Phase 3 Standards.

The CaRFG Phase 2 and CaRFG Phase 3 standards are set forth in the following table. For all properties but Reid vapor pressure (cap limit only) and oxygen content, the value of the regulated property must be less than or equal to the specified limit. With respect to The Reid vapor pressure cap limit and the oxygen content flat and cap limit, the limits are expressed as a range, and the Reid vapor pressure and oxygen content must be less than or equal to the upper limit, and more than or equal to the lower limit. A qualifying small refiner may comply with the small refiner CaRFG Phase 3 standards, in place of the CaRFG Phase 3 standards in this section, in accordance with section 2272.

The California Reformulated Gasoline Phase 2 and Phase 3 Standards

Property	*Flat Limits*		*Averaging Limits*		*Cap Limits*	
	CaRFG Phase 2	*CaRFG Phase 3*	*CaRFG Phase 2*	*CaRFG Phase 3*	*CaRFG Phase 2*	*CaRFG Phase 3*
Reid Vapor Pressure[1] (pounds per square inch)	7.00	7.00 or 6.90[2]	Not Applicable	Not Applicable	7.00[3]	6.40 - 7.20
Sulfur Content (parts per million by weight)	40	20	30	15	80	60[4]
						30[4]
Benzene Content (percent by volume)	1.00	0.80	0.80	0.70	1.20	1.10
Aromatics Content (percent by volume)	25.0	25.0	22.0	22.0	30.0[3]	35.0
Olefins Content (percent by volume)	6.0	6.0	4.0	4.0	10.0	10.0
T50 (degrees Fahrenheit)	210	213	200	203	220	220
T90 (degrees Fahrenheit)	300	305	290[5]	295	330	330
Oxygen Content (percent by weight)	1.8 - 2.2	1.8 - 2.2	Not Applicable	Not Applicable	1.8[6] - 3.5	1.8[6]-3.5[7]
					0[6] - 3.5	0[6] - 3.5[7]
Methyl tertiary-butyl ether (MTBE) and oxygenates other than ethanol	Not Applicable	Prohibited as provided in § 2262.6	Not Applicable	Not Applicable	Not Applicable	Prohibited as provided in § 2262.6

1 The Reid vapor pressure (RVP) standards apply only during the warmer weather months identified in section 2262.4.

2 The 6.90 pounds per square inch (psi) ~~standard~~ flat limit applies only when a producer or importer is using the evaporative emissions model element of the CaRFG Phase 3 Predictive Model, in which case all predictions for evaporative emissions increases or decreases made using the evaporative emissions model are made relative to 6.90 psi and the gasoline may not exceed the maximum RVP cap limit of 7.2 psi. Where the evaporative emissions model element of the CaRFG Phase 3 Predictive Model is not used, the RVP of gasoline sold or supplied from the production or import facility may not exceed 7.0 psi.

3 For sales, supplies, or offers of California gasoline downstream of the production or import facility starting on the date on which early compliance with the CaRFG Phase 3 standards is permitted by the executive officer

under section 2261(b)(3), the CaRFG Phase 2 cap limits for Reid vapor pressure and aromatics content shall be 7.20 psi and 35.0 percent by volume respectively.

4 The CaRFG Phase 3 sulfur content cap limits of 60 and 30 parts per million are phased in starting December 31, ~~2002~~ 2003, and December 31, 2004, respectively, in accordance with section 2261(b)(1)(A).

5 Designated alternative limit may not exceed 310.

6 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).

7 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.

NOTE: Authority cited: sections 39600, 39601, 43013, 43013.1, 43018, 43101, and 43830, Health and Safety Code; and *Western Oil and Gas Ass'n.* v. *Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). Reference: sections 39000, 39001, 39002, 39003, 39010, 39500, 39515, 39516, 41511, 43000, 43013, 43013.1, 43016, 43018, 43101, 43830, and 43830.8, Health and Safety Code; and *Western Oil and Gas Ass'n.* v. *Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

* * * * *

Section 2262.4. Compliance With the CaRFG Phase 2 and CaRFG Phase 3 Standards for Reid Vapor Pressure.

(a) ***Compliance with the cap limits for Reid vapor pressure.***

(1) No person shall sell, offer for sale, supply, offer for supply, or transport California gasoline which exceeds the applicable cap limit for Reid vapor pressure within each of the air basins during the regulatory period set forth in section (a)(2).

(2) ***Regulatory Control Periods.***

(A) *April 1 through October 31 (May 1 through October 31 in ~~2003~~ 2004):*
South Coast Air Basin and Ventura County
San Diego Air Basin
Mojave Desert Air Basin
Salton Sea Air Basin

(B) *May 1 through September 30:*
Great Basin Valley Air Basin

(C) *May 1 through October 31:*
San Francisco Bay Area Air Basin
San Joaquin Valley Air Basin
Sacramento Valley Air Basin
Mountain Counties Air Basin
Lake Tahoe Air Basin

(D) *June 1 through September 30:*
North Coast Air Basin
Lake County Air Basin
Northeast Plateau Air Basin

(E) *June 1 through October 31:*
North Central Coast Air Basin
South Central Coast Air Basin (Excluding Ventura County)

(b) ***Compliance by producers and importers with the flat limit for Reid vapor pressure.***

(1) ***Reid vapor pressure standard for producers and imports.*** In an air basin during the regulatory control periods specified in section (b)(2), no producer or importer shall sell, offer for sale, supply, or offer for supply from its production facility or import facility California gasoline which has a Reid vapor pressure exceeding the applicable flat limit set forth in section 2262 unless the gasoline is supplied from the production or import facility on or after March 1, ~~2003~~ 2004 and has been reported as a PM alternative gasoline formulation pursuant to section 2265(a).

(2) ***Regulatory control periods for production and import facilities.***

(A) *March 1 through October 31 (April 1 through October 31 in ~~2003~~ 2004):*
South Coast Air Basin and Ventura County
San Diego Air Basin
Mojave Desert Air Basin
Salton Sea Air Basin

(B) *April 1 through September 30:*
Great Basin Valley Air Basin

(C) *April 1 through October 31:*
San Francisco Bay Area Air Basin
San Joaquin Valley Air Basin
Sacramento Valley Air Basin
Mountain Counties Air Basin
Lake Tahoe Air Basin

(D) *May 1 through September 30:*
North Coast Air Basin
~~North Central Coast Air Basin~~
Lake County Air Basin
Northeast Plateau Air Basin

(E) *May 1 through October 31:*
North Central Coast Air Basin
South Central Coast Air Basin (Excluding Ventura County)
~~North Coast Air Basin~~

* * * * *

NOTE: Authority cited: sections 39600, 39601, 43013, 43013.1, 43018, and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n.* v. *Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). Reference: sections 39000, 39001, 39002, 39003, 39010, 39500, 39515, 39516, 41511, 43000, 43013, 43013.1, 43016, 43018, 43101, 43830, and 43830.8, Health and Safety Code; and *Western Oil and Gas Ass'n.* v. *Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

Section 2262.5. Compliance With the Standards for Oxygen Content.

(a) ***Compliance with the minimum oxygen content cap limit standard in specified areas in the wintertime.***

(1) Within the areas and periods set forth in section (a)(2), no person shall sell, offer for sale, supply, offer for supply, or transport California gasoline unless it has an oxygen content of not less than the minimum oxygen content cap limit in section 2262.

(2) (A) *November 1 through February 29:*
South Coast Area
Imperial County

(B) *October 1 through October 31, (1996 through ~~2002~~ 2003 only):*
South Coast Area

(b) ***Compliance with the maximum oxygen content cap limit standard.*** No person shall sell, offer for sale, supply, or transport California gasoline which has an oxygen content exceeding the maximum oxygen content cap limit in section 2262, or which has an ethanol content exceeding 10 percent by volume.

(c) ***Compliance by producers and importers with the flat limits for oxygen content.*** No producer or importer shall sell, offer for sale, supply, or offer for supply from its production or import facility California gasoline which has an oxygen content less than flat limit for minimum oxygen content, or more than flat limit for maximum oxygen content, unless the gasoline has been reported as a PM alternative gasoline formulation pursuant to section 2265(a) or as an alternative gasoline formulation pursuant to section 2266(c), and complies with the standards contained in sections (a) and (b).

(d) ***Restrictions on adding oxygenates to California gasoline after it has been supplied from the production or import facility.***

(1) ***Basic Restriction.*** No person may add oxygenates to California gasoline after it has been supplied from the production or import facility at which it was produced or imported, except where the person adding the oxygenates demonstrates that: [i] the gasoline to which the oxygenates are added has been reported as a PM alternative gasoline formulation pursuant to section 2265(a), or as an alternative gasoline formulation pursuant to section 2266(c), and has not been commingled with other gasoline, and [ii] both before and after the person adds the oxygenate to the gasoline, the gasoline has an oxygen content within the oxygen content specifications of the applicable PM alternative gasoline formulation or alternative gasoline formulation. Nothing in this section (d) prohibits adding oxygenates to CARBOB.

(2) ***Bringing gasoline into compliance with the minimum oxygen content cap limit.*** Notwithstanding section (d)(1), a person may add an oxygenate that is not prohibited under section 2262.6 to California gasoline that does not comply with an applicable minimum oxygen content cap limit under sections 2262 and 2262.5(a), where the person obtains the prior approval of the executive officer based on a demonstration that adding the oxygenate is necessary to bring the gasoline into compliance with the minimum oxygen content cap limit.

(e) ***Application of prohibitions.***

(1) Section (a) shall not apply to a transaction occurring in the areas and periods shown in (a)(2) where the person selling, supplying, or offering the gasoline demonstrates as an affirmative defense that, prior to the transaction, he or she has taken reasonably prudent precautions to assure that the gasoline will not be delivered to a retail service station or bulk purchaser-consumer's fueling facility in the areas and periods shown in (a)(2).

(2) (A) Section (a) shall not apply to a transaction occurring in the South Coast Area in October 2000, 2001, ~~or~~ 2002, or 2003, where the transaction involves the transfer of gasoline from a stationary storage tank to a motor vehicle fuel tank and the person selling, supplying, or offering the gasoline demonstrates as an affirmative defense that the last delivery of gasoline to the stationary storage tank occurred no later than September 16 of that year.

(B) Section (a) shall not apply to a transaction occurring in November either in Imperial County or, starting in ~~2003~~ 2004, in the South Coast Area, where the transaction involves the transfer of gasoline from a stationary storage tank to a motor vehicle fuel tank and the person selling, supplying, or offering the gasoline demonstrates as an affirmative defense that the last delivery of gasoline to the stationary storage tank occurred no later than October 17 of that year.

NOTE: Authority cited: sections 39600, 39601, 43013, 43013.1, 43018, and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n.* v. *Orange County Air Pollution Control District*, 14 Cal.3d.411, 121 Cal.Rptr. 249 (1975). Reference: sections 39000, 39001, 39002, 39003, 39010, 39500, 39515, 39516, 41511, 43000, 43013, 43013.1, 43016, 43018, 43101, and 43830.8, Health and Safety Code; and *Western Oil and Gas Ass'n.* v. *Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

Section 2262.6. Prohibition of MTBE and Oxygenates Other Than Ethanol in California Gasoline Starting December 31, ~~2002~~ 2003.

(a) ***Basic MTBE prohibitions.***

(1) Starting December 31, ~~2002~~ 2003, no person shall sell, offer for sale, supply or offer for supply California gasoline which has been produced with the use of methyl tertiary-butyl ether (MTBE).

(2) No person shall sell, offer for sale, supply or offer for supply California gasoline which contains MTBE in concentrations greater than: 0.3 volume percent starting December 31, ~~2002~~ 2003, 0.15 volume starting December 31, ~~2003~~ 2004, and 0.05 volume percent starting December 31, ~~2004~~ 2005.

(b) ***Phase-in of MTBE prohibitions.***

(1) In the first year in which a prohibition applies under section 2262.6(a), the prohibition shall be phased in as follows:

(A) Starting December 31, for all sales, supplies, or offers of California gasoline by a producer or importer from its production facility or import facility.

(B) Starting the following February 14, for all other sales, supplies, offers or movements of California gasoline except for transactions directly involving:

1. the fueling of motor vehicles at a retail outlet or bulk purchaser-consumer facility, or

2. the delivery of gasoline from a bulk plant to a retail outlet or bulk purchaser-consumer facility.

(C) Starting the following March 31, for all remaining sales, supplies, offers or movements of California gasoline, including transactions directly involving the fueling of motor vehicles at a retail outlet or bulk purchaser-consumer facility.

~~(3)~~(2) ***Phase-in for low-throughput fueling facilities.*** For the first year in which a prohibition applies under section 2262.6(a)(1), the prohibition shall not apply to transactions directly involving the fueling of motor vehicles at a retail outlet or bulk

purchaser-consumer facility, where the person selling, offering, or supplying the gasoline demonstrates as an affirmative defense that the exceedance of the standard was caused by gasoline delivered to the retail outlet or bulk purchaser-consumer facility prior to February 14 of that year, or delivered to the retail outlet or bulk purchaser-consumer facility directly from a bulk plant prior to March 31 of that year.

(c) ***Use of oxygenates other than ethanol or MTBE in California gasoline on or after December 31, ~~2002~~ 2003.*** Starting December 31, ~~2002~~ 2003, no person shall sell, offer for sale, supply or offer for supply California gasoline which has been produced with the use of any oxygenate other than ethanol or MTBE unless a multimedia evaluation of use of the ~~ether~~ oxygenate in California gasoline has been conducted and the California Environmental Policy Council established by Public Resources Code section 71017 has determined that such use will not cause a significant adverse impact on the public health or the environment.

NOTE: Authority cited: sections 39600, 39601, 43013, 43013.1, 43018, and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n.* v. *Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). Reference: sections 39000, 39001, 39002, 39003, 39010, 39500, 39515, 39516, 41511, 43000, 43013, 43013.1, 43016, 43018, 43101, and 43830.8, Health and Safety Code; and *Western Oil and Gas Ass'n.* v. *Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

Section 2262.9. Requirements Regarding Denatured Ethanol Intended For Use as a Blend Component in California Gasoline

(a) ***Standards.***

(1) ***Standards for denatured ethanol.*** Starting December 31, ~~2002~~ 2003, no person shall sell, offer for sale, supply or offer for supply denatured ethanol intended for blending with CARBOB or California gasoline that fails to comply with the following standards:

(A) ***Standards for properties regulated by the CaRFG Phase 3 standards.***

1. A sulfur content not exceeding 10 parts per million;

2. A benzene content not exceeding 0.06 percent by volume; or

3. An olefins content not exceeding 0.5 percent by volume; or

4. An aromatic hydrocarbon content not exceeding 1.7 percent by volume.

(B) ***Standards based on ASTM D 4806-99.*** All test methods and standards identified in the title and the table below are incorporated herein by reference.

Specification	*Value*	*Test method*
Ethanol, vol.%, min.	92.1	ASTM D 5501-94(1998)ε1
Methanol, vol.%, max.	0.5	
Solvent-washed gum, mg/100 ml, max.	5.0	ASTM D 381-00, air jet apparatus
Water content, vol.%, max.	1	ASTM E 203-96 or E 1064-00
Denaturant content, vol.%, min. vol.% max. The only denaturants shall be natural gasoline, gasoline components, or unleaded gasoline.	1.96 4.76	
Inorganic Chloride content, mass ppm (mg/l), max.	40 (32)	Modification of ASTM D512-89(1999), Procedure C[1]
Copper content, mg/kg, max.	0.1	Modification of ASTM D1688-95, Test Method A[2]
Acidity (as acetic acid), mass % (mg/l), max.	0.007 (56)	ASTM D 1613-96 (1999)
pHe	6.5 - 9.0	ASTM D 6423-99
Appearance	Visibly free of suspended or precipitated contaminants (clean and bright)	Determined at indoor ambient temperature unless otherwise agreed upon between the supplier and purchaser

Note 1: The modification of ASTM D 512-89(1999), Procedure C consists of using 5 ml of sample diluted with 20 ml of water in place of the 25 ml sample specified in the standard procedure. The water shall meet ASTM D 1193-99, Type II. The volume of the sample prepared by this modification will be slightly larger than 25 ml. To allow for the dilution factor, report the chloride ion present in the fuel ethanol sample as the chloride ion present in the diluted sample multiplied by five.

Note 2: The modification of ASTM D 1688-95, Test Method A (atomic absorption) consists of mixing reagent grade ethanol (which may be denatured according to the U.S. Bureau of Alcohol, Tobacco, and Firearms (BATF) of the

U.S. Treasury Department Formula 3A or 30, as set forth in 27 CFR sections 21.35 and 21.57, as in effect April 1, 2001) in place of water as the solvent or diluent for the preparation of reagents and standard solutions. However, this must not be done to prepare the stock copper solution described in 11.1 of ASTM D 1688-95. Because a violent reaction may occur between the acid and the ethanol, use water, as specified, in the acid solution part of the procedure to prepare the stock copper solution. Use ethanol for the rinse and dilution only.

(2) ***Exemption.***

(A) ***Inapplicability of basic standards.*** The standards in section (a)(1)(A) do not apply to a quantity of denatured ethanol sold, offered for sale, supplied, or offered for supply by a person who demonstrates as an affirmative defense that:

1. The person has complied with section (c)(1)(B); and

2. He or she has taken reasonably prudent precautions to assure that the denatured ethanol will only be added to CARBOB which has been designed to be lawfully oxygenated with denatured ethanol having the properties identified in the document provided pursuant to section (c)(1)(B).

(B) ***Substitute standards.*** Starting December 31, ~~2002~~ 2003, no person shall sell, offer for sale, supply or offer for supply denatured ethanol that is intended for blending with CARBOB or California gasoline and is exempt pursuant to section (a)(2)(A), if the denatured ethanol fails to comply with any of the properties identified in the document provided pursuant to section (c)(1)(B).

(3) ***Standards for products represented as appropriate for use as a denaturant in ethanol.***

(A) Except as otherwise provided in section (a)(3)(B), starting December 31, ~~2002~~ 2003, no person shall sell, offer for sale, supply or offer for supply a product represented as appropriate for use as a denaturant in ethanol intended for blending with CARBOB or California gasoline, if the denaturant has:

1. A benzene content exceeding 1.1 percent by volume; or

2. An olefins content exceeding 10 percent by volume; or

3. An aromatic hydrocarbon content exceeding 35 percent by volume.

(B) A person may sell, offer for sale, supply or offer for supply a product that is represented as only suitable for use as an ethanol denaturant in ethanol intended for blending with CARBOB or California gasoline if the denatured ethanol contains no more than a specified percentage of the denaturant that is less than 4.76 percent. In this case, the product must be prominently labeled as only lawful for use as a denaturant where the denatured ethanol contains no more than the specified percentage of the denaturant, and the seller, supplier or offeror must take reasonably

prudent precautions to assure that the denaturant will not be used in concentrations greater than the specified percentage in ethanol intended for blending with CARBOB or California gasoline. If these conditions are met, the standards in section (a)(3)(A) for the denaturant will be adjusted by multiplying the stated values by (4.76) max.%), where "max.%" is the maximum percentage of denaturant specified for the denatured ethanol.

(b) ***Test Methods.***

(1) In determining compliance with the denatured ethanol standards in section (a)(1)(A):

(A)The sulfur content of denatured ethanol shall be determined by ASTM D 5453-93, which is incorporated herein by reference.

(B) The aromatic hydrocarbon, benzene and olefins content of denatured ethanol shall be determined by sampling the denaturant and using the methods specified in section 2263 to determine the content of those compounds in the denaturant. The result will then be multiplied by 0.0476, except that where it is demonstrated that the denatured ethanol contains less than 4.76 percent denaturant, the result will be multiplied by the decimal fraction representing the percent denaturant.

(2) In determining compliance with the denaturant standards in section (a)(3), the aromatic hydrocarbon, benzene and olefins content of the denaturant shall be determined by the methods specified in section 2263 for determining the content of those compounds in gasoline.

(c) ***Documentation required for the transfer of denatured ethanol intended for use as a blend component in California gasoline.***

(1) (A) Starting December 31, ~~2002~~ 2003,and except as provided in section (c)(1)(B), on each occasion that any person transfers custody or title of denatured ethanol intended for use as a blend component in California gasoline, the transferor shall provide the transferee a document that prominently states that the denatured ethanol complies with the standards for denatured ethanol intended for use as a blend component in California gasoline.

(B) Starting December 31, ~~2002~~ 2003, on each occasion that any person transfers custody or title of denatured ethanol that is intended to be added to CARBOB designated for blending with denatured ethanol exceeding any of the standards in section (a)(1)(A), the transferor shall provide the transferee a document that prominently identifies the maximum sulfur, benzene, olefin and aromatic hydrocarbon content of the denatured ethanol, and states that the denatured ethanol may only be lawfully added to CARBOB that is designated for blending with denatured ethanol having such properties.

(2) Starting December 31, ~~2002~~ 2003, any person who sells or supplies denatured ethanol intended for use as a blend component in California gasoline from the California facility at which it was imported or produced shall provide the purchaser or recipient a document that identifies:

(A) The name and address of the person selling or supplying the denatured ethanol, and

(B) The name, location and operator of the facility(ies) at which the ethanol was produced and at which the denaturant was added to the ethanol.

NOTE: Authority cited: sections 39600, 39601, 43013, 43013.1, 43018, and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n.* v. *Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). Reference: sections 39000, 39001, 39002, 39003, 39010, 39500, 39515, 39516, 41511, 43000, 43013, 43013.1, 43016, 43018, 43101, and 43830.8, Health and Safety Code; and *Western Oil and Gas Ass'n.* v. *Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

Section 2266.5. Requirements Pertaining to California Reformulated Gasoline Blendstock for Oxygen Blending (CARBOB) and Downstream Blending.

(a) ***Application of the California gasoline standards to CARBOB.*** [No changes]

(1) ***Applicability of standards and requirements to CARBOB.*** [No changes]

(2) ***Determining whether a final blend of CARBOB complies with the standards for California gasoline.***

(A) ***General.*** [No changes]

(B) ***Determining whether a final blend of CARBOB complies with the standards for California gasoline by use of the CARBOB Model.*** [No changes]

(C) ***Determining whether a final blend of CARBOB complies with the standards for California gasoline by oxygenate blending and testing.*** Except as otherwise provided in section (a)(2)(B), the properties of a final blend of CARBOB shall be determined for purposes of compliance with sections 2262, 2262.3, 2262.4, 2262.5 2262.6, 2265 and 2266 by adding the specified type and amount of oxygenate to a representative sample of the CARBOB and determining the properties and characteristics of the resulting gasoline in accordance with an applicable test method identified in section 2263(b) or permitted under section 2263(c). Where the producer or importer has in accordance with section (b)(1)(E) designated a range for oxygen from denatured ethanol of 1.8 wt.% to 2.2 wt.% (or a range that is within 1.8 wt. % and 2.2 wt.% and includes 2.0 wt.%), denatured ethanol equal to 5.7 vol.% of the blended volume shall be added; where the designated range for oxygen from denatured ethanol is 2.5 wt.% to 2.9 wt.% (or is within 2.5 wt.% and 2.9% and includes 2.7 wt.%), denatured ethanol equal to 7.7 vol.% of the blended volume shall be added; and where the designated range for oxygen from denatured ethanol is 3.3 wt.% to 3.7 wt.% (or is within 3.3 wt.% and 3.7 wt.% and includes 3.5 wt.%), denatured ethanol equal to 10.0 vol.% of the blended volume shall be added. In all other cases where the designated range for oxygen from denatured ethanol ~~that~~ is no greater than 0.4 wt.% ~~and denatured ethanol as the oxygenate~~, the amount of denatured ethanol added shall be the volume percent that results in an oxygen content at the midpoint of the range of oxygen, based on the following equation:

$$\text{Vol.\% Denatured Ethanol} = \frac{\cancel{59.86}}{\cancel{(21.88/\text{ wt.\% oxygen}) - 0.0604}}$$

$$\underline{620 \div [(218.8 \div \text{wt.\% oxygen}) - 0.40]}$$

Where the producer or importer has in accordance with section (b)(1)(E) designated a range of amounts of oxygen that is greater than 0.4 wt.%, or an oxygenate other than denatured ethanol, the oxygenate shall be added in an amount that results in an oxygen content within 0.2 wt.% of the designated minimum oxygen level.

(D) ***Characteristics of denatured ethanol used in determining whether a final blend of CARBOB complies with the standards for California gasoline.***

1. ***Default denatured ethanol characteristics on or after December 31, ~~2002~~ 2003 when the CARBOB Model is used.*** Except as provided in section (a)(2)(D)3.,

where a producer or importer has elected to use the CARBOB Model for a final blend of CARBOB supplied from its production or import facility on or after December 31, ~~2002~~ 2003, the following default denatured ethanol specifications shall be specified for the CARBOB Model:

Sulfur content:	10 parts per million
Benzene content:	0.06 volume percent
Olefin content:	0.5 volume percent
Aromatic hydrocarbon content:	1.7 volume percent

2. ***Default denatured ethanol characteristics on or after December 31, ~~2002~~ 2003 when the CARBOB Model is not used.*** Except as provided in section (a)(2)(D)3., where a producer or importer has not elected to use the CARBOB Model, denatured ethanol used as the oxygenate must have the following properties in determining whether CARBOB complies with the standards applicable to California gasoline when it is supplied from the production facility or import facility on or after December 31, ~~2002~~ 2003:

Sulfur content:	3 - 10 parts per million
Benzene content:	0 - 0.06 volume percent
Olefin content:	0 - 0.5 volume percent
Aromatic hydrocarbon content:	0 - 1.7 volume percent

3. ***Producer- or importer-specified characteristics of denatured ethanol used in determining whether a final blend of CARBOB complies with the standards for California gasoline.***

   a. With respect to a final blend of CARBOB supplied from its production or import facility prior to December 31, ~~2002~~ 2003, the producer or importer must specify the properties of the oxygenate used in determining whether the final blend of CARBOB complies with the applicable California gasoline standards, by providing the notice in section (b)(1)(D). With respect to a final blend of CARBOB supplied from its production or import facility on or after December 31, ~~2002~~ 2003, the producer or importer may elect to specify the properties of the oxygenate in accordance with the preceding sentence. Where the producer or importer has elected to use the CARBOB model in connection with the final blend, the maximum value for each property identified in the section (b)(1)(D) notification shall be used for the CARBOB Model. Where the producer or importer has not elected to use the CARBOB model in connection with the final blend, the oxygenate used in oxygenate blending and testing in accordance with section (a)(2)(C)1. must not exceed the maximum value for each property identified in the section (b)(1)(D) notification; that oxygenate's specifications for each property may be under the maximum value

for each property identified in the section (b)(1)(D) notification by no more than the following:

Sulfur content:	5 parts per million
Benzene content:	0.06 volume percent
Olefin content:	0.1 volume percent
Aromatic hydrocarbon content:	1.0 volume percent

b. ***Maintaining oxygenate samples for use in compliance testing.*** A producer or importer who is specifying the properties of the oxygenate used in a final blend of CARBOB in accordance with the preceding section (a)(2)(D)3.a. must maintain at the production or import facility, while the final blend is at the facility, oxygenate meeting the required specifications in quantities that are sufficient to enable state board inspectors to use the oxygenate in compliance determinations.

(E) ***Protocol for determining whether a final blend of CARBOB complies with the standards for California gasoline.*** The executive officer may enter into a written protocol with any individual producer or importer for the purpose of specifying a alternative method for determining whether a final blend of CARBOB complies with the standards for California gasoline, as long as the executive officer reasonably determines that application of the protocol is not less stringent or enforceable than application of the express terms of section (a)(2)(A)-(D). Any such protocol shall include the producer's or importer's agreement to be bound by the terms of the protocol.

(3) ***Calculating the volume of a final blend of CARBOB.*** [No changes]

(4) ***Specifications for a final blend of CARBOB when the CARBOB model is not being used.*** [No changes]

(5) ***Assignment of designated alternative limits for CARBOB and for the oxygenated California gasoline where the producer or importer has elected to use the CARBOB model.*** [No changes]

(6) ***Determining whether downstream CARBOB complies with the cap limits for California gasoline.***

(A) ***Determining whether downstream CARBOB complies with the cap limits for California gasoline through the use of CARBOB cap limits derived from the CARBOB Model.*** Whenever downstream CARBOB designated for ethanol blending has already been supplied from its production or import facility, the CARBOB's compliance with the cap limits for California gasoline may be determined by applying the CARBOB cap limits in the following table:

Property	*CARBOB Cap Limits*	
	CaRFG2	*CaRFG3*
Reid Vapor Pressure[1] (pounds per square inch)	5.78	5.99
Sulfur Content (parts per million by weight)	89	66[2]
		32[2]
Benzene Content (percent by volume)	1.33	1.22
Aromatics Content (percent by volume)	33.1	38.7
Olefins Content (percent by volume)	11.1	11.1
T50 (degrees Fahrenheit)	232[3]	232[3]
	237[3]	237[3]
T90 (degrees Fahrenheit)	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~~ 2003, and December 31, 2004, in accordance with section 2261(b)(1)(A).

3 The first number applies to CARBOB that is subject to the Reid vapor pressure standard pursuant to section 2262.4, and the second number applies to CARBOB that is not subject to the Reid vapor pressure standard.

(B) ***Determining whether downstream CARBOB complies with the cap limits for California gasoline by oxygenate blending and testing.*** Whenever downstream CARBOB designated for ~~ethanol~~ oxygenate blending has already been supplied from its production or import facility, the CARBOB's compliance with the cap limits for California gasoline may be determined by adding the specified type and amount of oxygenate to a representative sample of the CARBOB and determining the properties and characteristics of the resulting gasoline in accordance with an applicable test method identified in section 2263(b) or permitted under section 2263(c). Denatured ethanol used as the oxygenate must have the properties set forth in section (a)(2)(D)2. ~~Where the CARBOB has been designated for a range of amounts of oxygenate, or more than one oxygenate type, to be added, the minimum designated amount of the oxygenate having the smallest designated volume is to be added to the CARBOB when determining the properties and characteristics of the final blend. However, w~~Where the designated range for oxygen from denatured ethanol is 1.8 wt.% to 2.2 wt.% (or is within ~~between~~ 1.8 wt.% and 2.2 wt.% and includes 2.0 wt.%), denatured ethanol equal to 5.7 vol.% ~~ethanol~~ of the blended volume shall be added~~,~~;

~~and~~ where the designated range for oxygen from denatured ethanol is 2.5 wt.% to 2.9 wt.% (or is within ~~between~~ 2.5 wt.% and 2.9 wt.% and includes 2.7 wt.%), denatured ethanol equal to 7.7 vol.% ~~ethanol~~ of the blended volume shall be added~~.~~; and where the designated range for oxygen from denatured ethanol is 3.3 wt.% to 3.7 wt.% (or is within 3.3 wt.% and 3.7 wt.% and includes 3.5 wt.%), denatured ethanol equal to 10.0 vol.% of the blended volume shall be added. In all other cases where the designated range for oxygen from denatured ethanol is no greater than 0.4 wt.%, the amount of denatured ethanol added shall be the volume percent that results in an oxygen content at the midpoint of the range of oxygen, based on the following equation:

$$\text{Vol.\% Denatured Ethanol} = 620 \div [(218.8 \div \text{wt.\% oxygen}) - 0.40]$$

Where the designated a range of amounts of oxygen is greater than 0.4 wt.%, or an oxygenate other than denatured ethanol is designated, the oxygenate shall be added in an amount that results in an oxygen content within 0.2 wt.% of the designated minimum oxygen level. ~~Denatured ethanol used as the oxygenate must have the properties set forth in section (a)(2)(D)2.~~

(C) ***Protocols.*** A person may enter into a protocol with the executive officer for the purpose of identifying more stringent specifications for the denatured ethanol used pursuant to section (a)(6)(B), or different CARBOB cap limits under section (a)(6)(A), if the executive officer reasonably determines that the specifications or cap limits are reasonably premised on the person's program to assure that the denatured ethanol added to the CARBOB by oxygenate blenders will meet the more stringent specifications.

[No changes to the rest of the section]

NOTE: Authority cited: sections 39600, 39601, 43013, 43013.1, 43018, and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n.* v. *Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). Reference: sections 39000, 39001, 39002, 39003, 39010, 39500, 39515, 39516, 41511, 43000, 43013, 43013.1, 43016, 43018, 43021, and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n.* v. *Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

* * * * *

Section 2269. Submittal of Compliance Plans

(a) Each producer shall, by September 1, 2000, submit to the executive officer a plan showing the producer's schedule for achieving compliance with the CaRFG Phase 3 standards set forth in this subarticle. Each producer shall, by September 1, 2001, ~~and~~ September 1, 2002, and September 1, 2003 submit an update of the plan. Each compliance plan and update shall include the projected sequence and dates of all key events pertaining to planning, financing, and construction of necessary refinery modifications.

NOTE: Authority cited: sections 39600, 39601, 43013, 43013.1, 43018, and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n.* v. *Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). Reference: sections 39000, 39001, 39002, 39003, 39010, 39500, 39515, 39516, 41511, 43000, 43013.1, 43016, 43018, and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n.* v. *Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

Section 2270. Testing and Recordkeeping.

(a) (1) The requirements of this section (a) shall apply to each producer and importer that has elected to be subject to an averaging limit in section 2262, or to a PM averaging limit. The references to sulfur content shall apply to each producer or importer that has elected to be subject to the section 2262~~.2(c)~~ averaging limit for sulfur, or to a PM averaging limit for sulfur. The references to benzene content shall apply to each producer or importer that has elected to be subject to the section 2262~~.3(c)~~ averaging limit for benzene, or to a PM averaging limit for benzene. The references to olefin content shall apply to each producer or importer that has elected to be subject to the section 2262 averaging limit for olefin content, or to a PM averaging limit for olefin content. The references to T90 shall apply to each producer or importer that has elected to be subject to the section 2262 averaging limit for T90, or to a PM averaging limit for T90. The references to T50 shall apply to each producer or importer that has elected to be subject to the section 2262 averaging limit for T50, or to a PM averaging limit for T50. The references to aromatic hydrocarbon content shall apply to each producer or importer that has elected to be subject to the section 2262 averaging limit for aromatic hydrocarbon content, or to a PM averaging limit for aromatic hydrocarbon content.

* * * * *

NOTE: Authority cited: sections 39600, 39601, 43013, 43013.1, 43018, and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n.* v. *Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). Reference: sections 39000, 39001, 39002, 39003, 39010, 39500, 39515, 39516, 41511, 43000, 43013, 43013.1, 43016, 43018, and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n.* v. *Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

Section 2271. Variances.

[No changes to subsections (a)-(c)

(d) ***Necessary findings for granting variances.*** The decision to grant or deny a variance shall be based solely upon substantial evidence in the record of the variance proceeding. No variance shall be granted unless the executive officer makes all of the following findings:

(1) That, because of reasons beyond the reasonable control of the applicant, requiring compliance with the applicable section(s) would result in an extraordinary economic hardship.

(2) That the public interest in mitigating the extraordinary hardship by issuing the variance outweighs the public interest in avoiding any increased emissions of air contaminants which would result from issuing the variance; and

(3) That the compliance plan proposed by the applicant can reasonably be implemented and will achieve compliance as expeditiously as possible.

(e) ***Factors to be considered in making the necessary findings for granting variances.***

In making the findings specified in section (d), the factors set forth below shall be considered. It is the responsibility of the applicant to provide the information necessary to adequately evaluate these factors.

[No changes to subsections (e)(1)-(2)]

(3) Regarding the finding specified in section (d)(3):

The applicant shall demonstrate why the proposed compliance plan is the most expeditious way to achieve compliance, and the applicant shall demonstrate sufficient control over the implementation of the plan to make the plan practical. In the case of a proposed variance that would begin on December 31, ~~2002~~ 2003, the compliance plan shall identify and provide a date for each key step that remains to be accomplished for attaining compliance. As applicable, these steps shall include financing, engineering plans, ordering and contracts, receipt of major equipment, commencement and completion of construction, and testing.

[No changes to the rest of the section]

NOTE: Authority cited: sections 39600, 39601, 43013, 43013.1, 43013.2, 43018, and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n.* v. *Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). Reference: sections 39000, 39001, 39002, 39003, 39010, 39500, 39515, 39516, 40000, 41511, 43000, 43013, 43013.1, 43013.2, 43016, 43018, and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n.* v. *Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

Section 2272. CaRFG Phase 3 Standards for Qualifying Small Refiners.

(a) ***CaRFG Phase 3 standards for qualifying small refiners.*** In place of the CaRFG Phase 3 standards set forth in section 2262, a qualifying small refiner may elect to have a final blend of California gasoline supplied from the small refiner's refinery subject to the "small refiner

CaRFG Phase 3 standards," which are identical to the CaRFG Phase 3 standards in section 2262 except that: (i) the flat limit for benzene content is 1.00 percent by volume (vol.%) instead of 0.80 vol.%, (ii) the flat limit for aromatics content is 35.0 vol.% instead of 25.0 vol.%, (iii) the flat limit for T50 is 220° F. instead of 213° F, and (iv) the flat limit for T90 is 312° F. instead of 305° F. This election may only be made if the small refiner has been issued a currently effective certification pursuant to section (b) and the gasoline qualifies for treatment under section (c).

(b) ***Certification of small refiners.***

(1) A small refiner wishing to produce gasoline subject to this section shall submit to the executive officer an application for certification on the Air Resources Board's ARB/SSD/CPB Form 00-3-1, for each of the small refiner's California refineries. The application shall be executed by a responsible corporate officer under penalty of perjury.

(2) The small refiner's application shall set forth: [A] the crude oil capacity of the refinery since January 1, 1978; [B] the crude oil capacities of all the refineries in California and the United States which are owned or controlled by, or under common ownership or control with, the small refiner since September 1, 1988; [C] data demonstrating that the refinery has the capacity to produce liquid fuels by distilling petroleum; and [D] a demonstration that the small refiner's California refinery was used in 1998 and 1999 to produce and supply California gasoline meeting the CaRFG Phase 2 standards.

(3) Within 30 days of receipt of the application, the executive officer shall grant or deny it in writing. The executive officer shall grant the application if he or she determines that: [A] the application contains all of the information identified in sections (b)(1) and (2) above, and [B] the applicant meets the definition of small refiner. Any denial of an application shall include a statement of the reasons for denial.

(c) ***Criteria for qualifying gasoline.*** Gasoline shall only be subject to treatment under this section if the small refiner demonstrates all of the following:

(1) The gasoline was produced by the small refiner at the small refiner's California refinery.

(2) The gasoline was supplied from the small refiner's California refinery in a calendar quarter in which 25 percent or more of the gasoline that was produced by the small refiner and that was supplied from the refinery in the calendar quarter was refined at the small refinery from crude oil. The volume of oxygenates in the gasoline shall not be counted in making this calculation. The period from December 31, ~~2002~~ 2003 through March 31, ~~2003~~ 2004 shall be treated as a calendar quarter under this section (c)(2).

(3) For the period December 31, ~~2002~~ 2003, through December 31, ~~2003~~ 2004, and for each subsequent calendar year, the gasoline was supplied from the small refiner's California refinery before the full qualifying volume of gasoline produced by the small refiner had

been supplied from the refinery during that period or year. In calculating the volume of gasoline supplied from the refinery, the volume of oxygenates in the gasoline shall not be counted. Gasoline that is designated by the small refiner as subject to all of the CaRFG Phase 3 standards in section 2262, and is reported to the executive officer pursuant to a protocol entered into by the small refiner and the executive officer, shall not be counted against the qualifying volume.

(4) At the time the gasoline was supplied from the small refiner's refinery, the small refiner met the definition of a small refiner.

(5) The excess emissions of hydrocarbons, oxides of nitrogen, and potency-weighted toxics are offset pursuant to section 2282, title 13, California Code of Regulations. The excess emissions from gasoline subject to the small refiner CaRFG Phase 3 standards are: 0.0206 pounds of exhaust hydrocarbons per barrel, 0.0322 pounds of oxides of nitrogen per barrel, and the potency-weighted toxic emissions equivalent of 0.0105 pounds of benzene per barrel.

(d) ***Compliance with applicable federal RFG requirements.*** Any small refiner subject to this section shall comply with all applicable requirements of the federal reformulated gasoline regulations in 40 CFR Part 80 Subpart D, commencing with § 80.40.

(e) ***Additional reporting requirements for small refiners.***

(1) In addition to the requirements of section 2270, each small refiner who qualifies for treatment under this section shall submit to the executive officer reports containing the information set forth below for each of the small refiner's California refineries, starting on the date on which a qualifying small refiner supplies from its refinery gasoline subject to the small refiner CaRFG Phase 3 standards. The reports shall be executed in California under penalty of perjury, and must be received within the time indicated below. December 31, ~~2002~~ 2003 through January 31, ~~2003~~ 2004 shall be treated as a month.

(A) The quantity of all gasoline, produced by the small refiner, that is supplied from the small refinery in each month, within 15 days after the end of the month, the quantity of all such gasoline that is California gasoline subject to the small refiner CaRFG3 standards, and the quantity of all such gasoline that is California gasoline not subject to the small refiner CaRFG3 standards;

(B) The identity and volume of each oxygenate contained in the gasoline described in section (d)(1)(A) above, within 15 days after the end of the month;

(C) For each calendar quarter, a statement whether 25 percent or more of the gasoline that was produced by the small refinery and that was supplied from the refinery in the calendar quarter was refined at the small refinery from crude oil, within 15 days after the close of such quarter;

(D) The date, if any, on which the small refiner completes transfer from its small refinery in the period December 31, ~~2002~~ 2003 through December 31, ~~2003~~ 2004, and in each subsequent calendar year, of the small refiner's qualifying volume of gasoline produced by the small refiner, calculated as described in section (c)(3), within 5 days after such date;

(E) Within 10 days after project completion, any refinery addition or modification which would affect the qualification of the refiner as a small refiner pursuant to the definition in section 2260(a)(22); and

(F) Any change of ownership of the small refiner or the small refiner's refinery, within 10 days after such change of ownership.

NOTE: Authority cited: sections 39600, 39601, 43013, 43018, and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). Reference: sections 39000, 39001, 39002, 39003, 39010, 39500, 39515, 39516, 40000, 41511, 43016, 43018, and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

§ 2296. Motor Fuel Sampling Procedures.

* * * *

(k) ~~"Sampling procedures."~~ *Sampling procedures.*

* * * *

(2) "Tap sampling." The tap sampling procedure is applicable for sampling liquids of 26 pounds (1.83 kgf/cm^2) RVP or less in tanks which are equipped with suitable sampling taps or lines. This procedure is recommended for volatile stocks in tanks of the breather and balloon roof type, spheroids, etc. (Samples may be taken from the drain cocks of gage glasses, if the tank is not equipped with sampling taps.) When obtaining a sample for ~~other than~~ RVP or distillation analysis, use the assembly as shown in Figure 3. When obtaining a sample for other than RVP or distillation analysis, the assembly as shown in Figure 3 need not be used.

* * * *

NOTE: Authority cited: sections 39600, 39601, 43013, 43018, 43101 and 43830, Health and Safety Code. Reference: sections 39000~~/~~, 39001, 39002, 39003, 39500, 41511, 43000, 43013, 43018, 43101, and 43830, Health and Safety Code; and *Western Oil and Gas Ass'n.* v. *Orange County APCD*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

APPENDIX B

EXECUTIVE ORDER D-5-99

EXECUTIVE DEPARTMENT

STATE OF CALIFORNIA

EXECUTIVE ORDER D-5-99

WHEREAS, the University of California prepared a comprehensive report on the "Health and Environmental Assessment of Methyl Tertiary-Butyl Ether (MTBE)" which has been peer reviewed by the Agency for Toxic Substances and Disease Registry and the Unites States Geological Survey and other nationally recognized experts;

WHEREAS, the University of California report was widely available for public review and written comment, including hearings in northern and southern California to receive public testimony;

WHEREAS, the findings and recommendations of the U.C. report, public testimony, and regulatory agencies are that, while MTBE has provided California with clean air benefits, because of leaking underground fuel storage tanks MTBE poses an environmental threat to groundwater and drinking water;

NOW, THEREFORE, I, GRAY DAVIS, Governor of the State of California, do hereby find that "on balance, there is significant risk to the environment from using MTBE in gasoline in California" and, by virtue of the power and authority vested in me by the Constitution and statutes of the State of California, do hereby issue this order to become effective immediately:

1. The Secretary for Environmental Protection shall convene a task force consisting of the California Air Resources Board, State Water Resources Control Board, Office of Environmental Health Hazard Assessment, California Energy Commission and the Department of Health Services for the purpose of implementing this Order.

2. On behalf of the State of California, the California Air Resources Board shall make a formal request to the Administrator of the U.S. Environmental Protection Agency for an immediate waiver for California cleaner burning gasoline from the federal Clean Air Act requirement for oxygen content in reformulated gasoline.

3. The California Environmental Protection Agency shall work with Senator Feinstein and the California Congressional Delegation to gain passage of Senate Bill 645. This legislation would grant authority to the Administrator of the U.S. Environmental Protection Agency to permanently waive the Clean Air Act requirements for oxygen content in reformulated gasoline to states such as California that have alternative gasoline programs that achieve equivalent air quality benefits.

4. The California Energy Commission (CEC), in consultation with the California Air Resources Board, shall develop a timetable by July 1, 1999 for the removal of MTBE from gasoline at the earliest possible date, but not later than December 31, 2002. The timetable will be reflective of the CEC studies and should ensure adequate supply and availability of gasoline for California consumers.

5. The California Air Resources Board shall evaluate the necessity for wintertime oxygenated gasoline in the Lake Tahoe air basin. The Air Resources Board and the California Energy Commission shall work with the petroleum industry to supply MTBE-free California-compliant gasoline year around to Lake Tahoe region at the earliest possible date.

6. By December 1999, the California Air Resources Board shall adopt California Phase 3 Reformulated Gasoline (CaRFG3) regulations that will provide additional flexibility in lowering or removing the oxygen content requirement and maintain current emissions and air quality benefits and allow compliance with the State Implementation Plan (SIP).

7. In order that consumers can make an informed choice on the type of gasoline they purchase, I am directing the California Air Resources Board to develop regulations that would require prominent identification at the pump of gasoline containing MTBE.

8. The State Water Resources Control Board (SWRCB), in consultation with the Department of Water Resources and the Department of Health Services (DHS), shall expeditiously prioritize groundwater recharge areas and aquifers that are most vulnerable to contamination by MTBE and prioritize resources towards protection and cleanup . The SWRCB, in consultation with DHS, shall develop a clear set of guidelines for the investigation and cleanup of MTBE in groundwater at these sites.

9. The State Water Resources Control Board shall seek legislation to extend the sunset date of the Underground Storage Tank Cleanup Fund to December 31, 2010. The proposed legislation would increase the reimbursable limits for MTBE groundwater cleanups from $1 million to $1.5 million.

10. The California Air Resources Board and the State Water Resources Control Board shall conduct an environmental fate and transport analysis of ethanol in air, surface water, and groundwater. The Office of Environmental Health Hazard Assessment shall prepare an analysis of the health risks of ethanol in gasoline, the products of incomplete combustion of ethanol in gasoline, and any resulting secondary transformation products. These reports are to be peer reviewed and presented to the Environmental Policy Council by December 31, 1999 for its consideration.

11. The California Energy Commission (CEC) shall evaluate by December 31, 1999 and report to the Governor and the Secretary for Environmental Protection the potential for development of a California waste-based or other biomass ethanol industry. CEC shall evaluate what steps, if any, would be appropriate to foster waste-based or other biomass ethanol development in California should ethanol be found to be an acceptable substitute for MTBE.

IN WITNESS WHEREOF I have hereunto set my hand and caused the Great Seal of the State of California to be affixed this 25th day of March 1999.

Gray Davis

Governor of California

ATTEST:

Secretary of State

APPENDIX C

California Energy Commission Report
Timetable for the Phaseout of MTBE from California's Gasoline Supply

STATE OF CALIFORNIA – THE RESOURCES AGENCY

GRAY DAVIS, Governor

CALIFORNIA ENERGY COMMISSION
1516 NINTH STREET
SACRAMENTO, CA 95814-5512

July 1, 1999

The Honorable Gray Davis
Governor
State Capitol Building
Sacramento, CA 95814

Dear Governor Davis:

The California Energy Commission prepared the enclosed report, ***Timetable for the Phaseout of MTBE from California's Gasoline Supply***, pursuant to Executive Order D-5-99, item 4. This order, in part, directed the Commission to develop a timetable for removing MTBE from gasoline at the earliest possible date, but not later than December 31, 2002. On June 28, 1999, the Commission conducted a public hearing and adopted this Report. It should be noted that nothing in this Report changes the findings and recommendations of the Commission's December 1998 report, **Supply and Cost Alternatives to MTBE in Gasoline.**

The Commission wishes to note one comment it heard at the public meeting. A representative of Kern Oil and Refining Co. offered the following suggested language:

> Small refiners operate under different, less flexible process scenarios than do large refiners. In particular, it should be noted that the small refiner interviewed by CEC and CARB staff indicated that these difficulties in producing complying gasoline without the use of MTBE may be insurmountable and that product specification flexibility should be considered for this class of refiner.

Kern stated that this comment related to the ARB's forthcoming decision regarding Phase 3 regulations for reformulated gasoline. Although this comment is more appropriately directed to the California Air Resources Board, the Commissioners discussed the concern and agreed it should be considered, but adopted the report unchanged.

If you have any questions regarding this report, please do not hesitate to contact me at (916) 654-5000.

Sincerely,

ROBERT PERNELL
California Energy Commission

COMMISSION FINDINGS: TIMETABLE FOR THE PHASEOUT OF MTBE FROM CALIFORNIA'S GASOLINE SUPPLY

DOCKET NO. 99-GEO-1

JUNE 1999

CALIFORNIA ENERGY COMMISSION

Gray Davis, *Governor*

P300-99-003

COMMISSION FINDINGS: TIMETABLE FOR THE PHASEOUT OF MTBE FROM CALIFORNIA'S GASOLINE SUPPLY

DOCKET NO. 99-GEO-1

CALIFORNIA ENERGY COMMISSION

CALIFORNIA ENERGY COMMISSION

Robert Pernell, *Chairman*
David A. Rohy, *Vice Chairman*
Commissioners
William J. Keese
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Michal C. Moore

Kent Smith,
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H. Daniel Nix, *Deputy Director*

ENERGY INFORMATION AND ANALYSIS DIVISION

Timetable for the Phaseout of MTBE from California's Gasoline Supply

Prepared by
Fuel Resources Office
Energy Information and Analysis Division
California Energy Commission
June 1999

(DOCKET NO. 99-GEO-1)

Acknowledgments

The Energy Information and Analysis Division, Fuel Office supported the work investigating the MTBE's phaseout detailed in this report. This report was prepared in consultation with the staff of the Air Resources Board. We would like to thank Commission staff, Gordon Schremp, Ramesh Ganeriwal, and Gary Yowell for their committed work in preparing this report. We would also like to thank ARB staff, Dean Simeroth and Steve Brisby, for their matched committed efforts attending the meetings and assisting in preparing this report.

List of Abbreviations

ARB	Air Resources Board
CaRFG2	California Reformulated Gasoline Phase 2
CaRFG3	California Reformulated Gasoline Phase 3
CEQA	California Environmental Quality Act
ETBE	Ethyl Tertiary Butyl Ether
MTBE	Methyl Tertiary Butyl Ether
RFG	Reformulated Gasoline
SIP	State Implementation Plan
TAME	Tertiary Amyl Methyl Ether
TBA	Tertiary Butyl Alcohol
U. S. EPA	United States Environmental Protection Agency

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Introduction

In this report, the California Energy Commission and California Air Resources Board (ARB) staff discuss their findings for phasing out Methyl Tertiary Butyl Ether (MTBE) from the gasoline supply in California. This report is in response to Executive Order D-5-99 that was signed by Governor Gray Davis on March 25, 1999.

Organization of this Report

This report provides background information on the California gasoline industry, and the refinery modifications needed to remove MTBE from California's gasoline, including modifications to the gasoline distribution infrastructure. Other topics covered are the adequacy of ethanol supplies, project timelines, and barriers to removing MTBE before December 31, 2002 — the date specified in the Governor's Executive Order.

Background

The ARB adopted the present reformulated gasoline (CaRFG2) regulations in the fall of 1991. These measures were undertaken in response to air quality concerns and actions taken by the United States Environmental Protection Agency (U.S. EPA). The refining industry in California and other areas of the United States reacted to the change in gasoline specifications by making significant modifications to their facilities.

Since the federal Reformulated Gasoline (RFG) regulations required the use of an oxygenate, refiners were compelled to make engineering and design decisions based on the use of a specific type of oxygenate. The refiners in California selected MTBE as their oxygenate of choice, mainly due to its availability, high octane value, ability to dilute less desirable gasoline properties (such as sulfur, aromatics, and olefins), and good distillation and volatility properties. Since the spring of 1996, MTBE has been used year-round as the predominant oxygenate in gasoline at approximately 11 percent by volume.

The federal Clean Air Act requires that areas in the United States that are designated either extreme or severe ozone nonattainment regions use federal RFG that contains a minimum amount of oxygen at all times. As a result, 30 percent of the gasoline consumed nationally has to meet federal RFG requirements. There are three such areas (or air basins) in California: Sacramento, South Coast (Los Angeles and surrounding areas), and San Diego. These regions collectively account for approximately 70 percent of the gasoline sold in the state or about 10 percent of the gasoline sold nationally.

The use of MTBE in gasoline and occasional leaks and spills associated with the distribution of gasoline have resulted in detectable MTBE levels greater than the Secondary Maximum Contaminant Level of 5 parts per billion in a limited number of drinking water wells and surface water resources throughout California. To date, less than 1 percent of all the public drinking

water wells tested have revealed the presence of MTBE. Nevertheless, compared to typical gasoline blending components, MTBE is more soluble in water, is more costly to remove, and can travel farther and faster once it comes in contact with a groundwater aquifer. In drinking water, even at very low concentrations such as 5 part per billion, MTBE can produce an unpleasant odor and taste.

The main concern associated with the continued use of MTBE is the potential to contaminate existing and future water sources. In response to this and other concerns, Governor Gray Davis signed Executive Order (D-5-99) on March 25, 1999.

As stipulated in item number 4 of the Executive Order, the Energy Commission was directed, in consultation with the ARB, to develop a timetable by July 1, 1999, to remove MTBE from gasoline at the earliest possible date, but no later than December 31, 2002.

In response to this Executive Order, the Energy Commission and ARB staff held meetings with representatives of the refining companies, petroleum product pipeline operators, environmental groups, permitting agencies, and the ethanol industry. The information obtained from these meetings was used as part of the rationale for the findings presented in this document. A public workshop was held on June 18, 1999, to hear comments on the contents of the staff draft document. At an Energy Commission Business Meeting held on June 28, 1999, the staff draft document was adopted by a vote of 5-0.

MTBE Removal - Refinery Modifications

Finding: Removing MTBE from California's gasoline requires refiners to pursue a combination of compliance strategies that will involve the absence of oxygenates or the use of ethanol, or both. Also, the federal minimum oxygenate requirement which impacts about 70 percent of California gasoline limits the refiners flexibility. But in either case, to produce similar volumes of reformulated gasoline meeting California specifications without MTBE, refiners need to initiate and complete substantial modifications at their facilities.

Removing MTBE from California's gasoline will necessitate several changes at refineries as companies struggle to replace the gasoline volume and octane value that will be lost. Depending on the strategy pursued by each refiner, the complexity and cost of the projects will vary.

For those refiners that decide to use ethanol in place of MTBE, equipment to lower the volatility of blending gasoline with ethanol will need to be installed. (Volatility is a measure of how easily gasoline evaporates.) Refiners using ethanol will have to produce a base gasoline with lower volatility. This volatility is approximately 5.5 to 5.8 pounds per square inch Reid vapor pressure during the summer months. Gasoline blending components with high volatility, such as pentanes, will have to be removed so that the less volatile base gasoline can be produced. These modifications are difficult and reduce refinery flexibility. Small refiners operate under different, less flexible process scenarios than do large refiners.

Because each gallon of ethanol contains more oxygen than MTBE, refiners do not have to blend as much ethanol into the gasoline to achieve the same oxygen level achieved with 11 percent by volume MTBE. The combination of having to remove pentanes, to lower volatility to an acceptable level - up to five percent of the gasoline volume, and adding a lesser volume of ethanol, approximately six percent, rather than 11 percent, means that refiners will not be able to completely displace the volume lost with the removal of MTBE. In fact, if ethanol is used only at 5.7 percent by volume, the total decline in gasoline production capability should be about 10 percent. If refiners choose to blend with greater amounts of ethanol the deficit in production capability will be less than the 10 percent. The additional volume deficit will have to be made up by increasing other gasoline blending components such as alkylates. Refiners can accomplish this by either expanding alkylation capacity within their own facilities or by importing alkylates from outside of California.

If flexibility from the federal minimum oxygen requirement is provided, then for those refiners that choose to produce gasoline without oxygenates, some of the engineering approaches will be different. First, the refiners will not have to remove pentanes to offset the higher volatility associated with ethanol blends. Refiners will, however, have to replace the octane and volume lost from removing MTBE. In this situation, the loss in production capability would be about 11 percent. Once again, refiners are expected to make up for this volume deficit by increasing the production of desirable gasoline blending components such as alkylates or by importing additional gasoline or blending components.

Few gasoline-blending components possess octane values greater than MTBE (110) or ethanol (115). The blending octane value for alkylates is 91 to 99; this octane value may be sufficient to meet the supplemental octane needs for regular (87) and mid-grade (89) gasoline. But premium (92) gasoline blends are very difficult to make with the loss of MTBE's higher-octane value. Toluene (103) and isooctene (109) have higher octane values, but toluene is an aromatic and isooctene is an olefin, two gasoline properties that are limited by CaRFG2 specifications. A potential drawback could be the expense to produce higher octane alkylates.

MTBE Removal - Distribution Infrastructure Modifications

Finding: The modifications to the distribution infrastructure required for ethanol blending at all terminals will require up to two years to complete.

Refineries are not the only facilities that require modifications to remove MTBE. The majority of California's gasoline is transported by pipeline from the refineries to a network of storage terminals located throughout the state. Tanker trucks are then used to haul the gasoline from the terminals to service stations. For gasoline produced without ethanol, the distribution system would require little change. But if refiners produce gasoline with ethanol, then modifications to certain portions of the distribution system will be necessary.

Ethanol is miscible in water (soluble), whereas gasoline components are generally not soluble in water. Water is usually present in storage tanks and pipelines, mostly due to contamination from rainwater and small amounts of water inherent in the refinery process system. Because

petroleum products do not readily mix with water, the industry does not have much of a problem dealing with this issue unless ethanol is used.

Currently, refiners and pipeline operators are reluctant to ship gasoline blends containing ethanol through the pipeline distribution infrastructure because ethanol will absorb water and associated contaminants present in the distribution system. The ensuing contaminated gasoline could cause problems for motorists. To address this problem, refiners and pipeline operators are likely to ship a base gasoline without ethanol to the terminals. The ethanol will then be combined with the base gasoline when the two components are loaded into the delivery truck's tank. (Ethanol itself is usually transported to the terminal by rail car or by delivery truck, then stored in a separate storage tank.)

Today, less than 30 percent of the terminals in California have the capability of dispensing gasoline containing ethanol. The remaining terminals will require the installation of a separate tank for the ethanol storage. In addition, many terminals will require special blending equipment be installed so that ethanol can be mixed in the correct proportions while the tanker truck is loading. Transporting ethanol to the terminals will also require the construction of some additional rail connections, rail off-loading racks, tanker truck off-loading racks, or some combination. The permitting and construction required to upgrade all of the remaining California terminals to distribute gasoline-containing ethanol will require up to two years to complete.

Brazil is the largest producer and consumer of ethanol in the world and has a great deal of experience moving ethanol through their distribution infrastructure. However, the products that Brazil sends by pipeline have different properties than the products moved by pipeline in California. Pipeline operators in California and other areas of the United States may develop techniques for shipping ethanol through the pipeline distribution system separately, without compromising the ethanol quality. If this change in pipeline operation can be accomplished, transportation costs could be reduced for delivering ethanol to the terminals.

MTBE Removal - Adequacy of Ethanol Supplies

Finding: Although California's demand for ethanol could be met if sufficient time were provided, the availability of adequate ethanol supplies would become an issue if other areas of the country were also to ban MTBE while the federal minimum oxygenate requirement is still in place for gasoline.

Current ethanol production in the United States is approximately 100,000 barrels per day. The majority of ethanol production facilities are located in the Midwest and use corn as a feedstock. If California were to use ethanol to replace MTBE, anywhere from 35,000 to 92,000 barrels per day would be required. Even though this volume is a rather large portion of today's total domestic production, adequate ethanol supplies could be brought to California if enough time were allowed to restart idle capacity, about 20,000 barrels per day, and to build new facilities.

If other states under federal RFG requirements reach the same conclusions as California with regard to MTBE, it is likely that they too may call for its removal. If these other federal RFG areas in the U.S. were to switch from MTBE to ethanol, this action could result in the ethanol demand tripling. It is possible that, if these potential phaseouts outside of California were to coincide with the deadline set for this State, adequate supplies of ethanol would be more difficult to obtain, driving up the market price for ethanol. But even if California were the only state to switch to ethanol, this action would require significant changes to the ethanol industry that could not be accomplished in one year. Idle production capacity would have to be restarted and new ethanol facilities constructed. Although idle capacity could be brought back on line within six months, it is likely that it would take two to three years to construct new ethanol production facilities.

MTBE Removal - Project Timelines

Finding: Project timelines for refinery modifications will require between 33 and 42 months to complete, assuming the California Environmental Quality Act (CEQA) review process is optimally accomplished in 12 months. Project timelines for distribution infrastructure modifications should be less than those of the refinery projects, mainly due to shorter construction periods.

Finding: The Energy Commission and the ARB staffs should prepare progress reports on the status of projects associated with the removal of MTBE from California's gasoline. The first of these reports should be prepared April 2000. The Energy Commission and ARB would use the reports to track progress and to identify any problems early on so that appropriate action can be taken.

Producing MTBE-free gasoline in California will require substantial modifications to refineries and the distribution infrastructure and an increase in ethanol production. Typical project timelines involve a number of discreet steps that must be accomplished to bring a project to completion. The main steps include planning and engineering, approval of financing and acquisition of funds, permitting, purchase of major equipment, construction, and testing of the new and modified equipment.

Planning, engineering, funding, and equipment orders can take up to a year to complete. But there is room here to overlap some of these activities and possibly shorten this time period to six months. Although circumstances are similar for the majority of the refiners in California, small refiners will likely require more time to acquire the necessary capital before refinery modifications could be commenced. Permits associated with the refinery modifications are expected to undergo the CEQA review process. This step must be completed and the "permits to construct" issued before any construction begins.

Depending upon the size, complexity, and contentiousness of the various projects, the CEQA process could easily take one year or more to complete. Also, there is substantial uncertainty with regard to how this public process could be impacted by events beyond the control of the permit applicant. Thus, no guarantees can be made that this step could be shortened. In fact, it is

possible that the CEQA process could take longer than the anticipated 12-month review period. Once the permits have been obtained, the actual construction could be completed within 12 to 18 months. Testing the new process equipment would take approximately three months.

Previous refinery modifications undertaken to produce CaRFG2 involved a monitoring process by the ARB, which included quarterly status reports. The purpose of these quarterly reports was to ascertain the relative progress of all the refiners towards completion of their individual projects. Since the anticipated timelines for each of the projects being considered by California refiners leave little room for delay, a similar approach could provide decision-makers with valuable updates. This approach could provide an opportunity for state and local officials to rectify delays that could impact completion of the various California refinery, terminal, and ethanol plant projects.

MTBE Removal - Ability to Advance the Timetable

Finding: To ensure adequate supply and availability of gasoline for California consumers, the timetable for removal of MTBE from California's gasoline should not be advanced any earlier than the deadline of December 31, 2002.

As noted above, refiners will have to undertake major construction projects before they can produce comparable volumes of RFG without MTBE. Planning and engineering for these projects will require conservatively up to six months to complete, followed by the permitting process, ordering of major process equipment, construction, and testing of the modified equipment. In total these activities will optimistically require, on average, three years to complete.

Before implementing these projects, refiners have identified three important areas of uncertainty that need to be resolved: (1) the potential removal of the federal minimum oxygen requirement, (2) the viability of ethanol as a potential replacement for MTBE, and (3) the proposed Phase 3 reformulated gasoline (CaRFG3) specifications. Since the assessment of ethanol as an acceptable gasoline component will not be completed until December 1999 as well as the adoption of the specifications for Phase 3 RFG, refiners will most likely have to refrain from finalizing any MTBE phase-out plans until at least January, 2000.

California's gasoline supply is in a fragile balance that can be subject to strong price increases if production capability or portions of the distribution infrastructure are even moderately impacted. The recent refinery problems and associated rapid increase in gasoline prices serve as a reminder of the important role of adequate production capability.

If the timetable for removing MTBE from California's gasoline were to be advanced, all of the refiners may not have sufficient time to complete the necessary modifications to their facilities. The lack of production and an associated decrease in supply would likely lead to price increases greater than experienced during the spring of 1999. To reduce the likelihood of such an occurrence, adequate time must be provided so that the necessary modifications to the refineries, distribution infrastructures, and ethanol transportation and storage facilities can be completed.

This approach will help to ensure that all gasoline, rather than a portion of the supply, can be produced without MTBE.

MTBE Removal Date - When and Where?

Findings: The removal date for MTBE of December 31, 2002, should apply to the production or importation point for finished gasoline and the bulk distribution facilities. With this requirement, the service stations should not have to take any action to come into compliance.

Adequate time will be necessary for the new MTBE-free gasoline to work its way through the distribution system. The majority of gasoline storage tanks throughout the distribution system will have some of the old gasoline in the bottom of the tank when new delivery of gasoline arrives. The two different fuels get mixed together creating a third fuel with properties that are a mixture of the two. If the "old" gasoline happens to contain MTBE, the resulting mixture of the two fuels will also contain MTBE, but in a lower concentration.

To ensure that all of the MTBE is completely flushed from the various pipelines, storage tanks, and service stations, a certain period of time will have to pass before locations downstream from the refineries are MTBE-free. The ARB adopted a "staged" introduction strategy as part of their regulations for CaRFG2. This approach allowed an additional 90 days from the compliance date at the refinery for compliance at the service station. This strategy was quite successful because all the storage tanks were cycled through several deliveries, effectively flushing out the old gasoline with the new fuel.

MTBE Removal Prior to December 31, 2002

The concept of removing MTBE from gasoline in California prior to December 31, 2002, was discussed during the meetings with the stakeholders. Basically, the idea manifests in three forms: a gradual phasing down of MTBE for the entire state; removing MTBE from specific geographic regions, and removing MTBE from gasoline during the winter months.

Gradually Phasing - Down MTBE for the Entire State

Finding: A gradual phase-down of MTBE by 30 percent by the end of the first year is possible only if the federal minimum oxygen requirement is removed. Even if the requirement were removed, refiners would not have adequate time to complete all the necessary modifications to permit a 60 percent phase-down of MTBE by the end of the second year.

This phase down concept involves gradually removing MTBE from California gasoline over three years: 30 percent by the end of the first year, 60 percent by the end of the second year, and

100 percent by the end of the third year. The start time for the gradual phase-down concept is assumed to begin on January 1, 2000. In this case, the staff expects that the entire gasoline supply would be in compliance by the end of the third year (December 31, 2002). (But mandated gradual compliance by earlier dates is another matter.)

Although this concept appears to have merit on the surface, a closer look reveals some hurdles that would be difficult to overcome. Assuming that the base comparison for reducing MTBE is that all of California's gasoline contains 11 percent by volume MTBE, then achieving a 30 percent reduction by the end of the first year would be possible only if the federal minimum oxygen requirement were to be eliminated. Removing the oxygen requirement would allow refiners to extend the practice of producing some portion of their gasoline without MTBE to other regions of the state outside of the San Francisco Bay Area.

If the federal minimum oxygen requirement remains in effect, refiners would be required to use ethanol in approximately 70 percent of the state's gasoline. To use ethanol during the low volatility season (essentially April through October), substantial equipment modifications would be necessary, as discussed earlier. This type of refinery work would require more than 12 months to complete.

Achieving a 60 percent reduction in MTBE by the end of the second year would require substantial refinery modifications, regardless of whether the federal minimum oxygen requirement was to remain in effect or be removed. The 60 percent reduction would require refiners to make equipment changes that as discussed earlier cannot be done in less than three years. Finally, the additional record keeping to track gradual reduction goals would be a significant burden for both the industry and State agencies that enforce the gradual phase-down.

Removing MTBE from Specific Geographic Regions

Finding: Creating "MTBE-free zones" would require a number of years for the necessary refinery modifications to be completed and put the MTBE-free region at greater risk for supply disruptions and significant price spikes.

Another concept for accelerating the removal of MTBE from gasoline ahead of the December 31, 2002, deadline is that specific geographic regions of California be designated "MTBE-free zones." This type of designation would require that all grades of gasoline sold in the area be free of any MTBE.

Even though some of the San Francisco Bay Area refiners are producing the majority of their regular grade of gasoline without MTBE, expanding this practice to the rest of the gasoline sold in the region would require modifications to the refineries and changes to some portions of the distribution system. These projects would require a number of years to complete the planning, engineering, permitting, construction, and testing of the new process equipment before all grades and adequate volumes of complying gasoline could be supplied.

In addition, creating an "MTBE-free island" within the state will limit the options for suppliers to obtain alternative gasoline supplies when one or more of the refiners producing gasoline for the "MTBE-free zone" has an unanticipated production problem. Because the gasoline being sold in the "MTBE-free zone" will be unique, the availability of complying gasoline that could be used in the special region will be scarce. As a result, the recent price spike that occurred during the spring of 1999 could reoccur. But this time, the severity of the price increase would be greater for two reasons. First, suppliers of gasoline to the "MTBE-free zone" would not be able to blend-in additional volumes of MTBE to extend the gasoline supply. Second, the number of alternative sources of supply would be considerably less, limiting any relief that could be provided by importers or other producers in the state.

Most refiners in California produce gasoline for different market areas of the State. Rarely are these areas confined to a specific geographic region. Rather, over the course of a typical year, gasoline produced by a specific refiner could end up anywhere in the state. The flexibility for refiners to be able to send gasoline to any area of the State would be curtailed by the creation of an "MTBE-free zone," reducing the efficiency of the distribution system and increasing the costs for consumers.

Removing MTBE from Gasoline During the Winter Months

Finding: The seasonal removal of MTBE could not be accomplished without modifications to both the refineries and the distribution infrastructure. These projects would require a number of years to complete. However, absent a federal minimum oxygen requirement, the seasonal use of ethanol could occur on a limited basis, where and when it meets the logistical, economic, and marketing plans of the various refiners.

A third concept for accelerating the removal of MTBE from gasoline in advance of the December 31, 2002, deadline is that refiners be required to remove MTBE from all grades of gasoline during the winter months.

If the federal minimum oxygen requirement remains in effect, refiners would be required to use ethanol as a substitute for MTBE. Even if adequate ethanol supplies could be secured quickly, the refiners would not be able to blend the ethanol at the terminals without making modifications to the distribution infrastructure. These modifications would take up to two years to complete the planning, engineering, permitting, and construction to enable all of the terminals to dispense gasoline blends containing ethanol. These additional modifications would require a substantial amount of time to complete.

Areas of Uncertainty

At the meetings, stakeholders identified several areas of uncertainty that will play a major role in decisions undertaken by refiners as they plan to remove MTBE. All of these issues, except for the federal minimum oxygen requirement, should be resolved by the end of this year. This resolution will provide refiners with additional certainty that should assist them with finalizing

their engineering projects and allow them to initiate a chain of events that will eventually lead to removing MTBE from California's gasoline supply.

Federal Minimum Oxygen Requirement

Finding: Removing the federal minimum oxygen requirement would lead to an almost immediate reduction in MTBE use throughout the state to a point where at least 30 percent of the gasoline would be produced without MTBE. The use of MTBE would still continue until all modifications to the refineries had been completed.

Finding: If the federal minimum oxygen requirement is not removed, then refiners will continue using MTBE in quantities similar to today's until all modifications to the refineries are completed.

Federal law requires that regions in the United States that are either extreme or severe ozone nonattainment use federal RFG that contains a minimum amount of oxygen at all time. These areas have resulted in 30 percent of the gasoline consumed nationally having to meet federal RFG requirements. There are three such areas in California: Sacramento, South Coast (Los Angeles and surrounding areas), and San Diego. These regions collectively account for approximately 70 percent of the gasoline sold in the state or about 10 percent of the gasoline sold nationally. If this minimum oxygen requirement remains in effect, ethanol will be the most likely oxygenate to replace MTBE.

California RFG regulations allow refiners to produce complying fuel without any oxygenates. Three refiners in the San Francisco Bay Area are producing the majority of their regular grade of gasoline without adding any MTBE. This gasoline is marketed in the San Francisco region because the area is not an extreme or severe ozone nonattainment region. However, the federal minimum oxygen requirement, refiners are unable to expand this practice into the Sacramento or Southern California federal RFG areas.

Viability of Ethanol

Finding: If ethanol in gasoline is found to pose a serious risk to people's health or our drinking water resources, then the December 31, 2002, date for removal of MTBE would have to be re-evaluated because no other viable alternative to ethanol is known at this time to be acceptable to industry, regulatory agencies, and health officials.

Finding: If ethanol is not a viable alternative to MTBE, refiners could produce sufficient volumes of reformulated gasoline by the December 31, 2002, deadline only if the federal minimum oxygen requirement were to be removed no later than January 31, 2000.

Finding: An "acceptable concentration level" for ethanol in drinking water would allow state water and health officials to better assess the implications of greater ethanol use in California's gasoline.

The Governor's Executive Order (D-5-99) also specifies that any substitute for MTBE be thoroughly assessed before it can be used in California's gasoline. Ethanol will be studied to see what the potential impacts might be for burning gasoline containing ethanol in a vehicle's engine and what problems could be associated with contamination of ground and surface water sources from leaks and spills of gasoline containing ethanol. Each of these studies is scheduled to be completed by December 31, 1999.

Even though other alternative oxygenates such as ethyl tertiary butyl ether (ETBE), tertiary amyl methyl ether (TAME), and tertiary butyl alcohol (TBA) have been used in gasoline, it is believed that none of these compounds will be used by the refining industry in California. The primary reasons are that all of these compounds possess similar undesirable environmental characteristics as MTBE: they can be detected by people as an unpleasant taste or odor at very low-concentration levels, they are more soluble than gasoline in water, and the cost to remove these compounds from contaminated drinking water resources is quite high (relative to other gasoline components). It is for these reasons that ethanol is thought to be the only alternative to MTBE that would be potentially acceptable to industry, regulatory agencies, and health officials.

The fate and transport studies of ethanol in surface and groundwater should assess the potential impacts on the environment of using ethanol in gasoline. As with MTBE, the definition of "acceptable concentrations" in drinking water is a useful guideline for water agencies and other health officials. If ethanol's "acceptable concentration" level is clearly defined as part of the findings associated with the completion of the fate and transport studies, State officials will be able to better assess the implications of greater ethanol use in California's gasoline.

The fate and transport studies are also expected to assess the potential risk to the environment of gasoline blends that do not contain any oxygenates. A concern has been raised about the potential increase in the use of certain gasoline blending components, such as alkylates. A great deal of emphasis has been placed on the uncertainty of ethanol's viability in terms of delaying the investment decisions for refiners. But it should also be noted that ethanol producers would probably wait to see if ethanol is acceptable to use as a replacement for MTBE before committing any capital to either expand existing ethanol production capacity or construct new facilities.

Phase 3 RFG Specifications

Finding: Even though the Phase 3 RFG regulations may require additional refinery modifications, the December 31, 2002 deadline should still allow sufficient time to complete the extra work, if the ARB were to use this same date for the introduction of their new regulations.

The Governor's Executive Order (D-5-99) also specifies that by December 1999 the ARB shall adopt California Phase 3 Reformulated Gasoline (CaRFG3) regulations that will provide additional flexibility to refiners to remove MTBE and maintain current emissions and air quality benefits while allowing compliance with the State Implementation Plan (SIP).

To comply with the CaRFG3 specifications, some additional refinery modifications may be necessary. The timing of the introduction of CaRFG3 could be important. Planning the introduction of CaRFG3 to coincide with the December 31, 2002, date to remove MTBE could afford planning and engineering advantages for refiners, as well as having the potential to optimize some of their capital expenditures.

Other Issues

Various stakeholders raised a number of important issues as "concerns." These matters do not necessarily relate to or directly impact the timetable for removing MTBE, but they will have to be resolved before MTBE is removed from California's gasoline. The staff addressed these issues at the public workshop, discussing such matters as: the definition of "MTBE-free" gasoline, the supply impacts of defining MTBE-free gasoline at too low a concentration of MTBE, fungibility of gasoline containing ethanol, the potential for California to become a net importer of gasoline, and transportation concerns associated with the movement of large volumes of ethanol into the state.

APPENDIX D

EXECUTIVE ORDER D-52-02

Executive Order D-52-02
by the
Governor of the State of California

WHEREAS, Executive Order D-5-99, issued March 26, 1999, found that, "on balance," use of MTBE posed a significant risk to California's environment. The State Energy Resource Conservation and Development Commission (Energy Commission) and the Air Resources Board (Board) were directed to develop a timetable for removing MTBE from gasoline at the earliest possible date, no later than December 31, 2002. The Board was directed to adopt regulations as needed to implement the Executive Order; and

WHEREAS, on December 9, 1999, the Board adopted regulations prohibiting the sale of gasoline containing MTBE in California after December 31, 2002; and

WHEREAS, Senate Bill 989 (Sher) of 1999 requires the Energy Commission to develop a timetable for removal of MTBE from gasoline "at the earliest possible date" that will still ensure adequate supply and availability of gasoline. (Health & Saf. Code, Section 43013.1.); and

WHEREAS, in order to comply with the federal requirements and also eliminate use of MTBE, California would need to import up to 900 million gallons of ethanol per year; and

WHEREAS, the current production, transportation and distribution of ethanol is insufficient to allow California to meet federal requirements and eliminate use of MTBE on January 1, 2003; and

WHEREAS, on June 12, 2001, the U.S. Environmental Protection Agency denied California's request for a waiver of the federal oxygen content requirement. As a result, if use of MTBE is prohibited January 1, 2003, California's motorists will face severe shortages of gasoline, resulting in substantial price increases; and

WHEREAS, strengthened underground storage tank requirements and enforcement have significantly decreased the volume and rate of MTBE discharges since Executive Order D-5-99 was issued in March of 1999;

NOW, THEREFORE, I, GRAY DAVIS, Governor of the State of California, by virtue of the power and authority vested in me by the Constitution and statutes of the State of California, do hereby issue this order to become effective immediately:

I FIND that it is not possible to eliminate use of MTBE on January 1, 2003, without significantly risking disruption of the availability of gasoline in California. This would substantially increase prices, harm California's economy and impose an unjustified burden upon our motorists.

IT IS ORDERED that by July 31, 2002, the board shall take the necessary actions to postpone for one year the prohibitions of the use of MTBE and other specified oxygenates in California gasoline, and the related requirements for California Phase 3 reformulated gasoline.

IT IS FURTHER ORDERED that the Board and Commission shall work with the petroleum industry to ensure that MTBE-free gasoline meeting California standards continues to be supplied to the Lake Tahoe region and any other areas of California currently receiving MTBE-free gasoline.

IT IS FURTHER ORDERED that the State Water Resources Control Board and the Department of Health Services shall work with California drinking water providers to ensure that the providers continue to take all appropriate measures to prevent discharge of MTBE into surface water reservoirs.

IN WITNESS WHEREOF I have hereunto set my hand and caused the Great Seal of the State of California to be affixed this the fourteenth day of March 2002.

_____/signed/_____
Gray Davis
Governor of California

APPENDIX E

Miscellaneous "Cleanup" Amendments to the CaRFG3 Regulations

MISCELLANEOUS "CLEAN-UP" AMENDMENTS TO THE CALIFORNIA REFORMULATED GASOLINE REGULAITONS

The following list covers the proposed amendments to title 13 of the California Code of Regulations that do not involving a one year postponement of the prohibition of methyl tertiary butyl ether (MTBE) and the Phase 3 California reformulated gasoline (CaRFG) compliance dates for one year.

1. **Section 2261(a)(1)(B) (Applicability of Phase 2 CaRFG standards)**

   An amendment would make clear that the standards that became applicable March 1, 1996 are the Phase 2 CaRFG standards.

2. **Section 2261(b)(3)(B)4. (Early compliance with the Phase 3 CaRFG3 standards)**

   An amendment would make clear how the prohibitions regarding MTBE apply to a batch of gasoline that a gasoline producer or importer designates as subject to the Phase 3 CaRFG standards before the mandatory Phase 3 CaRFG implementation date. Reflecting the staff's current interpretation of the regulations, such a batch is subject to the prohibitions in section 2262.6(a)(1) and 2262.6(c) regarding California gasoline produced with the use of MTBE or with the use of an oxygenate other than MTBE or ethanol, but is not subject to the section 2262.6(a)(2) limits on the concentration of MTBE in California gasoline.

   It is expected that any gasoline sold or supplied pursuant to the Phase 3 CaRFG early opt-in provisions would be designated pursuant to section 2273(d)(1) as not containing 0.6 percent by volume or more MTBE when it is delivered to the retail gasoline outlet.

3. **Section 2262, footnote 2 (Phase 3 CaRFG flat limit for RVP)**

   Language would be added to make clear how the Phase 3 CaRFG flat limits for Reid vapor pressure (RVP) apply. The 6.90 pounds per square inch (psi) flat limit applies only when a producer or importer is using the evaporative emissions model element of the CaRFG Phase 3 Predictive Model, in which case all predictions for evaporative emissions increases or decreases made using the evaporative emissions models are made relative to 6.90 psi, and the gasoline may not exceed the maximum RVP cap limit of 7.2 psi. Where the evaporative emissions model element of the CaRFG Phase 3 Predictive Model is not used, the RVP of gasoline sold or supplied from the production or import facility may not exceed 7.0 psi. This is consistent with Table 1 of the California Procedures for Evaluating Alternative Specifications for Phase 3 Reformulated Gasoline Using the California Predictive Model, which is incorporated by reference in section 2265(a)(2).

4. **Section 2262.4(b)(2)(D) and (E) (RVP control periods)**

   A correction to a drafting error in the original Phase 3 CaRFG amendments would reverse the RVP regulatory control periods for production and import facilities in the North Coast Air Basin and the North Central Coast Air Basin. This makes the end of the producer and importer control periods in the two air basins consistent with the end of the control periods that apply throughout the gasoline distribution system (section 2262.4(a)(2)(D) and (E)).

5. **Section 2262.5(d) (Adding oxygenate to California gasoline)**

A new subsection (2) would be added allowing a person to add a nonprohibited oxygenate to California gasoline that is subject to a minimum oxygen cap limit but does not meet that cap limit, where the person obtains prior approval from the Executive Officer. This is similar to the preexisting provisions in section 2266.5(h)(3), which allow a person to add nonoxygenate blendstock to California gasoline under similar circumstances to bring the gasoline into compliance with one or more cap limits.

6. **Section 2262.6(c) (Use of oxygenates other than ethanol or MTBE)**

A correction changes "ether" to "oxygenate," since the clear intent from the context is to refer to any oxygenate, alcohols as well as ethers.

7. **Section 2266.5(a)(2)(C) (Determining CARBOB compliance by using handblending)**

(a) **Background.** Shipping gasoline containing ethanol through a pipeline presents challenges due to the affinity of ethanol for water. Because of this, section 2266.5 allows producers and importers to supply a gasoline blendstock – called California Reformulated Blendstock for Oxygenate Blending or CARBOB – which when blended with ethanol will result in a complying gasoline. The CARBOB provisions specify the manner in which the properties of the final blend containing ethanol will be determined and the notification and reporting requirements applicable to the refiners.

Section 2266.5(a)(2)(C) specifies the method for determining whether a final blend of CARBOB complies with the standards for California gasoline by means of oxygenate blending and testing. Under this subsection, a specified amount and type of oxygenate is added to a representative sample of CARBOB, and the properties of the resulting blend are determined in accordance with the applicable test method specified in the regulations. These blends are referred to as "handblends." It is expected that ethanol will be the oxygenate most frequently used under these provisions. For each batch of CARBOB, the producer or importer will have designated the oxygen content range for which the CARBOB is designed, which is the same as the oxygen content range that is entered into the Predictive Model. The regulation contains an equation that is to be used to determine the amount of ethanol that is to be added during a handblend, based on the designated oxygen content range.

(b) **Identification of specific volumes of ethanol to be added to CARBOB during handblending to determine compliance.** The staff is proposing simplifying amendments that would apply in most handblending situations. Due to the tax treatment of ethanol used as an oxygenate in gasoline, it is expected that ethanol will generally be added to CARBOB to create an ethanol content of either 5.7 vol.%, 7.7 vol.%, or 10.0 vol.% of the blended volume. Just as the default minimum and maximum flat limits for oxygen allow a range of 0.4 wt.% oxygen (between 1.8 wt.% and 2.2 wt.%), the CaRFG2 and CaRFG3 Predictive Models allow the use of a single oxygen content of 2.0 wt.%, 2.7 wt.%, or 3.5 wt.% if the refiner has designated oxygen ranges of 1.8-2.2, 2.5-2.9, or 3.3-3.7 wt.%. Following this approach, the proposed

amendments provide that 5.7 vol.% denatured ethanol would be added during handblending if the designated range for oxygen from denatured ethanol is 1.8 wt.% to 2.2 wt.% (or a range that is within 1.8 wt.% and 2.2 wt.% and includes 2.0 wt.%). The treatment would be similar for the other two expected ranges. This approach allows the entity conducting the handblend to directly determine the exact amount of denatured ethanol to be added for the three ranges without needing to go through the step of applying an equation.

(c) Equation for determining volume of ethanol to be added to CARBOB during handblending.

Under the proposed amendments, an equation would still be used to determine the amount of ethanol that is to be added during a handblend to determine compliance when the designated oxygen range does not fall within one of the three ranges identified above. The current equation in the regulation is:

$$Vol.\ Denatured\ Ethanol = \frac{59.86}{\left(\frac{21.88}{wt.\%\ oxygen}\right) - 0.0604}$$

If the designated is range is not greater than 0.4 percent, the midpoint of the range is entered into the above equation as the wt.% oxygen. If the specified range is greater than or equal to 0.4 percent, the lower limit of the range plus 0.2 percent is the oxygen value that is put into the equation. The calculated Vol.% Denatured Ethanol is the volume of ethanol that is used in the handblend.

Based on comments provided by various stakeholders the staff proposes that the equation be changed to:

$$Vol.\ Denatured\ Ethanol = \frac{620}{\left(\frac{218.8}{wt.\%\ oxygen}\right) - 0.40}$$

In deriving the original equation, staff assumed a value for the CARBOB density that was too low. To correct this problem, the staff revised the equation using a density that was more representative of the CARBOBs that would be produced to comply with the standards for California gasoline.

8. Section 2266.5(a)(6)(B) (Determining CARBOB compliance with the cap limits by using handblending)

This subsection pertains to the use of oxygenate handblending for determining whether downstream CARBOB complies with the cap limits for California gasoline. The proposed amendments parallel the changes described in Item 6 above, so that the same mechanism applies both at the refinery and in downstream situations.

9. Section 2270(a)(1) (References to averaging limits for sulfur and benzene)

The amendments make corrections to update the references to the averaging limits for sulfur and benzene. These references should have been updated in the original CaRFG3 rulemaking when the listing of the averaging limits in section 2262 replaced the former references in sections 2262.2(c) and 2262.3(c).

APPENDIX F

Draft Assessment of the Real-World Impacts of Commingling California Phase 3 Reformulated Gasoline

California Environmental Protection Agency
Air Resources Board

Draft Assessment of the Real-World Impacts of Commingling California Phase 3 Reformulated Gasoline

May 28, 2002
(2nd Draft)

State of California
California Environmental Protection Agency

AIR RESOURCES BOARD
Stationary Source Division

Draft Assessment of the Real-World Impacts of Commingling California Phase 3 Reformulated Gasoline

May 28, 2002
(2nd Draft)

Acknowledgements

This assessment was prepared with the assistance and support from other divisions and offices of the Air Resources Board. In particular, we wish to thank staff from the Enforcement Division, the Monitoring and Laboratory Division, and the Research Division for their efforts in support of this assessment. We would also like to acknowledge the significant assistance provided by industry in conducting this assessment.

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I. EXECUTIVE SUMMARY

A. Introduction

There is an evaporative emissions effect associated with the mixing (or commingling) of a gasoline containing ethanol and a gasoline not containing ethanol. The addition of denatured ethanol to a non-ethanol-blended fuel can increase the Reid vapor pressure (RVP) of the fuel by up to one pound per square-inch (psi). However, this impact is less when a fuel produced without ethanol is commingled with a fuel produced with (already containing) ethanol. This is because the RVP increase from commingling is limited to that which occurs in the fuel produced without ethanol (the RVP increase has already been realized in the ethanol-produced fuel). In this case, the commingling impact is dependent upon the relative proportions of each fuel in the final commingled fuel, as well as the ethanol content of the fuel produced with ethanol. Because of this, for example, the maximum RVP increase of commingling a 6 percent ethanol fuel is about 0.7 psi RVP, based on the addition of ⅔ of a tank of non-ethanol fuel to ⅓ of a tank of ethanol fuel.

Due to the RVP increase associated with commingling, the federal reformulated gasoline (RFG) regulations prohibit the mixing of ethanol blended gasoline and non-ethanol blended gasoline in the distribution and marketing system. However, neither the federal nor the California Phase 3 Reformulated Gasoline (CaRFG3) regulations prohibit the mixing of ethanol-blended gasoline with non-ethanol-blended gasoline in vehicle tanks. To date, since virtually all CaRFG has been made with methyl tertiary butyl ether (MTBE) and little ethanol, this has not been a significant problem in California. However, as MTBE is phased out of California gasoline, the mixing of a non-ethanol-blended fuel and an ethanol-blended fuel in vehicle tanks could result in a significant new source of emissions.

In proposing the CaRFG3 regulations in 1999, staff of the Air Resources Board (ARB/Board) estimated that the potential impacts of commingling CaRFG3 containing ethanol with CaRFG3 not containing ethanol in motor vehicle fuel tanks would result in an average 0.1 psi or less RVP increase in the California gasoline pool. An increase in the RVP of a gasoline has the practical effect of increasing evaporative emissions from motor vehicles. To compensate for the anticipated increase in evaporative emissions due to commingling, the CaRFG3 regulations include a reduced RVP flat limit accordingly for gasoline produced using the revised CaRFG3 Predictive Model. However, due to uncertainty in the potential commingling impacts, in approving the CaRFG3 regulations, the Board directed staff to further evaluate the magnitude of the potential real-world commingling impacts. Staff has completed this further evaluation, and this report presents their findings.

In addition, the United States Environmental Protection Agency (U.S. EPA) based its denial of California's request for a waiver from the federal oxygenate mandate on its belief that California may have underestimated the emissions associated with

commingling. As a result, staff's evaluation not only addresses the Board's directive, but also collects data to address U.S. EPA's concerns about the likely emissions due to commingling.

B. Findings

Staff performed both simulation modeling and a field study to carry out the Board's directive to assess the likely magnitude of commingling impacts associated with the switch to CaRFG3. Based on the simulation model and field study, staff estimate that the likely overall RVP increase due to commingling is less than 0.1 psi. As such, the 0.1 psi RVP reduction provided for in the CaRFG3 Predictive Model is sufficiently protective against an increase in commingling evaporative emissions from gasoline powered motor vehicles.

Based on ethanol market share in the range between 25 to 65 percent, the modeling work predicted average RVP increases of 0.06-0.08 psi and 0.07-0.09 psi, for 6 and 7.7 volume percent ethanol blends, respectively. Staff also investigated the sensitivity of the simulation model results by varying the assumptions for consumers purchase propensity toward ethanol fuel. The sensitivity analysis yielded ± 0.01 psi RVP variations to the above estimates. These figures are in good agreement with the field study results that found the likely commingling impacts were a statewide gasoline pool RVP increase of 0.06-0.13 psi, with the most likely statewide impact of less than 0.07psi.

The results of ARB's recent commingling study, based on data collected specific to the California market place, demonstrates that the original ARB estimated commingling impact of no more than 0.1 psi increase in RVP in the California gasoline pool is correct, and that U.S. EPA's denial of California's waiver request was inappropriate.

C. Field Study

The first part of staff's evaluation consisted of a field study to collect fuel samples from in-use vehicle fuel tanks to provide information on the RVP of the gasoline before fueling. After fueling, a second sample was obtained to provide information on the increase in RVP due to commingling.

The general approach to obtaining these samples was to have sampling teams present at retail gasoline stations as consumers arrived to fuel their vehicles. Once permission from the operator was obtained, fuel samples were then taken from vehicle fuel tanks both before and after the vehicles were fueled. In order to determine the properties of the fuel being used for fueling the vehicles, morning and afternoon fuel samples were obtained from the gasoline station dispensers. During the sampling, descriptive information (such as initial vehicle fuel tank level, amount of fuel purchased, vehicle type, etc) specific to each fueling event was also collected. The fuel samples were then

analyzed for RVP, oxygenate concentration, and total oxygen content to determine the actual impacts associated with commingling.

During the months of August and September 2001 staff implemented the fuel sampling protocol in three areas of the state: Lake Tahoe, San Francisco, and Los Angeles. Sampling was performed at a total of 19 different gasoline stations resulting in data collection for 396 observed fueling events. Four of the 19 stations were dispensing ethanol-blended fuel. As anticipated, staff was unable to successfully obtain fuel samples from every vehicle due to various fill-pipe configuration constraints. Of the 396 observed fuelings, 254 complete sets of fuel samples were obtained for an overall sampling success rate of 64 percent. The model year of vehicles in the sample is representative of the 2001 statewide passenger car and light-duty truck population.

D. Consumer Fueling Habits

The second part of staff's evaluation included gathering information on California consumer fueling habits. Fueling habits are a critical factor in the evaluation of commingling impacts. Therefore, it was essential to collect current information specific to California consumers.

Data collected during the field study portion of staff's evaluation allow observation of several fueling habits critical to estimating commingling impacts. To supplement the field information, staff requested gasoline marketers to provide additional information on motorists fueling habits. Based on the information provided by California gasoline marketers, staff believes that the fueling data collected in the field study are sufficiently representative of California consumers for use in a commingling analysis.

E. Simulation Model

In addition to documenting actual impacts of commingling on individual vehicle fuel tanks from data of the field study, a simulation model was used to estimate the potential commingling impacts. The simulation model used was developed by Dr. David M. Rocke, University of California, Davis (UCD).

The actual impact on emissions of commingling depends on many variables associated with the gasoline marketplace and on consumer behavioral patterns. These include ethanol market penetration, brand loyalty, fuel tank levels prior to fueling, fillup vs. non-fillup preference, and quantity of fuel purchased. For staff's modeling analysis, the potential future ethanol market share was assumed to vary from 25 percent to 65 percent of the gasoline market pool.

The field study data drive the simulation model with the following input parameters:

- overall, almost 50 percent of consumers purchase the same gasoline brand as their previous fuel purchase;
- about 80 percent of consumers fuel when there is ¼ tank of gasoline or less remaining in their tanks, with more than 40 percent registering nearly an empty tank;
- more than 50 percent of consumers opt for fillup, and;
- non-fillup consumers purchase on average 7 gallons of fuel, about 1/3 to ½ of an average tank, assuming most tanks have a capacity between 14 and 20 gallons.

These figures are consistent with data identified in previous commingling studies, including those by the U.S. EPA staff.[1]

F. Analysis of U.S. EPA Denial of California's Waiver Request

On April 12, 1999, Governor Davis requested a waiver from the U.S. EPA from the federal oxygen requirement for federal reformulated gasoline areas. Additional information supporting the waiver request was submitted to the U.S. EPA as necessary. The justification for a waiver request was based on the fact that the use of oxygenates, such as ethanol, increases emissions of oxides of nitrogen (NOx). As a result, the federal oxygen requirement interferes with the ability of California to meet the national ambient air quality standards (NAAQS) for ozone and particulate matter (PM), where NOx is a precursor to both ozone and PM. The CaRFG3 Predictive Model clearly demonstrates that non-oxygenated fuels can be produced which provide additional NOx reductions for the state.

In June 2001, the U.S. EPA denied California's waiver request. In denying the waiver, the U.S. EPA acknowledged the NOx benefits of non-oxygenated fuels, but believed that there was too much uncertainty regarding potential increases in volatile organic compound (VOC) evaporative emissions. The U.S. EPA associated this uncertainty with uncertainty concerning the magnitude of emissions increase due to fuel commingling in vehicle fuel tanks, especially in the South Coast Air Quality Management District (SCAQMD).

The ARB field study data of California consumer fueling habits (brand loyalty, initial tank level, and frequency of fillup) are similar to the information possessed by the U.S. EPA. However, in their analysis of commingling U.S. EPA staff modified the data, because of a stated lack of confidence that the data adequately represent actual fueling habits. This modification produced in lower brand loyalty, lower percent of fillups, and higher initial fuel tank levels. Each of these changes leads to a higher commingling effect. Moreover, there is a distinct difference between the ARB's and U.S. EPA's analysis in the way "brand-loyal" consumers (those who always purchase one brand of gasoline) are handled. While the ARB assumed negligible commingling effects from this group of consumers, the U.S. EPA assumed the group would contribute to commingling.

[1] In-Use Volatility Impact of Commingling Ethanol and Non-Ethanol Fuels", Peter Caffrey and Paul Machiele, U.S. EPA, Society of Automotive Engineers (SAE) Paper 940765

Cumulatively, these factors produced an over estimation of potential commingling impacts by the U.S. EPA staff, at least, by a factor of two.

II. INTRODUCTION

This chapter provides information on the current requirements for gasoline sold in California, the State's phase out of MTBE, and California's request for a waiver from the federal oxygen mandate for federal RFG.

A. Current Requirements for California Gasoline

Both state and federal regulations govern California gasoline production.

1. California Regulations

The California Phase 2 Reformulated Gasoline (CaRFG2) regulations were adopted by the ARB in 1991 and were implemented in 1996. These regulations established a comprehensive set of specifications, including limits for eight gasoline properties, including:

- Reid vapor pressure
- Sulfur content
- Benzene content
- Aromatics content
- Olefins content
- 50 percent distillation point (T50)
- 90 percent distillation point (T90)
- Oxygen content

The CaRFG2 regulations have provided very significant reductions in ozone and particulate matter precursor emissions and toxic air pollutants. The emission benefits of the program have been equivalent to removing 3.5 million vehicles from California's roads.

2. Federal Regulations

California gasoline production is also governed by federal RFG regulations enacted by the U.S. EPA. Nationally, about 30 percent of the gasoline produced must meet these requirements. These regulations impose emission performance standards in conjunction with specific requirements for oxygen content (year-round average of 2.0 percent by weight), and limits on benzene content. The federal requirements were implemented in two phases. The first phase began in 1995 and the second phase began in December 1999. In the September 15, 1999 Federal Register, the U.S. EPA made the finding that the emission reduction benefits of California gasoline are at least as great as those from federal Phase II RFG.

For California, the federal RFG regulations were first implemented in 1995 in the South Coast and San Diego and in 1996 in the Sacramento Metropolitan Region. The South Coast, San Diego, and Sacramento areas of the State account for about 70 percent of the gasoline sold in California. Further, the San Joaquin Valley was recently reclassified by U.S. EPA as a "severe" ozone non-attainment area and will have to use federal RFG beginning December 10, 2002. With the San Joaquin Valley included in the federal RFG program, approximately 80 percent of the gasoline sold in California will need to meet both the federal and the more stringent state gasoline requirements.

Because of the 1990 federal Clean Air Act Amendments (CAAA) requirement that mandated the use of a minimum oxygen content, the use of oxygenates in California, and MTBE in particular, has grown significantly.

B. California Phase 3 Reformulated Gasoline

Because of concerns regarding the use of MTBE, on March 25 1999, Governor Gray Davis issued Executive Order D-5-99 which, among other things, called for the phase-out of MTBE no later than December 31, 2002. The Governor's Executive Order also directed the ARB to adopt CaRFG3 regulations that will provide additional flexibility in lowering or removing the oxygen content requirement while maintaining the emissions and air quality benefits of CaRFG2, and that the U.S. EPA be requested to provide a waiver from the federal oxygen mandate in California.

In December 1999, the ARB approved the CaRFG3 regulations. These regulations were designed to prohibit the use of MTBE in the production of California gasoline while preserving the benefits of the CaRFG2 program. They were also designed to provide additional flexibility to refiners to produce California gasoline. The CaRFG3 specifications are shown in Table II-1.

With the approval of the CaRFG3 regulations, ethanol is the only oxygenate approved to replace MTBE in California. Therefore, the phase out of MTBE is expected to result in large-scale replacement of MTBE with ethanol to comply with the federal RFG oxygen requirement. The addition of ethanol to gasoline results in a non-linear increase in the fuel's RVP. An RVP increase also results when ethanol blended gasoline is added to non-ethanol blended gasoline. This is called commingling, and the resulting RVP increase is called the commingling impact. In general, commingling results in an increase in evaporative VOC emissions from motor vehicles. In order to maintain the emissions and air quality benefits of the CaRFG2 program, the ARB included a reduction in the CaRFG3 Predictive Model[2] RVP fuel specification of 0.1 psi to offset the anticipated impacts associated with commingling.

[2] The Predictive Model is a mathematical set of equations that relate emission rates of certain pollutants to the values of the eight regulated gasoline properties. To date, most gasoline produced from refineries in California has been produced according to the Predictive Model.

Table II-1:
California Reformulated Gasoline Phase 3 Specifications

Property	*Units*	*Flat Limits*	*Averaging Limits*	*Cap Limits*
Reid Vapor Pressure[1]	psi	7.00 or 6.90[2]	Not Applicable	6.40 –7.20
Sulfur Content	ppmw	20	15	60[3] 30[3]
Benzene Content	Volume %	0.80	0.70	1.10
Aromatics Content	Volume %	25.0	22.0	35.0
Olefins Content	Volume %	6.0	4.0	10.0
T50	°F	213	203	225
T90	°F	305	295	335
Oxygen Content	Weight %	1.8 - 2.2	Not Applicable	0 – 3.7

1 The Reid vapor pressure standards apply only during the summer months.
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.

However, due to uncertainty in the potential commingling impacts, in approving the CaRFG3 regulations, the Board directed staff to further evaluate the real-world impacts of commingling. Staff's efforts to evaluate these impacts are described in Chapters III through VII.

C. California's Waiver Request

On April 12, 1999, Governor Davis requested a waiver from the U.S. EPA from the federal oxygen requirement for federal reformulated gasoline areas. Additional information supporting the waiver request was submitted to the U.S. EPA as necessary. The justification for a waiver request was based on the fact that the use of oxygenates, such as ethanol, increases emissions of NOx from gasoline powered motor vehicles. As a result, the federal oxygen requirement interferes with the ability of California to meet the NAAQS for ozone and PM, where NOx is a precursor to both ozone and PM. The CaRFG3 Predictive Model demonstrates that non-oxygenated fuels can be produced which provide additional NOx reductions for the state.

In June 2001, the U.S. EPA denied California's waiver request. In denying the waiver, the U.S. EPA acknowledged the NOx benefits of non-oxygenated fuels, but believed that there was too much uncertainty regarding potential increases in VOC evaporative

emissions from commingling in vehicle fuel tanks, especially in the SCAQMD. Staff's evaluation and analysis of U.S. EPA's denial of California's waiver request is provided in Chapter VIII.

D. Executive Order D-52-02

Because of the U.S. EPA's decision to deny California's waiver request, between 750 and 900 million gallons of ethanol will need to be imported into the state each year as soon as the ban on MTBE is implemented. The California Energy Commission (CEC) and independent consultants have questioned whether the necessary quantity of ethanol could be efficiently transported to and distributed within California by 2003. In February 2002, an independent study commissioned by the CEC advised that price spikes of up to 100 percent are likely if MTBE is phased out with an inadequate supply of ethanol available and ready for distribution. The independent study also emphasized that even with an adequate supply of ethanol available and ready for distribution, phasing out MTBE next year could result in a five to ten percent shortage of gasoline. In 1999, California experienced a supply reduction of similar magnitude due to major fires and facility outages at two California refineries, and the price of gasoline nearly doubled.

As a result, on March 15, 2002, Governor Davis issued Executive Order D-52-02 that directs the ARB, by no later than July 31,2002, to provide California refineries an additional twelve months for the transition from MTBE to ethanol in gasoline. Under the newly announced timeline, the MTBE phase-out will be accomplished no later than December 31, 2003. Individual refineries may continue to make the transition to ethanol earlier than December 2003.

III. DESIGN AND IMPLEMENTATION OF THE FIELD STUDY AND OTHER DATA COLLECTION EFFORTS

In better defining the impacts of commingling in California markets, ARB conducted both a field study and simulation modeling. This chapter describes the design and implementation of the ARB field study to evaluate the real-world impacts of commingling, including staff's efforts to collect specific information on California consumer fueling habits.

A. ARB Field Study

The first component of staff's evaluation of the real-world impacts of commingling CaRFG3 was the implementation of a field study. The field study was intended to collect real-world information regarding commingling in vehicle fuel tanks, as well as specific information on consumer fueling habits.

1. Establishment of ARB/Industry Working Group

In developing the scope and mission of a field study, staff formed an ARB/industry working group in April 2001. This working group was comprised of representatives from the ARB staff and the oil, ethanol and automotive industries. A list of the companies and organizations represented in the working group is provided in Appendix A. Between April and November 2001 the working group met four times.

Staff also used the working group to provide technical comments regarding staff's analysis. In April 2002, staff provided a preliminary draft version of staff's analysis to the working group for comment and feedback. Staff then made appropriate changes to the analysis based on the working group's comments. Appendix B contains the comments received from the working group by staff.

2. Development of Field Study Protocol

Staff's goal in conducting a field study was to collect fuel samples from motorist's fuel tanks to estimate base fuel RVP as well as verify the estimated increase in RVP due to commingling. In developing a field study, staff was interested in collecting the following information:

- Initial RVP of vehicle fuel tank (prior to fueling).
- RVP of dispensed fuel.
- Final RVP of vehicle fuel tank (after fueling).
- Total oxygen content of each fuel sample.
- Oxygenate types and concentration for each fuel sample.

- Consumer information (such as initial vehicle fuel tank level, amount of fuel purchased, vehicle type, etc).

Fuel Sampling Protocol: Staff's initial efforts to implement a field study began with the development of fuel sampling protocol. The general approach to obtaining these samples was to have sampling teams present at retail gasoline stations as consumers arrived to fuel their vehicles. Fuel samples collected through a chilling apparatus were then taken from vehicle fuel tanks both before and after the vehicles were fueled. In order to determine the properties of the fuel being used for fueling the vehicles, morning and afternoon fuel samples were obtained from the gasoline station dispensers. During the sampling, descriptive information (such as initial vehicle fuel tank level, amount of fuel purchased, vehicle type, etc) specific to each fueling event was also collected and noted on field data sheets. The fuel samples were then analyzed for RVP, oxygenate concentration and total oxygen content to determine the actual impacts associated with commingling.

While the field study was conceptually straightforward, due to the unique nature of such a fuel-sampling program, a standardized approved sampling protocol did not exist. Therefore, the primary focus of the first three working group meetings was the development of an appropriate protocol. By using various components of existing American Society of Testing and Materials (ASTM) and ARB fuel sampling test methods, staff was able to develop an effective fuel sampling protocol that was accepted by the working group for final implementation.

Samples from the vehicle tanks and the station's underground tanks were obtained using ASTM D 5842-95, "Standard Practice for Sampling and Handling of Fuels for Volatility Measurement". Since vehicle tanks are not mentioned in the ASTM sampling method, staff utilized the tank tap portion of ASTM D 5842-95, modified using apparatus that ARB has successfully used for some time to obtain diesel samples from vehicle tanks to check for presence of red dye. Special care, including cooling the sample line and sample container in an ice bath, was taken to ensure that minimal evaporation took place during the sampling process so that accurate RVP results were obtained.

Prior to the final implementation of the fuel sampling protocol, a trial run was performed to evaluate the efficacy of the protocol and to provide sampling staff the opportunity to gain experience and familiarity with the sampling procedure. Staff spent two days in the field conducting sampling operations at six different gas stations. Based on the trial run efforts, minor revisions were incorporated into the fuel sampling protocol.

The final fuel sampling protocol is provided in Appendix C.

Fuel Sample Analysis: Fuel sample analysis was performed by laboratory staff of the ARB. To minimize the amount of handling and the duration of sample storage prior to RVP analysis, the fuel samples were analyzed for RVP within 24 hours in the ARB's mobile laboratory that was located in the general vicinity of the stations participating in the field study. All samples were analyzed for RVP using ARB's "Test Method for the

Determination of the Reid Vapor Pressure Equivalent Using an Automated Vapor Pressure Test Instrument" (California Code of Regulation (CCR) Title 13 §2297).

After analysis for RVP in the ARB's mobile laboratory, the fuel samples were transported to the ARB's laboratory facilities in El Monte, California. There, the fuel samples were analyzed for the volumetric amount and type of oxygenate (MTBE, tertiary amyl methyl ether (TAME), and ethanol) as well as total oxygen content, by ASTM D 4815-94, "Standard Test Method for Determination of MTBE, ETBE, TAME, DIPE, tertiary-Amyl Alcohol and C1 to C4 Alcohols in Gasoline by Gas Chromatography".

Table III-1 provides a summary of the fuel properties analyzed and the analysis method used.

Table III-1:
Methodology for Fuel Sample Analysis

Fuel Property	*Units*	*Analysis Method*
RVP	psi	CCR, Title 13 §2297[1]
Oxygen Content	Weight %	ASTM D 4815-94
Ethanol Content	Volume %	ASTM D 4815-94
MTBE Content	Volume %	ASTM D 4815-94
TAME Content	Volume %	ASTM D 4815-94

[1] Paragraph (d)(1.0) which specifies a CCR, Title 13 sampling method will be replaced with ASTM D 5842 sampling method which allows for the use of either 32-oz or 4-oz bottles.

3. Field Study Areas, Sampling Sites, and Field Sampling

This section describes the areas selected for inclusion in the field study, the sampling sites selected (including station brand and location) and a discussion of staff's field sampling experience.

Field Study Areas: The production, distribution, and marketing of gasoline in California is essentially divided into two regions, north and south. Refineries in the Los Angeles area supply the majority of the gasoline used in southern California, and most of the gasoline used in northern California is supplied by refineries in the San Francisco Bay area. These two large metropolitan areas also account for a large portion of the regional demands. It was therefore decided that the field study would include each of these areas.

Although there are ethanol-blended fuels currently being marketed throughout California, they represent only a small fraction of the total statewide supply. However, due to the voluntary early phase out of MTBE in the Lake Tahoe area, ethanol blended fuels are much more prevalent in the Lake Tahoe area. Therefore, in order to increase

the number of potential commingling events observed during the field sampling, it was decided this area would also be included in the field study.

Sampling Sites: In identifying potential sampling sites (gas stations) to include in the field study, California gasoline marketers were asked to provide staff access to stations in each area. Participation in the field study was purely voluntary on the part of each gasoline marketer. However, in selecting sampling sites, staff attempted to include stations dispensing ethanol-blended fuels and non-oxygenated fuels.

In the Lake Tahoe area, nine stations were selected for participation in the field study. Four sampling sites in the Lake Tahoe area were dispensing ethanol-blended fuels, and five stations were dispensing non-oxygenated fuels. The following fuel brands were included as part of the field study in the Lake Tahoe area:

- **Lake Tahoe Area** (Kings Beach and South Lake Tahoe)
  - Beacon (2 different stations)
  - Chevron
  - Shell (2 different stations)
  - USA Gasoline (2 different stations)
  - Fox Gasoline
  - United Gasoline

In the San Francisco area, six stations were selected for participation in the field study. Because of the voluntary approach to the field study, staff was unable to secure any sampling sites dispensing ethanol-blended fuels. However, two stations were dispensing non-oxygenated regular and mid-grade gasoline. The following fuel brands were included as part of the field study in the San Francisco area:

- **San Francisco Bay Area** (Campbell, Los Gatos, San Jose, Sunnyvale, and Cupertino)
  - ARCO
  - Chevron (2 different stations)
  - Shell (2 different stations)
  - Valero

In the Los Angeles area, four stations were selected for participation in the field study. Staff had originally planned to include six stations in their assessment. However, because the planned sampling schedule included September 11, 2001, staff was unable to perform field sampling on that day. Similar to the San Francisco Bay area sampling, due to the voluntary approach to the field study, staff was unable to secure any sampling sites dispensing ethanol-blended fuels. All of the Los Angeles area stations were dispensing oxygenated fuels containing MTBE. The following fuel brands were included as part of the field study in the Los Angeles area:

- **Los Angeles Area** (Hacienda Heights, Azusa, and Glendora)
  - ARCO
  - Chevron
  - Mobil
  - Texaco

Field Sampling: During the months of August and September 2001 staff implemented the fuel sampling protocol in the three areas of the state: Lake Tahoe, San Francisco, and Los Angeles. Sampling was performed at a total of 19 different gasoline stations resulting in data collection for 396 observed fuelings. Four of the 19 stations were dispensing ethanol-blended fuel. In general, consumers were very willing to participate in the field study program. However, as anticipated, staff was unable to successfully obtain fuel samples from every vehicle due to various fill-pipe configuration constraints. Of the 396 vehicles participating in the field study, fuel samples were obtained from 254 vehicles (before and after fueling samples from the vehicle fuel tank) for an overall statewide sampling success rate of 64 percent. This information is shown in Table III-2.

Table III-2:
Field Sampling Results by Region

Region	No. of Stations				Number of Vehicles Participating	Number of Vehicles Sampled
	Oxy/MTBE[1]	Non-Oxy	Ethanol	Total		
Lake Tahoe	0	5	4	9	175	121
San Francisco	4	2[2]	0	6	121	79
Los Angeles	4	0	0	4	100	54
Statewide Total	8	7	4	19	396	254

1 Some of fuel dispensed from stations identified as MTBE also contained TAME.

2 These stations only sold non-oxygenated fuel in their regular and mid-grade gasoline. Their premium grade of gasoline was oxygenated with MTBE.

B. Data Collection on California Consumer Fueling Habits

The second part of staff's evaluation of the real-world impacts of commingling CaRFG3 included gathering information on California consumer fueling habits. Fueling habits are a critical factor in the evaluation of commingling impacts. Data available on consumer fueling habits prior to the start of the field study were either dated and/or not specific to

California consumers. Therefore, it was essential to collect current information specific to California consumers.

Data collected during the field study portion of staff's evaluation allowed estimation of California motorists fueling habits. Information collected included:

- Whether the consumer purchased the same brand of gasoline during their previous fueling
- Initial fuel tank level
- Whether the fueling event was a "fillup" or not
- Volume of fuel purchased
- Dollar amount of fuel purchased

To supplement the field information, staff requested gasoline marketers to provide additional information on motorists fueling habits. Based on the information provided by California gasoline marketers, staff believes that the fueling data collected in the field study are sufficiently representative of California consumers for use in the commingling evaluation.

C. Data Handling and Quality Control

In collecting the field study data, staff established uniform data handling procedures to ensure no losses in the data collected. In addition, thorough data quality assurance and quality control procedures were utilized during all phases of the evaluation to ensure the accuracy and completeness of the data.

1. Data Handling

In conducting the field study, two sets of data were collected. The first set of data, referred to as the field data sheets, contained the information collected in the field. These data consisted of the specific vehicle fueling information that was documented as well as information to identify specific fuel samples (before and after fueling) to a particular vehicle fueling. The field data collected were key data entered into a spreadsheet at the completion of the fieldwork.

The second data set was the results of the fuel analysis performed by the ARB laboratory staff. Data from the RVP fuel analysis were provided as paper printouts generated by the analytical equipment, with each data set identifying the fuel sample number, as referenced on the field data sheet. These data were key data entered into a spreadsheet for use in staff's analysis of the field study data results. The data generated from the oxygen and oxygenate fuel analysis were provided by the ARB laboratory staff in a spreadsheet format, also referenced by fuel sample number. Once all the fuel sample analysis data were received, these data were merged with the field data collected into a single main data file.

2. Data Quality Assurance/Quality Control

Data quality assurance and quality control were practiced in the field during the implementation of the field study, in the laboratory during analysis of the fuel samples, and during key data entry of the field data.

Field Work: In conducting the field study, various techniques were employed to assure the quality of the field operations. All staff involved in the field operations were thoroughly trained in the proper implementation of the fuel sampling protocol. As part of this training, staff spent several hours practicing the fuel sampling procedure on state-owned vehicles located at the Department of General Services garage in Sacramento. Additional experience was obtained by conducting a two-day trial run in the San Francisco Bay area. During the trial run, three sampling teams were deployed, conducting sampling operations at six different gasoline stations. The two-day trial provided invaluable experience, not only in actual vehicle fuel tank sampling, but also in how to successfully approach private vehicle owners to obtain their voluntary participation. Obtaining volunteers in a timely fashion was critical in the conduct of the field operations.

During the field operations, all sampling team members met on a daily basis to discuss the previous day's activities. The composition of each sampling team was varied by rotating individual team members on a daily basis. As resources allowed, an additional member of the field staff performed oversight activities at all sampling sites. Oversight activities included helping individual teams with any sampling equipment needs (such as maintenance or misplaced tools) in addition to critiquing individual team performance. All field data sheets were reviewed at the end of each day for consistent proper completion; any resultant questions or concerns were discussed immediately with associated team members.

Laboratory Analysis: All quality assurance procedures were followed as described in the applicable ASTM methods. Also, ARB laboratory staff followed appropriate sampling and analytical quality control procedures, as contained in the Standard Operating Procedures (SOPs) for the fuel methods as described below. Data on the quarterly quality control activities of the ARB laboratories are available.

Reid Vapor Pressure Equivalent (SOP MLD 125): At the beginning of each analysis day, a standard material (usually 2,3-dimethylbutane) is analyzed on each vapor pressure instrument. The absolute vapor pressure of the standard material must not differ from the published value by more than 0.15 psi.

Oxygenates in Gasoline (SOP MLD 115): Quality control for this test method occurs in three areas:

1. A quality control standard of known composition is analyzed at the beginning and end of each day's analyses. The QC standard is also run after every 10 samples if more than 10 samples are being analyzed at one time. The QC standard's

measured concentrations of MTBE, TAME, and ethanol must not differ from the known concentrations by more than twice the published repeatability of ASTM D4815.

2. A blank sample is run at the beginning of each day's analyses. The measured concentrations of MTBE, TAME, and ethanol in the blank sample must not be higher than 0.1 mass percent.

3. One sample out of every 10 is analyzed twice in succession. The difference in oxygenate concentrations measured in the two runs must not exceed the repeatability of ASTM D4815.

Data Entry: All hard copy of data was reviewed for any apparent errors prior to key data entry. Once key data entry was complete, the electronic data file was spot checked against the original hard copy for correctness. After all the data were entered into one master spreadsheet file, various additional methods (such as filtering, sorting, and statistical analysis) were used to further audit the data quality.

IV. FIELD STUDY DATA AND CONSUMER FUELING HABITS

This chapter discusses staff's observations in the field study. It includes information on the field study data, the representativeness of the sampled vehicles, and the range of gasoline specifications observed. Also included is staff's findings regarding California consumer fueling habits. These fueling habits include information on brand loyalty, initial fuel tank levels, fillup frequency, and grade purchasing propensity.

A. Field Study Data

A complete set of the field study data is contained in Appendix C. This data set includes both the individual information compiled from the field data sheets, as well as the fuel analysis information provided by ARB laboratory staff. The two data sets have been paired so that the fuel analysis information is associated with the information collected on a particular field data sheet. However, based on deliberations in the working group, gasoline brand information is not presented in the field study data contained in Appendix D.

B. Representativeness of Sampled Vehicles

In evaluating the field study data, staff was interested in determining if the age of the sampled vehicles was representative of the statewide vehicle population. This comparison is important to ensure that the vehicles observed in the field study are representative of the increasingly sophisticated emission control equipment found on more modern vehicles.

To perform this evaluation, staff compared the relative age of the sampled vehicle in the field study to that of the 2001 California passenger car and light-duty truck population, as contained in the ARB motor vehicle emission inventory model, EMFAC 2000 (version 2.02) that was based on California Department of Motor Vehicle (DMV) registration data. Three observations involving two motorcycles and a ski boat were excluded. This comparison is shown in Table IV-1, with vehicle age represented in five-year increments. As can be seen, the vehicle model years observed in each region are comparable to each other. The overall sample population is very similar to the statewide vehicle population as contained in EMFAC 2000, which is indicative of the representativeness of the field study data to the California passenger car and light-duty truck population.

Table IV-1:
Vehicle Model Year Comparison Between EMFAC 2000 and the ARB Field Study

Vehicle Age (Years)	Percentage of Vehicles Represented				
	Lake Tahoe	SF Bay Area	Los Angeles	Overall	EMFAC 2000 (Ver. 2.02)
1-5	34%	36%	30%	34%	31%
6-10	28%	31%	26%	29%	25%
11-15	18%	17%	15%	17%	23%
16-20	13%	8%	17%	12%	12%
21-25	3%	3%	5%	4%	4%
26-30	2%	2%	3%	2%	2%
> 30	2%	3%	4%	3%	3%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

C. Field Observations of Dispensed Gasoline

In evaluating the commingling impacts observed during the field study, it is important to first identify the types of fuels being dispensed. Non-oxygenated gasoline was considered fuel that had an MTBE content of less than or equal to 0.6 volume percent and an ethanol content less than 0.5 volume percent. MTBE-blended fuel had an MTBE content greater than 0.6 volume percent, and ethanol-blended fuel had an ethanol content greater than or equal to 0.5 volume percent. This is summarized in Table IV-2, along with the observed oxygenate concentrations in MTBE produced and ethanol-blended fuels.

Table IV-2:
Oxygenate Concentrations Observed in Field Study

Fuel Type	Defining Oxygenate Concentration (Vol %)		Range of Oxygenate Observed (Vol %)	
	Ethanol	MTBE	Ethanol	MTBE
Non-Oxygenated	< 0.5	≤ 0.6	N/A	N/A
MTBE-Blended	< 0.5	>0.6	N/A	7.68 – 13.59
Ethanol-Blended	≥0.5	≤ 0.6	5.30 - 5.97	N/A

It is also important to note that typical California fuels being produced generally have an RVP of between 6.6 psi and 6.9 psi. The average dispensed fuel RVP measured in the field study was 6.76 psi. Fuels generally are not produced above 6.9 psi RVP to ensure that the fuel meets the summertime RVP cap of 7.0 psi currently in effect in California.

D. Characterization of Brand Loyalty

In conducting the field study, staff collected information on the brand loyalty of each consumer participating in the field study. In collecting these data, each consumer was asked if a different brand of gasoline was used for the last fueling of the vehicle. Each consumer response was recorded by staff on the field data sheet as either "yes", "no", or "don't know". For the purposes of staff's evaluation, "loyal" customers were assumed to be those customers who answered "no"; "non-loyal" customers were assumed to be those customers who answered "yes". These data are shown in Figure IV-1 for each of the three regions in the field study.

Figure IV-1:
Regional Percentage of Consumers Using Same Brand of Fuel[1]

1 Current and previous fuelings.

As can be seen from Figure IV-1, in the Los Angeles and San Francisco Bay areas, over 50 percent of consumers participating in the field study identified themselves as loyal (used the same brand of gasoline as their previous fueling). In the Los Angeles area, this percentage was over 60 percent. Staff believes that the brand loyalty trend in these areas is indicative of consumers' normal, commuter type of behavior where they

likely pass the same fueling stations each day. In these same areas, non-loyal consumers (those using a different brand of gasoline as their previous fueling) ranged between 30 and 40 percent, with less than 5 percent of consumers unsure of the previous brand of fuel used.

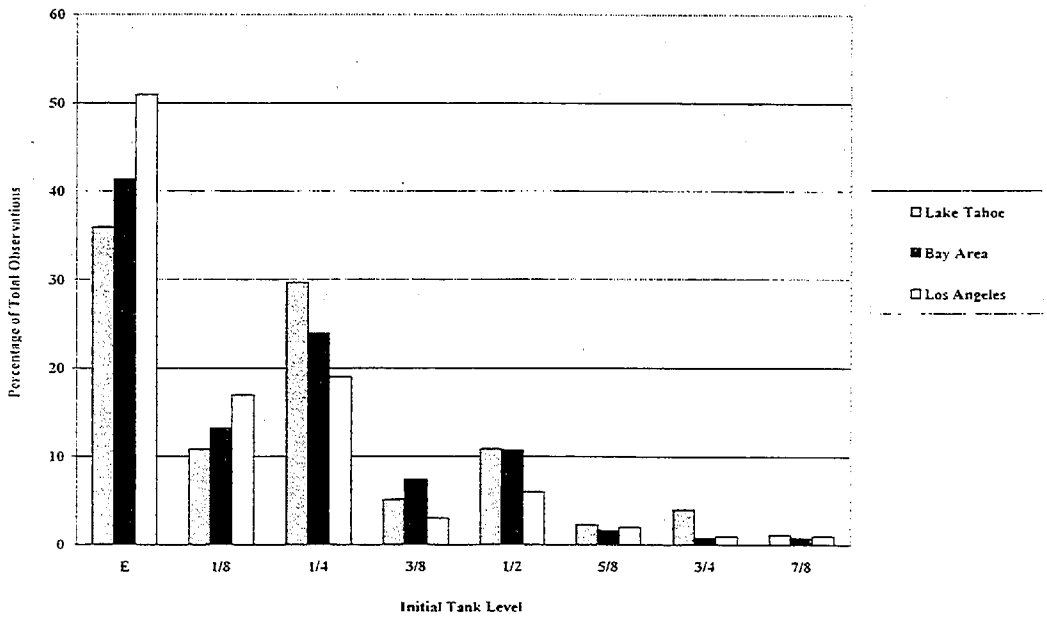
As compared to the Los Angeles and San Francisco Bay areas, the results in the Lake Tahoe area were significantly different. As can be seen in Figure IV-1, in the Lake Tahoe area the percentage of loyal consumers was slightly more than 30 percent, only about half the percentage as in the Los Angeles and San Francisco Bay areas; conversely, the percentage of non-loyal customers exceeded 65 percent, nearly twice that in these same two areas. In considering these results, this trend is expected since the Lake Tahoe region is a popular tourist destination, and there are fewer "major" brands of gasoline available in the region. Staff believes that the data are indicative of the need of non-local consumers to fuel in an unfamiliar area, thereby purchasing the most readily available fuel, regardless of brand. In reaching this conclusion, staff believes this pattern is likely atypical of a consumer's "normal" fuel purchasing patterns.

E. Initial Fuel Tank Levels

In conducting the field study, staff collected information on the initial fuel tank levels from each of the vehicles observed. The data are based on a visual observation of the fuel gauge display in the passenger compartment of the vehicle. These data are shown in Figure IV-2

As can be seen in Figure IV-2, almost 90 percent of the vehicles that were observed in Los Angeles region had fuel tank levels of a quarter tank or less when refueled, with about 50 percent registering near empty. In the Bay area, almost 80 percent of the vehicles had a quarter tank or less, and 40 percent of the vehicles were nearly empty. However, since Lake Tahoe is generally a tourist destination, staff expected higher initial fuel tank levels due to visitors unfamiliarity with the region. The data support this hypothesis, with only about 35 percent of vehicles fueled at or near an empty tank. In general, though, initial fuel tank levels in each of the three regions were most often (nearly 80 percent) less than a quarter tank.

Figure IV-2:
Distribution of Initial Fuel Tank Levels



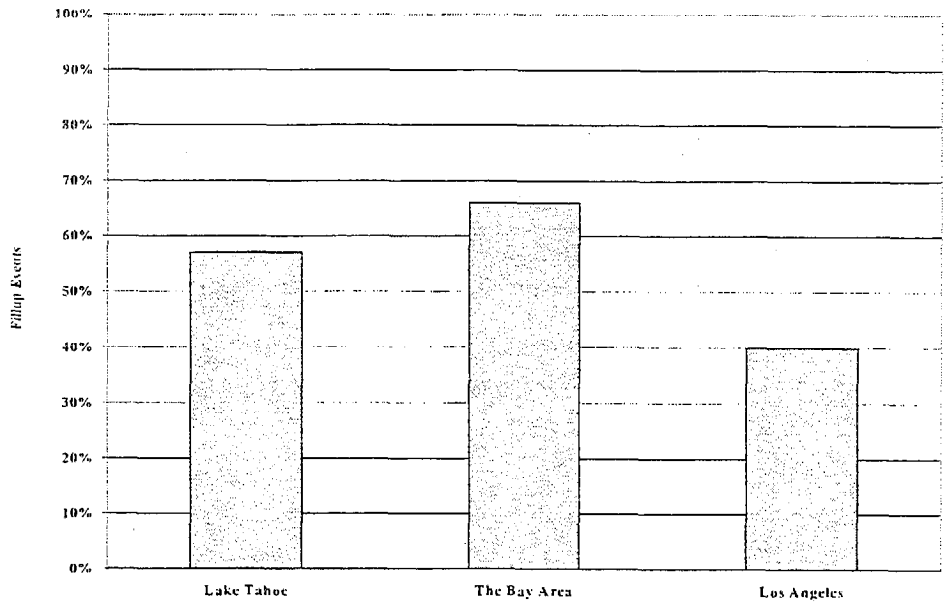
These data are consistent with data taken from a General Motors (GM) fueling survey of over 1100 fuelings[3]. In the GM data, nearly 60 percent of the fuelings occurred with less than 0.2 of the fuel tank capacity remaining, and about 85 percent occurred with less than 0.3 of the fuel tank capacity remaining.

F. Characterization of Fueling Events

In conducting the field study, staff also collected information regarding the characterization of fuelings. For this information, staff collected information on consumer fuel purchasing patterns regarding the amount of fuel purchased. This information is shown below in Figure IV-3.

[3] "In-Use Volatility Impact of Commingling Ethanol and Non-Ethanol Fuels", Peter Caffrey and Paul Machiele, U.S. EPA, Society of Automotive Engineers (SAE) Paper 940765.

Figure IV-3:
Percentage of Fillup Fueling Events



In the field study, a "fillup" was recorded as a fueling event where the activation of the gasoline dispenser's automatic shut-off function was observed. As can be seen in Figure IV-3, the highest percentage of fillup events occurred in the San Francisco area (over 65 percent), and the fewest fillup events were observed in the Los Angeles area (40 percent) while the Lake Tahoe area figure was in between. Staff believes this translates into about a 50 percent fillup rate within the State.

Similar to the initial vehicle fuel tank levels observed, the overall data for these three areas combined are consistent with the GM data reported by Caffrey and Machiele (SAE 940765). In that work, fillup (as represented by a final fuel tank level after fueling of 90 or 100 percent of capacity) events represented were nearly 50 percent of the 1,100 fuelings recorded.

G. Gasoline Grade Preference

In conducting the field study, staff recorded information on the grade of gasoline purchased for each fueling event observed. Staff then compared this to available data from the U.S. Department of Energy (U.S. DOE) regarding gasoline sales by grade in

California[4], averaged over the same two month period that coincided with the implementation of the field study. These data are provided in Table IV-3, which shows the percent of consumers purchasing each of the three grades of gasoline available in California by region. As can be seen from Table IV-3, the overall vehicle fueling observations in the field study (by grade) are comparable to the U.S. DOE data of the statewide gasoline consumption.

Table IV-3:
Grade Selection Comparison Between
U.S. Dept. of Energy and the ARB Field Study

Gasoline Grade	California Consumer Grade Selection (Percent of Statewide Totals)[1]				
	U.S. DOE	San Francisco Bay	Los Angeles	Lake Tahoe	Overall
Premium	13	16	15	9	13
Mid-Grade	15	12	16	13	13
Regular	72	72	69	78	75
Total	100	100	100	100	100

[1] Totals may not add-up to 100 percent due to rounding.

[4] U.S. Department of Energy, Energy Information Administration, "Petroleum Marketing Monthly," August and September 2001 issues.

V. FIELD STUDY COMMINGLING RESULTS

This chapter discusses the RVP impacts observed in the field study from mixing different types of fuels (i.e., non-ethanol, ethanol, etc). The first part of the chapter discusses each of the various fuel mixing combinations observed. Because a different commingling impact can be expected with a specific fuel blending combination (ie, mixing MTBE fuel with MTBE fuel versus mixing ethanol blended fuel with non-oxygenated fuel), the associated changes in RVP due to each fuel mixing scenario are also discussed. Based on this, the commingling impacts for each region (based on the individual fuel mixing scenarios), as well as for the state as a whole, are then estimated.

A. Field Observations of Commingling Impacts

Based on staff's observations, there were five potential fuel-mixing combinations that occurred during the field study. These fuel-mixing combinations included:

- Mixing non-ethanol-blended gasolines.
- Mixing ethanol-blended gasolines.
- Dispensing ethanol-blended gasoline into non-ethanol-blended gasoline
- Dispensing non-ethanol-blended gasoline into already commingled gasoline
- Dispensing ethanol-blended gasoline into already commingled gasoline
- Dispensing non-ethanol-blended gasoline into ethanol-blended gasoline.

With the exception of the last combination listed above, the RVP characteristics of each of these fuel-mixing combinations are discussed below. The mixing of non-ethanol blends into ethanol blends is not further discussed because there were not sufficient data collected to perform an analysis for this fuel-mixing combination. However, staff has estimated a commingling impact from this fuel-mixing combination based on available literature, and it is presented in Table V-6 at the end of this chapter. The fuel-mixing combinations identified above are inclusive of all the documented fuelings regardless of fuel grade purchased and brand loyalty.

When evaluating the field data based on the above classifications, it is important to note that "non-ethanol blends" refer to either non-oxygenated or MTBE produced gasoline. "Commingled gasoline" refers to gasoline that contains at least 0.5 volume percent ethanol, but less than 5 volume percent ethanol, regardless of the MTBE content.

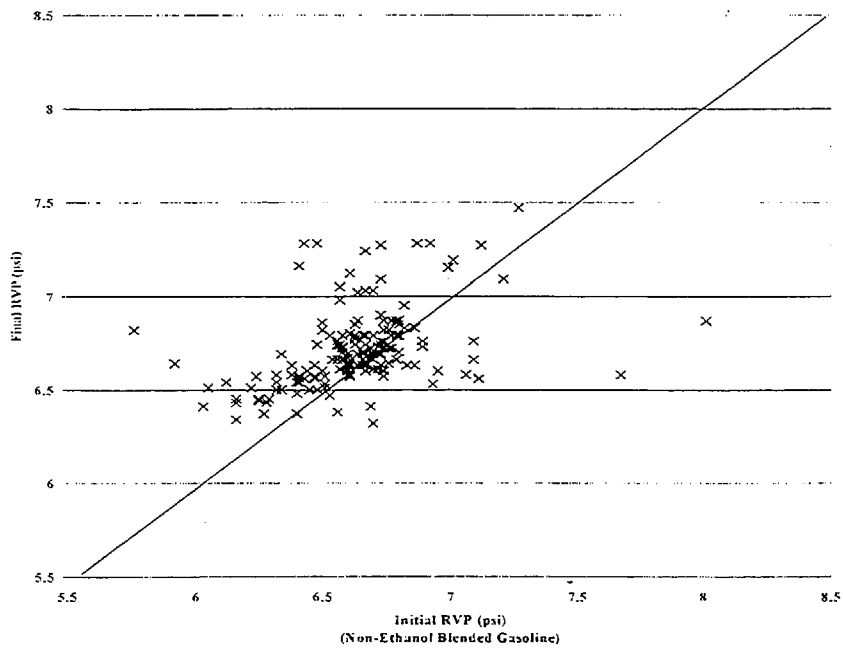
1. Mixing Non-Ethanol-Blended Gasolines

In general, the mixing of non-ethanol blended gasoline does not result in a commingling impact or unexpected increase in RVP of the resulting mixture. Because of this, both the federal RFG and the CaRFG3 regulations allow for the mixing of non-ethanol blends in the distribution system as long as any minimum oxygen content requirement is

satisfied. Currently, nearly 90 percent of gasolines supplied in California are non-ethanol blends. Because of this, most of the fuel samples obtained in the field study were non-ethanol blends.

In the field study, staff collected fuel samples from 165 fuelings involving non-ethanol blends. These data are shown in Figure V-1. The data are graphed according to the initial and final fuel tank RVP. In using this methodology, staff was able to graphically illustrate changes in the final fuel tank RVP as compared to the initial fuel tank RVP. The solid line in Figure V-1 represents no change in fuel tank RVP due to fueling.

Figure V-1:
RVP Characteristics of Mixing Non-Ethanol Blended Gasolines



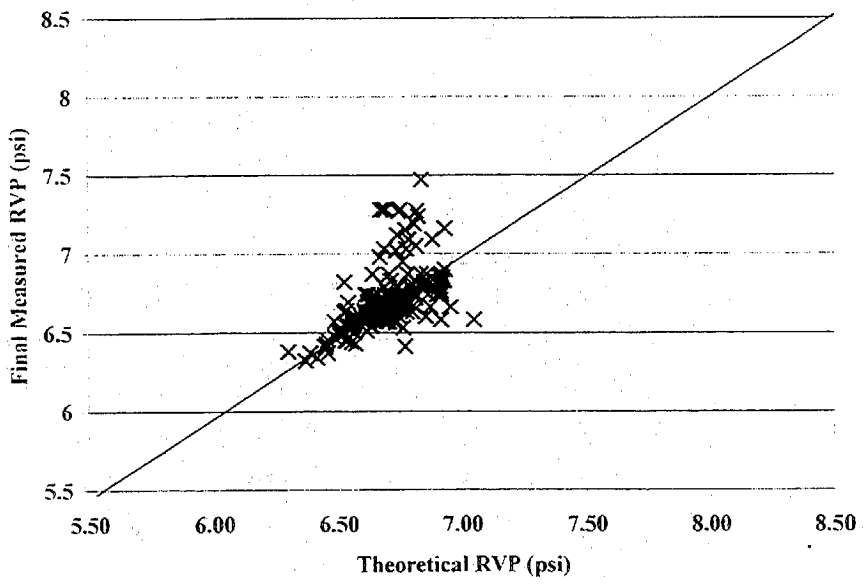
As can be seen in Figure V-1, on average small increases between the initial and final fuel tank RVP were observed in the field study data. The changes that were observed were likely the result of dispensing a higher RVP fuel into a "weathered" fuel in the vehicle fuel tank. Fuel weathering is a result of lighter, more volatile components evaporating from the fuel tank during the period between fuelings. This evaporative loss of volatile components results in a natural reduction in the fuel tank RVP with time. As a result, when higher RVP fuel is blended with a lower RVP weathered fuel in the vehicle fuel tank during fueling, the RVP of the existing fuel in the fuel tank increases linearly towards that of the dispensed fuel.

In light of this mixing of two fuels with different RVPs, staff was interested in evaluating how the final measured fuel tank RVP compared with what would be predicted due to the linear RVP response of mixing two dissimilar RVP fuels. To perform this evaluation, staff determined the initial tank volume prior to fueling as indicated by the

fuel gauge, considering that the vehicle tank included a five percent tank 'heel' defined as the unusable volume of fuel at the very bottom of a vehicle fuel tank[5]. Using this value and the volumetric amount of fuel dispensed, staff then calculated the theoretical final fuel tank RVP due solely to the linear contribution of each fuel's RVP in the final fuel. This value will be referred to as the "theoretical RVP". A more detailed explanation of staff's methodology is provided in Appendix F.

The results of staff's analysis are presented in Figure V-2. The data are graphed according to the measured final fuel tank RVP and the theoretical RVP. Staff believes that presenting the data in this manner is a better indicator of commingling impacts. This is because the theoretical RVP is independent of commingling impacts. Therefore, an increase in the measured final fuel tank RVP in relation to the theoretical RVP should represent the commingling impact. The solid line in Figure V-2 represents no change in fuel tank RVP due to commingling. As can be seen in Figure V-2, most of the data points are clustered along the solid line, indicating that, as expected, commingling does not occur when non-ethanol-blended gasolines are mixed.

Figure V-2:
RVP Characteristics of Mixing Non-Ethanol-Blended Gasolines



A descriptive statistical analysis of the complete set of fuel characteristics including mean, median, range, minimum, maximum, and sample count derived from these fuelings is presented in Appendix G.

[5] Support for consideration of a five percent tank heel is provided in the report, "A Vehicle Fuel Tank Flush Effectiveness Evaluation Program," Lee J. Grant, Southwest Research Institute, August 20, 2001. A copy is provided in Appendix E.

Table V-1 summarizes the average measured RVP characteristics of mixing non-ethanol-blended gasoline in vehicle fuel tanks, as well as the average theoretical RVP calculated. As can be clearly seen, when non-ethanol fuels are mixed, the final measured RVP in the vehicle fuel tank is nearly identical to the theoretical RVP calculated, both of which are also nearly identical to that of the average fuel being dispensed into the vehicle fuel tank.

In Table V-1, the fact that the average dispensed fuel RVP (6.74 psi) is nearly identical to the theoretical RVP (6.71 psi) is important. Since the theoretical RVP of mixing two hydrocarbon fuels should be a linear function of the two fuels RVP and their relative volume proportions in the blend (i.e., initial and dispensed), a resultant RVP very close to one of the fuels RVP is indicative of a very high proportion of that fuel in the final mix. In the case of Table V-1, a significantly high percentage of dispensed fuel in the fuel tank. This is indicative of very low initial fuel tank levels, and is consistent with the data presented in Chapter IV which showed a large majority of the fuelings occurred at very low initial fuel tank levels, generally less than a quarter tank. As a result, the dispensed fuel RVP dominates the volume-weighted RVP, particularly for fillup fuelings.

Table V-1:
Average RVP Characteristics from the Mixing of Non-Ethanol-Blended Gasolines[1]

Fuel Sample	RVP (psi)
Initial Measured	6.63
Dispensed	6.74
Theoretical	6.71
Final Measured	6.72

[1]Based on 160 observed fuelings.

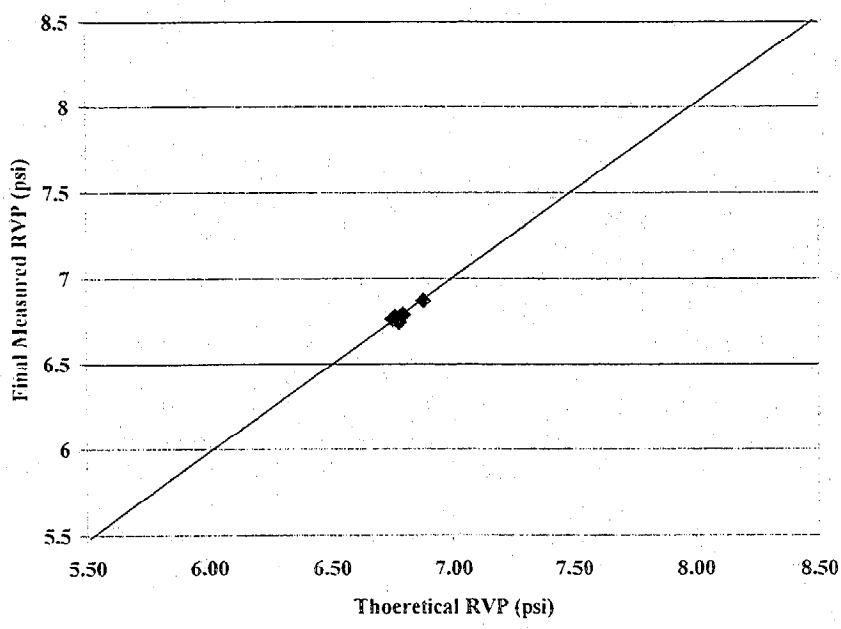
finally, although staff observed 165 fuelings in this category, the average values presented in Table V-1 are based on 160 of those events. Data from five fuelings were not included in this analysis due to the extremely low RVP of the dispensed fuels. The minimum RVP specification incorporated into the Phase II federal RFG complex model is 6.4 psi (40 Code of Federal Regulations[CFR], section 80.45). The RVP of the gasoline dispensed in these five events was below this minimum RVP specification, and therefore, did not meet the minimum requirements for federal RFG. Since federal RFG areas will represent 80 percent of the California gasoline market later this year, staff does not believe it is appropriate to include those fuels in their statewide analysis as these fuels are unlikely to be widely distributed in California.

2. Mixing Ethanol-Blended Gasolines

Similar to non-ethanol-blended gasolines, the mixing of ethanol-blended gasolines does not result in a commingling impact or unexpected increase in RVP. This is because the two ethanol fuels have already experienced an increase in their RVPs due to the addition of ethanol during their production. Mixing them together will not result in any further increases in their RVP. As a result, when two ethanol fuels are mixed, staff expected that they should experience the same linear RVP response as mixing non-ethanol gasolines, and that the measured final RVP should be similar to the theoretical RVP.

In the field study, staff collected only four fuel samples involving the mixing of ethanol blended gasolines. These data are presented in Figure V-3. The data are graphed according to the measured final fuel tank RVP and the theoretical RVP. The solid line in Figure V-3 represents no change in fuel tank RVP due to commingling. As can be seen, most of the data points fall along the solid line, indicating that, as expected, commingling does not occur when ethanol-blended gasolines are mixed.

Figure V-3:
RVP characteristics of mixing Ethanol-Blended Gasoline



A descriptive statistical analysis of the complete set of fuel characteristics including mean, median, range, minimum, maximum, and sample count derived from these fuelings is presented in Appendix H.

Table V-2 summarizes the average measured RVP characteristics of mixing ethanol-blended gasoline in vehicle fuel tanks, as well as the average theoretical RVP calculated. As can be clearly seen, when ethanol-blended fuels are mixed, the final measured RVP in the vehicle fuel tank is nearly identical to the theoretical RVP calculated.

Table V-2:
Average RVP Characteristics from the Mixing of Ethanol-Blended Gasolines[1]

Fuel Sample	RVP (psi)
Initial Measured	6.76
Dispensed	6.84
Theoretical	6.79
Final Measured	6.79

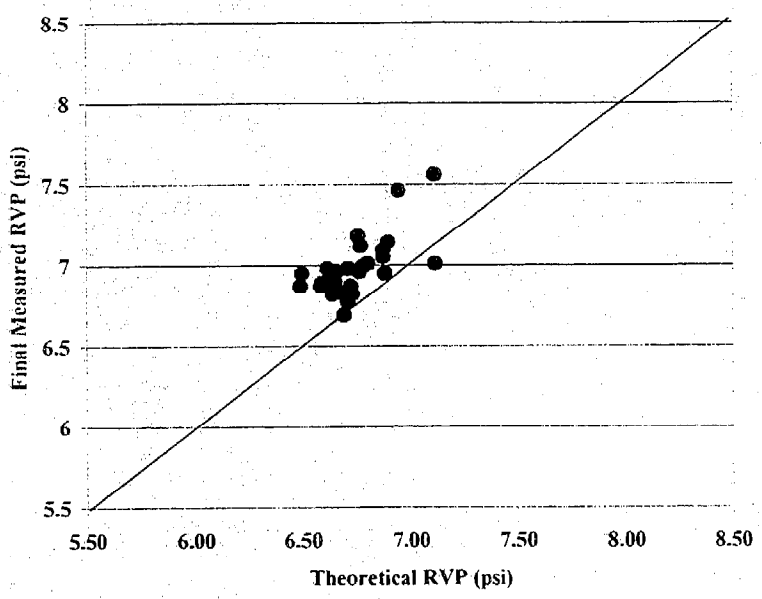
[1]Based on 4 observed fuelings.

3. Dispensing Ethanol-Blended Gasoline into Non-Ethanol-Blended Gasoline

As expected, the dispensing of ethanol blended gasoline into non-ethanol blended gasoline resulted in an overall increase in the RVP of the fuel originally in the fuel tank. Staff believes that this increase in RVP occurs as a result of two phenomena. First, as seen previously in the mixing of non-ethanol fuels, adding higher RVP fuel to weathered fuel in a vehicle fuel tank raises the RVP of the weathered fuel. In addition, the commingling of ethanol with the original fuel in the tank also increases the RVP of that fuel. These two mechanisms combined result in the overall measured RVP increase in the fuel originally in the tank prior to fueling.

In the field study, staff collected fuel samples from 29 fuelings involving dispensing ethanol-blended gasoline into non-ethanol blends. These data are shown in Figure V-4. The data are graphed according to the measured final fuel tank RVP and the theoretical RVP. The solid line in Figure V-4 represents no change in fuel tank RVP due to commingling. As can be seen, most of the data points are above the solid line, indicating there is an increase in RVP between the theoretical and final measured fuel tank RVP.

Figure V-4:
RVP Characteristics of Dispensing Ethanol-Blended Gasoline into Non-Ethanol-Blended Gasoline



A descriptive statistical analysis of the complete set of fuel characteristics including mean, median, range, minimum, maximum, and sample count, derived from these fuelings is presented in Appendix I.

Table V-3 shows the average initial and final fuel tank RVP, the average dispensed fuel RVP, as well as the average theoretical RVP calculated. As can be seen, the data show that there is an RVP increase due to commingling of about 0.23 psi between the average theoretical and final fuel tank RVP.

Table V-3:
Average RVP Characteristics from Dispensing Ethanol-Blended Gasoline into Non-Ethanol-Blended Gasoline[1]

Fuel Sample	RVP (psi)
Initial Measured	6.48
Dispensed	6.84
Theoretical	6.75
Final Measured	6.98

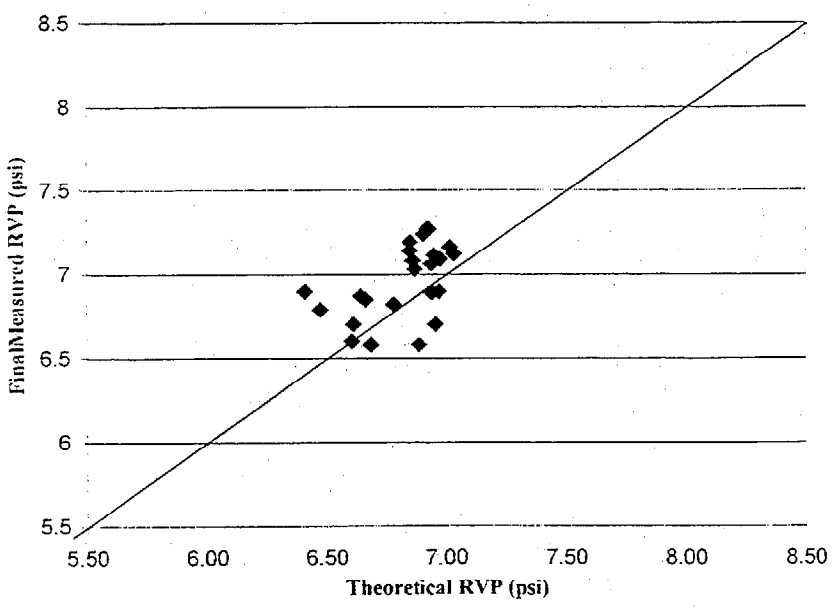
[1]Based on 29 observed fuelings.

4. Dispensing Non-Ethanol-Blended Gasoline into Already Commingled Gasoline

Staff's original expectation of dispensing non-ethanol-blended gasoline into already commingled gasoline was that an overall increase in the RVP of the fuel being dispensed into the tank would be observed. This is based on the anticipated commingling of the dispensed fuel by the ethanol present in the already commingled fuel in the vehicle fuel tank.

In the field study, staff collected fuel samples from 25 fuelings involving dispensing non-ethanol-blended gasoline into already commingled fuel. These data are shown in Figure V-5. The data are graphed according to the measured final fuel tank RVP and the theoretical RVP. The solid line in Figure V-5 represents no change in fuel tank RVP due to commingling. As can be seen, most of the data points are above the solid line, indicating there is an increase in RVP between the theoretical and final measured fuel tank RVP.

Figure V-5:
RVP Characteristics of Dispensing Non-Ethanol-Blended Gasoline into Commingled Gasoline



A descriptive statistical analysis of the complete set of fuel characteristics including mean, median, range, minimum, maximum, and sample count, derived from these fuelings is presented in Appendix J.

As can be seen in Figure V-5, similar to the previous fuel-blending scenario discussed, the results of this fuel-blending combination generally result in an increase in the measured final fuel tank RVP as compared to that predicted according to the theoretical RVP.

Table V-4 shows the average initial and final fuel tank RVP, the average dispensed fuel RVP, as well as the average theoretical RVP calculated. As can be seen, the data show that there is an RVP increase due to commingling of about 0.12 psi between the average theoretical and final fuel tank RVP.

Table V-4:
Average RVP Characteristics from Dispensing Non-Ethanol Blended Gasoline into Commingled Gasoline[1]

Fuel Sample	RVP (psi)
Initial Measured	6.93
Dispensed	6.77
Theoretical	6.85
Final Measured	6.97

[1]Based on 21 fuelings.

Although staff observed 24 fuelings in this category, the average values presented are based on 21 of those events. Data from three fuelings were not included in this analysis due to the extremely low RVP of the dispensed fuels. The minimum RVP specification incorporated into the Phase II federal RFG complex model is 6.4 psi (40,CFR, 80.45). The RVP of the gasoline dispensed in these four events was below this minimum RVP specification, and therefore, could not be used in federal RFG areas, which will represent 80 percent of the California market later this year.

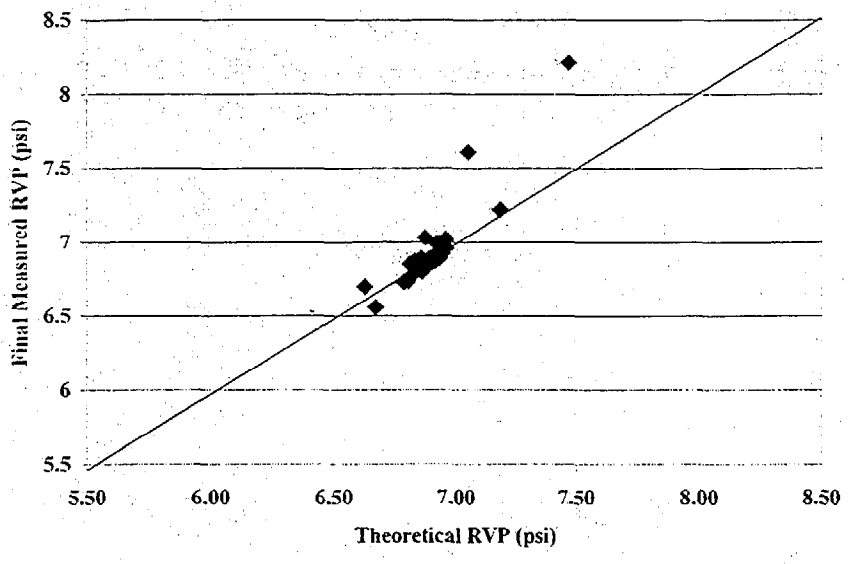
5. Dispensing Ethanol-Blended Gasoline into Already Commingled Gasoline

Staff did not expect that the mixing of an ethanol-blended gasoline into an already commingled gasoline would result in a significant increase in RVP. This is because a commingled fuel has already experienced an RVP increase and staff believed that the mixing of an ethanol blended gasoline into an already commingled gasoline would result in little, if any, RVP increase. In addition, since as little as two volume percent ethanol will effect the full commingling impact, it was expected that additional ethanol would not cause any RVP increases.

In the field study, staff collected fuel samples from 25 fuelings where a mixing of an ethanol-blended gasoline into an already commingled gasoline was observed. These data are shown in Figure V-6. The data are graphed according to the measured final fuel tank RVP and the theoretical RVP. The solid line in Figure V-6 represents no

change in fuel tank RVP due to commingling. As can be seen in Figure V-6, in general there were only minor differences in the final measured fuel tank RVP as compared to the theoretical RVP, indicating very small commingling impacts were observed.

Figure V-6:
RVP Characteristics of Dispensing Ethanol Blended Gasoline into Commingled Gasoline



A descriptive statistical analysis of the complete set of fuel characteristics including mean, median, range, minimum, maximum, and sample count, derived from these fuelings is presented in Appendix K.

Table V-5 shows the average initial and final fuel tank RVP, the average dispensed fuel RVP, as well as the average theoretical RVP calculated. As can be seen, the data show that there is an RVP increase of about 0.03 psi between the average theoretical and final fuel tank RVP.

Table V-5:
Average RVP Characteristics from Dispensing Ethanol-Blended Gasoline into Commingled Gasoline[1]

Fuel Sample	RVP (psi)
Initial Measured	6.90
Dispensed	6.86
Theoretical	6.88
Final Measured	6.91

[1]Based on 24 Fuelings

Although staff observed 25 fuelings in this category, the average values presented are based on 24 of those events. Data from one fueling event were not included in this analysis due a lack of confidence in the associated data. Data for this event indicated a 1977 Dodge Van with 7/8 initial fuel gage level, initial RVP of 7.56 psi, and an initial ethanol content of 2 percent, is then filled with 12.5 gallons of a dispensed fuel with an RVP of 6.75 psi and an ethanol content of 6 percent. The final fuel tank RVP was 8.2 psi. Due to the unconventional fuel characteristics in response to this vehicle's fueling, data associated with this event were excluded from the analysis for which the results are presented in Table V-5.

B. Overall Findings of Field Observations

Based on staff's above analysis, staff estimated the anticipated commingling impact on the statewide gasoline pool, as well as for the gasoline pools in each of the three areas. To do this, staff used the commingling impact expected for each of the previously discussed fuel blending scenarios, collectively shown in Table V-6.

Table V-6:
Commingling Impacts for Various Fuel Blending Scenarios

Fuel Mixing Scenario	Commingling Impact (ΔRVP, psi)
Mixing non-ethanol-blended gasolines	-0.01
Mixing ethanol-blended gasolines	0.00
Dispensing ethanol blends into non-ethanol blends	0.23
Dispensing non-ethanol blends into ethanol blends	0.37[1]
Dispensing non-ethanol blends into already commingled gasoline	0.12
Dispensing ethanol blends into already commingled gasoline	0.03

[1] This fuel mixing scenario was not addressed in the previous discussing since sufficient data were not collected in the field study to quantify this value. However, staff estimated this impact using data contained in Figure 3 of "Addition of Nonethanol Gasoline to E10 – Effect on Volatility", as contained in Appendix L.

To estimate the overall anticipated statewide commingling impact, staff first used the customer loyalty information collected in each area, as shown in Figure IV-1. In their analysis, staff assumed that brand loyal customers were represented by "Mixing of non-ethanol blended gasolines" and "Mixing of ethanol-blended gasolines", which results in no commingling impacts, and that the remaining four fuel mixing scenarios in Table V-6, apportioned equally, represented non-loyal customers. The potential impacts of each region in the field study are presented in Table V-7. Staff computed each region commingling impacts as the product of average RVP increase of the last four fuel mixing scenarios, as shown in Table V-6 and non-loyal consumers fraction of the corresponding region, as shown in Figure IV-1. The statewide result of staff's evaluation is also presented in Table V-7. To determine the anticipated statewide commingling impact, staff weighted the contribution of each area based on the percentage of the regional gasoline consumption that occurred in each area[6]. This is shown in Table V-8.

[6] For staff's analysis, each area was defined as the air basin in which the field sampling occurred, and the fuel consumption was based on the 1998 fuel consumption for each county comprising the respective air basins.

Table V-7:
Anticipated Commingling Impacts Based on Field Study Data

Region	Commingling Impact (ΔRVP, psi)	Weighting Factor by Region
Los Angeles	0.06	0.65
Bay Area	0.07	0.33
Lake Tahoe	0.13	0.02
Statewide Average	0.06	1.0

Table V-8:
1998 Gasoline Consumption by Region[1]

Region	1998 Gasoline Consumption (Thousands of Gallons)	Percent of Regional Gasoline Consumption
Los Angeles	6,074,673	65%
Bay Area	3,101,350	33%
Lake Tahoe	173,999	2%
Total	**9,350,023**	**100%**

[1] Source: California Energy Commission, Fuels Office, http://www.energy.ca.gov/fuels/gasoline_stations/index.html

While staff believes that their assessment has provided a reasonable estimation of the commingling impact of mixing non-ethanol fuel into already commingled fuel, it highlights the variability of commingling after the initial commingling event has occurred. This is because there are a significant number of variables that will influence the commingling impact, including the ethanol content of the commingled fuel, the number of subsequent fuelings, and the amount of fuel present prior to fueling. Staff believes that a more accurate estimation of the commingling impacts of mixing these two fuels can be achieved through the use of statistical modeling.

VI. SIMULATION MODELING OF COMMINGLING IMPACTS

In addition to documenting actual impacts of commingling on individual vehicle fuel tanks as observed in the field study, a simulation model was used to estimate potential statewide commingling impacts.

A. Introduction

Using statistical and mathematical approaches, a computer simulation model (model) can simulate complex consumer fuel purchasing decisions under a variety of different sets of conditions or scenarios. In the case of commingling, the model would use input data from assumed conditions that may be prevalent in the future and from field survey data of consumer fueling habits.

This is useful for several reasons. First and foremost, it allows a commingling impact analysis to proceed even though some key market factors that may affect the results are unobserved. In the case of CaRFG3, these factors include ethanol market share, consumers purchase propensity toward ethanol-blended fuel, and the properties of future gasoline blends. They are unknown since the use of ethanol as an oxygenate on a level comparable to MTBE has not yet occurred. In general, to arrive at meaningful results, reasonable assumptions concerning these factors are necessary.

Consumer fueling habits also play an integral role in commingling analysis. The type and volume of dispensed fuel as well as remaining fuel in tank prior to fueling influence the RVP of a mixed fuel, and, hence, the commingling impact. As an example, if consumers always purchased fuel when registering nearly an empty tank, the volume of remaining fuel would be nearly negligible, greatly minimizing potential commingling impacts, regardless of the type and volume of fuel being dispensed in each fueling event.

Laboratory analysis of a fuel tank RVP prior to fueling helps shed some light on a consumer's fueling history, e.g., if they had dispensed ethanol-blended fuel in the past. However, the laboratory testing can not establish sequential fuelings that led to a fuel's RVP. In the field, staff recorded only two fuelings—the current and previous. Because of the role consumer fueling habits play in commingling, and the difficulties in using laboratory analysis to determine the specifics of previous fuelings, a simulation model is indispensable. The model is capable of simulating a long sequence of fuelings from a large number of consumers who on average behave similarly to the field sample.

All things considered, commingling analysis is complex. So long as the sampled consumers are representative of the California consumer population, the simulation results can be generalized to approximate statewide commingling impacts.

B. Simulation Model

Staff used a simulation model that was developed by David M. Rocke, Ph.D., University of California, Davis (UCD), pursuant to an ARB contract, and made available to the public in 1999. A copy of the FORTRAN source code is attached (Appendix M), including a user's manual.

Using a statistical and mathematical approach, the model makes use of random sample data, expands the scope of the analysis that may not have been observed in the actual data by randomly drawing new observations based on the observed parameters of important variables (e.g., mean and standard deviation of initial fuel tank levels), and, at the end, summarizes the results. In the process, it also takes into account variation and uncertainty from which a valid inference can be drawn. This formed the guidelines for staff to pursue.

In evaluating commingling impacts, staff began with observations of consumer fueling patterns, as well as RVP changes in fuel tank, from a random sample of the California motorist population. Staff derived key parameters, means and standard deviations, from the sample that is assumed governed by certain probability distributions where variation and uncertainty are considered. The model takes this information, and simulates consumer fuel buying habits by allowing each individual to be randomly different from the others; yet, on average, they should mimic the observed random sample. In essence, randomness is vital. Only then could staff generalize the results for the entire population on which a valid conclusion of the report was based.

C. Methodology of Simulation Analysis

The field study showed that consumers behave differently across geographic region in the state. For example, consumers in Los Angeles showed higher brand loyalty, refueled when less fuel remained in the vehicle tank, but were less likely to fillup than consumers in San Francisco Bay Area or in Lake Tahoe (Table VI-1). Based on this information, consumers from each region were analyzed separately to determine commingling impacts.

1. Loyal Consumers

A key assumption in staff's modeling work was that fueling by those consumers that used the same brand of gasoline as their previous fuel purchase ("loyal" consumers) resulted in no or negligible commingling occurring in their vehicle tanks.

The basis for this assumption is that, a fuel station that sells a certain brand of gasoline is unlikely to sell two types of fuel, non-ethanol and ethanol-blended gasolines, simultaneously. Loyal customers get the same fuel type for every fueling, so the mixing

Table VI-1 Overall Consumers* Fueling Information

By Region

The 2001 ARB Field Study

Variable		Lake Tahoe	SF Bay Area	Los Angeles
Brand Loyalty (%)**	- Yes	31	58	62
	- No	67	38	31
	- Don't Know	2	4	7
Ave. Initial Fuel Tank Level (as a fraction of usable tank capacity)		0.24	0.20	0.16
Fillup (%)	- Yes	57	66	40
	- No	43	34	60

*Total observations = 393 (Lake Tahoe = 173, SF Bay Area = 120, and Los Angeles = 100).

**Based on consumers that bought the same brand of gasoline as their last purchase.

of non-ethanol and ethanol-blended gasolines, on which the commingling analysis is based, will never occur. Ideally, fuel-type loyalty data should be used instead of brand loyalty to assess the commingling impacts. However, in the absence of fuel-type loyalty data, brand loyalty data are the best surrogate data. More discussion on brand loyalty data is provided in the next section.

2. Non-Loyal Consumers

Staff then used the UCD model to simulate a wide range of scenarios of commingling impacts for "non-loyal" consumers in each region. To develop a statewide average of commingling impacts, non-loyal consumers commingling contribution from each region was weighted by the corresponding proportion of non-loyal consumers and gasoline consumption.

D. Input Data & Assumptions

As previously described, the actual impacts of commingling on emissions depend on many variables that are input to the model. The input data are bifurcated according to future ethanol market conditions and current consumer behavior patterns that are expected to hold in the future.

1. Future Ethanol Market Conditions

Uncertainty involved in dealing with these data necessitates staff to assume various scenarios that are expected to cover a wide range of potential commingling impacts and to bracket the likely range of commingling impacts. In selecting values to input into these scenarios, staff used the best data available, including recent reports, and stakeholder consultation.

Ethanol Market Share: Under a waiver scenario, staff assumed that the future California ethanol market share would vary from 25% to 65% of the gasoline market. This is consistent with that documented in a report prepared for the U.S. EPA by MathPro Inc., titled "Analysis Of The Production Of CaRFG3 With And Without An Oxygen Waiver," (2001). Staff further assumed that this assumption holds across gasoline grades. That is, ethanol market share is the same for all grades. By assuming a constant ethanol market share across grades, staff has attempted to account for the commingling impacts associated with potential grade switching when information on grade loyalty is currently unavailable.

Ethanol Blending Concentrations: After consulting with oil producers, staff assumed that gasoline produced with either 6 volume percent or 7.7 volume percent of ethanol are the likely future California fuel blends. As such, staff utilizes these fuels in their analysis. Like ethanol market share, these blends also apply to all grades due to fuel distribution system constraints (i.e., a fuel station would carry either "ethanol-blended" or "non-oxygenated" gasoline only). Consequently, grade switching within the same brand would not lead to commingling. This assumption seems reasonable, in part, because most of grade switching is likely within the same brand. Moreover, consumer survey data show grade market share remains constant over time, except during short periods of gasoline price spikes.

Based on average RVP of the dispensed fuels from the field study, staff assumed 6.71 psi base RVP for non-oxygenated fuel and 5.74 psi for ethanol fuel (i.e., 6.84 psi RVP from the average 5.6 volume percent ethanol-blended gasolines observed in the field minus a 1.1 psi expected RVP increase from ethanol blending).

Consumers Purchase Propensity Toward Ethanol Fuel: One of the most difficult tasks in estimating commingling impacts is the consideration staff had to provide in dealing with non-loyal consumers ethanol purchase propensity that defines their likelihood of purchasing ethanol-blended gasoline. In the loyal consumers case, the issue is simple. The consumers are grouped into two extremes: those who always buy ethanol-blended gasoline (100% ethanol purchase propensity) or those who always buy non-ethanol gasoline (0% ethanol purchase propensity), by the virtue of adherence to a fuel brand. The corresponding ethanol market share scenario being analyzed determines the proportions of these subgroups. If ethanol market share were 25% of the total gasoline market pool, for example, loyal consumers belong to the first extreme "always buy ethanol-blended gasoline" would be 25% of the total loyal consumers while the rest would belong to the other extreme "always buy non-ethanol fuel."

Unlike loyal consumers, ethanol purchase propensity for non-loyal consumers could not be observed in the field, nor could it be deduced from the gasoline brands they purchased; there is no other source to consult either. As a result, the model would randomly assign each of the 5,000 non-loyal consumers being simulated with an ethanol purchase propensity value that lies between the two extreme values of loyal consumers, i.e., between 0% and 100%. From the propensity values assigned, a frequency distribution plot reveals the number of non-loyal consumers who fall into that category. Like loyal consumers case, on average, the overall non-loyal consumers purchase propensity value must equal to the corresponding ethanol market share scenario being modeled.

For a given market share, the distribution of non-loyal consumers ethanol purchase propensity was assumed to follow three kinds of beta distributions ($\alpha+\beta$ equal 2, 3, or 5). A distinct feature that distinguishes these distributions is the way propensity values are assigned. If a majority of non-loyal consumers is assigned a similar propensity value, then the frequency distribution plot would shows a spike around that value. This approach leads to higher commingling impacts, and is called a more conservative scenario ($\alpha+\beta=5$). For example, if ethanol market share were 50% and everyone had similar purchase propensity behavior, then for this scenario the non-loyal consumers would be tightly clustered around 50% ethanol purchase propensity mark. These consumers would always be equally likely to go to either non-ethanol or ethanol fuel stations. As a result, the potential commingling impacts for this approach is high since a lot of mixing of the two fuels is expected to take place.

In contrast, a less conservative scenario ($\alpha+\beta=2$) shows a flatter frequency distribution plot since more non-loyal consumers are assigned to other propensity values, say 90 percent and 10 percent, than they would be with a more conservative scenario. Either case would produce lower commingling impacts than the 50 percent propensity case. In this report, base case scenario ($\alpha+\beta=3$) is between the more conservative and less conservative scenarios.

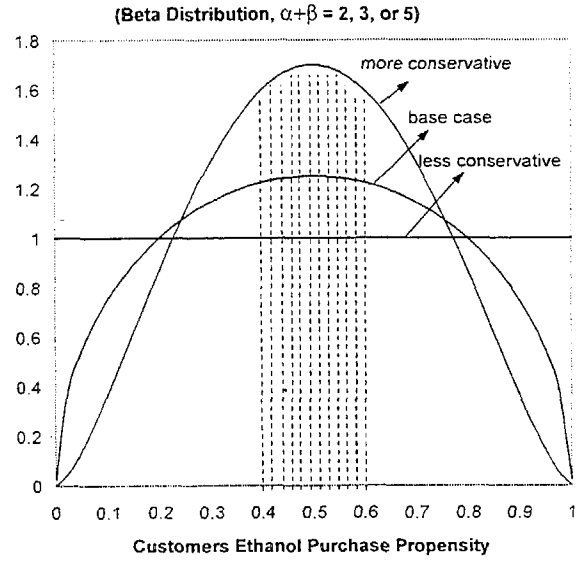
Figure VI-1 graphically illustrates these distributions. A series of beta distribution curves was plotted with a mean at 0.5 that indicates a 50 percent ethanol market share case. The shaded area under each curve represents the proportion of consumers who are assumed to have ethanol purchase propensity between 40 percent and 60 percent. The more conservative scenario assumes 32 percent of consumers fall into this category while the base case and less conservative scenarios assume 24 percent and 20 percent, respectively. Conversely, the last two scenarios show fatter distributions in the tails than the first since more non-loyal consumers fall into 0 percent to 10 percent or 90 percent to100 percent of ethanol purchase propensity ranges.

Fuel Type Switching Patterns: Having assumed the distribution of non-loyal consumers based on their ethanol purchase propensity, the simulation model must generate the non-loyal consumers fuel type switching patterns to produce an estimate of the commingling impacts. This is important because the order in which non-ethanol

and ethanol-blended gasolines are used can have a significant effect on the commingling impacts.

For example, consider a 50 percent ethanol purchase propensity case. In this case, non-loyal consumers are equally likely to switch between non-ethanol-blended and ethanol-blended gasolines. For ten fueling events, the consumers would cause maximum commingling impacts if they alternately switching fuel type. If "N" and "E" denote fueling non-ethanol and ethanol-blended gasolines, respectively, NENENENENE or ENENENENEN could represent the above sequence of ten fuelings. All else equal (e.g., remaining fuel in a vehicle fuel tank prior to fueling and amount of fuel dispensed), contrast this with minimal commingling impacts when the first five fuelings are of one type followed by the next five of another type as follows: NNNNNEEEEE or EEEEENNNNN. In the latter case, fueling number six and beyond are where the commingling impacts should be considered. However, if at the7th fueling a consumer rolled in with an empty tank, the commingling impacts would theoretically be limited to the 6th fueling only.

Figure VI-1 Customers Ethanol Purchase Propensity Distribution
For 50% Ethanol Market Share



2. Consumer Fueling Habits

Table IV-2 summarizes non-loyal consumer fueling habits by region. These fueling habits are more fully discussed below.

Table VI-2 Non-Loyal Consumers* Fueling Information
By Region
The 2001 ARB Field Study

Variable	Lake Tahoe	SF Bay Area	Los Angeles
Non-Loyal Consumer	69	42	38
Ave. Initial Fuel Tank Levels (as a fraction of usable tank capacity)	0.23	0.2	0.18
Fillup (%)	52	58	24
Ave. Fuel Amount Purchased for Non-Fillup (as a fraction of usable tank capacity)	0.35	0.32	0.37

*Including "don't know" group

Brand Loyalty: Overall, the percentages of loyal and non-loyal consumer observed do not add up to 100% since a small fraction of participants responded "don't know" when asked whether the current gasoline bought was the same as the last purchase (see Table VI-1). Staff believes this could be the result of several factors, including use of a rental car or a borrowed car from a friend or family member where the driver was unaware of the fueling history. To account for the "don't know" group in the commingling analysis, staff included this group into non-loyal consumers, as shown in Table VI-2. For any given ethanol market share, these figures, along with region gasoline consumption, as shown in Table V-8, were used as weighting factors to estimate statewide commingling impacts.

When the loyalty data in urban areas (58 percent of observed consumers in San Francisco and 62 percent in Los Angeles, as shown in Table VI-1) were compared to the statewide data provided to the staff by gasoline marketers, the field study data were somewhat higher. However, this is not unreasonable given the way the field questionnaire was worded. The loyalty figure from the field survey may include some non-loyal consumers who happened to purchase the same brand twice in a row. They were classified as consumers who "always" buy the same brand by default.

Using data from gasoline marketers, about 40% of California consumers always "use one gasoline brand," more than 50% "use two to three gasoline brands," and the remaining "use many gasoline brands." Rarely, if ever, do consumers make random brand switching. Most of the time, certain patterns are followed. In the "use two to three brands" case, it is very likely that consumers use one brand for several consecutive fuelings, and occasionally switch to another brand. This hypothesis is supported by the field study loyalty data where brand loyal consumers represent a somewhat higher percentage than the "use one brand" case reported by the gasoline marketers. From a commingling stand point, the frequency with which consumers switch fuel types is important, not the number of brands being used. Still, any brand switching in the future may not necessarily cause commingling when both brands are selling the same type of gasoline. It is with this reasoning, staff believes that the field study loyalty data are reasonable.

Initial Fuel Tank Level: According to the field study, the majority of consumers (about 80%) fuel when there is ¼ tank of gasoline or less remaining in their tanks, with more than 40% registering nearly an empty tank. In evaluating the data, the mean initial fuel tank level for non-loyal consumers is comparable to the overall sample's mean. On average, consumers in Los Angeles have lower initial fuel tank levels than consumers in San Francisco Bay Area or Lake Tahoe, as shown in Table VI-2.

In practice, although fuel gauge may register empty, staff believes that some fuel still remains in the tank. Staff assumed about five percent usable tank capacity for initial fuel tanks recorded as empty ("E") in the field study. The mean tank levels presented in Tables VI-1 and VI-2 were computed based on this assumption. In addition, as described in the previous chapter, staff assumed a five-percent tank "heel," regardless of initial fuel tank levels. This assumption is supported by two sources: Southwest Research Institute and Ford Motor Company data (see Appendix E). As a result, the simulation model also assumes a five-percent or one-gallon tank heel, based on an average 20-gallon usable tank capacity. This 20-gallon usable tank capacity is derived from weighted average usable tank capacity of passenger car, estimated to be16-gallon, and light-duty trucks estimated to be 24-gallon where both vehicle classes are about equally represented in the sample. The U.S. EPA model assumed a ten-percent heel. Staff does not agree with this assumption. A higher heel means more available fuel in the tank to mix with a dispensed fuel. Thus, it leads to higher commingling impacts.

Amount Of Fuel Purchased: As can be seen in Table VI-2, the data collected on non-loyal consumers follow similar fillup trends as the overall consumers observed. For example, non-loyal consumers in Los Angeles are the least likely to fillup among non-loyal consumers in the three regions. Also, the data for the average amount of fuel purchased for non-fillup events are comparable among the three regions.

3. Summary of Input Data

From the mean and standard deviation of each variable in Table VI-2, the corresponding input parameters (i.e., beta distribution) were derived for simulation analysis. Table VI-3 summarizes the input data and assumptions for the model. The upper portion of the table lists the input assumptions for the future ethanol market conditions while the lower portion identifies the field survey information. Unlike the future ethanol market conditions, the field survey information is assumed to remain constant for each different scenario analysis (This is further explained in Chapter VII.). For example, premium consumers would fillup with the same frequency, regardless of whether ethanol market share was 25 percent or 50 percent.

Table VI-3 Input Data & Assumptions
For Simulation Model

Variables		Lake Tahoe	SF Bay Area	Los Angeles
Ethanol Content (vol%)		6 or 7.7	6 or 7.7	6 or 7.7
Base RVP (psi)	- Non-oxygenate	6.71	6.71	6.71
	- Oxygenated	5.74	5.74	5.74
Ethanol Market Share (%)		25 - 65	25 - 65	25 - 65
Distribution of EtOH Purchase Propensity ($\alpha+\beta$)*		2, 3, or 5	2, 3, or 5	2, 3, or 5
Initial Fuel Tank Level (mean, fraction of tank cap.)		0.23	0.2	0.18
Distribution of Initial Fuel tank Level ($\alpha+\beta$)		3.3	4.5	2.6
Fillup Frequency (mean)		0.52	0.58	0.24
Distribution of Fillup Frequency ($\alpha+\beta$)		6.7	3.6	4.7
Fuel Purchased for Non-Fillup (mean, fraction of tank cap.)		0.42	0.36	0.42
Dist. of Fraction Amount Purchased for Non-Fillup ($\alpha+\beta$)		2.8	4.6	2.5

*The 2001 ARB field study did not specifically elicit cunsumers purchase propensity toward ethanol fuel.

The figures are for different assumptions (2 = less conservative, 3 = base case, and 5 = more conservative scenarios).

VII. SIMULATION RESULTS

This chapter describes the results of staff's use of the UCD simulation model to access the potential impacts of CaRFG3 commingling.

A. Statewide Potential Commingling Impacts

Using the UCD simulation model and assumed future ethanol market conditions (as discussed in Chapter VI), as well as consumer fueling behavior from the field study (as described in Chapter IV) as input, staff simulated a total of 162 fueling scenarios. These included all possible combinations of:

- 3 regions;
- 3 ethanol purchase propensity distributions;
- 9 ethanol market shares from 25 percent to 65 percent in five percent increments, and;
- 2 ethanol blends, 6 volume percent and 7.7 volume percent.

Each scenario represents 5,000 consumers with 500 fuelings per consumer, resulting in the modeling of over 400 million fuelings. The model then computes the average commingling effect for each scenario.

The first set of scenarios (i.e., ethanol purchase propensity based on a beta distribution, with $\alpha + \beta$ equal to 3) is collectively called the base case scenario. Table VI-1 summarizes the results of the base case scenario. Staff believes the base case scenario most likely represents the potential commingling impacts.

The top half of Table VII-1 shows the commingling impacts of using a 6 volume percent ethanol blend while the bottom half shows the impacts of using a 7.7 volume percent blend. The two blends are assumed to have the same base RVP. RVP increases due to commingling are estimated for each region. For example, if ethanol market share is 25% of total gasoline pool, the average RVP increases due to commingling are estimated to be 0.002 psi, 0.022 psi, and 0.040 psi in Lake Tahoe, SF Bay Area, and Los Angeles, respectively. These figures are calculated from the average RVP increases in each region weighted by the corresponding non-loyal consumer proportions and gasoline consumptions (Appendix N). The last column in Table VII-1 is the total statewide commingling impact as the sum of the three regions weighted-average RVP increases for each ethanol market penetration.

As expected, the anticipated commingling effect increases with ethanol market penetration, and peaks at around 45 percent to 50 percent market share. For the base case scenario, the model estimated average statewide commingling impacts of 0.064-0.080 psi RVP for 6 volume percent ethanol blends and 0.071-0.089 psi RVP for 7.7 volume percent ethanol blends.

Table VII-1
Estimated Statewide Commingling Impacts For Various Ethanol Blends And Market Shares
Using The 2001 ARB Field Study Input Parameters
Base Case Scenario (Beta Distribution, $\alpha+\beta=3$)
(Draft)

Ethanol Market Share (%)	Ethanol Content (%vol)	Base RVP Non-Oxy Fuel (psi)	Base RVP Ethanol Fuel (psi)	Estimated RVP Increase Due To Commingling By Region (psi)			
				Lake Tahoe*	Bay Area*	Los Angeles*	Statewide
25	6	6.71	5.74	0.002	0.022	0.038	0.062
30	6	6.71	5.74	0.003	0.025	0.040	0.068
35	6	6.71	5.74	0.003	0.025	0.046	0.074
40	6	6.71	5.74	0.003	0.026	0.046	0.075
45	6	6.71	5.74	0.003	0.027	0.046	0.076
50	6	6.71	5.74	0.003	0.027	0.047	0.077
55	6	6.71	5.74	0.003	0.027	0.047	0.077
60	6	6.71	5.74	0.003	0.026	0.045	0.074
65	6	6.71	5.74	0.002	0.024	0.041	0.068
25	7.7	6.71	5.74	0.003	0.025	0.043	0.070
30	7.7	6.71	5.74	0.003	0.028	0.045	0.076
35	7.7	6.71	5.74	0.003	0.028	0.052	0.083
40	7.7	6.71	5.74	0.003	0.029	0.051	0.084
45	7.7	6.71	5.74	0.003	0.031	0.052	0.085
50	7.7	6.71	5.74	0.003	0.030	0.053	0.086
55	7.7	6.71	5.74	0.003	0.030	0.052	0.085
60	7.7	6.71	5.74	0.003	0.029	0.050	0.082
65	7.7	6.71	5.74	0.003	0.027	0.045	0.075

*These figures are calculated from the average RVP increases in each region weighted by the corresponding non-loyal consumer proportions and gasoline consumptions.

B. Sensitivity Analysis

Using the UCD model, staff also performed sensitivity analysis of potential commingling impacts. The sensitivity analysis is related to staff's input assumptions, regarding different ethanol purchase propensities.

The results of this sensitivity analysis are shown in Tables VII-2 and VII-3. Table VII-2 presents a more conservative ($\alpha + \beta=5$) estimate of commingling impacts relative to the base case while Table VII-3 is less conservative ($\alpha + \beta=2$) compared to the base case.

Using the same methodology as in the base case, the statewide commingling impacts were estimated. Again as can be seen in the tables, the largest impacts occur when the ethanol market share is around 45%-50%.

Table VII-2

Estimated Statewide Commingling Impacts For Various Ethanol Blends And Market Shares Using The 2001 ARB Field Study Input Parameters

More Conservative Scenario (Beta Distribution, $\alpha+\beta=5$)

(Draft)

Ethanol Market Share (%)	Ethanol Content (%vol)	Base RVP Non-Oxy Fuel (psi)	Base RVP Ethanol Fuel (psi)	Estimated RVP Increase Due To Commingling By Region (psi)			
				Lake Tahoe*	Bay Area*	Los Angeles*	Statewide
25	6	6.71	5.74	0.003	0.026	0.043	0.072
30	6	6.71	5.74	0.003	0.028	0.046	0.076
35	6	6.71	5.74	0.003	0.029	0.050	0.082
40	6	6.71	5.74	0.003	0.031	0.052	0.086
45	6	6.71	5.74	0.003	0.030	0.054	0.087
50	6	6.71	5.74	0.003	0.030	0.053	0.086
55	6	6.71	5.74	0.003	0.030	0.052	0.084
60	6	6.71	5.74	0.003	0.028	0.050	0.081
65	6	6.71	5.74	0.003	0.026	0.046	0.075
25	7.7	6.71	5.74	0.003	0.029	0.048	0.081
30	7.7	6.71	5.74	0.003	0.031	0.052	0.086
35	7.7	6.71	5.74	0.003	0.032	0.056	0.091
40	7.7	6.71	5.74	0.003	0.034	0.058	0.096
45	7.7	6.71	5.74	0.003	0.034	0.060	0.097
50	7.7	6.71	5.74	0.003	0.033	0.059	0.096
55	7.7	6.71	5.74	0.003	0.033	0.057	0.094
60	7.7	6.71	5.74	0.003	0.031	0.055	0.090
65	7.7	6.71	5.74	0.003	0.029	0.051	0.083

*These figures are calculated from the average RVP increases in each region weighted by the corresponding non-loyal consumer proportions and gasoline consumptions.

Table VII-3
Estimated Statewide Commingling Impacts For Various Ethanol Blends And Market Shares
Using The 2001 ARB Field Study Input Parameters
Less Conservative Scenario (Beta Distribution, $\alpha+\beta=2$)
(Draft)

Ethanol Market Share (%)	Ethanol Content (%vol)	Base RVP Non-Oxy Fuel (psi)	Base RVP Ethanol Fuel (psi)	Estimated RVP Increase Due To Commingling By Region (psi)			
				Lake Tahoe*	Bay Area*	Los Angeles*	Statewide
25	6	6.71	5.74	0.002	0.020	0.033	0.055
30	6	6.71	5.74	0.002	0.022	0.037	0.062
35	6	6.71	5.74	0.002	0.022	0.040	0.064
40	6	6.71	5.74	0.002	0.022	0.043	0.067
45	6	6.71	5.74	0.003	0.024	0.041	0.068
50	6	6.71	5.74	0.003	0.024	0.042	0.069
55	6	6.71	5.74	0.002	0.024	0.043	0.069
60	6	6.71	5.74	0.002	0.024	0.039	0.066
65	6	6.71	5.74	0.002	0.022	0.037	0.061
25	7.7	6.71	5.74	0.002	0.022	0.037	0.062
30	7.7	6.71	5.74	0.002	0.025	0.042	0.069
35	7.7	6.71	5.74	0.003	0.025	0.044	0.072
40	7.7	6.71	5.74	0.003	0.025	0.048	0.075
45	7.7	6.71	5.74	0.003	0.027	0.046	0.076
50	7.7	6.71	5.74	0.003	0.027	0.047	0.077
55	7.7	6.71	5.74	0.003	0.026	0.048	0.077
60	7.7	6.71	5.74	0.003	0.026	0.044	0.073
65	7.7	6.71	5.74	0.002	0.025	0.041	0.068

*These figures are calculated from the average RVP increases in each region weighted by the corresponding non-loyal consumer proportions and gasoline consumptions.

C. Overall Findings Of Simulation Modeling

Figure VII-1 combines the statewide commingling impacts of 6 volume percent ethanol blend for three different scenarios. The solid line curve represents the results of the base case scenario as a function of ethanol market share while the two dashed lines represent the results of the sensitivity analysis. As previously discussed, the 6 volume percent ethanol blends are the most likely ethanol fuels to be produced by California refiners. As can be seen in Figure VII-1 the statewide commingling impacts are estimated to be less than 0.1 psi RVP, which is below the 0.1 CaRFG3 RVP offset in the Predictive Model.

Similarly, Figure VII-2 represents the statewide commingling impacts of 7.7 volume percent ethanol blends. These blends produce somewhat higher commingling impacts than the 6 volume percent blends. However, all scenarios show that the impacts are less than 0.1 psi RVP.

Figure VII-1
Statewide Commingling Impacts Of 6 Vol% Ethanol Blend For Various Market Shares
Using The 2001 ARB Field Study Input Parameters
(Each point represents the average RVP boost from 15,000 consumers with 500 fuel purchases each)
(Draft)

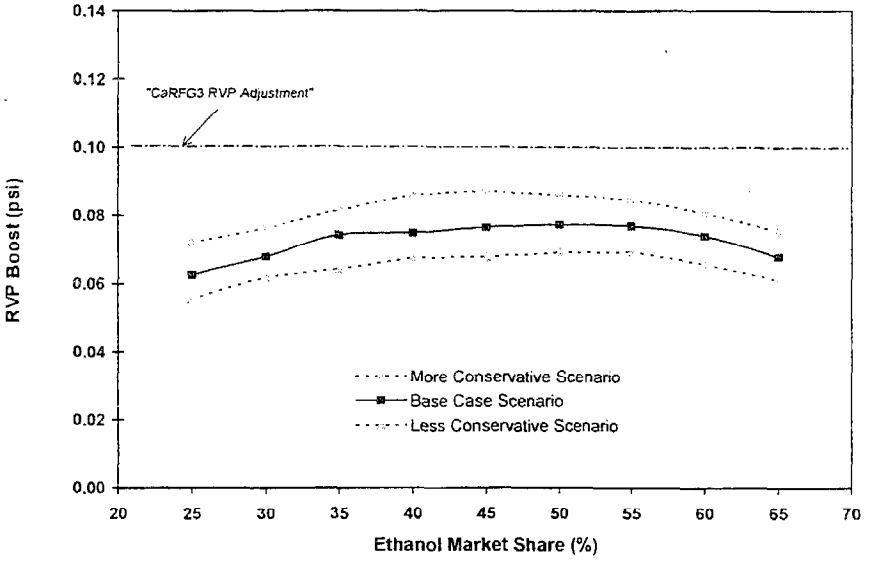
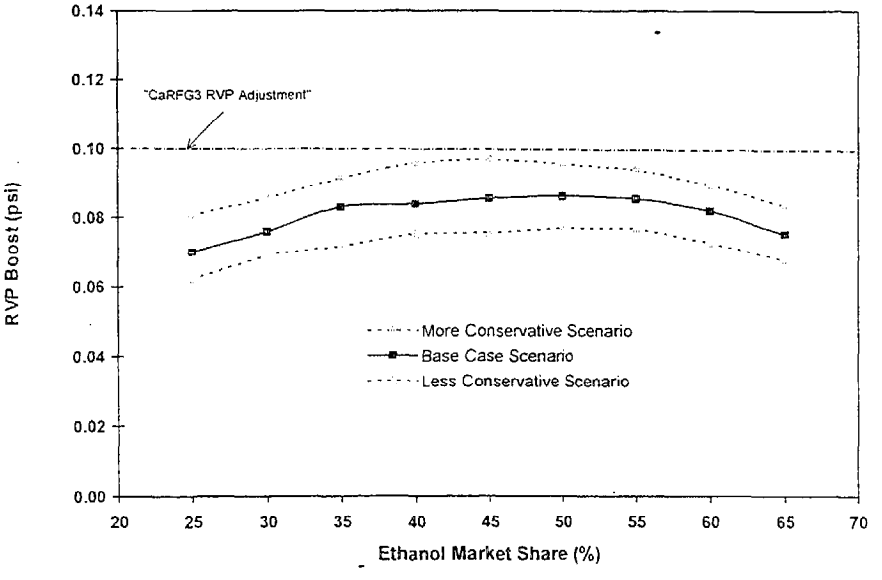


Figure VII-2
Statewide Commingling Impacts Of 7.7 Vol% Ethanol Blend For Various Market Shares
Using The 2001 ARB Field Study Input Parameters
(Each point represents the average RVP boost from 15,000 consumers with 500 fuel purchases each)
(Draft)



D. Comparison of Field Observations to Simulation Results of Statewide Potential of Commingling Impacts

A unique feature of staff's commingling analysis is the ability to verify the commingling impacts that were observed in the field, which could not encompass a wide range of scenarios to the modeling results that would bridge these gaps. Conversely, using the simulation model staff was able to analyze possible commingling scenarios, which were unobserved in the field, and then use field observed commingling impacts to gauge the reasonableness of such analysis.

Based on this comparison, both the field observations and simulation modeling results are in good agreement to conclude that the statewide potential commingling impacts of CaRFG3 is about 0.1 psi RVP.

E. Other Factors that May Reduce the Commingling Impacts

Staff plans to further refine some of the input parameters and modeling steps to better characterize consumer fueling habits. For example, it is likely that in certain areas, due to constraints in the fuel distribution systems, gasoline retailers would sell only one type of gasoline—either ethanol or non-ethanol blended gasoline—under different brand names. Although consumers described themselves as non-loyal with regard to gasoline brand, there should be limited commingling impacts in these "captive" areas.

VIII. ARB EVALUATION OF THE U.S. EPA COMMINGLING ANALYSIS

This chapter discusses staff's evaluation of the U.S. EPA's commingling analysis performed as part of their denial of California's request for a waiver of the federal oxygen mandate, including a comparison of the results of the U.S. EPA's analysis to that of the ARB.

A. U.S. EPA Findings on Commingling Impacts

Staff reviewed the U.S. EPA technical support document of potential commingling impacts in California, with the focus on the South Coast air basin, in response to Governor Davis request for a waiver from the U.S. EPA from the federal oxygen requirement for federal reformulated gasoline areas. A copy of the U.S. EPA commingling analysis is provided in Appendix P.

In its denial, the U.S. EPA stated that it believed there was great uncertainty regarding potential increases in volatile organic compound (VOC) evaporative emissions from commingling in vehicle fuel tanks. U.S. EPA rejected ARB's conclusion that a 0.1 psi increase was most likely, and stated that the potential commingling impacts could range from grater than 0.1 to 0.3 psi RVP. Using the upper end of this range, U.S. EPA concluded that the CaRFG3 regulations might not be sufficiently protective to prevent an overall increase in VOC emissions due to a large commingling effect.

B. Comparison of U.S. EPA and ARB Commingling Evaluations

A distinct difference between the ARB's and US EPA's analysis is in the way "brand-loyal" consumers, those who always purchase one brand of gasoline, are handled. Staff assumed no or negligible commingling effects from this group of consumers. In contrast, the U.S. EPA assumed the group would contribute to commingling.

For input data that are function of future market provisions, staff relied on the most up-to-date and reliable sources. Except for ethanol purchase propensity, both analyses shared similar information. For example, staff adopted ethanol market penetration from a study under the U.S. EPA contract.

Both the ARB and the U.S. EPA had access to consumer fueling habits information which, while obtained from different sources, was quite similar. However, the handling of these data was very different between the ARB and the U.S. EPA. ARB staff took precautionary steps to verify that these data were representative to population, and compared them to reliable sources for accuracy. However, the U.S. EPA, apparently based on its own judgement of what might possibly occur, modified the data.

These modifications produced lower brand loyalty, lower percent of fillup, and higher initial fuel tank levels than used by the ARB staff. Each of these modifications leads to a higher commingling effect. ARB staff believes that the data collected in their field study conclusively demonstrates that the use of modified data by U.S. EPA does not represent fueling habits in California, and produced an over estimation of the commingling analysis for the state. As a result, the U.S. EPA's analysis is fundamentally flawed, and the conclusions are questionable[7].

Because of these factors, the U.S. EPA's analysis has resulted in a 0.1-0.3 psi range of RVP increases from commingling in the South Coast air basin, with 0.2 psi RVP picked as the likely commingling impacts (see Appendix P). Given the field observations now available and improved simulation model, staff believes that the U.S. EPA has grossly overestimated the potential commingling impacts by, at least, a factor of two.

[7] A similar conclusion was reached in an analysis produced by Systems Applications International ("Analysis of Commingling Due to Ethanol Blends"). In that analysis, the validity of the U.S. EPA analysis was questioned. This analysis, using the same model, but inputting the actual U.S. EPA data instead (i.e., unmodified), concluded that using the modified data would result in commingling impacts approximately twice as high as what it would have been using the actual data. A copy of this analysis is provided in Appendix O.

APPENDIX G

Neighborhood Impacts of the Proposed Amendments to the CaRFG3 Regulation

Neighborhood Impacts of the Proposed Amendments to the CaRFG3 Regulations

A. Air Quality Impacts

The CaRFG3 regulations were implemented statewide in 1996. To implement the phase-out of MTBE in gasoline, CaRFG3 regulations were to be implemented by December 31, 2002. With the Governor's directive to delay implementation of the CaRFG3 regulations, staff is proposing to modify the CaRFG3 regulations to be implemented by December 31, 2003.

In California, nearly all of the CaRFG2 consumed is produced by refineries in the South Coast Air Quality Management District (SCAQMD), the Bay Area AQMD (BAAQMD), and the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD). Based on compliance plans submitted by each of the individual refineries, staff expects the same refineries that produce CaRFG2 will also produce CaRFG3.

B. CaRFG3 Refinery, Terminal, and Distribution Modifications

Refiners began shortly after the Board's approval of the CaRFG3 regulations in December of 1999 to develop the plans to make the refinery, terminal, distribution, and transportation modifications necessary to produce CaRFG3 and to transition to the use of ethanol in gasoline. Depending on the existing refinery's process equipment and their approach towards handling ethanol, the modification and construction of some new equipment was required. New construction or modifications of refinery and alkylation units are some of the more common items that were modified to meet CaRFG3 specifications. To blend with ethanol at terminals primarily requires modifications to allow injection of ethanol during loading of delivery tanks.

While there are a number of process modifications that are required to produce CaRFG3 gasoline with ethanol, there are also additional infrastructure needs that must be met due to ethanol's unique properties. For example, gasoline blending components such as ethanol and alkylate must be imported or transported via marine, rail, and truck from sources outside of California. In addition, there is traffic from California to other parts of the state and outside of the state to export rejected gasoline components like pentane, in this case due to the lower RVP base fuel needed to blend with ethanol. Also, as ethanol is not blended with gasoline at the refinery because of its affinity to water, truck and rail traffic is also increased further downstream than at the refinery as the gasoline and ethanol are trucked out to terminals, for blending, and once blended transported to retail stations.

C. CEQA Reviews for CaRFG3 Projects

The refinery modifications for CaRFG3 were subject to requirements to assess both local and regional multimedia environmental impacts (i.e., water, air, waste, toxics, etc.). In regards to emission impacts, the primary environmental requirements were the California Environmental Quality Act (CEQA) reviews, local governmental land use requirements, and local district air permitting requirements.

The CEQA process is used to address and mitigate the local emission impacts of the CaRFG3 refinery modifications. CEQA requires state and local agencies to identify significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. The CaRFG3 projects in the SCAQMD and BAAQMD have been reviewed under CEQA. The CaRFG3 projects in the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) probably will not be subject to CEQA as very minimal changes, if any, are expected.

D. California's Air Permit Requirements for CaRFG3 Projects

California's emission permit programs for new and modified stationary sources are referred to as New Source Review (NSR) programs. NSR programs, adopted by air districts, consist of regulations and requirements that govern the building and expansion of stationary sources. Stationary sources are industrial or commercial facilities which emit air contaminants. Mobile sources, such as trucks and automobiles, are not regulated under NSR programs.

The purpose of NSR is to provide the regulatory mechanism to allow continued industrial growth in non-attainment areas while minimizing the amount of emission increases from this growth. The California Clean Air Act (CCAA) mandates that the purpose of NSR is to keep emission levels from the permitting of new and modified stationary sources at a constant level; in other words, to allow no increase in emissions. Under the NSR program, air districts evaluate the potential emission increases from new and modified stationary sources. If emission increases are above specified levels, the district requires the source to apply best available control technology (BACT) to control those emissions.

After BACT is applied, the project's remaining emission levels are then compared to another specified level called the offset threshold. Offsets are required to mitigate any emission increases remaining after BACT has been applied. These offset requirements are usually at a ratio greater than one (e.g., a 100 pound per day emissions increase may have to be offset by 110 pounds of emission reductions). Offsets are emission reductions at the project location or at a nearby location used to compensate for the expected increase in emissions from the project. When a source reduces its emissions, beyond what is required under NSR, it can receive credit for those reductions, called emission reduction credits (or ERC's) which can be sold at a future date or used by the facility to offset future projects. The vast majority of CaRFG3 projects obtained the necessary offsets by achieving on-site emission reductions at their facilities through applying advanced control technologies.

The BAAQMD did not allow an offset exemption in their district for the CaRFG3 projects. As a result, except for carbon monoxide, refineries in the BAAQMD offset all of the criteria pollutant emissions associated with their CaRFG3 projects. The SCAQMD, however, chose to exempt new and modified CaRFG3 stationary source projects from their district offset requirements. The CaRFG3 projects in the SCAQMD were provided with offset exemptions when the associated emission increases were the result of complying with federal, state, or local air quality mandates - in this case the state's mandated CaRFG3 regulations. The Federal Clean Air Act Amendments of 1990 (Section 182(e)(2)) provides state and local agencies in extreme ozone non-attainment areas with the authority to exempt projects from offset requirements for emission increases resulting from compliance with federal, state, and local air quality mandates. This

provision provided specific authority to the SCAQMD, a federal extreme ozone non-attainment area, to exempt CaRFG3 refinery modifications from their offset requirements.

E. CaRFG3 Emissions Impacts

Since its implementation, the CaRFG2 program has provided significant reductions in ozone and particulate matter precursor emissions and toxic air pollutants. The emission benefits of this program have been equivalent to the removal of about 3.5 million vehicles from California's roads, and are a major component of California's plan for achieving both the federal and state ambient air quality standards. The emission reductions from CaRFG2 represent about one quarter of the emission reductions committed to in the 1996 State Implementation Plan. Table 1 shows the criteria pollutant emission benefits of both the CaRFG2 and CaRFG3 programs in the SCAQMD, BAAQMD, and the SJVUAPCD (i.e., areas in the California where refineries produce CaRFG2 and are expected to produce CaRFG3).

In order to produce CaRFG2, California refineries underwent significant modifications from 1992-1998 spending about 4 billion dollars on capital equipment. In order to produce CaRFG3, staff expects that refineries will spend about 500 million dollars (about one tenth of the CaRFG2 expenditures) on capital equipment for refinery and terminal modifications. Modifications for both CaRFG2 and CaRFG3 have included retooling of existing equipment and processes, as well as installation of new equipment. In performing these modifications, the permitted emissions from the refineries have changed. In some instances, these changes resulted in some increases in permitted emissions. In other cases, the change was a reduction in permitted emissions. The change in overall statewide permitted emissions from refineries as a result of the CaRFG2 and CaRFG3 modifications were small. The CaRFG3 projects were subject to California Environmental Quality Act (CEQA) and air district permit requirements and the CaRFG3 associated emissions were mitigated to the extent feasible. In the context of the overall CaRFG2 and CaRFG3 programs, any increases in permitted emissions from refineries were greatly overshadowed by the emission benefits of both the CaRFG2 and CaRFG3 programs.

Table 1 shows the changes in emissions within each of the three air districts as a result of implementing the CaRFG2 and CaRFG3 modifications. The changes in emissions include both changes in permitted emissions from the refineries (known as stationary source emission impacts) and changes in emissions from truck, marine, and employee traffic (known as indirect source emission impacts). As can be seen in Table 1, when the emission impacts of the CaRFG2 and CaRFG3 modifications are compared to the emission benefits of the CaRFG2 and CaRFG3 programs in each of the three districts, the CaRFG2 program emission benefits are on the order of 5 to 400 times greater than any increases in emissions.

Based on staff's assessment of the ARB emission inventory over the years 1990 through 1999, emissions of most pollutants from refineries within these three districts decreased on the order of 20 to 60 percent, depending on the pollutant. It is important to note that the period of time considered by staff is inclusive of the implementation of the CaRFG2 program, and the overall reductions in the emission inventory include the emission impacts associated with the significant modifications undertaken to produce CaRFG2. Continued implementation of air district refinery control measures will continue to reduce emissions from refineries.

The production of CaRFG2 necessitated changes in the movement of materials and components to produce CaRFG2. Changes in emissions from these sources, known as indirect sources, are generally mobile source related and include changes in marine, rail, truck, and employee traffic. There will be similar changes in emissions for indirect sources related to the CaRFG3 projects. There is also an expected increase for indirect sources associated with the CaRFG3 projects primarily in the SCAQMD.

For the CaRFG3 program, most of the indirect source emissions will occur in the SCAQMD and are due to expected increases in marine traffic related to the importation of ethanol, alkylate, and other gasoline blending components and the exportation of rejected pentane stocks. In addition, there will be emission impacts due to increased rail traffic to import ethanol from the Midwest. There will also be additional truck traffic primarily related to moving ethanol from hubs to gasoline distribution terminals for blending into gasoline. For CaRFG3 projects, there were approximately a 3 tpd and 1 ½ tpd emission increases for NOx and SOx, respectively, in the SCAQMD related to ship, rail, and truck traffic to import and distribute ethanol, alkylate, and other gasoline blending components.

As previously discussed, while there were emission impacts associated with the implementation of both the CaRFG2 and CaRFG3 programs, these impacts are small when compared to the benefits from both the CaRFG2 and CaRFG3 programs provided. Further, the anticipated indirect source emissions associated with the CaRFG2 and CaRFG3 programs are small when compared to the very significant benefits of both the CaRFG2 and CaRFG3 programs.

Table 1

Emission Benefits and Impacts of the CaRFG2 and CaRFG3 Programs

District	Emission Type	ROG (TPD)	NO_x (TPD)	CO (TPD)	SO_x (TPD)	PM_{10} (TPD)
SCAQMD	CaRFG2 Benefits	-42	-25	-440	-10	[2]
	CaRFG3 Benefits	-0.2	-6.27	0	0	0
	SUBTOTAL – Benefits	-42.2	-31.27	-440	-10	0
	Impacts of Implementing CaRFG2[1]	1.6	4.9	1.0	2.2	0.8
	Impacts of Implementing CaRFG3	.75	3.21	1.55	1.76	.61
	SUBTOTAL - Impacts	2.35	8.11	2.55	3.96	1.41
	NET CARFG2/CARFG3 IMPACTS*	**-40**	**-23**	**-437**	**-6**	**1.4**
BAAQMD	CaRFG2 Benefits	-26	-11	-210	-5	[2]
	CaRFG3 Benefits	-0.1	-3.63	0	0	0
	SUBTOTAL – Benefits	-26.1	-14.63	-210	-5	0
	Impacts of Implementing CaRFG2[1]	-0.3	0.7	1.4	1.3	0.1
	Impacts of Implementing CaRFG3	0	0	0	0	0
	SUBTOTAL - Impacts	-0.3	0.7	1.4	1.3	0.1
	NET CARFG2/CARFG3 IMPACTS*	**-26**	**-14**	**-209**	**-4**	**0.1**
SJVUAPCD	CaRFG2 Benefits	-9	-6	-100	-3	[2]
	CaRFG3 Benefits	-0.06	-2.66	0	0	0
	SUBTOTAL – Benefits	-9.06	-8.66	-100	-3	0
	Impacts of Implementing CaRFG2[1]	0.1	0.2	0.1	0.1	0
	Impacts of Implementing CaRFG3	0	0	0	0	0
	SUBTOTAL – Impacts	0.1	0.2	0.1	0.1	0
	NET CARFG2/CARFG3 IMPACTS*	**-9**	**-8**	**-100**	**-3**	**0**

1 Includes both direct and indirect emission impacts
2 It was estimated that the CaRFG2 reductions in NOx and SOx would significantly reduce the formation of PM_{10}.
* Total numbers were rounded off.

F. Impacts of Implementing New and Continuing District Controls

There are a number of control measures being implemented and under development by local districts that will reduce emissions from refineries and the marketing and distribution of CaRFG. These are summarized in Table 2. The combination of the control measures and the CaRFG serve to reduce emissions throughout the state.

Table 2

Examples of Refinery Related Control Measures

CONTROL MEASURES	ROG	NOx	CO	SOx	PM10
Statewide					
Emission Control Strategies for Gasoline Tanker Trucks					X
Refinery Flare Emissions	X	X	X	X	X
Refinery Emissions from Leaking Components	X				
Refinery Emergency Venting Emissions	X				
South Coast Air Quality Management District					
Reclaim – Facility Emissions Cap		X		X	
Rule 1178 – Petroleum Storage Tanks	X				
Rule 1158 – Storage, Handling, and Transport of Coke, Coal, and Sulfur					X
Bay Area Air Quality Management District					
Refinery Pressure Relief Devices, Blowdown Systems, and Flares	X	X	X	X	X
Refinery Wastewater Systems	X				
Refinery Storage Tanks	X				
Marine Tank Loading of Petroleum Products	X				
San Joaquin Valley Unified Air Pollution Control District					
Oil and Gas Fugitives	X				
Refinery Boilers		X			

APPENDIX H

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