

State of California
AIR RESOURCES BOARD

UPDATED INFORMATIVE DIGEST

AMENDMENTS TO THE CALIFORNIA REFORMULATED GASOLINE REGULATIONS,
INCLUDING A DECEMBER 31, 2002 PROHIBITION OF USING MTBE IN GASOLINE,
ADOPTION OF PHASE 3 GASOLINE STANDARDS, A PHASE 3 PREDICTIVE MODEL,
AND OTHER CHANGES

Sections Affected: Amendments to sections 2260, 2261, 2262.1, 2262.5, 2263, 2263.7, 2264, 2264.2, 2265, 2266, 2266.5, 2267, 2268, 2269, 2270 and 2271, repeal of sections 2262.2, 2262.3, 2262.4, 2262.6, 2262.7 and 2264.4, and adoption of sections 2262, 2262.3 and 2262.6, of Title 13, California Code of Regulations (CCR). Adoption of the “California Procedures for Evaluating Alternative Specifications for Phase 3 Reformulated Gasoline Using the California Predictive Model,” incorporated by reference in section 2265(a)(2), title 13, California Code of Regulations.

Background

The preexisting CaRFG regulations. The CaRFG Phase 2 (CaRFG2) regulations were adopted by the Air Resources Board (the Board or ARB) following a hearing in November 1991 and became applicable in the spring of 1996. The regulations established a comprehensive set of standards for gasoline designed to achieve the maximum feasible reductions in emissions of criteria pollutants and toxic air contaminants from gasoline-powered motor vehicles. The standards cover sulfur, benzene, olefin, oxygen, and aromatic hydrocarbon contents, the 50-percent and 90-percent distillation temperatures (T50 and T90), and summertime Reid vapor pressure (RVP). The table in the next part of this Digest shows the current CaRFG2 standards and compares them to the CaRFG Phase 3 (CaRFG3) standards adopted in this rulemaking.

The primary element of the CaRFG2 standards is a set of limits that apply to gasoline when it is first supplied from the production facility (typically a refinery) or import facility. These will be referred to as the “refiner” limits. The CaRFG2 standards also include a set of “cap limits” that apply throughout the gasoline distribution system and for all properties but RVP are less stringent than the refiner limits. This approach allows the imposition of very stringent standards at the refinery while allowing refiners to vary the composition of individual batches in a cost effective way up to the cap limits as long as overall equivalent emissions performance is achieved. The cap limits allow for effective enforcement for gasoline in transit to, and being sold at, service stations and other fueling facilities.

With the exception of RVP and oxygen content, the regulations provide three compliance options for meeting the refiner limits. One option is to have the gasoline subject to either a “flat limit,” set forth in the regulations which must be met by every gallon of gasoline leaving the refinery, or a

specified “averaging limit.” The averaging limits for each of the six properties are numerically more stringent than the comparable flat limits. Under the averaging option, the producer may assign differing “designated alternative limits” (DALs) to different batches of gasoline being supplied from the refinery. Each batch of gasoline must meet the DAL for the batch. A producer or importer supplying a batch of gasoline with a DAL above the averaging limit must, within 90 days before or after, supply sufficient quantities of gasoline subject to more stringent DALs to fully offset the excess over the averaging limit.

The CaRFG regulations also contain a second compliance mechanism under which a refiner may use the “CaRFG2 Predictive Model” to identify alternative flat and averaging limits applicable when gasoline is supplied from the refinery. The Predictive Model consists of mathematical equations which predict the changes in exhaust emissions of hydrocarbons, oxides of nitrogen (NO_x), and potency weighted toxics for four toxic air contaminants that result from different gasoline formulations. The four toxic air contaminants are benzene, 1,3-butadiene, acetaldehyde, and formaldehyde. The Predictive Model is based on data from 18 vehicle emission test programs analyzing the relationship of gasoline properties and emissions. An alternative gasoline formulation is acceptable if there will be essentially no increase in emissions of hydrocarbons, NO_x, and potency-weighted toxics under the Predictive Model. Currently, most of the gasoline sold in California complies with the CaRFG2 regulations through the use of the Predictive Model.

The third compliance option provided by the CaRFG regulations allow for certification of alternative gasoline formulations based on the results of vehicle emission testing. Under this option, producers must perform a comparative vehicle emissions test program to show that their gasoline formulation achieves equivalent emissions as compared to a CaRFG2 reference test fuel.

Gasoline oxygen content is regulated somewhat differently from the other properties in that there are both minimum and maximum oxygen content standards. Oxygen is added to gasoline by blending in an “oxygenate.” The oxygenate most used by far in California has been MTBE. Much smaller amounts of ethanol have been used. While the CaRFG2 oxygen standard is 1.8 to 2.2 percent by weight, producers and importers may use the Predictive Model to vary the applicable limit. The oxygen content may be as low as zero percent or as high as 3.5 wt. percent when the Predictive Model is used. Since adding oxygen to gasoline will reduce emissions of carbon monoxide (CO) from most vehicles now on the road, the CaRFG regulations originally required a minimum oxygen content of 1.8 wt. percent statewide in the winter months when CO concentrations are the highest. Last year, the ARB eliminated the wintertime minimum oxygen requirement in those areas where the requirement was not necessary to meet the national and state ambient CO standards. After this winter, the wintertime 1.8 wt. percent minimum oxygen requirement will apply only in Los Angeles, Orange, Ventura, San Bernardino, Riverside and Imperial Counties. The state is conditionally mandated by section 211(m) of the federal Clean Air Act (FCAA) to maintain a wintertime oxygen requirement in all of these counties except Imperial.

Comparable Federal Regulations. Pursuant to the 1990 amendments to the FCAA, the U. S. Environmental Protection Agency (U.S. EPA) has adopted federal RFG regulations that apply in

San Diego County, the greater Los Angeles area (Los Angeles, Orange and Ventura counties, and parts of Riverside and San Bernardino counties), and the greater Sacramento area (Sacramento county and parts of Yolo, Solano, Sutter, Placer, and El Dorado counties). Together, these areas make up about 70 percent of the state's gasoline market. Both the federal and state RFG regulations apply in those areas. To avoid unnecessary duplication of the enforcement requirements, in 40 C.F.R. §80.81, the U.S. EPA exempted California producers from many of the federal enforcement requirements until January 1, 2000 when federal "Phase II" requirements apply; this was recently extended indefinitely (64 F.R. 49992 (September 15, 1999)). The oxygen requirements in the federal RFG and CaRFG programs differ considerably. The FCAA requires a minimum 2.0 wt. percent oxygen requirement year-round, even when it is not needed to avoid exceedances of the ambient CO standards and formulations with less or no oxygen will achieve equivalent reductions in emissions of hydrocarbons and toxics. Thus because of federal law, California refiners must comply with the federal minimum oxygenate requirement in 70 percent of California's gasoline. For the remaining 30 percent of the state's gasoline, refiners have the flexibility to produce gasoline without oxygen if they choose, as long as minimum emissions performance required by the CaRFG regulations are met. Using this flexibility, California refiners have been providing substantial quantities of oxygen-free gasoline where permitted in Northern California with no loss in emission benefits.

Recent Developments. During the initial implementation of the federal RFG regulations in 1995, concerns were raised regarding exposure to MTBE during vehicle fueling and associated potential adverse health effects. These concerns were initially raised in other states. In addition, concerns were raised regarding the detection of MTBE in surface and ground water, including a number of drinking water supplies in California and other states. Legislation enacted in 1997 required the University of California (U.C.) to conduct a study of the health and other environmental risks and benefits of MTBE in gasoline compared to other oxygenates. This same legislation also required the Governor to take appropriate action based on the findings and information from public hearings conducted on the U.C. Report. The U.C. Report was released in late 1998, and concluded that there were significant risks to the environment, as well as costs associated with water contamination due to the use of MTBE. This was because MTBE is highly soluble in water and will transfer more readily than most other gasoline components to groundwater from gasoline leaking from underground storage tanks, pipelines and other parts of the gasoline distribution system. MTBE was also shown to pose an odor and taste problem in water at very low concentrations.

As a result, 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. Governor Davis directed the California Energy Commission (CEC) to issue a timetable for the removal of MTBE from gasoline at the earliest possible date but not later than December 31, 2002. The CEC subsequently determined that December 31, 2002 was in fact the earliest feasible time. The Executive Order also directed the ARB by December 1999 to adopt CaRFG3 regulations that will provide additional flexibility in lowering or removing the oxygen content requirement while maintaining current emissions and air quality benefits and ensuring compliance with the State Implementation Plan (SIP).

Senate Bill 989 (Sher) was signed by the Governor on October 10, 1999. It enacted a law requiring, in part, that the CEC develop a timetable for the removal of MTBE from gasoline at the earliest possible date, and requiring the ARB to ensure that the CaRFG3 regulations maintain or improve upon emissions and air quality benefits achieved by CaRFG2 as of January 1, 1999 and to provide additional flexibility to reduce or remove oxygen from motor vehicle fuel. Senate Bill 529 (Bowen), also signed by the Governor on October 10, established a mechanism for conducting environmental assessments of revisions to the ARB's CaRFG standards proposed before January 1, 2000 and adopted before July 1, 2000, and the mechanism has been used in connection with this rulemaking.

Removal of MTBE from California gasoline would be considerably easier and less expensive if federal law did not mandate that it be replaced by another oxygenate in 70 percent of the state's gasoline. In April, Governor Davis asked the U.S. EPA to issue a waiver of the oxygenate requirement under a waiver provision in the federal law, and legislation has been introduced in the House and Senate to allow the CaRFG program to substitute for the federal RFG program in the state as long as it achieves equivalent or greater reductions in ozone-forming compounds and toxic air contaminants.

The CaRFG3 Amendments

Following a December 9, 1999 hearing, the ARB has adopted amendments to the CaRFG regulations consistent with the Governor's Executive Order D-5-99, SB 989, and the timetable for removing MTBE approved by the CEC. In developing these amendments, staff held eight public workshops since February 1999 and had numerous meetings and discussions with a variety of interested parties.

Prohibition on MTBE in California gasoline produced after December 31, 2002. The amendments include a ban on production of California gasoline produced with the use of MTBE, which will apply to all gasoline supplied from production and import facilities starting December 31, 2002. This is consistent with the Governor's Executive Order D-5-99 and the schedule approved by the CEC. The prohibition on production of gasoline with MTBE should quickly result in its phase-out throughout the storage and marketing system. For enforcement purposes, the prohibition will apply 45 days later to all downstream facilities except bulk plants, retail outlets, and bulk purchaser-consumer facilities. After another 45 days, the ban on dispensing of California gasoline produced with the use of MTBE will apply throughout the distribution system. This phase-in is similar to the schedule used in the phase-in of CaRFG2 in 1996, and is necessary to avoid disruptions in the gasoline distribution system.

Along with the prohibition on the use of MTBE in gasoline, the amendments include a three-phase reduction of limits on the small residual levels of MTBE in produced and imported California gasoline. As the ban on the dispensing of MTBE in gasoline is implemented, it is expected that very low levels of MTBE may continue to exist in parts of the gasoline distribution system. During the first year, starting December 31, 2002, there is a prohibition of gasoline

containing 0.3 volume percent or more MTBE. This limit will have the same 90-day phase-in period for downstream facilities as the prohibition of gasoline made with the use of MTBE. Starting in December 31, 2003, California gasoline will be prohibited from containing 0.15 volume percent or more MTBE, and a permanent prohibition of 0.05 percent or more MTBE will apply starting December 31, 2004. A 90-day downstream phase in period will apply for each change in allowable MTBE.

In recognition that other ethers (such as ethyl tertiary-butyl ether and tertiary-amyl methyl ether) have similar characteristics as MTBE and could likely pose similar risks to the environment if used in significant volume, the amendments require a comprehensive evaluation prior to the use of any oxygenate other than ethanol, as replacements for MTBE. Under this requirement, any oxygenate other than ethanol, must undergo a multimedia evaluation regarding the use of the oxygenate. Furthermore, the California Environmental Policy Council, which was established by Public Resources Code section 71017, will also have to determine that the oxygenate will not cause a significant adverse impact on the public health or the environment before its use would be allowed in California gasoline.

The CaRFG3 standards. In addition to the required phase-out of MTBE use, The Board has adopted a number of changes to the current specifications for CaRFG2 gasoline. Collectively, these are referred to as the CaRFG3 standards. Table 1 shows the current CaRFG2 standards and the adopted CaRFG3 standards, which will become applicable starting December 31, 2002, with a 90-day phase-in period downstream of production and import facilities. It is important to note that refiners are generally expected to continue to use the Predictive Model in producing California gasoline. Thus for any particular batch of gasoline the refiner will vary the limits for the regulated properties from those in the table, as long as the Predictive Model shows that the alternative limits applicable to the batch will not increase emissions of hydrocarbons, NO_x, and potency-weighted toxics compared to the limits in the regulations.

Small refiners that have been producing CaRFG2 may elect to be subject to adjusted flat limits for aromatics of 35 vol.%, benzene of 1.0 vol.%, T50 of 220°F, and T90 of 312°F, as long as any increased hydrocarbon, NO_x, and potency-weighted toxic emissions associated with these alternative specifications are fully mitigated through a mechanism to be added to the small refiner diesel regulations.

The CaRFG3 Predictive Model. The amendments include a new CaRFG3 Predictive Model be applicable along with the CaRFG3 standards. The revised model is based on the existing Predictive Model with three basic changes. First, the ARB has added an evaporative hydrocarbon emissions element that will allow refiner to vary RVP and use the hydrocarbon impacts in conjunction with the exhaust emissions Predictive Model. This is expected to facilitate ethanol usage by permitting refiners that use ethanol to produce a fuel with higher RVP provided that the increase in evaporative emissions were offset by reductions in exhaust emissions. It will also allow refiners to use lower RVP gasolines as part of their

Table 1

<i>Property</i>	<i>Flat Limits</i>		<i>Averaging Limits</i>		<i>Cap Limits</i>	
	<i>CaRFG Phase 2</i>	<i>CaRFG Phase 3</i>	<i>CaRFG Phase 2</i>	<i>CaRFG Phase 3</i>	<i>CaRFG Phase 2</i>	<i>CaRFG Phase 3</i>
Reid Vapor Pressure (pounds per square inch; warmer months only)	7.00	7.00 or 6.90 w/ evap PM	Not Available	Not Available	7.00	6.40 – 7.20
Sulfur Content (parts per million by weight)	40	20	30	15	80	60
						30 (12/31/04)
Benzene Content (percent by volume)	1.0	0.8	0.8	0.7	1.2	1.1
Aromatics Content (percent by volume)	25.0	25.0	22.0	22.0	30.0	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 (max. 310)	295	330	330
Oxygen Content (percent by weight)	1.8 - 2.2	1.8 - 2.2	Not Available	Not Available	1.8 - 3.5 winter areas	1.8 - 3.7 winter areas
					0 - 3.5	0 – 3.7
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

compliance demonstration under the Predictive Model. When using the evaporative model, the RVP flat limit will be 6.9 psi.

A second change in the Predictive Model allows a hydrocarbon credit for gasoline that provides CO emissions reductions associated with an oxygen content greater than 2.0 wt. percent. The credit reflects the fact that CO contributes to ozone formation, and is based on the relative reactivity of CO compared to the various hydrocarbon species. This credit is expected to facilitate the use of ethanol in California gasoline.

Third, the Predictive Model has been updated to reflect recent vehicle test data and changes in the current vehicle fleet and to account for changes in newer vehicles' response to changes in fuel properties.

Refiners and importers will be allowed to trigger a mechanism under which they may comply with the CaRFG3 standards and use the CaRFG3 Predictive Model prior to December 31, 2002. This may facilitate the early removal of MTBE from California gasoline.

Other changes pertaining to the use of oxygenates in California gasoline. Certain characteristics of gasoline blends containing ethanol make them difficult to transport through pipeline systems. Because of this, ethanol is typically added to gasoline at the terminal or the delivery truck. The CaRFG regulations allow a refiner to ship non-oxygenated gasoline from the refinery without complying with the RFG standards if it is specially formulated to be combined with oxygenate “downstream” from the refinery and the resulting blend will meet all of the CaRFG standards. The non-oxygenated blend is called “California reformulated gasoline blendstock for oxygenate blending,” or “CARBOB”. The amendments make a number of changes to the CARBOB provisions, which in most cases will make it easier for refiners and oxygenate blenders to comply. These changes include elimination of quality audit requirements, allowing up to 3.7 wt. percent oxygen for 10 vol. percent ethanol blends, and facilitating use of the Predictive Model for gasoline containing 2.7 wt. percent oxygen from ethanol.