Air Resources Board

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Winston H. Hickox
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July 9, 1999

Mr. Robert Perciasepe
Assistant Administrator for Air and Radiation
U.S. Environmental Protection Agency (6101)
401 M. Street, S.W.
Washington, D.C. 20460

Re: Support Materials for California's Request for a Waiver from the Requirement that Federal RFG Contain at Least 2 Percent Oxygen Year-Round

Dear Mr. Perciasepe:

I am attaching a set of supplemental materials in support of California's request for a waiver under Clean Air Act section 211(k)(2)(B) from the requirement that federal reformulated gasoline contain at least 2.0 volume percent oxygen year-round. This waiver request was made in Governor Davis's April 12, 1999 to Administrator Carol Browner. The materials I am now transmitting are identical to the materials I gave you on June 21, 1999, except that Attachment 1 has been updated to reflect the emissions comparison based on the federal complex model.

I believe that our analysis presents a substantial and compelling justification for the requested waiver. Please call me at (916) 445-4383 if you have any questions. Your staff can address any questions to Dean Simeroth at (916) 322-6020 on technical issues, and to Tom Jennings at (916) 323-9608 on legal issues.

Sincerely,

Mike

Michael P. Kenny
Executive Officer

Attachment

Basis for a Waiver From the Federal RFG 2.0 Percent Oxygen Requirement For California As Authorized in CAA §211(k)(2)(B)

California believes that U.S. EPA can and should waive the year-round 2.0 percent by weight (wt.%) oxygen requirement for federal reformulated gasoline (RFG) in each of California's three federal RFG areas. This waiver is justified by the technical analysis of the California Air Resources Board (ARB) that maintaining the federal 2.0 wt.% oxygen requirement after MTBE has been phased out of California gasoline will diminish the extent to which the *California* RFG regulations can achieve emission reductions over and above the reductions achieved by the federal program. This loss of additional benefits from the California program will interfere with attainment of the national ambient air quality standards for ozone, PM10 and PM2.5 in California's federal RFG areas.

Because California faces the most intractable air pollution problems in the nation, the ARB has designed the California RFG (CaRFG) program to achieve significantly greater overall emission reductions than those resulting from the federal RFG program. ARB is now developing its Phase 3 CaRFG rules. This is being done to eliminate the State's reliance on MTBE — which has been found to present an unacceptable threat to water supplies — and to enhance the emission reductions that the CaRFG program contributes to the State Implementation Plan (SIP). ARB's assessment shows that revised California rules accommodating a federal RFG requirement for 2.0 wt.% oxygen in the fuel year-round will necessarily be less effective in reducing vehicular emissions than would be the case if the rules could be based on oxygen-content flexibility. This loss of additional potential emission reductions from CaRFG would delay attainment of the ozone standards in all three of California's federal RFG areas, and threaten eventual attainment of the ozone and PM2.5 standard in the Los Angeles region.

The CAA § 211(k)(2)(B) waiver provision. CAA § 211(k)(2)(B) expressly authorizes U.S. EPA to waive the federal RFG year-round 2.0 wt.% minimum oxygen requirement, in whole or in part,

> "... upon a determination by the Administrator that compliance with such requirement would prevent or interfere with the attainment by the area of a national ambient air quality standard."

California's need for additional emission reductions in its three federal RFG areas. The emission reductions from the CaRFG program are critical to attainment of the national ozone standards, and are essential to compliance with the PM10 and PM2.5 standards. California needs to add measures to its ozone SIP to assure attainment, and any loss of reductions of NOx or ozone-forming hydrocarbons will interfere with the timely attainment of both the ozone standards.

Additional emission reductions achieved by the CaRFG rules. The current CaRFG rules, which have been applicable since 1996, require reductions in emissions of NOx and toxics that are substantially greater than the emissions reductions that will be required by the federal RFG Phase II rules that apply starting January 2000. Attachment 1 provides a comparison of the emission benefits of the two sets of rules, based on application of U.S. EPA's Complex Model. The NOx emissions reductions from the California program are more than twice the reductions required by federal RFG Phase II — the CaRFG rules achieve an *additional* overall NOx reduction of 8 percent. The toxics emissions reductions from the California program, on a potency-weighted basis, are about 20% greater than the corresponding emissions reductions from federal RFG Phase II. The VOC emission reductions required by the two programs are roughly equal.

Alternative Scenarios for Phase 3 CaRFG

On March 26, 1999, Governor Davis issued Executive Order D-5-99, which outlines California's action plan for removing MTBE from all California gasoline by December 31, 2002 at the latest. California is phasing out MTBE because of the threat it presents to the State's groundwater, surface water, and drinking water systems. ARB has initiated its Phase 3 CaRFG rulemaking with two fundamental objectives in mind — to make the total removal of MTBE from the State's gasoline feasible and practical, and to preserve or enhance the emission reductions achieved by the existing program after the phase-out of MTBE.

The Phase 3 CaRFG regulations will ultimately be implemented in one of two distinctly different regulatory environments. In one, the year-round 2.0 wt.% oxygen requirement would continue to be mandated by the federal RFG regulations, applicable to about 70% of all of California's gasoline. In the other regulatory environment, affirmative action on California's waiver request by U.S. EPA — and/or action by Congress — would allow for oxygen flexibility. ARB technical staff have analyzed likely scenarios for a Phase 3 CaRFG program under the two environments and the results of this analysis are contained in Attachment 2.

If the federal RFG 2.0 wt.% oxygen mandate is maintained after the phase-out of MTBE, it is clear that ethanol would be the only practical oxygenate. Three scenarios have been identified: (1) No use of MTBE and federal oxygen flexibility; (2) No use of MTBE and a federal RFG 2.0 wt.% oxygen mandate met by 5.7 vol.% ethanol; and (3) No use of MTBE and a federal RFG 2.0 wt.% oxygen mandate met by 10 vol.% ethanol. For each scenario, staff started with a hypothetical gasoline meeting all of the "flat" limits in the current CaRFG regulations. The staff next identified the changes in gasoline properties that refiners would necessarily have to make under the scenario, and identified the emissions impact of these changes. The staff then identified potential changes to the CaRFG standards that could be made to preserve the emissions benefits of the current program and to enhance those benefits to the extent feasible. Staff evaluated the feasibility of these changes to the CaRFG standards and their

overall emissions impact. The underlying details supporting the analyses are attached.[1]

The analyses of the scenarios demonstrate that California's ability to have oxygen flexibility should result in technologically feasible *increased* reductions of NOx of 1.5% and toxics of 2.5% for CaRFG after the phase-out of MTBE. The scenarios for using ethanol to meet a federal RFG 2.0 wt.% year-round oxygen mandate show that essentially all pentanes would have to be removed from gasoline just to preserve the existing hydrocarbon benefits. Also, taking sulfur down to zero — compared to 10 ppm for the oxygen flexibility scenario — still does not achieve the same NOx or toxics reductions. Additional changes to other CaRFG specifications would have to be made to provide these benefits. For 10% ethanol, it simply may not be possible at any cost to achieve the same benefits as the oxygen flexibility scenario. Finally, the zero sulfur requirement in both of the ethanol scenarios will make imports difficult if not possible.

The loss of NOx benefits that would result from maintenance of the federal RFG 2.0 wt.% oxygen mandate would prevent or interfere with attainment of the federal ozone, PM10 and PM2.5 ambient standards in California's federal RFG areas. There is accordingly a sound technical and legal basis for U.S. EPA to waive the federal RFG year-round 2.0 wt.% oxygen requirement for California's federal RFG areas. However, because the use of oxygen during the winter months does not threaten ozone attainment, it may be possible to retain a lesser oxygen averaging requirement. A waiver that retains an oxygen requirement of 2 wt.% for the four winter months which is approximately 0.6 wt.%, averaged over a year, and which allows any given fuel to contain zero and 3.5 wt.% oxygen, would therefore be appropriate.

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[1] The California Predictive Model was used for projecting exhaust emissions impacts and the Complex Model was used for evaporative emissions. The Predictive Model is the tool in the CaRFG regulations for allowing alternative CaRFG formulations that achieve equivalent exhaust emissions reductions. It is more useful than the federal Complex Model in determining the future emissions impacts of California gasoline for purposes of CAA §211(k)(2)(B) waiver analysis, because the underlying fleet more closely represents the future California fleet. As required under CAA §211(k)(10)(A), the Complex Model is based on representative 1990 vehicle technology. This limitation is not present in the oxygen waiver provision. The Predictive Model does not have an evaporative emissions element because the CaRFG limit for RVP — the parameter affecting evaporative emissions — is not allowed to vary.

SUMMARY OF GASOLINE MODEL PREDICTIONS

MODEL PREDICTIONS ARE COMPUTED FOR THE FOLLOWING FUEL PROPERTY VALUES.

Property	CAA Baseline	CA Phase 2 Avg. Limits.	CA Mean Predictive Model Limits	Actual 1996 CA Mean Fuel Properties	EPA Phase II RFG	CA Phase I Limits
RVP	8.7	7.0	7.0	6.8	6.7	7.8
E200/T50	41/218	50/200	49/201	51/197	49/202	44/212
E300/T90	83/329	92/290	88/307	89/302	87/311	83/330
Aromatics	32	22	24	23	25	34
Olefins	9.2	4	5.8	3.9	11	11
Oxygen	0	2	1.9	2.07	2.1	0
Sulfur	339	30	28	20	150	151
Benzene	1.53	0.8	0.7	0.55	0.95	2.0

MODEL PREDICTIONS (PERCENT CHANGE RELATIVE TO CLEAN AIR ACT BASELINE FUEL)

Pollutant	EPA COMPLEX MODEL PREDICTIONS				ARB PREDICTIVE MODEL PREDICTIONS				
	CA Phase 2 Avg. Limits	CA Mean Predictive Model Limits	Actual 1996 CA Mean Fuel Properties	EPA Phase II RFG	CA Phase 2 Avg. Limits	CA Mean Predictive Model Limits	Actual 1996 CA Mean Fuel Properties	EPA Phase II RFG	CA Phase 2 Avg. Limits Relative to CA Phase I Limits
Exhaust VOC	-18.3	-18.0	-19.1	-18.1	-30.0	-29.2	-30.6	-22.5	-17.4
Evap. VOC	-44.4	-44.4	-47.4	-48.8	-45.3	-45.3	-50.7	-53.3	-28.1
Total VOC	-28.2	-28.1	-29.9	-29.8	-35.4	-34.9	-37.7	-33.5	-21.2
NOx	-14.6	-13.9	-14.6	-6.8	-11.6	-11.0	-12.1	-5.0	-7.0
Exhaust Benzene	-42.3	-42.7	-46.1	-35.9	-51.7	-50.7	-54.6	-38.8	-50.8
Evap. Benzene	-68.2	-72.0	-79.0	-64.3	-47.7	-54.2	-64.0	-37.9	-60.0
Acetaldehyde	-21.0	-17.8	-19.3	-15.6	4.5	6.5	5.1	6.8	8.2
Formaldehyde	18.1	16.7	21.5	7.8	43.1	46.0	46.6	34.0	29.7
1,3-Butadiene	-33.3	-18.0	-32.2	-8.8	-34.1	-26.2	-36.3	-9.9	-31.3
POM	-18.3	-18.0	-19.1	-18.1	Not Estimated	Not Estimated	Not Estimated	Not Estimated	Not Estimated
Total Toxics	-34.5	-34.1	-37.0	-28.4	Not Calculated	Not Calculated	Not Calculated	Not Calculated	Not Calculated
PWT	Not Calculated	Not Calculated	Not Calculated	Not Calculated	-43.2	-39.6	-44.1	-26.6	-41.8

Scenario 1: No use of MTBE and no federal year-round 2.0 wt.% oxygen mandate

Step 1. Initial impact

(a) *Variations from current flat specifications*

Reduce oxygen content from 2.0 to 0.0 (due to removal of MTBE)

(b) *Initial impact, emissions and other*

NOx	-0.5%
THC	+3%
CO	+10%
Toxics	-0.5%

Loss of 11% volume

Step 2. Changes to CaRFG standards

Reduce RVP standard by 0.2 psi, from 7.0 to 6.8 psi.

Reduce sulfur standard by 30 ppm, from 40 ppm to 10 ppm.

Step 3. Feasibility

Requires some capital investment and an increase in operating costs to reduce RVP by 0.2 psi and reduce sulfur to 10 ppm, but both are feasible.

The 11% lost volume will have to be made up by importing or increasing production of alkylates (blendstocks), or importing fully complying gasoline.

Step 4. Cumulative emissions impact

NOx	-1.5%	
THC	-0.3%	(includes loss of reduction in ozone-forming potential from loss of CO emission reductions from 2.0 wt% oxygen)
CO	+10%	(doesn't apply when in CO winter nonattainment area)
Toxics	-2.5%	

Winter oxygenates where required, using ethanol at 2.0 wt.% oxygen:

CO	-0%
RVP	Summertime limits not applicable

Scenario 2: No use of MTBE but federal year-round 2.0 wt.% oxygen mandate met with 5.7 vol% ethanol

Step 1. Initial impact

(a) *Variations from current flat specifications*

RVP increases 1 psi from 7.0 to 8.0 psi (due to ethanol effect)

(b) *Initial impact, emissions and other*

NOx	neutral
THC	+13% (from 1.0 psi increase in RVP)
CO	neutral
Toxics	+5.7%

Loss of 6% volume

Step 2.A. Changes to CaRFG standards *equivalent* to changes for no oxygen mandate (Scenario 1)

Reduce RVP standard by 0.2 psi, from 8.0 to 7.8 psi.

Reduce sulfur standard by 30 ppm, from 40 ppm to 10 ppm.

Step 2.B. Changes to CaRFG standards *to achieve same benefits* as the no oxygen mandate (Scenario 1)

Further reduce RVP by 0.8 psi, from 7.8 to 7.0 psi

Further reduce sulfur by 10 ppm, from 10 ppm to zero

Step 3. Feasibility

A. Feasibility of Step 2.A. changes is same as in Scenario 1

B. Reduction of RVP would necessitate removal of all pentanes. This is more expensive than in Scenario 1 and results in a loss of volume of about 4%. Reducing sulfur to zero is technically very difficult and would effectively preclude gasoline imports, as little or none available with zero sulfur. The overall 10% lost volume will have to be made up by importing or increasing production of alkylates (blendstocks), or importing fully complying gasoline.

Step 4. Cumulative emissions impact

Step 2.A		Step 2.B	
NOx	-1%	NOx	-1.3%
THC	+8.8%	THC	-1%
CO	neutral	CO	neutral
Toxics	+3.3	Toxics	-1%

Winter oxygenates where required, using ethanol:

CO	-0%
RVP	Summertime limits not applicable

Scenario 3: No use of MTBE but federal year-round 2.0 wt.% oxygen mandate met with 10 vol% ethanol

Step 1. Initial impact

(a) *Variations from current flat specifications*

RVP increases 1 psi from 7.0 to 8.0 psi (due to ethanol effect)

(b) *Initial impact, emissions and other*

NOx	+2.6%
THC	+12% (from 1.0 psi increase in RVP)
CO	-5%
Toxics	+6.7%

Loss of 1% volume

Step 2.A. Changes to CaRFG standards *equivalent* to changes for no oxygen mandate (Scenario 1)

Reduce RVP standard by 0.1 psi, from 7.9 to 7.8 psi (after allowing a 0.1 psi credit for impact of CO reduction on ozone)

Reduce sulfur standard by 30 ppm, from 40 ppm to 10 ppm.

Step 2.B. Changes to CaRFG standards *to achieve same benefits* as the no oxygen mandate (Scenario 1)

Further reduce RVP by 0.6 psi, from 7.8 to 7.2 psi

Further reduce sulfur by 10 ppm, from 10 ppm to zero

Step 3. Feasibility

A. Feasibility of Step 2.A. changes is same as in Scenario 1

B. Reduction of RVP by 0.7 psi would necessitate removal of all pentanes. This is more expensive than in Scenario 1 and results in a loss of volume of about 5%. Reducing sulfur to zero is technically difficult and would effectively preclude all gasoline imports, as little or none available with zero sulfur.

Step 4. Cumulative emissions impact

Step 2.A	
NOx	+1.6%
THC	+7.2%
CO	-5%
Toxics	+4.4%

Step 2.B	
NOx	+1.3%
THC	neutral
CO	-5%
Toxics	+1.2%