

# Proposed Amendments Refining The California Phase 3 Reformulated Gasoline Regulations

November 18, 2004

California Environmental Protection Agency



**Air Resources Board**

# Overview

- ✦ **CaRFG3 Regulations Implementation Update**
  - Background
  - CaRFG3 Regulations
  - Ethanol Permeation
- ✦ **Proposed Amendment to CaRFG3 Regulations**
  - Recommendation

# Background



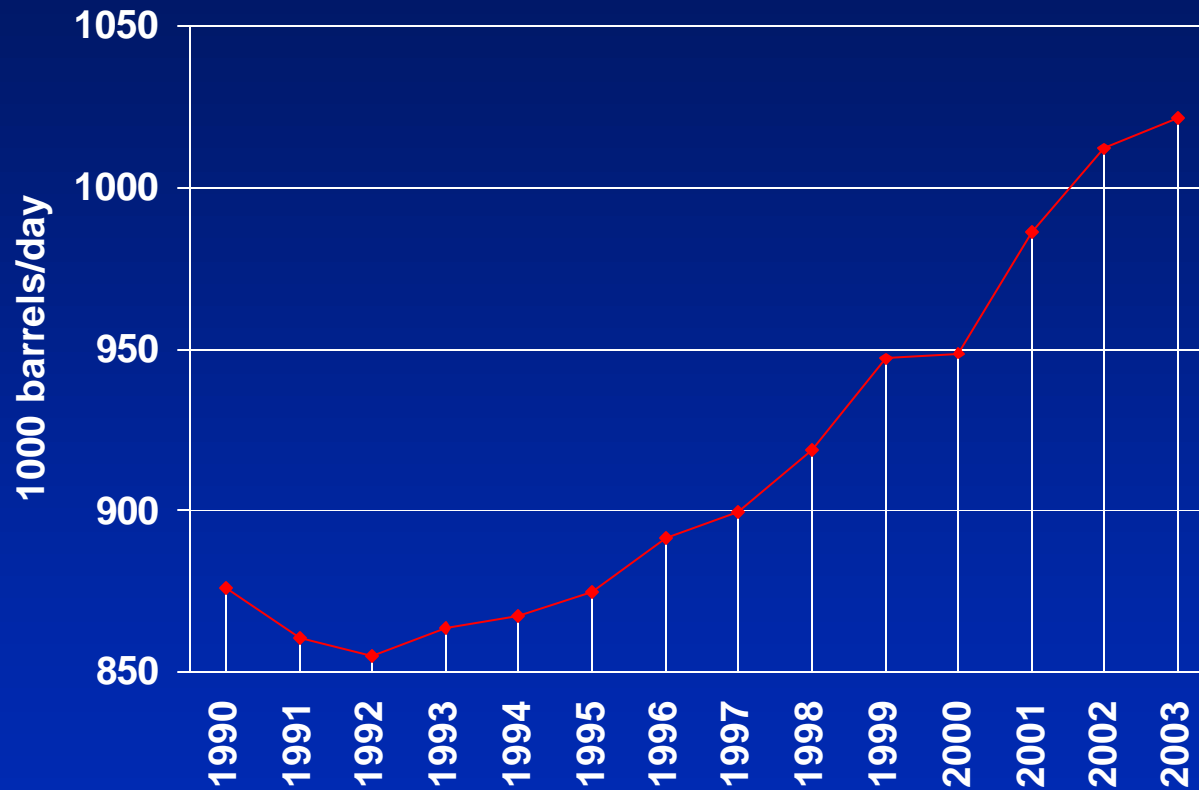
# California's Air Quality Problem

- ◆ 24 million gasoline-powered vehicles
- ◆ 1,250,000 diesel-fueled vehicles and engines\*
- ◆ 34.5 million people
- ◆ Over 90% of Californians breathe unhealthy air



\*October 2000 - Diesel Risk Reduction Plan

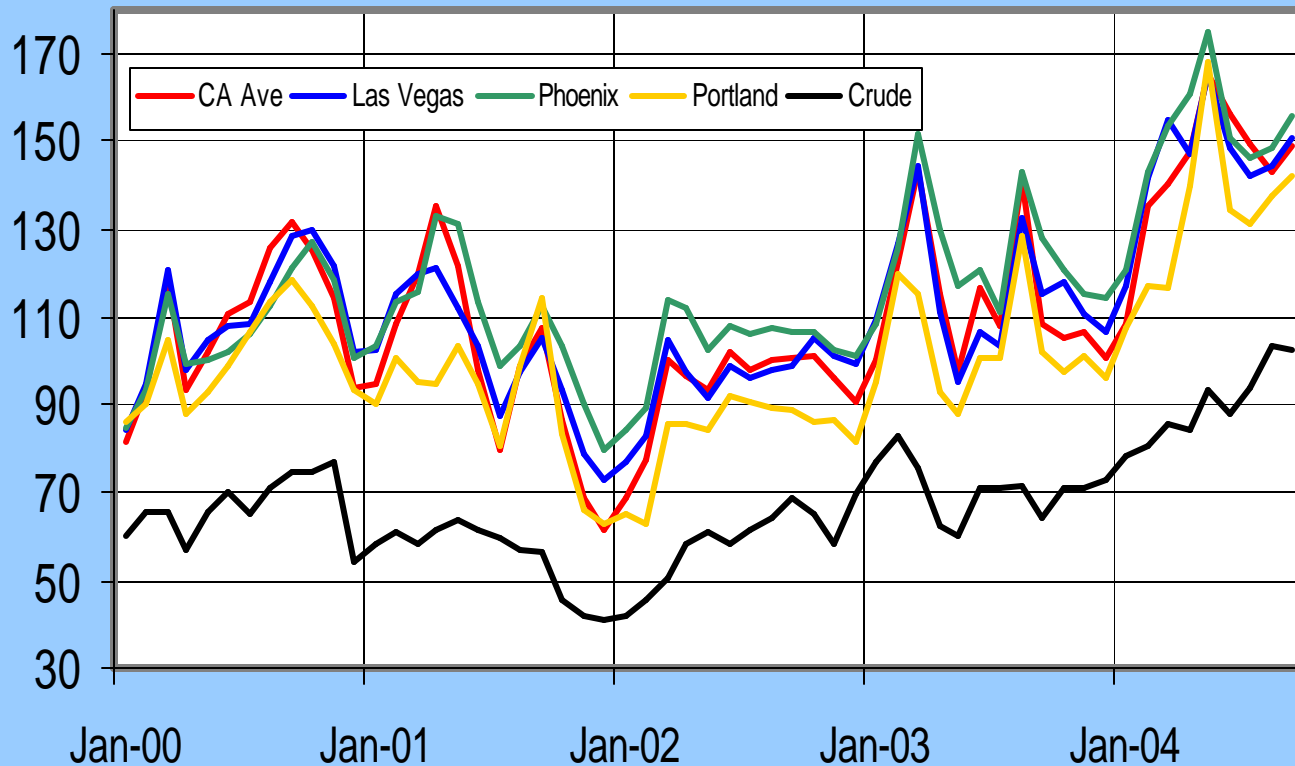
# Demand for Gasoline increased by 17% since 1990



# Gasoline Rack Price, 2000-2004

## Average CA vs. Las Vegas, Phoenix, and Portland

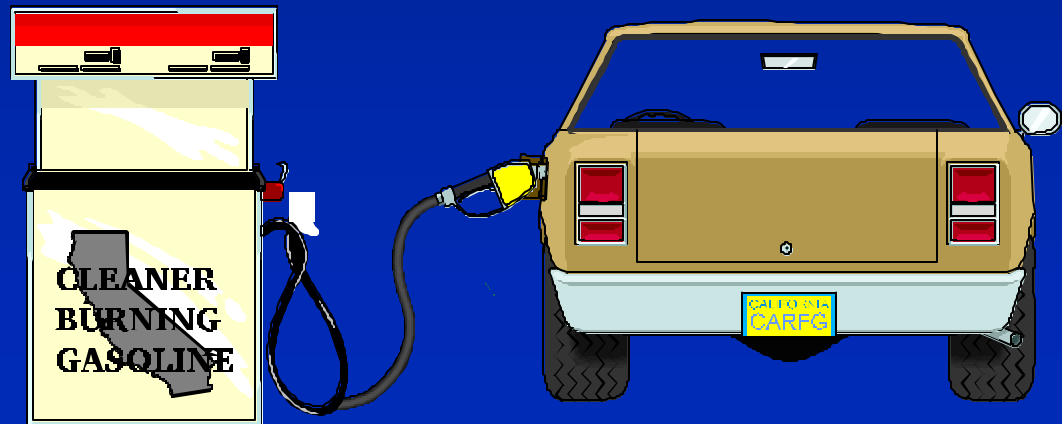
cents/gal



Source: Oil Price Information Service

# Motor Vehicle Fuels Control Strategy

- ✦ Treat vehicles and fuels as a system
  - Vehicle emission standards
  - Fuel standards
  - Include lubricants
- ✦ Flexible



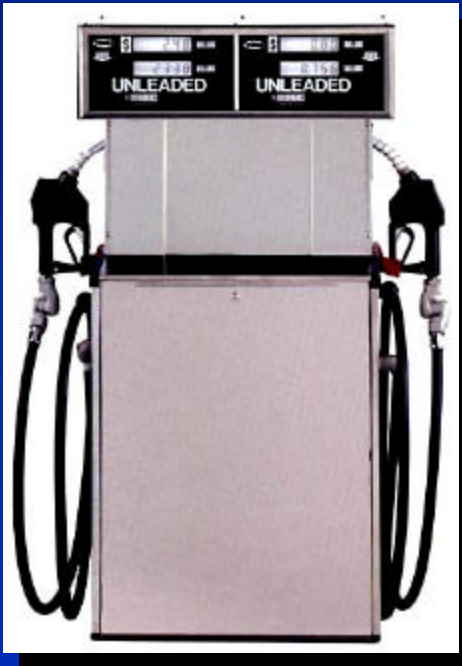
# California's Vehicle Fuel Programs

Year Adopted	Gasoline	Diesel	Alternative Fuels
1971	Reid Vapor Pressure Bromine Number	-----	-----
1975	Sulfur Manganese/Phosphorus	-----	-----
1976	Lead	-----	-----
1981	-----	Sulfur (SCAB)	-----
1982	Lead	-----	-----
1988	-----	Sulfur/Arom. HC	-----
1990	Phase 1 RFG -----	-----	Clean Fuels/LEV
1991	Phase 2 RFG Wintertime Oxygenates	-----	-----
1992	-----	-----	Commercial and Certification Specs
1994	Phase 2 RFG Predictive Model -----	-----	LPG (amended)
1998	Combustion Chamber Deposits (amended) Wintertime Oxygenates (amended) -----	-----	-----
1999	Wintertime Oxygenates (amended) -----	-----	LPG (amended)
2000	Phase 3 RFG (eliminates MTBE)	-----	Clean Fuels (amended)
2003	-----	Sulfur 15 ppm	-----



# CaRFG2 Program

- ◆ Adopted in 1991
- ◆ Implemented March 1996
- ◆ CaRFG2 Predictive Model



- ◆ Limits on eight gasoline properties:
  - 1). Sulfur
  - 2). T50
  - 3). T90
  - 4). Olefins
  - 5). RVP (Summertime)
  - 6). Benzene
  - 7). Aromatic hydrocarbons
  - 8). Oxygen content

# Benefits of CaRFG2

- ✦ Reduces smog forming emissions from motor vehicles by 15% (300 tons/day)
- ✦ Equivalent to removing 3.5 million vehicles from California's roads
- ✦ Contributes 25% of SIP reductions in 1996
- ✦ Reduces benzene emissions by about half
- ✦ Reduces potential cancer risk from vehicle emissions by 30-40%
- ✦ Fuel benefits are immediate

A vibrant sunset or sunrise over a field. The sun is low on the horizon, creating a bright glow and lens flare effects. The sky is filled with colorful clouds in shades of orange, pink, purple, and blue. The foreground shows a green field.

# CaRFG3 Regulations

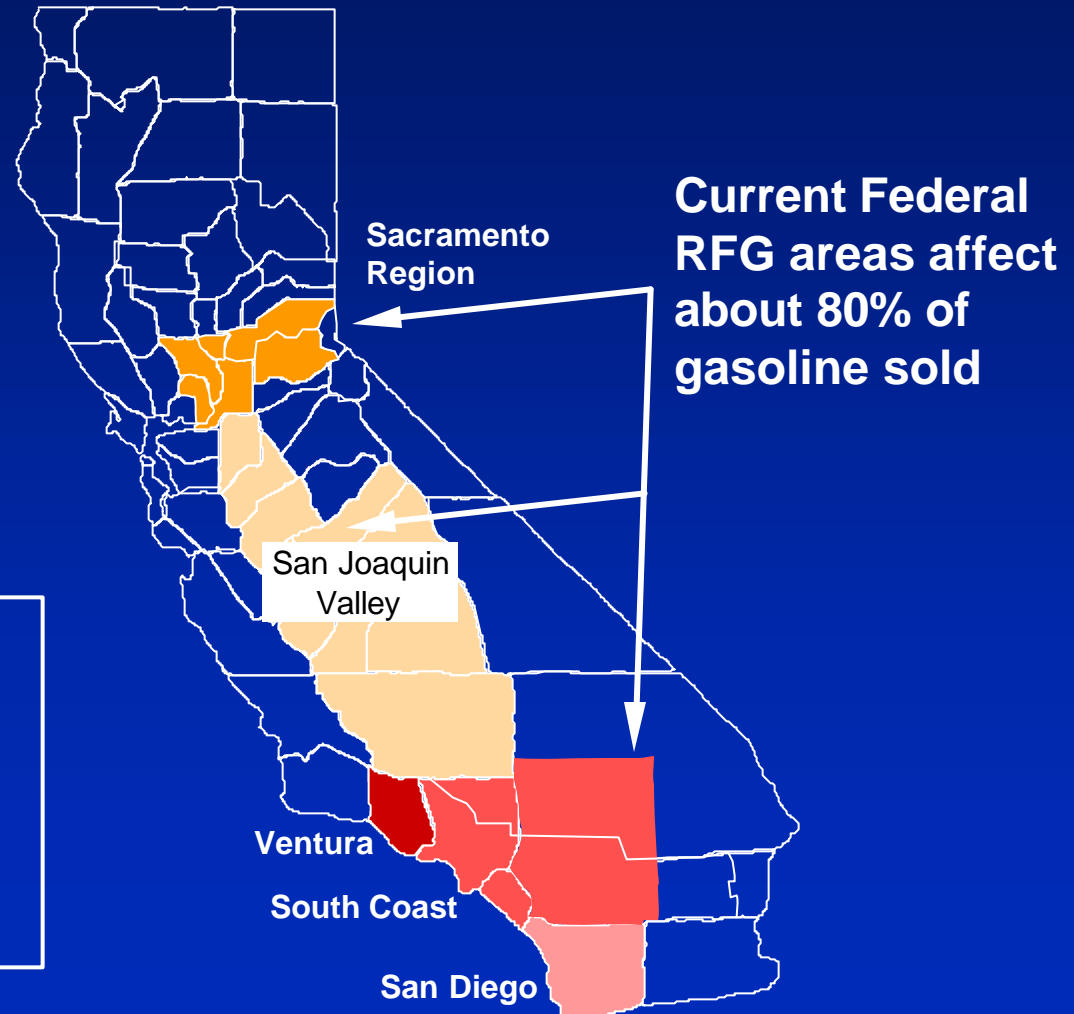
# CaRFG3 Regulations

- ✦ Approved December 9, 1999
- ✦ Implement the Governor's Executive Order
- ✦ Remove MTBE from California gasoline by December 31, 2003
- ✦ Provide additional flexibility to remove MTBE and use of ethanol

# Board Resolution 99-39

- ◆ In 1999, as part of the CaRFG3 rulemaking, the Board directed staff to:
  - Pursue an oxygenate waiver
  - Report on CaRFG3 sulfur levels
  - Investigate ethanol permeation issues

# Federal RFG Oxygenate Requirement Affects Most of the State



## Federal RFG Areas

- 1991 - San Diego  
South Coast Region  
Ventura
- 1995 - Sacramento Region
- 2002 - San Joaquin Valley

# Status of a Waiver Request

- ✦ On July 17, 2003 the 9th Circuit Court overturned the U.S. EPA's denial
- ✦ On January 29, 2004 Governor Schwarzenegger requested a waiver
- ✦ On February 2, 2004 Secretary Tamminen provided supplementary information to the U.S. EPA
- ✦ No response so far

# Benefits of a Waiver

## ✦ Refiners:

- Would result in reduced production costs from increased flexibility

## ✦ Consumers:

- Could see less gasoline prices at the pump

## ✦ Environment:

- Would reduce criteria pollutants: HC, NO<sub>x</sub>, and PM



# Implementation of CaRFG3

- ✦ California refining industry successfully phased-out MTBE at the end of 2003
- ✦ All refiners are producing CaRFG3
- ✦ California ethanol consumption:
  - About 900 million gallons/yr.
  - Almost all imported from the Midwest states

# In-Use Gasoline Properties

## (Sales Volume Weighted Average)

Properties	1998*	2004**
RVP (psi)	6.8	6.9
Olefin (vol%)	4.5	4.5
Aromatics (vol%)	23.4	22.5
T50 (oF)	201	209
T90 (oF)	310	306
Oxygen (wt%)	2.0	2.1
Sulfur (ppmw)	22	9
Benzene	0.59	0.54

**Source:** \*CEC survey (CaRFG2, MTBE oxygenate)

\*\*ARB survey (CaRFG3, ethanol oxygenate)

A dramatic sunset or sunrise over a field. The sun is low on the horizon, creating a bright glow and lens flare effects. The sky is filled with colorful clouds in shades of orange, pink, and purple. The foreground shows a green field. The text "Ethanol Permeation" is overlaid in the center in a blue, bold, sans-serif font.

# Ethanol Permeation

# Description of Ethanol Test Program

- ✦ In 2002, the CRC and ARB co-funded the study
- ✦ Ten vehicles:
  - 1978-2001 MY, CA in-use fleet
- ✦ Three CARB fuels:
  - Fuel A: MTBE
  - Fuel B: Ethanol @ 2.0 wt.% oxygen
  - Fuel C: non-oxy
- ✦ Test protocols:
  - Stabilize rigs at 105°F.
  - Measure permeation at 85°F, 105°F, and CA two-day diurnal.

# Typical Test Rig



# Test Results

- ✦ Two-day diurnal:
  - Ethanol fuel higher than MTBE on all vehicles and higher than non-oxy on almost all vehicles
- ✦ On Average, ethanol permeation increased:
  - 65% or 1.4 grams/day more than MTBE gasoline
  - 45% or 1.1 grams/day more than non-oxygenated gasoline

# Permeation Emissions Increase

- ✦ Study results do not directly provide the emissions impact of permeation
- ✦ Vehicle activity and fuel temperature data must be integrated to provide an appropriate temporal and spatial distribution of emissions
- ✦ Estimated on-road vehicles hydrocarbon emissions increase by 40-50 tons/day, statewide, 2004

# Estimated Permeation Emissions from Other Sources - Statewide

- ✦ Other sources:
  - Portable Fuel containers ~ 7 tons/day
  - Small offroad Engines ~ 10 tons/day
  - Refueling equipment ~ 1 ton/day
- ✦ Sources where data do not yet exist:
  - Offroad vehicles
  - Stationary & portable engines
  - Watercrafts
  - Others?



# How to Deal with the Hydrocarbon Emissions Increase from Ethanol Use?

- ✦ Hydrocarbon emissions increase well into the foreseeable future
  - New vehicle standards help
  - Slow turn over of fleet
- ✦ Report back to the Board next year
  - Better estimate of ethanol permeation impact
  - Measures to mitigate the impact



# Proposed Amendments to CaRFG3 Regulations

# Proposed Changes to the CaRFG3 Regulations

## ◆ Objectives:

- Clarifications, corrections, and improvements in compliance flexibility and enforceability
- ◆ Revise restriction on blending CARBOB with other products
  - Add provision to allow blending of transmix, limited amounts of California gasoline containing ethanol

# Proposed Changes to the CaRFG3 Regulations (continued)

- ✦ Revise RVP compliance requirements for CA gasoline transported to South Coast
- ✦ Delete CARBOB importer sampling, testing, and record-keeping requirement
- ✦ Revise requirements for documentation for transfer of denatured ethanol
- ✦ Miscellaneous improvements and corrections to enforcement language

# Impacts of Staff's Proposal

## ✦ Environment:

- No adverse effects
- No change to CaRFG3 specifications
- No change to the basic oxygenate prohibitions

## ✦ Costs:

- Potential benefit to: refiners, importers, ethanol suppliers, and consumers

# Recommendation

- ◆ The staff recommends that the Board adopt the proposed amendments to the CaRFG3 regulations.