

Proposed Amendments to the California Diesel Fuel Regulations

July 24, 2003

California Environmental Protection Agency



Air Resources Board

Overview

- ◆ **Background**
- ◆ **Staff Proposal**
- ◆ **Impacts of Proposal**
- ◆ **Peer Review**
- ◆ **Staff Recommendation**





Background

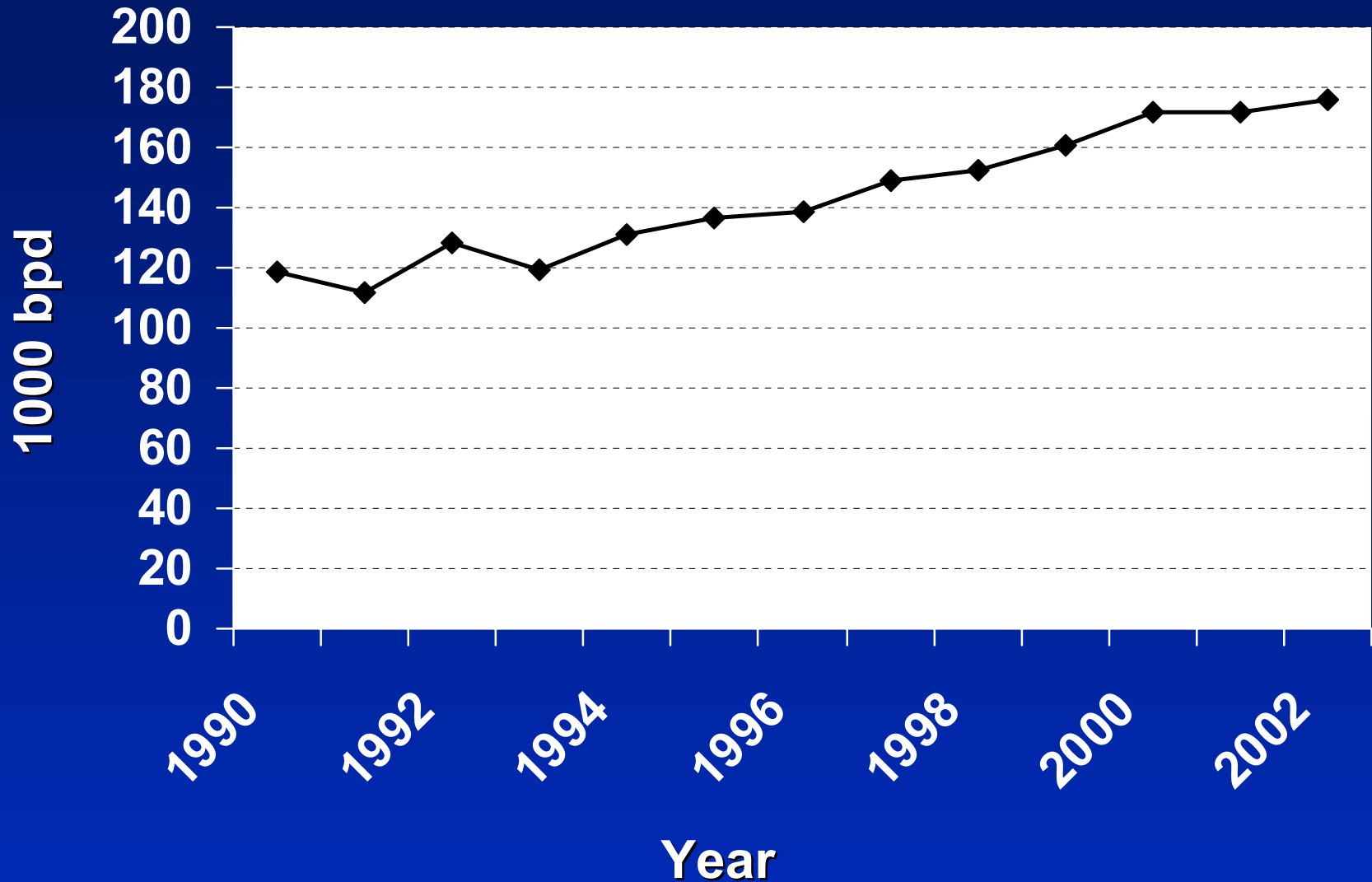
California's Air Quality Problem

- ◆ 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

Taxable California Diesel Fuel Sales



Contribution of Diesel Mobile Sources to Statewide Mobile Source Emissions in 2000^(a)

Pollutant	Percent of Statewide Mobile Source Total
PM ₁₀ ^(b)	72%
NOx	58%

- a. Off-road: The 2002 California Almanac of Emissions and Air Quality
On-road: EMFAC 2002 (V2.2)
- b. Directly emitted PM₁₀

Relative Contribution of Diesel Exhaust Emissions to Ambient PM_{2.5} Concentrations

	Total PM _{2.5}	Secondary PM ^(c)	
		Nitrate Fraction	Sulfate Fraction
SCAB	24%^(a)	48%	51%^(d)
SJVAB	26%^(b)	44%	51%^(d)

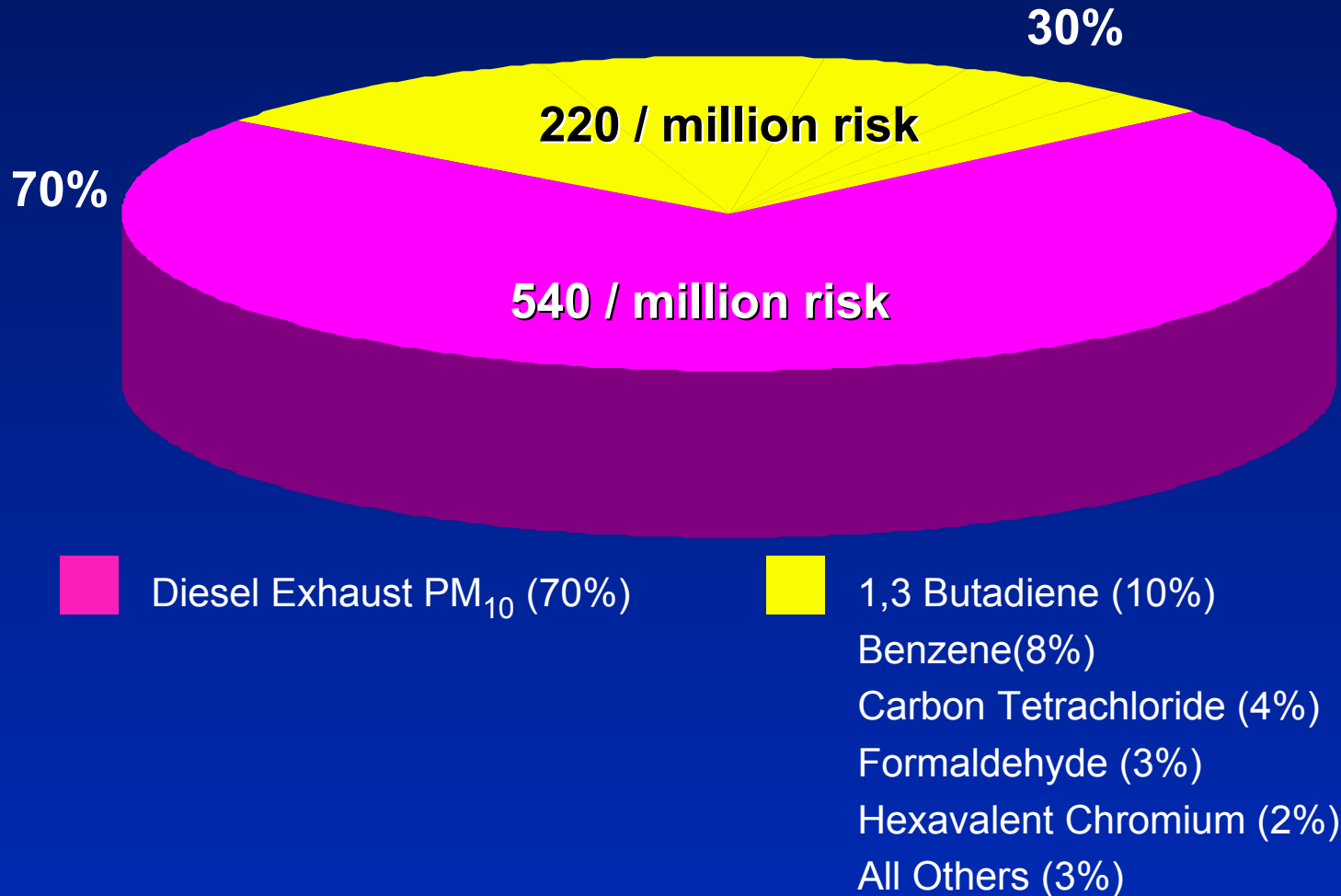
a. Schauer, Kleeman, and Cass, data from 1982, adjusted.

b. Schauer, Kleeman, and Cass, data from 1995-1996.

c. The 2002 California Almanac of Emissions and Air Quality

d. Statewide, data by air basin not available.

Diesel PM Responsible for 70% of Year 2000 Statewide Risk from Air Toxics Emissions*



*Air Resources Board Risk Reduction Plan

Mean California Morbidity and Mortality Effects Due to Diesel PM and NOx Emissions

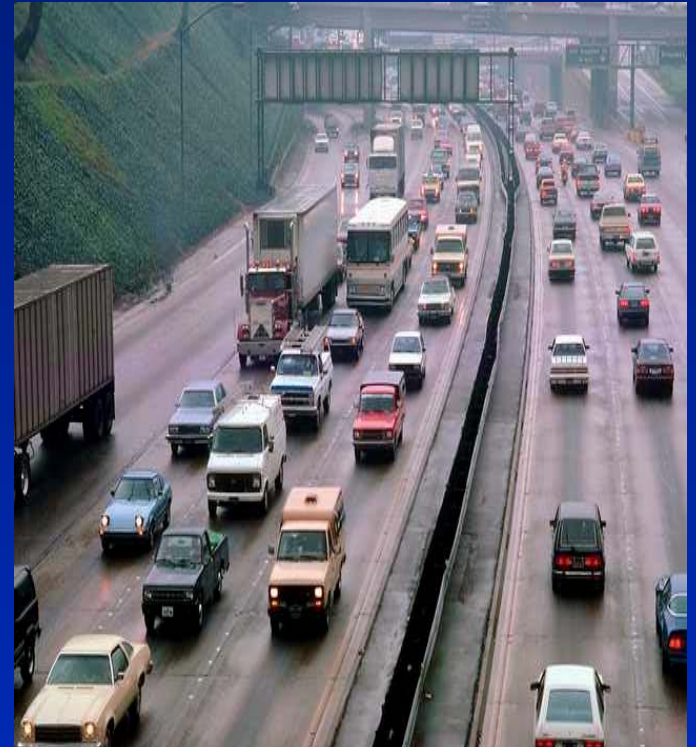
Morbidity	(cases/yr)
Chronic Bronchitis	2,600
Hospital Admissions	3,600
Asthma-related ER	1,700

Mortality	(deaths/yr)
Long-term Exp. (3 studies)	2,900 – 3,600
Short-term Exp. (4 studies)	700 – 2,500

Reference: ARB Memo, June 13, 2001.

Current California Diesel Fuel Regulations

- ◆ Implemented October 1993
- ◆ Applicable to diesel fuel sold for on-road and off-road motor vehicle use
- ◆ Provides flexibility by allowing certification of alternative formulations that maintain emissions benefits



Comparison of Current California and Federal Diesel Specifications

	California	Federal
Applicability	On- and Off-road	On-road
Specifications		
Sulfur	500 ppmw	500ppmw
Aromatic Hydrocarbons		
- Large refiners	10 vol. %*	35 vol.% or Cetane No \geq 40
- Small refiners	20 vol. %*	

* or equivalent alternative formulation

Effect of Regulations on Average Properties of Diesel Fuel^(a)

Specification	California		U.S. 1999
	Pre-1993	1999	
Aromatics, vol%	35	19	35
Sulfur, ppmw	440 ^(b)	140 ^(c)	360
Cetane No.	43	50	45

a. AAMA National Fuel Surveys

b. For Los Angeles area (greater than 3000 ppm in rest of California)

c. About 20 % of total California volume is < 15 ppmw

Emission Benefits of Federal and California Diesel Fuel Programs^(a) (tons/day - 2000 Emissions Inventory)

Pollutant	Federal	California ^(b)
SO ₂	64	85 (80%)
PM (Directly Emitted)	4	18 (25%)
NO _x	0	110 (7%)

a. Emissions reduction (tpd) relative to pre-1993 diesel

b. Percent reduction relative to pre-1993 California diesel

Emission Benefits by Air Basins (tons per day - 2000 Emissions Inventory)

Pollutant	Air Basins				
	SAC	SD	SF	SJV	SCAB
SO ₂	8	8	15	12	23
PM ₁₀ [*]	2	2	3	2	5
NOx	10	7	20	16	37

* Directly emitted

California Diesel Risk Reduction Plan

- ✦ Reduce diesel PM emissions and associated health risks by 85% by 2020
- ✦ Establish more stringent emission standards for new diesel engines
- ✦ Establish particulate trap retrofit requirements
- ✦ Require 15-ppmw sulfur limit for California diesel fuel

Other Diesel Fuel Programs

- ✦ U.S. EPA Diesel fuel sulfur requirements
 - **Adopted for on-road vehicles**
 - 15-ppmw limit effective in 2006
 - **Proposed for non-road engines**
 - 500 ppmw limit effective 2007 (excludes fuel for stationary sources)
 - 15-ppmw limit effective 2010 (excludes locomotive and marine engines)

Other Diesel Fuel Programs (cont.)

✦ South Coast AQMD Rule 431.2 - 15-ppmw sulfur limit

- Effective 2004 for stationary engines,
- Effective 2005 for motor vehicles
 - If ARB adopts, then implementation date for SCAQMD rule aligns with ARB's

Other Diesel Programs

✦ Transit Rule (ARB)

- Public Transit Bus Fleet Rule and Emission Standards for New Urban Buses approved Feb 2000

✦ Fleet Rule (SCAQMD)

- Shift public fleet with 15-vehicle or more to lower emissions or alternative fuelled vehicles

✦ School Bus

- The Lower-Emission School Bus Program approved December 2000
- ATCM to Limit School Bus Idling and Idling at schools adopted in Dec 2002



Staff Proposal


Summary of Staff Proposal

✦ Proposed Changes to Requirements of the Diesel Fuel Regulations

- Reduce CARB diesel sulfur limit to 15 ppmw
- Revise the requirements for certification of alternative diesel formulations
- Revise the sulfur specification for fuel used to certify diesel engines
- Other changes

Summary of Staff Proposal (cont.)

- ✦ **Proposal to increase flexibility**
- ✦ **New ATCM for nonvehicular diesel fuel**
- ✦ **New diesel fuel lubricity standard**



Proposed Changes to Requirements of the Diesel Fuel Regulations

Proposed Amendments to Sulfur Standard for California Diesel Fuel

- ✦ **Reduce the maximum allowable sulfur content from 500 ppm by weight (ppmw) to 15 ppmw**
 - Would apply to on-road and off-road diesel fuel
 - Effective June 1, 2006 – the same as EPA's implementation date for on-road diesel

The Proposed 15-ppm Sulfur Standard is Essential


- ✦ To enable new PM and NOx emissions control technologies**
- ✦ To enable the implementation of PM retrofit programs under the ARB's Risk Reduction Plan**

Proposed Amendments to the Requirements for Certifying Alternative Diesel Formulations

- ✦ **Revise the criteria for approving alternative diesel formulations**
 - will provide further assurance that new certified alternative formulations result in equivalent emissions to the 10-percent aromatic hydrocarbon standard

Other Proposed Changes

- ✦ **Change the allowable limit for sulfur in diesel fuel used to certify diesel engines**
- ✦ **Require a new test method that provides a more suitable detection limit and better precision for testing 15-ppm sulfur diesel**
- ✦ **Clarify the applicability of the diesel fuel regulations to ensure effective enforcement**



Proposal to Increase Flexibility

Proposal to Adopt New Equivalent Limits Option

- ✦ **An option for complying with the 10-percent aromatic hydrocarbon standard**
 - Allows refiners to meet a set of specified limits without undergoing testing
- ✦ **The limits are based on the average properties of certified formulations**
- ✦ **No change to the basic aromatic hydrocarbon standards**

Rationale for Proposed New Equivalent Limits Option


- ✦ Emission benefits of the California diesel fuel program are preserved
- ✦ Additional flexibility for refiners to comply with the 10-percent aromatic hydrocarbon standard
- ✦ Facilitate importation of diesel fuel into the California market



**Proposed ATCM for
Nonvehicular Diesel Fuel**

Proposed ATCM for Nonvehicular Diesel Fuel Standards

- ✦ Requires that California diesel fuel for stationary sources and other uses meet the same standards as California vehicular diesel fuel
- ✦ Needed to ensure emissions reductions required by diesel risk reduction plan for stationary engines and other sources



Diesel Fuel Lubricity Proposal

Background on Proposal to Adopt a Diesel Fuel Lubricity Standard

- ✦ Diesel fuel lubricity is the ability of diesel fuel to provide surface contact lubrication
- ✦ Refineries voluntarily implemented lubricity level recommended by 1994 Governor's Diesel Task Force
- ✦ Concerns
 - No ASTM lubricity standard
 - Advanced systems, becoming more prevalent, may require higher levels of lubricity

Current ASTM Activities

- ✦ **Lubricity standard passed at subcommittee level June 2003**
 - Maximum 520 micron WSD using HFRR for all grades of diesel
- ✦ **Commitment to evaluate future lubricity needs through CRC Diesel Performance Group**
 - CRC test program to investigate level of lubricity required by advanced technology high pressure fuel injection systems

Proposed Diesel Fuel Lubricity Standard

- ✦ **Add Section 2284. Lubricity of Diesel Fuel**
- ✦ **Two parts:**
 - Standard starting in 2004
 - Standard starting in 2006

Proposed Lubricity Standard Starting in 2004


- ✦ **Maximum WSD of 520 microns based on ASTM test method D6079-02 HFRR**
 - At least as protective as current California voluntary standard
 - Consistent with current ASTM ballot
- ✦ **90 day phase-in schedule starting August 1, 2004**

Lubricity Standard Starting in 2006

- ✦ **Reserved paragraphs for standard to protect new advanced fuel system technology**
 - Conduct technology assessment by 2005
 - Propose new lubricity standard to Board for 2006 if appropriate
 - Sunset lubricity standard if ASTM adopts lubricity standard

Rationale for Proposed Diesel Fuel Lubricity Standard

- ✦ **Need to ensure adequate fuel lubricity for fuel injection equipment**
 - Need to protect advanced technology equipment that is becoming more prevalent
- ✦ **Concern that additional processing to reduce diesel fuel sulfur content would reduce natural fuel lubricity**



Proposed Revision of Staff Proposal

Proposed Revision of Staff Proposal

- ✦ **Phase-in of 15-ppm sulfur limit at low-throughput facilities**
 - **Add provision to exempt fuel:**
 - Delivered prior to July 15, 2006
 - Delivered directly from a bulk plant prior to September 1, 2006
 - **Applicable to:**
 - retail outlets
 - bulk purchaser-consumer facilities

Proposed Revision of Staff Proposal (cont.)

- ✦ Modify definition of diesel fuel**
- ✦ Delete proposed section for downstream blending**

Proposed Revision of Staff Proposal (cont.)

- ✦ **Applicability of new candidate fuel requirements to previously certified diesel fuel formulations**
 - **Existing formulation with a candidate fuel not meeting the new specifications would no longer be effective if all of the following criteria apply:**
 - aromatic hydrocarbon content more than 3.5 times that of the reference fuel
 - sulfur, nitrogen, and PAH contents greater than that of the reference fuel
 - cetane number less than that of the reference fuel
 - **Decertification effective as of 90 days after the effective date of the amendments**

Proposed Revision of Staff Proposal (cont.)

- ◆ Add provision to sunset 2004 lubricity standard if:
 - ASTM adopts lubricity standard and DMS enforces

Proposed Revision of Staff Proposal (cont.)

- ✦ **Drop amendments to heavy-duty engine test procedures regarding California diesel test fuel**
 - Existing engine certification test procedures already specify 7-15 ppm sulfur diesel fuel for certification testing of 2007 and subsequent model year



Impact of Staff's Proposal

Effects of Staff Proposal on Emissions

- ✦ Enables use of new technologies for diesel engines which will result in significant additional reductions of diesel PM and ozone precursors (NO_x and NMHC) and reduced exposures to TACs
- ✦ Reduces SO_x emissions by about 90 percent or about 6.4 tons/day from 2000 levels
- ✦ Reduces direct diesel PM emissions by about 4 percent or about 0.6 tons/day for engines without PM emissions control

Other Environmental Impacts of Staff Proposal

- ✦ No known additional impacts on surface water, groundwater, or soil compared to current diesel fuel**
- ✦ Reduces atmospheric deposition of sulfuric acid and sulfates in water bodies**
- ✦ A multimedia environmental impact assessment will be prepared and reviewed by the California Environmental Policy Council prior to final adoption of the regulation**

Anticipated Costs

- ✦ **Cost estimates were based on:**
 - **Two surveys sent to California diesel refiners (April 2001 and March 2003)**
 - **Other studies, including U.S. EPA and SCAQMD**
- ✦ **Estimated capital costs to refineries of \$200 - \$300 million**
- ✦ **Estimated cost of the lubricity standard is 0.2 to 0.6 cents per gallon of diesel**

Estimated Production Cost for Low-Sulfur Diesel Fuel

- ✦ **Likely cost to California refiners estimated to be 2 to 3 cents per gallon of fuel**
 - Consistent with SCAQMD estimate of 1 to 3 cents
 - Lower than U.S. EPA estimate of 4 to 5 cents
- ✦ **Most of the cost would be incurred if no action is taken by the ARB**
 - Low sulfur diesel fuel regulations already adopted by the U.S. EPA and the SCAQMD



Peer Review of Staff's Proposal

Independent Peer Review of Staff's Proposal

- ✦ **Followed Cal/EPA's formal process for conducting peer review**

Recommendation

- ✦ **The staff recommends that the Board approve the proposed amendments**
- ✦ **The staff recommends that the Board direct staff to conduct a technology review and return to the Board in 2005 to address the appropriateness of the lubricity standard**