Proposed Amendments to the California Diesel Fuel Regulations

July 24, 2003

California Environmental Protection Agency

Air Resources Board

Overview

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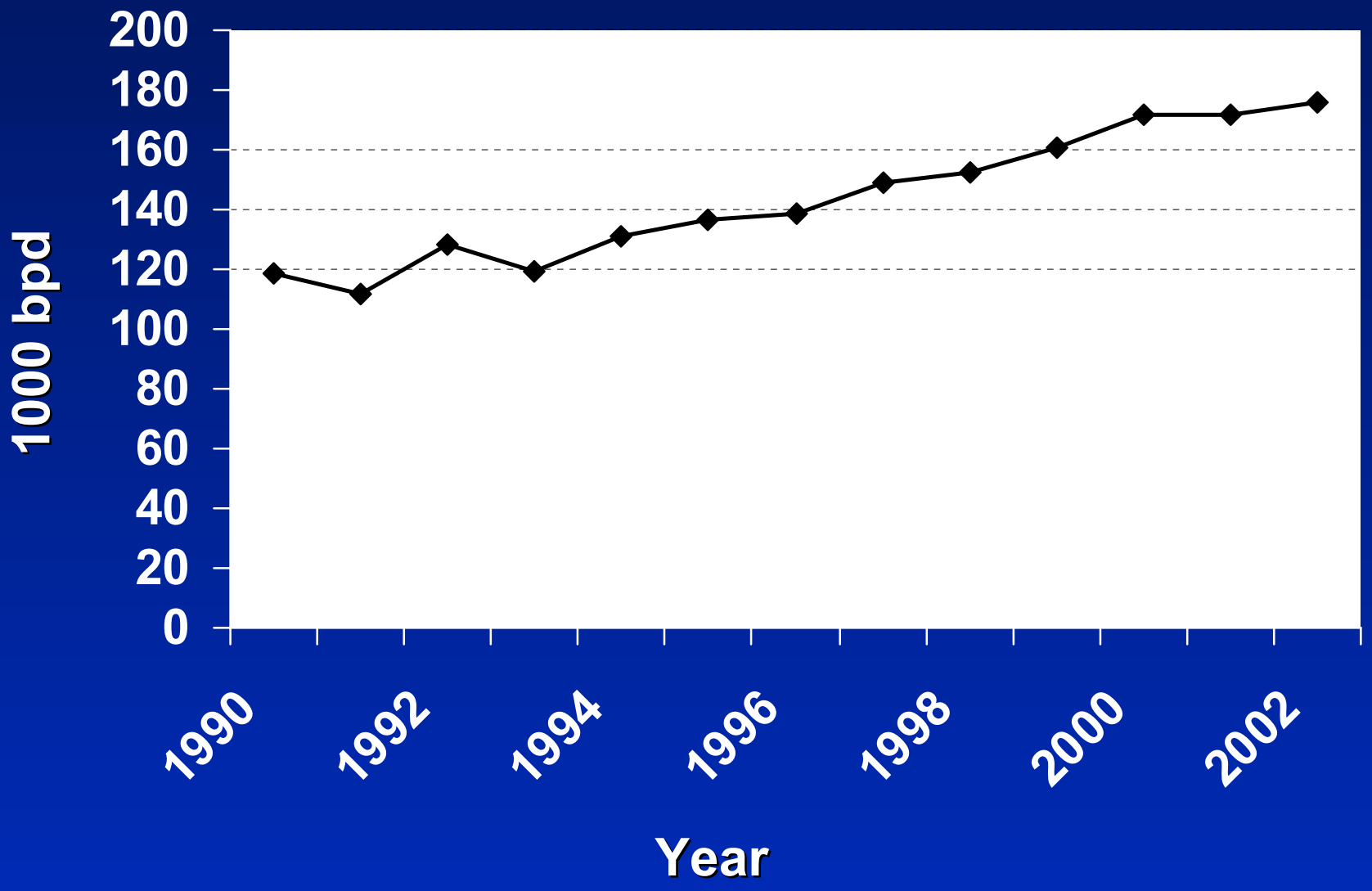
Background

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%

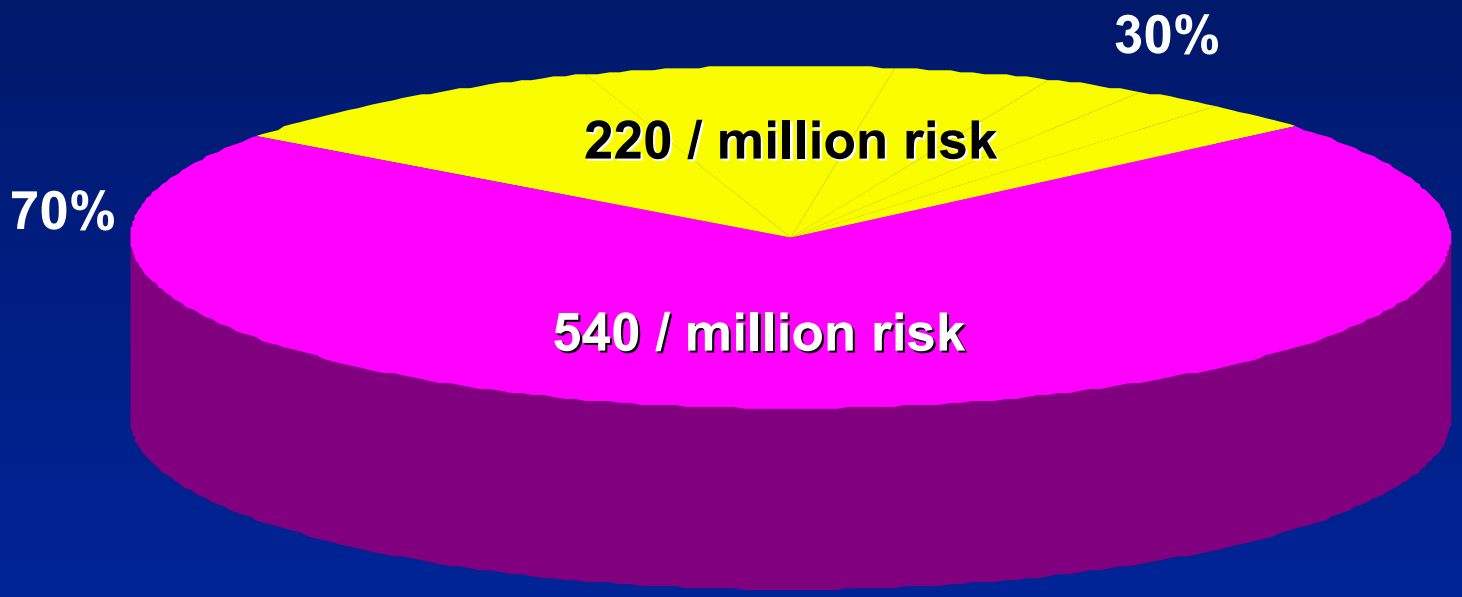
a. Off-road: The 2002 California Almanac of Emissions and Air Quality
   On-road: EMFAC 2002 (V2.2)
b. Directly emitted PM_{10}
   On-road:

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*



Diesel Exhaust PM_{10} (70%)

1,3 Butadiene (10%)
Benzene(8%)
Carbon Tetrachloride (4%)
Formaldehyde (3%)
Hexavalent Chromium (2%)
All Others (3%)

*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 ≥ 40
- Small refiners	20 vol. %*	

* or equivalent alternative formulation

Effect of Regulations on Average Properties of Diesel Fuel[(a)]

Specification	California Pre-1993	California 1999	U.S. 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 (NOx and NMHC) and reduced exposures to TACs
- Reduces SOx 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