

Strategy for Diesel Emission Reduction in California

Annette Hebert
California Air Resources Board

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Diesel Impacts

- Diesel NOx and ROG contribute to ozone and PM formation
- Diesel PM was identified as a toxic air contaminant in 1998
 - May cause or contribute to an increase in mortality or in serious illness, or which may pose a present or potential hazard to human health

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Significant Health Impacts Attributed to Diesel PM



- 2,900 premature deaths (3,700 car accident deaths, 2,000 homicides)
- 2,500 cases chronic bronchitis
- 600,000 lost work days
- 3.2 million minor restricted activity days

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Diesel Risk Reduction Plan

- Adopted 2000
 - 75 percent risk reduction by 2010
 - 85 percent risk reduction by 2020
- Multiple Strategies:
 - Stringent new engine standards
 - Cleaner diesel fuel (<15 ppm sulfur)
 - Ensure in-use emissions performance
 - Aggressive reductions from in-use engines

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Status of DRRP Implementation

- New engine standards
 - Trucks - **ADOPTED**
 - Off-road - **ADOPTED**
- Cleaner diesel fuel - **ADOPTED**
- Ensure in-use emissions performance
 - Recall testing - **AGREEMENT REACHED**
 - Engine Manufacturer Diagnostics - **ADOPTED**
 - On Board Diagnostics - **ADOPTED**
- In-use reductions
 - Mobile and Stationary Regulations - **12 ADOPTED**
 - Others - **PLANNED 2006/7**

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Existing Diesel Engines

Type of Diesel Engines	Calendar Year 2002
On-Road Trucks/Buses	620,000
Off-road equipment	500,000
Stationary and portable	60,000

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Adopted ARB Diesel PM Measures

- Transit agency fleet rule (2000)
- School bus idling (2002)
- Solid waste collection vehicles (2003)
- Stationary compression ignition engines (2004)
- Portable engines (2004)
- Transport refrigeration units (2004)
- Commercial vehicle idling (2004)

Adopted ARB Diesel PM Measures *(continued)*

- Locomotives/harborcraft fuel (2004)
- Transit fleet vehicles (2005)
- Public agency/utility on-road fleets (2005)
- Port/rail cargo handling equipment (2005)
- Ship auxiliary engine fuel (2005)

Future Regulations

- Harbor Craft
- Ocean Vessels - Propulsion Engines (Non-regulatory)
- Off-Road Equipment
- On-Road Privately Owned Fleets
- Agricultural Off-Road Equipment

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Anatomy of ARB's In-Use Regulations

- Use Best Available Control Technology
- Phase-in Based on Several Factors
 - Retrofit Availability (filters, catalysts)
 - New Engine Availability
 - Fuel Availability
- Compliance Flexibility

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Best Available Control Technology Approach

- Retrofit
 - Highest applicable level
- Repower
 - Newer engine
- Replacement
 - New diesel or alternative fuel vehicle
- Retire old vehicles
 - Reduce diesel fleet size

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Compliance Flexibility

- Allow additional time to repower engine if verified retrofit controls are not available
- Acknowledge needs of smaller fleets
- Evaluate approaches for very low usage fleets
- Consider early compliance credit

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Solid Waste Collection Vehicle Rule Adopted 2003

- Prevents 80 premature deaths at \$900,000 per premature death prevented
- Eliminates 2,260,000 lbs PM, 30,600 tons NOx + HC at an average cost per household of \$1 per year
- Phase-in: 2004-2010
- Requires BACT
 - For diesel engines
 - Must meet the 2007 PM standard, or
 - Meet current PM standard and install retrofit
 - Alternative-fuel or pilot ignition engine



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In-Use Rule Outreach Refuse Hauler Example

- Rulemaking
 - Refuse Hauler Workgroup
- Post-Rule Adoption
 - New Advisory Workgroup
 - Municipalities – Focused Efforts
 - Outreach Materials & Website Redesign
 - State-Wide Implementation Workshops
 - Promote Fair Cost Reimbursements

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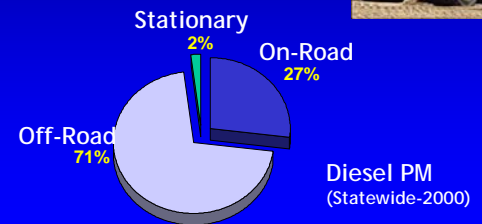
Municipal or Utility Owned On-Road Diesel Trucks Rule

- Adopted in 2005
- Applies to model years 1960 to 2006
- Diesel vehicles over 14,000 GVWR
- Vehicles owned and operated (includes leased vehicles) by municipality or utility
- Requires BACT
- Phased compliance through 2013
- Special provisions for low population counties

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Off-Road Equipment

- Largest source of mobile PM
- Will apply to construction, mining, and industrial off-road mobile equipment



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Concepts Being Considered

- Apply BACT
 - Retrofit with diesel emission control system (VDECS)
 - Must meet the Tier 4 PM standard, or
 - Meet current PM standard and install retrofit
 - Alternative-fuel engine
- Repower with a newer, cleaner engine
- Replace equipment with equipment with a newer, cleaner engine
- Rent newer, cleaner equipment
- Eliminate unnecessary idling

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Alternative to BACT

Fleet average path

- Average emissions level off all off-road vehicles
- Required to meet decreasing emissions limits
- Fleet average – declining fleet average target

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Impacts of Adopted In-Use Programs

Fleet	Affected Population	Cost (million \$)	% of all Diesels
Urban buses	10,300	103	2%
Other Transit	4,050	18.7	
Refuse trucks	11,900	155	
School buses	3,500	76	
TRUs	38,500	87-158	3%
Stationary	21,000	47	5%
Portable	33,000	350-420	
Other	3,600	39	
TOTALS	125,850	959-1029	10%

Diesel Emission Control Strategy Verification Process

- Description of the strategy or device
- Test data, field experience, & test plan
- Durability requirements - 50,000 miles or 1,000 hours
- Field demonstration of 10,000 miles or 200 hours
- Performance under real-world conditions
- Warranty requirements – 150,000 miles for HHD trucks

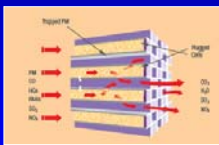
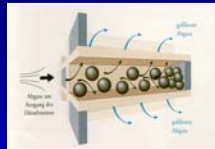
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Verified Technology

Level 1 (25 - 50% Reduction)

Diesel Oxidation Catalyst, SCR

9 Systems Verified; Diesel Oxidation Catalysts, some with crankcase filter
1988 and newer on and off road vehicles



Level 2 (50 - 85 % Reduction)

Flow-Through-Filter, DOC, & Emulsified Diesel Fuels

3 Systems Verified; Flow Through Filter, Alternative Fuel, & DOC + Alt Fuel
1988 through 2003 on and off road vehicles

Level 3 (> 85 % Reduction or ≤ 0.01 g/bhp-hr)

Active and Passive Diesel Particulate Filters

12 Systems Verified; All Diesel Particulate Filters
Currently only works on 1994 and newer engines



EPA Reciprocity

- Facilitate the Verification Process
 - Applicant Involves both EPA and ARB at Start of the Verification Process
 - Allows for Simultaneous Review by Both Programs
 - Potentially Allows Testing and Data to be Appropriate for Both Programs
- For Hardware Based Strategies Like DOCs and DPFs
- No Agreement for Fuel Based or SCR Technologies
- EPA Requires SOF Testing, ARB Requires NO₂ Testing

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Incentive Programs

- Carl Moyer Program
- Lower Emission School Bus Program

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Carl Moyer Program Core Principles

- A state and local partnership
 - ARB sets guidelines
 - Local districts administer the program
 - Districts match funds
- Provide incentive grants to obtain emission reductions from vehicles and equipment that are real, quantifiable, surplus, and enforceable
- Environmental justice funding requirement

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Carl Moyer Program Years 1-6

- On-going success led to six annual appropriations
 - total of \$154 million in funding
 - funded an estimated 7,000 engine projects
- Estimated emission reductions through Year 6
 - NOx: 16 tons per day
 - PM: 1 ton per day
- Cost-effectiveness: \$3,000 per ton of NOx reduced

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Carl Moyer Program 2004 Expansion

- Continued funding through 2015
 - \$140 million per year
- Expand pollutants to include PM & ROG
- Incorporate light-duty projects (e.g., car scrap)
- Incorporate on-road fleet modernization (heavy-duty scrap)
- Expand program to include agricultural sources

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Cleaner School Bus Program

- To reduce health and safety risks to California's school children
- \$76 million during first 4 years (2000-2004)
 - > 500 old buses retired
 - 3,000 School Buses Retrofitted
- 2005-2006 budget includes a one-time allocation of \$25 million
- Estimated reductions from 2005 to 2020
 - 12 tons NOx
 - 8 tons PM

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Summary

- In-use diesel strategies are essential for attainment and toxic risk reduction
- Costs are high, but benefits are higher
- Incentives help tremendously
- National mandates should also be considered
- Off-road sources are a top priority

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For Further Information

- General Information:
<http://www.arb.ca.gov/diesel/dieselrrp.htm>
- Verifications:
<http://www.arb.ca.gov/diesel/verdev/verdev.htm>
- Diesel Mobile Programs:
<http://www.arb.ca.gov/diesel/mobile.htm>
- Carl Moyer Program
<http://www.arb.ca.gov/msprog/moyer/moyer.htm>
- Lower-Emission School Bus Program
<http://www.arb.ca.gov/msprog/schoolbus/schoolbus.htm>

- **Annette Hebert, Branch Chief**
Heavy Duty Diesel In-Use Strategies
ahebert@arb.ca.gov (626) 575-6973
- **Kathleen Mead, Retrofit Implementation**
Trash Truck, Public/Private Utilities Onroad & Transit Fleet (Non Urban Buses) Measures
kmead@arb.ca.gov (916) 324-9550
- **Shawn Daley, Retrofit Assessment**
Retrofit Verification
sdaley@arb.ca.gov (626) 575-6972
- **Tony Brazil, In-Use Control Measures**
Offroad and Private Onroad Control Measures
abrazil@arb.ca.gov (916) 323-2927

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