ARB’s Diesel Emissions Programs

California Bus Association
October 16, 2007

Kathleen Mead, Manager
Retrofit Implementation Section
Mobile Source Control Division

ARB’s Diesel Emissions Programs

Presentation Outline

- Background
- Diesel Emission Controls Strategies
- Existing Regulations
- Regulations In Development
  - On-Road In-Use Heavy Duty
Where California Needs Regional Reductions

8-hr Ozone Annual

PM 2.5 Annual

Diesel PM Identified as a Toxic Air Contaminant
Today's Health Risks Attributed to Diesel PM

- 3,700 Premature Deaths
- 8,500 Chronic Bronchitis Cases
- 100,000 Asthma Attacks and Respiratory Symptoms
- 2,200 Hospital Admissions
- 620,000 Lost Work Days
- 3.6 Million Minor Restricted Activity Days

Emission Reduction Goals

- **PM strategies intended to:**
  - Reduce exposure risk
  - Reduce mortality
  - Address environmental justice concerns

- **NOx strategies intended to:**
  - Attain ambient air quality standards
  - Reduce mortality
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

Why Reduce In-use Diesel Emissions?

• Diesel Engines are Long Lived
• New Engine Standards Offer Long Term Reductions
• In-use Emission Rules Provide Near-Term Reductions
• Control Technology is Available
Regulatory Framework for Reducing In-Use Diesel Emissions

- Repower
- Retire
- Use Alternative Fuels
- Retrofit

ARB Verification Program

- Protects the end user
  - by ensuring after-market diesel emission control strategies obtain claimed emission reductions, and
  - by providing a warranty.
- Verified products based on model year and engine family

http://arb.ca.gov/diesel/verdev/verdev.htm
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
  - 10,000 miles or 200 hours
- Performance under real-world conditions
- Warranty requirements
  - 150,000 miles for HHD trucks

PM Verification Levels

- **Level 1**: 25 - 50% Reduction
- **Level 2**: 50 - 85% Reduction
- **Level 3**: > 85% Reduction or ≤ 0.01 g/bhp-hr
Verification of NOx Reductions

\[ \text{NOx Reduction} \geq 15\% \]

Verified Technology

Level 1 (25 - 50% Reduction)
Diesel Oxidation Catalyst, some with crankcase filter.

Level 2 (50 - 85% Reduction)
Flow-Through-Filter, Emulsified Diesel Fuel, DOC + Emulsified Diesel Fuels

Level 3 ( > 85% Reduction or \( < 0.01 \) g/bhp-hr )
Active and Passive Diesel Particulate Filters
**Diesel Oxidation Catalyst (DOC)**

- **Level 1 PM Reduction (25-49%)**
- **Large Reduction in Toxics**
  - Carbon monoxide and HC (90%)
- **Nearly Universal Application** with
  - Millions of Retrofits Worldwide
- **Tens of Millions of OE Applications**

**Flow Through or Partial Flow Particulate Filters**

- **Level 2 PM Reduction (50-75%)**
  - Options include catalyzed filter elements or DOC + uncatalyzed filter
  - Has applicability on older engines (e.g., 1991 and newer)
  - Minimum exhaust temperature requirements for regeneration
  - Filtering achieved with sintered metal sheets (shown) or wire meshes
  - Resistant to plugging
Wall Flow Filters Offer the Highest Filtration Efficiency

- Level 3 PM reduction (>85%)
- Large reduction in toxics
  - With catalyst-based filters
- Many ARB verified level 3 filters have minimum exhaust temperature requirements for regeneration (passive)
- Passive DPFs generally applicable to 1994 and newer engines
- > 200,000 Retrofits worldwide
- > 2 Million OE Applications
- Similar filter technology to new 2007 diesel trucks.

Diesel Particulate Filter (DPF)

Currently Verified Technologies: Level 3

http://www.arb.ca.gov/diesel/verdev/vt/cvt.htm

<table>
<thead>
<tr>
<th>Level 3</th>
<th>Product Name</th>
<th>Technology Type</th>
<th>PM Reduction</th>
<th>NOx Reduction</th>
<th>Applicability</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPF</td>
<td>Clean Air Systems, CleanAire</td>
<td>DPF</td>
<td>85%</td>
<td>26%</td>
<td>1994-2003 model year on-road, 15 ppm sulfur diesel.</td>
</tr>
<tr>
<td>DPF</td>
<td>Donohoe EPM</td>
<td>DPF</td>
<td>85%</td>
<td>N/A</td>
<td>1994-2003 on-road, 15 ppm sulfur diesel.</td>
</tr>
<tr>
<td>DPF</td>
<td>International Truck and Engine Corporation, DPF</td>
<td>DPF</td>
<td>85%</td>
<td>N/A</td>
<td>1994-2003 on-road, 15 ppm sulfur diesel.</td>
</tr>
<tr>
<td>DPF</td>
<td>Johnson Matthey DPF</td>
<td>DPF</td>
<td>85%</td>
<td>N/A</td>
<td>1994-2003 on-road, 15 ppm sulfur diesel.</td>
</tr>
</tbody>
</table>
Muffler is located on the lower road side rear. It exhausts downward below the bumper.

Basic Exhaust
DPF Installed in lieu of Muffler

Existing Regulations
Existing Regulations

- Heavy Duty In-Use Inspection Program (1997)
- Urban Buses (2000)
- Stationary Engines (2004)
- Transportation Refrigeration Units (2004)
- Portable Engines (2004)
- Transit Fleet Vehicles (2005)
- Public HDV Fleets (2005)
- AB 1008 Requirements - Engine Labels (2006)
- Off-Road Engines (2007)

Heavy Duty Vehicle Inspection Program:
Looking for Excessive Smoke and Tampering

- Updated regulations adopted by ARB in December 1997
- Opacity cutpoints retained
  - 1991+ engines: 40%
  - pre-1991 engines: 55%
- Use of SAE J1667 test protocol
- Looking for tampered engines & emission control equipment (gasoline & diesel engines)
- Administrative appeals through Administrative Law Judge (ALJ) hearing process
**Fleet Rule For Transit Agencies**

- Vehicles owned by or operated for Public Transit Agencies
  - Urban Buses
    - powered by or a type normally powered by a heavy heavy-duty diesel engine (>33,000 gvwr)
    - Urban Bus Engine certification required
    - In-Use Fleet Requirements
  - Transit Fleet Vehicles
    - Diesel or alternative fueled vehicle greater than 8,500 gvwr, powered by a heavy-duty engine and not an Urban Bus
    - In-Use Fleet Requirements

**School Bus Idling at Schools**

- Applicable to:
  - Buses and Heavy-duty Vehicles
  - All Fuel Types
  - At or Within 100 Feet of K-12 School
    - includes school bus stops and school activity destinations
  - Immediately turn off engine and restart 30 seconds before departing
- More Information:
  - [http://www.arb.ca.gov/regact/sbidling/fro.pdf](http://www.arb.ca.gov/regact/sbidling/fro.pdf)
Commercial Motor Vehicle Idling

- All commercial on-road diesel-fueled vehicles operating in California with GVWR > 10,000 pounds
- Applies to CA based and non-CA based vehicles operating in CA

Commercial Vehicle Idling Regulations

- Limits the idling to no longer than 5 minutes.
- Cannot idle within 100 feet of residence or school
- Limits diesel-fueled auxiliary power system (APS) to no longer than 5 minutes to a power heater, air conditioning, or any ancillary equipment unless sleeper cab in use and 100 feet from residence or school
- Buses
  - Allowed 10 minutes prior to passenger boarding
  - No limit when passengers onboard
AB 1009 Requirements

- ARB, in consultation with the CHP, adopted regulations January 1, 2006
- Regulations prohibit HDDVs with non-USEPA certified engines from operating in California
- All HDDEs must have a factory engine certification label - NTC issued – no violation if fixed within 45 days, $500 if not
- ARB and CHP to enforce regulations starting in 2007

Regulation in Development
On-Road In-Use Heavy Duty Vehicle Control Measure
Scope and Applicability

- All on-road heavy-duty diesel vehicles operating in California
  - Trucks, buses, motor homes, cranes, other
- Includes vehicles designed to be driven on-road, even though they might not be registered to be driven on-road
- Any person, business, or government agency who owns, sells or operates vehicles in California
- Excludes engines subject to other in-use regulations

Best Available Control Technology (BACT) Standard for Phase 1

- NOx exhaust emissions less than or equal to NOx emissions from a 2004 model-year heavy-duty diesel engine, AND
- PM exhaust emissions less than or equal to 0.10 g/bhp-hr PM plus retrofit with highest level DECS.
Proposed Phase 1 BACT Schedule

<table>
<thead>
<tr>
<th>Engine Model Years</th>
<th>Compliance Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre – 1994</td>
<td>December 31, 2009</td>
</tr>
</tbody>
</table>

Next Workshop Series

- October 18, Redding
- October 19, San Diego
- October 22, Sacramento (webcast)
- October 23, Fresno
- October 24, El Monte
- October 25 , Oakland
On-Road In-Use HD Control Measure
Contacts

Erik White, Chief
Heavy-Duty Diesel In-Use Strategies Branch
ewhite@arb.ca.gov
(916) 322-1017

Tony Brasil, Manager
In-Use Control Measures Section
abrasil@arb.ca.gov
(916) 323-2927

Gloria Lindner, Lead
On-Road In-Use HD Control Measure
glindner@arb.ca.gov
(916) 323-2803

Jackie Johnson
jjohnson@arb.ca.gov
(916) 323-2750

Ron Nunes
rnunes@arb.ca.gov
(916) 327-0376

www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm
1-866-6Diesel

Other Contacts

Diesel Activities:
www.arb.ca.gov/diesel/diesel.htm

Kathleen Mead, Manager
Retrofit Implementation Section
kmead@arb.ca.gov
(916) 324-9550