ARB’s Heavy-Duty Vehicle Smoke Inspection Program

Presented to the Diesel Engine Emissions Reduction Conference by Paul E. Jacobs, Chief Mobile Source Enforcement Branch, August 2000
Overview

• ARB’s Heavy-Duty Vehicle Smoke Inspection Program (Roadside Inspections, Fleet Inspections)

• Related Topics/Issues
• The Problem

• History of the Program, 1988 - 1996

• History of the Program, 1997 - present
The Problem

- HDDV: 2%
- LDV & MDV: 98%

% of Total On-Road Vehicles

% of On-Road Vehicle Emission Inventory

- NOx: 30%
- PM$_{10}$: 65%
<table>
<thead>
<tr>
<th>Constituent</th>
<th>Detrimental Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particulates (PM$<em>{10}$/PM$</em>{2.5}$)</td>
<td>Carcinogenic/Mutagenic Respiratory Disease</td>
</tr>
<tr>
<td>HC &amp; NOx (Smog Precursors)</td>
<td>Ozone (smog)</td>
</tr>
<tr>
<td>NOx &amp; SOx</td>
<td>Acid Deposition</td>
</tr>
<tr>
<td>Toxic Air Contaminants</td>
<td>Carcinogenic</td>
</tr>
</tbody>
</table>
Blue smoke is caused by unburned engine oil mixed in the exhaust.

White smoke is caused by drops of unburned liquid fuel and water vapor.

Black smoke is caused by incomplete combustion (wasted fuel).

Source: ATA, EMA “On the Road to Clean Air”
Mechanical Causes of Excessive Smoke

- Restricted air filter
- Improper injection timing
- Clogged, worn or mismatched fuel injectors
- Faulty fuel injection pump
- Defective or maladjusted puff limiter
- Low air box pressure

- Improperly adjusted governor
- Air manifold leaks
- Malfunctioning turbocharger
- Malfunctioning aftercoolers
- Maladjusted fuel rack
- Defective air fuel controller
- Poor fuel quality
- Improper driving gear

Source: ATA, EMA “On the Road to Clean Air”
History of the Heavy-Duty Vehicle Smoke Inspection Program 1988 - 1996
Initial Roadside Inspections

- Roadside smoke inspections required by legislation in 1988 (SB 1997, Presley)
- Initial regulations adopted 1990
  - Intrastate/interstate/ international vehicles
  - Inspections performed at roadside locations
  - Used SAE J1243 test protocol
  - Smoke opacity limits:
    - 1991+ engines: 40%
    - pre-1991 engines: 55%
- Program enforced from 1991 to 1993
Initial Fleet Inspections

- Fleet inspections required by legislation in 1990 (SB 2330, Killea)
- California fleets of two or more vehicles
- First regulations adopted in 1992; voluntary enforcement
- Annual self-inspection
- ARB audits
Initial Roadside Inspections - Litigation

- Valley Spreader et al. v. ARB
  Imperial County Superior Court
  1993 decision for ARB
  Upheld the program and test procedures

- Harris Transportation et al. v. ARB
  Sacramento County Superior Court
  1994 decision for ARB
  Upheld the program and test procedures
  Upheld by 3rd District Court of Appeals (Sacramento);
  California Supreme Court denied review

- Aura Hardwood et al. v. ARB
  Sacramento County Superior Court
  1994 decision for ARB
  Upheld the program and test procedures
  Upheld by 3rd District Court of Appeals (Sacramento);
  California Supreme Court denied review

- Viviano et al. v. ARB
  Sacramento County Superior Court
  1997 decision for ARB
  Upheld the program and test procedures
  Upheld by 3rd District Court of Appeals (Sacramento);
  California Supreme Court denied review
• Committee established in 1992
• Diverse membership: (ARB, US E.P.A., EMA, ATA, CTA, smokemeter manufacturers, other states, academia)
• Test protocol and smokemeter specifications
• Adopted by SAE in February 1996
• Consistent and repeatable tests
• No false failures (unless remedied without cost to owner)
• Adoption of SAE J1667 satisfies requirements
History of the Heavy-Duty Vehicle Smoke Inspection Program
1997 - present
Updated Roadside Inspections

- Updated regulations adopted by ARB in December 1997
- Opacity cutpoints retained
  - 1991+ engines: 40%
  - pre-1991 engines: 55%
- Use of SAE J1667 test protocol
- Administrative appeals through Administrative Law Judge (ALJ) hearing process
- Enforcement resumed June 1, 1998
<table>
<thead>
<tr>
<th>Violation</th>
<th>Correction</th>
<th>Penalty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notice of Violation</td>
<td>Repaired within 45 days</td>
<td>$0</td>
</tr>
<tr>
<td>First citation</td>
<td>Repaired within 45 days</td>
<td>$300</td>
</tr>
<tr>
<td>First citation</td>
<td>Not repaired within 45 days</td>
<td>$800 ($300 + $500)</td>
</tr>
<tr>
<td>More than one citation in a year</td>
<td>Repaired within 45 days</td>
<td>$1,800 ($300 + $1,500)</td>
</tr>
</tbody>
</table>
Updated Periodic Fleet Inspections

• Revised regulations adopted December 1997
  – Same cutpoints as roadside program
  – Uses SAE J1667 test protocol
  – Four-year rolling exemption

• Commenced July 1, 1998

• 15-month phase-in
### Statewide Benefits (tons per day)

<table>
<thead>
<tr>
<th>Year</th>
<th>ROG</th>
<th>NO(_x)</th>
<th>PM(_{10})</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>6.4</td>
<td>12.2</td>
<td>5.2</td>
</tr>
<tr>
<td>2010</td>
<td>5.3</td>
<td>14.0</td>
<td>3.2</td>
</tr>
</tbody>
</table>

*(EMFAC 7g)*
### Annual Costs (Combined Roadside and Fleet Programs)

<table>
<thead>
<tr>
<th></th>
<th>1999</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative Costs to Fleets</td>
<td>$17 million</td>
<td>$22 million</td>
</tr>
<tr>
<td>Costs to Vehicle Owners</td>
<td>$24 million</td>
<td>$20 million</td>
</tr>
<tr>
<td>Fuel Costs (Savings)</td>
<td>-$22 million</td>
<td>-$25 million</td>
</tr>
<tr>
<td><strong>Total Net Costs of Both Programs</strong></td>
<td>$19 million</td>
<td>$17 million</td>
</tr>
</tbody>
</table>

**Note** - Gallons of fuel saved: in 1999 - 16.7 million, in 2010 - 19.2 million
<table>
<thead>
<tr>
<th>Year</th>
<th>Cost Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>$1.12/pound*</td>
</tr>
<tr>
<td>2010</td>
<td>$1.05/pound*</td>
</tr>
</tbody>
</table>

*(ROG, NOx, PM-10)
## Roadside Inspections Statistics

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>No. Visual Inspections</td>
<td>38,947</td>
<td>43,098</td>
</tr>
<tr>
<td>Number of Citations</td>
<td>8,492</td>
<td>2,485</td>
</tr>
<tr>
<td>Number of NOVs</td>
<td>N/A</td>
<td>761</td>
</tr>
<tr>
<td>Total Violations</td>
<td>8,492</td>
<td>3,246</td>
</tr>
<tr>
<td>Failure Rate</td>
<td>22%</td>
<td>7.5%</td>
</tr>
<tr>
<td>Number Appealed</td>
<td>1,157 (14%)</td>
<td>65 (2.0%)</td>
</tr>
<tr>
<td>Penalties Assessed</td>
<td>$2,613,300</td>
<td>$ 756,000</td>
</tr>
<tr>
<td>Penalties Collected</td>
<td>$2,061,500 (79%)</td>
<td>$ 626,142 (82%)</td>
</tr>
</tbody>
</table>

Penalties Assessed and Collected for

*Roadside Inspections*
- 14,000+ fleets in state
- 56,000+ terminals in state (CHP 2000 BIT database)
- ARB audits these fleets/terminals for compliance
- Phase-in period ended October 1, 1999
- Activity to date:
  - 2,210 fleets audited
  - Compliance rates:
    - 51% show full compliance
    - 45% partial compliance
    - 4% require formal enforcement action
Outreach Activities

• Compliance assistance to fleets
• Presentations to associations
• Technical papers/presentations
• Mailouts
• Pamphlets/fact sheets
• Information on ARB website
• ARB to release updated video in fall 2000
California Council on Diesel Education and Technology

- Partnership: Community colleges, government, industry
- Low-cost training of smoke-test protocol and smoke-related engine repairs
- ARB audits classes for QA/QC
- Participating Schools:
  - College of Alameda (Oakland)
  - San Joaquin Delta College (Stockton)
  - L.A. Trade Tech College (Los Angeles)
  - Palomar College (San Diego County)
  - Santa Ana College (Orange County)
  - San Diego Miramar College
• National HDD I/M Guidance
• On the Road to Clean Air
• Enforcement at the Mexican Border
• Dyed Diesel Inspections
• Repair Effectiveness Study
• Use of Penalty Funds
• Smoking Vehicle Complaint Line
• M-17 Heavy-Duty Diesel Vehicle I/M
• Adopted February 1999
• ARB program serves as model
• Recommends nationwide use of SAE J1667 test protocol
• Recommends cutpoints (adjusted for altitude):
  – 40% for 1991+
  – 55% for pre-1991
• Other states/provinces with smoke programs:
  Arizona, Colorado, Connecticut, Maryland, Nevada, New Jersey, New York, Ohio, Utah, Washington, British Columbia and Ontario (Canada), Jalisco (Mexico), and others
On the Road to Clean Air

• Campaign co-sponsored by:
  – American Trucking Association
  – Engine Manufacturers’ Association
  – Supported by ARB

• Video, pamphlet, public service announcements and press releases - Spring 1997

• Strong anti-tampering message
Enforcement at the Mexican Border

- Legislation (Peace) in 1998 authorized:
  - 3 PYs for fulltime enforcement at Otay Mesa
  - Funding for inspection site improvements at Otay Mesa
  - Calexico full-time positions and site improvements authorized in current budget

- 2,200 commercial trucks cross into California at Otay Mesa each day

<table>
<thead>
<tr>
<th></th>
<th>Calexico*</th>
<th>Otay Mesa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspections</td>
<td>441</td>
<td>3,198</td>
</tr>
<tr>
<td>Citations</td>
<td>38</td>
<td>306</td>
</tr>
<tr>
<td>NOVs</td>
<td>3</td>
<td>90</td>
</tr>
<tr>
<td>Failure rate</td>
<td>9.3%</td>
<td>12.4%</td>
</tr>
</tbody>
</table>

* Data through June 30, 2000
Dyed Diesel Inspections

- Dyed diesel is a tax-free fuel intended for use in public fleets and non-road (agriculture and construction) vehicles

- ARB performs inspections for Board of Equalization
  - Concurrent with roadside inspections
  - Approximately 25,000 inspections per year
Cooperative project of ARB, American Trucking Association Foundation, Engine Manufacturers, and regulated industry

Determine effectiveness of various repairs for reducing smoke

Goal is to make recommendations to vehicle owners on effective repair strategies
• **Diesel Emissions Reduction Fund**
  - $300 portion of citation
  - Funds research for clean diesel technology
  - Provided $2.7 million, to date, towards research
  - Current program to support Advanced Technology Program and Carl Moyer Program low-NOx technology incentives

• **Vehicle Inspection and Repair Fund**
  - Funds from the portion of a citation that is greater than $300
  - Funds used for ARB, BAR (Smog Check) and other clean air programs
Smoking Vehicle Complaint Line

- Toll-free number and toll-free cellular telephone number available for motorists to report smoking vehicles: 1-800-END-SMOG or #SMOG on cellular telephone.
- ARB sends owner a courtesy letter alerting them that their vehicle is emitting excessive smoke.
- ARB receives approximately 1,500 calls each year.
- Approximately 45% of owners repair their vehicles.
• Board adopted M-17 SIP Amendment in February 1997
• Heavy-Duty Diesel Engine test cycles under development
On-road heavy-duty diesel vehicles produce a disproportionate amount of California’s NOx and Particulates.

ARB administers two-part program to reduce smoke emissions from these vehicles.

Program is cost-effective and achieves significant emissions reductions.

Program has become model for national and international programs.