DIESEL RETROFIT PROGRAM

Proposed Solid Waste Collection Vehicle Rule
Sept. 2001

California Environmental Protection Agency

Air Resources Board

Workshop Topics

- Workshop 1 (June 2001)
- Workshop 2 (September 2001)
  - Revised proposed regulation
  - Verification of emission control systems (ECS)
  - Cost effectiveness
70% Air Toxic Risk from Diesels

- Diesel PM (70%)
- Other Air Toxics (30%)
  - 1,3 Butadiene (10%)
  - Benzene (8%)
  - Carbon Tetrachloride (4%)
  - Formaldehyde (3%)
  - Hexavalent Chromium (2%)
  - All Others (3%)

540 / million risk
220 / million risk

Diesel Risk Reduction Plan (DRRP)

- Reduce Emissions from New Engines
- Ensure In-use Emission Performance
- Provide Low Sulfur Fuel (<15ppm) to Enable Aftertreatment Technology
- **Require Retrofit of Existing Engines**
Mobile Diesel PM Retrofit Rules

- Public Transit Bus Fleets (Feb. 2000)
- Solid Waste Collection Vehicles (Dec. 2001)
- Fuel Tanker Trucks (2002)

Proposed Rule Draft - Scope

- Definition of “Refuse Removal Vehicle” Changed to “Solid Waste Collection Vehicle”
  - HDDV greater than 14,000 lbs. GVWR
  - Used to collect residential and commercial waste
  - Front, side and rear manual and automatic loaders
  - Rolloffs
  - Fixed route generally
Proposed Rule Draft - Standards

- In-Use Engine Performance Standards:
  - Diesel PM certified to 0.01 g/bhp-hr
- Engines that Already Meet Standard:
  - Diesel PM certified to 0.01 g/bhp-hr
  - Alternative-fueled
- If Engine Doesn’t Meet Standard:
  - Retrofit using highest verified level ECS
  - Repower
  - Convert to alternative-fueled

Alternative Fueled Definition

- Alternative-fueled Defined
  - *Natural gas*
  - Propane
  - Ethanol
  - Methanol
  - Electricity
  - Fuel cells
  - Non-diesel fuel advanced technologies
  - These fuels used in combination with each other or in combination with other non-diesel fuels.
Dual Fuel = Alternative Fueled?

- Dual Fuel or Hybrid-electric Vehicles 0.01 g/bhp-hr diesel PM Emissions = Alt. Fueled Exempt
  - No solid waste collection vehicles meet explicitly
- Other Dual Fuel Collection Vehicles (>0.01 g/bhp-hr PM Emissions)
  - LNG dual fuel vehicles with Executive Orders
  - San Diego refuse hauler study
  - Implementation delay to Tier 3
  - Further study

Proposed Rule Draft - Retrofit

- Retrofit using an ECS
  - Verified to the highest level diesel PM emission reduction capability
    - Level 1 = between 30 and 60%
    - Level 2 = between 60 and 85%
    - Level 3 = greater than 85%, or 0.01 g/bhp-hr absolute
Retrofit - Current Status

- ECS have been Verified that Meet Level 3 85% PM Emission Reduction Goal
- Applications
  - Trucks (refuse, fuel tanker, long haul)
  - Buses (urban and long haul)

Retrofit - Collection Vehicles

- 67% Surveyed in California
- 65% Cummins Engines
- 13% M-11/ISM have Verified ECS
- No DDC Engines in Survey Meet Criteria
- More Verified ECS to Come
Proposed Rule Draft - Repower

- Repower Engine to a Certified 0.01 g/bhp-hr PM Emission Standard
  - Definition
    - Rebuilt, replaced, remanufactured
    - California certified kit or engine
    - Meets required certified PM emission level
  - Diesel engine certified to 0.01 g/bhp-hr PM emission standard
  - Diesel engine certified to 0.1 g/bhp-hr + ECS
  - Converted to alternative fueled engine

Proposed Rule Draft - Deadlines

<table>
<thead>
<tr>
<th>Tier</th>
<th>Deadline</th>
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<tbody>
<tr>
<td>TIER 1</td>
<td>7/1/2004 to 7/1/2006</td>
</tr>
<tr>
<td>TIERS 2</td>
<td>7/1/2006 to 7/1/2008</td>
</tr>
<tr>
<td>TIERS 3</td>
<td>7/1/2007 to 7/1/2009</td>
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ALL COLLECTION VEHICLES USE LOW SULFUR DIESEL BY 7/1/2003
Proposed Rule Draft - Deadlines

<table>
<thead>
<tr>
<th>Tier</th>
<th>Engine Model Year</th>
<th>Fleet %</th>
<th>Implementation Date</th>
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<tbody>
<tr>
<td>1</td>
<td>1991-2002</td>
<td>25%</td>
<td>2004</td>
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<tr>
<td></td>
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<td>50%</td>
<td>2005</td>
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<td>2006</td>
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<td>2</td>
<td>Pre-1991</td>
<td>25%</td>
<td>2006</td>
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<tr>
<td></td>
<td></td>
<td>50%</td>
<td>2007</td>
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<tr>
<td></td>
<td></td>
<td>100%</td>
<td>2008</td>
</tr>
<tr>
<td>3</td>
<td>2003-2006</td>
<td>25%</td>
<td>2007</td>
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<td></td>
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<td>2008</td>
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<tr>
<td></td>
<td></td>
<td>100%</td>
<td>2009</td>
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</tbody>
</table>

Proposed Rule Draft - Fuel

- Low Sulfur Diesel Fuel Used in all Diesel-fueled Collection Vehicles by July 1, 2003
- Application for Delay
  - Fuel/fuel infrastructure availability
    - Apply for delay to 7/1/2006
    - Documentation due to ARB by 1/31/2003
  - If fuel exemption granted, owner’s Tier 1 vehicles moved to Tier 2 implementation schedule
Proposed Rule Draft - ECS

- Compliance Extension
  - No ECS available by six months prior to the vehicle model year’s implementation date
  - Apply for one-year delay with annual report
  - Verifications announced by January 1st of each calendar year ➔ Automatic delays
  - After the one-year delay, engine must use another method to meet the standard

Proposed Rule Draft - Reporting

- INITIAL REPORT TO ARB BY 1/31/2003
- ALL COLLECTION VEHICLES USE LOW SULFUR DIESEL BY 7/1/2003
- ANNUAL REPORTS TO ARB BY
  1/31/2004
  1/31/2005
  1/31/2006
  1/31/2007
  1/31/2008
  1/31/2009
  1/31/2010
- TIER 1
  7/1/2004 to 7/1/2006
- TIER 2
  7/1/2006 to 7/1/2008
- TIER 3
  7/1/2007 to 7/1/2009
Proposed Rule Draft - Reporting

♦ Reporting Made Easier
  ▪ Initial report
    • Contact information
    • Vehicle/engine inventory
    • Retrofit information
  ▪ Annual report
    • Changes to initial report
  ▪ Maintenance and inspection records

Capital Costs

♦ Lowest Cost System:
  ▪ ECS
    • Average $2540 (range $630-$5500)
  ▪ Installation
    • Similar to muffler
    • Average $290 (range $160-$480)
  ▪ Engine backpressure monitor (~$1000)
  ▪ Costs not accounted for:
    • Training - included with cost of ECS
Operation & Maintenance Costs

- Low Sulfur Diesel Fuel
  - ~$0.06/gal extra

- Incremental Fuel Transportation
  - Average $230 (range $70 - $400) annually
  - Depends on distance, load, and frequency
  - Cost from 2003 - 2005

- Increased Maintenance/ECS Cleaning
  - Visual inspection
  - One cleaning per year
  - Average cost $80

Negligible Ash Disposal Fee

- Ash disposal from ECS cleaning
  - 10 - 15 grams per disposal
  - Once per year
- Manage with Other Hazardous Wastes
Cost Per Vehicle

<table>
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<tr>
<th>Cost</th>
<th>Average Annual Cost per Vehicle*</th>
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<tbody>
<tr>
<td>Annualized Capital</td>
<td>$225</td>
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<tr>
<td>O &amp; M</td>
<td>$80 ($510**)</td>
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<td>TOTAL:</td>
<td>$315 ($735**)</td>
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*Based on four year lifetime.

**Cost includes incremental fuel and fuel transportation costs before July 1, 2006.

Additional Data Collection

- Demonstration Programs
  - LA City Sanitation - 15 collection vehicles
  - Older vehicle demonstrations
    - September 2001 – September 2002
  - In-depth engine survey for pre-1991 model year engines
Regulation Plans

- Workshops
  - Public comment by September 7, 2001
- Staff Report and Proposed Rule
  - October 26, 2001
- Board Hearing:
  - December 13 – 14, 2001

www.arb.ca.gov/diesel/dieselrrp.htm

Comments Encouraged

- Dual Fuel
- Costs
- Revised Implementation Schedule
- Revised Standards

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