Public Workshop to Discuss Diesel Off-road Equipment Measure

July 13 and 19, 2005
El Monte and Sacramento, California
Heavy-Duty Diesel In Use Strategies Branch
California Environmental Protection Agency

Overview

- 2003 Public Fleet Survey
- 2005 Off-road Equipment Survey
- Field Investigations
- Verified Off-road Control Technologies
- Update on Other ARB Diesel Control Measures
- Regulatory Concepts
- Next Steps

2003 California Public Fleet Survey
California Public Fleet Survey: Methodology and Response Rate

- Conducted 2002-2003 by TIAX LLC for ARB
- Sent to state, county, and city government fleets and special water and irrigation districts
- 31% of fleets surveyed responded
- Highest response rate for utility districts and county fleets

Public Fleet Survey: Data Requested

- Included on-road vehicles and off-road equipment
- Asked for:
  - vehicle type
  - application
  - equipment make & model
  - engine make & model
  - model year
  - horsepower
  - displacement
  - hourmeter reading
  - annual hours use

Public Fleet Survey - Off-road Diesel Fleet Sizes

- Data for 127 off-road fleets
  - 68% with 10 or less pieces
  - 46% with 3 or less pieces

![Fleet Size Distribution of Public Fleet Mobile Diesel Equipment](image)
Public Fleet Survey: Equipment Types

- Data on 3,882 mobile diesel off-road machines
- 74% in top 5 equipment types

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loader</td>
<td>1046</td>
</tr>
<tr>
<td>Grader</td>
<td>717</td>
</tr>
<tr>
<td>Backhoe Loader</td>
<td>503</td>
</tr>
<tr>
<td>Mower</td>
<td>305</td>
</tr>
<tr>
<td>Tractor</td>
<td>301</td>
</tr>
</tbody>
</table>

Public Fleet Survey: Engine Sizes

- Data on 2,831 mobile diesel off-road engines
- 86% under 175 hp, 55% between 100-174 hp

Horsepower Distribution of Public Fleet Mobile Diesel Equipment

Public Fleet Survey - Operating Hours

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Annual Operating Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loader</td>
<td>588</td>
</tr>
<tr>
<td>Grader</td>
<td>415</td>
</tr>
<tr>
<td>Backhoe Loader</td>
<td>405</td>
</tr>
<tr>
<td>Mower</td>
<td>569</td>
</tr>
<tr>
<td>Tractor</td>
<td>432</td>
</tr>
</tbody>
</table>
Public Fleet Survey - Other Info

- Off-road diesel mobile equipment is on average 16 years old
- Report at http://www.arb.ca.gov/msprog/publicfleets/publicfleets.htm

2005 Off-Road Equipment Survey

Off-Road Equipment Survey: Data Requested

- Fleet sizes
- Equipment types
- Horsepower ranges
- Owned versus rented
- Frequency of rebuild
- Age of engine/equipment when purchased
- Emission controls used and funding received
Off-Road Equipment Survey: Outreach - March-April 2005

- **Phone contacts**
  - > 80 phone calls to businesses, manufacturers, trade associations, and government agencies
- **Email notification**
  - To > 600 listserv subscribers and > 65 others
- **Workgroup meetings**
- **Meetings with industry associations**
- **Newsletter articles, etc.**

Off-Road Equipment Survey: Responses so Far

- **47 responses received so far**
  - 11 government agencies
  - 11 ski resorts
  - 7 retail/wholesale companies
  - 5 airport or airline fleets
  - 4 construction companies
  - 3 refineries
  - 2 rental companies
  - 2 mining companies
  - 2 other
- **Data on over 4,500 pieces of equipment**

Off-Road Equipment Survey: Additional Responses Desired

- **Additional outreach:**
  - Letters to 65,000 licensed contractors
  - Outreach to State agencies such as California Department of Conservation
  - Letter to active mines in California
  - Additional outreach to rental companies
  - Further work with industry associations, Contractor State Licensing Board, etc.
- **Other suggestions?**
Field Investigations

Field Research Conducted

- Construction Companies
- Retrofit Manufacturers
- Equipment Dealers
- Rental Agencies
- Demonstration Projects

Possible Further Field Research Volunteers Needed

- Construction sites
- Retail
- Rental companies
- Power plants
- Recyclers
- Equipment service and repair shops
Verified Devices for Off-road Use

<table>
<thead>
<tr>
<th>Date Verified</th>
<th>Device Technology</th>
<th>Application</th>
<th>Model Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/13/04</td>
<td>Lubrizol Engine Control System</td>
<td>Actively regenerated diesel particulate filter</td>
<td>1996-2004</td>
</tr>
<tr>
<td>10/29/04</td>
<td>Lubrizol PuriNOx/AZ Purifier/AZ Purimuffler</td>
<td>Emulsified diesel fuel and diesel oxidation catalyst (DOC)</td>
<td>1996-2002</td>
</tr>
<tr>
<td>5/10/04</td>
<td>Lubrizol ECS AZ Purifier/AZ Purimuffler</td>
<td>DOC Port, railway yards, and other intermodal/freight handling operations</td>
<td>1996-2002</td>
</tr>
<tr>
<td>5/2/03</td>
<td>Donaldson DOC &amp; Spiracle™ closed crankcase filtration system</td>
<td>DOC and crankcase filter</td>
<td>1996-2003</td>
</tr>
<tr>
<td>1/20/05</td>
<td>Extengine Advanced Diesel Emission Control (ADEC)</td>
<td>DOC and selective catalytic reduction</td>
<td>1991-1995</td>
</tr>
</tbody>
</table>

Further Information on ARB Verified Systems

- See website
  http://www.arb.ca.gov/diesel/verdev/verdev.htm

- Contact:
  Shawn Daley, Manager, Retrofit Assessment Section,
sdaley@arb.ca.gov
Update on Other ARB Diesel Risk Reduction Measures

- Transit Agency Fleet Rule
- Solid Waste Collection Vehicles
- Stationary Compression-Ignition Engines
- Portable Engines
- Transport Refrigeration Units
- Commercial Vehicle Idling
- Harborcraft and instate locomotive fuel
- Harborcraft
- Oceangoing ships auxiliary engines
- Cargo handling
- On-road public fleets

Proposed Regulatory Concepts
Regulatory Concepts: Purpose

- Primary: reduce diesel PM emissions from off-road equipment as much as technically and economically feasible in short- and long-term
- Secondary: reduce NOx emissions

Regulatory Concepts: Proposed Applicability

- Applies to sellers, owners, and operators of any mobile diesel-fueled off-road compression ignition equipment over 25 horsepower
- Does not apply to
  - Stationary or portable equipment
  - Equipment used in agricultural operations
  - Equipment at ports or intermodal railyards
  - Locomotives, commercial marine vessels, marine engines, or recreational vehicles

Regulatory Concepts: Proposed Approach for Idling

- Have a policy to reduce unnecessary idling
- Definition of “unnecessary idling” is to be determined
Regulatory Concepts: Proposed Initial Reporting

- Due mid-2007 for all off-road mobile diesel equipment over 25 hp
- Report to ARB:
  - Owner contact information
  - Equipment and engine information
    - Fleet size
    - Make, model, model year, engine family, engine serial number, horsepower, etc.
  - Emission control system information
  - Type of fuel used
  - Operation information
    - Application, annual hours of operation

Regulatory Concepts: Newly Purchased/Leased Equipment

- Non-construction equipment and construction equipment >=175 horsepower:
  - Meet the final after-treatment based Tier 4 off-road PM standards, or
  - Have the highest level Verified Diesel Emission Control System (VDECS) available on each engine at time of purchase

- Construction equipment < 175 hp:
  No requirement at time of purchase

Regulatory Concepts: Proposed BACT Schedule

- Use Best Available Control Technology (BACT) on each engine as required by the compliance schedule below:

<table>
<thead>
<tr>
<th>Group</th>
<th>Engine Model Years</th>
<th>Compliance Phase-in Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>25%</td>
</tr>
<tr>
<td>1</td>
<td>Pre-1988</td>
<td>2007</td>
</tr>
<tr>
<td>5</td>
<td>2007-2014</td>
<td>Model year (MY)+4</td>
</tr>
</tbody>
</table>
Regulatory Concepts: Proposed BACT Definition

- **Tier 4 or equivalent:**
  - 0.01 g/bhp-hr PM or final after-treatment based Tier 4 PM emission standard; or

- **Tier 2/3 and At Least Level 2 VDECS:**
  - Tier 2 or 3 off-road PM standard or 0.1 g/bhp-hr PM, with the highest level VDECS available
  - If the highest level VDECS is Level 1, then by Dec. 31, 2015, either install a Level 2 or 3 VDECS, or meet the final Tier 4 PM standard; or

Regulatory Concepts: Proposed BACT Definition Cont’d

- **At Least Level 2 VDECS:**
  - Install highest level VDECS available. If the highest level VDECS is Level 1, then by Dec. 31, 2015, either install a Level 2 or 3 VDECS, or meet the final Tier 4 PM standard; or

- **Alternative fuel or heavy-duty pilot ignition engine:** or

Regulatory Concepts: Proposed BACT Definition Cont’d

- **Wait for VDECS or final Tier 4 engine**
  - If no engine meeting the final Tier 4 PM emission standard is available, and no VDECS is available, then either:
    - Install Tier 4 engine within 12 months after one becomes available, or
    - If a VDECS is verified for the engine, install it within 12 months. If the highest level VDECS is Level 1, then by Dec. 31, 2015, either install a Level 2 or 3 VDECS, or meet the final Tier 4 PM standard
Regulatory Concepts:
Proposed VDECS Failure Approach
- Within warranty period -- must replace it with same level VDECS
- Outside of warranty period -- must replace it with highest level VDECS available for engine at time of failure

Regulatory Concepts:
Proposed Compliance Flexibility
- Experimental diesel PM control strategy
- Engine scheduled to be retired within x years
- No VDECS commercially available and replacement or repower not commercially feasible
- Small fleets
- Low-use engines
- Early compliance

Regulatory Concepts:
Proposed Record Keeping
- Owner contact information
- Equipment and engine information
  - Fleet size
  - Make, model, model year, engine family, engine serial number, horsepower, etc.
- Emission control system information
- Type of fuel used, and
- Operation information
  - Application, annual hours of operation
Regulatory Concepts: Proposed Reporting

♦ Annual Demonstration of Compliance
  – Each year for which fleet has a compliance date
    • Provide information required under proposed record keeping
    • Identify control strategy implemented for each applicable engine
  – Provide justification that no VDECS or Tier 4 engine is available for any engines meeting BACT with the “Wait for VDECS or final Tier 4 engine” option

Regulatory Concepts: Example - Old backhoe loader

♦ 90 hp, model year 1987 (Tier 0)
♦ Compliance date = 2007-2010 for model year group
♦ Assume owner wants to meet BACT for this equipment in 2009
♦ Determine what BACT is:
  – In 2009, Tier 4 engines not available yet
  – Assume use of alternative fuel is not feasible or desirable

Regulatory Concepts: Example - Old backhoe loader Cont’d

♦ Determine BACT cont’d:
  – Assume highest level VDECS available for engine in 2009 and 2015 is Level 1
    – If install Level 1 VDECS, must either install a Level 2 or 3 VDECS or replace with a Tier 4 engine by Dec. 31, 2015
  – Assume Level 2 VDECS available for backhoe loader with Tier 2 engine
Follow compliance steps:

- **OPTION 1: Retrofit then replace**
  - Install Level 1 DOC in 2009.
  - Replace equipment by 2015 (when 28 years old)

- **OPTION 2: Repower and retrofit**
  - Repower to Tier 2 in 2009.
  - Install Level 2 VDECS.

- **OPTION 3: Retire and rent**
  - Retire old backhoe in 2009 and rent one instead

Next Steps and Contacts

- Workgroup Tuesday, August 30 in Sacramento
  - Recordkeeping/reporting
  - Regulatory concepts

- Further workgroup meetings and workshops as needed

- To Board for consideration mid-2006
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**Website:**

[http://www.arb.ca.gov/msprog/ordiesel/ordiesel.htm](http://www.arb.ca.gov/msprog/ordiesel/ordiesel.htm)