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

Air Resources Board
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
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
## 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 Off-road Diesel Emission Control Systems
## Verified Devices for Off-road Use

<table>
<thead>
<tr>
<th>Date Verified</th>
<th>Device</th>
<th>Technology</th>
<th>Application</th>
<th>Model Years</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level 3: &gt; 85% PM reduction or &lt; 0.01 g/bhp-hr PM</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12/13/04</td>
<td>Lubrizol Engine Control System Unikat Combifilter</td>
<td>Actively regenerated diesel particulate filter</td>
<td>Construction, material handling, or cargo handling</td>
<td>1996-2004</td>
</tr>
<tr>
<td><strong>Level 2: &gt; 50% PM reduction</strong></td>
<td></td>
<td></td>
<td></td>
<td></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>Port, railway yards, and other intermodal/ freight handling operations</td>
<td>1996-2002</td>
</tr>
<tr>
<td><strong>Level 1: &gt; 25% PM reduction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5/10/04</td>
<td>Lubrizol ECS AZ Purifier/AZ Purimuffler</td>
<td>DOC</td>
<td>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>Yard tractors, large lift trucks, top picks, side picks, gantry cranes</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>Rubber tired excavators, rubber tired loaders, rubber tired dozers, utility tractor rigs</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
Update on Other ARB Diesel 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
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
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
Next Steps

♦ Workgroup Tuesday, August 30 in Sacramento
  – Recordkeeping/reporting
  – Regulatory concepts
♦ Further workgroup meetings and workshops as needed
♦ To Board for consideration mid-2006
Contacts

♦ Kim Heroy-Rogalski (Staff)  
  kheroyro@arb.ca.gov  
  (916)327-2200

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

♦ Wayne Sobieralski (Field studies)  
  wsobiera@arb.ca.gov  
  (916) 323-2791

♦ Zerguy Maazouddin  
  (Website and meetings)  
  zmaazoud@arb.ca.gov  
  (916) 323-2809

♦ Annette Hebert (Chief, Heavy-duty Diesel In-use Strategies Branch)  
  ahebert@arb.ca.gov  
  (626)575-6973

♦ Kitty Martin (Manager, In Use Controls Section)  
  kmartin@arb.ca.gov  
  (916)324-1362

Website:  
http://www.arb.ca.gov/msprog/ordiesel/ordiesel.htm