

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

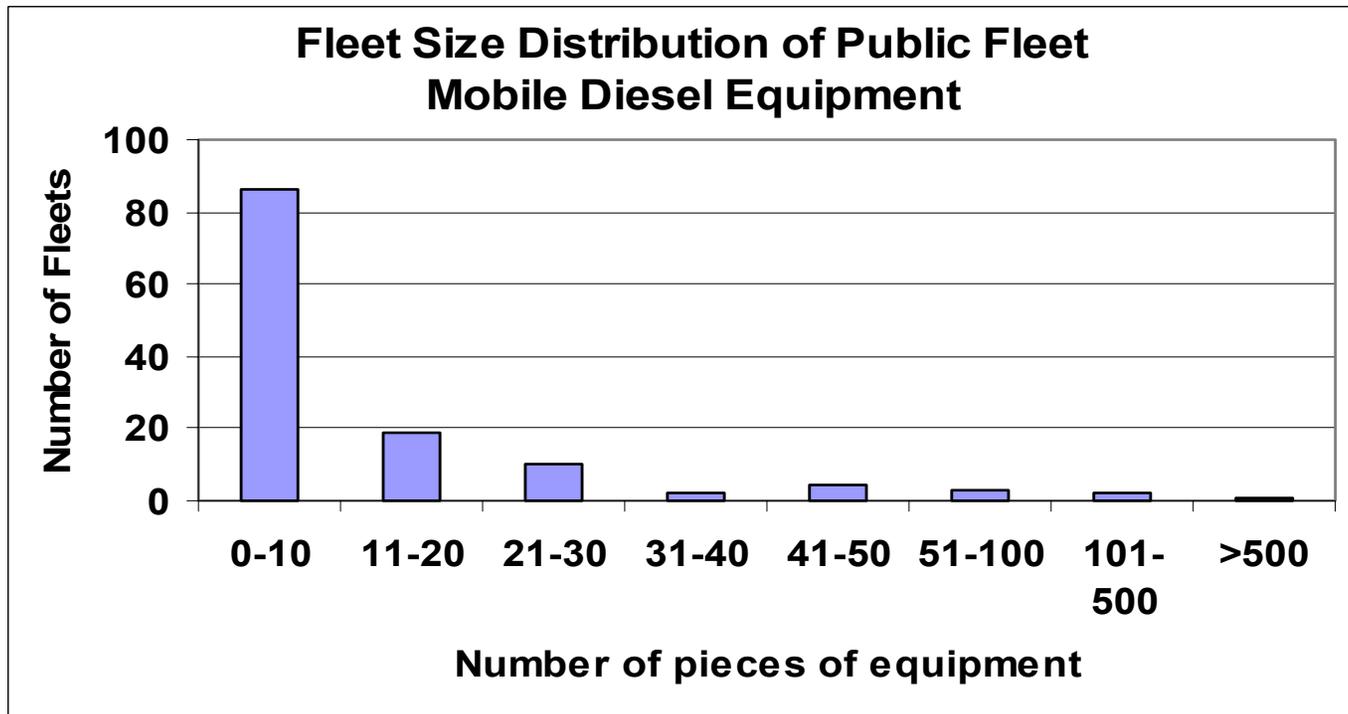
◆ **Included on-road vehicles and off-road equipment**

◆ **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



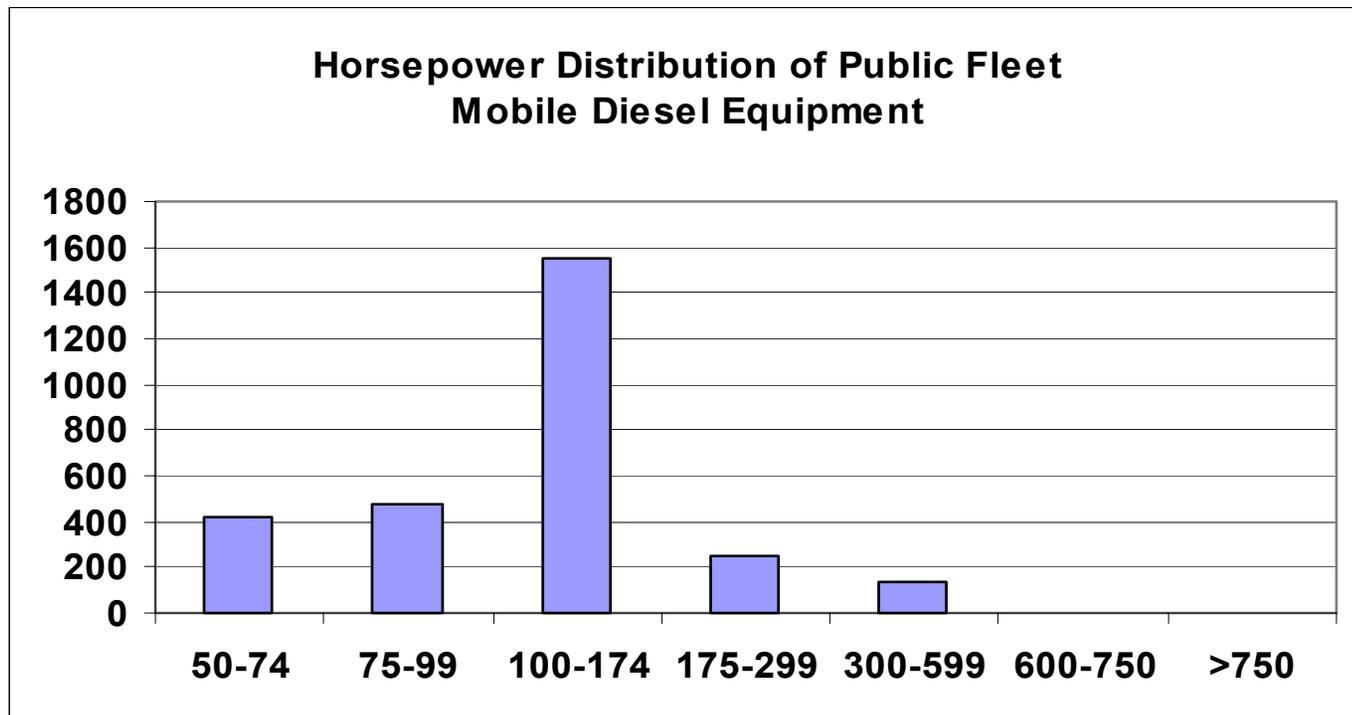
Public Fleet Survey: Equipment Types

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

Equipment Type	Quantity
Loader	1046
Grader	717
Backhoe Loader	503
Mower	305
Tractor	301

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

Equipment Type	Annual Operating Hours
Loader	588
Grader	415
Backhoe Loader	405
Mower	569
Tractor	432

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](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



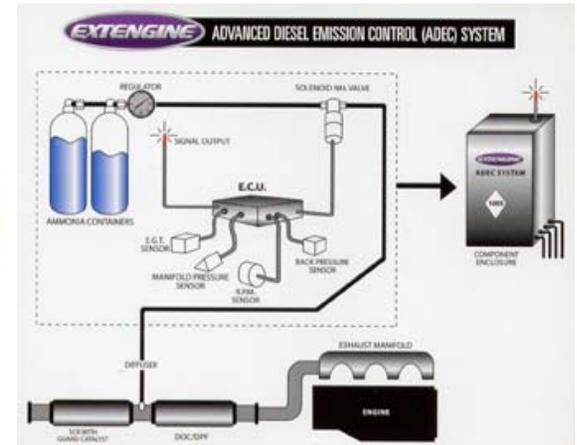
Field Research Conducted

- ◆ **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

Date Verified	Device	Technology	Application	Model Years
Level 3: > 85% PM reduction or < 0.01 g/bhp-hr PM				
12/13/04	Lubrizol Engine Control System Unikat Combifilter	Actively regenerated diesel particulate filter	Construction, material handling, or cargo handling	1996-2004
Level 2: > 50% PM reduction				
10/29/04	Lubrizol PuriNOx/AZ Purifier/ AZ Purimuffler	Emulsified diesel fuel and diesel oxidation catalyst (DOC)	Port, railway yards, and other intermodal/ freight handling operations	1996-2002
Level 1: > 25% PM reduction				
5/10/04	Lubrizol ECS AZ Purifier/AZ Purimuffler	DOC	Port, railway yards, and other intermodal/ freight handling operations	1996-2002
5/2/03	Donaldson DOC & Spiracle™ closed crankcase filtration system	DOC and crankcase filter	Yard tractors, large lift trucks, top picks, side picks, gantry cranes	1996-2003
1/20/05	Extengine Advanced Diesel Emission Control (ADEC)	DOC and selective catalytic reduction	Rubber tired excavators, rubber tired loaders, rubber tired dozers, utility tractor rigs	1991-1995

Further Information on ARB Verified Systems

- ◆ **See website**

<http://www.arb.ca.gov/diesel/verde/verde.htm>

- ◆ **Contact:**

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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:**

Group	Engine Model Years	Compliance Phase-in Dates			
		25%	50%	75%	100%
1	Pre-1988	2007	2008	2009	2010
2	1988-1995	2008	2009	2010	2011
3	1996-2002	2009	2010	2011	2012
4	2003-2006	2010	2011	2012	2013
5	2007-2014	Model year (MY) +4	MY+5	MY+6	MY+7

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

Regulatory Concepts: Example - Old backhoe loader Cont'd

◆ 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**

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<http://www.arb.ca.gov/msprog/ordiesel/ordiesel.htm>