

# In-Use Off-road Diesel Vehicle Activities and Verification



## Off-road Emission Reduction Technology Forum and Roundtable Discussion

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California Environmental Protection Agency



Air Resources Board

# Need for Emission Reductions



# Emission Reduction Drivers

- Must reduce Diesel Particulate Matter (PM) to reduce deaths from cancer, heart disease, etc.
  - Diesel PM responsible for 70% of known cancer risk from all air toxics
  - Thousands of deaths per year in California
- Must reduce oxides of nitrogen (NOx)
  - NOx leads to ozone and secondary PM
- Federal law dictates that the state must attain ozone and PM standards by certain<sup>3</sup>



# Diesel Risk Reduction Plan

- Established goals
  - Reduce PM emissions from all diesel-fueled engines in California
  - 85% reduction by 2020
- Four-pronged approach
  - New engine standards
  - Cleaner diesel fuel - <15 ppm sulfur content
  - Ensure in-use emissions maintained
  - Retrofit of existing engines

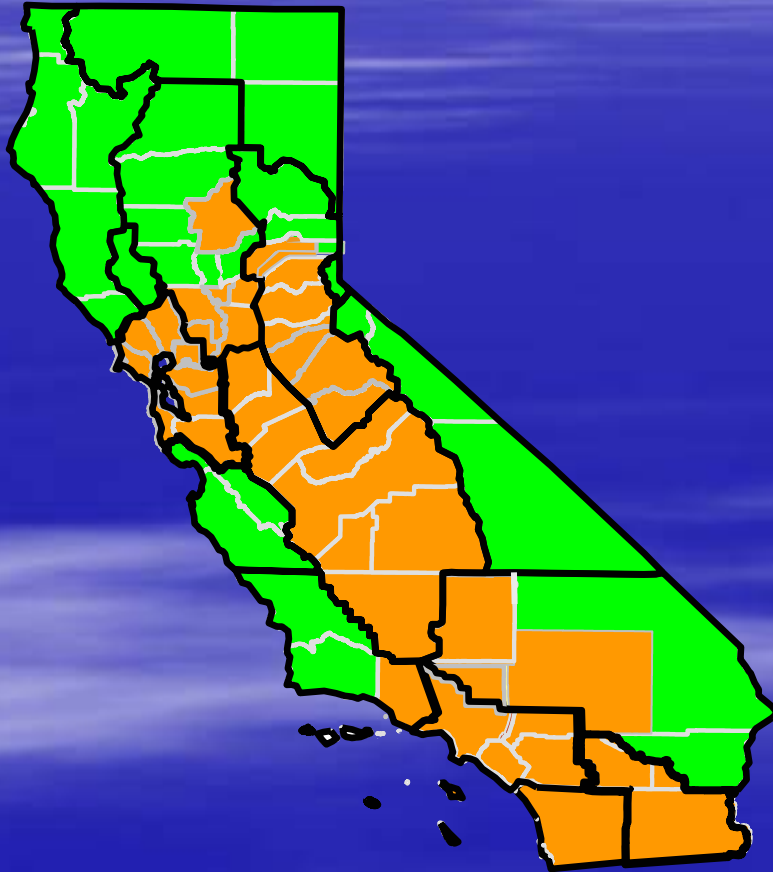


# Health Impacts from Off-road Diesel Vehicles (2005)

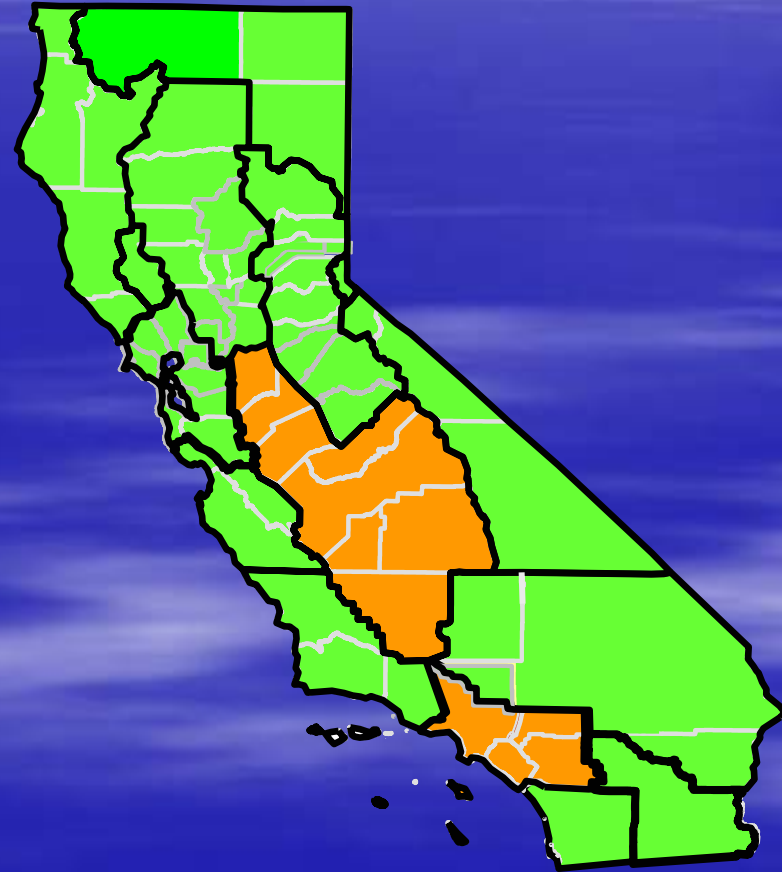
End Point	# of Cases (Mean)	# of Cases 95% Confidence Intervals (Low - High)
Premature Mortality	1,100	310-1,900
Hospital admissions (Respiratory)	240	150-330
Hospital admissions (Cardiovascular)	440	280-690
Asthma & Lower Respiratory Symptoms	32,000	12,000-51,000
Acute Bronchitis	2,600	0-5,700
Work Loss Days	190,000	170,000-220,000
Minor Restricted Activity Days	1,100,000	920,000-1,300,000

# Federal Nonattainment Areas

8-hr Ozone Annual



PM 2.5 Annual



# State Implementation Plans (SIP)

- Roadmap to reaching standards
- Required by United States Environmental Protection Agency
- Compilation of adopted and proposed regulations that demonstrate attainment



# Proposed In-Use Off-road Diesel Vehicle Rule





## Rule Overview

- Applies to construction, industrial, mining, airport ground support, and most other industries
- Off-Road vehicle engines  $\geq 25$  horsepower
  - Excludes vehicles designed to operate on-road regardless of use
  - Excludes vehicle primarily used for agricultural operations
- Annual reporting begins in 2009
- Idling limits begin in 2009
- Only cleaner vehicles may be added to

# General Approach

- NOx requirements, lesser of
  - Turn over engines (8%/10% of hp per year) or
  - Meet NOx average by any method
- PM requirements
  - Install PM retrofits (20% of hp per year) or
  - Meet PM average by any method
- Compliance options:
  - NOx or PM exhaust retrofits (VDECS)
  - Buy new or used vehicles, engine repowers
  - Alternative fuels or electric vehicles
  - Remove dirtiest vehicles from fleet or designate low use

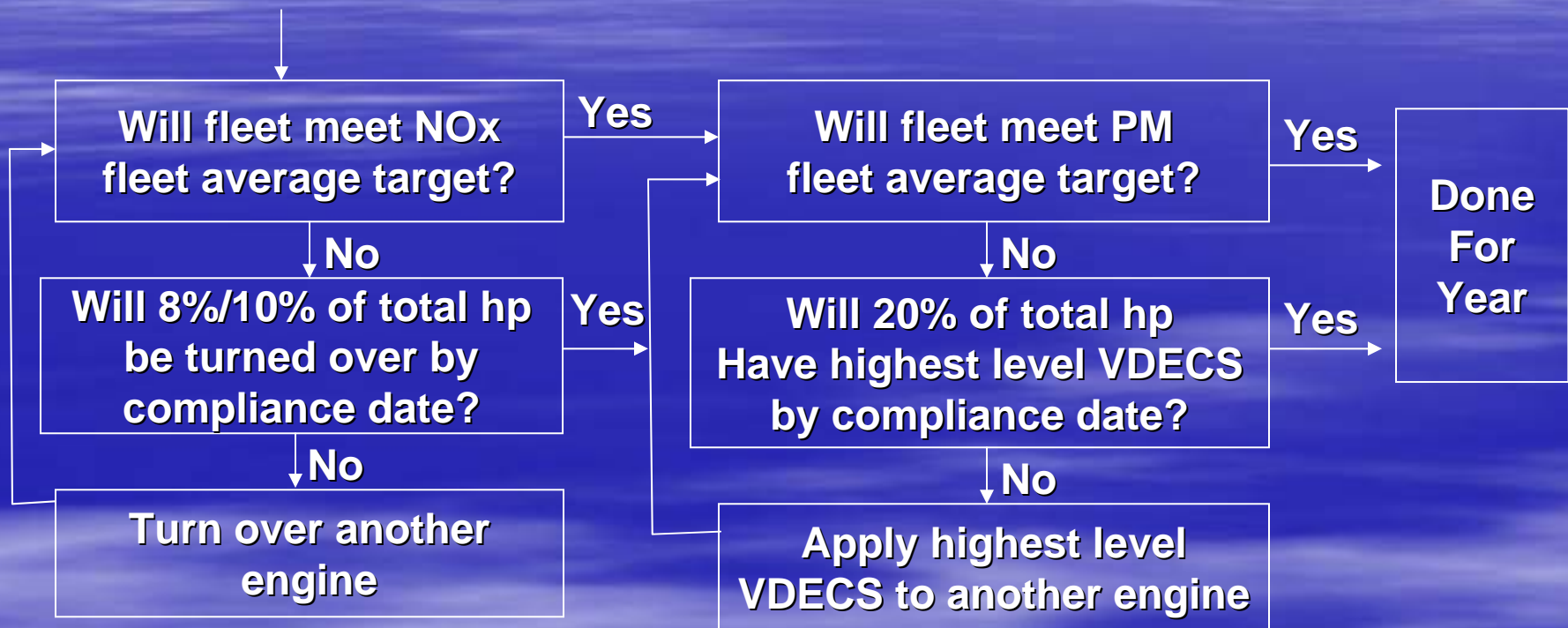
# Requirements Vary by Fleet Size

Fleet Size Category	Description	Dates and Requirement
Small	Small business less than 1,500 hp or Municipality less than 1,500 hp or Municipality fleet in low population county	2015-2025 PM only
Medium*	Municipality with 1,501 to 5,000 hp or Business less than 5,000 hp (not "Small")	2013-2020 PM and NOx
Large*	Fleets with more than 5,000 hp	2010-2020 PM and NOx

\* Same requirements for large and medium fleets, only initial compliance date varies.

# Annual Compliance Process

## Large and Medium Fleets



**Note: Turn over means repower with cleaner engine, replace vehicle with used vehicle or new vehicle, designate as low-use, or decrease fleet size.**

# Exemptions from Engine Turnover Requirements

- Small fleets
- Vehicles less than 10 years old
- Specialty vehicles
- Vehicles retrofit in past 6 years
- Vehicles meeting the cleanest new engine standards
  - Available 2008 to 2014
- Fleets in attainment counties
- Low-population municipal fleets

# Exemptions from Retrofit Requirements

- Engines in vehicles less than 5 years old
- Engines for which there is no retrofit available or cannot be safely installed
- New engines that come with a diesel particulate filter
- Engines already retrofit with the best available control



# Emission Benefits of Regulation

- Emission benefits associated with 4,000 fewer premature deaths over course of rule

<b>NOx Emissions</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>
Without Rule (tpd)	311	228	151
Benefits Rule (tpd)	13	30	48
% Reduction	4%	13%	19%

<b>PM Emissions</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>
Without Rule (tpd)	16.7	11.5	7.0
Benefits (tpd)	2.3	6.9	5.2
% Reduction	14%	60%	74%

# Costs of Regulation

- Total cost of expected to be \$3.0-\$3.4 billion
  - Anticipated increase of 0.3% per year in statewide construction costs
- Many fleets expected to pass through costs
  - Costs for 20-40% of fleets exceed 10% of annual profits
  - Costs for most heavily exceed annual profits
- Cost effectiveness

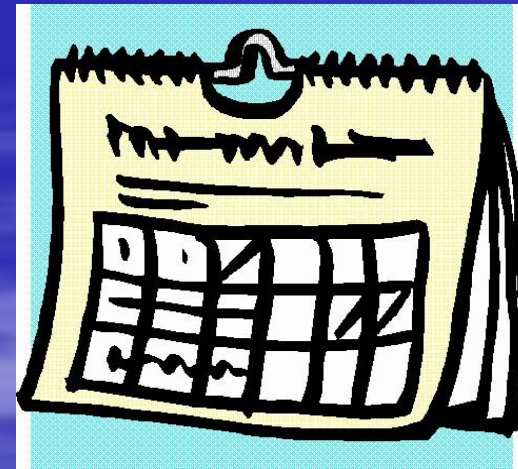


– \$37 - \$43/lb PM



# Next Steps

- April 6, 2007
  - Staff report released
- May 25, 2007
  - Consideration by Board



# ARB Retrofit Verification Program

# Program History

- Verification Procedure
  - Adopted May 2002
  - Amended February 2004
  - Amended March 2006
- Intended to support ARB in-use fleet regulations

# Verification Procedures

- Require at least 25% PM reduction
  - 3 Levels of PM control technologies
- Verify NO<sub>x</sub> reduction systems in 5% increments
  - Starting at 15%
- Require warranty and in-use compliance
- Establish NO<sub>2</sub> limits

# Verified Systems

- 35 systems verified since the beginning of the Verification Program
  - On- and off-road and stationary applications
  - Some achieve both PM and NO<sub>x</sub>
  - Some did not meet future effective NO<sub>2</sub> limits
- 26 systems currently verified

# Current Activities

- Launching a search database that matches verified control technologies with appropriate engines
- Planning to present amendments to Verification Procedure in November 2007

# Potential Future Amendments

- Restructure verified NOx reduction classifications
- Change required test plan for NOx reduction systems
- Change test cycles for off-road and stationary engines
- Require record keeping of sold products
- Clarification of in-use compliance, warranty, and proper sales and installation methods
- Enhanced enforcement provisions
- Require all fuel-based strategies to undergo same testing as alternative diesel fuels

# Off-Road Diesel Construction Equipment Retrofit Demonstration Program *“Off-Road Showcase”*





# Goals of the Showcase

- Demonstrate new emission control systems
- ARB verification of these systems
- Demonstrate durability and effectiveness of off-road construction equipment.
- Achieve near term emission reductions
- Cooperative effort with stakeholders
  - Technical Advisory Group

# Project Funding

- Current allocation \$1 Million
- Limit of \$200,000 per manufacturer
  - May participate with more than one fleet owner if does not exceed limit
- MSRC will reimburse equipment owners who will then purchase devices from manufacturer
- Funding expected to increase for 2008

# Manufacturer's Requirements

- Open to all manufacturers with previous ARB, EPA, or VERT verification
- Mix of technologies, not limited to DPF's
  - Must reduce PM by 85% (Level 3)
  - Preference for NOx+PM devices
- Must seek ARB verification as part of Showcase
- Applications will be ranked according to

# Equipment Owner Requirements

- Open to public, private and local government agencies in the SCAQMD
- 100% funding for cost of purchase and installation
  - Maximum of \$200,000 per fleet owner
- Participation based on equipment type
- Access by ARB or MSRC for periodic monitoring and/or on-site emissions testing

# Selection Process

- Equipment and manufacturer applications will be matched based on applicability
- Equipment owners may be asked to demonstrate a specific device
- Committee will be asked to provide input as to appropriateness of matching engine and device

# Coordination with ARB Verification

- Manufacturers must apply for ARB verification concurrent with Showcase
- May receive conditional verification
- Multimedia assessment requirements
- ARB staff will work with applicant through the verification process