

# Diesel Off-road Equipment Measure - Workshop

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**Air Resources Board**

# Overview

## ■ Introduction

## ■ Background

- ◆ Health Effects of Diesel PM
- ◆ Diesel Risk Reduction Plan
- ◆ ARB Diesel PM Control Measures

## ■ Off-Road Equipment Measure

- ◆ Equipment Affected
- ◆ Reduction Options/Verification
- ◆ Off-Road Activities
- ◆ Possible Approaches for Measure

## ■ Next Steps

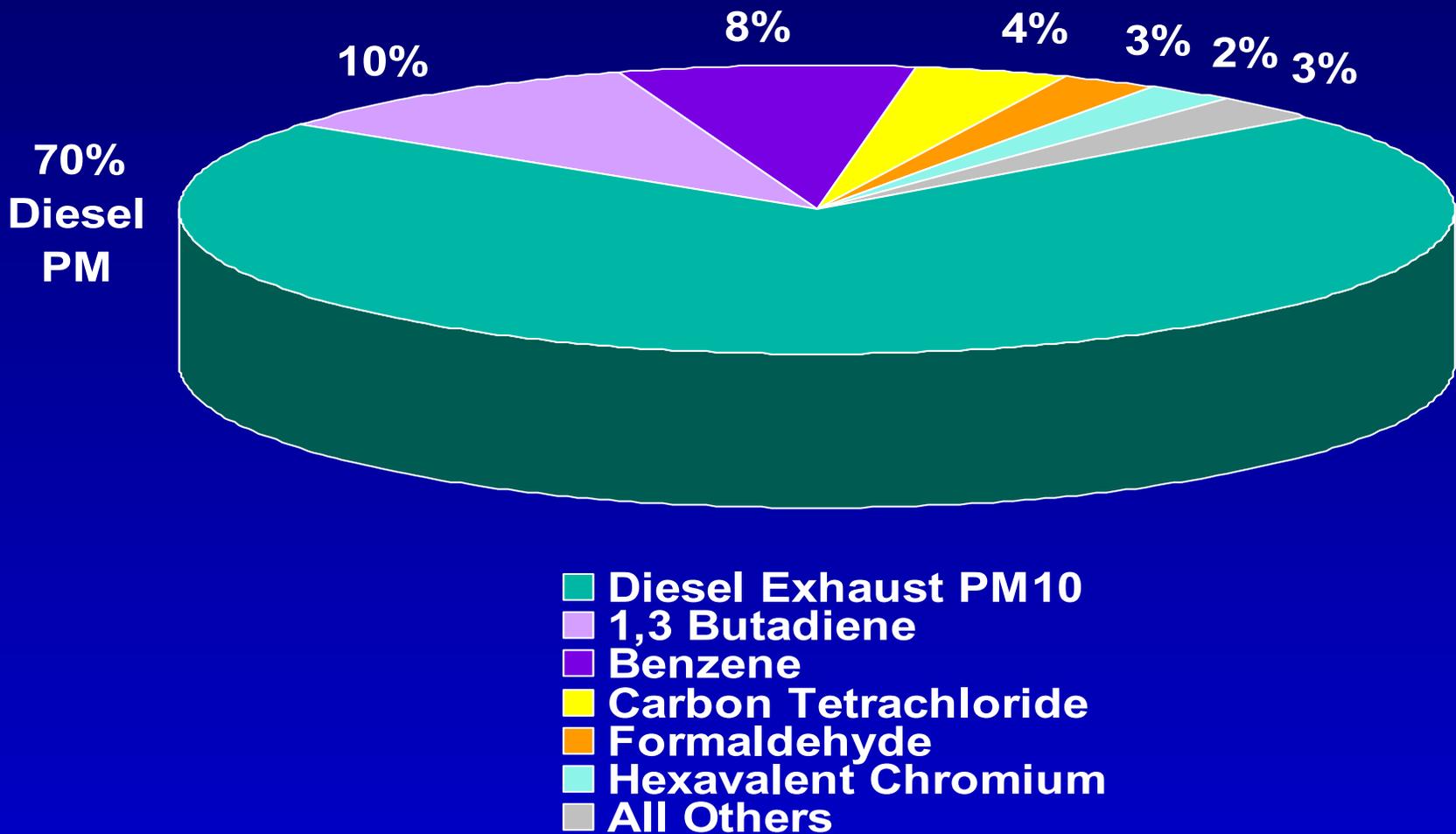
# Introduction

- **Why we are here**
- **Help we hope to get from stakeholders**
  - ◆ **Input on how to structure rule**
  - ◆ **Participation in workgroup(s)**
  - ◆ **Help with survey**
  - ◆ **Help identifying other stakeholders**
- **Products we will develop**
  - ◆ **Regulation**
  - ◆ **Staff report**

# Health Effects of Diesel PM

- **Increases Cancer Risk, Hospital Admissions & Premature Deaths**
- **In California in year 2000, diesel PM associated with:**
  - ◆ **2,000-2,500 annual premature deaths**
  - ◆ **~3,600 annual hospital admissions for pneumonia, cardiovascular disease, asthma, bronchitis**
- **By comparison, 3,700 deaths from car accidents, 2,000 homicides**

# 70% of Known Statewide Air Toxics Risk is from Diesel PM - Year 2000





# California Diesel Risk Reduction Plan

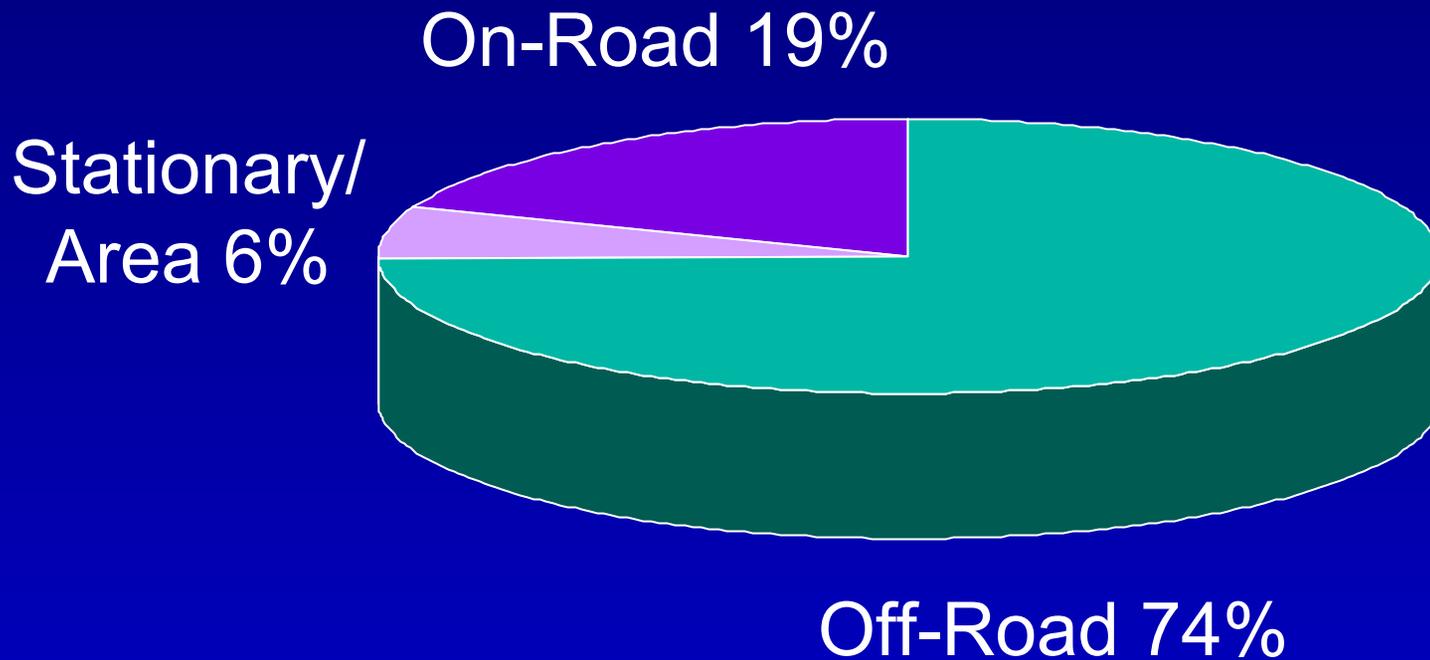
## ■ Established Goals

- ◆ Reduce PM emissions from all diesel-fueled engines in California
- ◆ 75% reduction by 2010
- ◆ 85% reduction by 2020

## ■ Four-pronged approach

- ◆ New engine standards
- ◆ Cleaner diesel fuel - <15 ppm S
- ◆ Retrofit of existing engines
- ◆ Ensure in-use emissions maintained

# California Diesel PM - Year 2010



# **Adopted ARB Diesel Measures**

- **Transit agency fleet rule (2/00)**
- **School bus idling (12/02)**
- **Airport Ground Support Equipment Memorandum of Understanding (12/02)**
- **Solid waste collection vehicles (9/03)**
- **Stationary CI engines (2/04)**
- **Portable engines (2/04)**
- **Transport Refrigeration Units (2/04)**
- **Commercial vehicle idling (7/04)**

# Future ARB Diesel Measures

## ■ 2004-5

- ◆ Intrastate Locomotive/Commercial Harbor Craft Fuel
- ◆ Transit Fleet Vehicles (Non Urban Buses)
- ◆ Public On Road and Private Utilities
- ◆ Cargo Handling Equipment (Ports and Intermodal Facilities)
- ◆ Harbor Craft
- ◆ Ship Auxiliary Engines
- ◆ Stationary Agricultural Engines

# Schedule for Future ARB Diesel PM Measure Adoption Cont'd

## ■ 2006

- ◆ Off-Road Equipment (Public and Private)
- ◆ Private On-Road Trucks

## ■ 2007+

- ◆ Agricultural Off-Road Equipment

# Off-Road Equipment Measure



# Scope of Off-Road Equipment Rule

| Category  | PM, 2010,<br>statewide [tpd] | # of<br>Units  |
|---|------------------------------|----------------|
| Construction & Mining   | 14.8                         | 175,000        |
| Industrial  | 0.8                          | 8,500          |
| Logging   | 0.4                          | 2,800          |
| Airport Ground<br>Support Equipment<br>(non South Coast,<br>non-portable) | 0.1                          | 800            |
| <b>TOTAL</b>  | <b>16.1</b>                  | <b>187,100</b> |

# PM Reduction Options

## ■ Replacement

- ◆ Newer equipment meets cleaner standards

## ■ Repower

- ◆ Replacement engines are cleaner

## ■ Retrofit

- ◆ Verified technologies reduce emissions



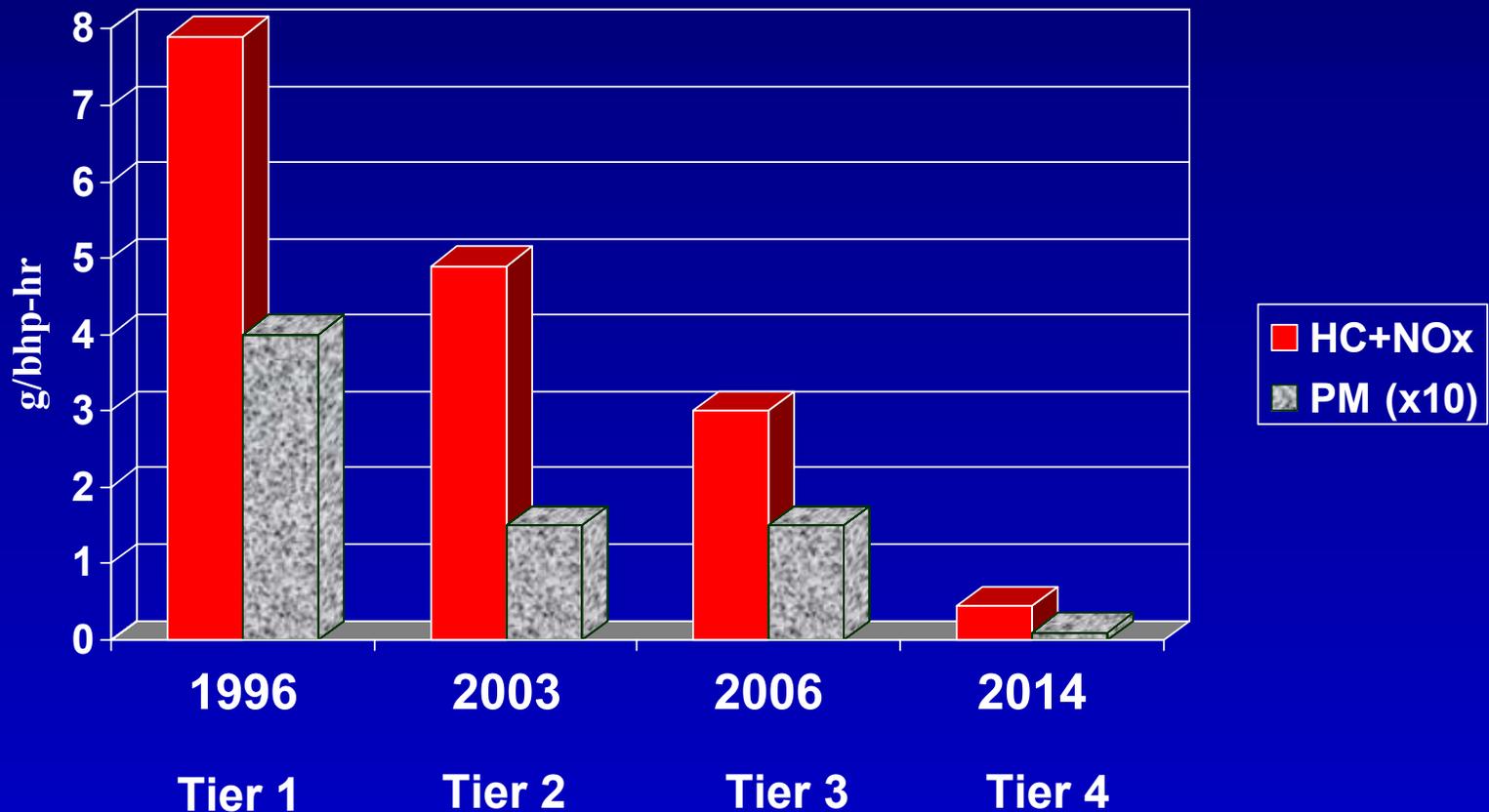
Controlled

Uncontrolled

# Emission Standards for New Diesel Off-Road Engines

- Becoming stricter over time
- Levels and effective dates depend on engine size (hp)
  - ◆ Tier 1: First effective in 1996-2000
  - ◆ Tier 2: First effective 2001-6
  - ◆ Tier 3: First effective 2005-8
  - ◆ Tier 4: First effective 2011-2015
- Low-sulfur diesel fuel (<15 ppm) required mid-2006

# Emission Standards for a 175 hp Diesel Engine



# Potential Reduction Technologies

## ■ Exhaust Aftertreatment

- ◆ Passive and Active Diesel Particulate Filters (DPFs)
- ◆ Flow-thru Filters
- ◆ Diesel Oxidation Catalyst (DOC)
- ◆ Urea-SCR Catalyst

## ■ Fuels

- ◆ Fuel additives - fuel-borne catalysts
- ◆ Emulsified Fuels
- ◆ Biodiesel
- ◆ Fischer Tropsch

# ARB Retrofit Verification Process

- Evaluates emission reduction capabilities of technology
- Ensures real and durable reductions
- 3 levels of verification:
  - ◆ Level 3 ( $\geq 85\%$  PM reduction or  $\leq 0.01$  g/bhp-hr PM)
  - ◆ Level 2 ( $\geq 50\%$  PM reduction)
  - ◆ Level 1 ( $\geq 25\%$  PM reduction)

# Current Verifications

## ■ Level 3

- Cleaire Flash & Catch CRT/DPX (**25% NO<sub>x</sub> ↓**)
- Cleaire Longview DPF + Lean NO<sub>x</sub> (**25% NO<sub>x</sub> ↓**)
- Clean Air Partners DPF
- CleanAIR Systems DPF (Stationary)
- Donaldson DPF
- Johnson Matthey CRT DPF
- Lubrizol ECS Purifilter DPF

# Current Verifications Cont'd

## ■ Level 2

- Environmental Solutions Worldwide Flow Thru Filter
- Lubrizol PuriNOx (**15% NOx ↓**)
- Lubrizol PuriNOx/Purimuffler (**20% NOx ↓**, off-road intermodal facilities)

# Current Verifications Cont'd

## ■ Level 1

- Cleaire Flash and Match (**25% NOx ↓**)
- Donaldson DOC
- Donaldson DOC + Spiracle
- Lubrizol ECS AZ Purifier & Purimuffler (off-road intermodal facilities)

# Further Information on ARB Verification Process

- **For further info, see website**  
<http://www.arb.ca.gov/diesel/verdev/verdev.htm>
- **Contact:**  
**Scott Rowland, Manager, Retrofit  
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# Off-road PM Control Activities

## ■ Sacramento Air District Construction Mitigation



- ◆ Suggests 20% NO<sub>x</sub>↓ and 45% PM↓ from state average construction fleet emissions
- ◆ Has encouraged the use of newer construction equipment

# Off-road PM Control Activities cont'd

## ■ San Luis Obispo Air District Construction Mitigation



- ◆ Best Available Control Technology for construction equipment
- ◆ Avila Beach Remediation - 12 DOCs, 3 DPFs on construction equipment
- ◆ Woodlands Housing Development - 12 DOCs on scrapers; repowered bulldozer

# Off-road PM Control Activities cont'd

## ■ CIAQC 2003 Demonstration

- ◆ Joint effort by CIAQC, SCAQMD, ARB
- ◆ Retrofitted 18 heavy-duty construction vehicles
- ◆ DPFs on 24 engines

## ■ Boston Central Artery Tunnel “Big Dig”

- ◆ >100 pieces of construction equipment retrofitted with DOCs (cranes, lifts, excavators, bulldozers, etc.)
- ◆ Idling limits



# Off-road PM Control Activities cont'd

- **World Trade Center Diesel Emissions Reduction Project**
- **New York City Construction Ordinance**
  - ◆ **Lower Manhattan, then all of New York City**
  - ◆ **Requires ultra-low S diesel fuel and best available PM control technology**
  - ◆ **Diesel off-road vehicles  $\geq$  50 hp owned by or operated on behalf of the City**

# Off-road PM Control Activities cont'd

## ■ Swiss Construction Retrofit Ordinance



- ◆ DPFs required for all construction equipment used at large construction sites
  - ◆ Equipment > 50 hp by 9/1/03
  - ◆ Equipment  $\geq$  25 hp by 9/1/05
- ◆ Over 6,000 construction machines have been retrofitted with DPFs

# Off-road PM Control Activities cont'd

## ■ VERT Filter List

- ◆ VERT began in response to diesel PM problem in tunnel construction
- ◆ Joint German, Austrian, Swiss project
- ◆ Suitability testing and subsequent field tests for particle-trap systems

# Possible Approaches for Off-Road Equipment Measure

- Accelerated turnover to cleaner engines
- Retrofit with Best Available Control Technology
  - ◆ Could include exhaust aftertreatment and/or alternate diesel fuels
- Idling limitations
- Registration, recordkeeping, reporting, and/or inspection

# Next Steps for Off-Road Equipment Rulemaking

- Survey
- Workgroup
- More workshops to come in 2005
- Public hearing and consideration by Board in early 2006

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## Website:

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