



# **Strategies to Reduce In-Use Emissions from Heavy-Duty Vehicles: Developing a Heavy-Duty Vehicle Inspection and Maintenance Program**

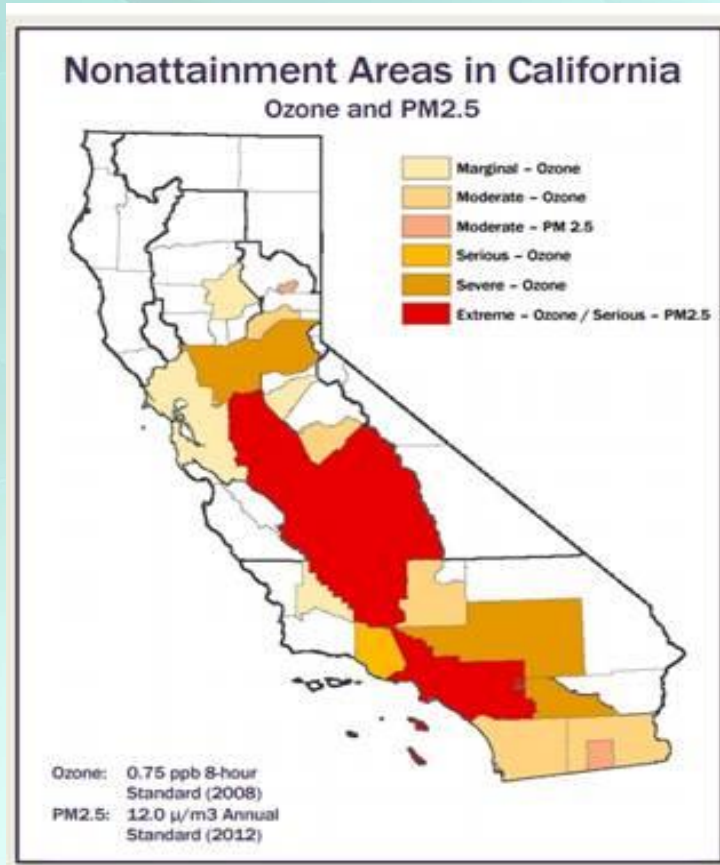
**Presentation for the North Central Texas Council of Governments (NCTCOG) Heavy-Duty  
Diesel Vehicle Inspection and Maintenance Working Group**

**April 18, 2019**

# Outline

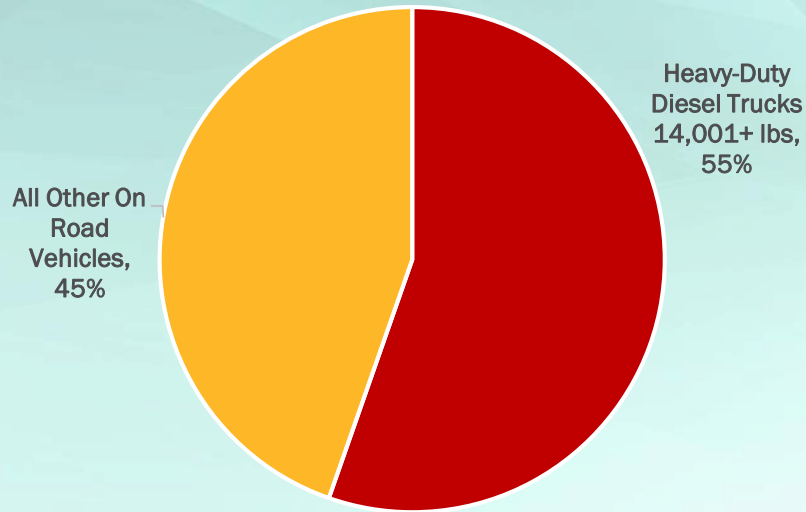
- California's emission challenges
- CARB's existing heavy-duty vehicle (HDV) programs
- HD I/M SIP commitment, program goals
- Potential heavy-duty vehicle inspection and maintenance (HD I/M) program elements
- HD I/M program development and next steps

# California Faces Greatest Air Quality Challenges in U.S.

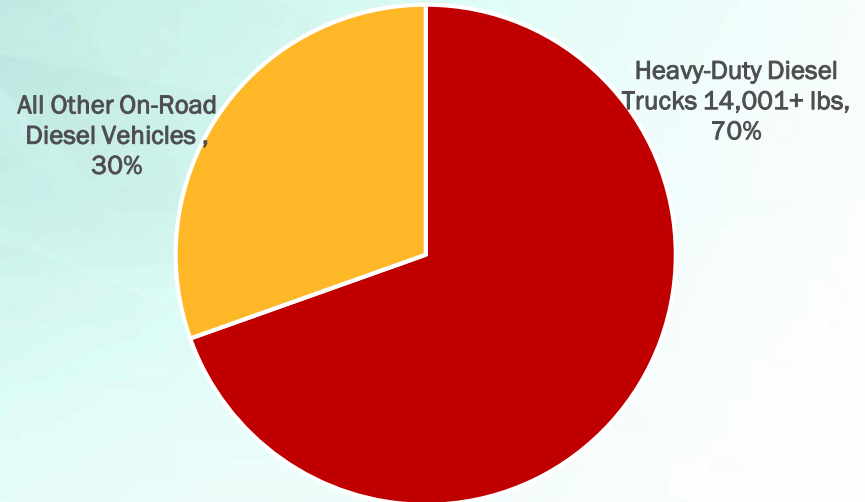


# On-Road Vehicle Emissions in California

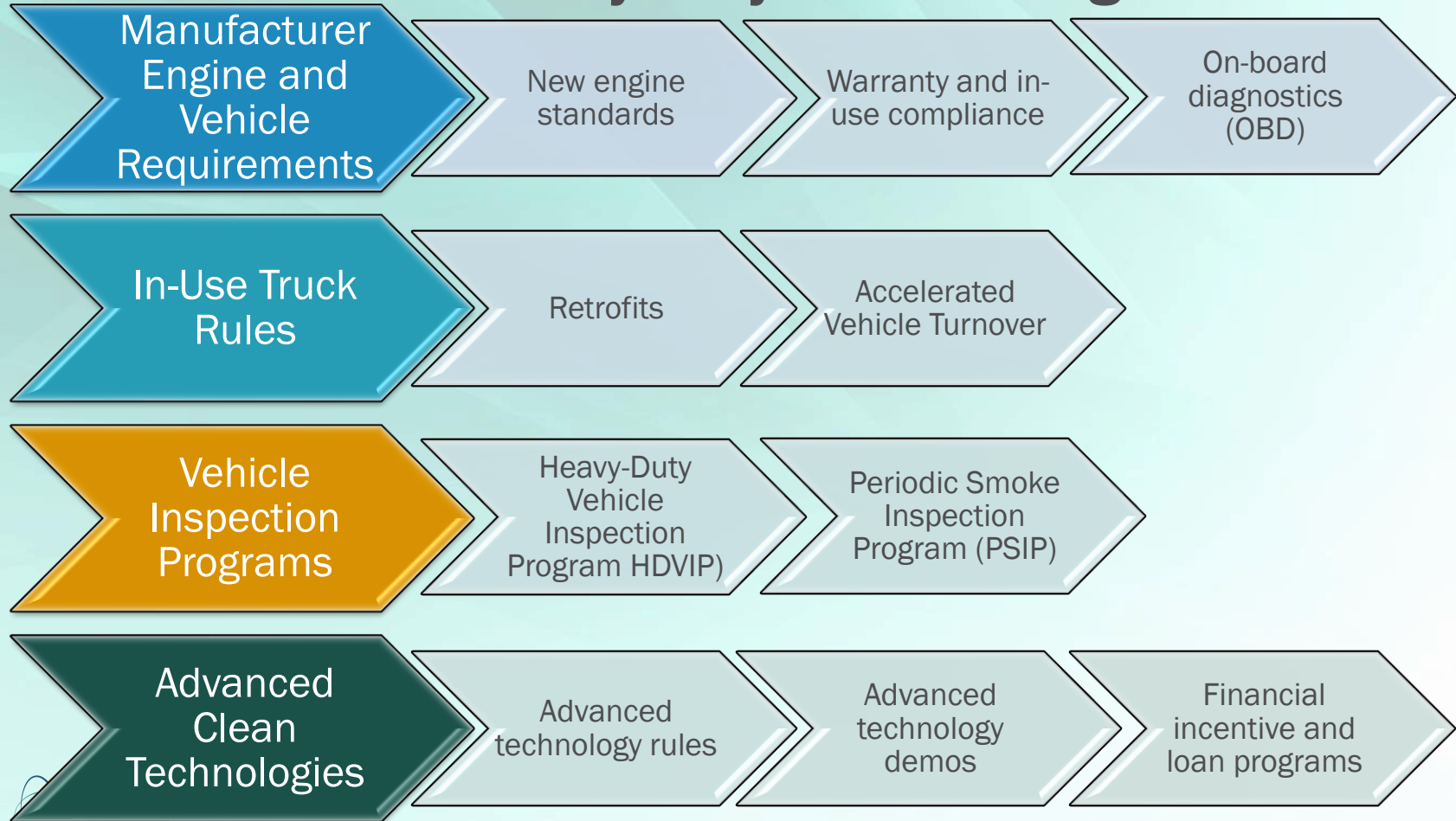
## NOx



## Diesel PM 2.5

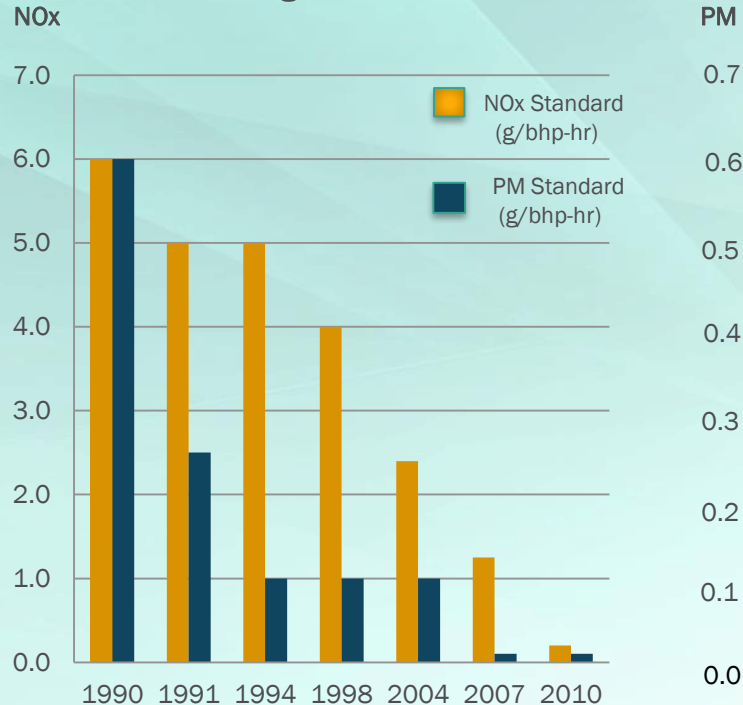


# CARB's Heavy-Duty Vehicle Programs



# Increasingly Stringent Heavy-Duty Engine Standards

Emission Standards for New Heavy-Duty  
Engines Since 1990



- Reductions in new engines standards since 1990:
  - ~97% NOx
  - ~98% PM
- 2010+ MYs equipped with aftertreatment: selective catalytic reduction systems and diesel particulate filters
- Must ensure emission controls are working properly to maintain low emissions

# Heavy-Duty Vehicle On-Board Diagnostics (OBD)

- HD OBD implemented starting with 2013 model year engines (vehicles > 14,000 lbs.)
  - Emission thresholds phased-in during 2013 – 2015 model years
- Intended as tool for inspection and maintenance
  - Monitors performance of emission control systems
  - Allows for quick identification of potential emissions issues and provides diagnostic information for repairs



# Current Inspection Programs

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**HDVIP:** Roadside inspections by CARB enforcement staff for excessive smoke and tampering

**PSIP:** Annual self-testing for California fleets of two or more vehicles

Requires vehicles to meet opacity limits to operate in California





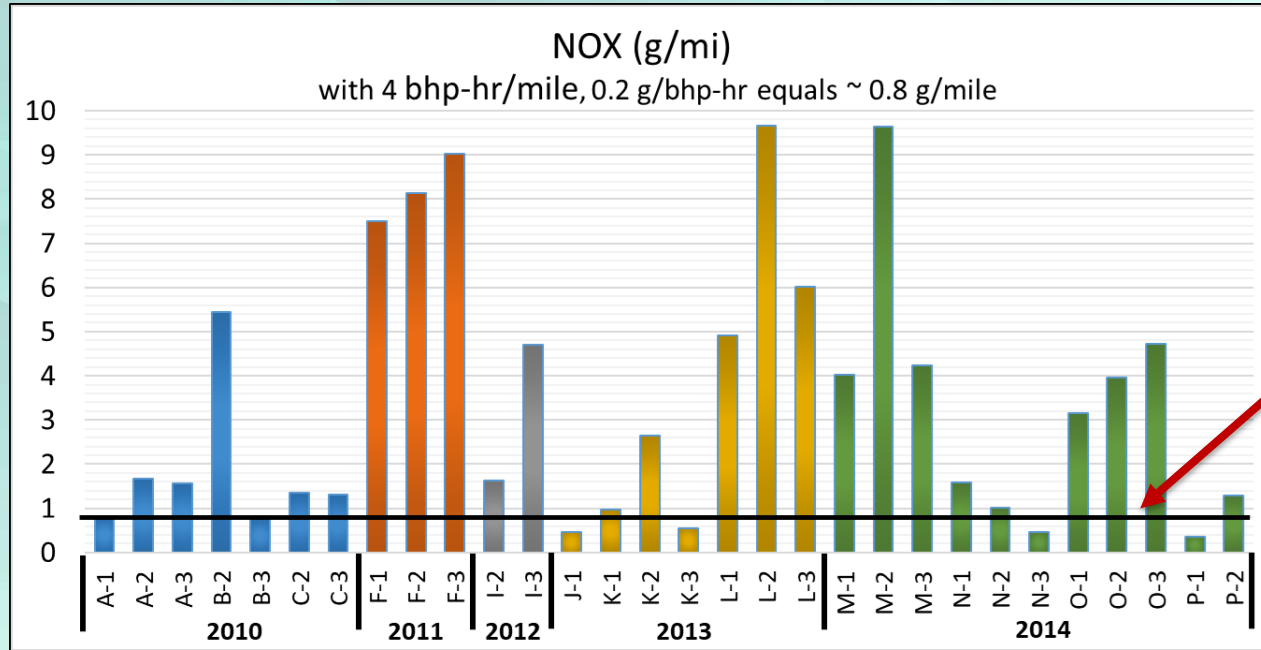
# Board Approved HDVIP and PSIP Amendments

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- DPF-equipped vehicles:
  - **5% opacity**
- Non DPF-equipped vehicles:
  - **20% - 40% opacity** depending on model year and technology
- PSIP voluntary OBD submittal
  - Fleets can choose to submit a vehicle's OBD data to CARB in lieu of performing annual PSIP smoke opacity test
- Changes effective mid-2019

# In-Use NOx Emissions Remain High



- Many HD vehicles operate with malfunctioning emissions controls
  - NOx emissions well above engine certification standards
- More needs to be done to reduce in-use NOx emissions

# Program to Ensure Timely Repairs Would Be Beneficial

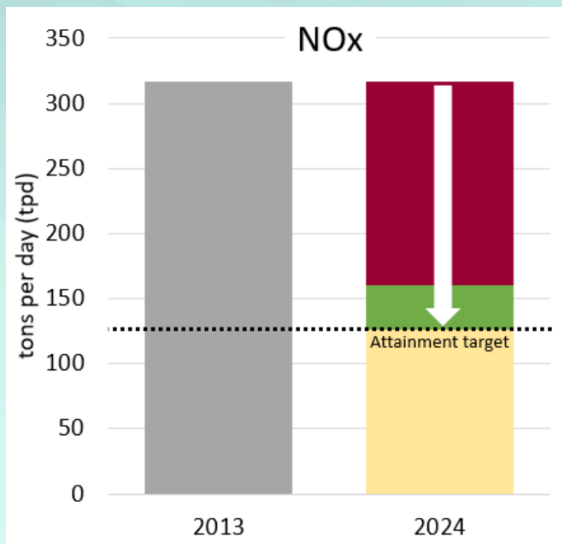
- CARB's roadside data collection
  - 11% of trucks had an illuminated Malfunction Indicator Light (MIL)
- Repairs are needed to keep emissions at certified level
  - UC Riverside study demonstrated
    - 50% - 75% NO<sub>x</sub> reductions achieved via repairs



# State SIP Strategy Commitment for San Joaquin Valley (SJV)



*Valley PM2.5 Plan meets Act requirements for all four standards*



- SJV needs emission reductions by 2024 to meet federal ambient air quality standards:
  - 32 tons per day NOx beyond what current regulations expected to achieve
- HD I/M is one of the largest NOx reduction measures for SJV SIP 2024 target:
  - NOx reductions: 6.8 tons per day
  - PM<sub>2.5</sub>: <0.1 tons per day

# Future Program Goals

- Maintain low emissions throughout a vehicle's life
- Ensure emissions control systems are functioning properly
- Ensure proper maintenance practices are followed
- Ensure quick and adequate repair of malfunctioning parts



# Possible Program Elements

- Conduct periodic inspections
- Require periodic OBD data submission from fleets
  - Several options for OBD data collection and transmittal
- Measure real world emissions
  - Remote sensing / plume capture for “dirty screening” and program validation
- Require Certificate of Compliance to operate in California
- Hold DMV registration for non-compliant vehicles
- Encourage training and education re: diagnosing and repairing emissions systems



# Possible Inspection Methods

- Periodic scans of the engine's OBD system for malfunctions
- Remote sensing devices (RSD) / Plume capture

*OBD and RSD / plume capture  
can work together*





# OBD System Inspection Options

- Kiosks
  - Drive up, plug in, and transmit data
- Station-based
  - Testing at a physical station
- Dongles
  - Transmit data via the cellular network
- Telematics
  - Fleet/vehicle software subscription service
  - Many fleets already enrolled in a telematics program
- Mobile inspectors
  - Third-party verifiers go to fleet facilities
  - Possibly via a state contractor





# Remote Sensing Devices (RSD) and Plume Capture Technologies

- Emissions snapshot in real-time
- Potential uses
  - “Dirty Screen” – identify high emitters when coupled with Automatic License Plate Recognition (ALPR)
  - Program validation – monitor real-world emissions; gauge program success



# Current Roadside Emissions Measurement Technologies

- RSD

- Uses light source, light reflection, light signal detection, and signal analysis algorithm to determine emissions

- HEAT's EDAR system (Differential Adsorption LIDAR)
- University of Denver's FEAT system, or similar (IR, UV)
- OPUS



- Plume capture

- Exhaust is pulled through a sampling inlet to a manifold connected to analytical instruments
- PEAQS (CARB in-house system)
- UC Berkeley's "overpass" system
- On-highway measurement system (University of Denver's HD "tent")



# Training and Education

- Fleet Owners
  - Establish education and training programs on preventative maintenance
    - Encourages fleet owners to implement best maintenance practices and perform timely repairs of malfunctioning equipment
- Mechanics/Technicians
  - Ensure that technicians are trained to diagnose and repair emissions systems for complete and durable repairs

# HD I/M Program Development, Next Steps

- 1<sup>st</sup> public workshop held on February 11, 2019
- 1<sup>st</sup> external workgroup meeting tentatively mid-May 2019
- Examples of possible workgroup discussion topics:
  - OBD data and how it is currently used by fleets for preventative maintenance
  - Enforcement methods for in-state and out-of-state vehicles
  - Remote OBD data submission methods: security and fraud prevention strategies
  - Remote sensing/plume capture devices to identify high emitters and to assess program effectiveness
  - Inspection methods for non-OBD vehicles
  - Training for fleets, repair technicians, drivers
- Next public workshop: ~late summer/early fall 2019
- Board hearing: tentatively 2021

## Stay Connected

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- Visit CARB website at: <https://ww2.arb.ca.gov/our-work/programs/heavy-duty-inspection-and-maintenance-program>