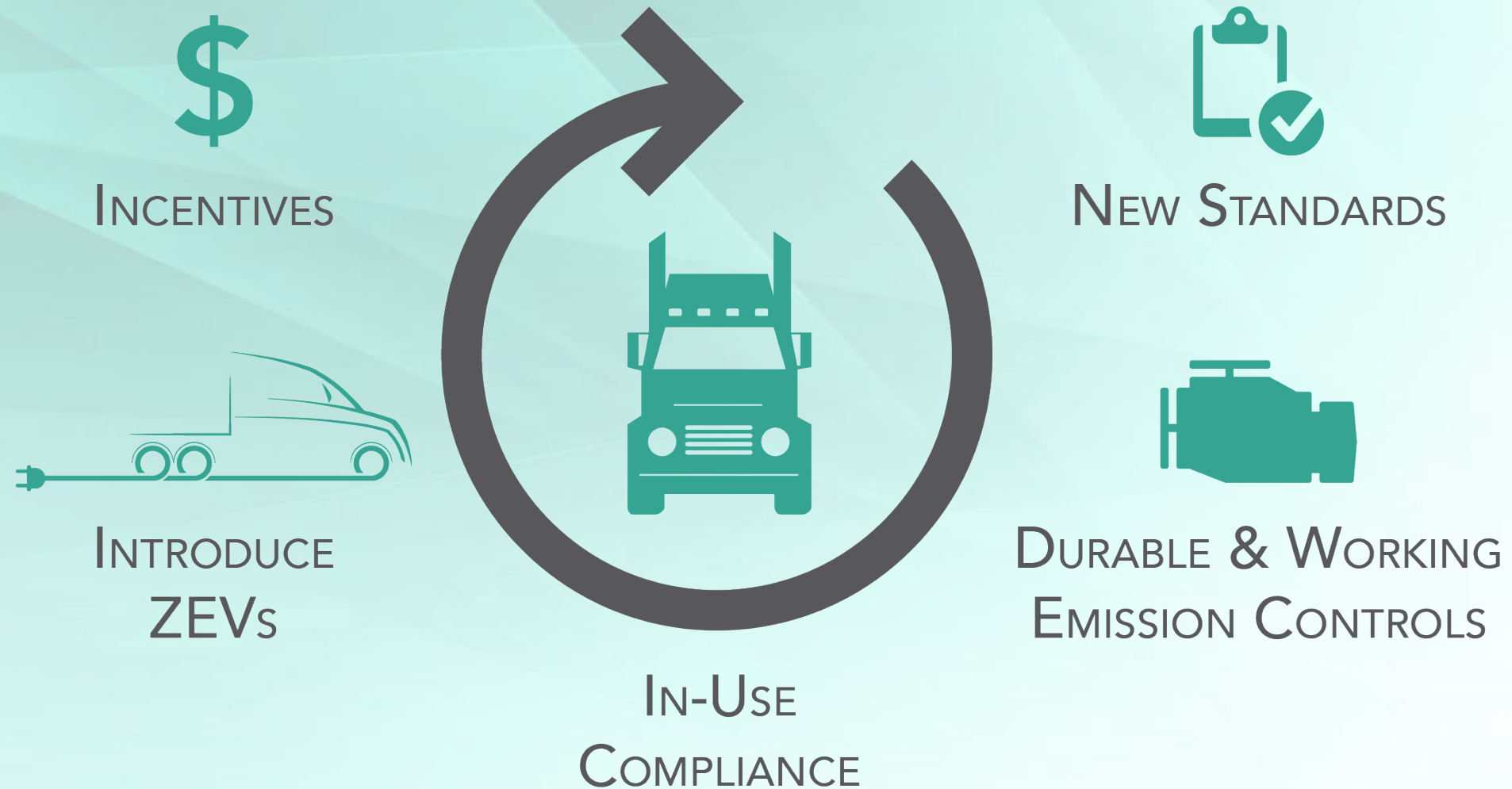**Amendments to Heavy Duty On-Board Diagnostic (HD OBD)
System Requirements and the Introduction of
Real Emissions Assessment Logging (REAL)**

Presentation to the Board

November 15, 2018

Presentation Overview

1. Context and Background

2. Proposed HD OBD Amendments

3. Costs and Benefits

4. Remaining Industry Concerns

5. Staff Recommendation

CARB

The Big Picture

$ INCENTIVES

INTRODUCE ZEVs

IN-USE COMPLIANCE

NEW STANDARDS

DURABLE & WORKING EMISSION CONTROLS

CARB

The Big Picture

DURABLE & WORKING EMISSION CONTROLS

Fleet Smoke Inspection Rules
May 2018

**HD Warranty (Step 1)**
June 2018

HD OBD and REAL
November 2018

HD Warranty (Step 2) & Warranty Reporting
December 2019

HD Inspection & Maintenance
Proposed 2020

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Context and Background

Reason for Changes

- Program updates occur regularly
  - Technology forcing regulation
  - Periodic reviews to check progress
  - Last comprehensive HD OBD update in 2012
- Proposal addresses:
  - Industry concerns regarding in-use testing burdens
  - Lack of clarity in portions of regulation
  - Issues discovered through certification and testing
  - Need to begin advancing mobile source program
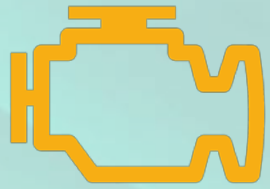
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What is OBD?

- Established by CARB for light and medium duty (LD, MD) starting in 1994; added HD starting in 2010
- A system in the engine's on-board computer that monitors the performance of emission-related components for malfunctions
  - Notifies owner and pinpoints malfunctioning component(s)
- Monitors emission systems in-use for the actual life of the vehicle/engine
- Designed as an inspection and maintenance (I/M) tool
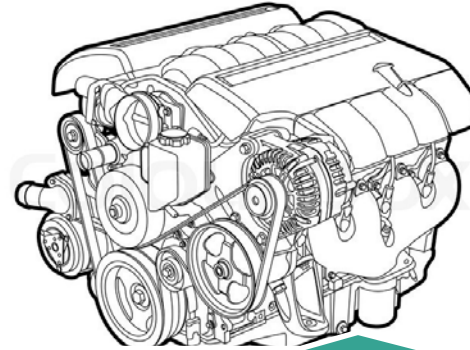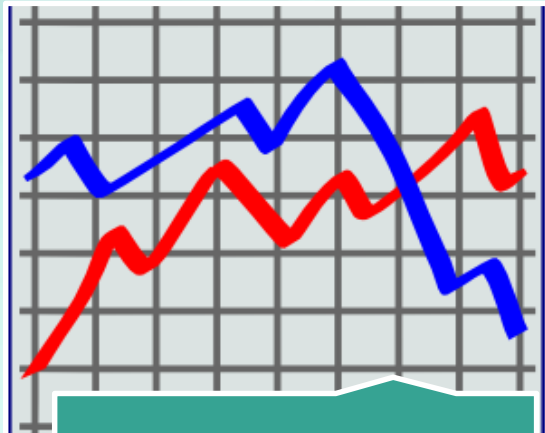- Cause of check engine light subject to emissions warranty

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Proposed HD OBD Amendments

Monitoring

Testing

Data

Compliance & Enforcement

CARB

Proposed Amendments

Monitoring Requirements

- Monitor = Signals entering onboard computer evaluated against malfunction criteria under specified conditions

- **Proposal:**
  - Require monitoring to occur more frequently
  - Require detection of more crankcase ventilation malfunctions
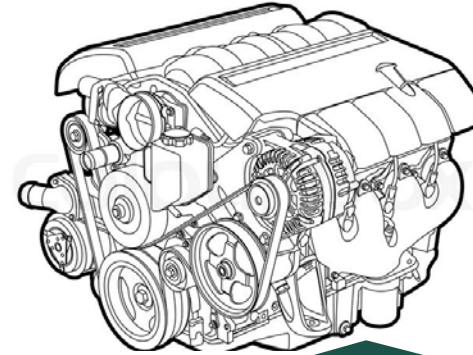 - Make it easier to exclude specific components from monitoring
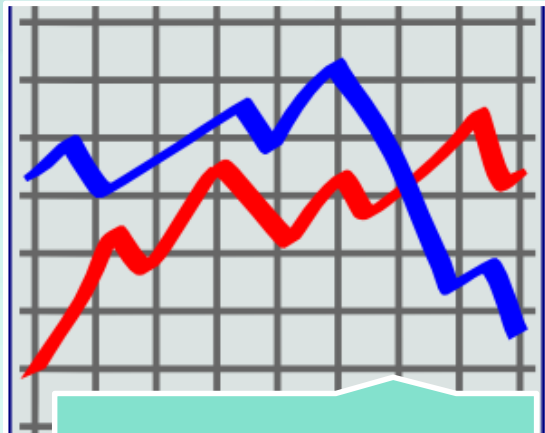
CARB

Proposed Amendments

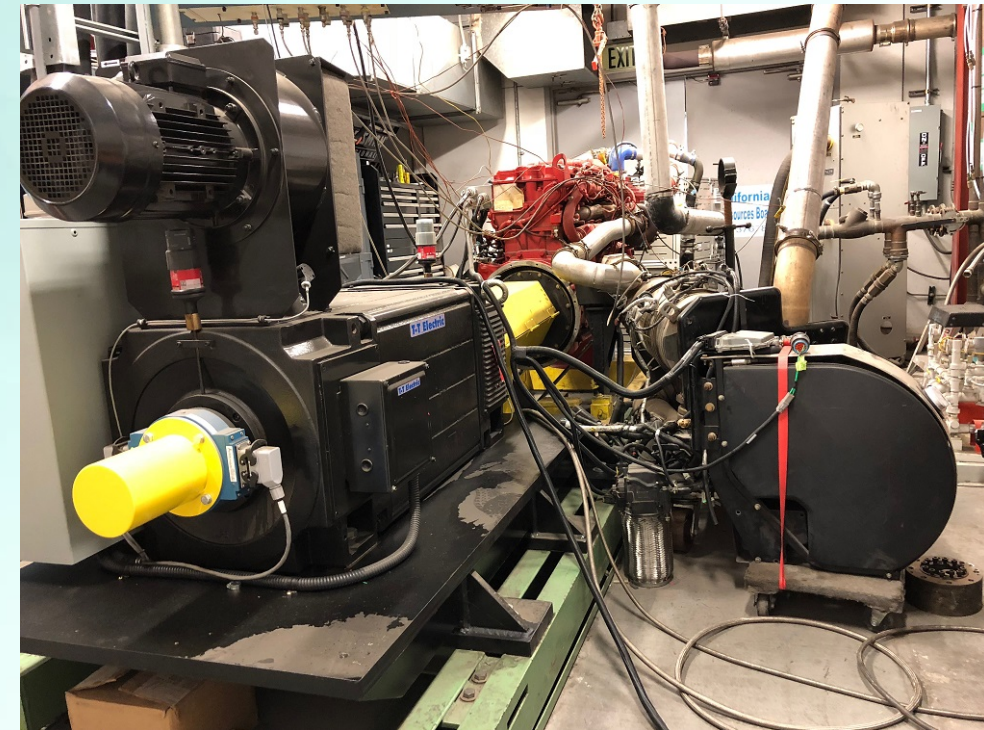# Proposed HD OBD Amendments

Monitoring

Testing

Data

Compliance & Enforcement

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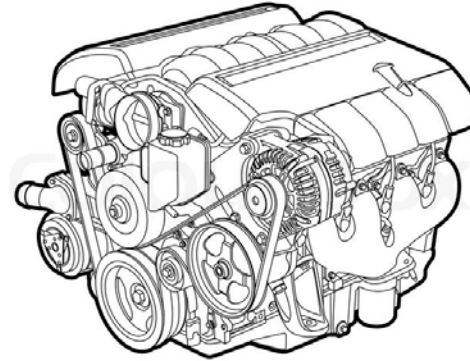# Certification Testing Requirements

- Conducted by the manufacturer and may take place before and after certification

- **Proposal:**
  - Engine demonstrations more representative of real-world aging

  - More data to evaluate compliance

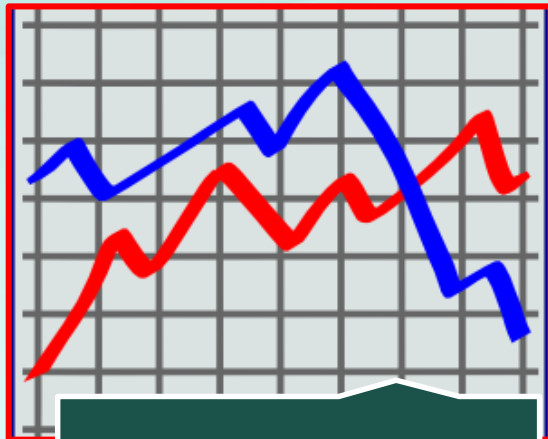 - Improved on-road verification of production OBD systems

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Proposed HD OBD Amendments

Monitoring

Testing

Data

Compliance & Enforcement

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"Real Emissions Assessment Logging" (REAL)

- Large scope of recent diesel emissions issues
  - Example 1 VW 2009-2015 – cheating scandal
    - Need to monitor actual real world emission performance
  - Example 2 Cummins 2010-2015 – SCR durability issue
    - Need to identify and resolve emissions problems sooner

- New tool on every new HD on-road engine for monitoring real world emission performance

- **Proposal**: Track and report data characterizing NOx and GHG/CO_2 emissions in the real world

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REAL: NOx Data Tracking

- Relies on existing technology and hardware to estimate and track NOx emissions
- Quick real world screening tool for flagging issues
- Emissions inventory development
- New tool for evolution of future regulatory development
- **Proposal:**
  - New MD and HD on-road diesel engines
  - Require engines to log NOx emissions and engine activity data (e.g., work, speed distributions)
  - Store recent and lifetime data separately

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Proposed Amendments

REAL: NOx Data Tracking (cont.)

- Working with industry to develop standard specifications

- Implementation of adopted standards straightforward and relies on existing technology

- Limitations exist in current engine control modules regarding space for proposed parameters

  - Sufficient lead-time needed

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REAL: GHG Data Tracking

- Relies on existing technology and hardware to estimate and track CO2 emissions
- Critical for determining actual benefits and establishing future standards
  - Federal Phase 2 Rule (2016)/CA Phase 2 Rule (2018)
- No GHG OBD malfunction criteria
- **Proposal:**
  - All HD on-road engines
  - Log GHG technology activity and CO_2 emissions/fuel consumption of HD trucks in real-world

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Proposed Amendments

Proposed HD OBD Amendments

Monitoring
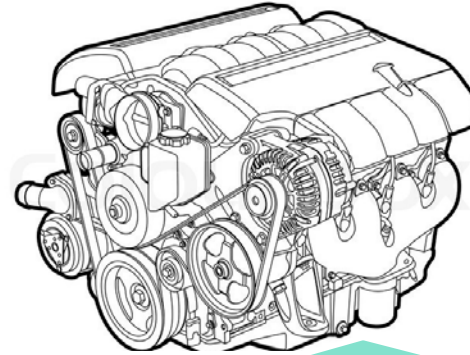
Testing
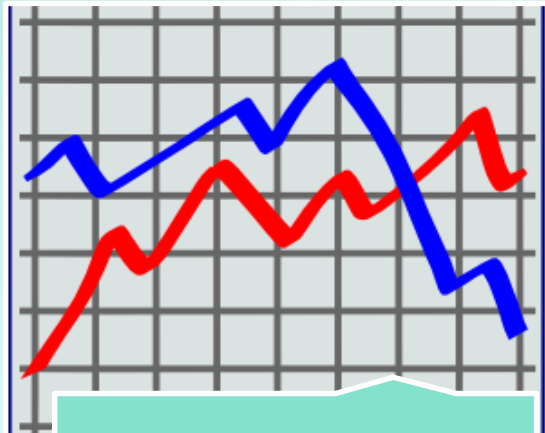
Data

Compliance & Enforcement

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Set Fines to Deter Noncompliance

Deficiencies allow CARB to certify OBD systems not in full compliance with OBD regulations.

	2010-2012	2013-2020	2021+
Emission Threshold (ET) Monitor	$0	$50	$100-$450
"Major" monitors	$0	$50	$100
All Other Monitors	$0	$25	$50
Total Fine Cap	$0	$500	$750 (2021), $1000 (2022), $1500 (2023+)

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Proposed Amendments

Compliance and Enforcement

- Manufacturer Self Testing (MST)
  - Provisions to make it easier to find engines to test
  - Reduced emissions testing burden
- Upon request, require manufacturers to provide hardware and software for in-depth investigations

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Proposed Amendments
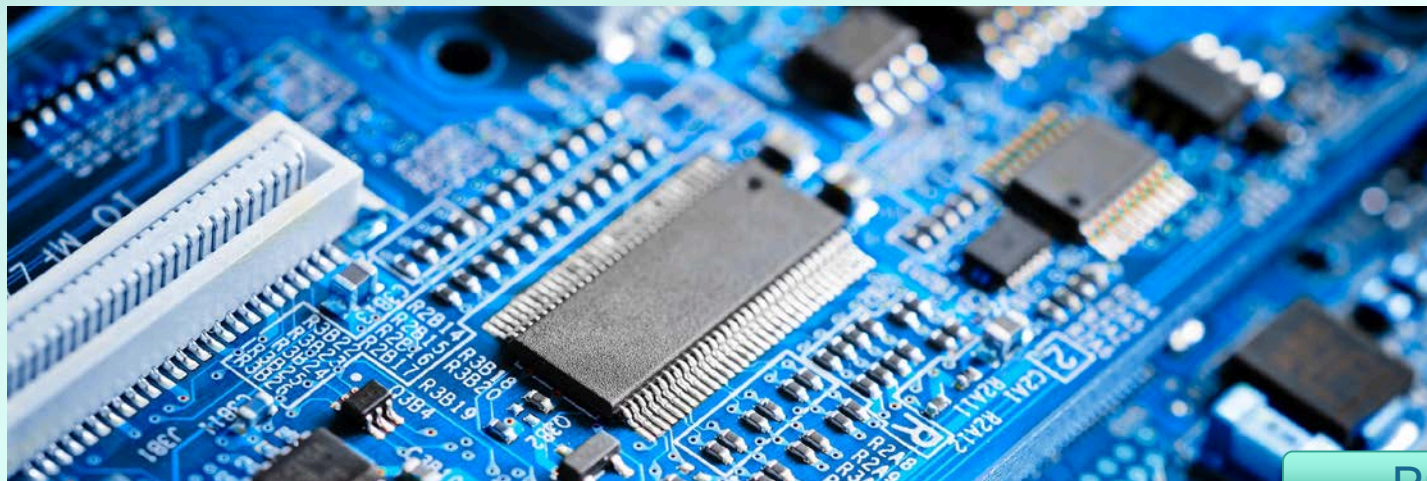
HD OBD Program Costs

- Calculated incremental costs to consumer of proposed amendments at $43 per engine

- Estimated costs based on published reports, related data, and input from manufacturers, suppliers, testing labs

- Non-compliance increases costs
  - Deficiencies
  - Increased MST costs

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Costs and Benefits

HD OBD Program Benefits

- Powerful tool on all on-road vehicles and trucks:
  - Ensures benefits of emissions programs are achieved in-use throughout the life of vehicle
  - Basis for warranty claims
  - Facilitates effective repairs
  - Promotes increased durability
  - Likely foundation for future HD I/M, similar to LD Smog Check
- Cumulative HD OBD program cost-effectiveness of $28 per pound of PM and $0.20 per pound of NOx comparable to other recent measures.

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Remaining Industry Concerns

- REAL better suited to HD emissions standards update
  - *Necessary tool for both current and future standards*
  - *Proposal based on current hardware and technology*
- Overall cost of OBD program too high
  - *CARB acknowledges cost of program, but necessary*
  - *Non-compliance can significantly increase costs*

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Industry Concerns

Overall HD OBD Program Costs to Consumers

Unit	First HD OBD Regulation ($2005)	MST ($2009)	Alt Fuels and Misfire Monitoring ($2012)	Current Proposal ($2018)	Total OBD Program ($2018)
Per engine	$132	$2	$23	$42	$242
Per "average" OEM	$9.5M	$123K	$1.8M	$1.8M	$14.3M
Industry Wide	$66.2M	$0.9M	$11.7M	$21.2M	$121.1M

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Industry Concerns

Costs of Non-compliance to OEMs

Cost Type	OEM A (0 ET & 9 other deficiencies)	OEM B (5 ET & 13 other deficiencies)
Cost of compliant engine (average OEM)		
Incremental cost of proposal	$32	$32
Cost of non-compliance (actual scenarios, proposed costs)		
Deficiencies	$450	Capped at $1500 ($1575)
Additional MST costs	$0	$20
Total cost to OEM (per engine)	$482	$1553

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Industry Concerns

Proposed Changes

15-day Changes:

- Delay HD OBD amendments, excluding REAL, MST relaxations, and other flexibilities, to 2024 MY

- Amend REAL proposal:

  - Option 1: Reduce required REAL parameters in 2022-2023 MY

  - Option 2: Full REAL in 2022, reduced OBD testing in 2022-2023 MY

- Delay deficiency fine increases to 2024 MY with 4 year increase trend and cap of $1250

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Industry Concerns

Staff Recommendation

Commitment to:

- Report to Board in 2021 calendar year
  - Technical review in light of HD on-highway program developments
  - Economic analysis for ongoing cost and benefits of OBD program

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Staff Recommendation

- Approve staff's proposal with 15-day changes
  - 15-day changes for clarifications and updating references
  - Staff-proposed 15-day changes
- Approve written response to environmental comments

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