On-Board Diagnostics II (OBD II) and Emission Warranty Regulatory Update

California Air Resources Board
Mobile Source Control Division

September 28, 2006
Sacramento, California

Today’s Presentation

- Background
- Gasoline OBD
- Diesel OBD
- Other Items
Background

- OBD II originally adopted 1989
  - 1996 and newer vehicles
- Monitors virtually every emission-related component
  - Threshold
  - Functional
- Illuminates warning light and stores fault info for repair technicians
- Program updates occur regularly
  - Last revisions adopted April 2002

Reasons for Changes

- Keep pace with technology
- I/M and technician feedback and experience
- Certification staff experience
- Review previous round of adopted requirements
Where we are today

- 120+ million OBD II equipped cars in the U.S.
  - More than 50% of the in-use fleet
  - Over 6 trillion miles accumulated in-use
- 25 states in the U.S. using OBD II for I/M, including CA
  - Nearly 13,000 OBD II inspections a day just in CA

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Gasoline OBD II Overview

- Requirements very mature
- Systems largely performing as designed
- Minimal changes proposed
- Updates focus primarily on issues identified in-use

Rear Oxygen Sensor Monitoring

- Problem: Not detecting some deteriorated catalysts
- Cause: Inadequate rear O₂ sensor performance
- Fix: Improved monitoring of rear O₂ sensor
- Proposal: 2009-2011 phase-in
### Cylinder A/F Imbalance

- **Problem:** Previously unconsidered failure mode with high emissions
- **Cause:** Cylinder to cylinder differences in air/fuel ratio
  - E.g., fuel injector variation
  - Improperly corrected by fuel control
- **Fix:** New monitor to specifically detect this fault using existing sensors
- **Proposal:** 2011-2014 phase-in

### Cold Start Emissions

- **Most emissions occur at cold start**
  - Before catalyst is warmed-up
- **“Cold start” strategies accelerate catalyst warm-up**
- **Monitoring currently required for failures that cause emissions to increase above a threshold**
Cold Start Strategy Monitoring

- Problem: Some only monitor entire strategy—requiring multiple components to fail before a fault is detected
- Fix: Require separate functional monitoring of each commanded element
  - E.g., ignition retard
- Industry concern: Individual elements have small emission impact and cannot be monitored as stringently as proposed
- Staff Response: If any element is non-functional (e.g., no ignition retard), something obviously broken

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Diesel Overview

• For Medium-duty, diesels:
  • Majority of the fleet
  • Share engines with Heavy-Duty
  • Align with Heavy-Duty OBD requirements
• For Light-duty, diesels:
  • Currently <1% of fleet
  • Compete with gasoline engines
  • OBD requirements should be comparable
  • New emission controls need time for OBD development

Medium-Duty Threshold Monitors

• For 2010+, thresholds identical to heavy-duty
  • Interim levels in 2010, drop to final in 2013
• For 2007-2009, thresholds reflect currently available technology
• Examples of threshold monitors include:
  • PM filter, EGR, fuel system, etc.
Light-Duty Threshold Monitors

- Goal is to achieve gasoline OBD parity by 2013
  - Less stringent requirements in 2007-2009 and 2010-2012
  - Necessary to allow entry of diesels into the market

### LD Diesel Threshold Table

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<th>Diesel Threshold Capability (multiple of FTP standard)</th>
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<td>3-5X</td>
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**RED = 2007 threshold**

**YELLOW = 2010 threshold**
Safeguards for Interim Diesels

- Some risk of excess emissions with reduced OBD capability in interim
  - Components degrade further before detected
  - Some unproven technologies (NOx catalyst)
- Additional in-use testing proposed to minimize risk
  - Vehicles tested at low and high mileage
  - Ensure compliance with tailpipe standards
  - Recall and remedy if high in-use emissions
- Pursue including diesels in Smog Check

Issue: Stringency of Diesel Thresholds

- Industry:
  - Proposed thresholds not feasible
  - Workload too great
- Staff Response:
  - Thresholds feasible considering unexplored potential of latest monitoring strategies
  - 6 year phase-in of thresholds addresses workload
Background: Adjustment Factors

- Periodic Regeneration Events
  - Stored/trapped emissions purged
  - Generally infrequent
  - Performed for several diesel components (e.g., PM filter)
  - Create periods of higher emissions
- Adjustment factors account for these emissions
  - Added to normal “driving” emissions
  - Gives a true average emission level
  - Used to determine compliance (e.g., certification)

Regeneration Emissions
**Issue: Adjustment Factors**

- Proposed Requirement: Calculate and use specific adjustment factors in determining OBD thresholds
- Industry Issue:
  - Use of factors increases stringency of thresholds
  - Workload too great
  - Must delay use of factors until 2010 or later
- Staff Response:
  - Necessary to ensure actual in-use emissions below malfunction thresholds
  - Interim flexibility proposed for early years
    - Use factors already calculated for tailpipe standard prior to 2010
    - Develop unique factor only for one monitor in 2008
    - Unique factors for all monitors in 2010

**Background: Tracking of Emission Bypass Strategies**

- Bypass strategies
  - Referred to as Emission Increasing-AECDs
  - Designed to avoid engine (or component) damage under specific conditions
  - Increase emissions when active
- Difficult for ARB to evaluate
  - necessity and frequency
  - quantify emission impact
- Need a means to validate manufacturer data
Issue: Tracking of Emission Bypass Strategies

- Requirement: Track cumulative operation with bypass strategy invoked
- Industry Issue:
  - Does not belong in OBD II regulation
  - Bypass strategies highly confidential
  - Test program of a few vehicles would yield same data
- Staff Response:
  - Confidentiality not being compromised
  - Data necessary to confirm minimal in-use activation (high emissions)

Other Items

- Conform OBD enforcement regulation to proposed changes in technical regulation
  - Recall for specific noncompliances that affect SmogCheck
- Emission Warranty regulations
  - Delete obsolete warranty parts list
Summary

- Effective OBD is essential to assuring emissions remain low
  - As important as the emission standards themselves
- Gasoline OBD working well
  - Only minor changes needed
- Diesel OBD is new
  - Time needed to develop highly effective OBD
  - Can be achieved by 2013

Staff Recommendation

- Adopt proposed regulations with 15 day changes
- Next technology review in 2 years