Discussion Points

- **Background**
- Gasoline Monitoring Changes
- Other OBD II Changes
- Enforcement Regulation Changes
- Emission Warranty Regulation Changes
- Diesel Monitoring Changes
Since its inception, OBDII regulation has been subject to biennial reviews
  - Report back to the Board on manufacturers’ progress in meeting the requirements and propose changes, as needed

Discuss proposed changes today
  - Follow up with a staff proposal in early 2006 for a ~March 2006 Board Hearing
Discussion today will also include proposed changes to Emission Warranty regulations
  • Primarily updating the high-priced components definition

Format for today’s discussion
  • Staff presentation on portion of changes followed by discussion of those items
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NOx Catalyst Monitoring

- Industry proposed 3.5 times the NOx standard as permanent NOx threshold
- Demonstration data indicate that 1.75 criterion is met on most demonstration vehicles
- Intend to retain final threshold of 1.75 x NOx standard for 2007 and subsequent model years
  - Industry has not justified need to extend 3.5 threshold
Cylinder A/F Imbalance Background

- Field testing has revealed a failure mode OBDII generally does not comprehend
  - Proposing an additional monitoring requirement to cover this
- Problem appears to be cylinder to cylinder differences in air/fuel ratio that are improperly corrected by fuel control
  - Can be caused by fuel injector variation, intake air delivery variation, or uneven EGR distribution
Zooming in on a plugged EGR orifice
Same EGR orifice after cleaning

~8mm orifice
Cylinder A/F Imbalance Background

- Imbalance can have a significant emission impact
  - NOx emissions on Altima:
    - 160k cat: 3.0x std before EGR cleaning, 2.4x std after
    - 0k cat: 1.1x std before EGR cleaning, 0.5x std after
  - Data from another manufacturer with varied fuel injection quantity
    - FTP emission impact from 0 to >5x std (depending on which cylinder) with ~25% quantity shift
- Many times front O2 sensor does not see all cylinders equally
  - Location of sensor in manifold collector
  - Oversensitive or “blind” to specific cylinders
  - Causes improper fuel system correction
Cylinder A/F Imbalance
Proposed Monitoring Requirements

- Detect an air-fuel ratio cylinder imbalance in one or more cylinders that prevents the fuel delivery system from maintaining emissions
- Emission Threshold: 1.5 x FTP standards
- Phase-in:
  - 25/50/75/100% for 2011/2012/2013/2014 model years
  - 100% in 2011MY for vehicles equipped with multiple EGR flow delivery passageways to deliver exhaust gas to individual cylinders or groups of cylinders
Cylinder A/F Imbalance
Possible Monitoring Strategies

• Problem first observed on a Geo Metro (Suzuki) with intake valve deposits
  • Caused cylinder A/F variations from internal EGR
• Investigation by Suzuki revealed front O2 sensor overcompensating for one cylinder
  • Close look at front O2 data by Suzuki showed “noise”
• Investigation by another manufacturer also showed some potential in front sensor signal analysis
Front Oxygen Sensor “Noise”
Cylinder A/F Imbalance
Possible Monitoring Strategies (cont)

- Rear O2 sensor signal often shows signs of cylinder imbalance as well
  - Geo Metro did not have rear O2 fuel control and rear sensor output was consistently lean (non-stoich)
- Rear sensor analysis alone might not be sufficient
  - Depending on catalyst and sensor configuration, rear sensor might not provide sufficient data
- Monitoring of rear O2 fuel control values not likely sufficient to cover all cases
  - This will remain a separate monitoring requirement
Rear Oxygen Sensor Monitoring

- **Current requirement includes:**
  - To the extent feasible, detect a fault when the rear sensor is no longer reliable for monitoring
- **Proper catalyst monitoring is a key concern**
  - In-use vehicles confirm suspicion that deteriorated rear sensors affect catalyst monitor (i.e., catalyst malfunction is detected after rear O2 sensor is replaced)
Rear Oxygen Sensor Concerns

- Ideal situation is that rear sensor is either:
  - Good enough to robustly detect a “threshold” catalyst; or
  - Detected as faulty rear sensor and turns on MIL
- Very few manufacturers meet this ideal situation
  - Most have a gap between where the sensor is no longer sufficient for catalyst monitoring and where it can be detected as malfunctioning
  - Even so, catalyst DTCs are a significant % of failures on high mileage cars in I/M
  - More malfunctioning catalysts will be properly identified in I/M with improved rear sensor monitoring
Rear Oxygen Sensor Regulation Changes

- Add specification as to minimum acceptable monitor:
  - Use experience from what manufacturers have been doing
  - Demonstration that ideal situation is met eliminates need for further improvement
- Require “two-prong” rich-to-lean monitoring
  - Verify sensor goes lean enough, fast enough during mandatory, intrusive fuel cut
  - Isolate sensor response from catalyst effects and transport time as much as possible
Rear Oxygen Sensor Changes (cont’d)

- The OBD II system shall, at a minimum, detect a slow rich to lean response malfunction during a fuel shut-off event (e.g., deceleration fuel cut event)
  - Monitor the sensor response time from a rich condition (e.g., 0.7 Volts) prior to the start of fuel shut-off to a lean condition (e.g., 0.1 Volts) expected during fuel shut-off conditions
  - Monitor the sensor transition time in the intermediate sensor range (e.g., from 0.55 Volts to 0.3 Volts)
  - Diagnostics should be calibrated to the extent feasible with application specific data (“corporate” calibrations are unacceptable)
- Required tracking and reporting of in-use monitoring frequency for 2010 model year
Rear Oxygen Sensor Monitoring

Time since fuel shutoff to go Lean

Transition Time
Further Rear O2 Investigation

- Still investigating feasible methods for lean-to-rich monitoring
  - Current strategies include enrichment or immediately following re-fueling after DFCO
  - No proposed regulatory changes at this time
Comprehensive Components

- Added exemption provisions under transfer case requirements
- Components/systems that are driven by the engine and affect emissions due to added engine load may be exempt if:
  - They are not related to the control of fueling, air handling, or emissions, AND
  - They are not used as part of the diagnostic strategy for any other monitored system or component.
- E.g., electronic power steering
Comprehensive Components cont’d

- Components/systems that affect emissions due to added electrical load may be exempt if:
  - They are not related to the control of fueling, air handling, or emissions, AND
  - They are not used as part of the diagnostic strategy for any other monitored system or component.
- E.g., smart charging system component malfunctions
Comprehensive Components - Hybrids

• Manufacturers shall submit monitoring plan of the hybrid components for ARB approval
• Monitoring required for
  • All components/systems used as part of the diagnostic strategy for any other monitored system or component
  • All energy input devices to the electrical propulsion system
  • Battery and charging system performance, electric motor performance, and regenerative braking performance
• Monitoring of performance accessory loads is not required
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Permanent DTCs

- The proposal requires the implementation of permanent DTCs as was done in HD OBD
- Feedback from I/M programs is showing an increase in readiness status loopholes
  - CA Smog Check allows up to two monitors to be not ready at the time of inspection w/o failing the OBD test
  - Running all monitors may be too burdensome
  - What we are really interested in are monitors that have detected a fault and commanded the MIL on
Structure of Permanent DTCs

- Any DTC that is commanding the MIL on must be logged as a permanent fault code
  - Permanent DTCs must be stored in memory that survives a battery disconnect and all scan tool clear code commands (e.g., Mode $04 clear, reset KAM, enhanced comm mode clearing, etc.)

- Permanent DTC can only be erased by the vehicle’s OBD II system. The following are two examples for clearing:
  - (1) If the fault is healed or fixed and MIL goes off, the permanent DTC can be erased at the time the MIL goes off
  - (2) If the Mode $03 DTC is cleared with a scan tool, the permanent DTC is not erased, but can be cleared after the specific monitor that set the MIL has run and reached a pass judgment

- Still working on the best format to retrieve PDTCs. Some possible solutions are creating a new mode in SAE J1979 or creating a new request as a subpart of the existing Mode $09
Permanent DTCs

- **NVRAM Memory Requirements**
  - Enough memory must be allocated to store a minimum of four permanent DTCs
  - Additionally, misfire and fuel system permanent DTCs must also store similar conditions in NVRAM to allow for proper erasure
- **Permanent DTCs will be fully implemented in the 2010 MY**
  - Not proposing phase-in requirements but all vehicles must comply in the 2010 MY
DDV and PVE Changes

- **DDV and PVE Selections**
  - **Existing Selection Requirements:**
    - 1 - 5: 1 DDV; 2 PVE
    - 6 - 10: 2 DDV; 4 PVE
    - 11+: 3 DDV; 6 PVE
  - **New Selection Requirements:**
    - 1 - 5: 1 DDV; 2 PVE
    - 6 - 15: 2 DDV; 4 PVE <= changed
    - 16+: 3 DDV; 6 PVE <= changed
PVE Testing

- **Section (j)(1) – J1699 Testing**
  - The regulation makes specific references to the J1699-3 test
  - The time to complete and submit test data has been extended from 1 month to 2 months after production

- **Section (j)(2) – MIL Demonstration Testing**
  - No Changes

- **Section (j)(3) Rate-Based**
  - The time to collect and submit rate-based data has been extended from 6 months to 12 months after production
Rate-Based Changes

- **Interim 0.100 Ratio**
  - The interim 0.100 ratio has been extended by one year for each phase-in year (Section (d)(3.2.1)(D))

- **PM Filter Monitoring**
  - Added language to allow the PM filter monitor and other monitors designed to execute on active regen events to increment the denominator every 500 miles
  - Required to meet 0.336 ratio
Rate-Based

- Background Rate-Based Calculations
  - For 0.020” Leak
    - Ratio of 0.26 = 50% in 2 weeks with MIL ON and 81% in 4 weeks
  - For 0.040” Leak
    - Ratio of 0.52 = 77% in 2 weeks with MIL ON and 90% in 4 weeks
MIL Circuit Monitoring

- I/M Programs & Bulb Check
  - Not obvious to a technician to initiate KOEO on keyless ignition vehicles
  - KOEO procedures are not standardized
  - More MFGs using Keyless ignition

- MIL Circuit Monitoring
  - OBD II system must be able to detect burned out bulb/circuit faults and report MIL status as “commanded on”
  - Requirement for 2010 MY and subsequent keyless ignition vehicles
Mail-Out

- Standardized Templates Referenced in Regulation
  - OBD II Certification Application
    - Existing Mail-Out #95-20
  - Misfire Data
    - Probability of Detection table Mail-Out #96-05, and
    - Misfire Disablement plot
  - Cal ID/CVN
    - Electronic submission per specified format
    - Allows for data to be efficiently uploaded into database
  - Rate-Based Data (j)(3)
    - Electronic submission and hardcopy
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Enforcement Regulation (1968.5) Updates

- Non-substantive changes
  - Updated references to sections within 1968.2
  - Modified to comprehend additive and multiplicative thresholds
- Rate-based
  - Aligned in-use rate-based compliance with longer roll-out of 0.100 ratio
Enforcement Regulation (1968.5) Updates (cont.)

- Change to Mandatory Recall criteria
  - Currently includes “…cannot be tested so as to obtain valid test results in accordance with the procedures of the California I/M program…”
  - Also references a BAR inspection manual
- Specific criteria now enumerated in 1968.5(b)(6)(C)(ii)
  - Same intent, but eliminated reference to other documents
  - Listed each item that needs to be communicated properly to ensure successful testing
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Emission Warranty Background

- Sections 2035, 2037, and 2038 are relevant
  - 2035 is definitions
  - 2037 is “defects” warranty
  - 2038 is “performance” warranty
- Current warranties essentially require:
  - 3yr/50k for all emission parts including anything that turns on the MIL (“defects”) plus anything that causes an I/M fail (“performance”)
  - 7yr/70k for “high-priced” parts
    - Meet a CPI adjusted cost for repair and are on a parts list
Emission Warranty Changes

- Sections 2035 and 2038 modified
- Non-substantive modifications
  - Reformatting and clean-up of 2035 and 2038
- For reference, 2035(c)(2) defines “warranted part” as:
  - “any part…which affects any regulated emission…subject to California emission standards”
- And, 2037(b)(2) requires:
  - 3yr/50k defects coverage for “warranted parts”
Emission Warranty Changes (cont.)

- Section 2037(c) modified
- Definition of “high-priced” parts changed
  - Cost numbers/equation unchanged
  - Changed coverage from:
    - Meets cost number and is on the “Emission Warranty Parts List,” last amended February 22, 1985
  - To:
    - Meets cost number and is subject to 3 yr/50k defects coverage as a “warranted part”
- Would apply starting with 2007 MY vehicles produced after June 1, 2006