

Misfire Monitoring

- Requirement for 2004+ MY:
 - Must detect misfire occurring continuously in one or more cylinders during idle
- Requirement for 2010+ MY vehicles equipped with combustion/combustion quality sensors:
 - Monitor for misfire that causes NMHC, CO, or NO_x emissions > 2.0 x standards; or PM emissions > applicable standard + 0.02 g/bhp-hr
 - Monitor during entire speed and load range



Misfire Monitoring (cont'd)

- Full-range, intermittent misfire monitoring necessary
 - Aggressive use of EGR and other concepts such as HCCI cause engine to operate near combustion limits at various speeds and loads



California Environmental Protection Agency

AIR RESOURCES BOARD

EGR System Monitoring

- 2004 + MY PCs, LDTs, and MDVs certified to a chassis dynamometer tailpipe emission standard
 - Detect following EGR faults before NMHC, CO, NO_x, or PM emissions > 1.5 x standards
 - EGR Flow Rate
 - EGR Response Rate
 - EGR Cooling System Performance
- 2007+ MY MDVs certified to an engine dynamometer tailpipe NO_x emission standard > 0.50 g/bhp-hr NO_x
 - Detect above faults before emissions exceed 1.5 x standards for NMHC, CO, or NO_x; or PM > standard + 0.02 g/bhp-hr



California Environmental Protection Agency

AIR RESOURCES BOARD

EGR System Monitoring

- 2007+ MY MDVs certified to an engine dynamometer tailpipe NOx emission standard ≤ 0.50 g/bhp-hr NO
 - Detect above faults before emissions exceed $2.0 \times$ standards for NMHC, CO, or NOx; or PM $>$ standard + 0.02 g/bhp-hr



California Environmental Protection Agency

AIR RESOURCES BOARD

EGR System Monitoring (cont'd)

- Additional requirement: Detect fault if closed loop EGR system:
 - Fails to enter closed loop
 - Defaults out of closed loop
 - Control authority reaches limits



California Environmental Protection Agency

AIR RESOURCES BOARD

Boost Pressure Control Monitoring

- 2004 + MY PCs, LDTs, and MDVs certified to a chassis dynamometer tailpipe emission standard
 - Detect following faults before emissions exceed 1.5 x standards:
 - Under and over boost malfunctions
 - Slow response (VGT systems only)
 - Charge air undercooling
- 2007+ MY MDVs certified to an engine dynamometer tailpipe NOx emission standard > 0.50 g/bhp-hr NOx
 - Detect above faults before emissions exceed 1.5 x standards for NMHC, CO, or NOx; or PM > standard + 0.02 g/bhp-hr



California Environmental Protection Agency

AIR RESOURCES BOARD

Boost Pressure Control Monitoring

- 2007+ MY MDVs certified to an engine dynamometer tailpipe NO_x emission standard ≤ 0.50 g/bhp-hr NO_x
 - Detect above faults before emissions exceed 2.0 x standards for NMHC, CO, or NO_x; or PM > standard + 0.02 g/bhp-hr



California Environmental Protection Agency

AIR RESOURCES BOARD

Boost Pressure Control Monitoring

- Additional requirement: Detect fault if closed loop system:
 - Fails to enter closed loop
 - Defaults out of closed loop
 - Control authority reaches limits



California Environmental Protection Agency

AIR RESOURCES BOARD

Diesel Engine Aftertreatment Monitors

- NMHC Catalyst
- NOx Catalyst (Lean NOx and SCR)
- NOx Adsorber
- PM Filter



California Environmental Protection Agency

AIR RESOURCES BOARD

NMHC Catalyst Monitoring

- 2004 + MY PCs, LDTs, and MDVs certified to a chassis dynamometer tailpipe emission standard
 - Detect conversion efficiency fault before NMHC emissions exceed 1.75 x standards
- 2007+ MY MDVs certified to engine dynamometer tailpipe NMHC emission standard > 0.14 g/bhp-hr NMHC:
 - Detect conversion efficiency fault before NMHC emissions exceed 1.75 x standards
- 2007+ MY MDVs certified to engine dynamometer tailpipe NMHC emission standard ≤ 0.14 g/bhp-hr :
 - Detect conversion efficiency fault before NMHC emissions exceed 2.0 x standards



California Environmental Protection Agency

AIR RESOURCES BOARD

NMHC Catalyst Monitoring (cont'd)

- For 2004 - 2009 MY vehicles, NMHC catalyst monitor may be exempted if the average FTP test NMHC conversion efficiency of the system < 30 percent
- Functional monitor to detect fault if:
 - Insufficient exotherm to achieve PM filter regen
 - Insufficient NO_2 feedgas generation for SCR
 - No NMHC conversion on clean-up/guard catalysts



California Environmental Protection Agency

AIR RESOURCES BOARD

NOx Catalyst Monitoring (Lean NOx and SCR)

- 2004 + MY PCs, LDTs, and MDVs certified to a chassis dynamometer tailpipe emission standard:
 - Detect NOx conversion efficiency faults before NOx emissions $> 1.75 \times$ standards.
- 2007+ MY MDVs certified to an engine dynamometer tailpipe NOx emission standard > 0.50 g/bhp-hr NOx :
 - Detect following faults before NOx emissions $> 1.75 \times$ standards:
 - NOx conversion efficiency
 - SCR reductant delivery
- 2007+ MY MDVs certified to an engine dynamometer tailpipe NOx emission standard ≤ 0.50 g/bhp-hr NOx:
 - Same as above except detect faults before NOx emissions exceed the standards by 0.2 g/bhp-hr



Miscellaneous

- Fuel System Component Tolerance Coding
 - Some manufacturers utilize coding of fuel injectors/fuel pumps to adjust for flow characteristic differences
 - Staff is concerned that an engine operating with the wrong coding for coded parts could have increased emissions without an indication of a malfunction to the vehicle operator
 - How do we address this issue?

Miscellaneous – standardization changes

- Updated standardization specifications: J1939-73, more diesel-specific engine parameters to be supported, etc.
 - Fuel inj. timing, intake man. temp., intercooler temp., etc.
 - 2010 MY+ eng.-dynamometer-certified MDVs
 - NOx NTE real-time control area status, PM NTE real-time control area status

Miscellaneous – In-use Performance/Tracking changes

- Track and report in-use performance:
 - Various Catalyst monitors
 - Exhaust Gas Sensors
 - EGR system
 - PM filter
 - NOx adsorber
- 0.336 minimum ratio
- No interim ratios

Miscellaneous- AECD Tracking

- For diesels, require real-time tracking and cumulative logged data:
 - Engine run time with each individual emission increasing AECD active
- Valuable tool for emission testing (verify collected data were valid)
- Can be used by certification staff for future model year approvals of AECDs
- Assist in evaluating OBD monitoring frequencies during certification



What is an emission-increasing AECD?

- Any approved AECD that is not classified as an NTE deficiency but causes emissions to exceed the NTE emission limits regardless of whether it occurs within or outside of the NTE control area.
 - Extended idle strategy or other engine protection strategies that cause emissions to exceed the numerical NTE emission limits even though they may not occur inside the NTE control area

