

EPA Clean Diesel Engine Implementation Workshop

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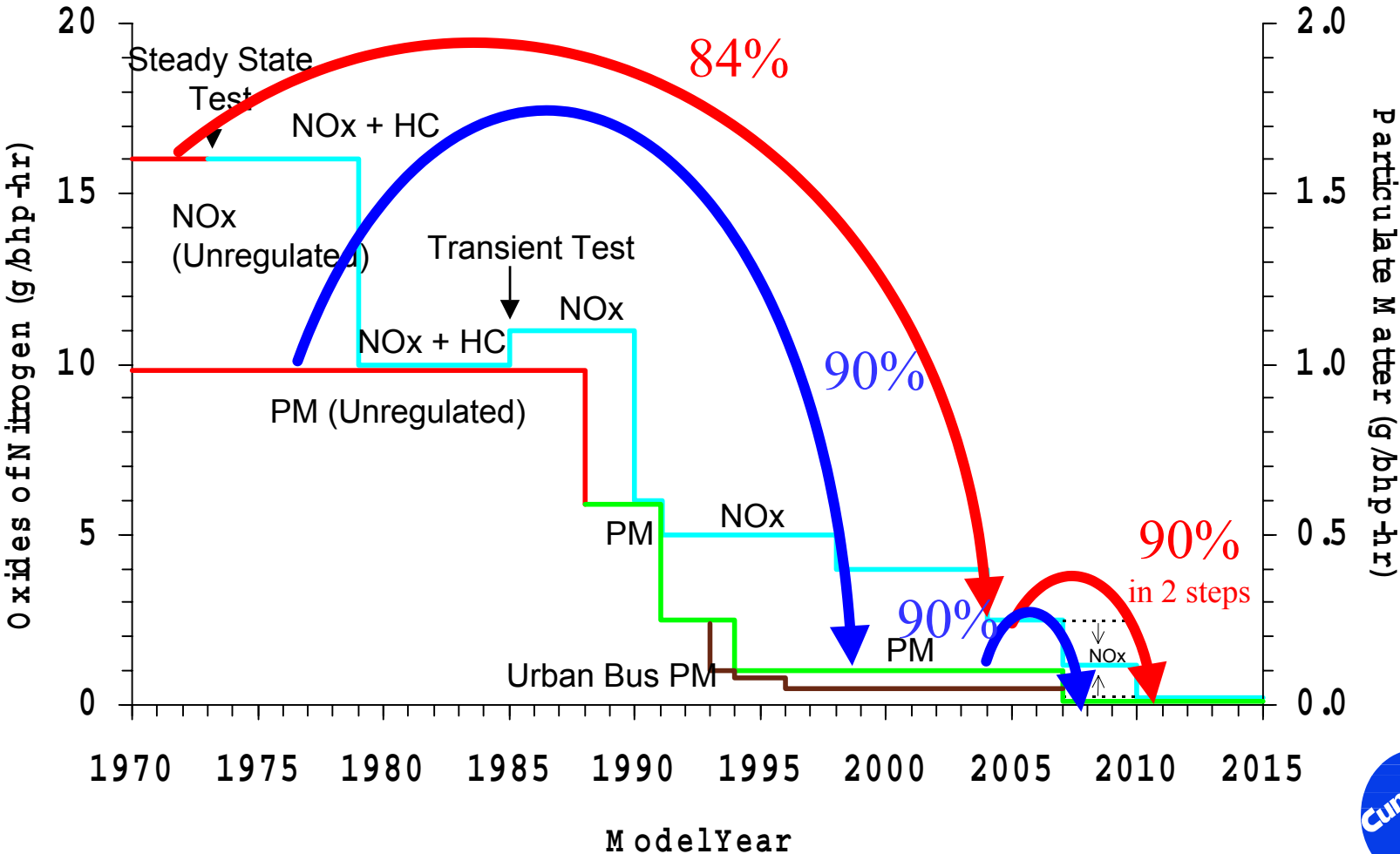


Implications of On-Board Diagnostics for Engine Manufacturers

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EPA Heavy-Duty Engine Emission Standards



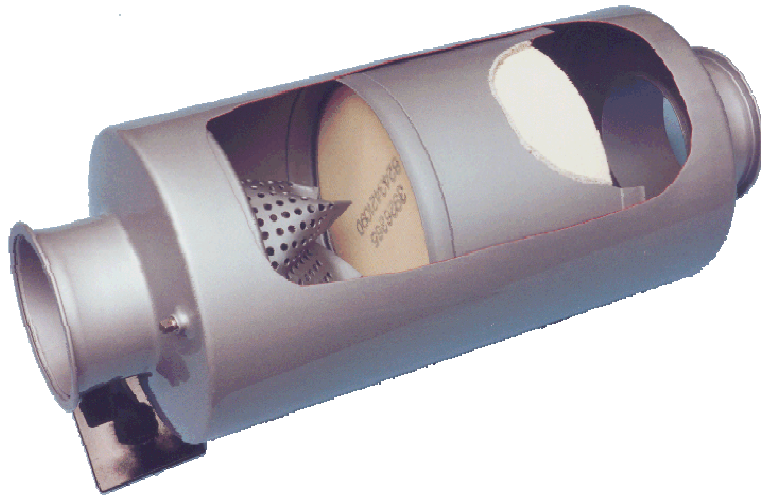
Future Emissions Standards

- Compliance represents a significant task
- Reducing NOx and PM the additional 90% will require more resources than the 84% and 90% already delivered
- Already are implementing a manufacturer led in-use compliance program
 - ◆ Testing required in 2007 with pilot to begin in 2005
 - ◆ In-use emission test 25% of our engine families per year
 - ◆ Approximately 10 vehicles per family



Emission Reduction Strategies

- Particulates and Hydrocarbons
 - ◆ Oxydation Catalyst
 - ◆ PM Filtration
- NOx
 - ◆ Selective Catalytic Reduction (SCR)
 - ◆ NOx Adsorbers
 - ◆ Exhaust Gas Recirculation (EGR)
 - ◆ Combustion System and Fuel Injection Equipment Improvements



July 25 CARB HD OBD Draft Regulation - Concerns from a quick review

- Compliance Date of 2007 **Vehicle Model Year is specified**, not Engine Model Year
- Diagnostic Monitoring of all electrical inputs and outputs, plus major systems for:
 - ◆ Engine, Aftertreatment, **Transmission and Vehicle Systems**
 - ◆ Major System Monitors that are **Vehicle Dependent**
 - This presents a calibration issue for items like vehicle cooling/electrical systems and transmissions

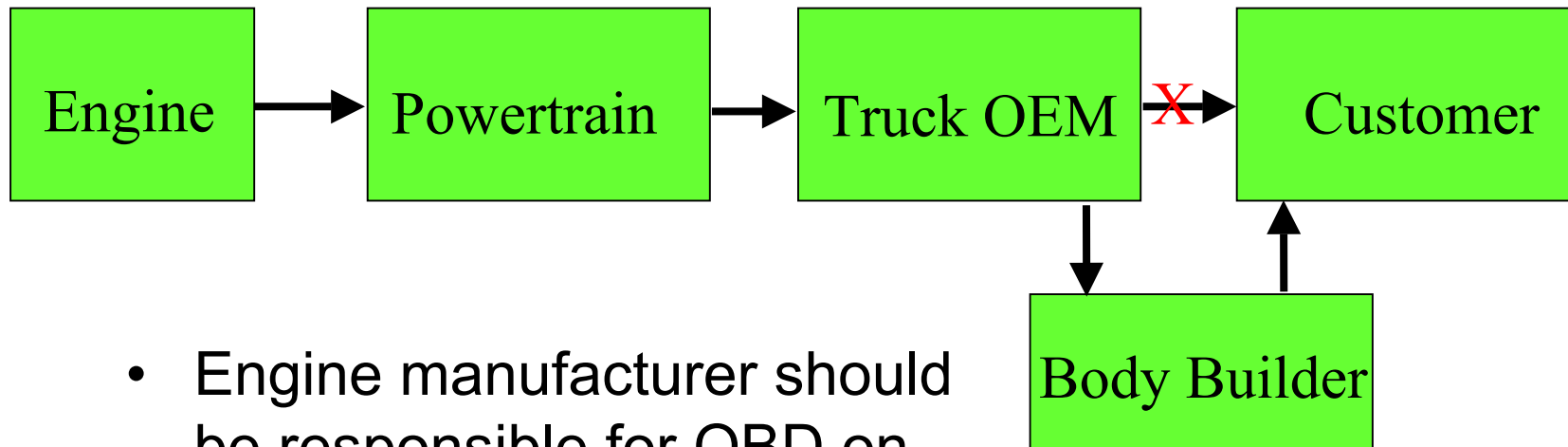


July 25 CARB HD OBD Draft Regulation - Concerns from a quick review

- Engine OEM responsible for the certification process **including vehicle functions**
 - ◆ OBD test cycles for validation/demonstration
 - ◆ Significant pre- and post-production requirements
- Specified Scan Tool protocol and connector
 - ◆ **Does not allow J1939 or existing connector**
- **Different service language and process** vs. today's
 - ◆ Confirmed fault, pending, readiness, continuous, non-continuous, etc.
 - ◆ Emissions vs. other faults
 - ◆ Impact on technician training and procedures



Who is Responsible for OBD Certification?



- Engine manufacturer should be responsible for OBD on the engine and corresponding aftertreatment system
 - ◆ Multiplexed sensors and systems present additional challenges
- Engine manufacturer should not be held responsible for OBD requirements beyond its expertise and influence



Magnitude and Complexity of OBD Work (Cummins Example)

Year	Engine Platforms	Ratings/ Engine	OEM's	Complexity Index
2003	1	4	1	4
2005/7	4	5	3	60
When >14K GVW included	10 CI/SI	7	5	350

- Bodybuilder scenario adds additional complexity



Resources and Timing

- Significant resources are required to implement
- The Industry has insufficient leadtime to fully implement OBD compliance
 - ◆ Light Duty OBD II promulgated in 1989 and implemented in 1996
 - ◆ Time of over 6 years with several years prior experience on OBD I
 - ◆ Current draft regulation allows 3 - 5 years for Heavy Duty



Recommendation

- Cummins advocates a phased implementation approach to Heavy Duty in-use compliance assurance
 - ◆ First phase should be the manufacturer run in-use test program
 - ◆ OBD requirements should be deferred to a later phase
- Cummins would like to be involved in further discussions on the listed concerns

