

Faster Freight – Cleaner Air 2004

Next Generation Natural Gas Vehicle (NGNGV) Engine & Vehicle Projects

Richard Parish
richard_parish@nrel.gov
303-275-4453

Mike Frailey
Margo Melendez
Jarett Zuboy

NGNGV Activity

- Initiated in 2000
- Focused on medium and heavy-duty trucks
- Supported by DOE, SCAQMD, and CEC
- Program development workshops attended by stakeholders:
 - Engine and vehicle OEMs
 - Fleet operators
 - Industry and trade associations
 - Funding partners
 - Utilities and fuel distributors
 - Equipment suppliers
 - National labs
 - Consultants and universities



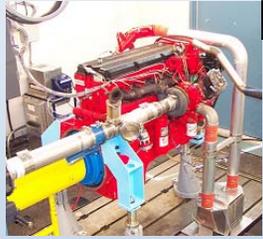
NGNGV Activity

Workshop Results

- Need engine R&D to meet proposed 2007/2010 standards (0.5 g/bhp-hr NO_x, 0.01 g/bhp-hr PM)
- Current plans
 - 2007: 1.2 g/bhp-hr NO_x, 0.01 g/bhp-hr PM
 - 2010: 0.2 g/bhp-hr NO_x, 0.01 g/bhp-hr PM
- Technologies
 - Lean-burn combustion
 - Stoichiometric combustion (EGR)
 - Exhaust after-treatment
- Market research: identify & define best application
- Customer demand for near-term engines/vehicles



NGNGV Integrated R&D Strategy



Commercialization

Research Development

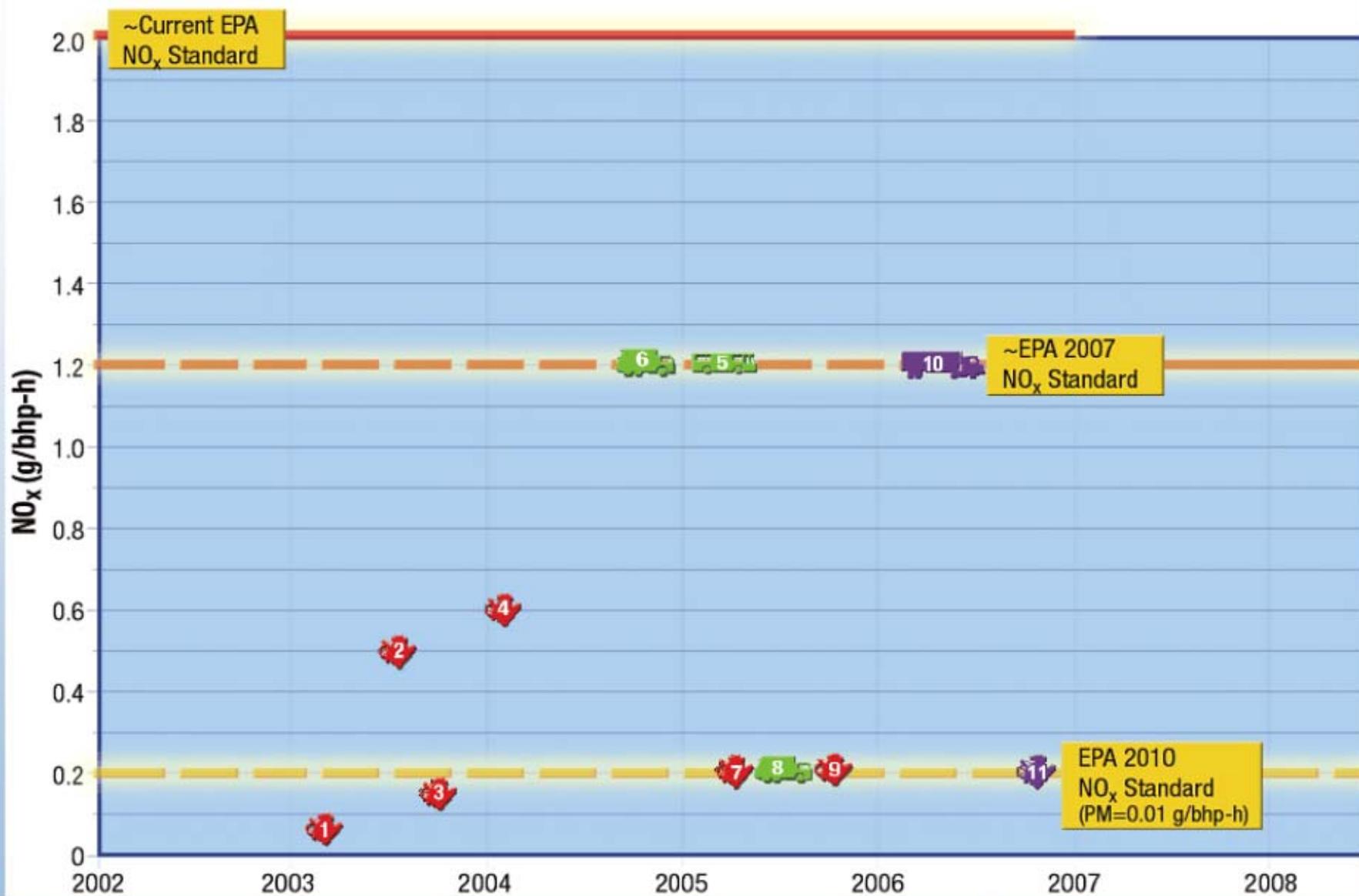
Proof of Concept

Engine Laboratory

Long-Term Engine/Vehicle

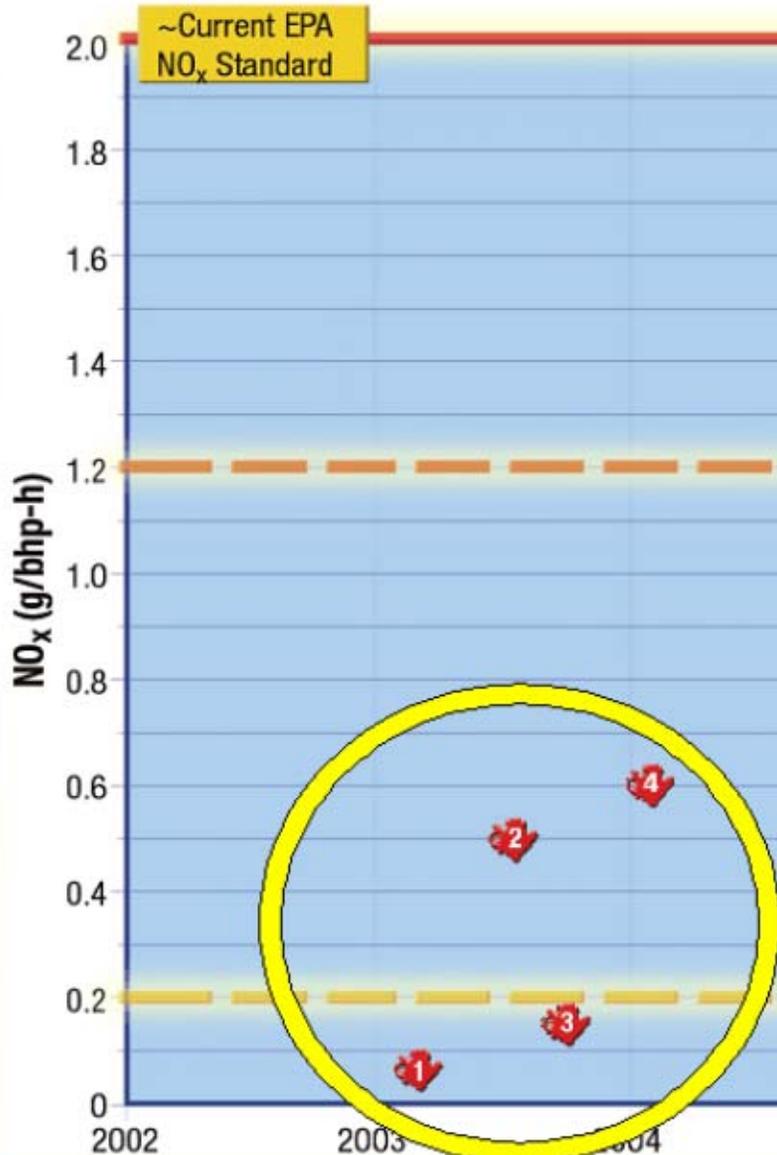
Vehicle Demonstration

Next Generation Natural Gas Vehicle Projects



ACTUAL/ANTICIPATED COMPLETION DATE

Completed NGENGV Projects

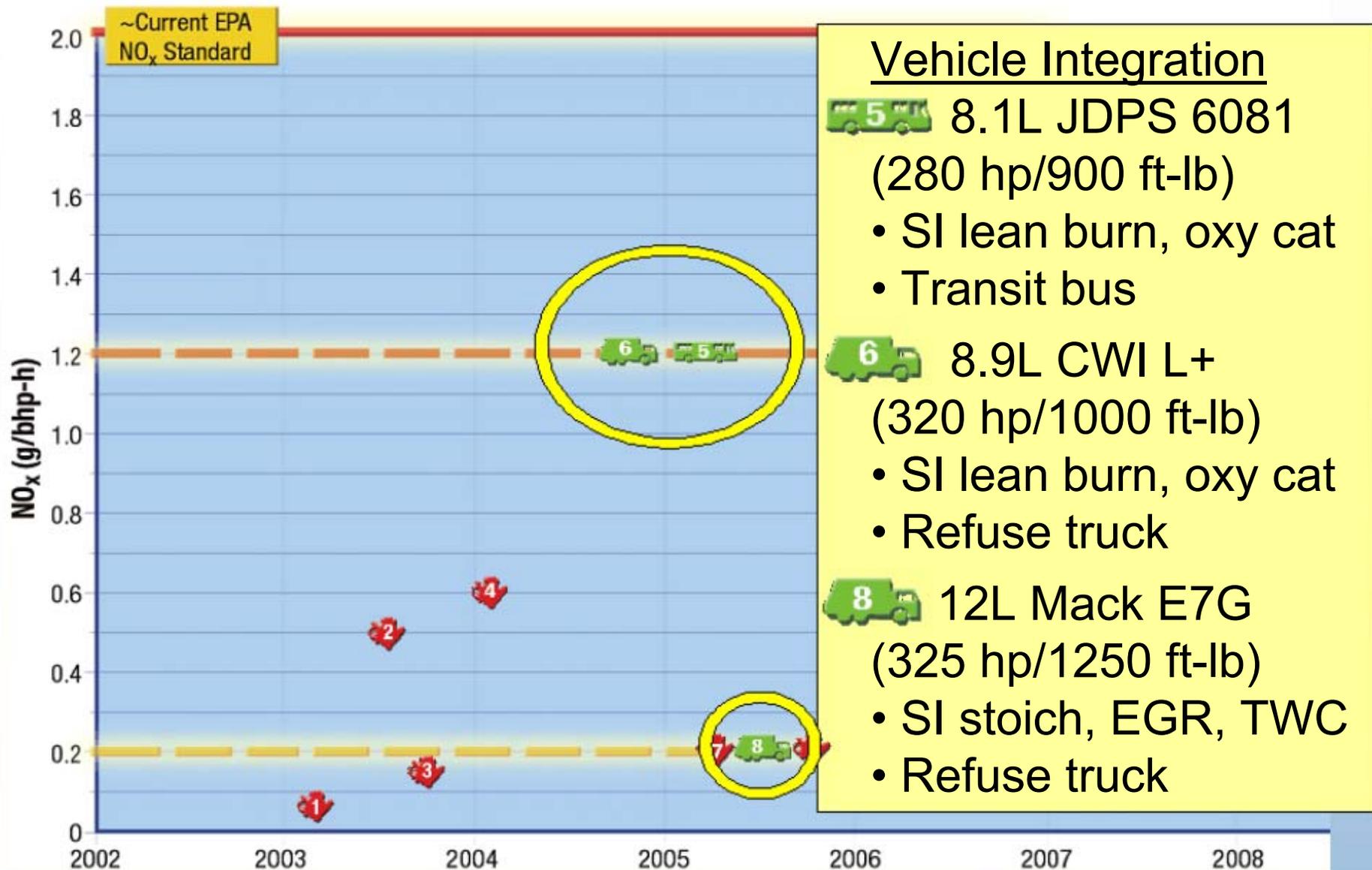


Engine Proof of Concept

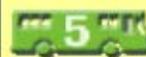
- 1 6L GM (286 hp/317 ft-lb)
 - SI stoichiometric w/TWC
 - 0.08 NOx, 0.002 PM
- 2 12L Cat C12 (410 hp/1250 ft-lb)
 - Dual-Fuel w/EGR & CDPF
 - 0.54 NOx, 0.004 PM
- 3 5.9L CWI B+ (230 hp/500 ft-lb)
 - SI lean burn w/LNA
 - 0.15 NOx, 0.01 PM
- 4 15L CWI ISX (450 hp/1650 ft-lb)
 - HPDI w/EGR & oxidation catalyst
 - 0.6 NOx, 0.03 PM

ACTUAL/ANTICIPATED COMPLETION DATE

Ongoing NGENGV Projects



Vehicle Integration



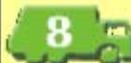
8.1L JDPS 6081
(280 hp/900 ft-lb)

- SI lean burn, oxy cat
- Transit bus



8.9L CWI L+
(320 hp/1000 ft-lb)

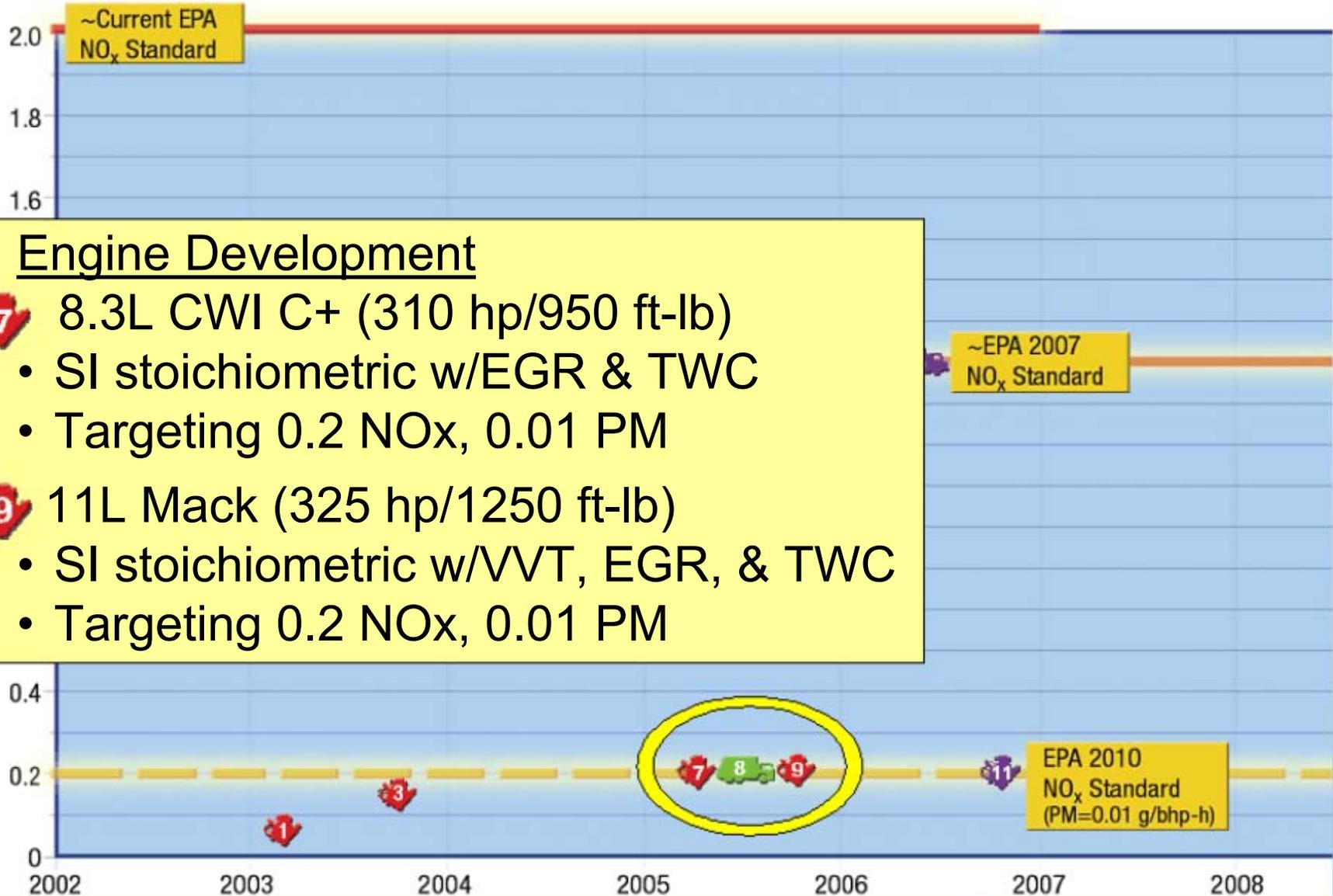
- SI lean burn, oxy cat
- Refuse truck



12L Mack E7G
(325 hp/1250 ft-lb)

- SI stoich, EGR, TWC
- Refuse truck

Ongoing NGENGV Projects

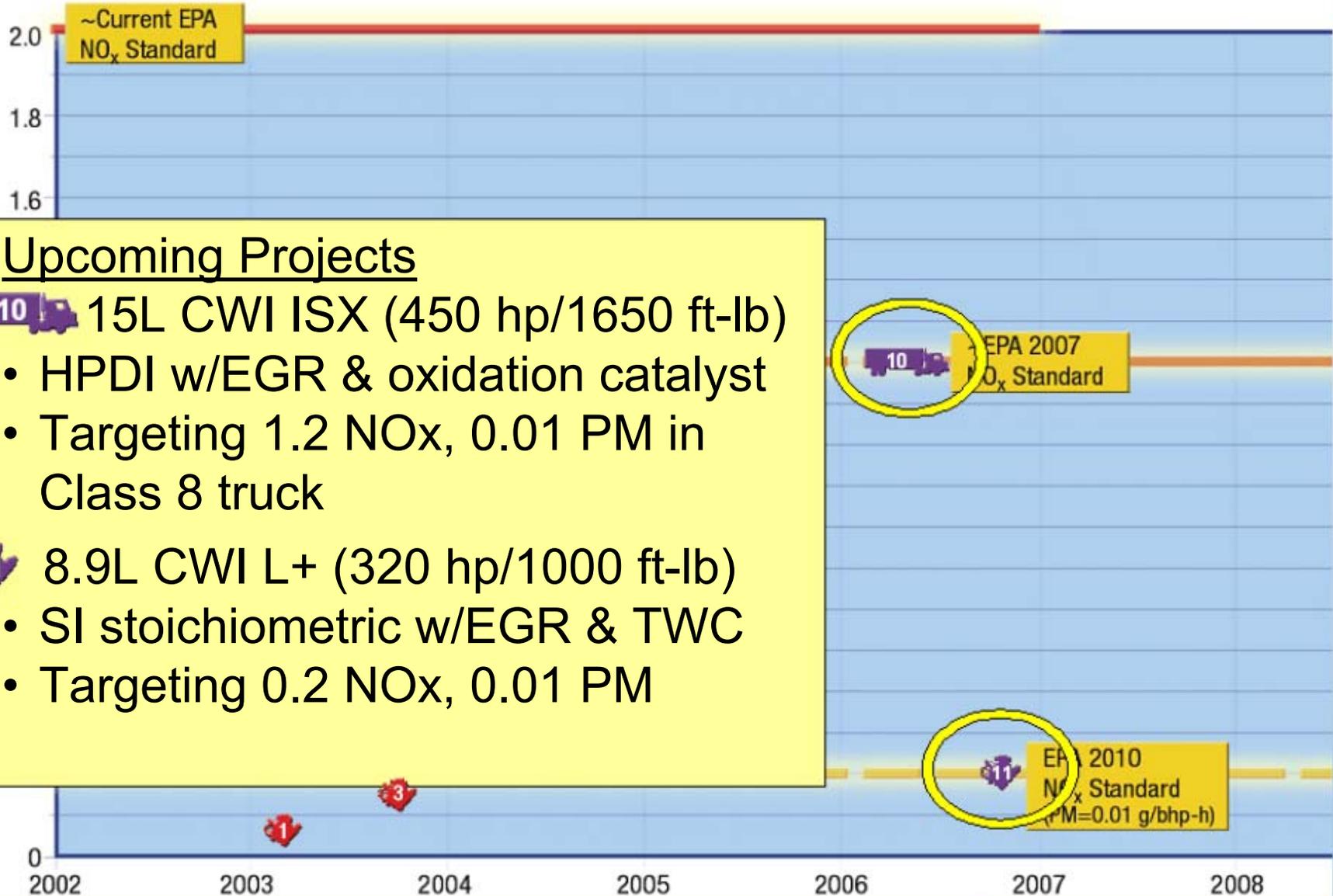


Engine Development

- 7** 8.3L CWI C+ (310 hp/950 ft-lb)
 - SI stoichiometric w/EGR & TWC
 - Targeting 0.2 NO_x, 0.01 PM
- 9** 11L Mack (325 hp/1250 ft-lb)
 - SI stoichiometric w/VVT, EGR, & TWC
 - Targeting 0.2 NO_x, 0.01 PM

ACTUAL/ANTICIPATED COMPLETION DATE

Upcoming NGNGV Projects



Upcoming Projects

- 10** 15L CWI ISX (450 hp/1650 ft-lb)
 - HPDI w/EGR & oxidation catalyst
 - Targeting 1.2 NO_x, 0.01 PM in Class 8 truck
- 11** 8.9L CWI L+ (320 hp/1000 ft-lb)
 - SI stoichiometric w/EGR & TWC
 - Targeting 0.2 NO_x, 0.01 PM

ACTUAL/ANTICIPATED COMPLETION DATE

NGNGV Progress

- Spark-ignited NG engine development
 - Near-term commercial engines certified to 2007 emission levels (1.2 g NO_x, 0.01 g PM) available MY2005
 - SI, EGR, TWC products aiming at 2010 (0.2 g NO_x) emission standards by 2007
- Direct-injection, diesel pilot, NG product (Westport Innovations/Cummins ISX, 15L) has been laboratory demonstrated with limited field testing
 - NREL and SCAQMD are conducting 1.2 g NO_x product demonstration with Westport
 - More R&D required for 2010 capability
- NG engines provide fuel diversity, lower emissions, and meet the needs of clean air non-attainment areas



ISX Engine