I/M Program Benefits in MOBILE6

12th CRC On-Road Vehicle Emissions Workshop

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Overview

- What are the methods?
- MOBILE6 I/M Inputs
- Model Runs
- Methods
- Uncertainties

Methods of Estimating I/M Benefits of an Ongoing I/M Program

- RSD results in adjacent I/M and non I/M areas
- Comparison of I/M240 from one state that has an ongoing program to another state that is just starting I/M
- Impact of repaired vehicles in 1 period
- Comparison of I/M program parameters with a benchmark I/M program (i.e., EPA “Arizona” method)
- MOBILE6

Major Factors Affecting Long-Term I/M Benefits

- Fleet turnover coupled with
  - New, much lower emission standards
  - Onboard diagnostics
- These items will continue to reduce the benefits of I/M in the long-term

MOBILE6 I/M Inputs

- Exhaust
  - Test type (OBD, I/M240, ASM, 2-spd Idle, Loaded, Idle) and cutpoints
  - Frequency
  - Vehicle classes
  - Start year
  - Compliance (they come for 1st test, but then disappear)
  - Waiver rate
  - Grace period (specifies age at which cars start test)
  - Exemption age (age at which car exits from testing)

MOBILE6 Inputs

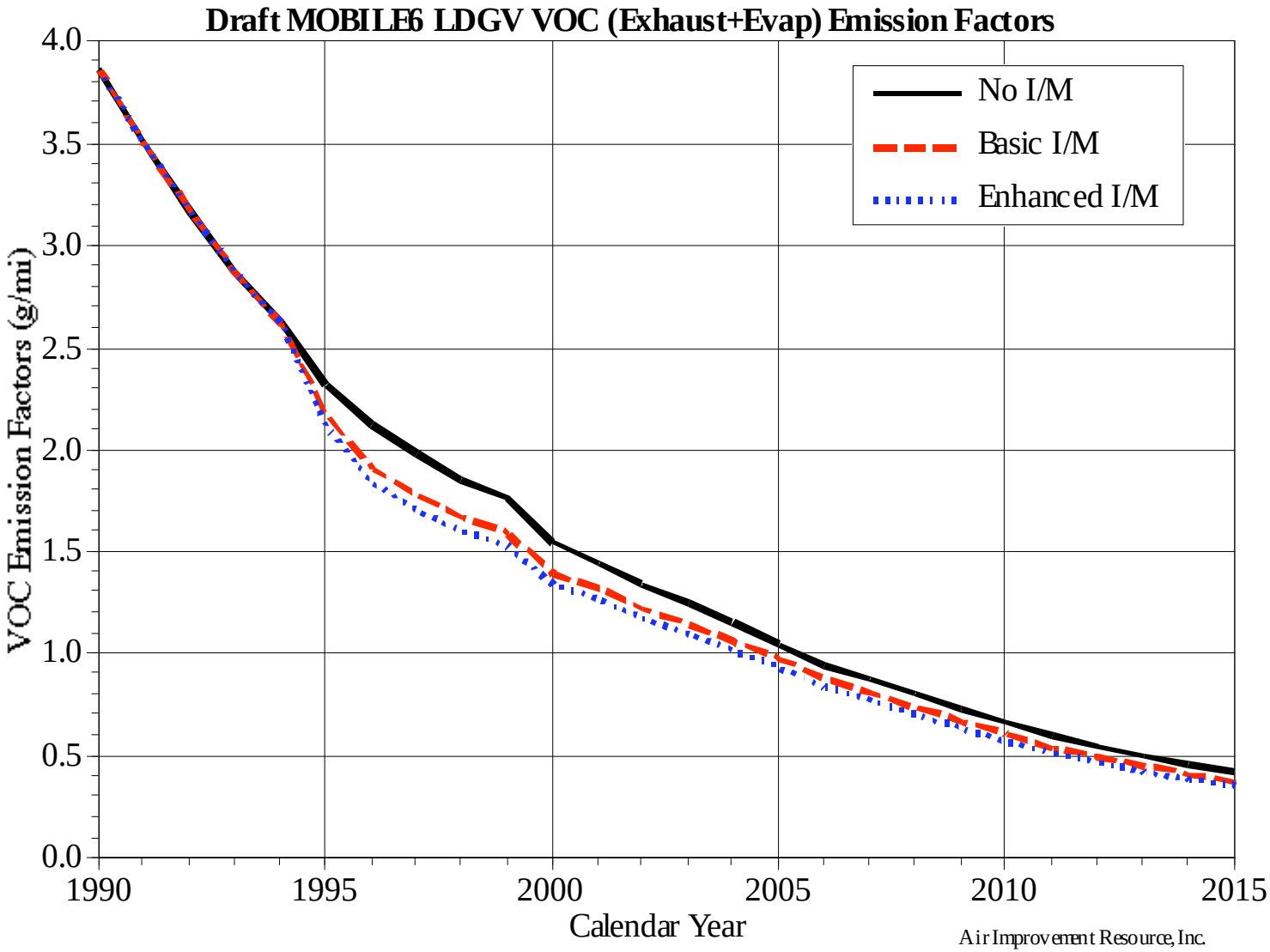
- Evaporative
  - Evap OBD
  - Evap OBD and gas cap check
  - Fill pipe and gas gap check
  - Gas cap check

MOBILE6 I/M Features

- Ability to model OBD light checks
- Ability to change grace periods and exemption years
- Ability to include different cutpoints in the same run

MOBILE6 Model Runs

- 1990-2015
- Implement I/M in 1995
- Basic I/M and Enhanced I/M
- VOC (exh + evap), CO, NOx
- LDGVs only


Draft MOBILE6 LDGV VOC (Exhaust+Evap) Emission Factors
VOC Emission Factors (g/mi)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1990
1995
2000
2005
2010
2015
Calendar Year
No I/M
Basic I/M
Enhanced I/M
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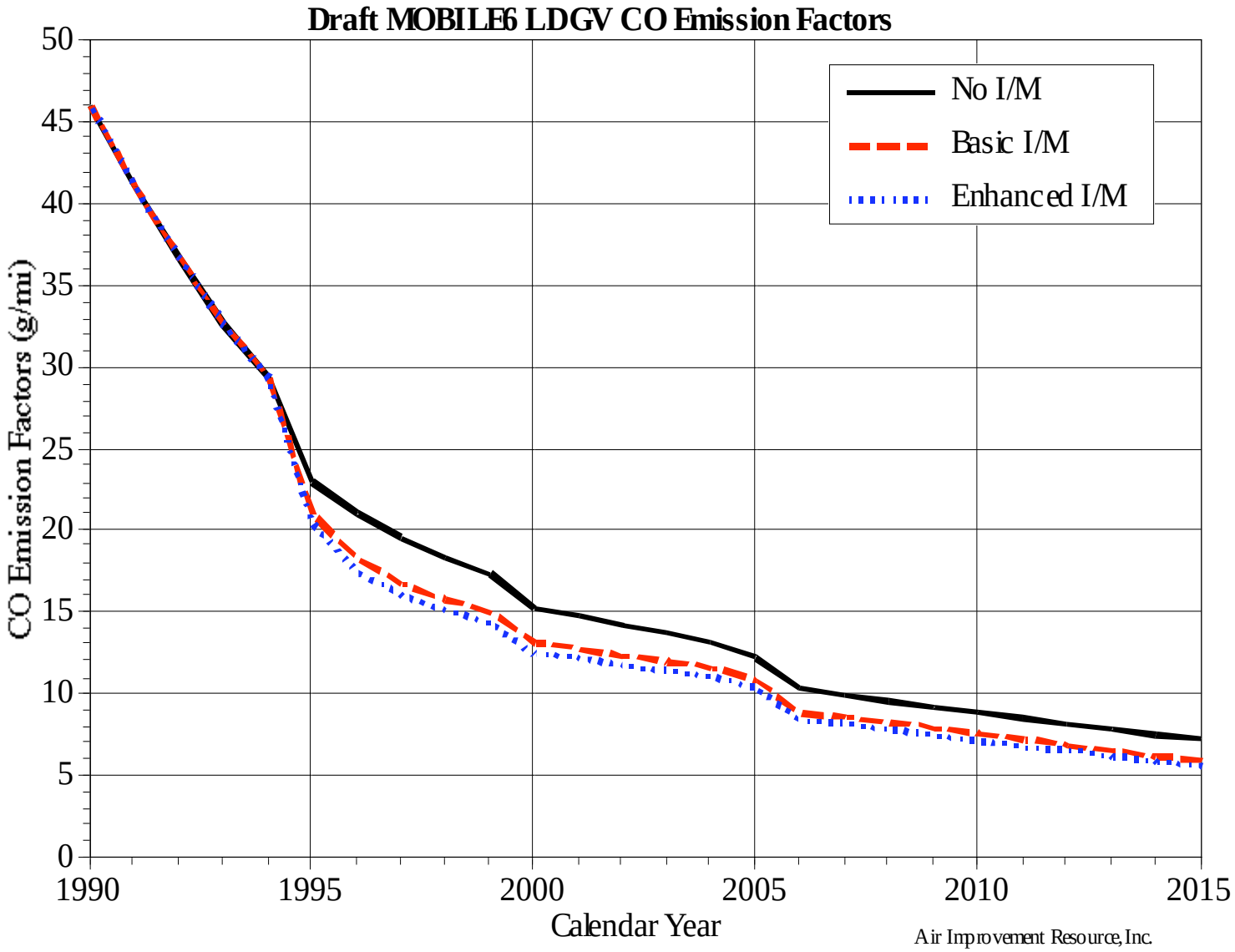
Draft MOBILE6 LDGV CO Emission Factors
CO Emission Factors (g/mi)
Calendar Year
No I/M
Basic I/M
Enhanced I/M
0
5
10
15
20
25
30
35
40
45
50
1990
1995
2000
2005
2010
2015
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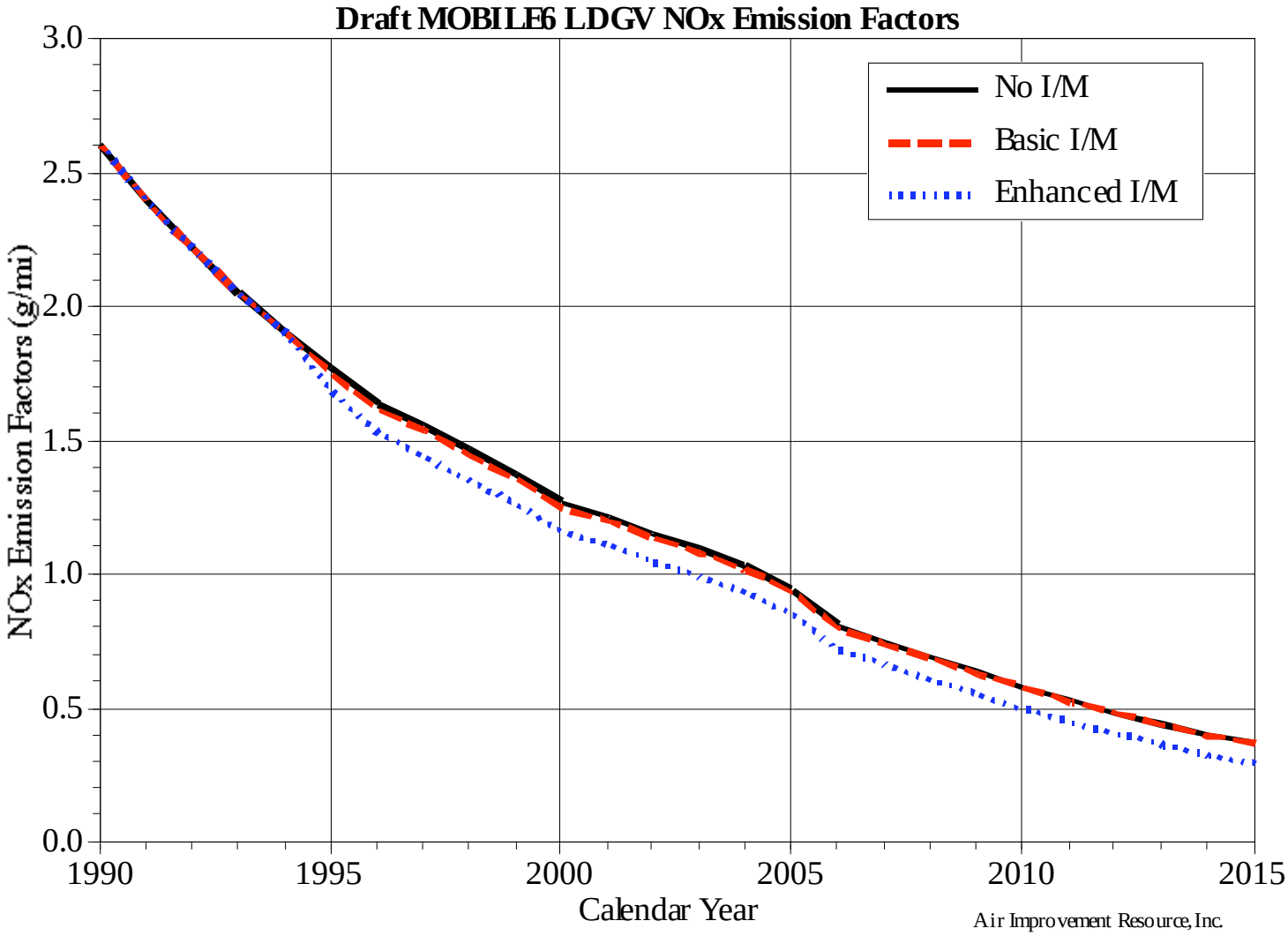

Draft MOBILE6 LDGV NOx Emission Factors
NOx Emission Factors (g/mi)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1990
1995
2000
2005
2010
2015
Calendar Year
No I/M
Basic I/M
Enhanced I/M
Air Improvement Resource, Inc.

Comparison with MOBILE5

CYR 2005 % Reductions

I/M	Poll	M5	M6
Basic	HC	18%	7%
	CO	27%	11%
	NOx	2%	1%
Enhanced	HC	45%	11%
	CO	42%	15%
	NOx	24%	10%

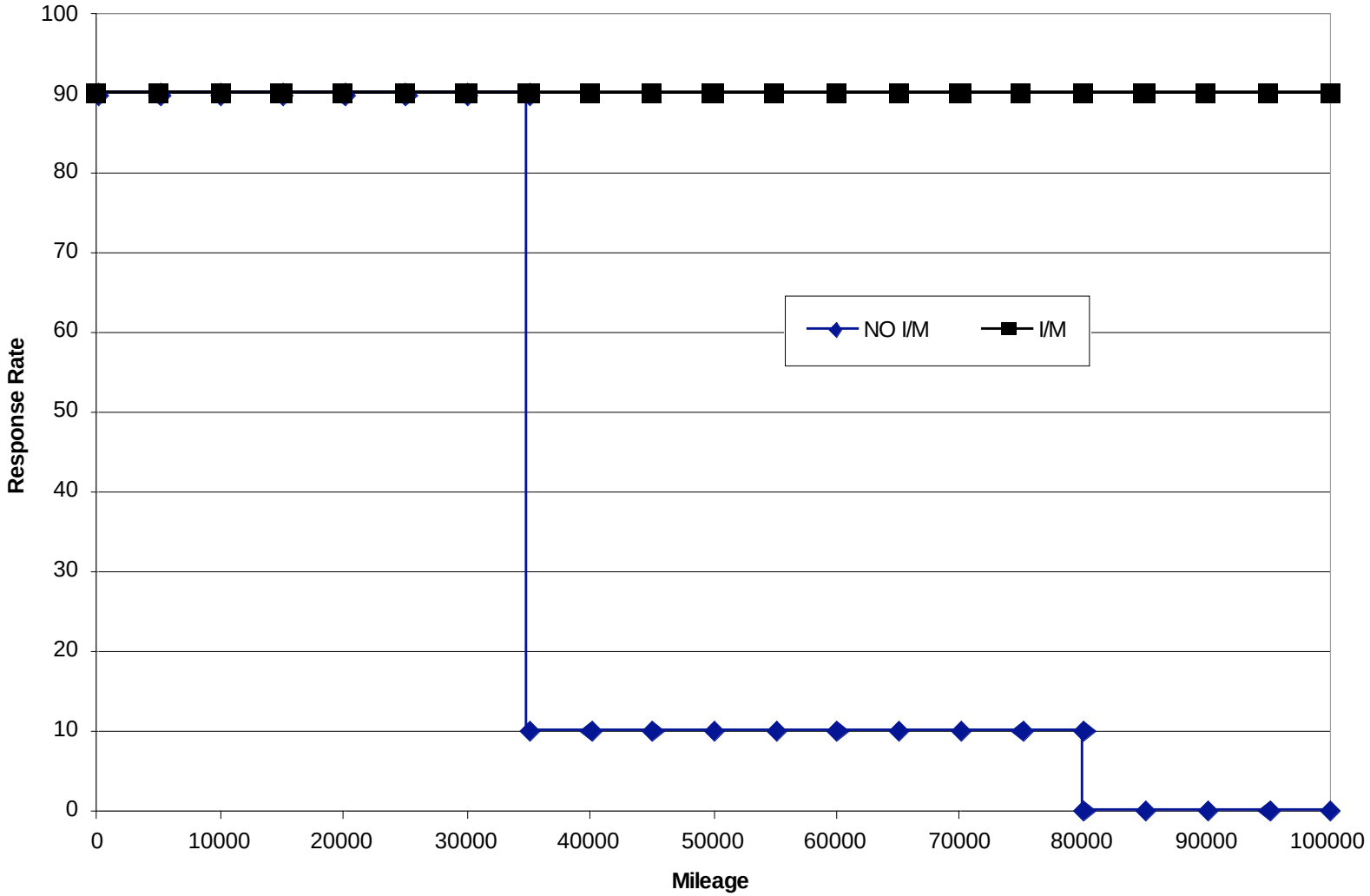
Methods

- Pre-1996 (pre-OBD)
  - Vehicles divided into normal and high emitters and emissions estimated
  - Normals deteriorate, highs do not
  - Frequency of highs also estimated from data as a function of age
  - I/M identifies high emitters through identification rates (IDRs)
  - Separate emission estimates for “repaired” vehicles
  - After fleet is inspected, some high emitters cannot be found, others are waived, others are noncompliant, and remainder are fixed
  - Waived vehicles get a small emission benefit (they spent some $)
  - Normals weighted with highs (not found, waived, or noncompliant) and repaired vehicles

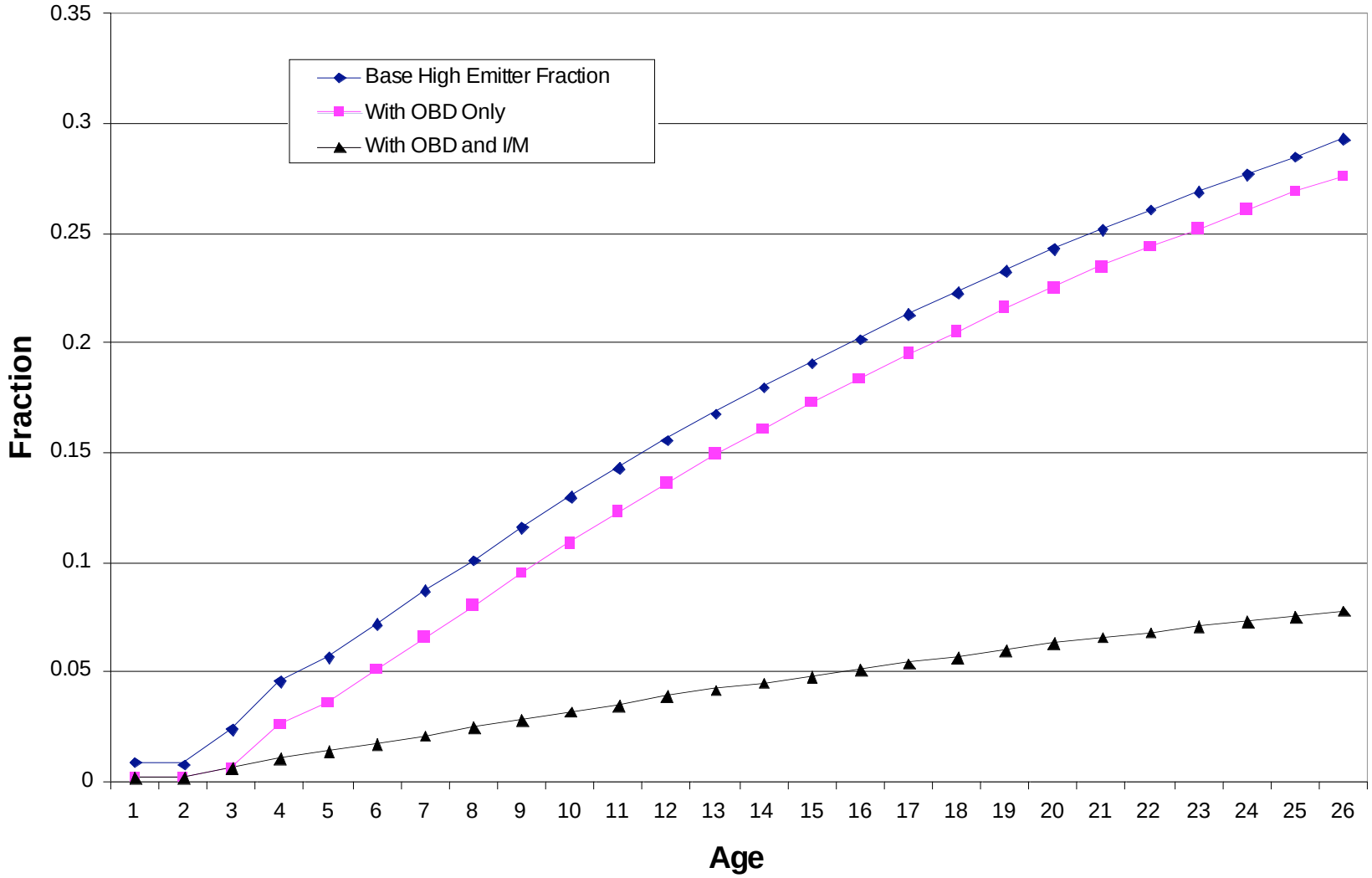
Methods

- OBD vehicles (1996 and later)
  - Depends on 2 things:
    - Ability of OBD system to identify problem
    - Response of owner to light
  - Assumes OBD finds 85% of problems (each pollutant)
  - In no I/M area, assumes owner response is 90% for first 36,000 miles, 10% between 36,000 and 80,000, and 0% after 80,000
  - In I/M area, assumes owner response is 90% forever

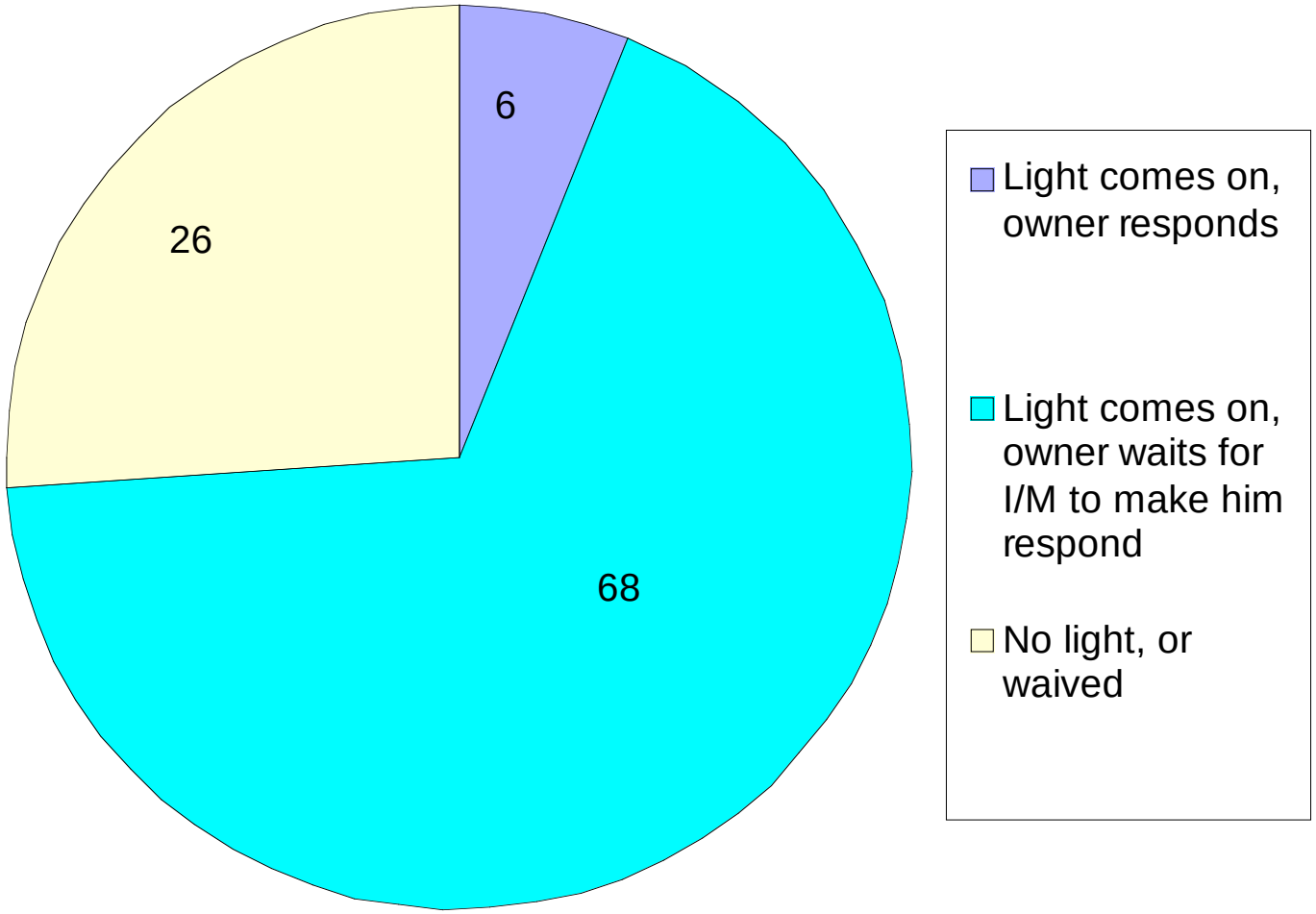
OBD Response Rate



Fraction of High Emitters - 1996 and Later Vehicles



High Emitter Detection Ability - Out of 100 High Emitters
(Over Life of Vehicles)

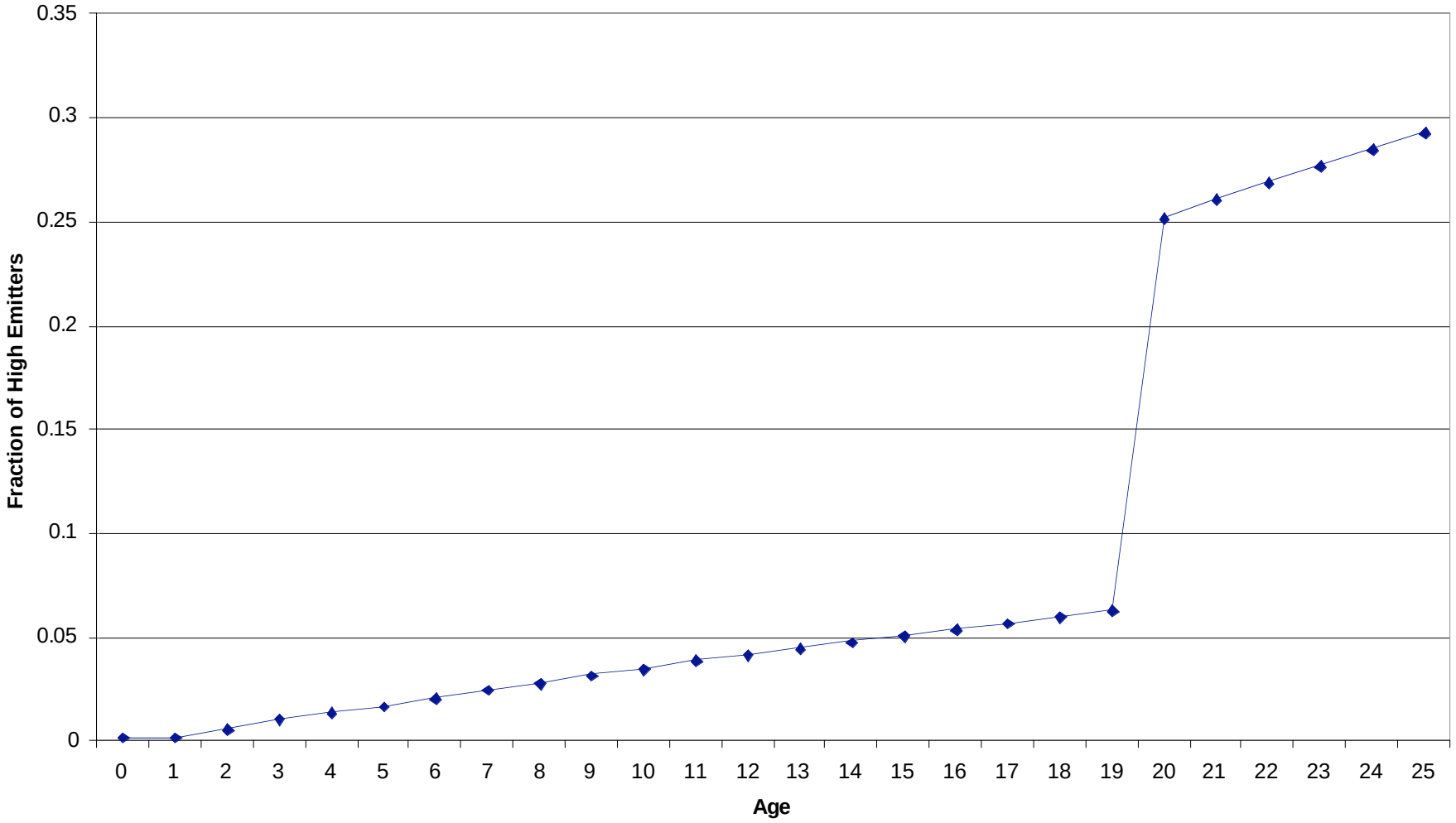


Concerns

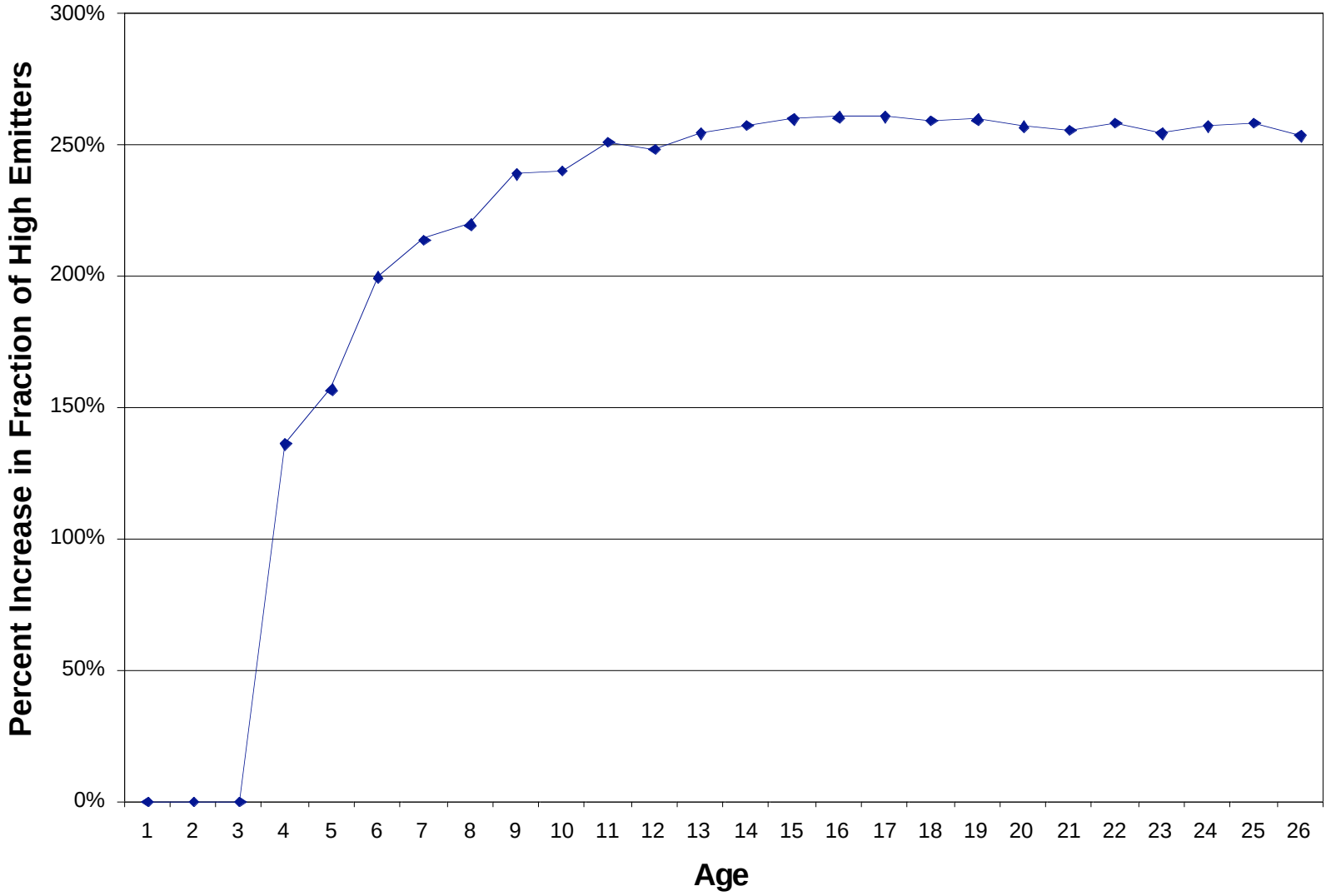
- Model does not track emitters from year-to-year
  - Effect of “exemptions” is overstated because the year they are not subject to I/M, the number of high emitters jumps back up to the no I/M case, as if there was never any I/M
  - Model cannot be used to estimate the impacts of discontinuing I/M for the same reason - all the high emitter rates by model year assume I/M never happened
- OBD response rates may be a low
  - If they are low, future I/M benefits may be significantly overstated

Fraction of Hgh CO Emitters vs Age

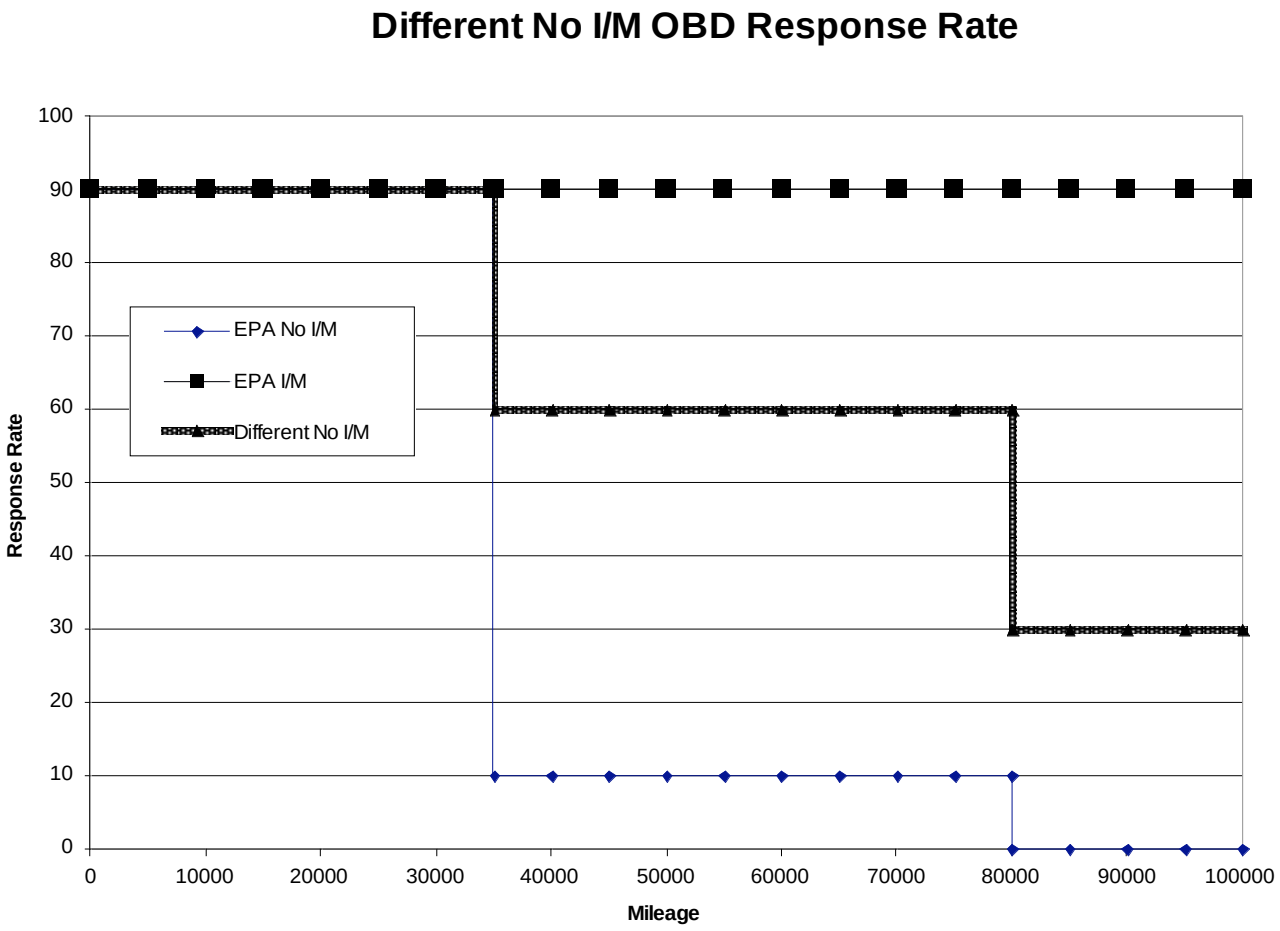
Effect of Exemption from Program at 20 years



Year-over-Year Increase in High Emitters if I/M Discontinued



Effect of Different Owner OBD Response of I/M Benefits



Comparison of I/M Benefits

Pollutant	EPA Assumed Owner OBD Response	Scenario with More Owner Response
HC	17%	10%
CO	22%	16%
NOx	20%	8%

Conclusions

- Estimating benefits of I/M programs is still tricky
- MOBILE6 contains much more flexibility for evaluating modifications to I/M
- Assumptions made in MOBILE6 may be overstating future I/M benefits
- I/M benefits are in a constant decline due to new technology and OBD
- MOBILE6 overstates the old car exemption effect
- MOBILE6 cannot be used to evaluate discontinuing I/M