On-Road Mobile Source Emissions Using Draft MOBILE6

by

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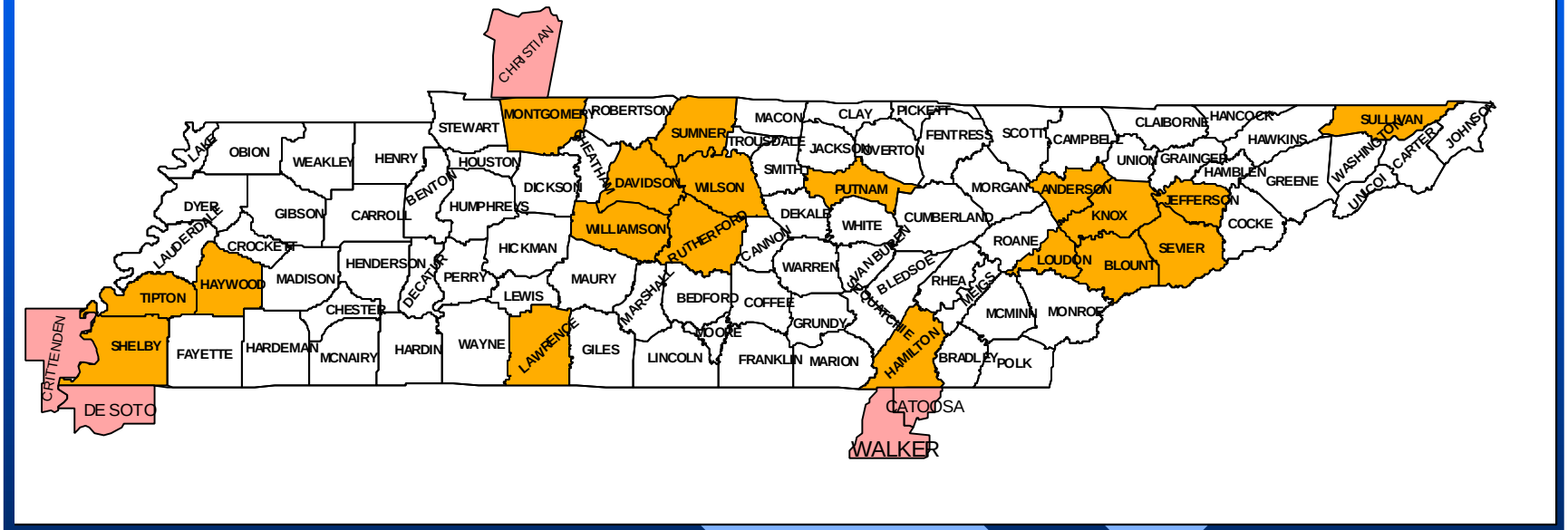
Objectives

- Evaluate VMT growth rate in US, with particular emphasis on Tennessee
- Evaluate the combined effects of VMT growth rate and new mobile source emission standards that will be implemented during 2001-2010 time frame on NO_x and VOC emissions from mobile sources using Draft MOBILE6
- Predict county level emissions of NOx and VOCs for 1999-2030 for TDOT to support MPO efforts related to Transportation Conformity and as input to ATMOS

Tennessee Proposed

Ozone Non-attainment Areas



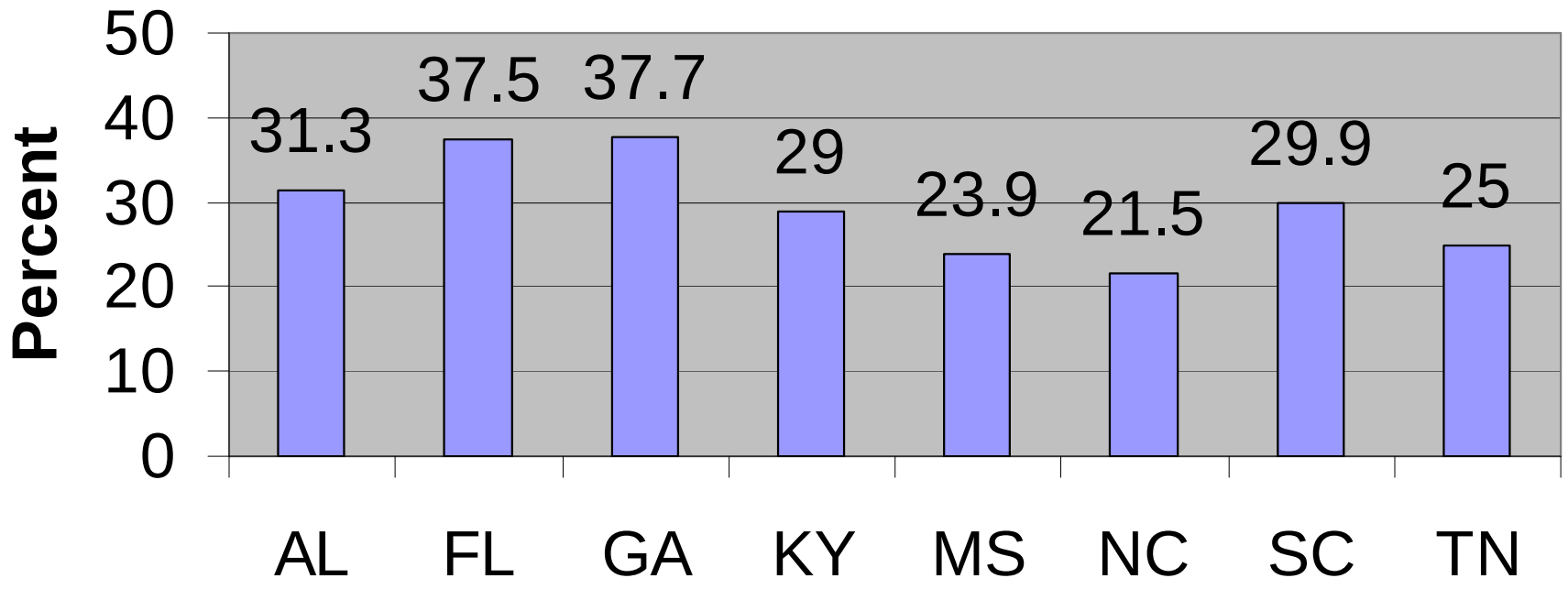
Tennessee Non-attainment Areas

Areas Outside of Tennessee

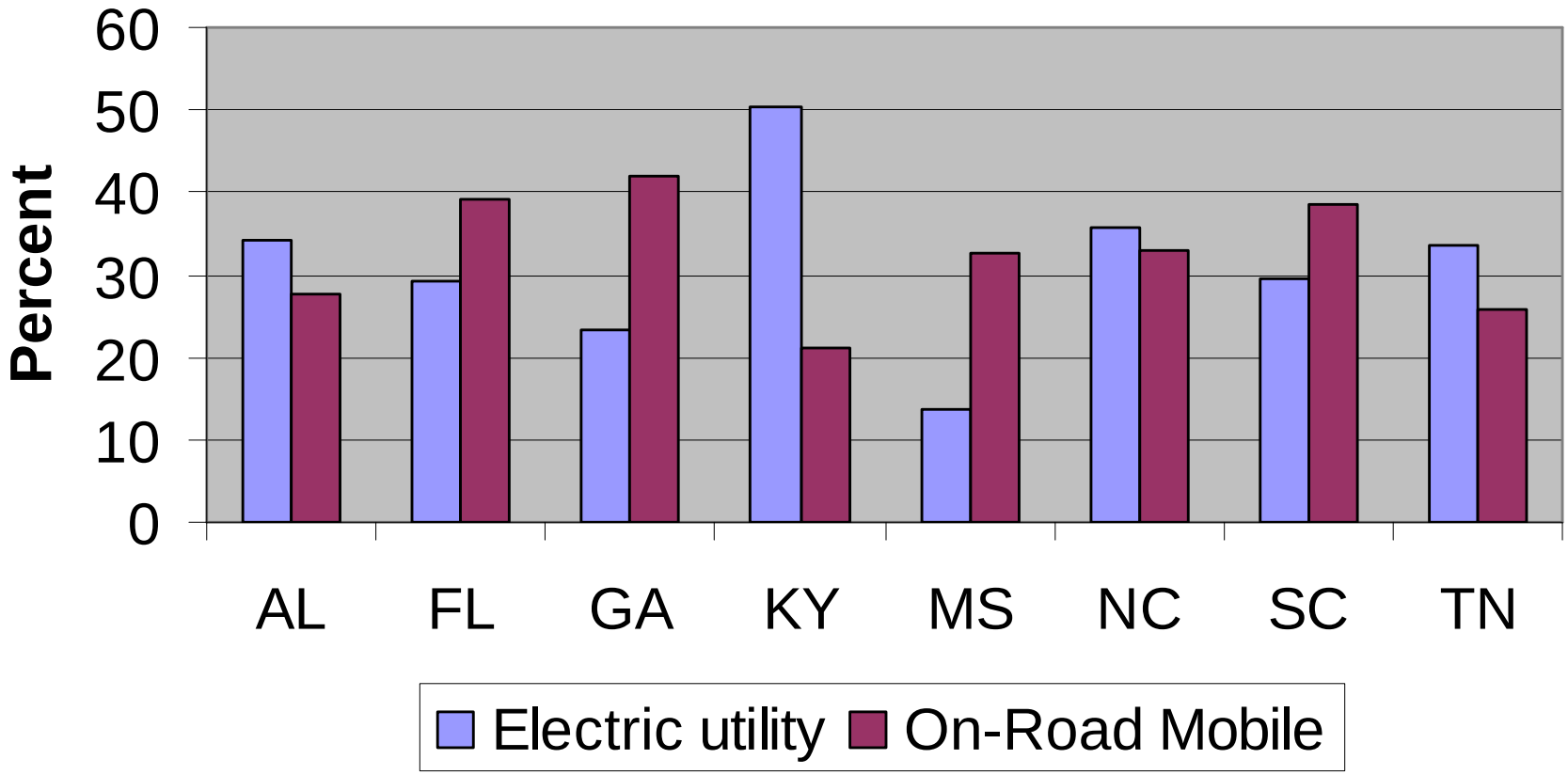
Role of On-Road Mobile Sources

- Nitrogen Oxides (NO_x) and Volatile Organic Compounds (VOCs), commonly referred to as ozone precursor pollutants, are photochemically reactive, and thus participate in the formation of ozone
- On-road vehicular traffic is a significant source of NO_x and VOCs
- In 1998, on-road vehicles were responsible for 32% and 14% of the nationwide emissions of NO_x and VOCs, respectively.

On-road Mobile Source Contribution to Anthropogenic VOCs (Source: NET 96)



Electric Utility and Mobile Source Contributions to Total NOx



VMT Growth Rate in US

- National and state-level annual VMT data for 1991-1998 were obtained from The Highway Statistic Series published annually at Federal Highway Administration's Office of Highway Policy Information (OHPI) website
- Actual compound annual growth rate in Vehicle Miles Traveled (VMT) was evaluated on a national and state level using a least squares best fit
- TN county level growth rates were also determined

VMT Growth Rate in US

- Compound growth rate of VMT (1991-1998) in the U.S. was 2.7% with an R^2 of 0.999
- State-level VMT growth rates varied from -0.88% (Washington D.C) to +7.61% (Nevada)
- In the Southeast, growth rates were between 3.5 and 4.5%
- In TN, county growth rates ranged from 0.6% to 6.5%, with Shelby and Davidson at 4.7%, Knox County at 4.2%.

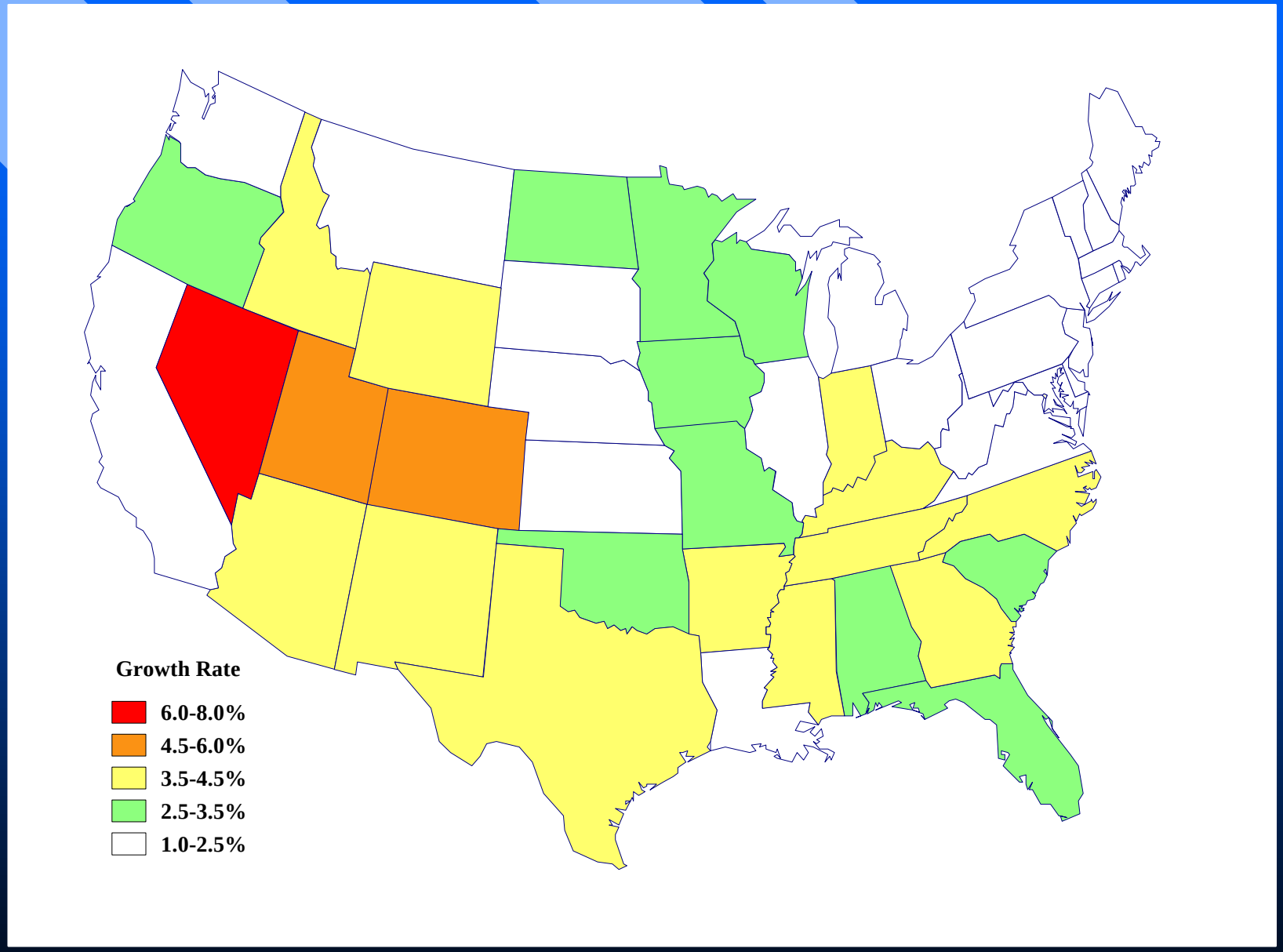


FIGURE 1. Annual Compound Growth Rate of VMT in the United States, 1991-1998.

VMT Growth Rates in ATMOS area (1991-1998)

- Tennessee—4.0%
- Arkansas—3.99%
- Mississippi—4.33%
- Alabama—3.4%
- Georgia—4.05%
- Kentucky—3.99%
- North Carolina—4.03%

Regulatory Status – Mobile Sources

- Four regulations will be implemented over the next six years all of which are incorporated into the MOBILE6 emissions model:

  1) National Low Emission Vehicle (NLEV) Standards for Light Duty Gasoline Vehicles (LDGV) - 2001

  2) 2004 NO_x Standards for Heavy Duty Diesel Vehicle (HDDV)

  3) Tier2/Sulfur Standards (2004-2006)

  4) Diesel Fuel Sulfur Standard (2006)

Summary of LDV Standards

Year	HC standard	NO_x standard
1994-1996 Tier 1	0.25 g/mile	0.4 g/mile
2001-nationwide LEV	0.075 g/mile	0.2 g/mile
2004-2006+ Tier 2/S	0.075 g/mile	0.07 g/mile
% Reduction	70% approx.	82.5%

2004 NO_x Standards for HDDV

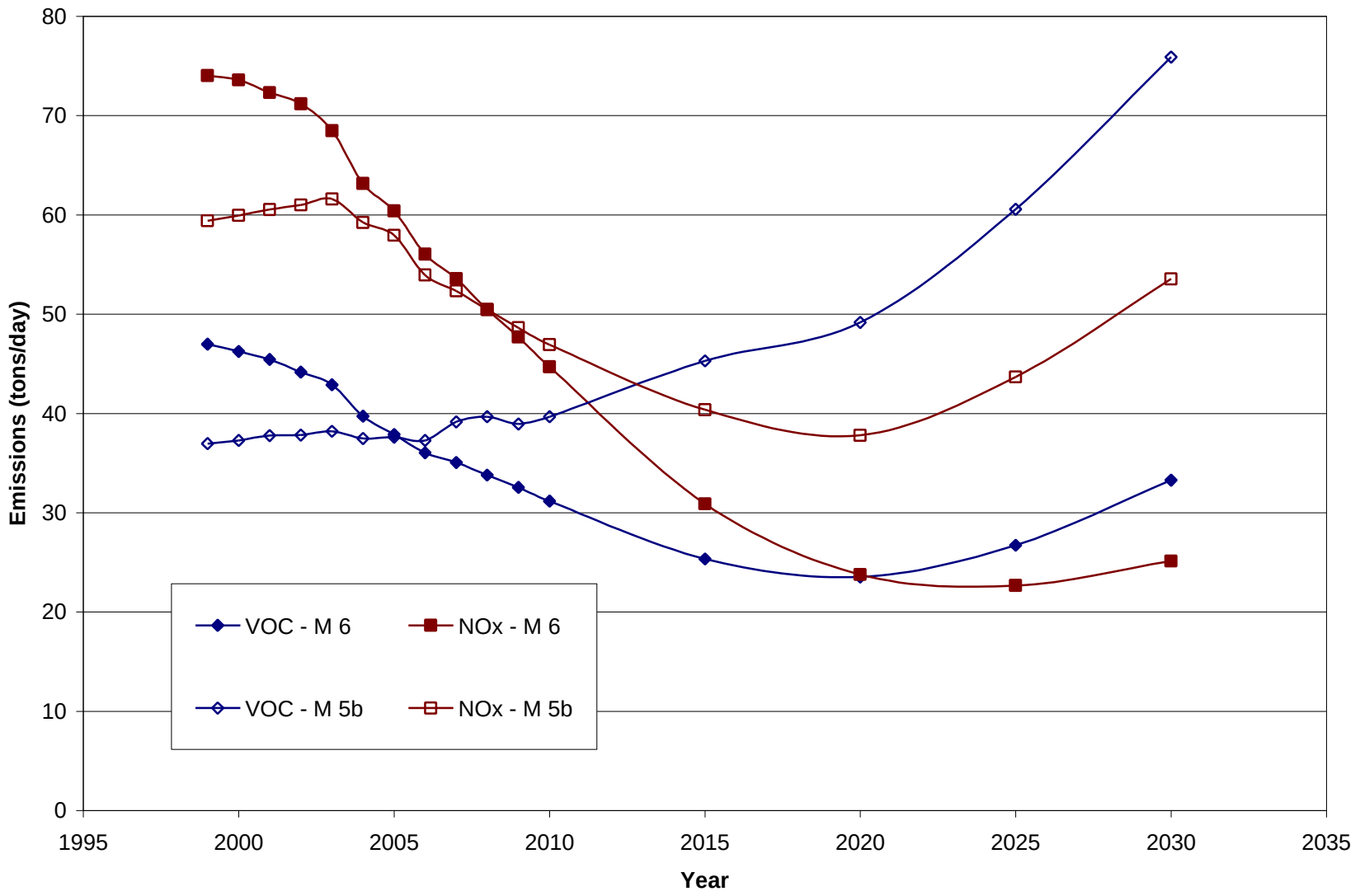
- The new rule has a combined emission standard for NO_x and non-methane hydrocarbon (NMHC).
- Manufacturers of such engines have the choice of certifying their new engines to either 2.4g/bhp-hr NMHC plus NO_x standard or 2.5g/bhp-hr NMHC plus NO_x standard with a limit of 0.5g/bhp-hr for NMHC
- This standard is expected to reduce the NO_x emissions by almost 50%
- Diesel Fuel Sulfur Content to be reduced from 500 to 15 ppm beginning in 2006

TN County Level Emission Projections (MOBILE6)

- Uitilized mobile source inputs consistent with those used by existing MPOs (Shelby, Nashville, Knoxville) relative to speeds, I/M …
- Used Temperature and Relative Humidity inputs corresponding to values associated with 10 highest ozone days in 1998-2000 specifically for West, Middle and East TN
- Developed specific vehicle age distribution profiles based on TN vehicle registration data for LDGV and LDGT that are MPO-area specific, and used national default for other vehicle categories
- Used County-level VMT by functional road classification for urban and rural categories

TN County Level Emission Projections (MOBILE6)

- Draft MOBILE6 input files have been provided to SAI for use in ATMOS for each county, including county level VMT for 1999
- Final report on the emission projections on county-level basis to be submitted to TDOT in early Sept. 2001 for 1999-2030.
- Report will be available in electronic format for distribution to State and Local Air Agencies, MPOs, and other Transportation agencies after review by TDOT
- Draft MOBILE6 is a “DRAFT!” and cannot be used to make final control strategy decisions until the final MOBILE6 is released (October 2001??)

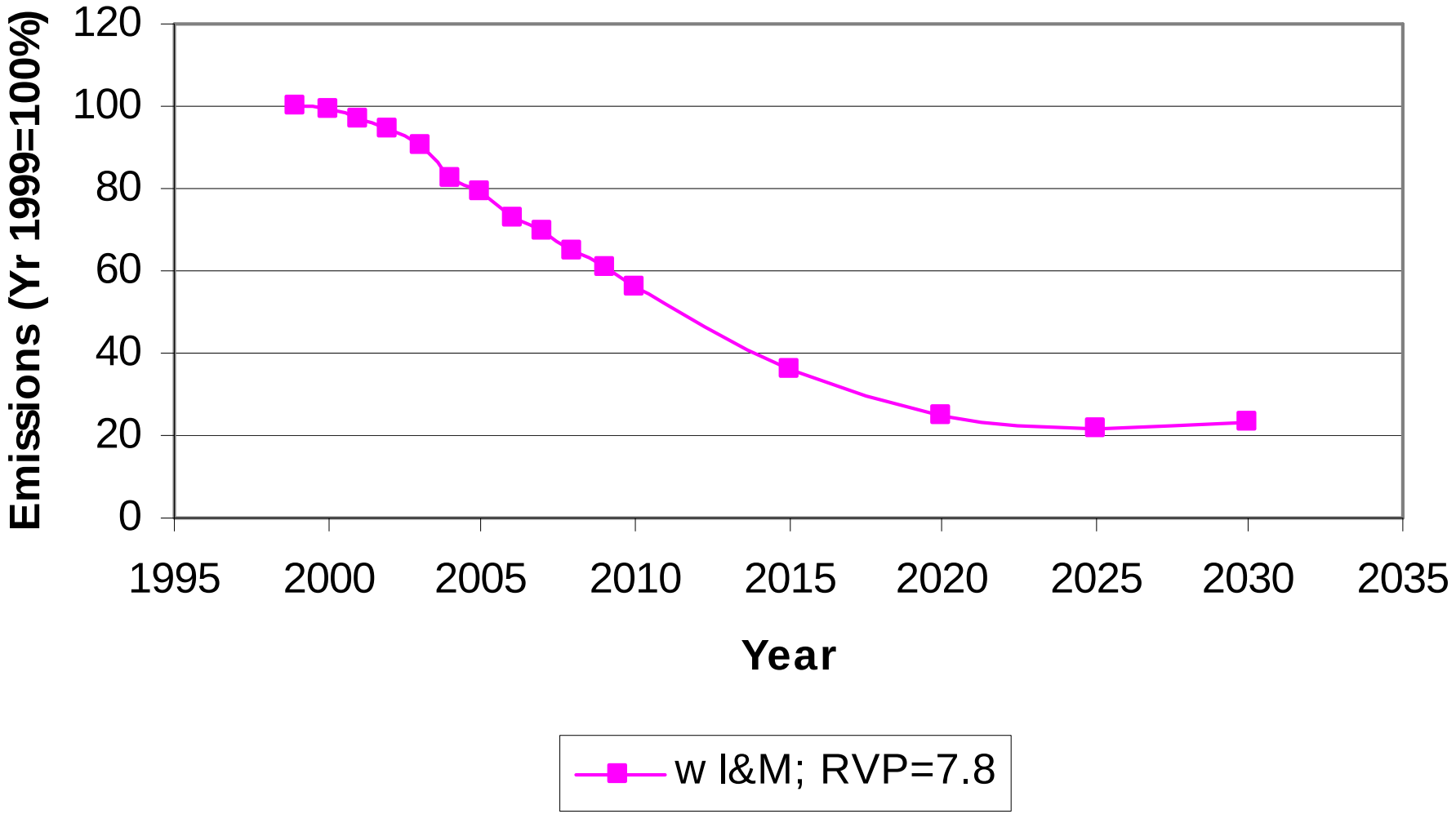

Shelby County - Mobile Source Emissions
MOBILE 6 and MOBILE 5b
Emissions (tons/day)
80
70
60
50
40
30
20
10
0
1995
2000
2005
2010
2015
2020
2025
2030
2035
Year
VOC - M 6
NOx - M 6
VOC - M 5b
NOx - M 5b

Short-Term Quick Fix?

- ATMOS is using the U.S. EPA NET96 Version 4 inventory (which uses MOBILE5)
- Emissions will be grown to 1999 for basecase using appropriate growth rates—(1.04)^3 = 1.125 for TN to arrive at a NET96(M5)G99
- For TN, the ratio of the 1999 MOBILE6 statewide emissions (based on UT/TDOT study) to the NET96(M5)G99 is:
  - NOx: 794 tpd/611 tpd = 1.30
  - VOCs: 446 tpd/423 tpd = 1.08
  - CO: 4425 tpd/3888 tpd = 1.14

MOBILE 6 Draft NOx Emissions

(Based on Davidson Co. TN w 4.7% growth)



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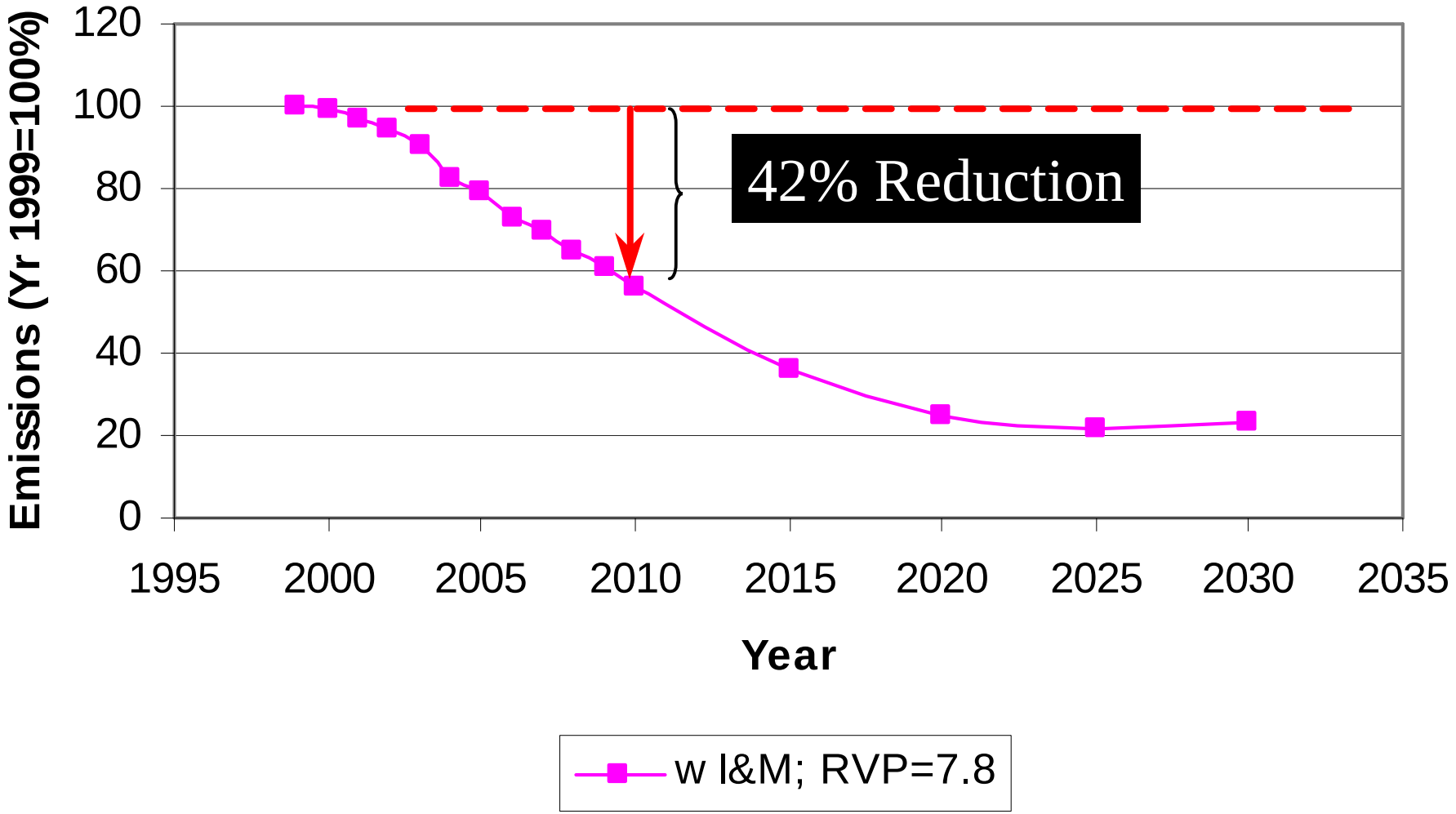
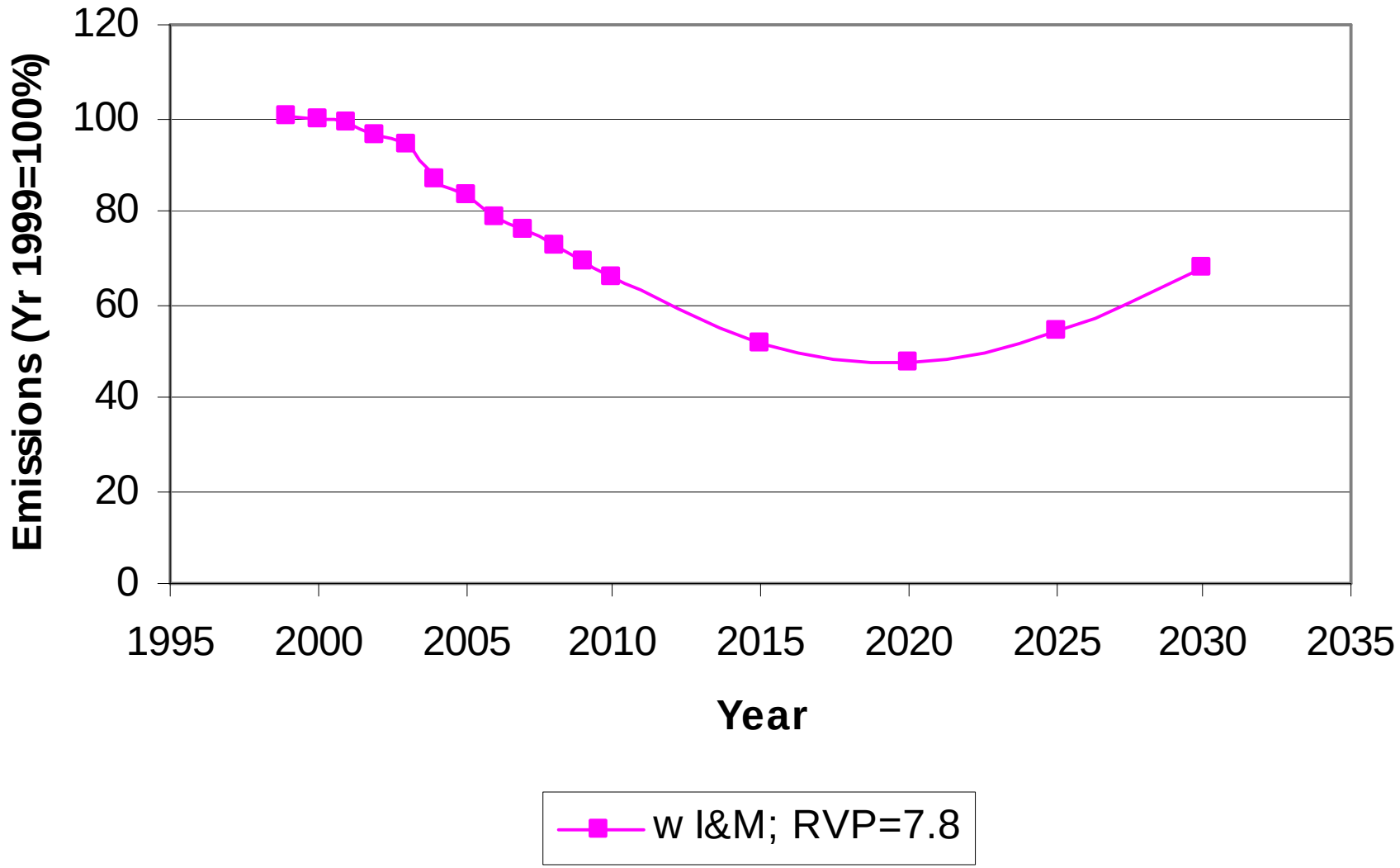


Conformity with NOx Budget

- An on-road mobile source emission budget that is greater than a 42% reduction from 1999 emissions would result in being out of conformity on day one.
- It is unlikely that a greater reduction could be achieved in the short term by means other than will be given by the FMVCP.
- Long term conformity (25 years out) does not appear to be a problem based on preliminary draft MOBILE6 projections.

MOBILE 6 Draft VOC Emissions

(Based on Davidson Co. TN w 4.7% growth)



MOBILE 6 Draft VOC Emissions

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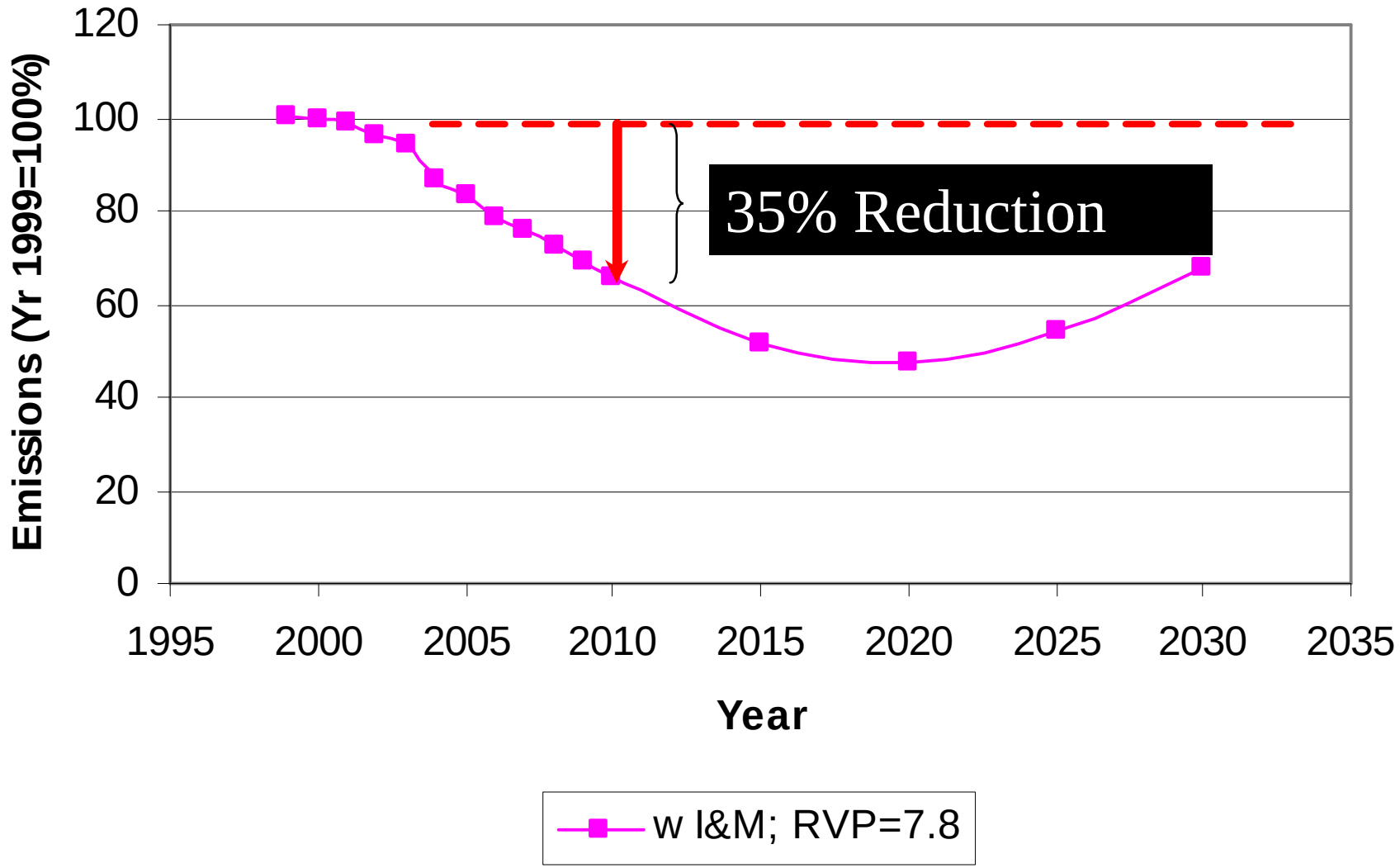

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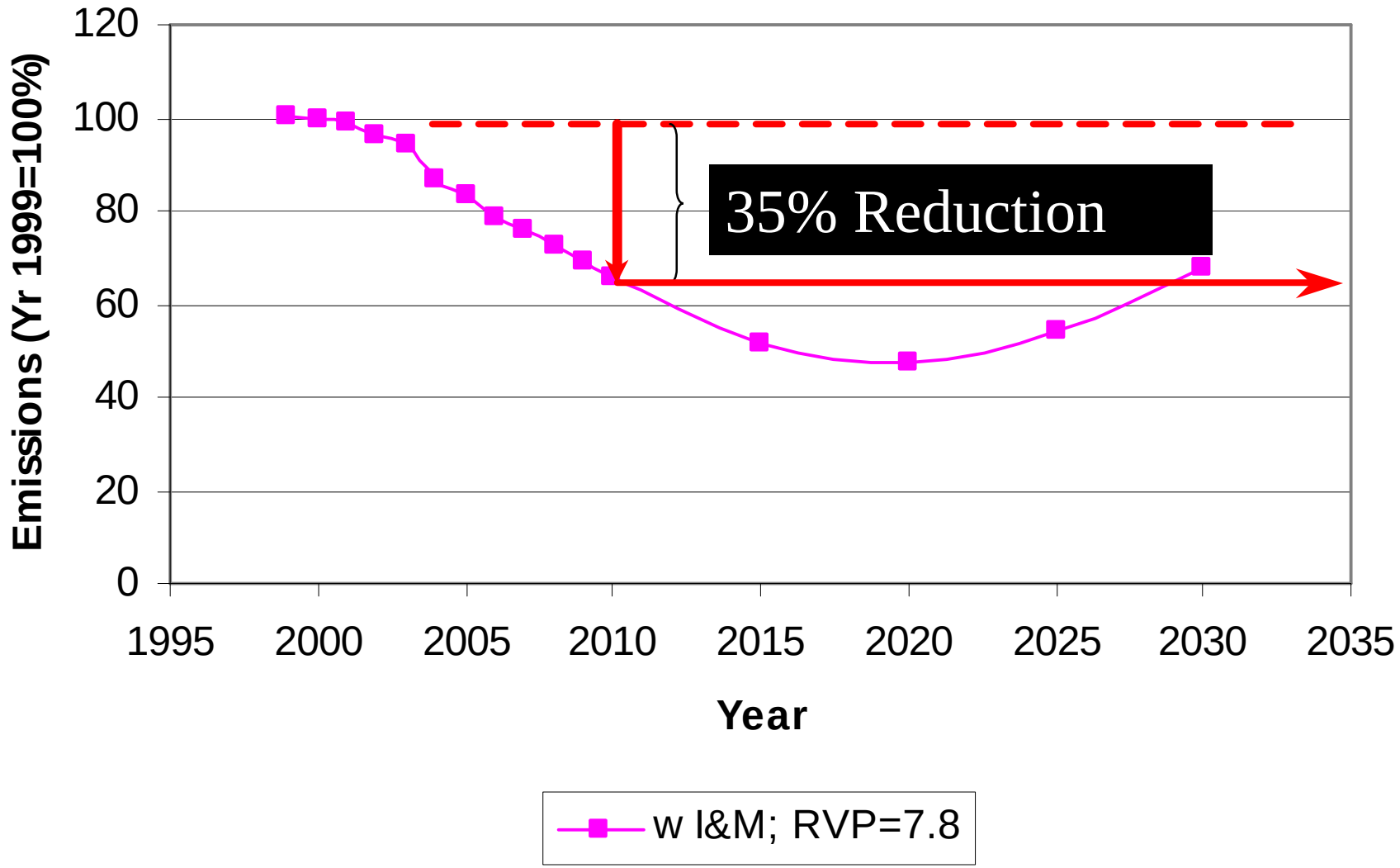

MOBILE 6 Draft VOC Emissions

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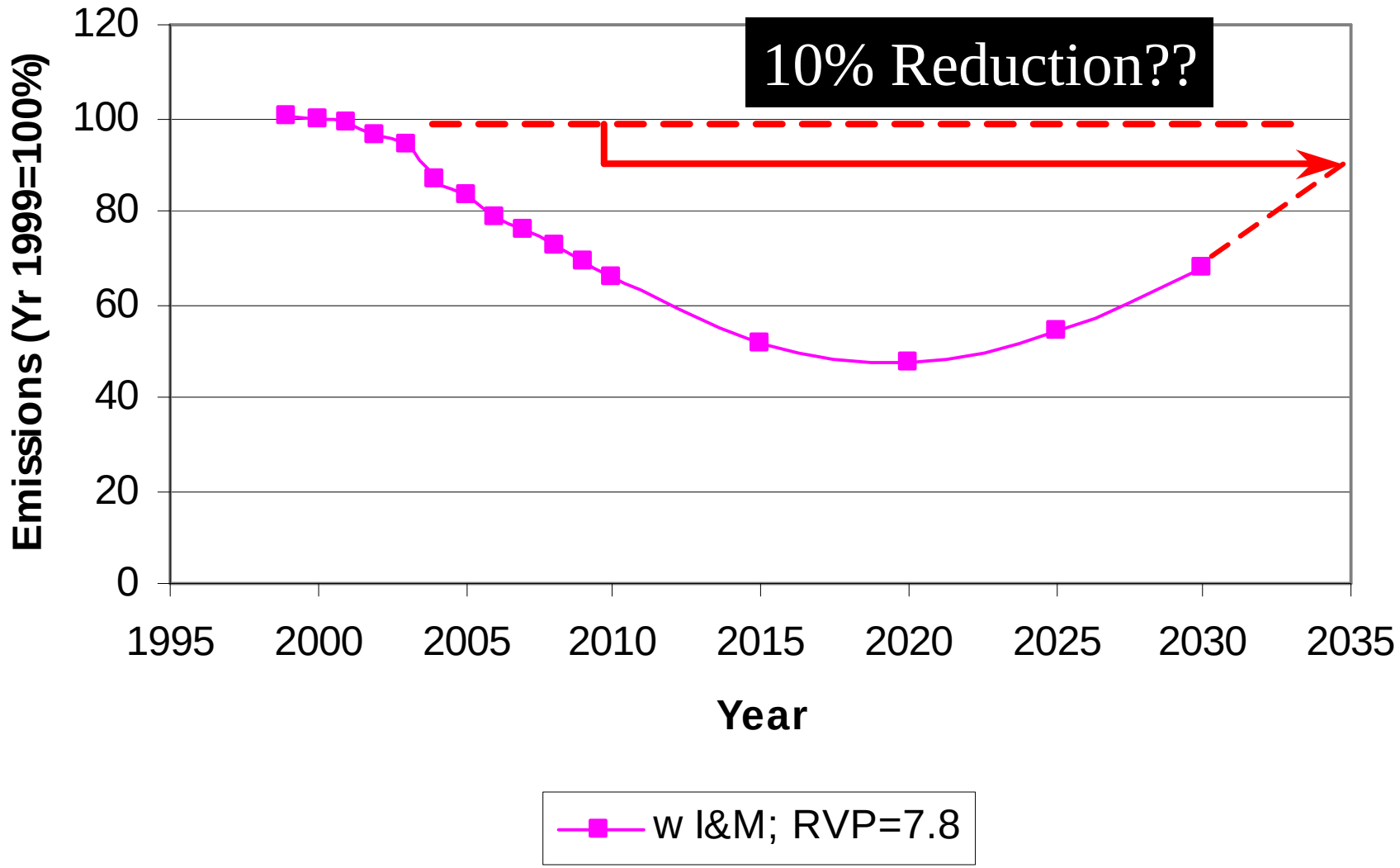

Conformity with VOC Budget

- A on-road mobile source VOC emission budget that is more than 10% less than 1999 emission levels would likely be out of conformity due to failure to meet the 25 year conformity requirement, unless …
- VMT growth rate control measures can be successfully implemented or alternative, lower emission vehicles are mandated which have more stringent emission levels than currently required under the FMVCP.