ITEM 14 - Information
November 16, 2011

Briefing on the Composition of the Vehicle Fleet in the
Washington Region in 2011

Staff Recommendation: Receive briefing on results of an analysis of decoded 2011 vehicle identification number (VIN) registration data showing the characteristics of the 2011 vehicle fleet in the Washington Region, and comparing them with the fleet characteristics from similar analyses for 2008 and 2005.

Issues: None

Background: As mobile source emissions vary significantly according to vehicle characteristics such as vehicle type, fuel use, weight and year of manufacture, TPB staff periodically examine the composition of the Washington area vehicle fleet. Beginning in 2005, staff has utilized a VIN decoder to determine the composition of the vehicle fleet in the Washington Region.

National Capital Region Transportation Planning Board

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M E M O R A N D U M

To: Transportation Planning Board
From: Elena Constantine, Systems Planning Applications Director
Date: November 16, 2011
Subject: 2011 Vehicle Registration Data Analysis in the Washington Region

BACKGROUND

Mobile source emissions inventories in the Washington region are influenced by the composition and characteristics of the vehicle fleet on the regional highway network. Vehicles of different types (i.e., motorcycles, passenger cars and sport utility vehicles, light duty trucks, heavy duty trucks and buses) and characteristics (i.e., age, gasoline versus diesel fuel source and weight) are associated with different emissions rates. Finally, as the size of the regional vehicle fleet increases over time due to natural population growth, increased levels of emissions are generated.

In this context, TPB staff periodically requests updated databases from the motor vehicle administrations and air management agencies of Maryland, Virginia and the District of Columbia with respect to the numbers, types and characteristics of the vehicles registered in their respective jurisdictions that are within the TPB air quality planning area. In recent years, such updates took place in 2005 and 2008 and again this year. The triennial cycle allows TPB to conduct comparative analyses and to detect trends, which often reflect prevailing socioeconomic conditions. The 2011 Vehicle Identification Numbers (VIN) database was eagerly anticipated since it could reflect modified vehicle purchasing patterns resulting from the economic recession and the popular 2009 Car Allowance Rebate System (i.e., CARS) also known as Cash-for-Clunkers program.

The motor vehicle administrations and air management agencies of Maryland, Virginia and the District of Columbia provided their respective 2011 VIN databases as of July 1, 2011. The "raw" data was decoded using specialty software in order to sort through the data records and to link each registered vehicle with the characteristics that define it: manufacturer, model, model year, fuel type etc. The decoded vehicle records were subsequently subjected to thorough reviews and comparative tests – using years 2005 and 2008 as benchmarks – prior to using them in air quality-related applications. The 2011 VIN databases will be used in the upcoming PM2.5 State Implementation Plan (SIP) update and in future Air Quality Conformity determination cycles. For the first time, this database will be used in modeling emissions inventories using MOVES2010, the latest emissions model recommended by EPA.

KEY STATISTICS

- *Over 3.8 million vehicles are registered in the Washington region in 2011;* approximately 1.8 million are registered in each of Maryland and Virginia; almost 280,000 in the District of Columbia (Exhibit 1).

- *The regional vehicle fleet increased over 4 percent in the 2008-2011 period;* jurisdictions in Maryland and Virginia exhibited 4 percent growth while the District of Columbia exhibited approximately 3 percent growth.

- *Light Duty Vehicles* (i.e., motorcycles and passenger cars) account for 56 percent of the overall vehicle fleet in Maryland and Virginia jurisdictions; they account for 65 percent in the District of Columbia (Exhibit 2).

- *Light Duty Trucks* (i.e., sport utility vehicles) account for 40 percent of the overall vehicle fleet in Maryland and Virginia jurisdictions; they account for 30 percent in the District of Columbia (Exhibit 2).

- *Heavy Duty Trucks and buses* account for approximately 5 percent of the entire fleet (Exhibit 2).

OBSERVED TRENDS

- *The light duty vehicle/light duty truck split was 60/40 in 2011,* which is close to the split in 1996; it was 65/35 then. The number of light duty trucks had been steadily increasing between 1996 and 2004 as the numbers of light duty vehicles had been proportionately decreasing. In 2004 these two types of vehicles reached a 50/50 split but the pattern has reversed since then. The smooth trend lines for each vehicle type were disrupted in 2008 and 2009, possibly due to the recession and the popular 2009 Cash-for-Clunkers program, whose goal was to replace low-mileage vehicles with more efficient ones (Exhibit 3).

- *The numbers of hybrid vehicles have been steadily increasing since their introduction in 2000.* There was a one-time drop in the hybrid vehicles sales in 2009. It is speculated that it was due to the relatively high sticker price of such vehicles at the onset of the recession, the moderate prices of gasoline during that time period and the Cash-for-Clunkers Program (Exhibit 4).

- *The average age of the regional vehicle fleet has been increasing for all vehicle types since 2005.* The average age increased by 0.34 years between 2005 and 2008 and by a further 0.87 years between 2008 and 2011. Vehicle owners have been keeping their vehicles longer before replacing them with newer models; as a result, older vehicles comprise larger percentages of the vehicle fleet than ever before. Heavy duty trucks in commercial fleets, which traditionally do not turn over as frequently as light duty vehicles and light duty trucks, exhibited the lowest turnover rates as indicated by the largest age increase in the regional vehicle fleet (Exhibit 5). These are also the vehicles powered by diesel, thus contributing towards NOx and PM2.5 emissions inventories.

IMPACTS ON EMISSIONS RATES

- *Changes in the regional vehicle fleet composition relative to 2008 result in higher emissions rates for Volatile Organic Compounds (VOCs).* The increases, however, are modest because Tier I standards went into effect with model year 1994 and continued until model year 2004 when Tier II standards were instituted. These standards have had a long time to yield beneficial results, which are substantiated by the modest differences between the 2008 and 2011 VOC emissions rates curves (Exhibit 6).

- *Changes in the regional vehicle fleet composition relative to 2008 result in higher emissions rates for NOx,* a pollutant associated mainly with diesel fuel. The increases, however, are moderate because the heavy duty engine rule went into effect with model year 2004. By July 2006 all diesel fuel sold had to be 15 ppb. The rule had a short time period to be integrated into the regional fleet (Exhibit 7).

- *Changes in the regional vehicle fleet composition relative to 2008 result in higher emissions rates for PM2.5,* a pollutant associated mainly with diesel fuel. The increases, however, are modest in absolute terms. The July 2006 standard on diesel fuel ushered in PM2.5 standards with model year 2007. The rules had a short time to be integrated into the regional fleet (Exhibit 8).

SUMMARY

- The regional vehicle fleet in the Washington region is getting older. While the average age increase during the 2005-2008 period was 0.34 years, it was 0.87 years for the 2008-2011 period.

- The share of light duty vehicles in the overall vehicle fleet continues to increase despite a disruption in the trend lines due possibly to the recession and the 2009 Cash-for-Clunkers program.

- The popularity of hybrid vehicles continues despite a disruption in upward trend in 2009 possibly due to the recession.

- The changing composition of the vehicle fleet increases the emissions rates of the criteria pollutants for Air Quality Conformity analyses. Various criteria pollutants are affected differently: VOC is less sensitive to changes in the vehicle fleet composition as gasoline standards have had a long time to yield beneficial results. NOx and PM2.5 are more sensitive to changes in the vehicle fleet as the rules have had a short time to be integrated into the regional fleet.
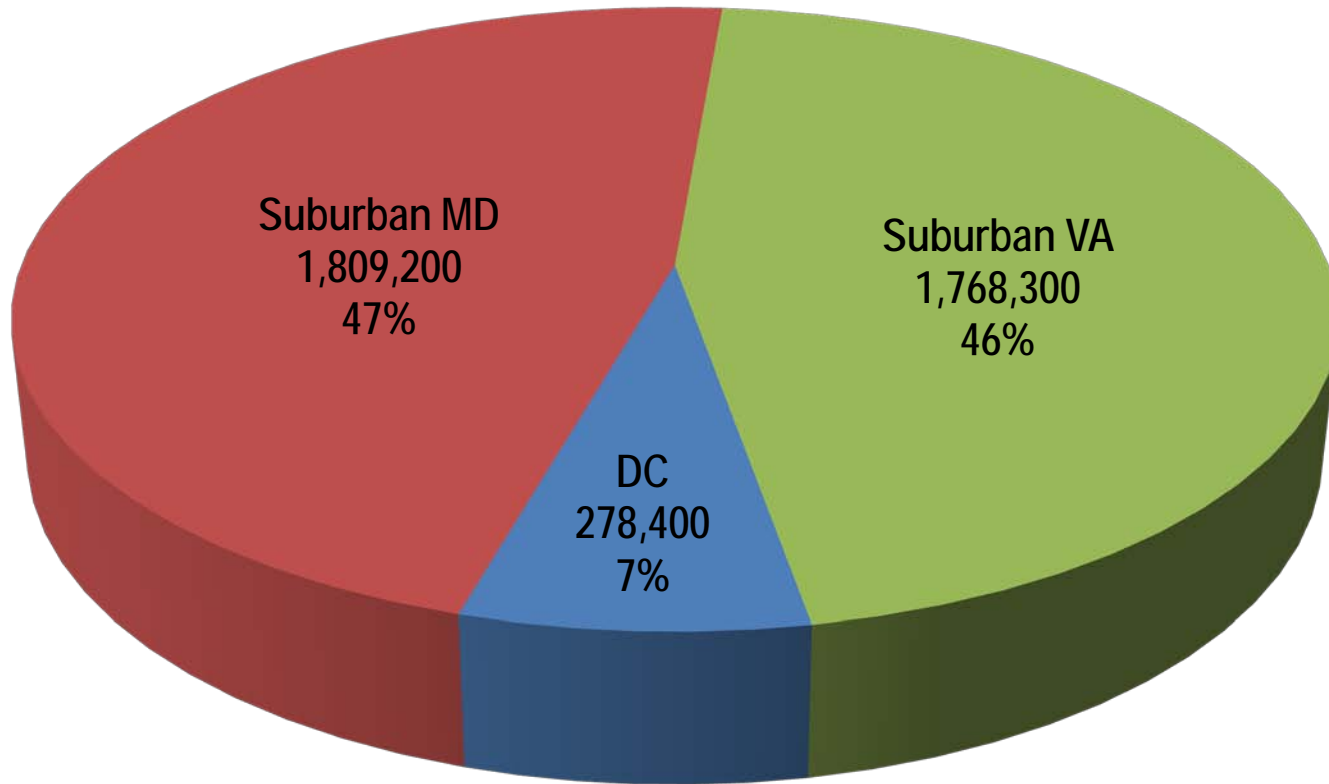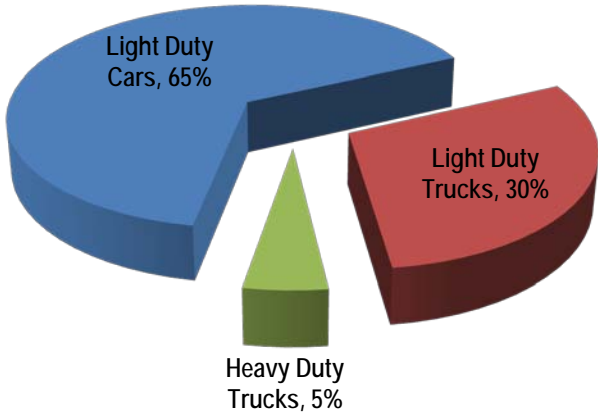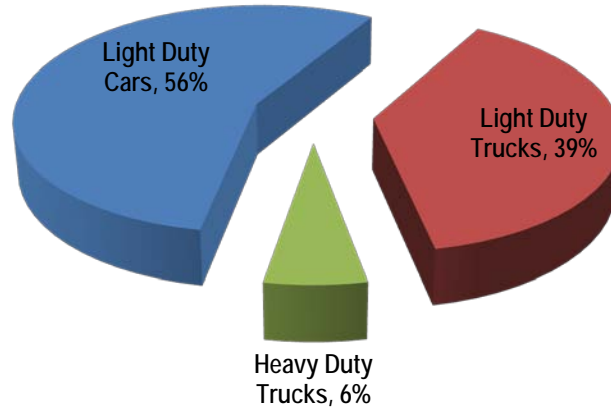
METROPOLITAN WASHINGTON REGION

Suburban MD
1,809,200
47%

Suburban VA
1,768,300
46%

DC
278,400
7%

EXHIBIT 1

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METROPOLITAN WASHINGTON REGION

DC

Light Duty Cars, 65%

Light Duty Trucks, 30%

Heavy Duty Trucks, 5%

Suburban MD

Light Duty Cars, 56%

Light Duty Trucks, 39%

Heavy Duty Trucks, 6%

Suburban VA

Light Duty Cars, 56%

Light Duty Trucks, 40%

Heavy Duty Trucks, 5%
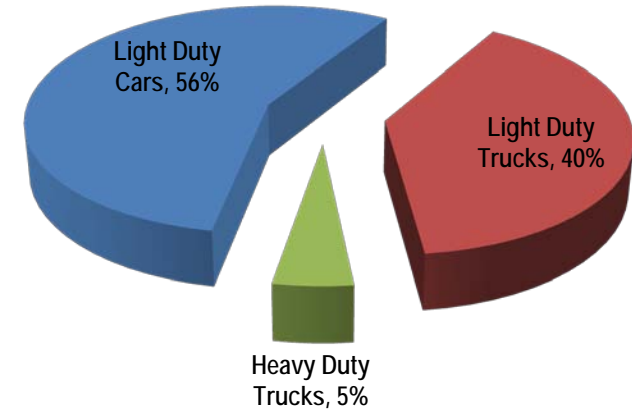
EXHIBIT 2

METROPOLITAN WASHINGTON REGION

Light Duty Vehicles (LDV) vs Light Duty Trucks (LDT)
(1996-2010)
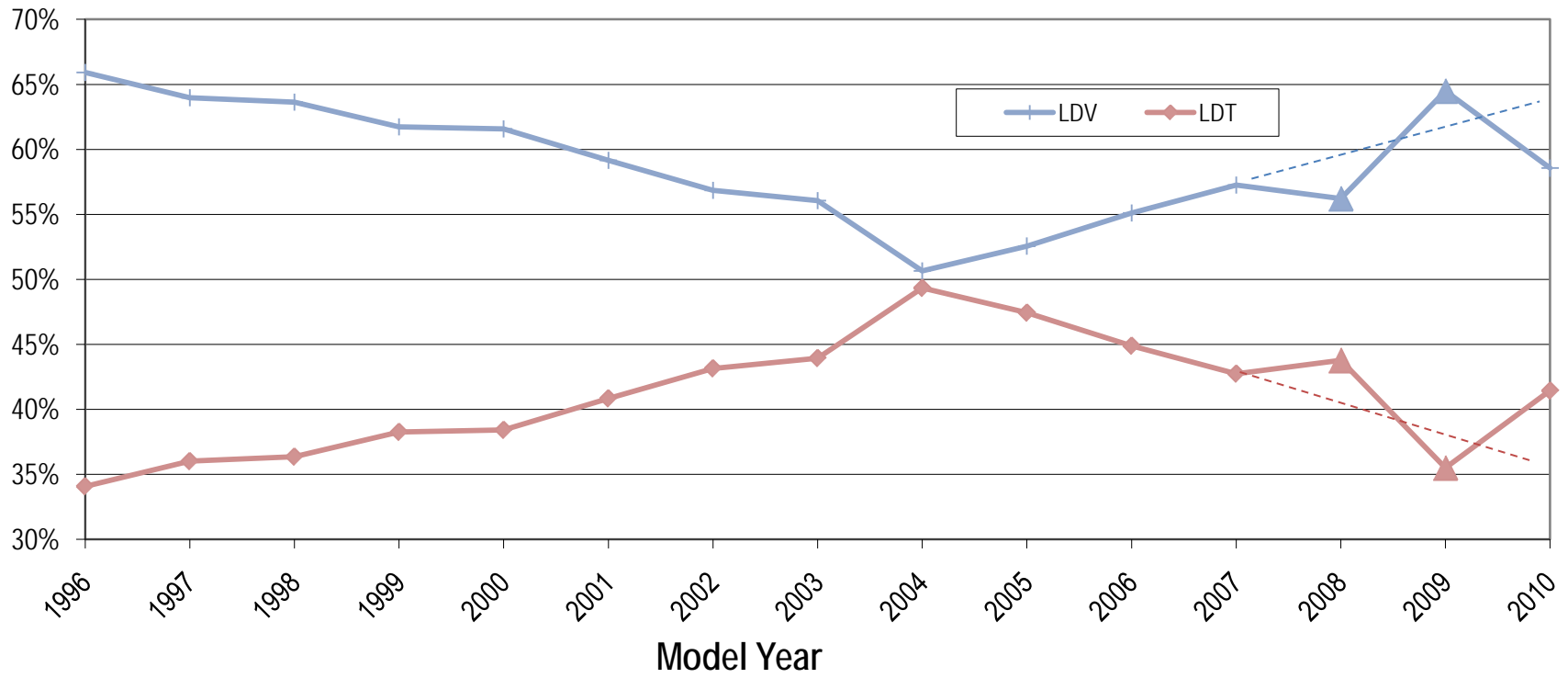
EXHIBIT 3
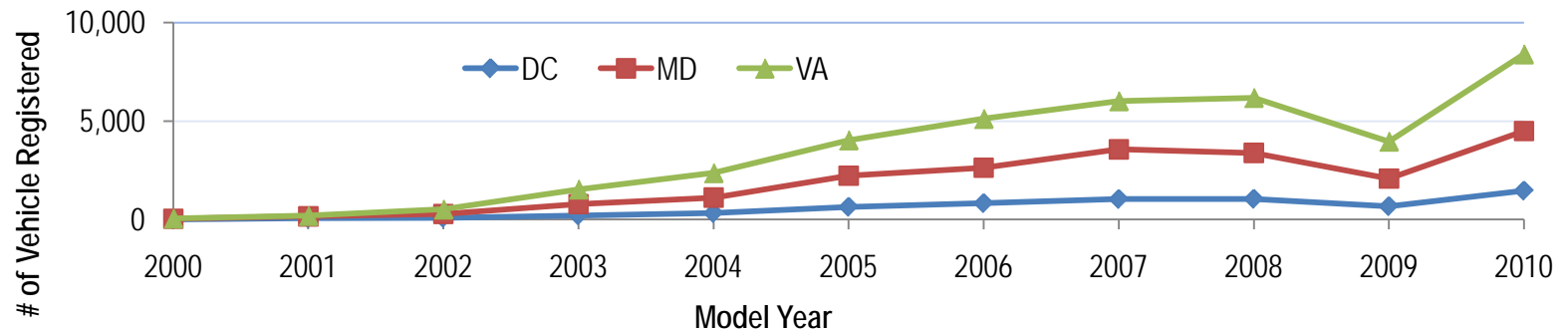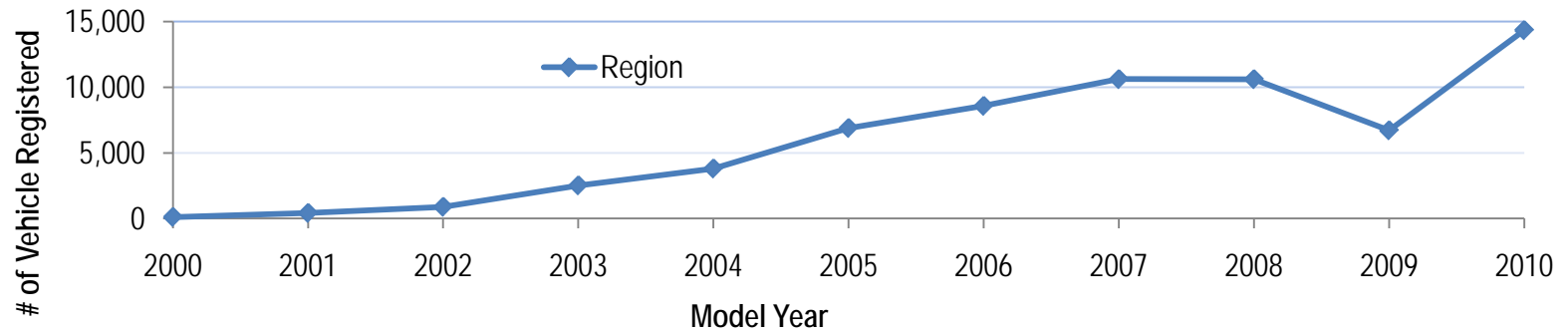
METROPOLITAN WASHINGTON REGION

Popularity of Hybrids

(2000-2010)

EXHIBIT 4

METROPOLITAN WASHINGTON REGION

Average Age of the Regional Vehicle Fleet

Year	Average Vehicle Age			
	Light Duty Vehicles (LDV)	Light Duty Trucks (LDT)	Heavy Duty Vehicles (HDV)	All Vehicle Types
2005	8.23	7.06	8.61	7.84
2008	8.51	7.53	9.21	8.18
2011	9.25	8.55	10.56	9.05
2005-08 Difference	0.28	0.47	0.60	0.34
2008-11 Difference	0.74	1.02	1.35	0.87
2005-11 Difference	1.02	1.49	1.95	1.21

EXHIBIT 5

METROPOLITAN WASHINGTON REGION

VOC Emissions Rates
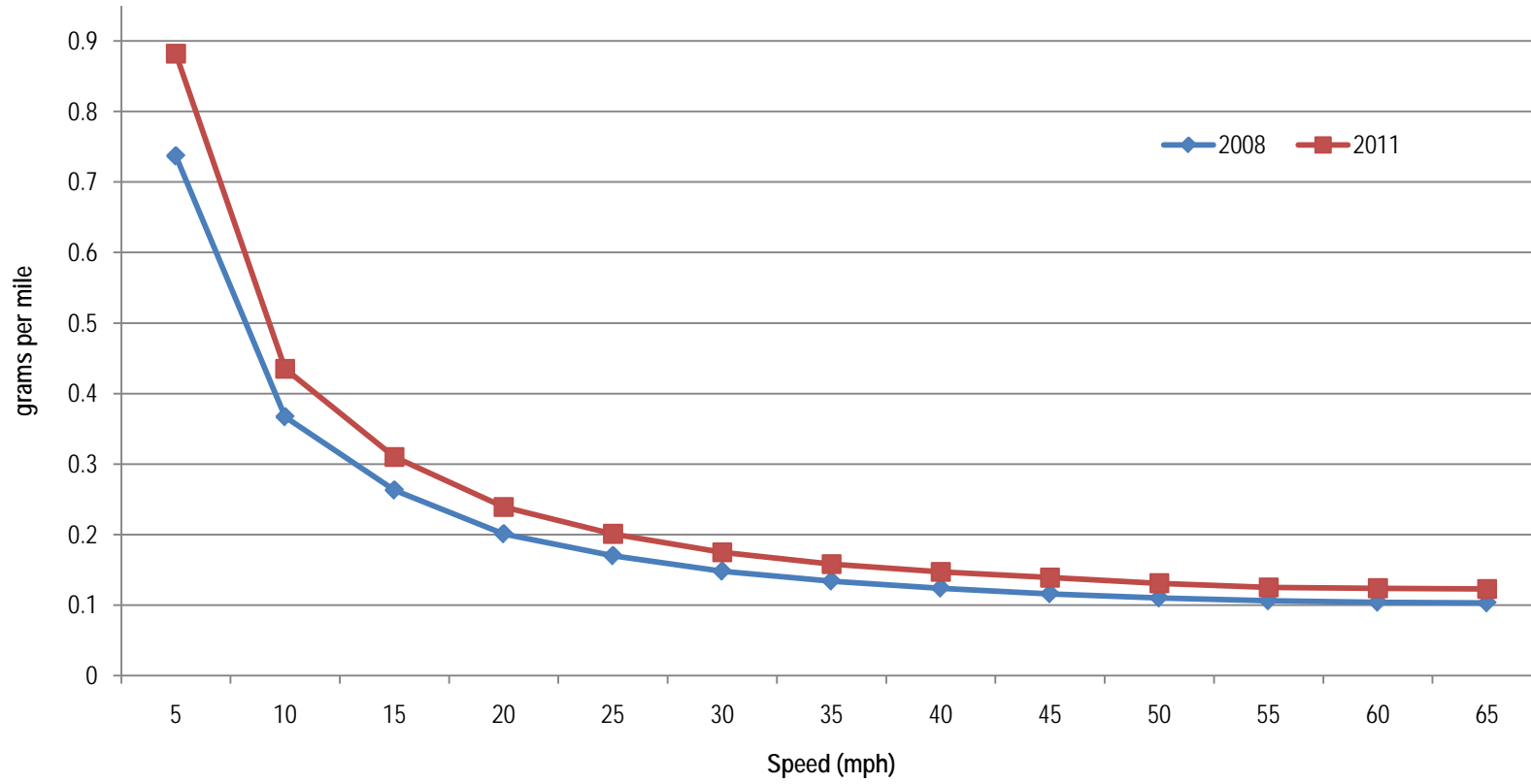## Example: Year 2016 Frederick Co.

EXHIBIT 6

METROPOLITAN WASHINGTON REGION

NOx Emissions Rates
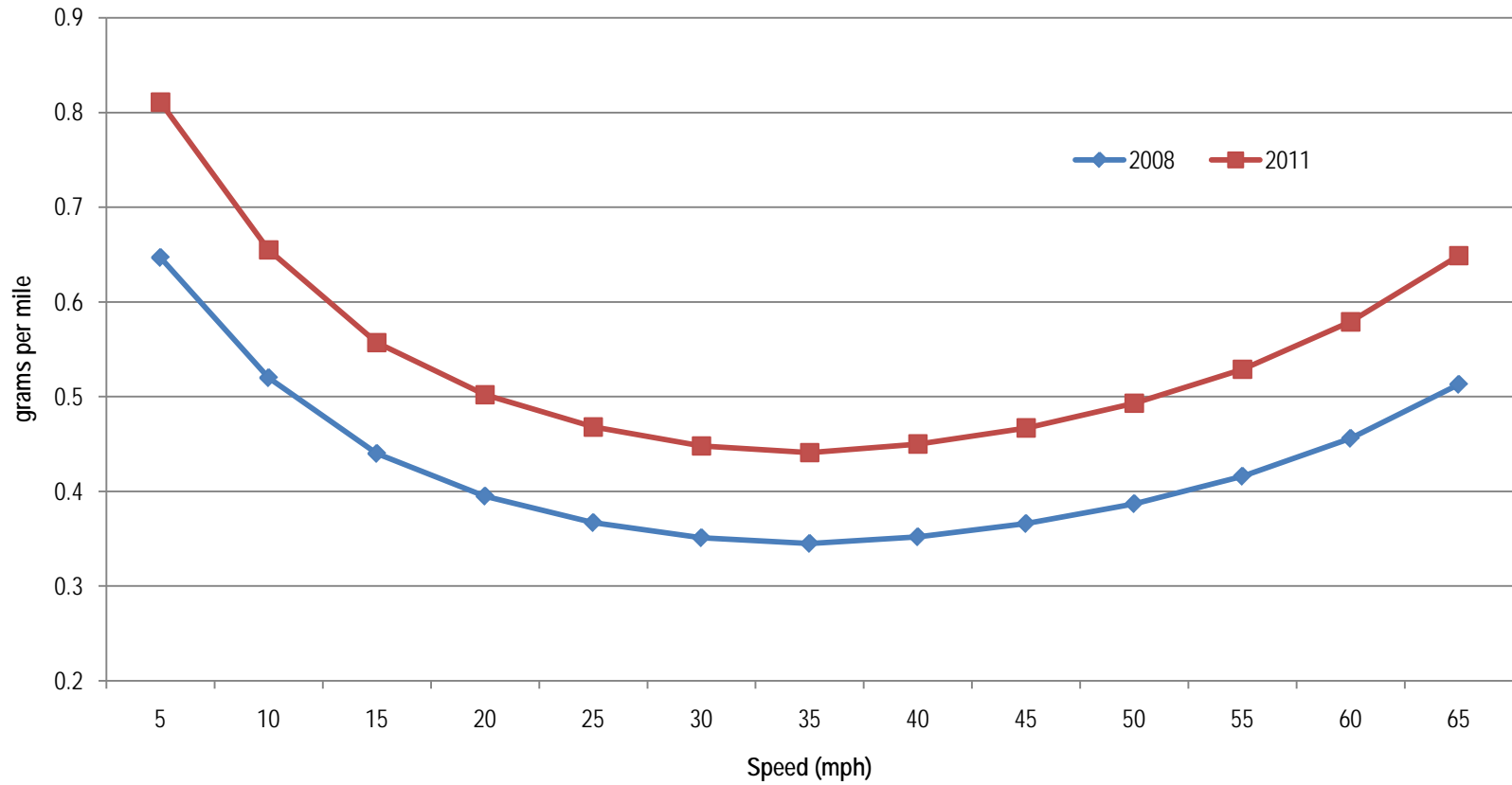### Example: Year 2016 Frederick Co.

EXHIBIT 7

METROPOLITAN WASHINGTON REGION
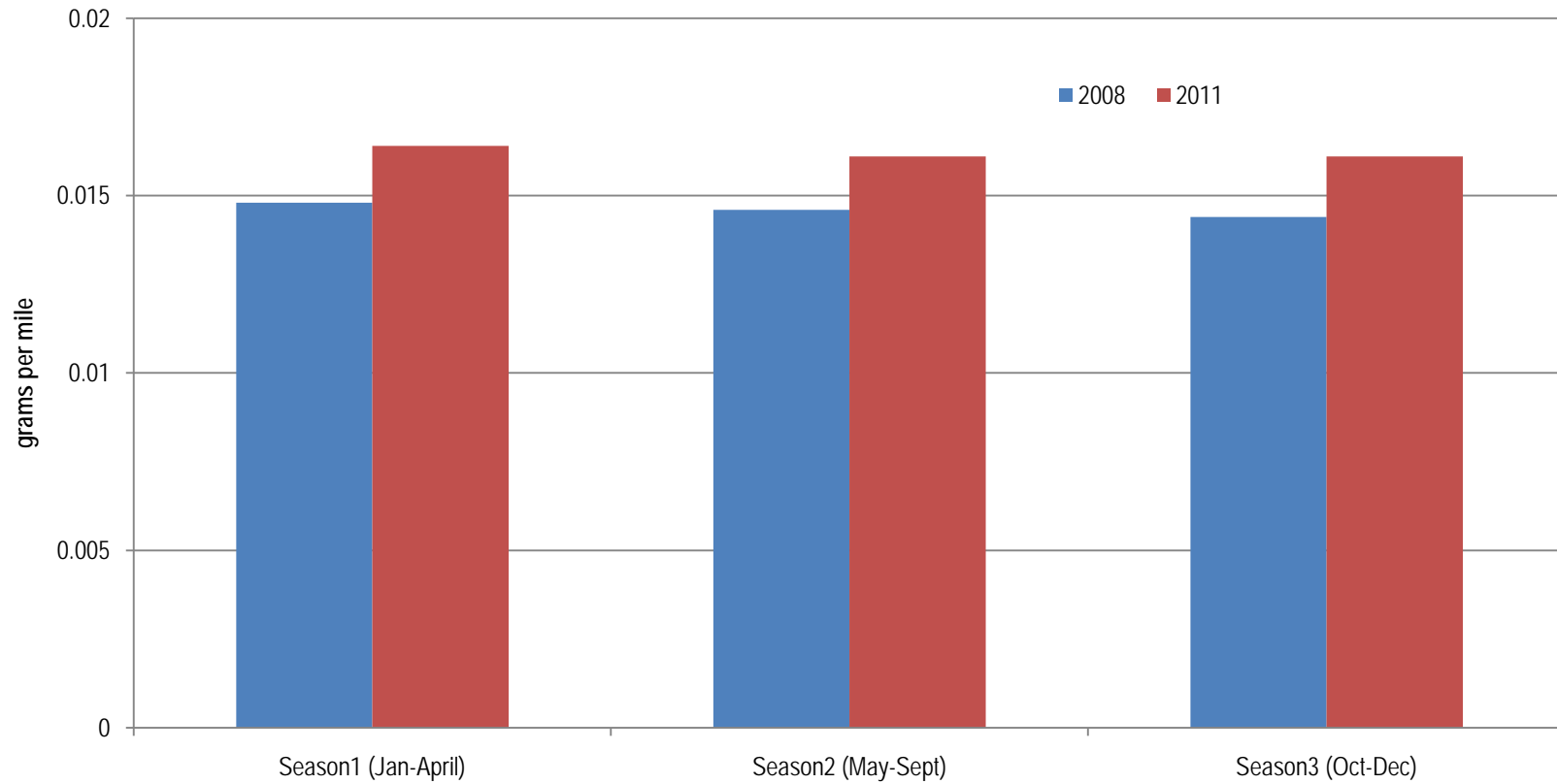
PM2.5 Emissions Rates
Example: Year 2016 Frederick Co.

EXHIBIT 8