

MEMORANDUM

November 23, 2009

To: Mike Clifford

From: Eulalie Gower-Lucas
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Subject: Mobile Source Greenhouse Gas (GHG) Emissions for the Metropolitan
Washington Region: 2005, 2010, 2020 and 2030

Introduction

This memo transmits draft mobile source emissions results for CO₂ and documents input assumptions and technical methods used in the preparation of these emission estimates. This memo also serves to document the impact of the latest Corporate Average Fuel Economy CAFE standards on these emissions estimates. Inventories were developed in response to one of the work items listed in the FY 2010 Unified Planning Work Program, Item 3 B Mobile Emissions Analysis.

Current work activities and results presented in this memo update the original inventories which were documented in a technical memo dated March 6, 2009 to the TPB Technical Committee. This current analysis applies all latest planning assumptions for some inputs, for example 2008 vehicle registration data. The geography used for the analysis is the 8-hour ozone non-attainment area illustrated in the attached Map 1.

Emissions Calculation

Network Development

A network for 2005 was created for this analysis and networks for 2010, 2020, and 2030 from the air quality analysis of the 2009 Constrained Long Range Plan (CLRP) and the FY2010-2015 Transportation Improvement Plan (TIP) were used in this analysis. A detailed list of projects and documentation of this process are contained in the report *Air Quality Conformity Determination of the 2009 Constrained Long Range Plan and the FY 2010-2015 Transportation Improvement Program for the Washington Region*, dated July 15, 2009.

Travel Demand

The travel demand component for this work was based upon execution of the COG/TPB's Version 2.2D travel forecasting process; see *COG/TPB's Version 2.2 Specification, Validation, and User's Guide: TPB, March 1, 2008*. Inputs to the process include Round 7.2 Cooperative Forecast land activity assumptions, and CLRP and TIP network inputs

contained in the conformity report mentioned in the previous paragraph. Table 1 summarizes for baseline (2005) as well as forecast years by jurisdiction.

Emissions Factors

CO₂ emission factors were prepared using EPA's Mobile model version 6.2; these rates were also used in the initial set of CO₂ results and do not include CAFE standards. COG/DTP staff estimated reductions associated with the latest CAFE standards and this is addressed in the CAFE section. Table 2 shows regional average rates for CO₂ for selected all analysis based on individual jurisdiction specific rates.

Mobile Source Emissions-Mobile6.2 Results

CO₂, emissions were calculated using software developed by COG/TPB'S consultant, E.H. Pechan (EHP) using an approach consistent with COG/TPB's emission calculation procedures: **Emission Factor * Travel Component**. Unlike COG's post-processor which was previously used for calculating CO₂ emissions EHP's software is designed to calculate total GHG emissions for both network and off-network components of the trip cycle. Emissions are shown in Table 3, by year and trip cycle. A summary of inputs used in this analysis are shown below the results.

Total GHG emissions which will include N₂O and CH₄ are available but are not included in this memorandum. Since these two emissions are obtained by factoring the CO₂ emissions this step will be the last step in the analysis at every stage.

Corporate Average Fuel Economy (CAFE) Impacts

Since the EPA Mobile 6.2 model does not consider the impact of the latest CAFE standards of 35.5 mpg by 2016, staff embarked on an off-line analysis to incorporate the impacts in the baseline estimation of CO₂ emissions. The spread sheet program used for this off-line analysis was developed by a consultant (Dan Meszler). The program uses baseline CAFE, fleet age, and vehicle miles of travel to estimate fuel consumption and CO₂ in the region. Using the new CAFE, market penetration of new vehicles, and VMT estimates, the new fuel consumption and associated CO₂ emissions are estimated. The difference between the baseline and the new 35.5 mpg CAFE is then applied to the CO₂ emissions from the network described above to estimate the new baseline CO₂ emissions.

Exhibit 1 shows the output page from the off-line analysis program developed by our consultant. The new fuel efficient vehicles will be introduced beginning in model year 2012. The calculations of the baseline, control and reduced emissions shown in exhibit 1 are all in millions of metric tons. Since the regional CO₂ emissions estimates are in short tons, we use the final column which shows the emissions reduction in percentages. With the new CAFE program we would achieve a reduction of 25.8% by 2020 and 34.1% by 2030.

Exhibit 2 illustrates the estimation of the reduction in short tons by 2020 and 2030. Since the new standards affect only light duty vehicles, we apply the 25.8% reduction to light duty portion of the emissions. Row A shows the emissions broken up by the various components namely network, local, transit, school bus and auto access to transit stations. Row B shows the percentage reduction from exhibit 1. Row C shows the percentage of emissions from light duty vehicles for the various components shown on Row A. Row D shows the reductions by the various components, and the final row shows the net emissions for 2020 and 2030.

Since the new CAFE standards are the law, the CO₂ rates from the MOBILE model were adjusted to reflect the CAFE standards for use in off-line emissions estimates of implemented TERMS, Potential TERMS and control strategies from the COG Climate Change Report are shown in Exhibit 3.

Results and Next Steps

Exhibit 4 illustrates the impact of the new CAFE standards in graphical form. By 2020 and 2030 the new fuel economy program results in a reduction of 24% and 34% of CO₂ emissions respectively. The following steps will illustrate how the region will march towards meeting the COG GHG emissions goal.

- Estimate the CO₂ benefits of implemented TERMS in the region and subtract them from the new baseline emissions.
- Compare the above number with the COG Goal and estimate the additional reduction needed to meet the goals.
- Estimate CO₂ benefits for Potential TERMS, measures in the Climate Change Report and any new regional measures.
- Estimate “What It Would Take” to meet the goals.
- Apply GHG factors to estimate total GHG.

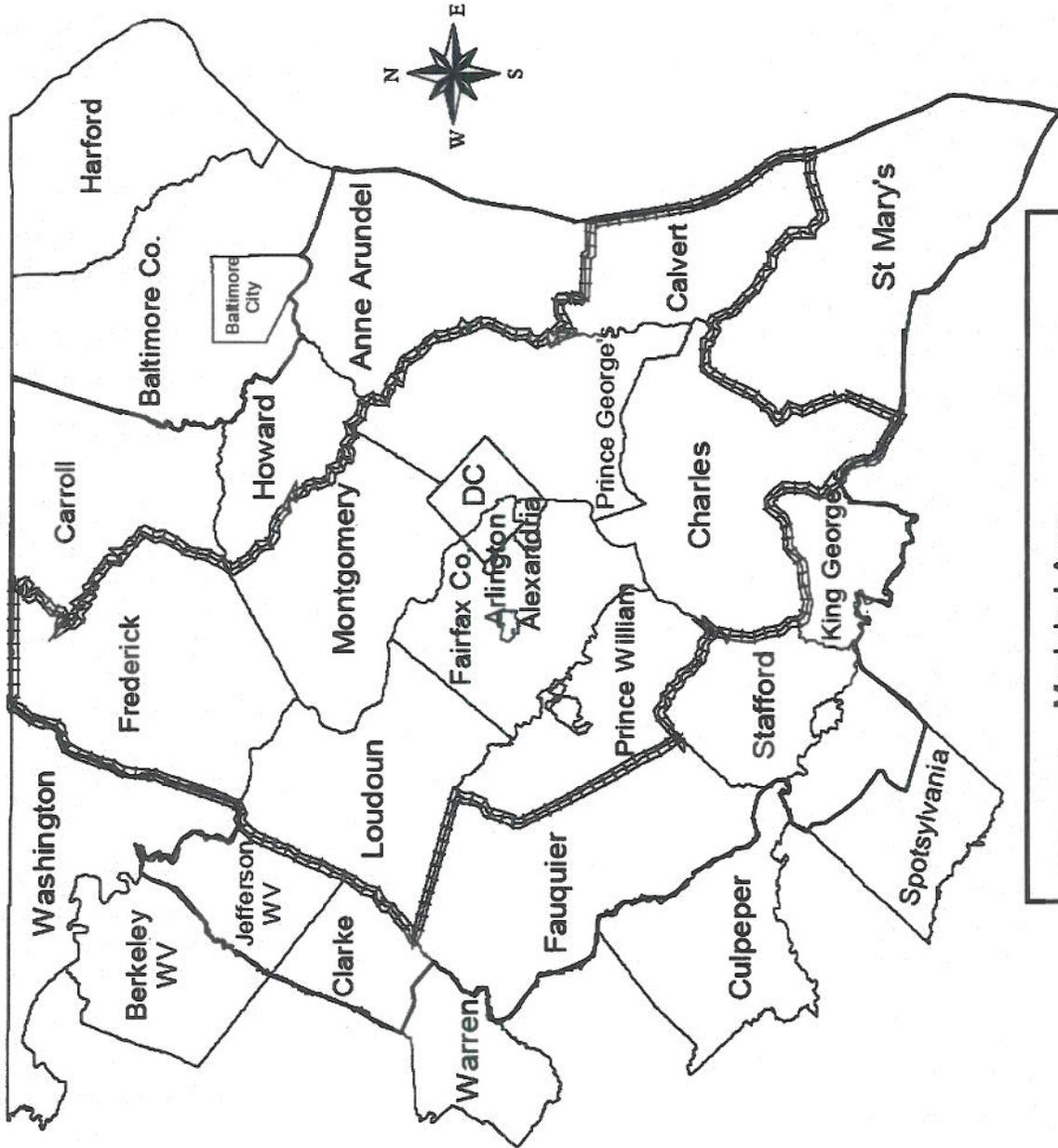
Following

Map 1

Tables 1 - 3

Exhibits 1- 4

Map 1



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Table 1
Annual Vehicle Miles of Travel (000,000's)
2009 CLRP and the FY 2010-2015 TIP

Jur	2005	2010	2020	2030
DC	3657	3704	3797	3883
Mtg	7854	8009	8741	9298
PG	7974	8379	9093	9610
Cal	591	635	736	779
Chs	1049	1110	1299	1460
Frd	3373	3668	4157	4608
Arl	1749	1762	1836	1859
Ffx	9721	10209	11551	12150
Ldn	2049	2383	3119	3624
PW	3175	3594	4210	4795
Sta	1288	1452	1838	2110
Alx	827	902	979	1005
Total	43306	45805	51355	55182

Table 2
Regional Average Rates for CO₂
 (Grams per Vehicle Mile)
 Does not include CAFE Standards

	2005	2010	2020	2030
Major Road Network	512	526	542	546
Local Roads	461	474	487	490
School Bus	1,637	1642	1,646	1,647
Transit Bus	2,373	2348	2,334	2,334

Table 3
MOBILE6.2 Emissions in Annual Tons

8-Hour Non-Attainment Area	2005	2010	2020	2030
Major Roads	21,898,100	23,680,381	27,233,592	29,436,515
Local Roads	1,711,442	1,852,746	2,123,439	2,278,660
School Buses	152,025	157,141	157,564	157,564
Transit Buses	247,489	259,702	258,062	258,062
Auto Access	85,490	103,979	142,268	149,590
Total	24,094,546	26,053,949	29,914,925	32,280,391

Notes on Inputs:

Mobile Source Inventory
2009 CLRP and the FY2010-2015 TIP Ver 2.2 Travel Demand Model Round 7.2 Cooperative Forecast 2008 Vehicle Registration "Pechan Software" Emissions Estimation

Exhibit 1 CAFE IMPACTS 35.5 MPG By 2016

Light Duty Cars and Trucks Combined

Year	Baseline LDV/T CO2-eq MMtons	Control LDV/T CO2-eq MMtons	Reduced LDV/T CO2-eq MMtons	Pct Chg LDV/T CO2-eq
2010	22.34	22.34	0.00	0.0%
2011	22.57	22.38	0.19	-0.8%
2012	22.80	22.21	0.59	-2.6%
2013	23.03	21.90	1.13	-4.9%
2014	23.27	21.48	1.78	-7.7%
2015	23.50	21.01	2.49	-10.6%
2016	23.74	20.38	3.35	-14.1%
2017	23.97	19.74	4.24	-17.7%
2018	24.21	19.19	5.03	-20.8%
2019	24.46	18.71	5.74	-23.5%
2020	24.70	18.34	6.36	-25.8%
2021	24.94	18.05	6.90	-27.7%
2022	25.19	17.83	7.36	-29.2%
2023	25.44	17.69	7.75	-30.5%
2024	25.70	17.62	8.08	-31.5%
2025	25.95	17.59	8.36	-32.2%
2026	26.21	17.61	8.60	-32.8%
2027	26.47	17.66	8.81	-33.3%
2028	26.73	17.74	8.99	-33.6%
2029	27.00	17.84	9.16	-33.9%
2030	27.27	17.96	9.31	-34.1%

Note: The program begins in Model Year 2012

MM tons = Millions of Metric Tons

Exhibit 2
2009 CLRP CO2 Emissions with reductions from CAFE 35.5 by 2016 Standards Effective with MY 2012

Based on Dan Meszler's spreadsheet February 21, 2009 with adjustments made for CAFE 35.5 by 2016 proposal and 2009 CLRP

2020	Network	Local	Transit	School	Auto Access	Total
Baseline Emissions	27,233,592	2,123,439	258,062	157,564	142,268	29,914,925

A.

Percent Reductions in 2020

+24.3%

Network	Local	Transit	School	Auto Access
80.6%	95.1%	0%	0%	100%

B.

C.

Reductions by Travel Component

Network	Local	Transit	School	Auto Access	Total
5,337,015.12	490,992.88	-	-	34,607.72	5,862,615.72

D= A*B*C

Net Emissions for 2020

Network	Local	Transit	School	Auto Access	Total
21,896,577	1,632,446	258,062	157,564	107,660	24,052,309

A-D

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Percent Reductions in 2030

2030	Network	Local	Transit	School	Auto Access	Total
Baseline Emissions	29,436,515	2,278,660	258,062	157,564	149,590	32,280,391

A.

+34.1%

Network	Local	Transit	School	Auto Access
80.2%	95.0%	0%	0%	100%

B.

C.

Reductions by Travel Component

Network	Local	Transit	School	Auto Access	Total
8,048,536.69	738,036.81	-	-	50,995.66	8,837,569.15

D= A*B*C

Net Emissions for 2030

Network	Local	Transit	School	Auto Access	Total
21,387,978	1,540,623	258,062	157,564	98,594	23,442,822

A-D

Exhibit 3

Rates for Analyzing Off-Line TERMS And Measures in the COG Climate Change Report

2009 CLRP

	35.5 mpg by 2016
2020	24.33%
2030	34.09%

2010

	Commuter TERMS (LDV only)	Traffic Stream (all veh.) (35 mph)
CAFE 35.5 by 2016 (2009 CLRP)	461.70	526.03

2020

	Commuter TERMS (LDV only)	Traffic Stream (all veh.) (35 mph)
CAFE 35.5 by 2016 (2009 CLRP)	358.78	436.97

2030

	Commuter TERMS (LDV only)	Traffic Stream (all veh.) (35 mph)
CAFE 35.5 by 2016 (2009 CLRP)	312.53	400.50

Annual CO₂ Emissions based on the 2009 CLRP & 2010-2015 TIP

