

ATTACHMENT 6

MOBILE 6 Input and Output Files

INPUTS

MOBILE6 INPUT FILE

POLLUTANTS : HC CO NOX
SPREADSHEET :
RUN DATA

* July 2009 Runs

* No. 1: GATEWAY VEHICLE INSPECTION PROGRAM

NO REFUELING :
EXPAND EXHAUST :
EXPAND EVAPORATIVE :
MIN/MAX TEMP : 74. 97.
FUEL RVP : 7.0
ABSOLUTE HUMIDITY : 60.4
REG DIST : C:\RUN\VRegSt1.d
FUEL PROGRAM : 2 S

*Calendar year 2009. Tailpipe OBD II for LDGV 1996-2012 model years.

I/M PROGRAM : 1 1983 2020 2 TRC OBD I/M
I/M MODEL YEARS : 1 1996 2009
I/M VEHICLES : 1 22222 11111111 1
I/M STRINGENCY : 1 20.0
I/M COMPLIANCE : 1 96.0
I/M WAIVER RATES : 1 0.0 8.0
I/M GRACE PERIOD : 1 2
I/M EFFECTIVENESS : 0.90 0.90 0.90

*Calendar year 2009. Evaporative OBD II for LDGV 1996-2009 model years.

I/M PROGRAM : 2 1983 2020 2 TRC EVAP OBD
I/M MODEL YEARS : 2 1996 2009
I/M VEHICLES : 2 22222 11111111 1
I/M STRINGENCY : 2 20.0
I/M COMPLIANCE : 2 96.0
I/M WAIVER RATES : 2 0.0 8.0
I/M GRACE PERIOD : 2 2

SCENARIO RECORD : JULY 2009 LDG EMISSIONS GVIP W/ 90% OF CENTRALIZED CREDIT
CALENDAR YEAR : 2009
EVALUATION MONTH : 7

END OF RUN

* No. 2: BASIC I/M PERFORMANCE STANDARD

NO REFUELING :
EXPAND EXHAUST :
EXPAND EVAPORATIVE :
MIN/MAX TEMP : 74. 97.
FUEL RVP : 7.0
ABSOLUTE HUMIDITY : 60.4
REG DIST : C:\RUN\VRegSt1.d
FUEL PROGRAM : 2 S

*Calendar year 2009. SSI for LDGV 1968-1995 model years.

I/M PROGRAM : 1 1983 2020 1 T/O IDLE
I/M MODEL YEARS : 1 1968 1995
I/M VEHICLES : 1 21111 11111111 1
I/M STRINGENCY : 1 20.0
I/M COMPLIANCE : 1 100.0
I/M WAIVER RATES : 1 0.0 0.0
NO I/M TTC CREDITS : 1

*Calendar year 2009. Tailpipe OBD II for LDGV 1996-2009 model years.

I/M PROGRAM : 2 1983 2020 1 T/O OBD I/M
I/M MODEL YEARS : 2 1996 2009
I/M VEHICLES : 2 21111 11111111 1
I/M STRINGENCY : 2 20.0
I/M COMPLIANCE : 2 100.0
I/M WAIVER RATES : 2 0.0 0.0
NO I/M TTC CREDITS : 2

* Calendar year 2009. Evap OBD II for LDGV 1996-2009 model years.
I/M PROGRAM : 3 1983 2020 1 T/O EVAP OBD
I/M MODEL YEARS : 3 1996 2009
I/M VEHICLES : 3 21111 11111111 1
I/M STRINGENCY : 3 20.0
I/M COMPLIANCE : 3 100.0
I/M WAIVER RATES : 3 0.0 0.0
NO I/M TTC CREDITS : 3

SCENARIO RECORD : JULY 2009 LDG EMISSIONS BASIC I/M PERFORMANCE STANDARD
CALENDAR YEAR : 2009
EVALUATION MONTH : 7

END OF RUN

* No. 3: NO I/M

NO REFUELING :
EXPAND EXHAUST :
EXPAND EVAPORATIVE :
MIN/MAX TEMP : 74. 97.
FUEL RVP : 7.0
ABSOLUTE HUMIDITY : 60.4
REG DIST : C:\RUN\VRegSt1.d
FUEL PROGRAM : 2 S

SCENARIO RECORD : JULY 2009 LDG EMISSIONS W/O I/M
CALENDAR YEAR : 2009
EVALUATION MONTH : 7

END OF RUN

REG DIST

* This file contains the combined St. Louis vehicle registration for
 * LDGV, LDGT1 & 2, and LDGT3 & 4 with the default MOBILE6 values for the distribution of
 * vehicles by age for July of any calendar year. The St. Louis data is from July 2002.
 * There are sixteen (16) sets of values representing 16 combined gasoline/diesel vehicle class
 * distributions. These distributions are split for gasoline and diesel
 * using the separate input (or default) values for diesel sales fractions.
 * Each distribution contains 25 values which represent the fraction of
 * all vehicles in that class (gasoline and diesel) of that age in July.
 * The first number is for age 1 (calendar year minus model year plus one)
 * and the last number is for age 25. The last age includes all vehicles
 * of age 25 or older. The first number in each distribution is an integer
 * which indicates which of the 16 vehicle classes are represented by the
 * distribution. The sixteen vehicle classes are:

* 1 LDV Light-Duty Vehicles (Passenger Cars)
 * 2 LDT1 Light-Duty Trucks 1 (0-6,000 lbs. GVWR, 0-3750 lbs. LVW)
 * 3 LDT2 Light Duty Trucks 2 (0-6,001 lbs. GVWR, 3751-5750 lbs. LVW)
 * 4 LDT3 Light Duty Trucks 3 (6,001-8500 lbs. GVWR, 0-3750 lbs. LVW)
 * 5 LDT4 Light Duty Trucks 4 (6,001-8500 lbs. GVWR, 3751-5750 lbs. LVW)
 * 6 HDV2B Class 2b Heavy Duty Vehicles (8501-10,000 lbs. GVWR)
 * 7 HDV3 Class 3 Heavy Duty Vehicles (10,001-14,000 lbs. GVWR)
 * 8 HDV4 Class 4 Heavy Duty Vehicles (14,001-16,000 lbs. GVWR)
 * 9 HDV5 Class 5 Heavy Duty Vehicles (16,001-19,500 lbs. GVWR)
 * 10 HDV6 Class 6 Heavy Duty Vehicles (19,501-26,000 lbs. GVWR)
 * 11 HDV7 Class 7 Heavy Duty Vehicles (26,001-33,000 lbs. GVWR)
 * 12 HDV8A Class 8a Heavy Duty Vehicles (33,001-60,000 lbs. GVWR)
 * 13 HDV8B Class 8b Heavy Duty Vehicles (>60,000 lbs. GVWR)
 * 14 HDBS School Busses
 * 15 HDBT Transit and Urban Busses
 * 16 MC Motorcycles (All)

* The 25 age values are arranged in two rows of 10 values followed by a row
 * with the last 5 values. Comments (such as this one) are indicated by
 * an asterisk in the first column. Empty rows are ignored. Values are
 * read "free format," meaning any number may appear in any row with as
 * many characters as needed (including a decimal) as long as 25 values
 * follow the initial integer value separated by a space.

* If all 28 vehicle classes do not need to be altered from the default
 * values, then only the vehicle classes that need to be changed need to
 * be included in this file. The order in which the vehicle classes are
 * read does not matter, however each vehicle class set must contain 25
 * values and be in the proper age order.

* LDV
 1 0.0484 0.0757 0.0819 0.0822 0.0735 0.0682 0.0611 0.0662 0.0565 0.0525
 0.0468 0.0438 0.0402 0.0382 0.0330 0.0267 0.0235 0.0190 0.0135 0.0079
 0.0046 0.0036 0.0031 0.0046 0.0253
 * LDT1
 2 0.0331 0.0648 0.0678 0.0747 0.0736 0.0676 0.0527 0.0563 0.0639 0.0482
 0.0438 0.0428 0.0346 0.0399 0.0384 0.0334 0.0324 0.0239 0.0182 0.0118
 0.0089 0.0067 0.0051 0.0109 0.0465
 * LDT2
 3 0.0331 0.0648 0.0678 0.0747 0.0736 0.0676 0.0527 0.0563 0.0639 0.0482
 0.0438 0.0428 0.0346 0.0399 0.0384 0.0334 0.0324 0.0239 0.0182 0.0118
 0.0089 0.0067 0.0051 0.0109 0.0465
 * LDT3
 4 0.0495 0.0846 0.0839 0.0822 0.0566 0.0694 0.0535 0.0620 0.0511 0.0360
 0.0329 0.0277 0.0336 0.0360 0.0335 0.0244 0.0272 0.0259 0.0191 0.0121
 0.0099 0.0079 0.0088 0.0164 0.0558
 * LDT4
 5 0.0495 0.0846 0.0839 0.0822 0.0566 0.0694 0.0535 0.0620 0.0511 0.0360
 0.0329 0.0277 0.0336 0.0360 0.0335 0.0244 0.0272 0.0259 0.0191 0.0121
 0.0099 0.0079 0.0088 0.0164 0.0558
 * HDV2B
 6 0.0503 0.0916 0.0833 0.0758 0.0690 0.0627 0.0571 0.0519 0.0472 0.0430
 0.0391 0.0356 0.0324 0.0294 0.0268 0.0244 0.0222 0.0202 0.0184 0.0167
 0.0152 0.0138 0.0126 0.0114 0.0499
 * HDV3
 7 0.0503 0.0916 0.0833 0.0758 0.0690 0.0627 0.0571 0.0519 0.0472 0.0430
 0.0391 0.0356 0.0324 0.0294 0.0268 0.0244 0.0222 0.0202 0.0184 0.0167
 0.0152 0.0138 0.0126 0.0114 0.0499
 * HDV4
 8 0.0388 0.0726 0.0679 0.0635 0.0594 0.0556 0.0520 0.0486 0.0455 0.0425
 0.0398 0.0372 0.0348 0.0326 0.0304 0.0285 0.0266 0.0249 0.0233 0.0218
 0.0204 0.0191 0.0178 0.0167 0.0797
 * HDV5
 9 0.0388 0.0726 0.0679 0.0635 0.0594 0.0556 0.0520 0.0486 0.0455 0.0425
 0.0398 0.0372 0.0348 0.0326 0.0304 0.0285 0.0266 0.0249 0.0233 0.0218
 0.0204 0.0191 0.0178 0.0167 0.0797
 * HDV6
 10 0.0388 0.0726 0.0679 0.0635 0.0594 0.0556 0.0520 0.0486 0.0455 0.0425
 0.0398 0.0372 0.0348 0.0326 0.0304 0.0285 0.0266 0.0249 0.0233 0.0218
 0.0204 0.0191 0.0178 0.0167 0.0797
 * HDV7
 11 0.0388 0.0726 0.0679 0.0635 0.0594 0.0556 0.0520 0.0486 0.0455 0.0425

	0.0398	0.0372	0.0348	0.0326	0.0304	0.0285	0.0266	0.0249	0.0233	0.0218
	0.0204	0.0191	0.0178	0.0167	0.0797					
* HDV8a										
12	0.0388	0.0726	0.0679	0.0635	0.0594	0.0556	0.0520	0.0486	0.0455	0.0425
	0.0398	0.0372	0.0348	0.0326	0.0304	0.0285	0.0266	0.0249	0.0233	0.0218
	0.0204	0.0191	0.0178	0.0167	0.0797					
* HDV8b										
13	0.0388	0.0726	0.0679	0.0635	0.0594	0.0556	0.0520	0.0486	0.0455	0.0425
	0.0398	0.0372	0.0348	0.0326	0.0304	0.0285	0.0266	0.0249	0.0233	0.0218
	0.0204	0.0191	0.0178	0.0167	0.0797					
* HDBS										
14	0.0393	0.0734	0.0686	0.0641	0.0599	0.0559	0.0522	0.0488	0.0456	0.0426
	0.0398	0.0372	0.0347	0.0324	0.0303	0.0283	0.0264	0.0247	0.0231	0.0216
	0.0201	0.0188	0.0176	0.0165	0.0781					
* HDBT										
15	0.0307	0.0614	0.0614	0.0614	0.0614	0.0614	0.0614	0.0614	0.0614	0.0613
	0.0611	0.0607	0.0595	0.0568	0.0511	0.0406	0.0254	0.0121	0.0099	0.0081
	0.0066	0.0054	0.0044	0.0037	0.0114					
* Motorcycles										
16	0.1440	0.1680	0.1350	0.1090	0.0880	0.0700	0.0560	0.0450	0.0360	0.0290
	0.0230	0.0970	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000					

OUTPUTS

ATTACHMENT 7

MOBILE 6 Sample Calculations

Sample Calculations for I/M SIP

The EPA recommended model (MOBILE 6.2) was used to estimate emission factors for different vehicle types and pollutants. This model considers many variables, such as summer day temperatures and regional fuel characteristics. This model also predicts emissions factors given a particular vehicle emissions inspection and maintenance (I/M) program.

Because I/M programs are only required for light duty gasoline powered vehicles and trucks, the I/M SIP excludes consideration of the emissions factors of vehicles that are not impacted by the I/M program such as buses and motorcycles. The vehicle types that are impacted by the I/M program are light duty gasoline vehicles and light duty gasoline trucks types one, two, three and four.

Once the MOBILE 6.2 inputs were run, the comma-delimited results were imported into a Microsoft Excel worksheet where the composite emissions factors for hydrocarbons (HC), also called volatile organic compounds (VOC), carbon monoxide (CO), and oxides of nitrogen (NO_x) could be calculated and compared. Emissions for the composite emissions factors from light duty vehicles were calculated as follows:

$$\begin{aligned} & [EF_{LDGV} * VMT_{LDGV} / VMT_{TOTAL}] + [EF_{LDGT1} * VMT_{LDGT1} / VMT_{TOTAL}] + \\ & [EF_{LDGT2} * VMT_{LDGT2} / VMT_{TOTAL}] + [EF_{LDGT3} * VMT_{LDGT3} / VMT_{TOTAL}] + \\ & [EF_{LDGT4} * VMT_{LDGT4} / VMT_{TOTAL}] = EM_{TOTAL} \end{aligned}$$

where:

EF_{LDGV} = Light duty gasoline vehicle emissions factor (VOC, CO, NO_x) (grams/mile)

EF_{LDGT1} = Light duty gasoline truck one emissions factor (VOC, CO, NO_x) (grams/mile)

EF_{LDGT2} = Light duty gasoline truck two emissions factor (VOC, CO, NO_x) (grams/mile)

EF_{LDGT3} = Light duty gasoline truck three emissions factor (VOC, CO, NO_x) (grams/mile)

EF_{LDGT4} = Light duty gasoline truck four emissions factor (VOC, CO, NO_x) (grams/mile)

EM_{TOTAL} = Light duty gasoline composite emissions factor (VOC, CO, NO_x) (grams/mile)

VMT_{LDGV} = Fraction of daily vehicle miles traveled by light duty gasoline vehicles

VMT_{LDGT1} = Fraction of daily vehicle miles traveled by light duty gasoline truck ones

VMT_{LDGT2} = Fraction of daily vehicle miles traveled by light duty gasoline truck twos

VMT_{LDGT3} = Fraction of daily vehicle miles traveled by light duty gasoline truck threes

VMT_{LDGT4} = Fraction of daily vehicle miles traveled by light duty gasoline truck fours

VMT_{TOTAL} = Fraction of daily vehicle miles traveled by light duty gasoline vehicles and trucks
one through four

A Microsoft Excel worksheet and graph are included after this explanation to further illustrate these sample calculations and results.

The MOBILE 6.2 runs take into account the impact of reformulated gasoline fuel, region two south, and low sulfur gasoline, 30 parts per million. The MOBILE 6.2 runs do not take into account any refueling emissions. Three MOBILE 6.2 runs were used for comparison: 1) a run without an I/M program in effect, 2) a run with the Basic I/M Performance Standard in effect, and 3) a run with the Gateway Vehicle Inspection Program in effect. Although the Gateway Vehicle Inspection Program is a decentralized (test-and-repair) I/M program, and will not be as fraud resistant as a centralized (test-only) I/M program, Missouri modeled the Gateway Vehicle Inspection Program with 90 percent of the centralized I/M program credit available. The reason that Missouri is claiming 90 percent of the centralized I/M program credit available is that the

robust design of the decentralized I/M program is utilizing state-of-the-art equipment to prevent and detect inspection fraud. This design includes, but is not limited to, real time data sharing between all inspection stations and the state, digital pictures of the license plate, vehicle identification number, and odometer of the vehicles being inspected, electronic equipment lockouts, and data triggers and reports that quickly identify testing or repair anomalies.

The Gateway Vehicle Inspection Program VOC, CO and NO_x light duty gasoline vehicle and truck composite emissions factors are lower than the Basic I/M Performance standard in July 2009 as the following table demonstrates.

Composite Emissions Factor Comparison at 27.6 Miles Per Hour

Type of Program	VOC (gpm)	CO (gpm)	NO_x (gpm)
No I/M Controls	0.906	9.363	0.864
EPA Basic Performance Standard	0.868	8.696	0.819
Gateway Vehicle Inspection Program	0.842	8.241	0.776

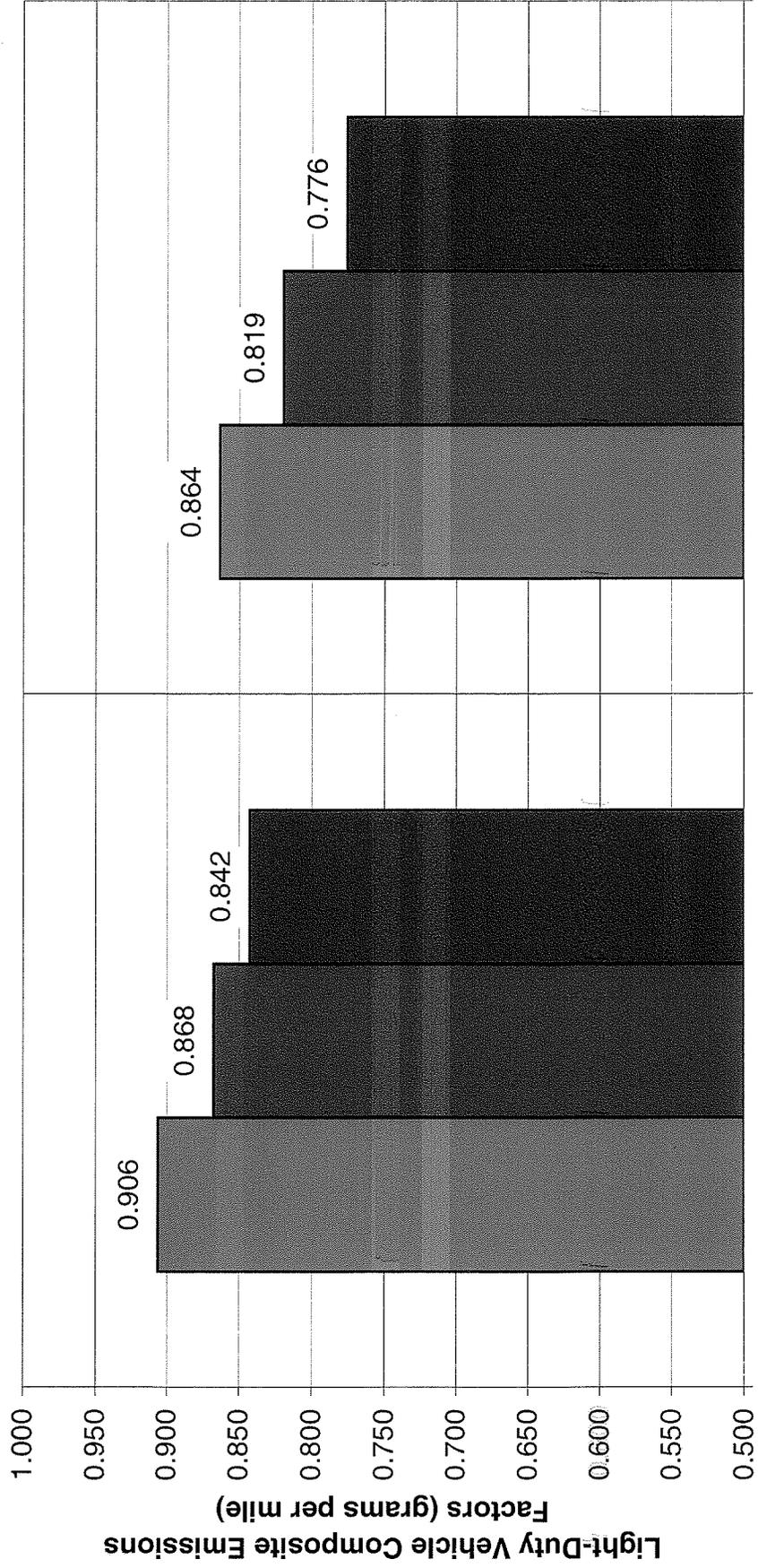
MOBILE 6.2 Comparison of July 2009 Light-Duty Composite Emissions Factors

Run	Month	CY	Poi Name	LDGV	LDGT1	LDGT2	LDGT3	LDGT4	LDG Total	Description
	7	2009	VMT	0.3670	0.0832	0.2768	0.0961	0.0442	0.8673	JULY 2009 VEHICLE MILES TRAVELED BY LDG CATEGORY
1	7	2009	VOC	0.725	0.881	0.918	0.965	1.006	0.842	JULY 2009 LDG EMISSIONS GVP W/ 90% OF CENTRALIZED CREDIT
1	7	2009	Total Tailpipe	0.273	0.366	0.403	0.465	0.506	0.357	JULY 2009 LDG EMISSIONS GVP W/ 90% OF CENTRALIZED CREDIT
1	7	2009	Total Evap	0.452	0.515	0.515	0.500	0.500	0.486	JULY 2009 LDG EMISSIONS GVP W/ 90% OF CENTRALIZED CREDIT
1	7	2009	CO	6.891	8.403	9.206	9.708	9.917	8.241	JULY 2009 LDG EMISSIONS GVP W/ 90% OF CENTRALIZED CREDIT
1	7	2009	NOx	0.599	0.659	0.905	0.956	1.263	0.776	JULY 2009 LDG EMISSIONS GVP W/ 90% OF CENTRALIZED CREDIT
2	7	2009	VOC	0.684	0.953	0.993	1.035	1.081	0.868	JULY 2009 LDG EMISSIONS BASIC I/M PERFORMANCE STANDARD
2	7	2009	Total Tailpipe	0.234	0.433	0.473	0.531	0.577	0.380	JULY 2009 LDG EMISSIONS BASIC I/M PERFORMANCE STANDARD
2	7	2009	Total Evap	0.450	0.520	0.520	0.504	0.504	0.488	JULY 2009 LDG EMISSIONS BASIC I/M PERFORMANCE STANDARD
2	7	2009	CO	6.261	9.663	10.504	10.867	11.051	8.696	JULY 2009 LDG EMISSIONS BASIC I/M PERFORMANCE STANDARD
2	7	2009	NOx	0.565	0.760	1.008	1.050	1.363	0.819	JULY 2009 LDG EMISSIONS BASIC I/M PERFORMANCE STANDARD
3	7	2009	VOC	0.776	0.953	0.993	1.035	1.081	0.906	JULY 2009 LDG EMISSIONS W/O I/M
3	7	2009	Total Tailpipe	0.318	0.433	0.473	0.531	0.577	0.415	JULY 2009 LDG EMISSIONS W/O I/M
3	7	2009	Total Evap	0.458	0.520	0.520	0.504	0.504	0.491	JULY 2009 LDG EMISSIONS W/O I/M
3	7	2009	CO	7.838	9.663	10.504	10.867	11.051	9.363	JULY 2009 LDG EMISSIONS W/O I/M
3	7	2009	NOx	0.669	0.760	1.008	1.050	1.363	0.864	JULY 2009 LDG EMISSIONS W/O I/M

Grams/Mile	No I/M	Basic I/M Performance Standard	Gateway Vehicle Inspection Program	Performance Difference	Exceeds Basic I/M Performance Standard?
2009 VOC	0.906	0.868	0.842	0.025	Yes
2009 CO	9.363	8.696	8.241	0.455	Yes
2009 NOx	0.864	0.819	0.776	0.044	Yes

**MOBILE 6.2 Comparison of July 2009
Light-Duty Vehicle Composite Emissions Factors**

No I/M
 Basic I/M Performance Standard
 Gateway Vehicle Inspection Program



VOC

NOx

Ground-Level Ozone-Forming Pollutant