MOBILE6
Day 5 Examples

MOBILE6
On-Road Motor Vehicle Emissions Model

Training Course

Sierra Research, Inc.
September 2001

Example 28

Quantify the emissions benefits of adding new a new Park and Ride facility on emissions in 2005.

Assume that 1,500 vehicle trips with a 10 mile commute trip (each way) will now be riding on transit buses and that they will be driving 1 mile each way to and from the Park and Ride lot.

Estimate the overall emission reductions for HC, CO and NOx.

Temperature: 72°F to 92°F
RVP: 8.7 psi
Evaluation month: July

Example 28 Solution

1. Determine baseline commute trip emissions; assume all LDGVs.

    1500 round trips * 2 * 10 mi each way = 30,000 mi

    VOC = (30,000 mi * 1.500 g/mi) / 454 g/lb = 99.1 lbs
    CO = (30,000 mi * 13.11 g/mi) / 454 g/lb = 866.3 lbs
    NOx = (30,000 mi * 0.947) / 454 g/lb = 62.6 lbs

2. Determine trip emissions to and from the park and ride lot.

    1500 round trips * 2 * 1 mi each way = 3,000 mi
    a. Assume only local road VMT
    b. Assume that hot soaks are eliminated

    VOC = (3,000 mi * [2.278 - 0.213] g/mi) / 454 g/lb = 13.6 lbs
    CO = (3,000 mi * 10.26 g/mi) / 454 g/lb = 67.8 lbs
    NOx = (3,000 mi * 0.932) / 454 g/lb = 6.2 lbs

3. Determine emissions from the transit buses.

    a. Assume that each bus carries 40 passengers

    Bus trips = 1500 round trips/40 = 38 round trips

    38 round trips * 2 * 9 mi each way = 684 mi

    VOC = (684 mi * 0.541 g/mi) / 454 g/lb = 0.8 lbs
    CO = (684 mi * 4.432 g/mi) / 454 g/lb = 6.7 lbs
    NOx = (684 mi * 17.653 g/mi) / 454 g/lb = 26.6 lbs

4. Summarize park and ride lot trip emissions.

    VOC = 13.6 + 0.8 =14.4 lbs
    CO = 67.8 + 6.7 = 74.5 lbs.
    NOx = 6.2 + 26.6 = 32.8 lbs.

5. Overall daily benefits.

    VOC = 99.1 - 14.4 = 84.7 lbs
    CO = 866.3 - 74.5 = 791.8 lbs
    NOx = 62.6 - 32.8 = 29.8 lbs

Additional Issues to Consider

a. Cold starts (should be nearly 100% cold operation for LDGVs)
b. Diurnal losses (how does not having access to the vehicle during the day impact diurnals)
c. Temperature (should reflect morning and afternoon instead of daily)

Example 28 Input File

```
* Exam_28.in
* Input file to generate emission factors for class
* example 28

******************   Header Section   *****************
MOBILE6 INPUT FILE :

RUN DATA
*  Baseline emission factors
******************   Run Section   ********************
EXPAND BUS EFS     :

******************   Scenario Section   ***************
SCENARIO REC       : Example 28 - CY2005
CALENDAR YEAR      : 2005
MIN/MAX TEMP       : 72. 92.
FUEL RVP           : 8.7
EVALUATION MONTH   : 7

******************   End of this Run   ****************
END OF RUN

* Local road emission factors
******************   Run Section   ********************
EXPAND EXHAUST     :
EXPAND EVAPORATIVE :
VMT BY FACILITY    : LOCALVMT.X28

******************   Scenario Section   ***************
SCENARIO REC       : Example 28 - CY2005
CALENDAR YEAR      : 2005
MIN/MAX TEMP       : 72. 92.
FUEL RVP           : 8.7
EVALUATION MONTH   : 7

******************   End of this Run   ****************
END OF RUN
```

Example 28 Output File

```
************************************************************************
* MOBILE6 Draft (31-Aug-2001)                                          *
* Input file: EXAM_28.IN (file 1, run 1).                              *
************************************************************************

* # # # # # # # # # # # # # # # # # # # # # # # #
* Example 28 - CY2005

* File 1, Run 1, Scenario 1.
* # # # # # # # # # # # # # # # # # # # # # # # #
  M 48 Warning:
              there are no sales for vehicle class HDGV8b

                   Calendar Year:  2005
                           Month:  July
                        Altitude:  Low
              Minimum Temperature:  72.0 (F)
              Maximum Temperature:  92.0 (F)
                Absolute Humidity:   75. grains/lb
                 Nominal Fuel RVP:   8.7 psi
                    Weathered RVP:   8.3 psi
              Fuel Sulfur Content:   92. ppm

              Exhaust I/M Program:  No
                 Evap I/M Program:  No
                      ATP Program:  No
                 Reformulated Gas:  No

       Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT      HDDV        MC   All Veh
              GVWR:                 <6000     >6000     (All)
                        ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
   VMT Distribution:    0.4158    0.3387    0.1165              0.0359    0.0006    0.0019    0.0849    0.0057    1.0000
  ---------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
     Composite VOC :      1.500     1.494     2.315     1.704     2.213    0.578     0.801     0.540      2.46     1.541
     Composite CO  :     13.11     15.13     19.16     16.16     17.68    1.617     1.408     3.046     16.57    13.799
     Composite NOX :      0.947     1.134     1.465     1.219     4.261    1.319     1.371    11.442      1.16     2.083
  ---------------------------------------------------------------------------------------------------------------------------
          Veh. Type:    GasBUS     URBAN    SCHOOL
                        ------    ------    ------
            VMT Mix:    0.0003    0.0009    0.0016
---------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
     Composite VOC :     8.991     0.541     0.733
     Composite CO  :   112.27      4.432     2.650
     Composite NOX :     8.326    17.653    11.882
---------------------------------------------------------------------------------------------------------------------------
************************************************************************
* MOBILE6 Draft (31-Aug-2001)                                          *
* Input file: EXAM_28.IN (file 1, run 2).                              *
************************************************************************

* Reading Hourly Roadway VMT distribution from the following external
* data file: LOCALVMT.X28

  Reading User Supplied ROADWAY VMT Factors

* # # # # # # # # # # # # # # # # # # # # # # # #
* Example 28 - CY2005

* File 1, Run 2, Scenario 1.
* # # # # # # # # # # # # # # # # # # # # # # # #
  M 48 Warning:
              there are no sales for vehicle class HDGV8b

                   Calendar Year:  2005
                           Month:  July
                        Altitude:  Low
              Minimum Temperature:  72.0 (F)
              Maximum Temperature:  92.0 (F)
                Absolute Humidity:   75. grains/lb
                 Nominal Fuel RVP:   8.7 psi
                    Weathered RVP:   8.3 psi
              Fuel Sulfur Content:   92. ppm

              Exhaust I/M Program:  No
                 Evap I/M Program:  No
                      ATP Program:  No
                 Reformulated Gas:  No

       Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT      HDDV        MC   All Veh
              GVWR:                 <6000     >6000     (All)
                        ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
   VMT Distribution:    0.4158    0.3387    0.1165              0.0359    0.0006    0.0019    0.0849    0.0057    1.0000
  ---------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
     Composite VOC :      2.278     2.116     3.219     2.399     3.928    0.863     1.207     1.012      3.30     2.288
     Composite CO  :     10.26     13.21     17.75     14.37     35.23    2.504     2.176     6.257     28.71    12.774
     Composite NOX :      0.932     1.071     1.398     1.154     3.455    1.463     1.522    11.213      0.89     1.998
  ---------------------------------------------------------------------------------------------------------------------------
Exhaust emissions (g/mi):
        VOC   Start:     0.222     0.294     0.489     0.344               0.251     0.336                0.391
      VOC   Running:     0.394     0.518     0.837     0.599               0.612     0.871                2.070
  VOC Total Exhaust:     0.616     0.812     1.326     0.943     1.644     0.863     1.207     1.012      2.46     0.847

           CO Start:      2.90      4.72      6.57      5.19               0.776     0.680                3.404
         CO Running:      7.36      8.49     11.19      9.18               1.728     1.496               25.309
    CO Total Exhaust:     10.26     13.21     17.75     14.37     35.23     2.504     2.176     6.257     28.71    12.774

          NOx Start:     0.150     0.192     0.239     0.204               0.072     0.069                0.367
```

NOx Running:	0.782	0.879	1.159	0.950		1.391	1.453		0.527	
NOx Total Exhaust:	0.932	1.071	1.398	1.154	3.455	1.463	1.522	11.213	0.89	1.998
Non-Exhaust Emissions (g/mi):										
Hot Soak Loss:	0.213	0.169	0.249	0.190	0.269				0.355	
Diurnal Loss:	0.033	0.031	0.050	0.036	0.057				0.115	
Resting Loss:	0.114	0.106	0.180	0.125	0.203				0.367	
Running Loss:	1.207	0.833	1.176	0.921	1.350					
Crankcase Loss:	0.008	0.010	0.010	0.010	0.010				0.000	
Refueling Loss:	0.086	0.155	0.229	0.174	0.395					
Total Non-Exhaust:	1.662	1.305	1.893	1.458	2.284	0.000	0.000	0.000	0.837	1.440

Example 29

Quantify the emissions benefits of shifting all commute trips using SUVs to LDGVs in 2005. Assume that all SUVs are LDGT2s and LDGT3s.

Assume that commute trips represent 30 percent of all VMT within the region and for the sake of simplicity that they are distributed in proportion to the default VMT by Hour distribution.

Estimate the overall change in fleet average HC, CO and NOx emissions.

Temperature: 72°F to 92°F
RVP: 8.7 psi
Evaluation month: July

Example 29 Input File

```
* Exam_29.in
* Input file to generate emission factors for class
* example 29

******************   Header Section   *****************
MOBILE6 INPUT FILE :

DATABASE OUTPUT    :
AGGREGATED OUTPUT  :
WITH FIELDNAMES    :

RUN DATA
******************   Run Section   ********************

******************   Scenario Section   ***************
SCENARIO REC       : Example 29 - CY2005
CALENDAR YEAR      : 2005
MIN/MAX TEMP       : 72. 92.
FUEL RVP           : 8.7
EVALUATION MONTH   : 7

******************   End of this Run   ****************
END OF RUN
```

Example 29 Output File (Partial)

FILE	RUN	SCEN	CAL_YE	POL	VTYPE	GM_MILE	GM_DAY	STARTS	ENDS	MILES	MPG	VMT
1	1	1	2005	1	1	1.4995	43.741	0.0698	0.0516	29.1701	22.66	0.415838
1	1	1	2005	1	2	1.4614	50.992	0.2731	0.195	34.8925	16.89	0.078249
1	1	1	2005	1	3	1.5041	52.48	0.2731	0.195	34.8925	16.89	0.26049
1	1	1	2005	1	4	2.2997	78.091	0.5963	0.4257	33.9569	16.66	0.079782
1	1	1	2005	1	5	2.3481	79.734	0.5963	0.4257	33.9569	16.66	0.03669
1	1	1	2005	1	6	1.9281	69.608	0.4286	0.306	36.1025	10.48	0.029721
1	1	1	2005	1	7	2.5864	88.708	1.0242	0.7313	34.298	10.45	0.001052
1	1	1	2005	1	8	5.7055	113.44	1.6909	1.2073	19.8824	10.35	0.000422
1	1	1	2005	1	9	3.2366	88.282	0.8281	0.5913	27.2758	10.45	0.001091
1	1	1	2005	1	10	3.0308	85.452	0.7089	0.5062	28.1946	10.46	0.002314
1	1	1	2005	1	11	3.5263	94.822	0.7943	0.5671	26.8901	10.45	0.000987
1	1	1	2005	1	12	4.182	102.129	0.7625	0.5444	24.4213	10.43	0.000003
1	1	1	2005	1	13	0	0	0	0	0	0	0
1	1	1	2005	1	14	0.5778	11.412	2.6805	1.9139	19.751	0	0.000557
1	1	1	2005	1	15	2.5923	17.118	5.976	4.2669	6.6033	0	0.000192
1	1	1	2005	1	16	0.228	9.608	0.0218	0.0156	42.1399	0	0.009222
1	1	1	2005	1	17	0.2493	11.333	0.0039	0.0028	45.4542	0	0.002798
1	1	1	2005	1	18	0.3064	17.382	0.0318	0.0227	56.7227	0	0.002672
1	1	1	2005	1	19	0.3187	18.804	0.0093	0.0066	58.9966	0	0.001226
1	1	1	2005	1	20	0.4584	26.842	0.4119	0.2941	58.558	0	0.006316
1	1	1	2005	1	21	0.5704	32.204	0.4766	0.3403	56.4564	0	0.00923
1	1	1	2005	1	22	0.549	59.48	0.5297	0.3782	108.3384	0	0.011129
1	1	1	2005	1	23	0.6511	108.876	0.53	0.3784	167.2209	0	0.039698
1	1	1	2005	1	24	2.4638	24.888	0	0	10.1013	0	0.005745
1	1	1	2005	1	25	8.9911	244.829	2.3162	1.6538	27.2301	10.09	0.000336
1	1	1	2005	1	26	0.5414	52.497	0.0765	0.0546	96.9596	0	0.000941
1	1	1	2005	1	27	0.7333	19.968	0.1653	0.118	27.2301	0	0.001632
1	1	1	2005	1	28	0.5938	24.311	0.0654	0.0467	40.9421	0	0.001666
1	1	1	2005	2	1	13.1068	382.327	0.0698	0.0516	29.1701	22.66	0.415838
1	1	1	2005	2	2	14.704	513.057	0.2731	0.195	34.8925	16.89	0.078249
1	1	1	2005	2	3	15.2541	532.253	0.2731	0.195	34.8925	16.89	0.26049
1	1	1	2005	2	4	19.0906	648.258	0.5963	0.4257	33.9569	16.66	0.079782
1	1	1	2005	2	5	19.3204	656.06	0.5963	0.4257	33.9569	16.66	0.03669
1	1	1	2005	2	6	14.4141	520.386	0.4286	0.306	36.1025	10.48	0.029721
1	1	1	2005	2	7	28.0269	961.265	1.0242	0.7313	34.298	10.45	0.001052
1	1	1	2005	2	8	51.0799	1015.594	1.6909	1.2073	19.8824	10.35	0.000422
1	1	1	2005	2	9	26.4636	721.815	0.8281	0.5913	27.2758	10.45	0.001091
1	1	1	2005	2	10	24.6585	695.238	0.7089	0.5062	28.1946	10.46	0.002314
1	1	1	2005	2	11	32.4931	873.741	0.7943	0.5671	26.8901	10.45	0.000987
1	1	1	2005	2	12	37.0491	904.787	0.7625	0.5444	24.4213	10.43	0.000003
1	1	1	2005	2	13	0	0	0	0	0	0	0
1	1	1	2005	2	14	1.6172	31.941	2.6805	1.9139	19.751	0	0.000557
1	1	1	2005	2	15	4.5357	29.951	5.976	4.2669	6.6033	0	0.000192
1	1	1	2005	2	16	1.0475	44.141	0.0218	0.0156	42.1399	0	0.009222

Example 29 Results

		BASELINE EMISSION FACTORS			ASSIGN LDGV EMISSIONS TO SUVS			
VTYPE	BASE VMT	GM_MILE VOC	GM_MILE CO	GM_MILE NOX	GM_MILE VOC	GM_MILE CO	GM_MILE NOX	
1	0.416	1.500	13.107	0.947	1.500	13.107	0.947	
2	0.078	1.461	14.704	0.923	1.461	14.704	0.923	
3	0.260	1.504	15.254	1.198	1.500	13.107	0.947	
4	0.080	2.300	19.091	1.357	1.500	13.107	0.947	
5	0.037	2.348	19.320	1.699	2.348	19.320	1.699	
6	0.030	1.928	14.414	4.018	1.928	14.414	4.018	
7	0.001	2.586	28.027	4.572	2.586	28.027	4.572	
8	0.000	5.706	51.080	5.796	5.706	51.080	5.796	
9	0.001	3.237	26.464	5.266	3.237	26.464	5.266	
10	0.002	3.031	24.659	5.173	3.031	24.659	5.173	
11	0.001	3.526	32.493	5.950	3.526	32.493	5.950	
12	0.000	4.182	37.049	6.657	4.182	37.049	6.657	
13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
14	0.001	0.578	1.617	1.319	0.578	1.617	1.319	
15	0.000	2.592	4.536	2.726	2.592	4.536	2.726	
16	0.009	0.228	1.048	3.921	0.228	1.048	3.921	
17	0.003	0.249	1.203	4.357	0.249	1.203	4.357	
18	0.003	0.306	1.388	5.328	0.306	1.388	5.328	
19	0.001	0.319	1.428	5.596	0.319	1.428	5.596	
20	0.006	0.458	1.759	7.837	0.458	1.759	7.837	
21	0.009	0.570	2.213	9.749	0.570	2.213	9.749	
22	0.011	0.549	3.210	12.582	0.549	3.210	12.582	
23	0.040	0.651	4.137	14.764	0.651	4.137	14.764	
24	0.006	2.464	16.568	1.160	2.464	16.568	1.160	
25	0.000	8.991	112.275	8.326	8.991	112.275	8.326	
26	0.001	0.541	4.433	17.653	0.541	4.433	17.653	
27	0.002	0.733	2.650	11.882	0.733	2.650	11.882	
28	0.002	0.594	1.047	1.215	0.594	1.047	1.215	
	Fleet-Ave	1.541	13.799	2.083	1.476	12.762	1.985	100% SUV VMT ASSIGNED TO LDGT2/3
	EMISSION FACTORS:				1.521	13.488	2.053	30% SUV VMT ASSIGNED TO LDGT2/3
	PERCENT REDUCTION:				1.3%	2.3%	1.4%	