

**Amendment to EMFAC Modeling Change Technical Memo  
 “Revision of Heavy Heavy-Duty Diesel Truck Emission Factors  
 and Speed Correction Factors”**

**SUBJECT: MODIFICATION OF HEAVY HEAVY-DUTY DIESEL TRUCK SPEED CORRECTION FACTORS**

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**SUMMARY**

This memo describes modifications to the speed correction factors (SCFs) for heavy heavy-duty diesel trucks (HHDDT) developed in the EMFAC Modeling Change Technical Memo entitled “Revision of Heavy Heavy-Duty Diesel Truck Emission Factors and Speed Correction Factors” (hereinafter EMFAC HHDDT Tech Memo). Specifically, the existing Pre-1991&2003+ model year group was split into a Pre-1991 group and a 2003+ group and separate SCFs were calculated for each of these two groups.

The impact of the the proposed change on the statewide emissions inventory and the inventories of several air basins for Calendar Years 2002 and 2015 are given in Tables 1a and 1b. As shown in the tables, splitting into the Pre-1991&2003+ model year group into two groups results in an increase in NOx inventory for Calendar Year 2002 but a decrease for 2015. However, the effect on the PM inventory is opposite of that for NOx.

**Table 1a. Summary of Emission Changes due to Modification to Speed Correction Factors (Calendar Year 2002)\***

Area	Emission Changes by Pollutant (tons per day)				
	ROG	CO	NOx	PM	CO <sub>2</sub>
Statewide	0.55	-14.25	5.95	-3.75	0
South Coast	0.18	-4.57	1.60	-1.39	0
San Joaquin Valley	0.12	-3.03	1.43	-0.62	0
Sacramento Valley	0.04	-0.96	0.46	-0.19	0
San Francisco Bay Area	0.03	-0.79	0.38	-0.16	0
San Diego	0.02	-0.51	0.23	-0.10	0

\* See Tables 4-9 for details of emission changes.

**Table 1b. Summary of Emission Changes due to Modification to Speed Correction Factors (Calendar Year 2015)\***

Area	Emission Changes by Pollutant (tons per day)				
	ROG	CO	NOx	PM	CO <sub>2</sub>
Statewide	-0.40	18.45	-13.29	2.12	0
South Coast	-0.19	4.53	-3.12	0.57	0
San Joaquin Valley	-0.04	5.16	-3.62	0.52	0
Sacramento Valley	-0.01	1.60	-1.12	0.16	0
San Francisco Bay Area	-0.01	1.32	-0.93	0.14	0
San Diego	-0.01	0.92	-0.81	0.13	0

\* See Tables 4-9 for details of emission changes.

**REASON FOR CHANGE**

After the release of the EMFAC HHDDT Tech Memo, it was suggested that the SCFs for the Pre-1991/2003+ model year group should be separated into a Pre-1991 group and a 2003-2006 group because of the difference in emission standards and hence the likely difference in engine design and emission control technologies. In analyzing Pre-1991 and 2003+ model years as one group previously, staff was attempting to address the concern that the dataset used for SCF development contains only four 2003+ model year trucks. However, a reexamination of the data reveals that the emission characteristics of the four trucks generally are similar, thereby lessening staff’s initial concern. Additionally, splitting the Pre-1991/2003+ group into two offers the benefit of more accurately modeling the emissions of both the Pre-1991 and 2003+ model year trucks. As a result, staff decided to develop separate SCFs for the Pre-1991 group and 2003+ group.

It was also suggested that two more groups, a 2007-2009 group and a 2010+ group, should be created to reflect future engine designs and emission control technologies in response to changing emission standards in 2007 and 2010. Although this leads to a total of five SCF groups, for EMFAC2007 the SCFs for the 2007-2009 and 2010+ groups are to be the same as those for the 2003-2006 group until data become available to allow staff to calculate the SCFs specific to these two groups.

**METHODOLOGY**

The method for calculating the three sets of SCFs are similar to that described in the EMFAC HHDDT Tech Memo. No change was made to the SCFs for the 1991-2002 model year group. The test data from the Pre-1991 and 2003+ model year trucks were reanalyzed as two separate groups: Pre-1991 group and 2003-2006 group.

The SCF for a given pollutant and speed can be calculated using the following equation:

$$SCF = A + Bx(\text{Speed}) + Cx(\text{Speed})^2 \quad (1)$$

where *A*, *B*, and *C* are coefficients. Table 2 lists the coefficients of the best fit equations for calculating the SCFs of all five pollutants. A series of graphs comparing the proposed SCFs and the SCFs used in EMFAC2002 are provided in Appendix A.

**Table 2. Coefficients for Proposed HHDDT Speed Correction Factors\***

	Model Year Group	Speed (mph)	A	B	C
HC	Pre-1991	5-18.8	7.1195	-0.4789	$8.159 \times 10^{-3}$
		18.8-65	1.6373	$-4.189 \times 10^{-2}$	$3.884 \times 10^{-4}$
	1991-2002	5-18.8	11.614	-0.9929	$2.278 \times 10^{-2}$
		18.8-65	2.3019	$-8.712 \times 10^{-2}$	$9.773 \times 10^{-4}$
	2003+	5-18.8	10.219	-0.8937	$2.146 \times 10^{-2}$
		18.8-65	1.6053	$-3.799 \times 10^{-2}$	$2.985 \times 10^{-4}$
CO	Pre-1991	5-65	1.6531	$-4.198 \times 10^{-2}$	$3.352 \times 10^{-4}$
	1991-2002	5-18.8	3.0388	-0.1511	$2.267 \times 10^{-3}$
		18.8-65	1.8753	$-5.664 \times 10^{-2}$	$5.141 \times 10^{-4}$
	2003+	5-18.8	6.2796	-0.5021	$1.177 \times 10^{-2}$
		18.8-65	1.3272	$-2.463 \times 10^{-2}$	$3.360 \times 10^{-4}$
NOx	Pre-1991	5-18.8	2.2973	-0.1173	$2.571 \times 10^{-3}$
		18.8-65	1.3969	$-2.658 \times 10^{-2}$	$2.725 \times 10^{-4}$
	1991-2002	5-18.8	3.7668	-0.2862	$7.394 \times 10^{-3}$
		18.8-65	1.0771	$-5.981 \times 10^{-3}$	$9.271 \times 10^{-5}$
	2003+	5-18.8	2.7362	-0.1480	$2.958 \times 10^{-2}$
		18.8-65	1.5116	$-3.357 \times 10^{-2}$	$3.118 \times 10^{-4}$
PM	Pre-1991	5-18.8	2.6039	-0.1266	$2.198 \times 10^{-3}$
		18.8-65	1.4902	$-3.121 \times 10^{-2}$	$2.733 \times 10^{-4}$
	1991-2002	5-18.8	5.7807	-0.4032	$7.918 \times 10^{-3}$
		18.8-65	2.2766	$-8.661 \times 10^{-2}$	$9.948 \times 10^{-4}$
	2003+	5-18.8	1.4086	$-2.313 \times 10^{-2}$	$7.449 \times 10^{-5}$
		18.8-65	1.4881	$-4.080 \times 10^{-2}$	$7.894 \times 10^{-4}$
CO <sub>2</sub>	All Model Years	5-18.8	2.0722	$-7.559 \times 10^{-2}$	$9.873 \times 10^{-4}$
		18.8-65	1.3256	$-2.142 \times 10^{-2}$	$1.969 \times 10^{-4}$

\* Based on analysis of the emission test data of the CRC E-55/59 project.

Note that with the exception of CO in the Pre-1991&2003+ group, it was found that for all model year groups the data were better fit when different equations were used for the two specified speed domains.

The proposed SCFs, which were developed based on test data from California trucks, are assumed to apply to corresponding federal HHDDTs.

**AFFECTED SOURCE CODE**

The source code file **SCF\_Data.for** of the EMFAC model is affected by the proposed revision of SCFs.

**Methodology for Source Code Revision**

Five sets of speed correction factors will be established for California and federally certified trucks: Pre-1991, 2003-06, 2007-09, and 2010+ model years. The parameters of the SCF equation are given in Table 2, and the affected technology groups in SCF\_Data.for are modified listed in Table 3.

**Table 3. Speed Correction Factor Technology Groups**

Model Year Group	Technology Group
Pre-1991	150-155, 200-204
1991-2002	156-159, 205-208
2003-2006	160, 209
2007-2009	161, 210
2010+	162-163, 211

**IMPACT ON EMISSIONS INVENTORY**

The impacts on the statewide emissions inventory and inventories of several air basins are shown in Tables 4-9. In general, the changes to the SCFs result in increases in NOx emissions inventories for years before 2005 and decreases for years after 2005. However, the changes lead to decreases in PM emissions inventories in 2005 and earlier years but increases for 2010 and later years.

**Table 4. Impact on Statewide Emissions Inventory**

<b>Statewide Summer Episodic On-Road Motor Vehicle Inventories</b>							
(Calculated Using EMFAC2007 draft ver 2.224)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	14820281	446763070	3479.84	31176.98	2389.85	303160.40	67.55
1990	22523632	708317890	2511.55	24733.60	2592.32	443226.20	107.14
2000	26785744	809525950	1427.33	12866.84	1973.40	494218.60	75.23
2002	28178674	864034110	1183.47	10506.13	1821.02	532159.10	72.11
2005	30423048	935561280	1018.42	8418.17	1732.99	586735.90	74.93
2010	32329124	970317630	742.90	5788.77	1283.88	602671.60	64.20
2015	34878012	1046666300	564.22	4020.69	911.39	658138.80	60.10
2020	37058640	1113107600	446.69	2871.21	647.78	707186.20	58.10
<b>Statewide Summer Episodic On-Road Motor Vehicle Inventories With Changes to HHDV SCFs</b>							
(Calculated Using EMFAC2007 draft ver 2.225)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	14820281	446763070	3480.70	31160.43	2402.16	303160.40	62.80
1990	22523632	708317890	2512.96	24706.47	2612.23	443226.20	99.27
2000	26785744	809525950	1428.08	12847.74	1981.89	494218.60	70.39
2002	28178674	864034110	1184.02	10491.88	1826.97	532159.10	68.36
2005	30423048	935561280	1018.77	8410.54	1732.19	586735.90	73.16
2010	32329124	970317630	742.80	5796.25	1273.24	602671.60	65.23
2015	34878012	1046666300	563.83	4039.14	898.10	658138.80	62.22
2020	37058640	1113107600	446.20	2893.54	635.08	707186.20	60.24
<b>Difference (Ver. 2.225 - Ver. 2.224) in Statewide Emission Inventories (tons per day)</b>							
Cal. Year	Population	VMT(miles)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	0	0	0.86	-16.55	12.32	0.00	-4.75
1990	0	0	1.41	-27.13	19.91	0.00	-7.88
2000	0	0	0.75	-19.10	8.48	0.00	-4.84
2002	0	0	0.55	-14.25	5.95	0.00	-3.75
2005	0	0	0.34	-7.63	-0.79	0.00	-1.77
2010	0	0	-0.10	7.48	-10.64	0.00	1.03
2015	0	0	-0.40	18.45	-13.29	0.00	2.12
2020	0	0	-0.49	22.34	-12.69	0.00	2.14
<b>Percentage Change in Statewide Emission Inventories (relative to Ver. 2.224)</b>							
Cal. Year	Population	VMT	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	0.00%	0.00%	0.02%	-0.05%	0.52%	0.00%	-7.03%
1990	0.00%	0.00%	0.06%	-0.11%	0.77%	0.00%	-7.35%
2000	0.00%	0.00%	0.05%	-0.15%	0.43%	0.00%	-6.43%
2002	0.00%	0.00%	0.05%	-0.14%	0.33%	0.00%	-5.20%
2005	0.00%	0.00%	0.03%	-0.09%	-0.05%	0.00%	-2.36%
2010	0.00%	0.00%	-0.01%	0.13%	-0.83%	0.00%	1.61%
2015	0.00%	0.00%	-0.07%	0.46%	-1.46%	0.00%	3.53%
2020	0.00%	0.00%	-0.11%	0.78%	-1.96%	0.00%	3.68%

1. ROG\_Tot - This includes running, start, idle exhaust emissions and evaporative emissions.

2. PM\_Tot - Total emissions from running, start, idle processes, and tire wear and brake wear.

**Table 5. Impact on South Coast Air Basin Emissions Inventory**

<b>South Coast Summer Episodic On-Road Motor Vehicle Inventories</b>							
(Calculated Using EMFAC2007 draft ver 2.224)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	6132014	183651630	1323.80	11440.09	880.57	122893.30	21.48
1990	9485569	289884830	997.10	9617.42	949.64	176882.10	32.10
2000	11074646	327246430	552.77	4951.33	679.79	193280.70	24.28
2002	11605898	349016580	453.85	4058.11	621.05	210944.40	24.52
2005	12664966	384365980	385.35	3250.91	573.62	234773.10	25.99
2010	12632730	374008290	255.62	2050.08	404.82	225471.30	22.51
2015	13426979	393295620	193.50	1426.59	294.89	240786.00	21.86
2020	13980593	406764290	152.34	1019.02	207.37	251059.00	21.02
<b>South Coast Summer Episodic On-Road Motor Vehicle Inventories With Changes to HHDV SCFs</b>							
(Calculated Using EMFAC2007 draft ver 2.225)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	6132014	183651630	1324.03	11435.59	883.69	122893.30	20.22
1990	9485569	289884830	997.46	9610.44	954.41	176882.10	30.19
2000	11074646	327246430	553.00	4945.47	681.99	193280.70	22.59
2002	11605898	349016580	454.03	4053.55	622.65	210944.40	23.12
2005	12664966	384365980	385.45	3248.26	573.65	234773.10	25.24
2010	12632730	374008290	255.56	2051.45	402.59	225471.30	22.67
2015	13426979	393295620	193.31	1431.13	291.77	240786.00	22.43
2020	13980593	406764290	152.11	1024.55	204.42	251059.00	21.60
<b>Difference (Ver. 2.225 - Ver. 2.224) in South Coast Emission Inventories (tons per day)</b>							
Cal. Year	Population	VMT(miles)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	0	0	0.23	-4.50	3.13	0.00	-1.26
1990	0	0	0.36	-6.98	4.77	0.00	-1.91
2000	0	0	0.23	-5.86	2.20	0.00	-1.68
2002	0	0	0.18	-4.57	1.60	0.00	-1.39
2005	0	0	0.10	-2.65	0.02	0.00	-0.75
2010	0	0	-0.06	1.37	-2.24	0.00	0.16
2015	0	0	-0.19	4.53	-3.12	0.00	0.57
2020	0	0	-0.24	5.53	-2.96	0.00	0.59
<b>Percentage Change in South Coast Emission Inventories (relative to Ver. 2.224)</b>							
Cal. Year	Population	VMT	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	0.00%	0.00%	0.02%	-0.04%	0.35%	0.00%	-5.87%
1990	0.00%	0.00%	0.04%	-0.07%	0.50%	0.00%	-5.95%
2000	0.00%	0.00%	0.04%	-0.12%	0.32%	0.00%	-6.93%
2002	0.00%	0.00%	0.04%	-0.11%	0.26%	0.00%	-5.69%
2005	0.00%	0.00%	0.03%	-0.08%	0.00%	0.00%	-2.89%
2010	0.00%	0.00%	-0.03%	0.07%	-0.55%	0.00%	0.70%
2015	0.00%	0.00%	-0.10%	0.32%	-1.06%	0.00%	2.62%
2020	0.00%	0.00%	-0.15%	0.54%	-1.43%	0.00%	2.80%

1. ROG\_Tot - This includes running, start, idle exhaust emissions and evaporative emissions.  
 2. PM\_Tot - Total emissions from running, start, idle processes, and tire wear and brake wear.

**Table 6. Impact on San Joaquin Valley Air Basin Emissions Inventory**

<b>San Joaquin Summer Episodic On-Road Motor Vehicle Inventories</b>							
(Calculated Using EMFAC2007 draft ver 2.224)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	1024248	33835264	266.73	2585.39	242.66	26827.77	13.04
1990	1680357	55922216	230.65	2267.18	316.26	42138.86	21.72
2000	2331738	72940840	157.32	1382.03	308.46	52774.10	13.95
2002	2488685	79023384	132.02	1118.12	296.37	56348.71	12.37
2005	2817390	89610120	121.87	929.28	308.38	65258.95	12.66
2010	3298758	103020200	97.81	691.22	238.06	73344.68	9.85
2015	3633203	115810910	73.57	472.63	162.93	83721.09	8.22
2020	4008386	129425270	57.85	336.45	116.67	94348.48	7.58
<b>San Joaquin Summer Episodic On-Road Motor Vehicle Inventories With Changes to HHDV SCFs</b>							
(Calculated Using EMFAC2007 draft ver 2.225)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	1024248	33835264	266.95	2581.05	245.94	26827.77	11.78
1990	1680357	55922216	231.01	2260.14	321.51	42138.86	19.62
2000	2331738	72940840	157.49	1377.73	310.58	52774.10	13.07
2002	2488685	79023384	132.14	1115.09	297.80	56348.71	11.75
2005	2817390	89610120	121.95	927.83	307.99	65258.95	12.44
2010	3298758	103020200	97.81	693.63	234.94	73344.68	10.19
2015	3633203	115810910	73.53	477.78	159.32	83721.09	8.74
2020	4008386	129425270	57.79	342.63	113.23	94348.48	8.09
<b>Difference (Ver. 2.225 - Ver. 2.224) in San Joaquin Emission Inventories (tons per day)</b>							
Cal. Year	Population	VMT(miles)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	0	0	0.22	-4.34	3.29	0.00	-1.26
1990	0	0	0.37	-7.04	5.25	0.00	-2.10
2000	0	0	0.17	-4.30	2.12	0.00	-0.89
2002	0	0	0.12	-3.03	1.43	0.00	-0.62
2005	0	0	0.08	-1.45	-0.38	0.00	-0.21
2010	0	0	0.00	2.42	-3.12	0.00	0.34
2015	0	0	-0.04	5.16	-3.62	0.00	0.52
2020	0	0	-0.06	6.19	-3.44	0.00	0.51
<b>Percentage Change in San Joaquin Emission Inventories (relative to Ver. 2.224)</b>							
Cal. Year	Population	VMT	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	0.00%	0.00%	0.08%	-0.17%	1.35%	0.00%	-9.66%
1990	0.00%	0.00%	0.16%	-0.31%	1.66%	0.00%	-9.67%
2000	0.00%	0.00%	0.11%	-0.31%	0.69%	0.00%	-6.36%
2002	0.00%	0.00%	0.09%	-0.27%	0.48%	0.00%	-4.99%
2005	0.00%	0.00%	0.07%	-0.16%	-0.12%	0.00%	-1.68%
2010	0.00%	0.00%	0.00%	0.35%	-1.31%	0.00%	3.44%
2015	0.00%	0.00%	-0.06%	1.09%	-2.22%	0.00%	6.37%
2020	0.00%	0.00%	-0.10%	1.84%	-2.95%	0.00%	6.75%

1. ROG\_Tot - This includes running, start, idle exhaust emissions and evaporative emissions.

2. PM\_Tot - Total emissions from running, start, idle processes, and tire wear and brake wear.

**Table 7. Impact on Sacramento Valley Air Basin Emissions Inventory**

<b>Sacramento Summer Episodic On-Road Motor Vehicle Inventories</b>							
(Calculated Using EMFAC2007 draft ver 2.224)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	1189825	32719290	286.79	2550.36	184.40	22180.73	5.44
1990	1761186	51269384	202.59	1929.45	202.18	32536.57	9.21
2000	2069101	56313896	119.54	1007.34	157.36	35188.09	5.94
2002	2254310	62287916	103.68	841.41	147.72	38597.25	5.55
2005	2458620	68064928	92.94	683.18	144.55	43199.04	5.77
2010	2687600	72315480	72.21	481.85	106.39	45328.09	4.81
2015	2937262	80229872	55.04	327.41	72.73	50407.80	4.38
2020	3183412	87974056	43.00	227.67	51.01	55577.20	4.25
<b>Sacramento Summer Episodic On-Road Motor Vehicle Inventories With Changes to HHDV SCFs</b>							
(Calculated Using EMFAC2007 draft ver 2.225)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	1189825	32719290	286.86	2548.95	185.46	22180.73	5.03
1990	1761186	51269384	202.72	1926.98	204.02	32536.57	8.47
2000	2069101	56313896	119.60	1005.96	158.04	35188.09	5.66
2002	2254310	62287916	103.71	840.45	148.17	38597.25	5.35
2005	2458620	68064928	92.97	682.72	144.43	43199.04	5.71
2010	2687600	72315480	72.22	482.59	105.44	45328.09	4.91
2015	2937262	80229872	55.02	329.01	71.61	50407.80	4.54
2020	3183412	87974056	42.98	229.60	49.95	55577.20	4.41
<b>Difference (Ver. 2.225 - Ver. 2.224) in Sacramento Emission Inventories (tons per day)</b>							
Cal. Year	Population	VMT(miles)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	0	0	0.07	-1.41	1.07	0.00	-0.41
1990	0	0	0.13	-2.47	1.84	0.00	-0.74
2000	0	0	0.05	-1.37	0.68	0.00	-0.28
2002	0	0	0.04	-0.96	0.46	0.00	-0.19
2005	0	0	0.03	-0.46	-0.12	0.00	-0.07
2010	0	0	0.00	0.74	-0.95	0.00	0.11
2015	0	0	-0.01	1.60	-1.12	0.00	0.16
2020	0	0	-0.02	1.93	-1.06	0.00	0.16
<b>Percentage Change in Sacramento Emission Inventories (relative to Ver. 2.224)</b>							
Cal. Year	Population	VMT	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	0.00%	0.00%	0.03%	-0.06%	0.58%	0.00%	-7.51%
1990	0.00%	0.00%	0.06%	-0.13%	0.91%	0.00%	-8.01%
2000	0.00%	0.00%	0.04%	-0.14%	0.43%	0.00%	-4.73%
2002	0.00%	0.00%	0.04%	-0.11%	0.31%	0.00%	-3.50%
2005	0.00%	0.00%	0.03%	-0.07%	-0.08%	0.00%	-1.14%
2010	0.00%	0.00%	0.00%	0.15%	-0.89%	0.00%	2.20%
2015	0.00%	0.00%	-0.02%	0.49%	-1.53%	0.00%	3.77%
2020	0.00%	0.00%	-0.04%	0.85%	-2.08%	0.00%	3.78%

1. ROG\_Tot - This includes running, start, idle exhaust emissions and evaporative emissions.

2. PM\_Tot - Total emissions from running, start, idle processes, and tire wear and brake wear.



**Table 8. Impact on San Francisco Bay Area Air Basin Emissions Inventory**

<b>San Francisco Summer Episodic On-Road Motor Vehicle Inventories</b>							
(Calculated Using EMFAC2007 draft ver 2.224)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	3577716	104632620	854.94	7805.35	552.17	66213.66	9.83
1990	4628040	140976000	489.55	4909.77	468.50	81414.85	13.36
2000	5519135	164072610	276.10	2527.72	321.02	97120.80	10.25
2002	5644102	169352020	233.04	2133.07	295.74	100987.20	9.93
2005	5761704	171450350	186.43	1566.45	248.01	104052.90	10.14
2010	6354504	185684960	138.70	1101.29	184.70	112854.10	10.07
2015	6831801	199520180	102.80	750.83	127.06	121385.40	10.01
2020	7185647	209588190	78.87	523.29	89.75	129496.40	10.21
<b>San Francisco Summer Episodic On-Road Motor Vehicle Inventories With Changes to HHDV SCFs</b>							
(Calculated Using EMFAC2007 draft ver 2.225)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	3577716	104632620	855.02	7803.79	553.37	66213.66	9.38
1990	4628040	140976000	489.67	4907.42	470.26	81414.85	12.66
2000	5519135	164072610	276.14	2526.60	321.58	97120.80	10.02
2002	5644102	169352020	233.07	2132.28	296.11	100987.20	9.77
2005	5761704	171450350	186.45	1566.08	247.91	104052.90	10.09
2010	6354504	185684960	138.70	1101.92	183.88	112854.10	10.16
2015	6831801	199520180	102.79	752.16	126.13	121385.40	10.15
2020	7185647	209588190	78.85	524.84	88.88	129496.40	10.34
<b>Difference (Ver. 2.225 - Ver. 2.224) in San Francisco Emission Inventories (tons per day)</b>							
Cal. Year	Population	VMT(miles)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	0	0	0.08	-1.56	1.20	0.00	-0.45
1990	0	0	0.12	-2.34	1.76	0.00	-0.70
2000	0	0	0.04	-1.12	0.56	0.00	-0.23
2002	0	0	0.03	-0.79	0.38	0.00	-0.16
2005	0	0	0.02	-0.38	-0.10	0.00	-0.05
2010	0	0	0.00	0.63	-0.82	0.00	0.09
2015	0	0	-0.01	1.32	-0.93	0.00	0.14
2020	0	0	-0.01	1.55	-0.87	0.00	0.13
<b>Percentage Change in San Francisco Emission Inventories (relative to Ver. 2.224)</b>							
Cal. Year	Population	VMT	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	0.00%	0.00%	0.01%	-0.02%	0.22%	0.00%	-4.61%
1990	0.00%	0.00%	0.02%	-0.05%	0.38%	0.00%	-5.22%
2000	0.00%	0.00%	0.02%	-0.04%	0.17%	0.00%	-2.24%
2002	0.00%	0.00%	0.01%	-0.04%	0.13%	0.00%	-1.61%
2005	0.00%	0.00%	0.01%	-0.02%	-0.04%	0.00%	-0.54%
2010	0.00%	0.00%	0.00%	0.06%	-0.44%	0.00%	0.90%
2015	0.00%	0.00%	-0.01%	0.18%	-0.73%	0.00%	1.36%
2020	0.00%	0.00%	-0.02%	0.30%	-0.97%	0.00%	1.27%

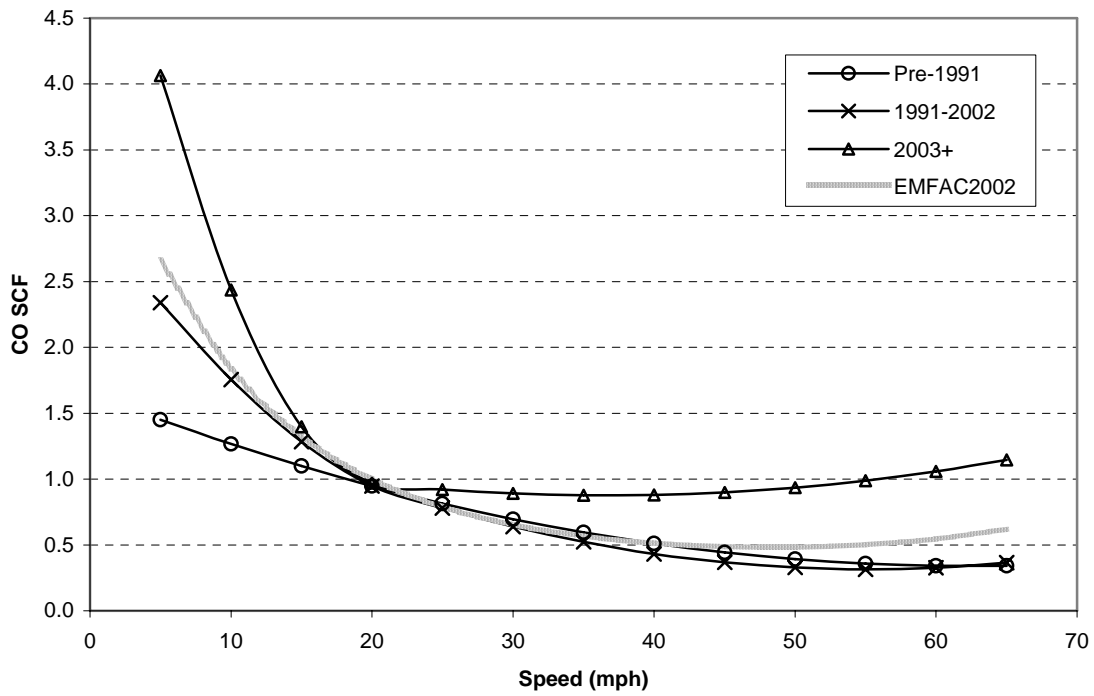
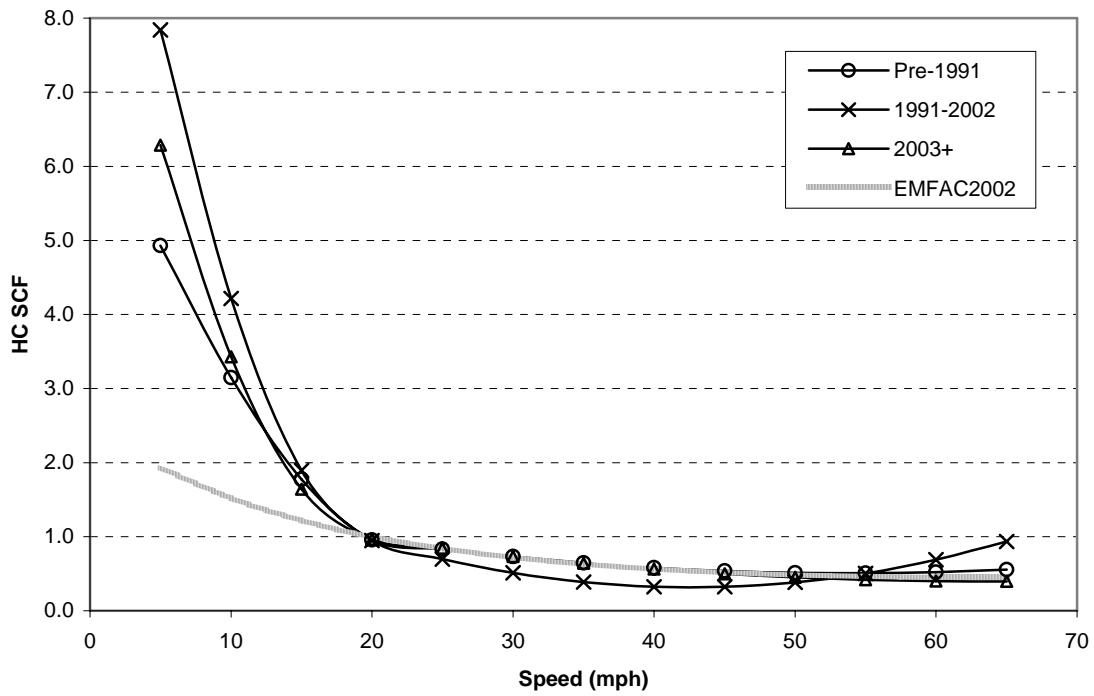
1. ROG\_Tot - This includes running, start, idle exhaust emissions and evaporative emissions.  
 2. PM\_Tot - Total emissions from running, start, idle processes, and tire wear and brake wear.

**Table 9. Impact on San Diego Air Basin Emissions Inventory**

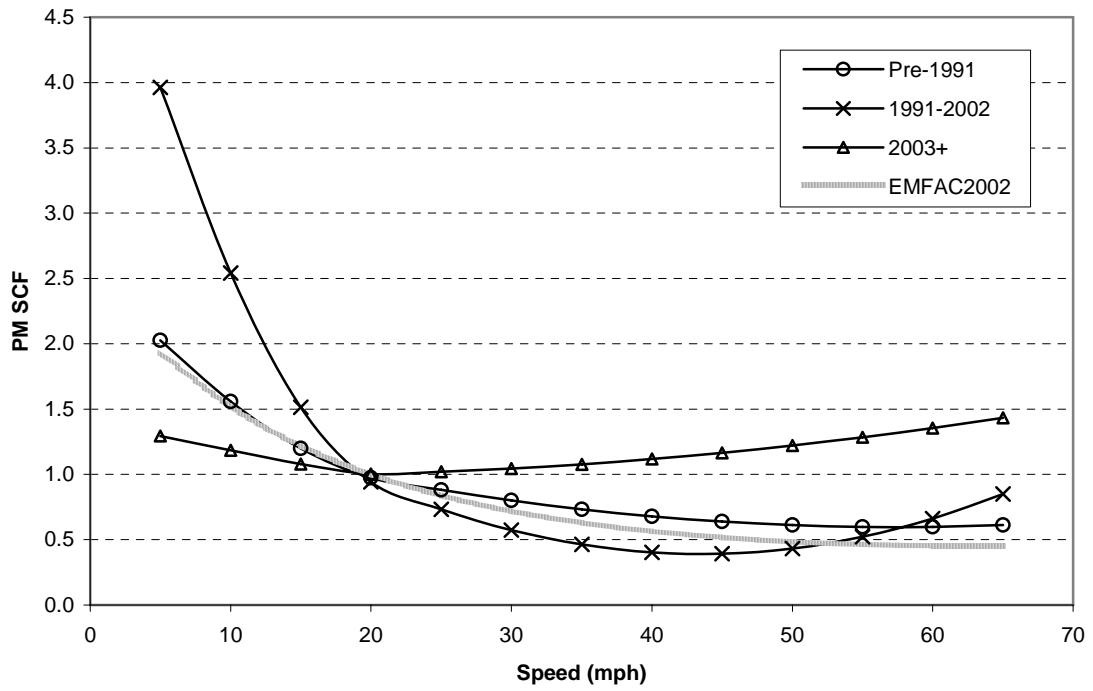
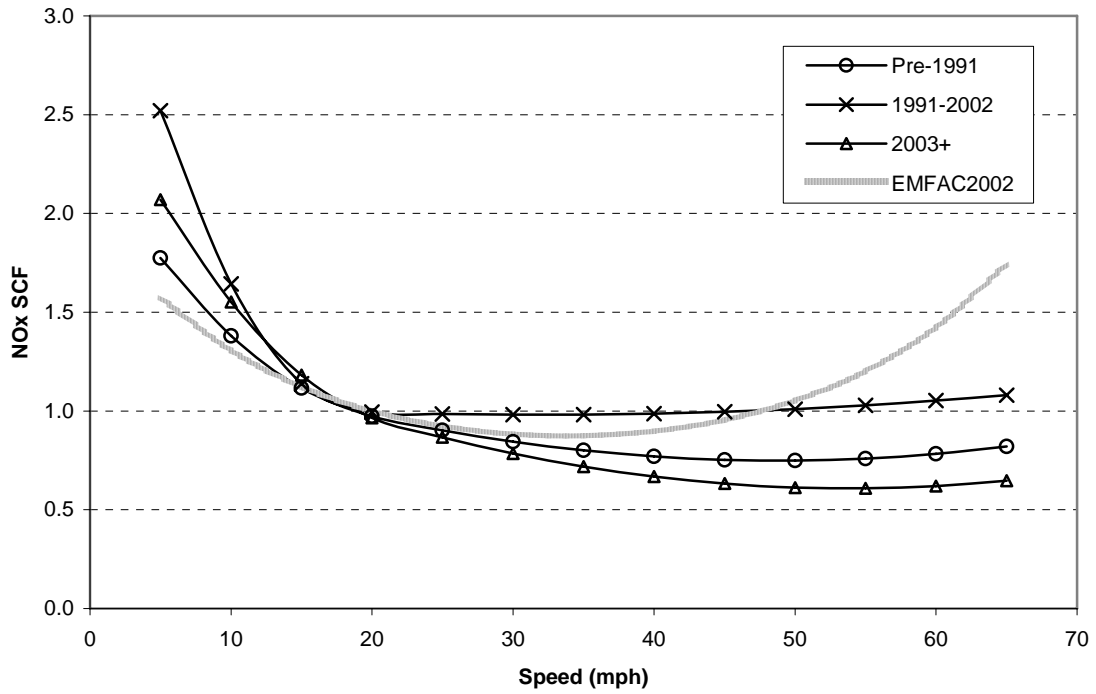
<b>San Diego Summer Episodic On-Road Motor Vehicle Inventories</b>							
(Calculated Using EMFAC2007 draft ver 2.224)							
Cal. Year	Population	VMT*(1000)	ROG_Tot1	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot2
1980	1097540	33494036	299.22	2707.44	176.71	23589.49	3.53
1990	1874233	64682144	204.77	2145.71	202.98	40797.50	6.19
2000	2227704	73165952	105.03	1022.88	143.39	41832.86	4.90
2002	2373876	79045424	87.64	845.85	128.57	45701.95	4.92
2005	2517309	83751264	72.23	666.73	113.15	49170.48	5.12
2010	2717240	87449160	53.51	469.72	86.51	50967.56	4.91
2015	2948011	93969632	41.85	334.80	64.04	55537.42	4.98
2020	3165209	100312400	35.01	252.36	49.84	59526.68	5.14
<b>San Diego Summer Episodic On-Road Motor Vehicle Inventories With Changes to HHDV SCFs</b>							
(Calculated Using EMFAC2007 draft ver 2.225)							
Cal. Year	Population	VMT*(1000)	ROG_Tot1	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot2
1980	1097540	33494036	299.25	2706.90	177.10	23589.49	3.38
1990	1874233	64682144	204.82	2144.62	203.74	40797.50	5.87
2000	2227704	73165952	105.05	1022.19	143.71	41832.86	4.77
2002	2373876	79045424	87.66	845.33	128.80	45701.95	4.82
2005	2517309	83751264	72.25	666.47	113.11	49170.48	5.08
2010	2717240	87449160	53.51	470.12	85.96	50967.56	4.98
2015	2948011	93969632	41.84	335.72	63.23	55537.42	5.12
2020	3165209	100312400	35.00	253.54	48.94	59526.68	5.30
<b>Difference (Ver. 2.225 - Ver. 2.224) in San Diego Emission Inventories (tons per day)</b>							
Cal. Year	Population	VMT(miles)	ROG_Tot1	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot2
1980	0	0	0.03	-0.53	0.39	0.00	-0.15
1990	0	0	0.06	-1.09	0.77	0.00	-0.32
2000	0	0	0.03	-0.69	0.32	0.00	-0.14
2002	0	0	0.02	-0.51	0.23	0.00	-0.10
2005	0	0	0.01	-0.26	-0.04	0.00	-0.04
2010	0	0	0.00	0.39	-0.55	0.00	0.07
2015	0	0	-0.01	0.92	-0.81	0.00	0.13
2020	0	0	-0.01	1.18	-0.90	0.00	0.16
<b>Percentage Change in San Diego Emission Inventories (relative to Ver. 2.224)</b>							
Cal. Year	Population	VMT	ROG_Tot1	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot2
1980	0.00%	0.00%	0.01%	-0.02%	0.22%	0.00%	-4.34%
1990	0.00%	0.00%	0.03%	-0.05%	0.38%	0.00%	-5.17%
2000	0.00%	0.00%	0.03%	-0.07%	0.22%	0.00%	-2.81%
2002	0.00%	0.00%	0.02%	-0.06%	0.18%	0.00%	-2.08%
2005	0.00%	0.00%	0.02%	-0.04%	-0.04%	0.00%	-0.78%
2010	0.00%	0.00%	0.00%	0.08%	-0.64%	0.00%	1.44%
2015	0.00%	0.00%	-0.02%	0.28%	-1.26%	0.00%	2.68%
2020	0.00%	0.00%	-0.03%	0.47%	-1.81%	0.00%	3.13%

1. ROG\_Tot - This includes running, start, idle exhaust emissions and evaporative emissions.
2. PM\_Tot - Total emissions from running, start, idle processes, and tire wear and brake wear.

### Appendix A. Proposed HHDT SCFs as Compared with SCFs in EMFAC



Appendix A (continued)



Appendix A (continued)

