

APPENDIX B

**PUBLIC AND UTILITY FLEET VEHICLES
EMISSIONS INVENTORY**

I. Methodology

The EMFAC model used by the Air Resource Board (ARB) does not specifically address the emissions inventory of public and utility vehicles as a distinct part of the heavy-duty diesel (HD) truck fleet. This is largely because of the lack of emission and activity data specific to public and utility vehicles, which operate differently on local streets from trucks driving on highways or freeways. In addition, ARB has not previously needed a detailed specific inventory for these vehicles. As ARB developed this regulation, however, staff required a more detailed inventory of emissions than was previously available.

A number of studies have been carried out recently to explore the effects of emission control technologies and to evaluate the population characteristics of public and utility vehicles for emission data. Staff has reviewed available information and emission data and has estimated an emissions inventory for these vehicles as discussed in the following sections.

A. Public and Utility Vehicle Activity Data

The following public and utility vehicle activity data were gathered from different sources and analyzed:

- Vehicle mile traveled (VMT), accrual rate and cumulative mileage;
- Population (POP) and age distribution; and
- Additional Idling.

The information was collected when possible for two categories of vehicles included in the HD fleet: medium-heavy duty (MHD) vehicles with a gross vehicle weight rating (GVWR) between 14,000 and 33,000 lbs and for heavy-heavy duty (HHD) vehicles of GVWR greater than 33,000 lbs.

The accrual rate for HHD vehicles was estimated to be 7776 miles per year based on the annual mileage data gathered from a report by TIAX (2003) and by information provided by public and utility agencies. For the case of HHD vehicles, staff assumes that this average annual mileage would apply to all model years. The cumulative mileage for public and utility vehicles with age i is then the sum of accrual rates of public and utility vehicles with ages 1 through i .

In contrast the accrual rate for MHD vehicles was estimated to decrease from 7151 miles per year for the first year of operation to 6028 miles per year at the beginning of the tenth year of operation, decreasing in a linear fashion. This estimation is based on the data gathered by and by the information provided by public and utility agencies.

The total statewide public and utility vehicle population (POP) of 29822 vehicles in year 2003 was obtained from the Department of Motor Vehicle (DMV) annual vehicle registration database and reports from the public and utility agencies.

Public and utility vehicle populations for future years were projected from the following linear growth rate equation:

$$\text{Population} = 1.2 \times 10^6 (\text{Calendar Year}) - 2.34 \times 10^9. \quad (1)$$

Equation 1 is derived from the TIAX report from 2003. The projected future populations were adjusted with the survival rates of urban diesel buses used in EMFAC model.

The split between HHD and MHD was also derived from the TIAX report and applied to the total population from DMV. Staff estimated that in 2003 the HHD fleet was 11318 and the MHD fleet was 18504 for these agencies. In a similar fashion the age distribution for public and utility vehicles was determined. The populations of individual model years were obtained by applying the age distribution to the total public and utility vehicle population for a given year.

The public and utility vehicle daily VMT for a given year was estimated from the public and utility vehicle POP and accrual rate using the following equation:

$$\text{VMT} = \sum (\text{POP}_i \times \text{Accrual Rate}_i), i = 1 \text{ to } 45 \quad (2)$$

The public and utility vehicle accrual rate, cumulative mileage, and age distribution are shown in Table 1.

In addition staff assumed that the public and utility vehicles operate at a duty cycle similar to the other HD vehicles modeled in EMFAC with the difference that the public and utility vehicles operate with additional idling during 1.2 hours per day not accounted in our current model.

Table 1. Accrual Rate, Cumulative Mileage, and Population Distribution

Model Year	Age	HHD				MHD			
		Annual Accrual Rate	Cumulative Mileage	Idle hr/day	Agency Counts	Annual Accrual Rate	Cumulative Mileage	Idle hr/day	Agency Counts
2003	0	7776	7776	1.2	546	7151	7151	1.2	762
2002	1	7776	15552	1.2	710	7000	14151	1.2	1140
2001	2	7776	23328	1.2	646	6879	21030	1.2	2100
2000	3	7776	31104	1.2	1044	6757	27787	1.2	1231
1999	4	7776	38880	1.2	393	6636	34423	1.2	1181
1998	5	7776	46656	1.2	755	6514	40937	1.2	571
1997	6	7776	54432	1.2	694	6392	47329	1.2	1359
1996	7	7776	62208	1.2	345	6271	53600	1.2	836
1995	8	7776	69984	1.2	463	6149	59749	1.2	902
1994	9	7776	77760	1.2	284	6028	65777	1.2	672
1993	10	7776	85536	1.2	390	5906	71683	1.2	878
1992	11	7776	93312	1.2	455	5784	77467	1.2	898
1991	12	7776	101088	1.2	488	5663	83130	1.2	824
1990	13	7776	108864	1.2	476	5541	88671	1.2	643
1989	14	7776	116640	1.2	539	5420	94091	1.2	476
1988	15	7776	124416	1.2	466	5298	99389	1.2	578
1987	16	7776	132192	1.2	489	5177	104566	1.2	514
1986	17	7776	139968	1.2	438	5055	109621	1.2	538
1985	18	7776	147744	1.2	393	4933	114554	1.2	420
1984	19	7776	155520	1.2	185	4812	119366	1.2	233
1983	20	7776	163296	1.2	129	4609	123975	1.2	229
1982	21	7776	171072	1.2	162	4569	128544	1.2	243
1981	22	7776	178848	1.2	201	4447	132991	1.2	392
1980	23	7776	186624	1.2	91	4326	137317	1.2	149
1979	24	7776	194400	1.2	99	4204	141521	1.2	114
1978	25	7776	202176	1.2	69	4082	145603	1.2	135
1977	26	7776	209952	1.2	42	3691	149294	1.2	62
1976	27	7776	217728	1.2	46	3839	153133	1.2	91
1975	28	7776	225504	1.2	63	3718	156851	1.2	107
1974	29	7776	233280	1.2	33	3596	160447	1.2	63
1973	30	7776	241056	1.2	55	3474	163921	1.2	41
1972	31	7776	248832	1.2	46	3353	167274	1.2	44
1971	32	7776	256608	1.2	27	3231	170505	1.2	33
1970	33	7776	264384	1.2	31	3110	173615	1.2	15
1969	34	7776	272160	1.2	8	2988	176603	1.2	16
1968	35	7776	279936	1.2	6	2867	179470	1.2	4
1967	36	7776	287712	1.2	5	2745	182215	1.2	6
1966	37	7776	295488	1.2	6	2623	184838	1.2	4
1965	38	7776	303264	1.2	0	2623	187461	1.2	0
1964	39	7776	311040	1.2	0	2623	190084	1.2	0
1963	40	7776	318816	1.2	0	2623	192707	1.2	0
1962	41	7776	326592	1.2	0	2623	195330	1.2	0
1961	42	7776	334368	1.2	0	2623	197953	1.2	0
1960	43	7776	342144	1.2	0	2623	200576	1.2	0
1959	44	7776	349920	1.2	0	2623	203199	1.2	0

Total	11318	18504
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B. Public and Utility Vehicle Emission Rates

The emissions inventory for public and utility vehicles were calculated for both the HHD and the MHD (Table 2). The emission rates, were based on test data collected over the Urban Dynamometer Driving Schedule (UDDS) used in EMFAC2002.

Table 2. EMFAC2002 HHD and MHD Truck Emission Rates

HHD												
Model Year Group	EMFAC2002 HHD Truck Emission Rates (g/mi)*								Idle Emission Rates (g/hour)			
	HC		CO		NOx		PM		HC	CO	NOx	PM
	ZM	DR	ZM	DR	ZM	DR	ZM	DR				
up to 1974	1.6	0.018	8.36	0.095	28.52	0.012	1.98	0.016	3.48	26.3	80.7	5.37
1975-1983	1.45	0.018	7.81	0.098	27.17	0.013	1.85	0.016	3.48	26.3	80.7	5.37
1984-1986	0.74	0.011	4.87	0.074	20.18	0.011	1.18	0.012	3.48	26.3	80.7	5.37
1987-1990	0.34	0.009	2.48	0.065	16.79	0.015	0.84	0.008	3.48	26.3	80.7	5.37
1991-1993	0.28	0.009	1.74	0.056	15.97	0.03	0.51	0.009	3.48	26.3	80.7	1.86
1994-1997	0.19	0.016	0.84	0.068	19.06	0.042	0.32	0.01	3.48	26.3	80.7	1.004
1998	0.18	0.014	0.63	0.049	23.01	0.037	0.26	0.007	3.48	26.3	80.7	1.004
1999-2002	0.18	0.009	0.63	0.031	13.36	0.013	0.21	0.003	3.48	26.3	80.7	1.004
2003-2006	0.14	0.003	1.01	0.023	6.68	0.007	0.26	0.003	3.48	26.3	80.7	1.004
2007-2009	0.089	0.003	0.646	0.023	3.674	0.007	0.026	0.003	3.48	26.3	80.7	1.004
2010 and on	0.039	0.003	0.283	0.023	0.668	0.007	0.026	0.003	3.48	26.3	80.7	1.004
MHD												
Model Year Group	EMFAC2002 HHD Truck Emission Rates (g/mi)*								Idle Emission Rates (g/hour)			
	HC		CO		NOx		PM		HC	CO	NOx	PM
	ZM	DR	ZM	DR	ZM	DR	ZM	DR				
up to 1983	0.34	0.011	3.17	0.1	18.5	0.32	1.07	0.016	3.48	26.3	80.7	5.37
1984-1986	0.33	0.14	2.99	0.131	17.91	0.43	1	0.21	3.48	26.3	80.7	5.37
1987-1990	0.21	0.016	1.8	0.14	15.74	0.34	0.73	0.17	3.48	26.3	80.7	5.37
1991-1993	0.18	0.018	1.43	0.139	13.11	0.078	0.45	0.022	3.48	26.3	80.7	1.86
1994-1997	0.11	0.017	0.78	0.121	11.55	0.048	0.27	0.018	3.48	26.3	80.7	1.004
1998-2002	0.09	0.014	0.64	0.097	10.52	0.032	0.24	0.012	3.48	26.3	80.7	1.004
2003-2006	0.09	0.007	1.04	0.074	5.79	0.018	0.29	0.009	3.48	26.3	80.7	1.004
2007-2009	0.057	0.006	0.665	0.074	3.014	0.017	0.029	0.009	3.48	26.3	80.7	1.004
2010 and on	0.025	0.006	0.291	0.074	0.548	0.017	0.029	0.009	3.48	26.3	80.7	1.004

* ZM = Zero mile emission rate; DR = Deterioration rate per 10,000 miles.

Public and utility vehicle specific average emission rates were calculated from the EMFAC2002 model. Since in the current model the idle emissions are constant regardless of vehicle model year, as shown in Table 2, these were adjusted. The adjustment used emissions calculated by EMFAC for 2003 and then scaled them using data generated by the Coordinating Research Council E55/E59 study.

Table 3. Idle Adjustment

Calendar Year	HC	CO	NOX	PM
2003	1.000	1.000	1.000	1.000
2004	0.967	0.984	1.036	0.936
2005	0.935	0.969	1.073	0.873
2006	0.908	0.955	1.108	0.816
2007	0.885	0.943	1.142	0.765
2008	0.865	0.931	1.175	0.718
2009	0.848	0.921	1.208	0.674
2010	0.834	0.911	1.239	0.633
2015	0.802	0.877	1.388	0.476
2020	0.821	0.883	1.536	0.390

II. Public and Utility Vehicle Emission Inventory

Table 4 shows the combined public and utility vehicle emissions inventory for calendar years 2005, 2010, and 2020. The inventory given in Table 3 includes the U.S. EPA 2007 heavy-duty diesel engine regulations and U.S. EPA 2006 low sulfur diesel fuel regulation.

Table 4. Statewide Public and Utility Vehicle Emissions Inventory (tons/day)

Year	HC	CO	NOX	PM
2003	0.309	2.430	11.729	0.432
2004	0.296	2.361	11.547	0.408
2005	0.282	2.292	11.366	0.384
2006	0.271	2.236	11.206	0.363
2007	0.260	2.171	10.941	0.325
2008	0.250	2.114	10.689	0.299
2009	0.241	2.063	10.444	0.276
2010	0.231	1.999	10.084	0.254
2015	0.197	1.765	8.474	0.173
2020	0.162	1.644	7.332	0.124