APPENDIX D

OFFROAD MODEL CHANGE TECHNICAL MEMO

ADDENDUM

to

OFFROAD Modeling Change Technical Memo

The OFFROAD Modeling Change Memo discussed that during the process of updating the emissions inventory for TRUs, engine manufacturers were asked to provide staff with data regarding TRU and TRU generator set PM engine emission rates. Although some manufacturers responded by providing PM emission factor estimates, no test data was received. The zero-hour rates provided by the manufacturers suggest lower zero-hour emission rates than currently assumed in the OFFROAD model. Staff attempted to validate these estimates by reviewing engine certification data in both the U.S. EPA and ARB engine certification data bases. However, using the engine models and engine families provided by the TRU engine manufacturers resulted in finding only a small fraction of the engines that have been used in TRUs since these engines required emissions certification. In the absence of new test data and engine certification data, staff chose to utilize the current OFFROAD PM emission factors.

It was noted in the OFFROAD Modeling Memo, however, that based on the manufacturers submission, the possibility exists that the zero hour emissions estimates of TRUs may be lower than currently assumed. To get an estimate of the potential magnitude of this difference, staff used the PM emission factors provided by the engine manufacturers to estimate the year 2000 statewide fleet average PM emissions factors for each horsepower category. Staff substituted the average manufacturer PM emission factor for each model year in which data was available from all engine manufacturers supplying engines in a horsepower category. The OFFROAD Model PM emission factors were applied to those model years where data was not available from all engine manufacturers supplying engines in a horsepower category. These factors were applied to the remaining model year populations of TRU and TRU generator sets that were modeled to be in use in year 2000. Deterioration factors from the OFFROAD Model and fuel factors that adjust emissions for sulfur content were applied. This produced a statewide PM emission factor that averaged 25percent less considering all horsepower categories than what was estimated using just the OFFROAD Model emission factors.

This difference was determined to be large enough to warrant an adjustment in the PM Emissions for years 2000 through 2020. The values that were calculated from the OFFROAD Model were multiplied by 75 percent to revise the PM emissions for 2000 from 2.65 tons per day to 1.98 tons per day and for 2010, the PM emissions were revised similarly from 3.19 tons per day to 2.23 tons per day. Table D-1 shows these revised emissions. Table D-1 also includes the assumptions that Tier 4 Nonroad emission standards would be implemented in 2008 ("interim standards) and 2013 ("long term standards) and that the ATCM would be implemented according to the proposed schedule.

Table D-1

TRU and TRU Generator Sets In Use Compliance Program Emissions Benefit

For Particulate Matter (PM) Emissions

CY	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<15														
Baseline tpd	0.044	0.043	0.041	0.040	0.038	0.037	0.036	0.035	0.034	0.034	0.034	0.034	0.034	0.034
After tpd	0.044	0.043	0.033	0.032	0.029	0.027	0.025	0.024	0.022	0.022	0.022	0.023	0.024	0.025
Benefit tpd	0.000	0.000	0.008	0.008	0.009	0.010	0.011	0.012	0.012	0.012	0.011	0.011	0.010	0.010
15-25														
Baseline tpd	0.026	0.025	0.024	0.023	0.023	0.022	0.021	0.021	0.020	0.020	0.020	0.020	0.020	0.020
After tpd	0.026	0.025	0.019	0.019	0.017	0.016	0.015	0.014	0.013	0.013	0.013	0.013	0.014	0.014
Benefit tpd	0.000	0.000	0.005	0.005	0.005	0.006	0.006	0.007	0.007	0.007	0.007	0.006	0.006	0.006
25-50ca														
Baseline tpd	1.599	1.568	1.527	1.481	1.431	1.375	1.265	1.155	1.045	0.931	0.819	0.711	0.613	0.524
After tpd	1.599	1.568	1.131	1.075	0.963	0.880	0.754	0.631	0.506	0.396	0.380	0.308	0.245	0.180
Benefit tpd	0.000	0.000	0.396	0.405	0.467	0.495	0.511	0.524	0.539	0.535	0.439	0.403	0.368	0.345
25-50fed														
Baseline tpd	0.528	0.517	0.504	0.489	0.472	0.454	0.418	0.381	0.345	0.307	0.270	0.235	0.202	0.173
After tpd	0.528	0.517	0.373	0.355	0.318	0.290	0.249	0.208	0.167	0.131	0.125	0.102	0.081	0.059
Benefit tpd	0.000	0.000	0.131	0.134	0.154	0.163	0.169	0.173	0.178	0.176	0.145	0.133	0.122	0.114
25-50rail														
Baseline tpd	0.120	0.118	0.115	0.111	0.107	0.102	0.094	0.085	0.077	0.069	0.060	0.052	0.045	0.039
After tpd	0.120	0.118	0.084	0.080	0.072	0.065	0.056	0.047	0.037	0.029	0.028	0.023	0.018	0.013
Benefit tpd	0.000	0.000	0.030	0.031	0.035	0.037	0.038	0.039	0.040	0.040	0.032	0.030	0.027	0.025
25-50gensets														
Baseline tpd	0.084	0.084	0.085	0.085	0.086	0.087	0.083	0.078	0.073	0.067	0.060	0.053	0.047	0.042
After tpd	0.084	0.084	0.069	0.067	0.063	0.060	0.053	0.046	0.038	0.031	0.031	0.026	0.021	0.016
Benefit tpd	0.000	0.000	0.016	0.018	0.023	0.027	0.030	0.033	0.035	0.035	0.029	0.028	0.026	0.025

Sums from above

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline w/ Tier 4	1.98	2.1	2.2	2.3	2.35	2.4	2.43	2.401	2.356	2.296	2.228	2.156	2.077	1.917	1.756	1.594	1.427	1.262	1.104	0.962	0.832
With TRU ATCM	1.98	2.1	2.2	2.3	2.35	2.4	2.43	2.401	2.356	1.710	1.628	1.462	1.338	1.152	0.970	0.783	0.623	0.599	0.495	0.402	0.307
Em Reduxns (tpd)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.586	0.600	0.695	0.739	0.765	0.786	0.811	0.805	0.664	0.610	0.559	0.525
Em Redux (tpy)	0	0	0	0	0	0	0	0	0	214	219	254	270	279	287	296	294	242	223	204	191

"Baseline" includes the effects of implementing "interim" Tier 4 Nonroad standards in 2008 and "long term" Tier 4 in 2013.

"After" includes the effects of implementing the TRU ATCM in-use performance standards with the following assumptions:

- 50% reduction for model year 2001 and previous, starting 2009 (December 31, 2008 compliance date).
- 50% reduction for model year 2002, starting 2010 (December 31, 2009 compliance date).
- 85% reduction for model years 2003 and subsequent, starting 7 years after model year (December 31, 2010 compliance date for 2007).
- 85% reduction for model year 2001 and previous, starting 2016 (December 31, 2015 compliance date).
- 85% reduction for model year 2002, starting 2017 (December 31, 2016 compliance date).

Staff plans to continue the effort to identify the certified emission values for all TRU engines that have been certified and the related deterioration factors that would apply. These factors will be used to improve the accuracy of the TRU and TRU generator set emission inventory.

TRU and TRU generator set NOx emissions were estimated using the OFFROAD Model as shown in Table D-2. The estimate included the assumptions that the Tier 4 Nonroad emission standards would be implemented in 2008 ("interim standards) and 2013 ("long term standards) and that there would be a 10 percent NOx reduction associated with implementation of the TRU ATCM.

Table D-2

TRU and TRU Generator Sets In Use Compliance Program Emissions Benefit														
			For Oxides of Nitrogen (NOx) Emissions											
CY	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<15														
Baseline tpd	0.832	0.822	0.814	0.807	0.804	0.805	0.809	0.819	0.838	0.860	0.887	0.918	0.954	0.995
After tpd	0.832	0.822	0.780	0.775	0.772	0.773	0.780	0.791	0.811	0.833	0.860	0.891	0.926	0.966
Benefit tpd	0.000	0.000	0.034	0.033	0.032	0.031	0.030	0.028	0.027	0.027	0.027	0.027	0.028	0.029
15-25														
Baseline tpd	0.474	0.474	0.474	0.475	0.476	0.479	0.482	0.487	0.494	0.503	0.513	0.525	0.538	0.553
After tpd	0.474	0.474	0.456	0.456	0.458	0.460	0.464	0.470	0.478	0.486	0.496	0.508	0.521	0.536
Benefit tpd	0.000	0.000	0.018	0.018	0.018	0.018	0.018	0.017	0.017	0.016	0.017	0.017	0.017	0.017
25-50ca														
Baseline tpd	15.202	15.550	15.933	16.368	16.874	17.442	17.392	17.419	17.486	17.578	17.706	17.859	18.059	18.298
After tpd	15.202	15.550	15.336	15.769	16.267	16.835	16.783	16.798	16.845	12.057	17.152	17.279	17.449	17.655
Benefit tpd	0.000	0.000	0.597	0.600	0.607	0.607	0.609	0.621	0.641	5.521	0.554	0.580	0.610	0.643
25-50fed														
Baseline tpd	5.017	5.132	5.258	5.402	5.569	5.756	5.740	5.748	5.771	5.801	5.843	5.894	5.960	6.038
After tpd	5.017	5.132	5.061	5.204	5.368	5.556	5.539	5.544	5.559	3.979	5.660	5.702	5.758	5.826
Benefit tpd	0.000	0.000	0.197	0.198	0.200	0.200	0.201	0.205	0.212	1.822	0.183	0.191	0.201	0.212
25-50rail														
Baseline tpd	1.120	1.146	1.174	1.206	1.243	1.285	1.282	1.284	1.288	1.295	1.305	1.316	1.331	1.348
After tpd	1.120	1.146	1.130	1.162	1.199	1.241	1.237	1.238	1.241	0.888	1.264	1.273	1.286	1.301
Benefit tpd	0.000	0.000	0.044	0.044	0.045	0.045	0.045	0.046	0.047	0.407	0.041	0.043	0.045	0.047
25-50gensets														
Baseline tpd	0.914	0.978	1.051	1.136	1.232	1.341	1.391	1.451	1.515	1.585	1.665	1.755	1.858	1.974
After tpd	0.914	0.978	1.025	1.106	1.200	1.306	1.353	1.409	1.469	1.175	1.623	1.710	1.809	1.921
Benefit tpd	0.000	0.000	0.026	0.029	0.032	0.035	0.039	0.042	0.046	0.410	0.042	0.045	0.049	0.053
Total Benefit tpd	0.000	0.000	0.916	0.922	0.935	0.937	0.941	0.958	0.990	8.203	0.862	0.903	0.950	1.002
Prepared by Sandee Kidd														
Date October 9, 2003														
In use compliance scenario provided by Toni Andreoni is shown in the worksheet "compliance".														
"Baseline" emissions assume that Tier 4 Nonroad standards are implemented in 2008 ("interim" standards) and 2013 ("long term" sta														
"After" emissions includes the effects of implementing the TRU ATCM in-use performance standards and assumes a 10% NOx reduc														

OFFROAD Modeling Change Technical Memo

SUBJECT: Revisions to the Diesel Transport Refrigeration Units (TRU) Inventory

LEAD: Sandee Kidd

SUMMARY

Transport refrigeration units (TRUs) are diesel powered cooling units that are installed on vehicles used in transporting produce, meat, dairy products, and other perishable goods. TRUs are found on refrigerated vans, trucks, trailers, and railroad cars.

TRU emissions are estimated in the Air Resources Board's (ARB or Board) OFFROAD model. Since late 2002, ARB staff obtained more up to date population and activity estimates from surveys of TRU manufacturers. We analyzed these data and are proposing to use the results to revise the input factors to the OFFROAD model. Staff proposes to revise the population, activity, load factor, average horsepower, survival rates, and useful life estimates for TRUs. These modifications are projected to decrease the emissions inventory of oxides of nitrogen (NOx) by 6.72 tons per day, and increase hydrocarbons (HC) by 4.60 tons per day and particulate matter (PM) by 0.03 tons per day, statewide in the year 2000 (See Table 1). For 2010, the emissions inventory is projected to increase by 0.84 tons per day for PM, 4.31 tons per day for NOx, and 4.61 tons per day for HC compared to the current estimates (See Table 2).

Table 1
Statewide TRU Emissions Inventory in Tons per Day in 2000

	PM	PM	NOx	NOx	HC	HC
Horsepower	**Existing**	**Proposed**	**Existing**	**Proposed**	**Existing**	**Proposed**
<15 hp	NA	0.06	NA	0.84	NA	0.11
15-25-hp	0.02	0.04	0.20	0.44	0.03	0.09
25-50 hp (CA)	0.43	1.82	2.80	12.67	1.64	6.75
25-50 hp Out-of-state	NA	0.60	NA	4.18	NA	2.22
25-50 hp (Rail)	NA	0.13	NA	0.93	NA	0.49
> 50 hp	2.17	NA	22.78	NA	3.39	NA
Totals	**2.62**	**2.65**	**25.78**	**19.06**	**5.06**	**9.66**

Table 2
Statewide TRU Emissions Inventory in Tons per Day in 2010

	PM	PM	NOx	NOx	HC	HC
Horsepower	**Existing**	**Proposed**	**Existing**	**Proposed**	**Existing**	**Proposed**
<15 hp	NA	0.06	NA	0.81	NA	0.09
15-25-hp	0.01	0.04	0.15	0.47	0.02	0.06
25-50 hp (CA)	0.40	2.20	2.64	16.37	1.35	6.11
25-50 hp Out-of-state	NA	0.73	NA	5.40	NA	2.02
25-50 hp Rail	NA	0.16	NA	1.21	NA	0.45
> 50 hp	1.94	NA	17.16	NA	2.56	NA
Totals	**2.35**	**3.19**	**19.95**	**24.26**	**3.93**	**8.74**

BACKGROUND

The emissions inventory for TRUs is calculated in the OFFROAD model in tons per day using the following equation:

Emission Inventory = Emission Rate*Population*Activity*Average Horsepower*Load Factor

The emission rates are pollutant specific and are expressed in grams/horsepower-hour (gms/hp-hr). Activity is expressed in hours/year or hours/day of engine run time. The "average horsepower" is defined as the average maximum rated horsepower within each horsepower group. The "load factor" is the average operation level in a given application and is expressed as a percent of the engine manufacturer's maximum horsepower ratings. The population estimate is a function of original sales, useful life and survival rate of the equipment.

With the exception of the emission rates, all other factors used in the current emissions inventory calculations were obtained from the 1997 Power Systems Research (PSR) report. PSR is an independent marketing firm involved in research and development related to engine product life cycles. The ARB approved the current emission inventory for diesel-powered TRUs in January of 2000.

INPUT FACTORS

Useful Life

Useful life is defined as the age at which at least fifty percent of the originally sold equipment population still exists. However, some of the remaining engines could last twice as long. Currently, the useful life for TRU's in the OFFROAD model is assumed to be 16 years. The staff proposes to reduce this estimate to 10 years based on the responses to the survey of TRU manufacturers.

Survival Rate

The survival rate curve describes the percentage of the original equipment population remaining in the fleet as a function of age. For TRU's, this estimate was obtained from the PSR database. However, based on conversations with manufacturers, it was determined that in the last ten years, the trend showing a rapid decrease in the population may not be realistic. Therefore, the survival rate of TRUs 11 to 20 years old was revised to reflect a more gradual decrease in population. In addition, survival rate for age 0 was modified from 0.5 to 1.0 to reflect that age 0 includes sales for the entire calendar year. Table 3 compares the survival rates from PSR at the useful life of 10 and 16 years, to the proposed survival rate.

TRU Sales

The current estimate of the population of TRUs by horsepower group was obtained from PSR. The proposed revision to the population was derived from national TRU sales data provided by TRU manufacturers and TRU engine manufacturers, reported for a twelve year period between 1991 and 2002 for each horsepower category. A curve fit of the data was performed to estimate the sales going back to 1981 for each horsepower category (See Charts 1, 2, and 3). The "Original Sales" data shown in Charts 1, 2, and 3 represent an estimate of the number of TRUs originally sold in a particular year in the entire U.S. and should not be confused with the actual population in a given calendar year.

Using the 1997 Commodity Flow Survey data from the U.S. Census Website (www.census.gov), it was determined that the truck ton-mile share in California compared to the entire U.S. for refrigerated goods is 6.4 percent. Refrigerated goods include meats, agricultural products and other prepared perishable goods. Therefore, 6.4 percent of the U.S. TRU sales in all horsepower groups were assumed to be in California.

Table 3
Comparison of TRU Survival Rates from Original Sales (%)

Age	Current (PSR) Survival Rate Useful Life = 10	Proposed Survival rate Useful Life = 10	Current (PSR) Survival rate Useful Life = 16
0	0.50	1.00	0.50
1	0.98	0.98	0.99
2	0.97	0.97	0.98
3	0.95	0.95	0.97
4	0.92	0.92	0.96
5	0.90	0.90	0.95
6	0.87	0.87	0.93
7	0.83	0.83	0.91
8	0.80	0.80	0.90
9	0.75	0.75	0.88
10	0.50	0.67	0.84
11	0.25	0.59	0.83
12	0.20	0.49	0.82
13	0.17	0.38	0.80
14	0.13	0.26	0.76
15	0.10	0.12	0.70
16	0.08	0.08	0.50
17	0.05	0.05	0.30
18	0.03	0.03	0.24
19	0.02	0.02	0.20
20	NA	NA	0.18
21	NA	NA	0.17
22	NA	NA	0.16
23	NA	NA	0.12
24	NA	NA	0.10
25	NA	NA	0.09
26	NA	NA	0.07
27	NA	NA	0.05
28	NA	NA	0.04
29	NA	NA	0.028
30	NA	NA	0.017
31	NA	NA	0.010
32	NA	NA	0.005

Chart1: TRU U.S. Sales for < 15 hp engines

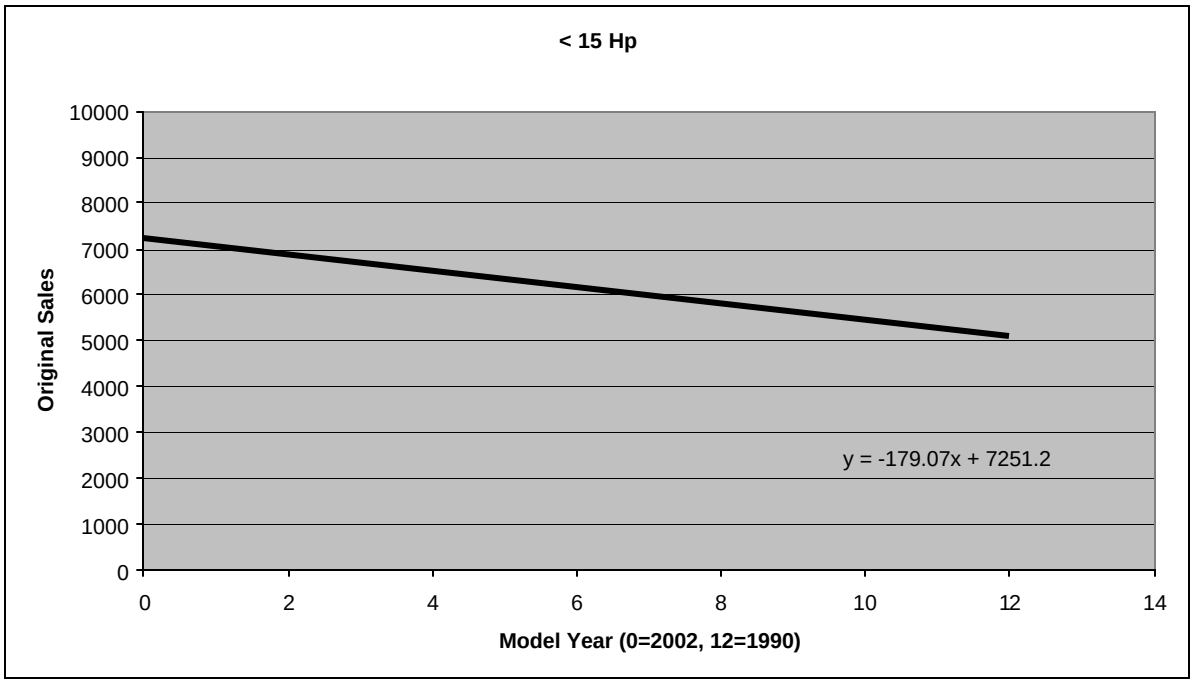


Chart 2: TRU U.S. Sales for 15-25 hp engines

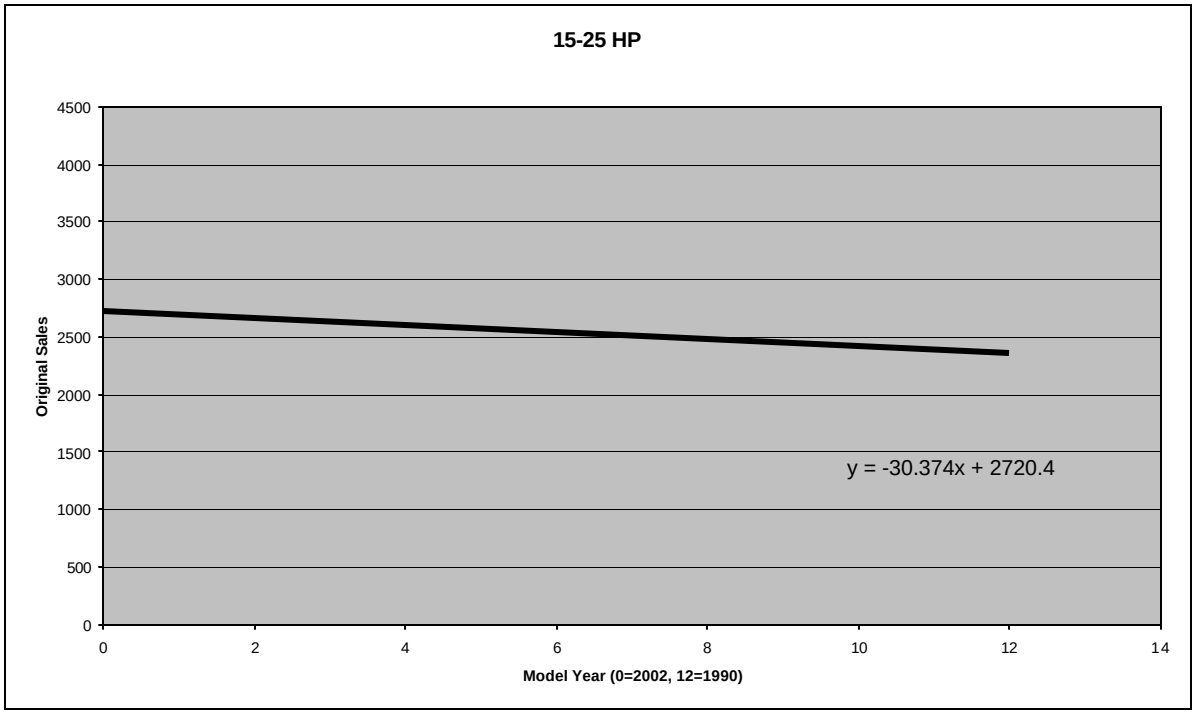
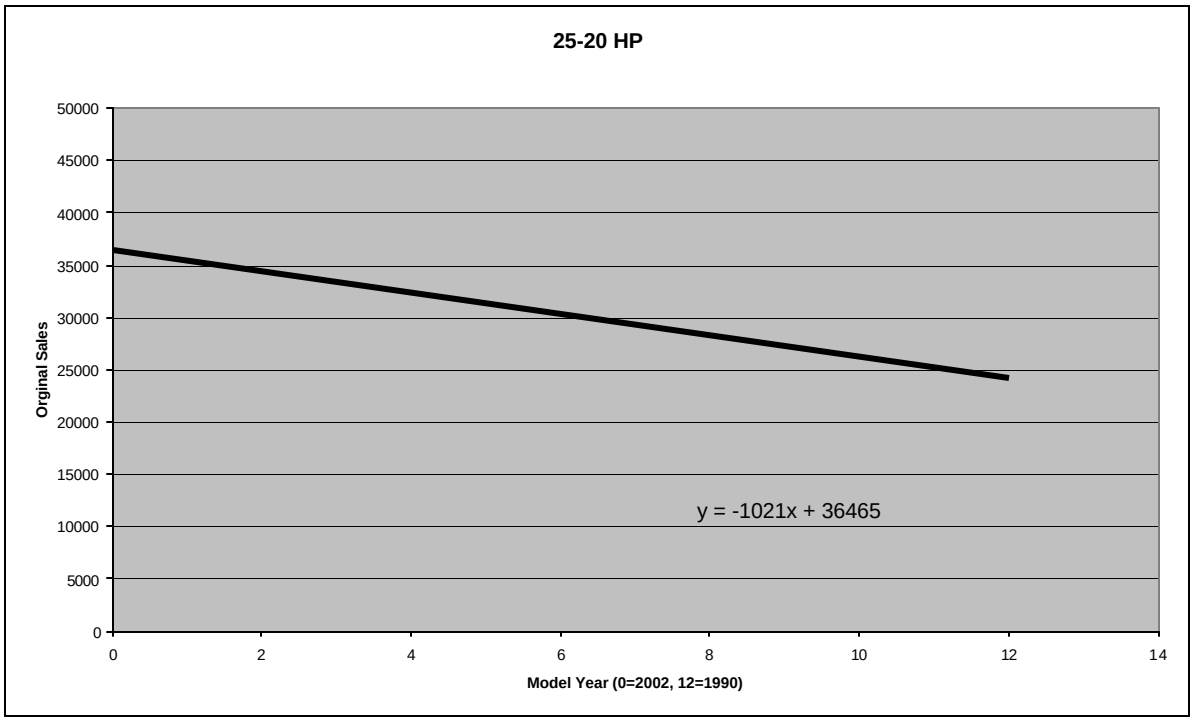


Chart 3: TRU U.S. Sales for 25-50 hp engines



Population

(CALIFORNIA REGISTERED TRU)

Using the manufacturers sales data and sales equations, 20 years of sales were estimated and the revised survival rates were applied to update the TRU population assumed to be installed on California registered, on-road vehicles as shown in Table 4. These numbers will be used in the offroad model.

(Out of State TRU)

In California's on-road vehicle emissions inventory model, EMFAC2002, it is assumed that 25 percent of the total heavy-heavy duty diesel (HHDD) truck population that travels on California roads are trucks registered outside of California. This equates to 33 percent of the California only HHDD trucks. Using the estimate cited above for the 25-50 hp category, staff included an additional 7,515 TRUs into the 25-50 hp group to account for TRUs operating in California that are installed on trucks registered out of state. For purposes of emissions calculation, staff assumed that these out of state TRUs have the same age distribution and usage as TRUs installed on California registered trucks.

(Railcar TRUs)

ARB staff also sent surveys to several railroad operators that do business in California regarding the use of refrigerated railcars. Staff used the American Association of Railroads UMLER files to obtain the U.S. population of railcars with mechanical refrigeration systems (reefer railcars). Reefer railcars use TRUs in the 25-50 hp group. Using the Commodity Flow Survey data mentioned earlier, it was determined that the rail ton-miles in California compared to the entire U.S. for refrigerated goods is 19 percent. Therefore, 19 percent of the U.S. reefer railcar usage was assumed to occur in California. Due to the lack of additional information, staff again assumed the same age distribution and usage for railcar TRUs as that used for TRUs that are installed on California registered trucks (See Table 4).

Table 4
Statewide TRU Population in CY 2000

Horsepower Group	Existing Population	Proposed Population
<15 hp (Ca)	0	4623
15-25 hp (Ca)	1517	1947
25-50 hp (Ca)	8412	22772
25-50 hp (Out of State)	0	7515
25-50 hp (Rail)	0	1678
>50 hp	30902	0
Total	**40831**	**38535**

Unlike the existing estimates in the OFFROAD model, data provided by manufacturers and railroad operators indicated that there are a significant number of TRUs under 15 hp and there are no TRUs over 50 hp.

Average Horsepower, Load Factor, and Usage

Each engine in a specific application is assumed to operate for the average annual number of hours at the average load factor number. The average horsepower values, load factor, and usage estimates currently used in the OFFROAD model were taken from the PSR database. Survey responses obtained from the manufacturers also provided data to update these estimates. The revised estimates are compared to current estimates in Table 6 that summarizes all of the current and proposed input factors used to calculate the TRU emissions inventory.

Growth Factors

Growth factors (GF) used to forecast yearly sales beyond the year 2000 are derived from socio-economic indicators (e.g., housing units and manufacturing employment) that are assumed to have a close relationship with the off-road equipment categories. Growth factors contained in the OFFROAD model were obtained from the 1994 study by California State University, Fullerton (CSUF) entitled "A study to Develop Projected Activity for Non-Road Mobile Categories in California, 1970-2020." Growth factors for the proposed revisions of the OFFROAD model for the TRU category are derived from the average growth indicated by yearly sales data provided by the manufacturers. Actual, rather than average growth factors were used for years where the sales data were available. Table 5 shows the growth factors by hp for 2003+ calendar years.

Table 5
Yearly Growth Factors for TRU for Calendar years 2003+

HP	GF (%)
<15	4.58
15-25	3.04
25-50	5.20

Table 6
TRU Input Factors

HP GROUPS	<15 hp	15-25 hp	25-50 hp	>50 hp
Average hp				
Existing	NA	17	39	56
Proposed	10	17	34	NA
Activity (hrs/yr)				
Existing	NA	750	1341	1341
Proposed	1038	1038	1465	NA
Load Factor				
Existing	NA	0.50	0.28	0.28
Proposed	0.64	0.64	0.53	NA
Population (CY 2000)				
Existing	0	1517	8412	30902
Proposed	4623	1947	31965	NA
Useful Life (yrs)				
Existing	NA	6	16	16
Proposed	10	10	10	NA
Fleet Average NOx gms/hp-hr (CY 2000)				
Existing	NA	6.82	7.53	11.61
Proposed	9.04	6.64	6.89	NA
Fleet Average PM gms/hp-hr (CY 2000)				
Existing	NA	0.60	1.15	1.10
Proposed	0.65	0.57	1.00	NA
Fleet Average HC gms/hp-hr (CY2000)				
Existing	NA	1.03	4.04	1.73
Proposed	1.19	1.28	3.72	NA

Emission Rates

The emission rates used in this analysis are those currently used in the OFFROAD model. These rates are based on pre-1995 diesel fuel. Fuel correction factors are applied in the model to reflect lower emissions due to low sulfur and aromatic content of 1995+ diesel fuel in California. Staff is not proposing to modify these estimates at this time (See Attachment A). Although the basic emission rates did not change, the proposed fleet average emissions as shown in Table 6 differ because the population distribution has been revised.

During the process of updating the emissions inventory for TRUs, engine manufacturers were asked to provide staff with data regarding their emission rates. Although some manufacturers responded by providing emission factor estimates, no test data was received. The zero hour rates provided by the manufacturers suggest lower zero hour

emission rates than currently assumed in the OFFROAD model. Staff attempted to validate these estimates using certification data but found that only a small fraction of the in-use engines was represented in the manufacturers' submissions.

In the absence of new test data, staff chose to utilize the current OFFROAD emission factors. It should be noted, however, that based on the manufacturer submission, the possibility exists that the zero hour emissions estimates of TRUs may be lower than currently assumed. The current inventory reflect our best available estimate but the inventory will continue to be refined and improved as more data is collected.

GENERATOR SETS FOR TRUS (25-50HP)

The methodology used to estimate the emission inventory for generator sets used in TRU applications is similar to that described earlier in this document. Sales data were provided by generator set manufacturers for a ten year period between 1991 and 2000. Similar to TRUs, a curve fit of the data was performed to estimate the sales going back to 1981. Based on TRU generator set manufacturer's responses to ARB's surveys, the average horsepower, load factor and the activity was assumed to be 31 hp, 0.45 and 1100 hours per year, respectively. The useful life used was 10 years, which is the same as used for TRUs. In addition, emission factors used are the same as TRUs. Based on yearly sales data the yearly average growth factor was determined to be 10.2 percent. Table 7 shows the population along with the emissions in tons per day for the years 2000 and 2010.

Table 7
Statewide TRU Related Generator Sets for TRUs Emissions Inventory
(tons per day)

	PM Proposed	NOX Proposed	HC Proposed	POPULATION Proposed
CY 2000	0.08	0.59	0.29	1844
CY 2010	0.13	1.14	0.30	4870

REASON FOR CHANGE

In support of pending regulation and in light of new data made available by TRU manufacturers, staff is proposing to update the emissions inventory for this segment of the off-road engine population as outlined above.

METHODOLOGY

The current estimates of population, average horsepower, activity and load factor will be updated to conform to the data recently provided by TRU manufacturers. Reflecting these proposed changes will affect the emissions inventory for this category of engines.

Attachment A

MY Specific Emission Rates for Diesel Engines

		ZH	DR	ZH	DR	ZH	DR	ZH	DR
		(g/hp-hr)	(g/hp-hr2)	(g/hp-hr)	(g/hp-hr2)	(g/hp-hr)	(g/hp-hr2)	(g/hp-hr)	(g/hp-hr2)
HP	**Year**	**ROG**	**ROG**	**CO**	**CO**	**NOX**	**NOX**	**PM**	**PM**
15	1994	1.50	0.00	5.00	0.00	10.00	0.00	1.00	0.00
15	1999	1.05	0.00	5.00	0.00	9.35	0.00	0.57	0.00
15	2004	0.68	0.00	3.47	0.00	6.08	0.00	0.47	0.00
15	2020	0.49	0.00	3.47	0.00	4.37	0.00	0.38	0.00
25	1994	1.84	0.00	5.00	0.00	6.92	0.00	0.764	0.00
25	1999	0.90	0.00	5.00	0.00	6.92	0.00	0.573	0.00
25	2004	0.64	0.00	2.34	0.00	5.79	0.00	0.382	0.00
25	2020	0.51	0.00	2.34	0.00	4.57	0.00	0.382	0.00
50	1987	1.84	2.35E-04	5.00	5.13E-04	6.90	1.04E-04	0.76	5.89E-05
50	1998	1.80	2.30E-04	5.00	5.13E-04	6.90	1.04E-04	0.76	5.89E-05
50	2003	1.45	1.85E-04	4.10	4.20E-04	5.55	1.03E-04	0.60	4.65E-05
50	2004	0.64	9.80E-05	3.27	3.34E-04	5.10	9.33E-05	0.43	3.36E-05
50	2005	0.37	6.90E-05	3.00	3.05E-04	4.95	9.67E-05	0.38	2.93E-05
50	2007	0.24	5.45E-05	2.86	2.90E-04	4.88	9.83E-05	0.35	2.72E-05
50	2020	0.10	4.00E-05	2.72	1.27E-04	4.80	1.00E-04	0.32	2.50E-05

*NOTE:

15	0 to 15 hp
25	16 to < 25 hp
50	25 to 50 hp

Composite Emission Factor = ZH + (DR * cumulative hours)

ZH - Zero hour

DR - Deterioration rate