

# **Appendix C**

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## **Emission Calculations**

## Summary of Operational Emissions under the Shoreline Plan Alternatives

### Net Change in Mobile-Source Emissions under Alternative 1

<u>Emissions Source</u>	Peak-Day Emissions (lb/day)					<u>units</u>	<u>source</u>
	<u>NOx</u>	<u>ROG</u>	<u>CO</u>	<u>PM10</u>	<u>PM2.5</u>		
Existing Boating Activity (2017)	322	1,376	5,536	90	68	lb/day	wksht: WC Emiss Inventory CA
Boating Activity in 2040	270	610	5,485	43	32	lb/day	wksht: WC Emiss Inventory CA
Increased On-Road Vehicle Travel	1.0	0.7	10.2	1.2	0.5	lb/day	wksht: On-Rd Veh Emiss
Net Change	-51	-765	-41	-46	-36	lb/day	calculation

### Net Change in Mobile-Source Emissions under Alternative 2

<u>Emissions Source</u>	Peak-Day Emissions (lb/day)					<u>units</u>	<u>source</u>
	<u>NOx</u>	<u>ROG</u>	<u>CO</u>	<u>PM10</u>	<u>PM2.5</u>		
Existing Boating Activity (2017)	322	1,376	5,536	90	68	lb/day	wksht: WC Emiss Inventory CA
Boating Activity in 2040	344	777	6,980	54	40	lb/day	wksht: WC Emiss Inventory CA
Increased On-Road Vehicle Travel	4.3	2.9	44.0	5.0	2.0	lb/day	wksht: On-Rd Veh Emiss
Net Change	26	-597	1,488	-31	-26	lb/day	calculation

### Net Change in Mobile-Source Emissions under Alternative 3

<u>Emissions Source</u>	Peak-Day Emissions (lb/day)					<u>units</u>	<u>source</u>
	<u>NOx</u>	<u>ROG</u>	<u>CO</u>	<u>PM10</u>	<u>PM2.5</u>		
Existing Boating Activity (2017)	322	1,376	5,536	90	68	lb/day	wksht: WC Emiss Inventory CA
Boating Activity in 2040	249	562	5,051	39	29	lb/day	wksht: WC Emiss Inventory CA
Increased On-Road Vehicle Travel	0.7	0.5	6.8	0.8	0.3	lb/day	wksht: On-Rd Veh Emiss
Net Change	-72	-814	-478	-50	-39	lb/day	calculation

### Net Change in Mobile-Source Emissions under Alternative 4

<u>Emissions Source</u>	Peak-Day Emissions (lb/day)					<u>units</u>	<u>source</u>
	<u>NOx</u>	<u>ROG</u>	<u>CO</u>	<u>PM10</u>	<u>PM2.5</u>		
Existing Boating Activity (2017)	322	1,376	5,536	90	68	lb/day	wksht: WC Emiss Inventory CA
Boating Activity in 2040	240	542	4,872	38	28	lb/day	wksht: WC Emiss Inventory CA
Increased On-Road Vehicle Travel	0.0	0.0	0.0	0.0	0.0	lb/day	wksht: On-Rd Veh Emiss
Net Change	-82	-834	-664	-52	-40	lb/day	calculation

**Projections of Recreational Boat Emissions**

**Daily Emissions Inventory Projections for Recreational Boats in the Lake Tahoe Air Basin (without implementation of the Shoreline Plan)**

Calendar Year	Peak Summer Day (ton/day)					Average Annual Day (ton/day)				
	NOx	ROG	CO	PM10	PM2.5	NOx	ROG	CO	PM10	PM2.5
2017	0.161	0.688	2.768	0.045	0.034	0.115	0.490	1.977	0.032	0.024
2035	0.120	0.271	2.436	0.019	0.014	0.086	0.193	1.740	0.013	0.010

Source: California Air Resources Board. 2017. CEPAM: 2016 SIP - Standard Emission Tool, Emission Projections By Summary Category, Base Year: 2012. Available: <https://www.arb.ca.gov/app/emsinv/fcemsumcat/fcemsumcat2016.php>. Accessed January 25, 2018. Web page last updated February 15, 2017.

**Notes**

- 1 This emissions inventory only accounts for boats registered in the California side of the Lake Tahoe Air Basin. Emission projections for future years take into account the projected increase in boat ownership in California, the turnover in the fleet of recreational boats over time, and the more stringent emissions standards to which new model-year recreational boats will be subject over time.
- 2 These emission projections do not account for boats registered in Nevada or other places outside of California.

**Daily Emissions Inventory Projections for Recreational Boats in the Lake Tahoe Air Basin (without implementation of the Shoreline Plan)**

Calendar Year	Peak Summer Day (lb/day)				
	NOx	ROG	CO	PM10	PM2.5
2017	322	1,376	5,536	90	68
2035	240	542	4,872	38	28

Source: mass conversion calculation

	value	units	source	Annual Emissions Inventory Projections for Recreational Boats in the Lake Tahoe Air Basin					
				Annual Emissions (ton/year)					
				Calendar Year	NOx	ROG	CO	PM10	PM2.5
mass conversion rate	2,000	lb/ton	wksh: Conv Rts	2017	42.0	178.9	721.6	11.7	8.8
time conversion rate	365	days/year	wksh: Conv Rts	2035	31.4	70.4	635.1	4.7	3.7

Source: calculation using time conversion rate

**Growth in Boating Activity under the Shoreline Plan Alternatives (Baseline to 2040)**

	Peak Day	Annual
	(summer)	
Baseline + Alternative 1	12.6%	15.9%
Baseline + Alternative 2	43.3%	51.7%
Baseline + Alternative 3	3.7%	3.7%
Baseline + Alternative 4	0.0%	0.0%

Source: wksh: WC Activity Levels

**Adjusted Emissions Inventory Projections for Recreational Boats in the Lake Tahoe Air Basin, 2035**

Buildout Scenario	Daily, Summer (ton/day)					CO2e	Annual Emissions (ton/year)				
	NOx	ROG	CO	PM10	PM2.5		NOx	ROG	CO	PM10	PM2.5
Alternative 1 in 2035	270	610	5,485	43	32	35.3	79.3	715.0	5.3	4.1	
Alternative 2 in 2035	344	777	6,980	54	40	45.0	100.9	909.9	6.8	5.2	
Alternative 3 in 2035	249	562	5,051	39	29	32.5	73.0	658.5	4.9	3.8	
Alternative 4 in 2035	240	542	4,872	38	28	31.4	70.4	635.1	4.7	3.7	

Source: These values are based on calculations that incorporate the additional growth in boating activity under the Shoreline Plan Alternatives (Baseline to 2040)

**Change from Baseline to 2035 with Growth in Boating Activity Under Shoreline Plan Alternatives, California Side Only**

Buildout Scenario	Summer Peak Day (lb/day)					CO2e	Annual Emissions (ton/year)				
	NOx	ROG	CO	PM10	PM2.5		NOx	ROG	CO	PM10	PM2.5
Baseline + Alternative 1	-52	-766	-51	-47	-36	-6.6	-99.5	-6.6	-6.3	-4.7	
Baseline + Alternative 2	22	-599	1,444	-36	-28	3.0	-77.9	188.3	-4.9	-3.5	
Baseline + Alternative 3	-73	-814	-485	-51	-39	-9.4	-105.8	-63.1	-6.8	-5.0	
Baseline + Alternative 4	-82	-834	-664	-52	-40	-10.6	-108.4	-86.5	-6.9	-5.1	

## Boating Activity Levels

	Peak-Day Boating Activity		Annual Boating Activity	
	boat-hr/day	% change	boat-hr/yr	% change
Baseline Conditions	12,521	—	489,155	—
Baseline + Alternative 1	14,096	12.6%	566,814	16%
Baseline + Alternative 2	17,939	43.3%	742,260	52%
Baseline + Alternative 3	12,982	3.7%	507,368	4%
Baseline + Alternative 4	12,521	0.0%	489,155	0%

Source: Values from Project Description, Table 2-3; % change based on calculations

	Peak-Day Boating Activity		Annual Boating Activity	
	boat-hr/day	% change	boat-hr/yr	% change
Cumulative + Alternative 1	14,549	16.2%	626,653	28%
Cumulative + Alternative 2	18,392	46.9%	808,317	65%
Cumulative + Alternative 3	13,435	7.3%	565,653	16%
Cumulative + Alternative 4	12,965	3.5%	545,885	12%

Source: Values from Project Description, Table 2-3; % change based on calculations

## On-Road Motor Vehicle Emissions

### On-Road Vehicle Activity Levels at Buildout (2040)

	Peak Day Activity			Annual Activity		
	VMT <i>mile/day</i>	Trips <i>trips/day</i>	Veh Involved <i>veh-days/day</i>	VMT <i>mile/year</i>	Trips <i>trips/year</i>	Veh Involved <i>veh-days/year</i>
Alternative 1	11,368	632	316	373,841	20,769	10,385
Alternative 2	49,007	2,723	1,362	1,662,124	92,340	46,170
Alternative 3	7,613	423	212	299,771	16,654	8,327
Alternative 4	0	0	0	0	0	0

#### Notes/Sources

- 1 On-road vehicle activity was determined by the traffic analysis.
- 2 The number of trips and VMT for Alternative 4 is zero
- 3 The estimates of VMT only include travel in the Tahoe Basin (both the California and Nevada sides). Some trips may include additional travel outside of the Lake Tahoe Basin; however, there is no reliable method for estimating this amount of travel.
- 4 It is conservatively assumed there is one vehicle-day associated for every two trips: 2

### Composite Emission Factors for On-Road Vehicles, 2040

<u>ROG</u>	<u>CO</u>	<u>NOx</u>	<u>CO2</u>	<u>PM10</u>	<u>PM2.5</u>	<u>units</u>
0.0272	0.4073	0.0402	213.7683	0.0463	0.0189	<i>g/mile</i>

Source: wksht On-Rd Comp Emfacs 2017

### Peak-Day Emissions from On-Road Motor Vehicle Activity

	<u>ROG</u>	<u>CO</u>	<u>NOx</u>	<u>CO2</u>	<u>PM10</u>	<u>PM2.5</u>
units:	<i>lb/day</i>	<i>lb/day</i>	<i>lb/day</i>	<i>lb/day</i>	<i>lb/day</i>	<i>lb/day</i>
Alternative 1	0.7	10.2	1.0	5,357	1.2	0.5
Alternative 2	2.9	44.0	4.3	23,096	5.0	2.0
Alternative 3	0.5	6.8	0.7	3,588	0.8	0.3
Alternative 4	0.0	0.0	0.0	0	0.0	0.0

Source: calculation, and conversion calculation for totals

	<u>value</u>	<u>units</u>	<u>source</u>
mass conversion rate	453.59	<i>g/lb</i>	wksht: Conversion Rates
mass conversion rate	907,185	<i>g/ton</i>	wksht: Conversion Rates
mass conversion rate	1,000,000	<i>g/MT</i>	wksht: Conversion Rates

### Annual Emissions from On-Road Motor Vehicle Activity

	<u>ROG</u>	<u>CO</u>	<u>NOx</u>	<u>CO2</u>	<u>PM10</u>	<u>PM2.5</u>
units:	<i>ton/year</i>	<i>ton/year</i>	<i>ton/year</i>	<i>MT/year</i>	<i>ton/year</i>	<i>ton/year</i>
Alternative 1	0.001	0.009	0.001	4.4	0.001	0.0004
Alternative 2	0.003	0.041	0.004	19.7	0.005	0.002
Alternative 3	0.0005	0.007	0.001	3.6	0.001	0.0003
Alternative 4	0.000	0.000	0.000	0.0	0.000	0.000

## On-Road Mobile-Source Emission Rates, Lake Tahoe Air Basin, 2017, Annual

Vehicle Model Year: Aggregated

Speed: Aggregated

Fleet: Heavy trucks are not included. Only passenger vehicles and typically sized trucks used for towing are included.

### EMFAC Output

VehClass	Fuel	Population	VMT	Trips	ROG_RUNEX	ROG_IDLEX	ROG_STREX	ROG_HOTSOAK	ROG_RUNLOSS	ROG_RESTLOSS	ROG_DIURN	CO_RUNEX
<i>g/trip</i>	<i>n/a</i>	<i>#</i>	<i>miles/day</i>	<i>trips/day</i>	<i>g/mile</i>	<i>g/veh/day</i>	<i>g/trip</i>	<i>g/trip</i>	<i>g/trip</i>	<i>g/veh/day</i>	<i>g/veh/day</i>	<i>g/mile</i>
LDA	GAS	8,935	372,838	55,160	0.0318	0	0.353171108	0.230258109	0.514336101	0.125662844	0.219636582	1.291122333
LDA	DSL	105	4,288	625	0.0472	0	0	0	0	0	0	0.439112971
LDA	ELEC	60	3,879	392	0.0000	0	0	0.004883985	0	0.00127348	0.006411651	0
LDT1	GAS	1,724	46,629	9,860	0.1189	0	0.979415379	0.604338592	2.588927553	0.334944841	0.620418192	4.565728647
LDT1	DSL	9	185	49	0.1566	0	0	0	0	0	0	1.061633991
LDT1	ELEC	0	7	1	0.0000	0	0	0.004883985	0	0.001407833	0.006970088	0
LDT2	GAS	6,396	231,756	39,368	0.0403	0	0.462177743	0.256533063	1.036879283	0.141709528	0.244389797	1.787598832
LDT2	DSL	9	429	59	0.0296	0	0	0	0	0	0	0.253098339
LHDT1	GAS	798	25,318	11,892	0.2368	0.366328368	0.832839354	0.224828126	2.364162651	0.017134218	0.041615326	5.841820536
LHDT1	DSL	707	25,492	8,887	0.2475	0.109759705	0	0	0	0	0	1.18997743
MDV	GAS	5,253	151,853	31,899	0.0861	0	0.848753243	0.305563938	1.171629401	0.170517079	0.282977059	3.095381824
MDV	DSL	41	1,679	249	0.0296	0	0	0	0	0	0	0.354709501

Source: wksht EMFAC Output 2017

Totals: 24,037 864,353 158,440

### Composite Emission Factors (for all vehicle types)

ROG_RUNEX	ROG_IDLEX	ROG_STREX	ROG_HOTSOAK	ROG_RUNLOSS	ROG_RESTLOSS	ROG_DIURN	CO_RUNEX
<i>g/mile</i>	<i>g/veh/day</i>	<i>g/trip</i>	<i>g/trip</i>	<i>g/trip</i>	<i>g/veh/day</i>	<i>g/veh/day</i>	<i>g/mile</i>
0.0606	0.0154	0.5321	0.2599	1.0111	0.1463	0.2544	2.0358

Source: calculations of weighted averages based on VMT/day, trips/day, or vehicle population

### Composite Emission Factors by Activity

	<u>units</u>	<u>ROG</u>	<u>CO</u>	<u>NOx</u>	<u>CO2</u>	<u>PM10</u>	<u>PM2.5</u>	<u>Crosscheck</u>
Combined per-VMT emissions	<i>g/mile</i>	0.0606	2.0358	0.3941	421.3050	0.0514	0.0227	522.5941
Combined per-trip emissions	<i>g/trip</i>	1.8032	6.5458	0.5632	81.1561	0.0037	0.0034	522.5941
Combined per-vehicle emissions	<i>g/vehicle/day</i>	0.4161	0.1293	0.0771	8.0249	0.0008	0.0008	100%

	<u>value</u>	<u>units</u>	<u>source</u>
average trip length	18.0	miles/trip	traffic analysis
trips/vehicle-day	2.0	trips/veh-day	assumption

### Composite Emission Factors by VMT

<u>units</u>	<u>ROG</u>	<u>CO</u>	<u>NOx</u>	<u>CO2</u>	<u>PM10</u>	<u>PM2.5</u>
<i>g/mile</i>	0.1724	2.4030	0.4276	426.0366	0.0517	0.0229

CO_IDLEX g/veh/day	CO_STREX g/trip	NOx_RUNEX g/mile	NOx_IDLEX g/veh/day	NOx_STREX g/trip	CO2_RUNEX g/mile	CO2_IDLEX g/veh/day	CO2_STREX g/trip	PM10_RUNEX g/mile	PM10_IDLEX g/veh/day	PM10_STREX g/trip	PM10_PMTW g/mile	PM10_PMBW g/mile
0	4.363466671	0.113910881	0	0.240181168	313.7298491	0	68.43448319	0.002418379	0	0.003720246	0.008000002	0.036750011
0	0	0.375150477	0	0	307.1698906	0	0	0.028081844	0	0	0.008000002	0.036750011
0	0	0	0	0	0	0	0	0	0	0	0.008000002	0.036750011
0	12.94182385	0.351848518	0	0.50632854	382.4119858	0	82.67965401	0.005248641	0	0.00828378	0.008000002	0.036750011
0	0	1.515513989	0	0	417.0373874	0	0	0.116842267	0	0	0.008000002	0.036750011
0	0	0	0	0	0	0	0	0	0	0	0.008000002	0.036750011
0	6.079700097	0.236992046	0	0.48213137	442.5901878	0	94.86546905	0.002259321	0	0.003125777	0.008000002	0.036750011
0	0	0.161218747	0	0	405.2302925	0	0	0.011717307	0	0	0.008000002	0.036750011
3.088080379	9.78046243	0.80102933	0.030549792	2.252852235	854.9339484	116.3298466	55.32392233	0.004567481	0	0.002954897	0.008000002	0.076440022
0.909745076	0	5.373113546	2.589759138	0	592.0324304	141.5938488	0	0.050569854	0.028549406	0	0.012000003	0.076440022
0	9.817831107	0.444189451	0	0.790892706	576.9103194	0	121.5026568	0.002716839	0	0.004195028	0.008000002	0.036750011
0	0	0.130438166	0	0	518.3569959	0	0	0.015444068	0	0	0.008000002	0.036750011

CO_IDLEX g/veh/day	CO_STREX g/trip	NOx_RUNEX g/mile	NOx_IDLEX g/veh/day	NOx_STREX g/trip	CO2_RUNEX g/mile	CO2_IDLEX g/veh/day	CO2_STREX g/trip	PM10_RUNEX g/mile	PM10_IDLEX g/veh/day	PM10_STREX g/trip	PM10_PMTW g/mile	PM10_PMBW g/mile
0.1293	6.5458	0.3941	0.0771	0.5632	421.3050	8.0249	81.1561	0.0042	0.0008	0.0037	0.0081	0.0391

Crosscheck Okay

PM2_5_RUNEX	PM2_5_IDLEX	PM2_5_STREX	PM2_5_PMTW	PM2_5_PMBW
<i>g/mile</i>	<i>g/veh/day</i>	<i>g/trip</i>	<i>g/mile</i>	<i>g/mile</i>
0.002225493	0	0.003429893	0.002000001	0.015750005
0.026867036	0	0	0.002000001	0.015750005
0	0	0	0.002000001	0.015750005
0.004835478	0	0.007651451	0.002000001	0.015750005
0.111787722	0	0	0.002000001	0.015750005
0	0	0	0.002000001	0.015750005
0.002078156	0	0.002877436	0.002000001	0.015750005
0.011210421	0	0	0.002000001	0.015750005
0.004202226	0	0.002721879	0.002000001	0.032760009
0.048382224	0.027314371	0	0.003000001	0.032760009
0.002500694	0	0.003865625	0.002000001	0.015750005
0.014775965	0	0	0.002000001	0.015750005

PM2_5_RUNEX	PM2_5_IDLEX	PM2_5_STREX	PM2_5_PMTW	PM2_5_PMBW
<i>g/mile</i>	<i>g/veh/day</i>	<i>g/trip</i>	<i>g/mile</i>	<i>g/mile</i>
0.0040	0.0008	0.0034	0.0020	0.0167



EMFAC2014 (v1.0.7) Emission Rates

Region Type: Air Basin

Region: Lake Tahoe

Calendar Year: 2017

Season: Annual

Vehicle Classification: EMFAC2007 Categories

Units: miles/day for VMT, trips/day for Trips, g/mile for RUNEX, PMBW and PMTW, g/trip for STREX, HTSK and RUNLS, g/vehicle/day for IDLEX, RESTL and DIURI

Region	CalYr	VehClass	MdlYr	Speed	Fuel	Population	VMT	Trips	ROG_RUNE	ROG_IDLE	ROG_STRE	ROG_HOTS	ROG_RUNI
Lake Tahoe	2017	HHDT	Aggregate	Aggregate	GAS	6.337695	673.4604	126.8046	1.138093	0	3.044436	0.116408	0.513289
Lake Tahoe	2017	HHDT	Aggregate	Aggregate	DSL	181.7022	20152.32	0	0.166868	3.006841	0	0	0
Lake Tahoe	2017	LDA	Aggregate	Aggregate	GAS	8935.03	372837.6	55159.62	0.031783	0	0.353171	0.230258	0.514336
Lake Tahoe	2017	LDA	Aggregate	Aggregate	DSL	104.7788	4288.205	625.3244	0.047185	0	0	0	0
Lake Tahoe	2017	LDA	Aggregate	Aggregate	ELEC	60.31106	3878.763	391.5045	0	0	0	0.004884	0
Lake Tahoe	2017	LDT1	Aggregate	Aggregate	GAS	1723.549	46628.84	9859.765	0.118862	0	0.979415	0.604339	2.588928
Lake Tahoe	2017	LDT1	Aggregate	Aggregate	DSL	9.297967	184.7388	48.61327	0.156631	0	0	0	0
Lake Tahoe	2017	LDT1	Aggregate	Aggregate	ELEC	0.143854	7.29612	0.903489	0	0	0	0.004884	0
Lake Tahoe	2017	LDT2	Aggregate	Aggregate	GAS	6395.559	231755.8	39368.4	0.04026	0	0.462178	0.256533	1.036879
Lake Tahoe	2017	LDT2	Aggregate	Aggregate	DSL	9.456142	428.8747	59.08469	0.029616	0	0	0	0
Lake Tahoe	2017	LHDT1	Aggregate	Aggregate	GAS	798.194	25318.07	11891.9	0.236842	0.366328	0.832839	0.224828	2.364163
Lake Tahoe	2017	LHDT1	Aggregate	Aggregate	DSL	706.5285	25491.94	8887.239	0.24753	0.10976	0	0	0
Lake Tahoe	2017	LHDT2	Aggregate	Aggregate	GAS	70.56562	2623.544	1051.323	0.180439	0.37288	0.687539	0.170915	1.850871
Lake Tahoe	2017	LHDT2	Aggregate	Aggregate	DSL	183.9437	7440.013	2313.78	0.198928	0.10976	0	0	0
Lake Tahoe	2017	MCY	Aggregate	Aggregate	GAS	1014.064	7365.376	2027.925	3.343116	0	3.647633	0.882014	4.07339
Lake Tahoe	2017	MDV	Aggregate	Aggregate	GAS	5253.486	151853.2	31898.77	0.086094	0	0.848753	0.305564	1.171629
Lake Tahoe	2017	MDV	Aggregate	Aggregate	DSL	40.62431	1679.293	249.3701	0.029586	0	0	0	0
Lake Tahoe	2017	MH	Aggregate	Aggregate	GAS	203.5937	1685.875	20.36751	0.667411	0	1.362611	0.154295	4.453634
Lake Tahoe	2017	MH	Aggregate	Aggregate	DSL	49.08579	474.5728	4.908579	0.168215	0	0	0	0
Lake Tahoe	2017	MHDT	Aggregate	Aggregate	GAS	53.26957	2478.714	1065.818	0.389013	0.774178	1.830951	0.174515	1.117009
Lake Tahoe	2017	MHDT	Aggregate	Aggregate	DSL	309.5568	14525.27	0	0.251898	0.095467	0	0	0
Lake Tahoe	2017	OBUS	Aggregate	Aggregate	GAS	23.41876	1392.764	468.5626	0.28244	0.588186	1.250212	0.048271	0.670983
Lake Tahoe	2017	OBUS	Aggregate	Aggregate	DSL	16.6943	1697.462	0	0.218444	1.600826	0	0	0
Lake Tahoe	2017	SBUS	Aggregate	Aggregate	GAS	3.443281	171.6206	13.77313	0.607268	8.036486	4.297506	0.274874	3.296407
Lake Tahoe	2017	SBUS	Aggregate	Aggregate	DSL	16.88823	643.5279	0	0.195928	0.400806	0	0	0
Lake Tahoe	2017	UBUS	Aggregate	Aggregate	GAS	1.570819	255.4441	6.283276	5.673616	0	7.148466	0.59695	3.895702
Lake Tahoe	2017	UBUS	Aggregate	Aggregate	DSL	8.902789	1337.305	35.61115	1.317661	0	0	0	0

N

ROG_REST	ROG_DIUR	TOG_RUNE	TOG_IDLEX	TOG_STRE	TOG_HOTS	TOG_RUNL	TOG_REST	TOG_DIUR	CO_RUNEX	CO_IDLEX	CO_STREX	NOx_RUNE	NOx_IDLEX
0.009781	0.018349	1.658826	0	3.333025	0.116408	0.513289	0.009781	0.018349	36.6101	0	56.84895	6.147946	0
0	0	0.189966	3.423059	0	0	0	0	0	0.683373	10.72256	0	5.569062	89.04985
0.125663	0.219637	0.04382	0	0.38636	0.230258	0.514336	0.125663	0.219637	1.291122	0	4.363467	0.113911	0
0	0	0.053717	0	0	0	0	0	0	0.439113	0	0	0.37515	0
0.001273	0.006412	0	0	0	0.004884	0	0.001273	0.006412	0	0	0	0	0
0.334945	0.620418	0.161753	0	1.071128	0.604339	2.588928	0.334945	0.620418	4.565729	0	12.94182	0.351849	0
0	0	0.178314	0	0	0	0	0	0	1.061634	0	0	1.515514	0
0.001408	0.00697	0	0	0	0.004884	0	0.001408	0.00697	0	0	0	0	0
0.14171	0.24439	0.057727	0	0.505907	0.256533	1.036879	0.14171	0.24439	1.787599	0	6.0797	0.236992	0
0	0	0.033716	0	0	0	0	0	0	0.253098	0	0	0.161219	0
0.017134	0.041615	0.340941	0.534059	0.911637	0.224828	2.364163	0.017134	0.041615	5.841821	3.08808	9.780462	0.801029	0.03055
0	0	0.281796	0.124954	0	0	0	0	0	1.189977	0.909745	0	5.373114	2.589759
0.014126	0.034229	0.263203	0.544095	0.752764	0.170915	1.850871	0.014126	0.034229	4.703894	3.135005	8.411258	0.537939	0.031139
0	0	0.226466	0.124954	0	0	0	0	0	0.948805	0.909745	0	3.593752	2.582176
0.378446	0.841185	3.929214	0	3.962429	0.882014	4.07339	0.378446	0.841185	29.4923	0	13.75312	1.305291	0
0.170517	0.282977	0.120633	0	0.928905	0.305564	1.171629	0.170517	0.282977	3.095382	0	9.817831	0.444189	0
0	0	0.033682	0	0	0	0	0	0	0.35471	0	0	0.130438	0
0.033232	0.096932	0.866525	0	1.487307	0.154295	4.453634	0.033232	0.096932	27.4262	0	22.38151	1.424253	0
0	0	0.191501	0	0	0	0	0	0	0.64718	0	0	6.754573	0
0.016201	0.036479	0.553278	1.122573	2.00233	0.174515	1.117009	0.016201	0.036479	10.46763	12.46573	32.70932	2.07742	0.064676
0	0	0.286767	0.108682	0	0	0	0	0	0.687937	0.907747	0	4.199845	6.919342
0.013647	0.034412	0.397873	0.851657	1.366063	0.048271	0.670983	0.013647	0.034412	7.573834	4.866309	20.92485	1.592827	0.048842
0	0	0.248682	1.822418	0	0	0	0	0	0.712301	7.107771	0	6.362114	58.97624
0.017919	0.057483	0.886124	11.72682	4.705228	0.274874	3.296407	0.017919	0.057483	17.26033	67.29587	113.3547	3.16424	0.680591
0	0	0.223049	0.456287	0	0	0	0	0	0.516565	3.131238	0	8.798037	50.10823
0.025913	0.049597	8.266338	0	7.826211	0.59695	3.895702	0.025913	0.049597	49.76031	0	157.3319	2.771925	0
0	0	3.937149	0	0	0	0	0	0	12.07291	0	0	23.60308	0

NOx_STRE	CO2_RUNE	CO2_IDLE	CO2_STRE	PM10_RUN	PM10_IDLE	PM10_STR	PM10_PM	PM10_PMI	PM2_5_RU	PM2_5_IDI	PM2_5_ST	PM2_5_PN	PM2_5_PN
6.920416	1865.256	0	147.87	0.000923	0	0.001493	0.02	0.06174	0.000849	0	0.001376	0.005	0.02646
0	1672.217	14957.15	0	0.045161	0.233455	0	0.035611	0.061072	0.043207	0.223356	0	0.008903	0.026174
0.240181	313.7298	0	68.43448	0.002418	0	0.00372	0.008	0.03675	0.002225	0	0.00343	0.002	0.01575
0	307.1699	0	0	0.028082	0	0	0.008	0.03675	0.026867	0	0	0.002	0.01575
0	0	0	0	0	0	0	0.008	0.03675	0	0	0	0.002	0.01575
0.506329	382.412	0	82.67965	0.005249	0	0.008284	0.008	0.03675	0.004835	0	0.007651	0.002	0.01575
0	417.0374	0	0	0.116842	0	0	0.008	0.03675	0.111788	0	0	0.002	0.01575
0	0	0	0	0	0	0	0.008	0.03675	0	0	0	0.002	0.01575
0.482131	442.5902	0	94.86547	0.002259	0	0.003126	0.008	0.03675	0.002078	0	0.002877	0.002	0.01575
0	405.2303	0	0	0.011717	0	0	0.008	0.03675	0.01121	0	0	0.002	0.01575
2.252852	854.9339	116.3298	55.32392	0.004567	0	0.002955	0.008	0.07644	0.004202	0	0.002722	0.002	0.03276
0	592.0324	141.5938	0	0.05057	0.028549	0	0.012	0.07644	0.048382	0.027314	0	0.003	0.03276
1.86298	957.4885	135.1709	65.42506	0.003371	0	0.002402	0.008	0.08918	0.0031	0	0.002209	0.002	0.03822
0	662.4718	226.5992	0	0.038177	0.027711	0	0.012	0.08918	0.036526	0.026512	0	0.003	0.03822
0.365888	171.6161	0	51.14069	0.002609	0	0.007266	0.004	0.01176	0.002471	0	0.006914	0.001	0.00504
0.790893	576.9103	0	121.5027	0.002717	0	0.004195	0.008	0.03675	0.002501	0	0.003866	0.002	0.01575
0	518.357	0	0	0.015444	0	0	0.008	0.03675	0.014776	0	0	0.002	0.01575
1.954183	1309.349	0	91.03887	0.005159	0	0.00465	0.012	0.13034	0.004784	0	0.00435	0.003	0.05586
0	1072.567	0	0	0.20181	0	0	0.016	0.13034	0.19308	0	0	0.004	0.05586
3.879376	1301.613	529.7898	122.8123	0.002458	0	0.004041	0.012	0.13034	0.002266	0	0.003755	0.003	0.05586
0	1219.941	697.4648	0	0.109348	0.027611	0	0.012	0.13034	0.104618	0.026417	0	0.003	0.05586
2.683701	1301.822	375.458	84.3191	0.001498	0	0.002539	0.012	0.13034	0.001383	0	0.002376	0.003	0.05586
0	1666.948	6677.697	0	0.049755	0.096214	0	0.012	0.13034	0.047603	0.092051	0	0.003	0.05586
5.099219	674.5143	2508.201	127.1327	0.004934	0	0.004879	0.008	0.7448	0.004537	0	0.004486	0.002	0.3192
0	1309.571	3748.232	0	0.079347	0.115285	0	0.012	0.7448	0.075914	0.110298	0	0.003	0.3192
4.730913	1702.003	0	309.1915	0.007665	0	0.009172	0.012	0.13034	0.007052	0	0.008437	0.003	0.05586
0	2365.997	0	0	0.388783	0	0	0.012	0.84182	0.371965	0	0	0.003	0.36078

SOx_RUNE	SOx_IDLEX	SOx_STREX
0.019241	0	0.002469
0.015954	0.142698	0
0.003153	0	0.000763
0.002932	0	0
0	0	0
0.003894	0	0.001061
0.003981	0	0
0	0	0
0.004448	0	0.001058
0.003869	0	0
0.008635	0.001225	0.000733
0.005652	0.001352	0
0.009639	0.001414	0.000808
0.006324	0.002163	0
0.002291	0	0.000846
0.005811	0	0.001395
0.004949	0	0
0.013525	0	0.001305
0.010239	0	0
0.013173	0.005517	0.0018
0.011639	0.006654	0
0.013125	0.003849	0.001211
0.015903	0.063708	0
0.007029	0.026435	0.00319
0.012494	0.03576	0
0.018011	0	0.005792
0.016875	0	0

## On-Road Mobile-Source Emission Rates, Lake Tahoe Air Basin, 2040, Annual

Vehicle Model Year: Aggregated

Speed: Aggregated

Fleet: Heavy trucks are not included. Only passenger vehicles and typically sized trucks used for towing are included.

### EMFAC Output

VehClass	Fuel	Population	VMT	Trips	ROG_RUNEX	ROG_IDLEX	ROG_STREX	ROG_HOTSOAK	ROG_RUNLOSS	ROG_RESTLOSS	ROG_DIURN	CO_RUNEX
<i>g/trip</i>	<i>n/a</i>	<i>#</i>	<i>miles/day</i>	<i>trips/day</i>	<i>g/mile</i>	<i>g/veh/day</i>	<i>g/trip</i>	<i>g/trip</i>	<i>g/trip</i>	<i>g/veh/day</i>	<i>g/veh/day</i>	<i>g/mile</i>
LDA	GAS	14,729	620,411	92,381	0.0042	0	0.017185372	0.043270996	0.166021478	0.022444033	0.030874079	0.338773541
LDA	DSL	203	8,617	1,274	0.0066	0	0	0	0	0	0	0.209482291
LDA	ELEC	2,521	111,681	16,008	0.0000	0	0	0.004883985	0	0.001272816	0.00640889	0
LDT1	GAS	933	37,653	5,709	0.0049	0	0.03802789	0.07807609	0.291193541	0.050177182	0.068717127	0.36352877
LDT1	DSL	1	24	5	0.0319	0	0	0	0	0	0	0.319222792
LDT1	ELEC	0	17	2	0.0000	0	0	0.004883985	0	0.001293652	0.006495494	0
LDT2	GAS	6,260	249,981	38,589	0.0057	0	0.038062195	0.069092657	0.268136911	0.0549843	0.072789303	0.452922185
LDT2	DSL	14	550	84	0.0210	0	0	0	0	0	0	0.212883201
LHDT1	GAS	192	5,742	2,865	0.0114	0.291751325	0.337185467	0.186923205	0.912433372	0.01436237	0.024505608	0.21609104
LHDT1	DSL	227	7,851	2,853	0.1513	0.109759705	0	0	0	0	0	0.727031286
MDV	GAS	3,894	117,148	22,478	0.0098	0	0.150459105	0.179003114	0.522280863	0.133850241	0.173592664	0.615076205
MDV	DSL	90	3,219	559	0.0077	0	0	0	0	0	0	0.23854819

Source: wksht EMFAC Output 2040

Totals: 29,064 1,162,892 182,807

### Composite Emission Factors (for all vehicle types)

ROG_RUNEX	ROG_IDLEX	ROG_STREX	ROG_HOTSOAK	ROG_RUNLOSS	ROG_RESTLOSS	ROG_DIURN	CO_RUNEX
<i>g/mile</i>	<i>g/veh/day</i>	<i>g/trip</i>	<i>g/trip</i>	<i>g/trip</i>	<i>g/veh/day</i>	<i>g/veh/day</i>	<i>g/mile</i>
0.0058	0.0028	0.0417	0.0643	0.2281	0.0430	0.0575	0.3601

Source: calculations of weighted averages based on VMT/day, trips/day, or vehicle population

### Composite Emission Factors by Activity

	<u>units</u>	<u>ROG</u>	<u>CO</u>	<u>NOx</u>	<u>CO2</u>	<u>PM10</u>	<u>PM2.5</u>	<u>Crosscheck</u>
Combined per-VMT emissions	<i>g/mile</i>	0.0058	0.3601	0.0363	211.2082	0.0462	0.0188	260.0112
Combined per-trip emissions	<i>g/trip</i>	0.3341	0.8345	0.0640	45.2072	0.0012	0.0011	260.0112
Combined per-vehicle emissions	<i>g/vehicle/day</i>	0.1033	0.0275	0.0121	1.7507	0.0001	0.0001	100%

	<u>value</u>	<u>units</u>	<u>source</u>
average trip length	18.0	miles/trip	traffic analysis
trips/vehicle-day	2.0	tirps/veh-day	assumption

### Composite Emission Factors by VMT

<u>units</u>	<u>ROG</u>	<u>CO</u>	<u>NOx</u>	<u>CO2</u>	<u>PM10</u>	<u>PM2.5</u>
<i>g/mile</i>	0.0272	0.4073	0.0402	213.7683	0.0463	0.0189

CO_IDLEX g/veh/day	CO_STREX g/trip	NOx_RUNEX g/mile	NOx_IDLEX g/veh/day	NOx_STREX g/trip	CO2_RUNEX g/mile	CO2_IDLEX g/veh/day	CO2_STREX g/trip	PM10_RUNEX g/mile	PM10_IDLEX g/veh/day	PM10_STREX g/trip	PM10_PMTW g/mile	PM10_PMBW g/mile
0	0.600171019	0.02604778	0	0.019831341	199.2018644	0	42.65737326	0.000917103	0	0.001260468	0.008000002	0.036750011
0	0	0.012522845	0	0	194.6015216	0	0	0.000983792	0	0	0.008000002	0.036750011
0	0	0	0	0	0	0	0	0	0	0	0.008000002	0.036750011
0	0.864467749	0.029501919	0	0.036847273	214.6901068	0	47.60634747	0.000929233	0	0.001345701	0.008000002	0.036750011
0	0	0.270476208	0	0	237.9582649	0	0	0.012741548	0	0	0.008000002	0.036750011
0	0	0	0	0	0	0	0	0	0	0	0.008000002	0.036750011
0	0.895490639	0.033319778	0	0.043744606	250.7791232	0	55.19290863	0.000926782	0	0.001297055	0.008000002	0.036750011
0	0	0.038372929	0	0	244.2251436	0	0	0.004809892	0	0	0.008000002	0.036750011
3.077494475	3.164655609	0.150260906	0.026349652	1.55362347	804.7505374	111.5846389	55.85408463	0.002093301	0	0.001249903	0.008000002	0.076440022
0.909745076	0	1.14043054	1.527658311	0	528.8465454	129.7223706	0	0.016744719	0.017407846	0	0.012000003	0.076440022
0	2.160248041	0.056169501	0	0.156878294	338.3762241	0	78.38096918	0.001034265	0	0.001579789	0.008000002	0.036750011
0	0	0.013510529	0	0	317.5881933	0	0	0.001278304	0	0	0.008000002	0.036750011

CO_IDLEX g/veh/day	CO_STREX g/trip	NOx_RUNEX g/mile	NOx_IDLEX g/veh/day	NOx_STREX g/trip	CO2_RUNEX g/mile	CO2_IDLEX g/veh/day	CO2_STREX g/trip	PM10_RUNEX g/mile	PM10_IDLEX g/veh/day	PM10_STREX g/trip	PM10_PMTW g/mile	PM10_PMBW g/mile
0.0275	0.8345	0.0363	0.0121	0.0640	211.2082	1.7507	45.2072	0.0010	0.0001	0.0012	0.0080	0.0372

Crosscheck Okay

PM2_5_RUNEX	PM2_5_IDLEX	PM2_5_STREX	PM2_5_PMTW	PM2_5_PMBW
<i>g/mile</i>	<i>g/veh/day</i>	<i>g/trip</i>	<i>g/mile</i>	<i>g/mile</i>
0.000843242	0	0.001158953	0.002000001	0.015750005
0.000941234	0	0	0.002000001	0.015750005
0	0	0	0.002000001	0.015750005
0.000854396	0	0.001237322	0.002000001	0.015750005
0.012190354	0	0	0.002000001	0.015750005
0	0	0	0.002000001	0.015750005
0.000852142	0	0.001192594	0.002000001	0.015750005
0.004601818	0	0	0.002000001	0.015750005
0.001924713	0	0.00114924	0.002000001	0.032760009
0.01602035	0.01665479	0	0.003000001	0.032760009
0.000950969	0	0.001452557	0.002000001	0.015750005
0.001223005	0	0	0.002000001	0.015750005

PM2_5_RUNEX	PM2_5_IDLEX	PM2_5_STREX	PM2_5_PMTW	PM2_5_PMBW
<i>g/mile</i>	<i>g/veh/day</i>	<i>g/trip</i>	<i>g/mile</i>	<i>g/mile</i>
0.0009	0.0001	0.0011	0.0020	0.0159

EMFAC2014 (v1.0.7) Emission Rates

Region Type: Air Basin

Region: Lake Tahoe

Calendar Year: 2040

Season: Annual

<https://www.arb.ca.gov/emfac/2014/>

Vehicle Classification: EMFAC2007 Categories

Units: miles/day for VMT, trips/day for Trips, g/mile for RUNEX, PMBW and PMTW, g/trip for STREX, HTSK and RUNLS, g/vehicle/day for IDLEX, RESTL and DIURI

Region	CalYr	VehClass	MdlYr	Speed	Fuel	Population	VMT	Trips	ROG_RUNE	ROG_IDLEX	ROG_STREX	ROG_HOTS	ROG_RUNI
Lake Tahoe	2040	HHDT	Aggregatec	Aggregatec	GAS	3.126938	373.5623	62.56377	0.331503	0	0.906498	0.079744	0.400309
Lake Tahoe	2040	HHDT	Aggregatec	Aggregatec	DSL	268.9877	32994.77	0	0.073522	1.240693	0	0	0
Lake Tahoe	2040	LDA	Aggregatec	Aggregatec	GAS	14729.17	620410.7	92381.13	0.004174	0	0.017185	0.043271	0.166021
Lake Tahoe	2040	LDA	Aggregatec	Aggregatec	DSL	202.5227	8616.505	1274.188	0.006556	0	0	0	0
Lake Tahoe	2040	LDA	Aggregatec	Aggregatec	ELEC	2521.181	111681	16008.15	0	0	0	0.004884	0
Lake Tahoe	2040	LDT1	Aggregatec	Aggregatec	GAS	932.8471	37652.68	5709.346	0.00487	0	0.038028	0.078076	0.291194
Lake Tahoe	2040	LDT1	Aggregatec	Aggregatec	DSL	0.921832	24.24532	4.862377	0.031925	0	0	0	0
Lake Tahoe	2040	LDT1	Aggregatec	Aggregatec	ELEC	0.387455	16.72668	2.434664	0	0	0	0.004884	0
Lake Tahoe	2040	LDT2	Aggregatec	Aggregatec	GAS	6259.739	249980.7	38588.64	0.005723	0	0.038062	0.069093	0.268137
Lake Tahoe	2040	LDT2	Aggregatec	Aggregatec	DSL	13.50262	550.1817	84.09248	0.021008	0	0	0	0
Lake Tahoe	2040	LHDT1	Aggregatec	Aggregatec	GAS	192.2911	5741.502	2864.85	0.011372	0.291751	0.337185	0.186923	0.912433
Lake Tahoe	2040	LHDT1	Aggregatec	Aggregatec	DSL	226.8211	7851.323	2853.125	0.15132	0.10976	0	0	0
Lake Tahoe	2040	LHDT2	Aggregatec	Aggregatec	GAS	30.90957	1361.274	460.5065	0.005968	0.218629	0.09381	0.044873	0.241223
Lake Tahoe	2040	LHDT2	Aggregatec	Aggregatec	DSL	77.82468	3394.63	978.9366	0.122884	0.10976	0	0	0
Lake Tahoe	2040	MCY	Aggregatec	Aggregatec	GAS	991.921	6680.808	1983.644	2.638985	0	2.986582	0.634087	1.29768
Lake Tahoe	2040	MDV	Aggregatec	Aggregatec	GAS	3893.859	117147.7	22477.97	0.009756	0	0.150459	0.179003	0.522281
Lake Tahoe	2040	MDV	Aggregatec	Aggregatec	DSL	90.29432	3218.57	558.6195	0.007735	0	0	0	0
Lake Tahoe	2040	MH	Aggregatec	Aggregatec	GAS	47.94036	486.0857	4.795953	0.01575	0	0.297233	0.036314	0.44681
Lake Tahoe	2040	MH	Aggregatec	Aggregatec	DSL	15.32224	148.7304	1.532224	0.095176	0	0	0	0
Lake Tahoe	2040	MHDT	Aggregatec	Aggregatec	GAS	52.15805	2829.467	1043.578	0.013993	0.786736	0.455472	0.075532	0.382798
Lake Tahoe	2040	MHDT	Aggregatec	Aggregatec	DSL	919.0016	37282.45	0	0.046091	0.016032	0	0	0
Lake Tahoe	2040	OBUS	Aggregatec	Aggregatec	GAS	15.75036	983.3668	315.1331	0.017442	0.590315	0.37302	0.023506	0.252744
Lake Tahoe	2040	OBUS	Aggregatec	Aggregatec	DSL	15.60043	2027.973	0	0.080674	0.80713	0	0	0
Lake Tahoe	2040	SBUS	Aggregatec	Aggregatec	GAS	4.742857	233.4546	18.97143	0.011356	8.291075	0.939918	0.065111	0.458662
Lake Tahoe	2040	SBUS	Aggregatec	Aggregatec	DSL	17.19808	611.601	0	0.058847	0.087473	0	0	0
Lake Tahoe	2040	UBUS	Aggregatec	Aggregatec	GAS	3.882165	662.5184	15.52866	0.022997	0	1.811585	0.08946	0.805445
Lake Tahoe	2040	UBUS	Aggregatec	Aggregatec	DSL	4.34164	726.5361	17.36656	0.162905	0	0	0	0



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ROG_REST	ROG_DIUR	TOG_RUNE	TOG_IDLEX	TOG_STRE	TOG_HOTS	TOG_RUNL	TOG_REST	TOG_DIUR	CO_RUNEX	CO_IDLEX	CO_STREX	NOx_RUNE	NOx_IDLEX
0.008274	0.013735	0.483728	0	0.992502	0.079744	0.400309	0.008274	0.013735	30.49822	0	52.70054	3.584459	0
0	0	0.0837	1.412435	0	0	0	0	0	0.432362	4.624384	0	1.315522	39.21756
0.022444	0.030874	0.006091	0	0.018816	0.043271	0.166021	0.022444	0.030874	0.338774	0	0.600171	0.026048	0
0	0	0.007463	0	0	0	0	0	0	0.209482	0	0	0.012523	0
0.001273	0.006409	0	0	0	0.004884	0	0.001273	0.006409	0	0	0	0	0
0.050177	0.068717	0.007106	0	0.041636	0.078076	0.291194	0.050177	0.068717	0.363529	0	0.864468	0.029502	0
0	0	0.036345	0	0	0	0	0	0	0.319223	0	0	0.270476	0
0.001294	0.006495	0	0	0	0.004884	0	0.001294	0.006495	0	0	0	0	0
0.054984	0.072789	0.008351	0	0.041673	0.069093	0.268137	0.054984	0.072789	0.452922	0	0.895491	0.03332	0
0	0	0.023916	0	0	0	0	0	0	0.212883	0	0	0.038373	0
0.014362	0.024506	0.016595	0.425723	0.369176	0.186923	0.912433	0.014362	0.024506	0.216091	3.077494	3.164656	0.150261	0.02635
0	0	0.172267	0.124954	0	0	0	0	0	0.727031	0.909745	0	1.140431	1.527658
0.0053	0.009133	0.008708	0.319023	0.10271	0.044873	0.241223	0.0053	0.009133	0.144193	3.155571	2.95093	0.045942	0.01964
0	0	0.139896	0.124954	0	0	0	0	0	0.554858	0.909745	0	0.170132	0.976517
0.321302	0.797584	3.296777	0	3.251464	0.634087	1.29768	0.321302	0.797584	20.53926	0	14.86578	1.263035	0
0.13385	0.173593	0.014236	0	0.164734	0.179003	0.522281	0.13385	0.173593	0.615076	0	2.160248	0.05617	0
0	0	0.008805	0	0	0	0	0	0	0.238548	0	0	0.013511	0
0.009895	0.020589	0.022982	0	0.325432	0.036314	0.44681	0.009895	0.020589	0.292871	0	5.227045	0.164145	0
0	0	0.108352	0	0	0	0	0	0	0.30647	0	0	3.211522	0
0.00781	0.013071	0.020418	1.148004	0.498685	0.075532	0.382798	0.00781	0.013071	0.273928	12.53091	7.171956	0.130205	0.070888
0	0	0.052471	0.018251	0	0	0	0	0	0.241864	0.120428	0	1.216905	1.77864
0.007045	0.014301	0.025451	0.861386	0.40841	0.023506	0.252744	0.007045	0.014301	0.34193	4.847041	6.36839	0.152217	0.052979
0	0	0.091842	0.918856	0	0	0	0	0	0.476251	2.987393	0	1.64583	24.69253
0.006599	0.013362	0.016571	12.09832	1.029092	0.065111	0.458662	0.006599	0.013362	0.195022	68.2562	22.38094	0.103179	0.745087
0	0	0.066992	0.099582	0	0	0	0	0	0.305891	0.655688	0	1.390593	9.51838
0.007662	0.010821	0.033558	0	1.983457	0.08946	0.805445	0.007662	0.010821	0.425944	0	23.87758	0.396692	0
0	0	0.824949	0	0	0	0	0	0	3.823393	0	0	3.406161	0

NOx_STRE	CO2_RUNE	CO2_IDLE	CO2_STRE	PM10_RUN	PM10_IDLE	PM10_STR	PM10_PM	PM10_PMI	PM2_5_RU	PM2_5_IDI	PM2_5_ST	PM2_5_PN	PM2_5_PN
3.926223	1610.498	0	128.2391	0.001144	0	0.001455	0.02	0.06174	0.001052	0	0.001338	0.005	0.02646
0	1452.252	13372.77	0	0.005154	0.006916	0	0.035479	0.060846	0.004931	0.006617	0	0.00887	0.026077
0.019831	199.2019	0	42.65737	0.000917	0	0.00126	0.008	0.03675	0.000843	0	0.001159	0.002	0.01575
0	194.6015	0	0	0.000984	0	0	0.008	0.03675	0.000941	0	0	0.002	0.01575
0	0	0	0	0	0	0	0.008	0.03675	0	0	0	0.002	0.01575
0.036847	214.6901	0	47.60635	0.000929	0	0.001346	0.008	0.03675	0.000854	0	0.001237	0.002	0.01575
0	237.9583	0	0	0.012742	0	0	0.008	0.03675	0.01219	0	0	0.002	0.01575
0	0	0	0	0	0	0	0.008	0.03675	0	0	0	0.002	0.01575
0.043745	250.7791	0	55.19291	0.000927	0	0.001297	0.008	0.03675	0.000852	0	0.001193	0.002	0.01575
0	244.2251	0	0	0.00481	0	0	0.008	0.03675	0.004602	0	0	0.002	0.01575
1.553623	804.7505	111.5846	55.85408	0.002093	0	0.00125	0.008	0.07644	0.001925	0	0.001149	0.002	0.03276
0	528.8465	129.7224	0	0.016745	0.017408	0	0.012	0.07644	0.01602	0.016655	0	0.003	0.03276
0.613442	877.7537	124.1847	64.73626	0.002187	0	0.001158	0.008	0.08918	0.002011	0	0.001064	0.002	0.03822
0	576.6894	199.737	0	0.010024	0.016741	0	0.012	0.08918	0.00959	0.016017	0	0.003	0.03822
0.358152	182.8879	0	43.70881	0.002539	0	0.003133	0.004	0.01176	0.002368	0	0.002929	0.001	0.00504
0.156878	338.3762	0	78.38097	0.001034	0	0.00158	0.008	0.03675	0.000951	0	0.001453	0.002	0.01575
0	317.5882	0	0	0.001278	0	0	0.008	0.03675	0.001223	0	0	0.002	0.01575
0.844552	1223.592	0	72.11977	0.001385	0	0.001116	0.012	0.13034	0.001274	0	0.001026	0.003	0.05586
0	1019.987	0	0	0.052616	0	0	0.016	0.13034	0.05034	0	0	0.004	0.05586
0.994399	1214.466	495.8463	108.0667	0.0014	0	0.001481	0.012	0.13034	0.001287	0	0.001362	0.003	0.05586
0	1156.003	628.507	0	0.003302	0.00018	0	0.012	0.13034	0.003159	0.000172	0	0.003	0.05586
0.983361	1214.671	352.0448	71.75234	0.001414	0	0.001127	0.012	0.13034	0.0013	0	0.001036	0.003	0.05586
0	1605.846	9607.097	0	0.004926	0.002381	0	0.012	0.13034	0.004713	0.002278	0	0.003	0.05586
0.985607	630.1938	2343.303	118.7746	0.001586	0	0.002597	0.008	0.7448	0.001458	0	0.002387	0.002	0.3192
0	1239.77	3404.552	0	0.003325	0.000758	0	0.012	0.7448	0.003181	0.000726	0	0.003	0.3192
2.826277	1610.62	0	291.6185	0.002374	0	0.003436	0.012	0.13034	0.002183	0	0.00316	0.003	0.05586
0	2099.39	0	0	0.024859	0	0	0.012	0.84182	0.023783	0	0	0.003	0.36078

SOx_RUNE	SOx_IDLEX	SOx_STREX
0.016568	0	0.002137
0.013855	0.127582	0
0.001994	0	0.000436
0.001858	0	0
0	0	0
0.002149	0	0.00049
0.002272	0	0
0	0	0
0.002511	0	0.000566
0.002332	0	0
0.008037	0.001175	0.000618
0.005049	0.001238	0
0.008764	0.001298	0.000696
0.005505	0.001907	0
0.002245	0	0.000768
0.003388	0	0.000821
0.003032	0	0
0.012219	0	0.000812
0.009737	0	0
0.012127	0.00518	0.001206
0.011029	0.005996	0
0.012131	0.003615	0.000828
0.015321	0.091656	0
0.006294	0.024815	0.001568
0.011828	0.032481	0
0.016084	0	0.003346
0.017059	0	0

EMFAC201 1 Veh & Tech	EMFAC201 1 Vehicle	Description	Source	EMFAC200 7 Vehicle	EMFAC200 7 Vehicle Code	Truck / Non-Truck Category	Truck 1 / Truck 2 / Non-Truck Category
LDA - DSL	LDA	Passenger Cars	EMFAC201 1-LDV	LDA	PC	Non-Trucks	Non-Trucks
LDA - GAS			EMFAC201 1-LDV			Non-Trucks	Non-Trucks
LDT1 - DSL	LDT1	Light-Duty Trucks (GVWR <6000 lbs. and ETW <= 3750 lbs)	EMFAC201 1-LDV	LDT1	T1	Non-Trucks	Non-Trucks
LDT1 - GAS			EMFAC201 1-LDV			Non-Trucks	Non-Trucks
LDT2 - DSL	LDT2	Light-Duty Trucks (GVWR <6000 lbs. and ETW 3751- 5750 lbs)	EMFAC201 1-LDV	LDT2	T2	Non-Trucks	Non-Trucks
LDT2 - GAS			EMFAC201 1-LDV			Non-Trucks	Non-Trucks
LHD1 - DSL	LHD1	Light-Heavy-Duty Trucks (GVWR 8501-10000 lbs)	EMFAC201 1-LDV	LHDT1	T4	Trucks	Truck 1
LHD1 - GAS			EMFAC201 1-LDV			Trucks	Truck 1
LHD2 - DSL	LHD2	Light-Heavy-Duty Trucks (GVWR 10001-14000 lbs)	EMFAC201 1-LDV	LHDT2	T5	Trucks	Truck 1
LHD2 - GAS			EMFAC201 1-LDV			Trucks	Truck 1
MCY - GAS	MCY	Motorcycles	EMFAC201 1-LDV	MCY	MC	Non-Trucks	Non-Trucks
MDV - DSL	MDV	Medium-Duty Trucks (GVWR 6000-8500 lbs)	EMFAC201 1-LDV	MDV	T3	Non-Trucks	Non-Trucks
MDV - GAS			EMFAC201 1-LDV			Non-Trucks	Non-Trucks
MH - DSL	MH	Motor Homes	EMFAC201 1-LDV	MH	MH	Non-Trucks	Non-Trucks
MH - GAS			EMFAC201 1-LDV			Non-Trucks	Non-Trucks
T6 Ag - DSL	T6 Ag	Medium-Heavy Duty Diesel Agriculture Truck	EMFAC201 1-HD	MHDT	T6	Trucks	Truck 2
T6 CAIRP heavy - DSL	T6 CAIRP heavy	Medium-Heavy Duty Diesel CA International Registration Plan Truck with GVWR>26000 lbs	EMFAC201 1-HD			Trucks	Truck 2
T6 CAIRP small - DSL	T6 CAIRP small	Medium-Heavy Duty Diesel CA International Registration Plan Truck with GVWR<=26000 lbs	EMFAC201 1-HD			Trucks	Truck 2
T6 instate constructio n heavy - DSL	T6 instate constructio n heavy	Medium-Heavy Duty Diesel instate construction Truck with GVWR>26000 lbs	EMFAC201 1-HD			Trucks	Truck 2
T6 instate constructio n small - DSL	T6 instate constructio n small	Medium-Heavy Duty Diesel instate construction Truck with GVWR<=26000 lbs	EMFAC201 1-HD			Trucks	Truck 2
T6 instate heavy - DSL	T6 instate heavy	Medium-Heavy Duty Diesel instate Truck with GVWR>26000 lbs	EMFAC201 1-HD			Trucks	Truck 2

EMFAC201 1 Veh & Tech	EMFAC201 1 Vehicle	Description	Source	EMFAC200 7 Vehicle	EMFAC200 7 Vehicle Code	Truck / Non-Truck Category	Truck 1 / Truck 2 / Non-Truck Category
T6 instate small - DSL	T6 instate small	Medium-Heavy Duty Diesel instate Truck with GVWR<=26000 lbs	EMFAC201 1-HD			Trucks	Truck 2
T6 OOS heavy - DSL	T6 OOS heavy	Medium-Heavy Duty Diesel Out-of-state Truck with GVWR>26000 lbs	EMFAC201 1-HD			Trucks	Truck 2
T6 OOS small - DSL	T6 OOS small	Medium-Heavy Duty Diesel Out-of-state Truck with GVWR<=26000 lbs	EMFAC201 1-HD			Trucks	Truck 2
T6 Public - DSL	T6 Public	Medium-Heavy Duty Diesel Public Fleet Truck	EMFAC201 1-HD			Trucks	Truck 2
T6 utility - DSL	T6 utility	Medium-Heavy Duty Diesel Utility Fleet Truck	EMFAC201 1-HD			Trucks	Truck 2
T6TS - GAS	T6TS	Medium-Heavy Duty Gasoline Truck	EMFAC201 1-LDV			Trucks	Truck 2
T7 Ag - DSL	T7 Ag	Heavy-Heavy Duty Diesel Agriculture Truck	EMFAC201 1-HD	HHDT	T7	Trucks	Truck 2
T7 CAIRP - DSL	T7 CAIRP	Heavy-Heavy Duty Diesel CA International Registration Plan Truck	EMFAC201 1-HD			Trucks	Truck 2
T7 CAIRP construction - DSL	T7 CAIRP construction	Heavy-Heavy Duty Diesel CA International Registration Plan Construction Truck	EMFAC201 1-HD			Trucks	Truck 2
T7 NNOOS - DSL	T7 NNOOS	Heavy-Heavy Duty Diesel Non- Neighboring Out-of-state Truck	EMFAC201 1-HD			Trucks	Truck 2
T7 NOOS - DSL	T7 NOOS	Heavy-Heavy Duty Diesel Neighboring Out-of-state Truck	EMFAC201 1-HD			Trucks	Truck 2
T7 other port - DSL	T7 other port	Heavy-Heavy Duty Diesel Drayage Truck at Other Facilities	EMFAC201 1-HD			Trucks	Truck 2
T7 POAK - DSL	T7 POAK	Heavy-Heavy Duty Diesel Drayage Truck in Bay Area	EMFAC201 1-HD			Trucks	Truck 2
T7 POLA - DSL	T7 POLA	Heavy-Heavy Duty Diesel Drayage Truck near South Coast	EMFAC201 1-HD			Trucks	Truck 2
T7 Public - DSL	T7 Public	Heavy-Heavy Duty Diesel Public Fleet Truck	EMFAC201 1-HD			Trucks	Truck 2
T7 Single - DSL	T7 Single	Heavy-Heavy Duty Diesel Single Unit Truck	EMFAC201 1-HD			Trucks	Truck 2
T7 single construction - DSL	T7 single construction	Heavy-Heavy Duty Diesel Single Unit Construction Truck	EMFAC201 1-HD			Trucks	Truck 2
T7 SWCV - DSL	T7 SWCV	Heavy-Heavy Duty Diesel Solid Waste Collection Truck	EMFAC201 1-HD			Trucks	Truck 2
T7 tractor - DSL	T7 tractor	Heavy-Heavy Duty Diesel Tractor Truck	EMFAC201 1-HD			Trucks	Truck 2
T7 tractor construction - DSL	T7 tractor construction	Heavy-Heavy Duty Diesel Tractor Construction Truck	EMFAC201 1-HD			Trucks	Truck 2

EMFAC201 1 Veh & Tech	EMFAC201 1 Vehicle	Description	Source	EMFAC200 7 Vehicle	EMFAC200 7 Vehicle Code	Truck / Non-Truck Category	Truck 1 / Truck 2 / Non-Truck Category
T7 utility - DSL	T7 utility	Heavy-Heavy Duty Diesel Utility Fleet Truck	EMFAC201 1-HD			Trucks	Truck 2
T7IS - GAS	T7IS	Heavy-Heavy Duty Gasoline Truck	EMFAC201 1-LDV			Trucks	Truck 2
PTO - DSL	PTO	Power Take Off	EMFAC201 1-HD			Trucks	Truck 2
SBUS - DSL	SBUS	School Buses	EMFAC201 1-HD	SBUS	SB	Non-Trucks	Non-Trucks
SBUS - GAS			EMFAC201 1-LDV			Non-Trucks	Non-Trucks
UBUS - DSL	UBUS	Urban Buses	EMFAC201 1-LDV	UBUS	UB	Non-Trucks	Non-Trucks
UBUS - GAS			EMFAC201 1-LDV			Non-Trucks	Non-Trucks
Motor Coach - DSL	Motor Coach	Motor Coach	EMFAC201 1-HD	OBUS	OB	Non-Trucks	Non-Trucks
OBUS - GAS	OBUS	Other Buses	EMFAC201 1-LDV			Non-Trucks	Non-Trucks
All Other Buses - DSL	All Other Buses	All Other Buses	EMFAC201 1-HD			Non-Trucks	Non-Trucks

This file contains a description for each vehicle category in EMFAC2011.

It describes which module is used to calculate each category, as well as  
how the categories are grouped into the EMFAC2007 and Other categorization schemes

For more information contact [msei@arb.ca.gov](mailto:msei@arb.ca.gov)

Ver: May 2015

**Exhaust Emission Standards for Recreational Watercraft**

**EPA Emission Standards for Marine Spark-Ignition Engines and Vehicles: Exhaust Emission Standards**

where P stands for the maximum engine power in kilowatts (kW).

Model Year	HC + NOx (g/kW-hr)		CO (g/kW-hr)	
	P<=4.3 kW	P>4.3 kW	P<=4.3 kW	P>4.3 kW
1998	278	$(0.917*(151+557/P^{0.9}))+2.44$	—	—
1999	253	$(0.833*(151+557/P^{0.9}))+2.89$	—	—
2000	228	$(0.75*(151+557/P^{0.9}))+3.33$	—	—
2001	204	$(0.667*(151+557/P^{0.9}))+3.78$	—	—
2002	179	$(0.583*(151+557/P^{0.9}))+4.22$	—	—
2003	155	$(0.5*(151+557/P^{0.9}))+4.67$	—	—
2004	130	$(0.417*(151+557/P^{0.9}))+5.11$	—	—
2005	105	$(0.333*(151+557/P^{0.9}))+5.56$	—	—
2006-2009	81	$(0.25*(151+557/P^{0.9}))+6$	—	—
2010 and newer	30	$2.1+0.09*(151+557/P^{0.9})$	500-5.0*P	300

Source: EPA. 2016 (March). Marine Spark-Ignition Engines and Vehicles: Exhaust Emission Standards. EPA-420-B-16-026. Available: <https://nepis.epa.gov/Exec/zyPDF.cgi?Dockey=P1000A0G.pdf>. Accessed February 2, 2018.

	value	units	source
power conversion rate	0.75	kW/hp	wksht: Conversion Rates

**Federal Exhaust Emission Standards for Spark-Ignition Personal Watercraft and Outdoor Marine Engines of 50, 100, and 200 Horsepower**

Model Year	HC + NOx (g/kW-hr)		
	37	75	149
Engine Power (kW)	37	75	149
Engine Power (hp)	50	100	200
1998	161	151	147
1999	147	138	134
2000	133	125	121
2001	119	112	109
2002	105	99	96
2003	91	86	83
2004	77	73	71
2005	63	60	58
2006-2009	49	47	45
2010 and newer	18	17	16
Percent reduction from 1998 to 2010	89%	89%	89%
Factor of increased level of stringency from 1998 model year to 2010 model year	9.1	9.1	9.0

Source: calculations

This shows that emission standard become more stringent the later the engine model year.

**CARB Emission Standards for Marine Spark-Ignition Engines and Vehicles: Exhaust Emission Standards**

where P stands for the maximum engine power in kilowatts (kW).

Model Year	HC + NOx (g/kW-hr)		CO (g/kW-hr)	
	P<=4.3 kW	P>4.3 kW	P<=4.3 kW	P>4.3 kW
2001-2003	81.00	$(0.25*(151+557/P^{0.9}))+6.0$	—	—
2004-2007	64.80	$(0.20*(151+557/P^{0.9}))+4.8$	—	—
2008 +	30.00	$(0.09*(151+557/P^{0.9}))+2.1$	—	—
2009 +			500-5.0*P	300

Source: 13 CCR 2442, Emission Standards. Available at:

[https://govt.westlaw.com/calregs/Document/DF97161C458740979280AFCDDB1CFDE0?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=\(sc.Default\)](https://govt.westlaw.com/calregs/Document/DF97161C458740979280AFCDDB1CFDE0?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default)). Accessed February 7, 2018.

**CARB Exhaust Emission Standards for Spark-Ignition Personal Watercraft and Outdoor Marine Engines of 50, 100, and 200 Horsepower**

Model Year	HC + NOx		
	37	75	149
Engine Power (kW)	37	75	149
Engine Power (hp)	50	100	200
2001-2003	49	47	45
2004-2007	39	37	36
2008 +	18	17	16
Percent reduction from 1998 federal standard to 2008 CARB standard	89%	89%	89%
Increased level of stringency from 1998 model year to 2008 model year	9.1	9.1	9.0

Source: calculations

This shows that emission standard become more stringent the later the engine model year.

## Conversion Rates

### Mass Conversion Rates

<u>value</u>	<u>units</u>	<u>source</u>
1,000,000	g/MT	onlineconversion.com
2,000	lb/ton	onlineconversion.com
1,000	g/kg	onlineconversion.com
453.59237	g/lb	onlineconversion.com
907,184.74	g/ton	onlineconversion.com

### Time Conversions Rates

<u>rate</u>	<u>units</u>	<u>source</u>
365	days/year	The Sun

### Power

	<u>units</u>	<u>source</u>
0.7457	kW/hp	<a href="https://www.rapidtables.com/convert/power/hp-to-kw.html">https://www.rapidtables.com/convert/power/hp-to-kw.html</a>