

Construction Emissions Summary - PEAK DAILY - Controlled Dust
(By Activity)

Activity	Emissions (lbs)					
	ROG	CO	Nox	Sox	PM10	PM2.5
<i>Survey</i>						
Exhaust Emissions	0.0	0.2	0.0	0.0	0.0	0.0
Fugitive Dust Emissions	-	-	-	-	1.7	0.4
<i>ROW Clearing</i>						
Exhaust Emissions	2.5	9.0	19.8	0.0	0.7	0.7
Fugitive Dust Emissions	-	-	-	-	18.4	3.9
<i>Guard Structure Installation</i>						
Exhaust Emissions	2.2	8.2	15.3	0.0	0.5	0.5
Fugitive Dust Emissions	-	-	-	-	15.1	3.2
<i>Install OPGW</i>						
Exhaust Emissions	7.77	18.45	30.42	0.05	1.1	1.0
Fugitive Dust Emissions	-	-	-	-	15.1	3.2
<i>Install OPGW-A</i>						
Exhaust Emissions	5.7	11.6	14.8	0.0	0.6	0.5
Fugitive Dust Emissions	-	-	-	-	13.4	2.8
<i>Install OPGW-B</i>						
Exhaust Emissions	6.2	13.7	19.1	0.0	0.7	0.7
Fugitive Dust Emissions	-	-	-	-	15.1	3.2
<i>Guard Structure Removal</i>						
Exhaust Emissions	1.7	6.0	12.2	0.0	0.4	0.4
Fugitive Dust Emissions	-	-	-	-	15.1	3.2
<i>Restoration</i>						
Exhaust Emissions	1.4	5.3	10.8	0.0	0.4	0.4
Fugitive Dust Emissions	-	-	-	-	16.7	3.5
Total Project Emissions (lbs)						
	15.60	47.17	88.67	0.18	85.32	20.21
Total Project Emissions (tons)						
	0.008	0.024	0.044	0.000	0.043	0.010

Construction Emissions Summary - PEAK DAILY - Controlled Dust
(Scenarios By Possible Simultaneous Activities)

Scenario	Activity	Emissions (lbs)					
		ROG	CO	Nox	Sox	PM10	PM2.5
1	<i>Survey</i>	0.0	0.2	0.0	0.0	1.7	0.4
2	<i>ROW Clearing</i>	2.5	9.0	19.8	0.0	19.1	4.5
3	<i>Guard Structure Installation/Install OPGW-A</i>	7.9	19.7	30.1	0.1	29.6	7.0
4	<i>Install OPGW-B/Guard Structure Removal</i>	7.9	19.7	31.3	0.1	31.4	7.4
5	<i>Restoration</i>	1.4	5.3	10.8	0.0	17.1	3.9

Fugitive Dust Emissions From Road Travel During Construction - PEAK DAILY

Equipment	Quantity	Days	Miles	Paved (lbs of PM10)	Paved (lbs of PM2.5)	Unmitigated		Mitigated		Unmitigated		Mitigated	
						Unpaved (lbs of PM10)	Unpaved (lbs of PM2.5)	Unpaved (lbs of PM10)	Unpaved (lbs of PM2.5)	Total (lbs of PM10)	Total (lbs of PM2.5)	Total (lbs of PM10)	Total (lbs of PM2.5)
Survey													
1/2 Ton Pick-up Truck, 4X4	1	1	34	0.04	0.01	5.06	1.07	1.64	0.35	5.10	1.08	1.68	0.35
<i>Subtotal</i>				0.04	0.01	5.06	1.07	1.64	0.35	5.10	1.08	1.68	0.35
ROW Clearing													
3/4 Ton Pick-up Truck, 4X4	2	1	34	0.08	0.01	10.13	2.15	3.28	0.70	10.21	2.16	3.36	0.71
Water Truck	1	1	34	0.04	0.01	5.06	1.07	1.64	0.35	5.10	1.08	1.68	0.35
Lowboy Truck/Trailer	2	1	34	0.08	0.01	10.13	2.15	3.28	0.70	10.21	2.16	3.36	0.71
<i>Subtotal</i>				0.19	0.03	25.32	5.37	8.20	1.74	25.52	5.40	8.40	1.77
Guard Structure Installation													
3/4 Ton Pick-up Truck, 4X4	2	1	34	0.08	0.01	10.13	2.15	3.28	0.70	10.21	2.16	3.36	0.71
Auger Truck	1	1	34	0.04	0.01	5.06	1.07	1.64	0.35	5.10	1.08	1.68	0.35
22 Ton Manitex	1	1	34	0.04	0.01	5.06	1.07	1.64	0.35	5.10	1.08	1.68	0.35
Water Truck	1	1	34	0.04	0.01	5.06	1.07	1.64	0.35	5.10	1.08	1.68	0.35
Extendable Flat Bed Pole Truck	1	1	34	0.04	0.01	5.06	1.07	1.64	0.35	5.10	1.08	1.68	0.35
<i>Subtotal</i>				0.23	0.04	30.39	6.44	9.85	2.09	30.62	6.48	10.08	2.13
Install OPGW													
3/4 Ton Pick-up Truck, 4X4	5	1	34	0.19	0.03	25.32	5.37	8.20	1.74	25.52	5.40	8.40	1.77
Wire Truck & Trailer	1	1	34	0.04	0.01	5.06	1.07	1.64	0.35	5.10	1.08	1.68	0.35
Fuel, Helicopter Support Truck	1	1	34	0.04	0.01	5.06	1.07	1.64	0.35	5.10	1.08	1.68	0.35
Water Truck	1	1	34	0.04	0.01	5.06	1.07	1.64	0.35	5.10	1.08	1.68	0.35
Low Boy Truck & Trailer	1	1	34	0.04	0.01	5.06	1.07	1.64	0.35	5.10	1.08	1.68	0.35
<i>Subtotal</i>				0.35	0.06	45.58	9.66	14.77	3.13	45.93	9.72	15.12	3.19
<i>Subtotal Install OPGW-A</i>				0.31	0.05	40.52	8.59	13.13	2.78	40.83	8.64	13.44	2.84
<i>Subtotal Install OPGW-B</i>				0.35	0.06	45.58	9.66	14.77	3.13	45.93	9.72	15.12	3.19
Guard Structure Removal													
3/4 Ton Pick-up Truck, 4X4	2	1	34	0.08	0.01	10.13	2.15	3.28	0.70	10.21	2.16	3.36	0.71
22 Ton Manitex	1	1	34	0.04	0.01	5.06	1.07	1.64	0.35	5.10	1.08	1.68	0.35
Water Truck	1	1	34	0.04	0.01	5.06	1.07	1.64	0.35	5.10	1.08	1.68	0.35
Extendable Flat Bed Pole Truck	2	1	34	0.08	0.01	10.13	2.15	3.28	0.70	10.21	2.16	3.36	0.71
<i>Subtotal</i>				0.23	0.04	30.39	6.44	9.85	2.09	30.62	6.48	10.08	2.13
Restoration													
3/4 Ton Pick-up Truck, 4X4	2	1	34	0.08	0.01	10.13	2.15	3.28	0.70	10.21	2.16	3.36	0.71
Water Truck	1	1	34	0.04	0.01	5.06	1.07	1.64	0.35	5.10	1.08	1.68	0.35
Lowboy Truck/Trailer	1	1	34	0.04	0.01	5.06	1.07	1.64	0.35	5.10	1.08	1.68	0.35
<i>Subtotal</i>				0.16	0.03	20.26	4.29	6.56	1.39	20.41	4.32	6.72	1.42
Total (lbs)				1.2	0.2	157.0	33.3	50.9	10.8	158.2	33.5	52.1	11.0

Assumptions:

*20 percent of roads are unpaved and 80 percent are paved.

*PM10 Emission factors derived from URBEMIS2007 default assumptions (see reference below)

*PM2.5 Emissions are derived from PM2.5 fractions of PM10 (0.169 for paved roads and 0.212 for unpaved roads) obtained from the South Coast Air Quality Management District (see reference below)

* Mitigated unpaved road emissions assume a 28 percent control by limiting speed limits to 15 mph and a 55 percent control from watering unpaved roads.

References:

Jones and Stokes Associates, 2007. Software User's Guide: URBEMIS2007 for Windows, Appendix C, Pages C-2 through C-3, prepared by Jones and Stokes Associates for South Coast Air Quality

South Coast Air Quality Management District (SCAQMD), 2006. Final Methodology to Calculate PM2.5 and PM2.5 Significance Thresholds. Appendix A, Updated CEIDARS Table with PM2.5 Fraction.

PM10 Calculations:

UNPAVED defaults assumed by URBEMIS2007				
Description	Variable	Value	Unit	Range
fraction < 10 microns	k	1.8	lb/VMT	<=10 microns
surface silt content	s	4.3	%	1.8-25.2%
avg vehicle speed	S	40	mph	10-43mph
surface moisture content	M	0.5	%	0.03-13%

$$\text{Unpaved} = (k (s/12)^{1.0} (S/30)^{0.5}) / ((M/0.5)^{0.2})$$

0.744781847

PAVED defaults assumed by URBEMIS2007				
Description	Variable	Value	Unit	Range
particle size multiplier	k	0.016	-	-
road surface silt loading	sL	0.1	g/m2	0.02-400 grams/m2
average vehicle weight	W	2.2	Mg	1.8-38 megagrams

$$\text{Paved} = k (sL/2)^{0.65} (W/3)^{1.5}$$

0.001433516

Fugitive Dust Emissions From Earth Disturbance During Construction - PEAK DAILY¹

Activity	Acres Disturbed Per Day	Work Days Per Activity	Uncontrolled		Controlled ²	
			Lbs of PM10 Per Activity	Lbs of PM2.5 Per Activity	Lbs of PM10 Per Activity	Lbs of PM2.5 Per Activity
ROW Clearing	1.00	1	20	4	10	2
Guard Structure Installation	0.50	1	10	2	5	1
Install Optical Ground Wire	0.00	1	0	0	0	0
Guard Structure Removal	0.50	1	10	2	5	1
Restoration	1.00	1	20	4	10	2
Total (Lbs)			60	12	30	6

Notes:

1) PM10 emissions were estimated based on an emission factor of 20 pounds of PM10 per acre per day (see below for reference). Number of acres disturbed per day assume ROW clearing and Restoration activities are 1 acre, Guard Structure Activities are 0.5 acre, and OPGW activities are 0 acres. Workdays per activity set to 1 to calculate daily rates for this overall analysis. PM2.5 emissions were estimating using a SCAQMD PM2.5 fraction (0.208) of PM10 for construction fugitive dust (see reference)

2) Controlled emissions assume a 50 percent control from watering.

References:

CARB, 2002. Area-Wide Source Methodologies, Chapter 7.7 Building Construction Dust , Revised September, 2002.

SCAQMD, 2006. Final Methodology to Calculate PM2.5 and PM2.5 Significance Thresholds. Appendix A, Updated CEIDARS Table with PM2.5 Fraction.

Construction Equipment Exhaust Emissions - PEAK DAILY

Equipment	HP	Fuel	Qty	Days	Hours	Miles	ROG EF	ROG (lbs)	CO EF	CO (lbs)	NOx EF	NOx (lbs)	SOx EF	SOx (lbs)	PM10 EF	PM10 (lbs)	PM2.5 Fraction	PM2.5 (lbs)	CO2 EF	CO2 (lbs)	CH4 EF	CH4 (lbs)	
Survey																							
1/2 Ton Pick-up Truck, 4X4	200	Gas	1	1		34	0.0007	0.02	0.006	0.21	0.001	0.02	0.00001	0.00	0.00009	0.00	0.93	0.00	1.102	37.47	0.00006	0.00	
								<i>Subtotal Survey (pounds/activity)</i>		<i>0.02</i>		<i>0.21</i>		<i>0.02</i>		<i>0.00</i>		<i>0.00</i>		<i>1.102</i>	<i>37.47</i>		<i>0.00</i>
ROW Clearing																							
3/4 Ton Pick-up Truck, 4X4	300	Diesel	2	1		34	0.0007	0.05	0.006	0.42	0.001	0.04	0.00001	0.00	0.00009	0.01	0.93	0.01	1.102	74.93	0.00006	0.00	
Road Grader	350	Diesel	1	1	6		0.1666	1.00	0.574	3.44	1.376	8.26	0.00225	0.01	0.04956	0.30	0.92	0.27	229.484	1376.91	0.01503	0.09	
Water Truck	350	Diesel	1	1		34	0.0017	0.06	0.012	0.40	0.013	0.44	0.00003	0.00	0.00050	0.02	0.92	0.02	2.812	95.62	0.00008	0.00	
Lowboy Truck/Trailer	500	Diesel	2	1		34	0.0018	0.12	0.008	0.52	0.021	1.44	0.00004	0.00	0.00105	0.07	0.92	0.07	4.209	286.21	0.00008	0.01	
Backhoe	350	Diesel	1	1	6		0.2085	1.25	0.709	4.25	1.607	9.64	0.00388	0.02	0.05589	0.34	0.92	0.31	344.853	2069.12	0.01881	0.11	
								<i>Subtotal ROW Clearing (pounds/activity)</i>		<i>2.48</i>		<i>9.03</i>		<i>19.82</i>		<i>0.04</i>		<i>0.73</i>		<i>0.67</i>		<i>3902.80</i>	<i>0.22</i>
Guard Structure Installation																							
3/4 Ton Pick-up Truck, 4X4	300	Diesel	2	1		34	0.0007	0.05	0.006	0.42	0.001	0.04	0.00001	0.00	0.00009	0.01	0.93	0.01	1.102	74.93	0.00006	0.00	
Auger Truck	500	Diesel	1	1	4		0.1118	0.45	0.551	2.20	0.769	3.08	0.00306	0.01	0.02356	0.09	0.92	0.09	311.309	1245.23	0.01008	0.04	
Extendable Flat Bed Pole Truck	350	Diesel	1	1		34	0.0017	0.06	0.012	0.40	0.013	0.44	0.00003	0.00	0.00050	0.02	0.92	0.02	2.812	95.62	0.00008	0.00	
Water Truck	350	Diesel	1	1		34	0.0017	0.06	0.012	0.40	0.013	0.44	0.00003	0.00	0.00050	0.02	0.92	0.02	2.812	95.62	0.00008	0.00	
80ft. Hydraulic Man-lift	350	Diesel	1	1	4		0.1960	0.78	0.595	2.38	1.416	5.67	0.00267	0.01	0.05050	0.20	0.92	0.19	272.334	1089.34	0.01768	0.07	
22 Ton Manitex	350	Diesel	1	1	4		0.1960	0.78	0.595	2.38	1.416	5.67	0.00267	0.01	0.05050	0.20	0.92	0.19	272.334	1089.34	0.01768	0.07	
								<i>Subtotal Guard Structure Installation (pounds/activity)</i>		<i>2.18</i>		<i>8.18</i>		<i>15.32</i>		<i>0.04</i>		<i>0.54</i>		<i>0.50</i>		<i>3690.08</i>	<i>0.19</i>
Install OPGW																							
Wire Truck & Trailer	350	Diesel	1	1		34	0.0007	0.02	0.006	0.21	0.001	0.02	0.00001	0.00	0.00009	0.00	0.93	0.00	1.102	37.47	0.00006	0.00	
3/4 Ton Pick-up Truck, 4X4	300	Diesel	5	1		34	0.0007	0.11	0.006	1.04	0.001	0.10	0.00001	0.00	0.00009	0.02	0.93	0.01	1.102	187.33	0.00006	0.01	
80ft. Hydraulic Man-lift	350	Diesel	1	1	4		0.1960	0.78	0.595	2.38	1.416	5.67	0.00267	0.01	0.05050	0.20	0.92	0.19	272.334	1089.34	0.01768	0.07	
22 Ton Manitex	350	Diesel	1	1	4		0.1960	0.78	0.595	2.38	1.416	5.67	0.00267	0.01	0.05050	0.20	0.92	0.19	272.334	1089.34	0.01768	0.07	
3 Drum Straw line Puller	300	Diesel	1	1	4		0.1960	0.78	0.595	2.38	1.416	5.67	0.00267	0.01	0.05050	0.20	0.92	0.19	272.334	1089.34	0.01768	0.07	
60lk Puller	525	Diesel	1	1	3		0.1960	0.59	0.595	1.78	1.416	4.25	0.00267	0.01	0.05050	0.15	0.92	0.14	272.334	817.00	0.01768	0.05	
Sag Cat w2 winch	350	Diesel	1	1	2		0.2300	0.46	0.835	1.67	1.899	3.80	0.00254	0.01	0.07317	0.15	0.92	0.13	259.229	518.46	0.02075	0.04	
D8 Cat	300	Diesel	1	1	1		0.2300	0.23	0.835	0.84	1.899	1.90	0.00254	0.00	0.07317	0.07	0.92	0.07	259.229	259.23	0.02075	0.02	
Hughes 500 E Helicopter		Jet A	1	1	6		0.6378	3.83	0.808	4.85	0.245	1.47	0.00000	0.00	0.00816	0.05	0.92	0.05	590.520	3543.12	0.00343	0.02	
Fuel, Helicopter Support Truck	300	Diesel	1	1		34	0.0018	0.06	0.008	0.26	0.021	0.72	0.00004	0.00	0.00105	0.04	0.92	0.03	4.209	143.11	0.00008	0.00	
Water Truck	350	Diesel	1	1		34	0.0017	0.06	0.012	0.40	0.013	0.44	0.00003	0.00	0.00050	0.02	0.92	0.02	2.812	95.62	0.00008	0.00	
Low Boy Truck & Trailer	500	Diesel	1	1		34	0.0018	0.06	0.008	0.26	0.021	0.72	0.00004	0.00	0.00105	0.04	0.92	0.03	4.209	143.11	0.00008	0.00	
								<i>Subtotal Install OPGW (pounds/activity)</i>		<i>7.77</i>		<i>18.45</i>		<i>30.42</i>		<i>0.05</i>		<i>1.13</i>		<i>1.04</i>		<i>9012.45</i>	<i>0.37</i>
								<i>Subtotal Install OPGW-A (pounds/activity)</i>		<i>5.69</i>		<i>11.57</i>		<i>14.78</i>		<i>0.03</i>		<i>0.56</i>		<i>0.51</i>		<i>6290.96</i>	<i>0.18</i>
								<i>Subtotal Install OPGW-B (pounds/activity)</i>		<i>6.20</i>		<i>13.69</i>		<i>19.08</i>		<i>0.03</i>		<i>0.73</i>		<i>0.67</i>		<i>6833.78</i>	<i>0.23</i>
Guard Structure Removal																							
3/4 Ton Pick-up Truck, 4X4	300	Diesel	2	1		34	0.0007	0.05	0.006	0.42	0.001	0.04	0.00001	0.00	0.00009	0.01	0.93	0.01	1.102	74.93	0.00006	0.00	
Extendable Flat Bed Pole Truck	350	Diesel	1	1		34	0.0017	0.06	0.012	0.40	0.013	0.44	0.00003	0.00	0.00050	0.02	0.92	0.02	2.812	95.62	0.00008	0.00	
80ft. Hydraulic Man-lift	350	Diesel	1	1	4		0.1960	0.78	0.595	2.38	1.416	5.67	0.00267	0.01	0.05050	0.20	0.92	0.19	272.334	1089.34	0.01768	0.07	
Water Truck	350	Diesel	1	1		34	0.0017	0.06	0.012	0.40	0.013	0.44	0.00003	0.00	0.00050	0.02	0.92	0.02	2.812	95.62	0.00008	0.00	
22 Ton Manitex	350	Diesel	1	1	4		0.1960	0.78	0.595	2.38	1.416	5.67	0.00267	0.01	0.05050	0.20	0.92	0.19	272.334	1089.34	0.01768	0.07	
								<i>Subtotal Guard Structure Removal (pounds/activity)</i>		<i>1.73</i>		<i>5.97</i>		<i>12.25</i>		<i>0.02</i>		<i>0.44</i>		<i>0.41</i>		<i>2444.85</i>	<i>0.15</i>
Restoration																							
3/4 Ton Pick-up Truck, 4X4	300	Diesel	2	1		34	0.0007	0.05	0.006	0.42	0.001	0.04	0.00001	0.00	0.00009	0.01	0.93	0.01	1.102	74.93	0.00006	0.00	
Backhoe	350	Diesel	1	1	6		0.2085	1.25	0.709	4.25	1.607	9.64	0.00388	0.02	0.05589	0.34	0.92	0.31	344.853	2069.12	0.01881	0.11	
Water Truck	350	Diesel	1	1		34	0.0017	0.06	0.012	0.40	0.013	0.44	0.00003	0.00	0.00050	0.02	0.92	0.02	2.812	95.62	0.00008	0.00	
Lowboy Truck/Trailer	500	Diesel	1	1		34	0.0018	0.06	0.008	0.26	0.021	0.72	0.00004	0.00	0.00105	0.04	0.92	0.03	4.209	143.11	0.00008	0.00	
								<i>Subtotal Restoration (pounds/activity)</i>		<i>1.42</i>		<i>5.329265</i>		<i>10.84</i>		<i>0.03</i>		<i>0.39</i>		<i>0.36</i>		<i>2382.78</i>	<i>0.12</i>
Total Emissions From Construction of the Proposed Project																							
								ROG		CO		NOx		SOx		PM10		PM2.5		CO2		CH4	
								Total (pounds)	15.60	47.17	88.67	0.18	3.24	2.98	21470.43	1.05							
								Total (tons)	0.01	0.02	0.04	0.00	0.00	0.00	10.74	0.00							

N2O
1.05
0.00

Construction Greenhouse Gas Emissions			
Pollutant	Metric Tons	GWP	Metric Tons CO2e
CO2	9.7	1	9.74
CH4	0.0	25	0.01
N2O	0.0	298	0.14
Total Metric Tons of CO2e	10		

Notes:

- * Equipment and durations are assumed based on typical needs for each activity.
- * Days all set to 1 to calculate daily rates for this overall analysis.
- * All daily mileage assumed as double the length of the project (2x 17 miles).
- * Emission factors for all off-road equipment derived from CARBs OFFROAD2007 model. (<http://www.aqmd.gov/home/regulations/ceqa/air-quality-analysis-handbook/off-road-mobile-source-emission-factors>)
- * Emission factors for commute and on-road trips were derived from CARB's EMFAC2007 model. (<http://www.aqmd.gov/home/regulations/ceqa/air-quality-analysis-handbook/emfac-2007-%28v2-3%29-emission-factors-%28on-road%29>)
- * See 'Helicopter' tab for emission factor calculations and assumptions
- * PM2.5 fractions of PM10 were obtained from SCAQMD, 2006.
- * GWP = Global Warming Potential

References:

SCAQMD, 2006. Final Methodology to Calculate PM2.5 and PM2.5 Significance Thresholds. Appendix A, Updated CEIDARS Table with PM2.5 Fraction.



Highest (Most Conservative) EMFAC2007 (version 2.3) Emission Factors for On-Road Passenger Vehicles & Delivery Trucks

Projects in the SCAQMD (Scenario Years 2007 - 2026)

Derived from Peak Emissions Inventory (**Winter**, **Annual**, **Summer**)

Vehicle Class:

Passenger Vehicles (<8500 pounds) & Delivery Trucks (>8500 pounds)

The following emission factors were compiled by running the California Air Resources Board's EMFAC2007 (version 2.3) Burden Model, taking the weighted average of vehicle types and simplifying into two categories:
Passenger Vehicles & Delivery Trucks.

These emission factors can be used to calculate on-road mobile source emissions for the vehicle categories listed in the tables below, by use of the following equation:

$$\text{Emissions (pounds per day)} = N \times TL \times EF$$

where N = number of trips, TL = trip length (miles/day), and EF = emission factor (pounds per mile)

This methodology replaces the old EMFAC emission factors in Tables A-9-5-J-1 through A-9-5-L in Appendix A9 of the current SCAQMD CEQA Handbook. All the emission factors account for the emissions from start, running and idling exhaust. In addition, the ROG emission factors include diurnal, hot soak, running and resting emissions, and the PM10 & PM2.5 emission factors include tire and brake wear.

Scenario Year: 2007

All model years in the range 1965 to 2007

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.01155158	CO	0.02407553
NOx	0.00121328	NOx	0.02508445
ROG	0.00118234	ROG	0.00323145
SOx	0.00001078	SOx	0.00002626
PM10	0.00008447	PM10	0.00091020
PM2.5	0.00005243	PM2.5	0.00078884
CO2	1.10672236	CO2	2.72245619
CH4	0.00010306	CH4	0.00016030

Scenario Year: 2008

All model years in the range 1965 to 2008

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.01054844	CO	0.02194915
NOx	0.00110288	NOx	0.02371258
ROG	0.00107919	ROG	0.00299270
SOx	0.00001075	SOx	0.00002565
PM10	0.00008505	PM10	0.00085607
PM2.5	0.00005293	PM2.5	0.00073933
CO2	1.09953226	CO2	2.71943400
CH4	0.00009465	CH4	0.00014769

Scenario Year: 2009

All model years in the range 1965 to 2009

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00968562	CO	0.02016075
NOx	0.00100518	NOx	0.02236636
ROG	0.00099245	ROG	0.00278899
SOx	0.00001066	SOx	0.00002679
PM10	0.00008601	PM10	0.00080550
PM2.5	0.00005384	PM2.5	0.00069228
CO2	1.09755398	CO2	2.72330496
CH4	0.00008767	CH4	0.00013655

Scenario Year: 2010

All model years in the range 1966 to 2010

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00826276	CO	0.01843765
NOx	0.00091814	NOx	0.02062460
ROG	0.00091399	ROG	0.00258958
SOx	0.00001077	SOx	0.00002701
PM10	0.00008698	PM10	0.00075121
PM2.5	0.00005478	PM2.5	0.00064233
CO2	1.09568235	CO2	2.73222199
CH4	0.00008146	CH4	0.00012576



Highest (Most Conservative) EMFAC2007 (version 2.3) Emission Factors for On-Road Passenger Vehicles & Delivery Trucks

Projects in the SCAQMD (Scenario Years 2007 - 2026)

Derived from Peak Emissions Inventory (**Winter**, **Annual**, **Summer**)

Vehicle Class:

Passenger Vehicles (<8500 pounds) & Delivery Trucks (>8500 pounds)

Scenario Year: **2011**

All model years in the range 1967 to 2011

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00826276	CO	0.01693242
NOx	0.00084460	NOx	0.01893366
ROG	0.00085233	ROG	0.00241868
SOx	0.00001077	SOx	0.00002728
PM10	0.00008879	PM10	0.00070097
PM2.5	0.00005653	PM2.5	0.00059682
CO2	1.10235154	CO2	2.75180822
CH4	0.00007678	CH4	0.00011655

Scenario Year: **2012**

All model years in the range 1968 to 2012

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00765475	CO	0.01545741
NOx	0.00077583	NOx	0.01732423
ROG	0.00079628	ROG	0.00223776
SOx	0.00001073	SOx	0.00002667
PM10	0.00008979	PM10	0.00064975
PM2.5	0.00005750	PM2.5	0.00054954
CO2	1.10152540	CO2	2.76628414
CH4	0.00007169	CH4	0.00010668

Scenario Year: **2013**

All model years in the range 1969 to 2013

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00709228	CO	0.01407778
NOx	0.00071158	NOx	0.01577311
ROG	0.00074567	ROG	0.00206295
SOx	0.00001072	SOx	0.00002682
PM10	0.00009067	PM10	0.00059956
PM2.5	0.00005834	PM2.5	0.00050174
CO2	1.10087435	CO2	2.78163459
CH4	0.00006707	CH4	0.00009703

Scenario Year: **2014**

All model years in the range 1970 to 2014

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00660353	CO	0.01284321
NOx	0.00065484	NOx	0.01425162
ROG	0.00070227	ROG	0.00189649
SOx	0.00001069	SOx	0.00002754
PM10	0.00009185	PM10	0.00054929
PM2.5	0.00005939	PM2.5	0.00045519
CO2	1.10257205	CO2	2.79845465
CH4	0.00006312	CH4	0.00008798

Scenario Year: **2015**

All model years in the range 1971 to 2015

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00614108	CO	0.01169445
NOx	0.00060188	NOx	0.01285026
ROG	0.00066355	ROG	0.00173890
SOx	0.00001070	SOx	0.00002741
PM10	0.00009259	PM10	0.00050307
PM2.5	0.00006015	PM2.5	0.00041268
CO2	1.10192837	CO2	2.81247685
CH4	0.00005923	CH4	0.00008076

Scenario Year: **2016**

All model years in the range 1972 to 2016

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00575800	CO	0.01080542
NOx	0.00055658	NOx	0.01172881
ROG	0.00063254	ROG	0.00161521
SOx	0.00001071	SOx	0.00002767
PM10	0.00009392	PM10	0.00046606
PM2.5	0.00006131	PM2.5	0.00037868
CO2	1.10677664	CO2	2.83134285
CH4	0.00005623	CH4	0.00007355



Highest (Most Conservative) EMFAC2007 (version 2.3) Emission Factors for On-Road Passenger Vehicles & Delivery Trucks

Projects in the SCAQMD (Scenario Years 2007 - 2026)

Derived from Peak Emissions Inventory (**Winter**, **Annual**, **Summer**)

Vehicle Class:

Passenger Vehicles (<8500 pounds) & Delivery Trucks (>8500 pounds)

Scenario Year: **2017**

All model years in the range 1973 to 2017

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00537891	CO	0.00998101
NOx	0.00051297	NOx	0.01070034
ROG	0.00060109	ROG	0.00150242
SOx	0.00001079	SOx	0.00002723
PM10	0.00009446	PM10	0.00043131
PM2.5	0.00006192	PM2.5	0.00034605
CO2	1.10627489	CO2	2.84005015
CH4	0.00005300	CH4	0.00006663

Scenario Year: **2018**

All model years in the range 1974 to 2018

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00502881	CO	0.00923234
NOx	0.00047300	NOx	0.00979416
ROG	0.00057178	ROG	0.00139856
SOx	0.00001071	SOx	0.00002749
PM10	0.00009494	PM10	0.00040110
PM2.5	0.00006234	PM2.5	0.00031792
CO2	1.10562643	CO2	2.84646835
CH4	0.00005003	CH4	0.00006203

Scenario Year: **2019**

All model years in the range 1975 to 2019

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00471820	CO	0.00857192
NOx	0.00043716	NOx	0.00900205
ROG	0.00054654	ROG	0.00130563
SOx	0.00001072	SOx	0.00002706
PM10	0.00009523	PM10	0.00037393
PM2.5	0.00006259	PM2.5	0.00029276
CO2	1.10496100	CO2	2.85060182
CH4	0.00004743	CH4	0.00005619

Scenario Year: **2020**

All model years in the range 1976 to 2020

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00444247	CO	0.00799617
NOx	0.00040506	NOx	0.00831802
ROG	0.00052463	ROG	0.00122382
SOx	0.00001073	SOx	0.00002733
PM10	0.00009550	PM10	0.00035054
PM2.5	0.00006279	PM2.5	0.00027128
CO2	1.10456157	CO2	2.85148109
CH4	0.00004495	CH4	0.00005330

Scenario Year: **2021**

All model years in the range 1977 to 2021

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00421218	CO	0.00748303
NOx	0.00037757	NOx	0.00773500
ROG	0.00050573	ROG	0.00115568
SOx	0.00001073	SOx	0.00002755
PM10	0.00009640	PM10	0.00033125
PM2.5	0.00006364	PM2.5	0.00025331
CO2	1.11009559	CO2	2.86434187
CH4	0.00004322	CH4	0.00004905

Scenario Year: **2022**

All model years in the range 1978 to 2022

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00397866	CO	0.00699290
NOx	0.00035150	NOx	0.00722470
ROG	0.00048658	ROG	0.00108569
SOx	0.00001072	SOx	0.00002774
PM10	0.00009661	PM10	0.00031501
PM2.5	0.00006389	PM2.5	0.00023906
CO2	1.11019931	CO2	2.87006769
CH4	0.00004121	CH4	0.00004557



Highest (Most Conservative) EMFAC2007 (version 2.3) Emission Factors for On-Road Passenger Vehicles & Delivery Trucks

Projects in the SCAQMD (Scenario Years 2007 - 2026)

Derived from Peak Emissions Inventory (**Winter**, **Annual**, **Summer**)

Vehicle Class:

Passenger Vehicles (<8500 pounds) & Delivery Trucks (>8500 pounds)

Scenario Year: **2023**

All model years in the range 1979 to 2023

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00377527	CO	0.00658123
NOx	0.00032851	NOx	0.00679147
ROG	0.00046900	ROG	0.00102852
SOx	0.00001070	SOx	0.00002790
PM10	0.00009676	PM10	0.00030109
PM2.5	0.00006405	PM2.5	0.00022582
CO2	1.11023373	CO2	2.87466338
CH4	0.00003951	CH4	0.00004218

Scenario Year: **2024**

All model years in the range 1980 to 2024

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00358611	CO	0.00625076
NOx	0.00030721	NOx	0.00647083
ROG	0.00045136	ROG	0.00096578
SOx	0.00001080	SOx	0.00002807
PM10	0.00009676	PM10	0.00029407
PM2.5	0.00006410	PM2.5	0.00021880
CO2	1.11061572	CO2	2.88010717
CH4	0.00003781	CH4	0.00004019

Scenario Year: **2025**

All model years in the range 1981 to 2025

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00342738	CO	0.00595363
NOx	0.00028846	NOx	0.00615945
ROG	0.00043545	ROG	0.00092178
SOx	0.00001070	SOx	0.00002761
PM10	0.00009679	PM10	0.00028425
PM2.5	0.00006418	PM2.5	0.00020958
CO2	1.11078571	CO2	2.88143570
CH4	0.00003641	CH4	0.00003765

Scenario Year: **2026**

All model years in the range 1982 to 2026

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00328779	CO	0.00569435
NOx	0.00027141	NOx	0.00589869
ROG	0.00042052	ROG	0.00088403
SOx	0.00001076	SOx	0.00002716
PM10	0.00009687	PM10	0.00027657
PM2.5	0.00006415	PM2.5	0.00020187
CO2	1.11105829	CO2	2.88298299
CH4	0.00003518	CH4	0.00003581



CO	0.0062
NOx	0.0006
ROG	0.0007
SOx	0.00001
PM10	0.0001
PM2.5	0.0001
CO2	1.1050
CH4	0.0001

CO	0.0121
NOx	0.0130
ROG	0.0018
SOx	0.00003
PM10	0.0005
PM2.5	0.0004
CO2	2.8141
CH4	0.0001



Highest (Most Conservative) EMFAC2007 (version 2.3) Emission Factors for On-Road Heavy-Heavy-Duty Diesel Trucks

Projects in the SCAQMD (Scenario Years 2007 - 2026)

Derived from Peak Emissions Inventory (**Winter**, **Annual**, **Summer**)

Vehicle Class:

Heavy-Heavy-Duty Diesel Trucks (33,001 to 60,000 pounds)

The following emission factors were compiled by running the California Air Resources Board's EMFAC2007 (version 2.3) Burden Model and extracting the **Heavy-Heavy-Duty Diesel Truck (HHDT)** Emission Factors.

These emission factors can be used to calculate on-road mobile source emissions for the vehicle/emission categories listed in the tables below, by use of the following equation:

$$\text{Emissions (pounds per day)} = N \times TL \times EF$$

where N = number of trips, TL = trip length (miles/day), and EF = emission factor (pounds per mile)

The **HHDT-DSL** vehicle/emission category accounts for all emissions from heavy-heavy-duty diesel trucks, including start, running and idling exhaust. In addition, ROG emission factors account for diurnal, hot soak, running and resting emissions, and the PM10 & PM2.5 emission factors account for tire and brake wear.

The **HHDT-DSL, Exh** vehicle/emission category includes only the exhaust portion of PM10 & PM2.5 emissions from heavy-heavy-duty diesel trucks.

Scenario Year: **2007**

All model years in the range 1965 to 2007

HHDT-DSL (pounds/mile)	
CO	0.01446237
NOx	0.04718166
ROG	0.00372949
SOx	0.00003962
PM10	0.00230900
PM2.5	0.00204018
CO2	4.22184493

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00216752
PM2.5	0.00199491

Scenario Year: **2008**

All model years in the range 1965 to 2008

HHDT-DSL (pounds/mile)	
CO	0.01361368
NOx	0.04458017
ROG	0.00351579
SOx	0.00004136
PM10	0.00215635
PM2.5	0.00189990
CO2	4.21067145
CH4	0.00016269

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00201296
PM2.5	0.00185303

Scenario Year: **2009**

All model years in the range 1965 to 2009

HHDT-DSL (pounds/mile)	
CO	0.01282236
NOx	0.04184591
ROG	0.00329320
SOx	0.00004013
PM10	0.00199572
PM2.5	0.00175227
CO2	4.21080792
CH4	0.00015249

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00185393
PM2.5	0.00170680

Scenario Year: **2010**

All model years in the range 1966 to 2010

HHDT-DSL (pounds/mile)	
CO	0.01195456
NOx	0.03822102
ROG	0.00304157
SOx	0.00004131
PM10	0.00183062
PM2.5	0.00160083
CO2	4.21120578
CH4	0.00014201

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00168861
PM2.5	0.00155435



Highest (Most Conservative) EMFAC2007 (version 2.3) Emission Factors for On-Road Heavy-Heavy-Duty Diesel Trucks

Projects in the SCAQMD (Scenario Years 2007 - 2026)

Derived from Peak Emissions Inventory (**Winter**, **Annual**, **Summer**)

Vehicle Class:

Heavy-Heavy-Duty Diesel Trucks (33,001 to 60,000 pounds)

Scenario Year: **2011**

All model years in the range 1967 to 2011

HHDT-DSL (pounds/mile)	
CO	0.01112463
NOx	0.03455809
ROG	0.00279543
SOx	0.00003972
PM10	0.00166087
PM2.5	0.00144489
CO2	4.22045680
CH4	0.00012910

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00151936
PM2.5	0.00139772

Scenario Year: **2012**

All model years in the range 1968 to 2012

HHDT-DSL (pounds/mile)	
CO	0.01021519
NOx	0.03092379
ROG	0.00252764
SOx	0.00004042
PM10	0.00149566
PM2.5	0.00129354
CO2	4.21590774
CH4	0.00011651

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00135537
PM2.5	0.00124837

Scenario Year: **2013**

All model years in the range 1969 to 2013

HHDT-DSL (pounds/mile)	
CO	0.00931790
NOx	0.02742935
ROG	0.00226308
SOx	0.00004086
PM10	0.00133697
PM2.5	0.00114629
CO2	4.21518556
CH4	0.00010441

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00119623
PM2.5	0.00109863

Scenario Year: **2014**

All model years in the range 1970 to 2014

HHDT-DSL (pounds/mile)	
CO	0.00846435
NOx	0.02418049
ROG	0.00201594
SOx	0.00004092
PM10	0.00118458
PM2.5	0.00100582
CO2	4.21279345
CH4	0.00009261

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00104243
PM2.5	0.00096059

Scenario Year: **2015**

All model years in the range 1971 to 2015

HHDT-DSL (pounds/mile)	
CO	0.00766891
NOx	0.02122678
ROG	0.00178608
SOx	0.00004082
PM10	0.00104715
PM2.5	0.00087977
CO2	4.20902225
CH4	0.00008369

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00090631
PM2.5	0.00083282

Scenario Year: **2016**

All model years in the range 1972 to 2016

HHDT-DSL (pounds/mile)	
CO	0.00704604
NOx	0.01887374
ROG	0.00161035
SOx	0.00003952
PM10	0.00094448
PM2.5	0.00078443
CO2	4.21063031
CH4	0.00007508

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00080419
PM2.5	0.00073898



Highest (Most Conservative) EMFAC2007 (version 2.3) Emission Factors for On-Road Heavy-Heavy-Duty Diesel Trucks

Projects in the SCAQMD (Scenario Years 2007 - 2026)

Derived from Peak Emissions Inventory (**Winter**, **Annual**, **Summer**)

Vehicle Class:

Heavy-Heavy-Duty Diesel Trucks (33,001 to 60,000 pounds)

Scenario Year: **2017**

All model years in the range 1973 to 2017

HHDT-DSL (pounds/mile)	
CO	0.00650533
NOx	0.01690387
ROG	0.00145203
SOx	0.00004033
PM10	0.00084894
PM2.5	0.00069721
CO2	4.20820129
CH4	0.00006722

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00070873
PM2.5	0.00065111

Scenario Year: **2018**

All model years in the range 1974 to 2018

HHDT-DSL (pounds/mile)	
CO	0.00604721
NOx	0.01526414
ROG	0.00131697
SOx	0.00003934
PM10	0.00076808
PM2.5	0.00062383
CO2	4.20756838
CH4	0.00006182

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00062758
PM2.5	0.00057700

Scenario Year: **2019**

All model years in the range 1975 to 2019

HHDT-DSL (pounds/mile)	
CO	0.00565433
NOx	0.01389113
ROG	0.00120235
SOx	0.00004032
PM10	0.00070198
PM2.5	0.00056085
CO2	4.20637830
CH4	0.00005499

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00056085
PM2.5	0.00051320

Scenario Year: **2020**

All model years in the range 1976 to 2020

HHDT-DSL (pounds/mile)	
CO	0.00532242
NOx	0.01274755
ROG	0.00110621
SOx	0.00003957
PM10	0.00064574
PM2.5	0.00050904
CO2	4.20541416
CH4	0.00005216

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00050364
PM2.5	0.00046227

Scenario Year: **2021**

All model years in the range 1977 to 2021

HHDT-DSL (pounds/mile)	
CO	0.00503726
NOx	0.01179977
ROG	0.00103095
SOx	0.00004033
PM10	0.00059437
PM2.5	0.00046287
CO2	4.21495573
CH4	0.00004734

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00045411
PM2.5	0.00041729

Scenario Year: **2022**

All model years in the range 1978 to 2022

HHDT-DSL (pounds/mile)	
CO	0.00478830
NOx	0.01098794
ROG	0.00096142
SOx	0.00004106
PM10	0.00055427
PM2.5	0.00042597
CO2	4.21520828
CH4	0.00004448

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00041399
PM2.5	0.00037807



**Highest (Most Conservative) EMFAC2007 (version 2.3)
Emission Factors for On-Road Heavy-Heavy-Duty Diesel Trucks**

Projects in the SCAQMD (Scenario Years 2007 - 2026)

Derived from Peak Emissions Inventory (**Winter**, **Annual**, **Summer**)

Vehicle Class:

Heavy-Heavy-Duty Diesel Trucks (33,001 to 60,000 pounds)

Scenario Year: **2023**

All model years in the range 1979 to 2023

HHDT-DSL (pounds/mile)	
CO	0.00457902
NOx	0.01031407
ROG	0.00090210
SOx	0.00004009
PM10	0.00052122
PM2.5	0.00039592
CO2	4.21483461
CH4	0.00004176

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00037922
PM2.5	0.00034915

Scenario Year: **2024**

All model years in the range 1980 to 2024

HHDT-DSL (pounds/mile)	
CO	0.00444444
NOx	0.00974372
ROG	0.00084009
SOx	0.00003930
PM10	0.00050766
PM2.5	0.00038320
CO2	4.19552935
CH4	0.00003930

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00036682
PM2.5	0.00033735

Scenario Year: **2025**

All model years in the range 1981 to 2025

HHDT-DSL (pounds/mile)	
CO	0.00431086
NOx	0.00932573
ROG	0.00080206
SOx	0.00004018
PM10	0.00048541
PM2.5	0.00036326
CO2	4.19512979
CH4	0.00003697

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00034397
PM2.5	0.00031664

Scenario Year: **2026**

All model years in the range 1982 to 2026

HHDT-DSL (pounds/mile)	
CO	0.00420297
NOx	0.00898990
ROG	0.00077178
SOx	0.00003946
PM10	0.00046717
PM2.5	0.00034564
CO2	4.19349747
CH4	0.00003630

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00032670
PM2.5	0.00029830

SCAB Fleet Average Emission Factors (Diesel)

Off Road 2015

Air Basin	SC
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Equipment	MaxHP	(lb/hr) ROG	(lb/hr) CO	(lb/hr) NOX	(lb/hr) SOX	(lb/hr) PM	(lb/hr) CO2	(lb/hr) CH4
Aerial Lifts	15	0.0101	0.0528	0.0631	0.0001	0.0025	8.7	0.0009
	25	0.0155	0.0486	0.0902	0.0001	0.0046	11.0	0.0014
	50	0.0480	0.1641	0.1699	0.0003	0.0129	19.6	0.0043
	120	0.0460	0.2377	0.3272	0.0004	0.0246	38.1	0.0042
	500	0.1026	0.4261	1.2422	0.0021	0.0368	213	0.0093
	750	0.1912	0.7702	2.3263	0.0039	0.0680	385	0.0173
Aerial Lifts Composite		0.0439	0.1837	0.2670	0.0004	0.0167	34.7	0.0040
Air Compressors	15	0.0108	0.0466	0.0664	0.0001	0.0040	7.2	0.0010
	25	0.0229	0.0681	0.1247	0.0002	0.0069	14.4	0.0021
	50	0.0747	0.2360	0.2056	0.0003	0.0183	22.3	0.0067
	120	0.0691	0.3182	0.4334	0.0006	0.0375	47.0	0.0062
	175	0.0903	0.5019	0.7101	0.0010	0.0388	88.5	0.0082
	250	0.0892	0.2803	0.9294	0.0015	0.0286	131	0.0080
	500	0.1463	0.4915	1.4297	0.0023	0.0470	232	0.0132
	750	0.2285	0.7595	2.2932	0.0036	0.0743	358	0.0206
Air Compressors Composite		0.0773	0.3257	0.5175	0.0007	0.0357	63.6	0.0070
Bore/Drill Rigs	15	0.0120	0.0632	0.0754	0.0002	0.0029	10.3	0.0011
	25	0.0193	0.0658	0.1220	0.0002	0.0047	16.0	0.0017
	50	0.0234	0.2235	0.2240	0.0004	0.0075	31.0	0.0021
	120	0.0376	0.4676	0.3736	0.0009	0.0160	77.1	0.0034
	175	0.0618	0.7540	0.5364	0.0016	0.0198	141	0.0056
	250	0.0681	0.3425	0.4900	0.0021	0.0144	188	0.0061
	500	0.1118	0.5511	0.7692	0.0031	0.0236	311	0.0101
	750	0.2212	1.0888	1.5301	0.0062	0.0466	615	0.0200
Bore/Drill Rigs Composite		0.0673	0.5022	0.6138	0.0017	0.0200	165	0.0061
Cement and Mortar Mixers	15	0.0074	0.0386	0.0464	0.0001	0.0019	6.3	0.0007
	25	0.0251	0.0782	0.1456	0.0002	0.0074	17.6	0.0023
Cement and Mortar Mixers Composite		0.0088	0.0419	0.0545	0.0001	0.0024	7.2	0.0008
Concrete/Industrial Saws	25	0.0199	0.0678	0.1256	0.0002	0.0047	16.5	0.0018
	50	0.0782	0.2745	0.2652	0.0004	0.0206	30.2	0.0071
	120	0.0892	0.4759	0.6249	0.0009	0.0486	74.1	0.0080
	175	0.1340	0.8674	1.1593	0.0018	0.0585	160	0.0121
Concrete/Industrial Saws Composite		0.0835	0.3982	0.4921	0.0007	0.0374	58.5	0.0075
Cranes	50	0.0853	0.2729	0.2235	0.0003	0.0202	23.2	0.0077
	120	0.0800	0.3559	0.4822	0.0006	0.0415	50.1	0.0072
	175	0.0919	0.4794	0.6684	0.0009	0.0378	80.3	0.0083
	250	0.0925	0.2713	0.8284	0.0013	0.0286	112	0.0083
	500	0.1393	0.4663	1.1812	0.0018	0.0426	180	0.0126
	750	0.2358	0.7835	2.0490	0.0030	0.0729	303	0.0213
	9999	0.8682	2.8913	9.2743	0.0098	0.2775	971	0.0783
Cranes Composite		0.1204	0.4395	1.0200	0.0014	0.0426	129	0.0109
Crawler Tractors	50	0.1017	0.3087	0.2464	0.0003	0.0232	24.9	0.0092
	120	0.1143	0.4774	0.6815	0.0008	0.0579	65.8	0.0103
	175	0.1509	0.7384	1.0951	0.0014	0.0614	121	0.0136
	250	0.1582	0.4614	1.3531	0.0019	0.0514	166	0.0143
	500	0.2300	0.8352	1.8987	0.0025	0.0732	259	0.0207
	750	0.4140	1.4936	3.4863	0.0047	0.1327	465	0.0374
	1000	0.6278	2.3640	6.6574	0.0066	0.2075	658	0.0566
Crawler Tractors Composite		0.1415	0.5650	1.0059	0.0013	0.0594	114	0.0128

Crushing/Proc. Equipment	50	0.1392	0.4644	0.4024	0.0006	0.0346	44.0	0.0126
	120	0.1167	0.5646	0.7374	0.0010	0.0629	83.1	0.0105
	175	0.1654	0.9559	1.2783	0.0019	0.0700	167	0.0149
	250	0.1646	0.5171	1.6355	0.0028	0.0506	245	0.0149
	500	0.2358	0.7790	2.1722	0.0037	0.0722	374	0.0213
	750	0.3723	1.2184	3.5561	0.0059	0.1154	589	0.0336
	9999	0.9726	3.0901	11.5626	0.0131	0.3225	1,308	0.0878
Crushing/Proc. Equipment Composite		0.1465	0.6549	0.9893	0.0015	0.0607	132	0.0132
Dumpers/Tenders	25	0.0093	0.0315	0.0591	0.0001	0.0025	7.6	0.0008
Dumpers/Tenders Composite		0.0093	0.0315	0.0591	0.0001	0.0025	7.6	0.0008
Excavators	25	0.0198	0.0677	0.1253	0.0002	0.0047	16.4	0.0018
	50	0.0650	0.2683	0.2256	0.0003	0.0167	25.0	0.0059
	120	0.0912	0.5102	0.5787	0.0009	0.0455	73.6	0.0082
	175	0.1052	0.6653	0.7408	0.0013	0.0405	112	0.0095
	250	0.1117	0.3431	0.8935	0.0018	0.0297	159	0.0101
	500	0.1577	0.4964	1.1619	0.0023	0.0413	234	0.0142
	750	0.2630	0.8225	1.9926	0.0039	0.0698	387	0.0237
Excavators Composite		0.1064	0.5248	0.7416	0.0013	0.0379	120	0.0096
Forklifts	50	0.0324	0.1522	0.1324	0.0002	0.0092	14.7	0.0029
	120	0.0345	0.2143	0.2326	0.0004	0.0174	31.2	0.0031
	175	0.0486	0.3316	0.3442	0.0006	0.0189	56.1	0.0044
	250	0.0518	0.1582	0.4040	0.0009	0.0133	77.1	0.0047
	500	0.0724	0.2164	0.5170	0.0011	0.0185	111	0.0065
Forklifts Composite		0.0459	0.2200	0.3163	0.0006	0.0156	54.4	0.0041
Generator Sets	15	0.0135	0.0658	0.0929	0.0002	0.0051	10.2	0.0012
	25	0.0247	0.0831	0.1522	0.0002	0.0080	17.6	0.0022
	50	0.0706	0.2465	0.2628	0.0004	0.0193	30.6	0.0064
	120	0.0910	0.4811	0.6607	0.0009	0.0484	77.9	0.0082
	175	0.1120	0.7350	1.0463	0.0016	0.0485	142	0.0101
	250	0.1090	0.4148	1.3776	0.0024	0.0381	213	0.0098
	500	0.1556	0.6639	1.9429	0.0033	0.0567	337	0.0140
	750	0.2599	1.0718	3.2483	0.0055	0.0934	544	0.0234
	9999	0.6582	2.3655	8.9789	0.0105	0.2325	1,049	0.0594
Generator Sets Composite		0.0640	0.2913	0.4717	0.0007	0.0268	61.0	0.0058
Graders	50	0.0897	0.3082	0.2569	0.0004	0.0217	27.5	0.0081
	120	0.1081	0.5230	0.6726	0.0009	0.0555	75.0	0.0098
	175	0.1299	0.7319	0.9534	0.0014	0.0526	124	0.0117
	250	0.1326	0.4046	1.1596	0.0019	0.0400	172	0.0120
	500	0.1666	0.5739	1.3760	0.0023	0.0496	229	0.0150
	750	0.3549	1.2133	3.0011	0.0049	0.1066	486	0.0320
Graders Composite		0.1277	0.5931	0.9795	0.0015	0.0489	133	0.0115
Off-Highway Tractors	120	0.1905	0.7051	1.1159	0.0011	0.0952	93.7	0.0172
	175	0.1870	0.8216	1.3703	0.0015	0.0771	130	0.0169
	250	0.1489	0.4320	1.2644	0.0015	0.0520	130	0.0134
	750	0.5975	2.5165	5.0885	0.0057	0.2047	568	0.0539
	1000	0.9006	3.9378	9.2072	0.0082	0.3063	814	0.0813
Off-Highway Tractors Composite		0.1893	0.7244	1.5085	0.0017	0.0717	151	0.0171
Off-Highway Trucks	175	0.1259	0.7559	0.8596	0.0014	0.0477	125	0.0114
	250	0.1252	0.3702	0.9818	0.0019	0.0328	167	0.0113
	500	0.1960	0.5949	1.4165	0.0027	0.0505	272	0.0177
	750	0.3198	0.9645	2.3779	0.0044	0.0835	442	0.0289
	1000	0.4873	1.4801	5.2216	0.0063	0.1505	625	0.0440
Off-Highway Trucks Composite		0.1924	0.5974	1.4932	0.0027	0.0516	260	0.0174
Other Construction Equipm	15	0.0118	0.0617	0.0737	0.0002	0.0029	10.1	0.0011
	25	0.0159	0.0544	0.1008	0.0002	0.0039	13.2	0.0014
	50	0.0597	0.2506	0.2369	0.0004	0.0162	28.0	0.0054
	120	0.0827	0.5202	0.6012	0.0009	0.0441	80.9	0.0075
	175	0.0796	0.5864	0.6636	0.0012	0.0331	107	0.0072
	500	0.1310	0.4963	1.1867	0.0025	0.0394	254	0.0118

Other Construction Equipment Composite		0.0768	0.3645	0.6392	0.0013	0.0264	123	0.0069
Other General Industrial Equipment	15	0.0066	0.0391	0.0466	0.0001	0.0018	6.4	0.0006
	25	0.0185	0.0632	0.1170	0.0002	0.0044	15.3	0.0017
	50	0.0786	0.2532	0.2077	0.0003	0.0191	21.7	0.0071
	120	0.0987	0.4387	0.5864	0.0007	0.0521	62.0	0.0089
	175	0.1083	0.5684	0.7866	0.0011	0.0448	95.9	0.0098
	250	0.1050	0.3015	0.9812	0.0015	0.0312	136	0.0095
	500	0.1931	0.5811	1.6702	0.0026	0.0569	265	0.0174
	750	0.3208	0.9578	2.8569	0.0044	0.0959	437	0.0289
1000	0.4546	1.4023	5.2482	0.0056	0.1513	560	0.0410	
Other General Industrial Equipment Composite		0.1355	0.4843	1.1215	0.0016	0.0475	152	0.0122
Other Material Handling Equipment	50	0.1090	0.3501	0.2887	0.0004	0.0265	30.3	0.0098
	120	0.0959	0.4271	0.5727	0.0007	0.0509	60.7	0.0087
	175	0.1365	0.7201	0.9997	0.0014	0.0567	122	0.0123
	250	0.1109	0.3211	1.0483	0.0016	0.0332	145	0.0100
	500	0.1376	0.4182	1.2042	0.0019	0.0409	192	0.0124
	9999	0.6190	1.8527	6.9410	0.0073	0.1995	741	0.0558
Other Material Handling Equipment Composite		0.1289	0.4698	1.0967	0.0015	0.0460	141	0.0116
Pavers	25	0.0234	0.0780	0.1458	0.0002	0.0066	18.7	0.0021
	50	0.1198	0.3421	0.2775	0.0004	0.0271	28.0	0.0108
	120	0.1235	0.4969	0.7477	0.0008	0.0636	69.2	0.0111
	175	0.1608	0.7707	1.2155	0.0014	0.0673	128	0.0145
	250	0.1858	0.5585	1.6747	0.0022	0.0640	194	0.0168
	500	0.2059	0.8113	1.8097	0.0023	0.0697	233	0.0186
Pavers Composite		0.1347	0.5203	0.7607	0.0009	0.0526	77.9	0.0122
Paving Equipment	25	0.0152	0.0520	0.0963	0.0002	0.0037	12.6	0.0014
	50	0.1023	0.2901	0.2367	0.0003	0.0231	23.9	0.0092
	120	0.0969	0.3891	0.5874	0.0006	0.0503	54.5	0.0087
	175	0.1254	0.6025	0.9549	0.0011	0.0528	101	0.0113
	250	0.1140	0.3441	1.0498	0.0014	0.0394	122	0.0103
Paving Equipment Composite		0.1023	0.4234	0.6842	0.0008	0.0469	68.9	0.0092
Plate Compactors	15	0.0050	0.0263	0.0314	0.0001	0.0012	4.3	0.0005
Plate Compactors Composite		0.0050	0.0263	0.0314	0.0001	0.0012	4.3	0.0005
Pressure Washers	15	0.0065	0.0315	0.0445	0.0001	0.0024	4.9	0.0006
	25	0.0100	0.0337	0.0617	0.0001	0.0033	7.1	0.0009
	50	0.0251	0.0970	0.1183	0.0002	0.0077	14.3	0.0023
	120	0.0245	0.1416	0.1947	0.0003	0.0128	24.1	0.0022
Pressure Washers Composite		0.0133	0.0590	0.0799	0.0001	0.0049	9.4	0.0012
Pumps	15	0.0111	0.0479	0.0683	0.0001	0.0041	7.4	0.0010
	25	0.0309	0.0919	0.1682	0.0002	0.0094	19.5	0.0028
	50	0.0855	0.2910	0.2982	0.0004	0.0228	34.3	0.0077
	120	0.0949	0.4887	0.6710	0.0009	0.0508	77.9	0.0086
	175	0.1158	0.7365	1.0489	0.0016	0.0502	140	0.0104
	250	0.1088	0.3998	1.3270	0.0023	0.0376	201	0.0098
	500	0.1686	0.6929	2.0163	0.0034	0.0603	345	0.0152
	750	0.2872	1.1454	3.4529	0.0057	0.1018	571	0.0259
	9999	0.8773	3.1134	11.7387	0.0136	0.3072	1,355	0.0792
Pumps Composite		0.0621	0.2825	0.4121	0.0006	0.0267	49.6	0.0056
Rollers	15	0.0074	0.0386	0.0461	0.0001	0.0018	6.3	0.0007
	25	0.0161	0.0549	0.1018	0.0002	0.0039	13.3	0.0015
	50	0.0871	0.2754	0.2405	0.0003	0.0209	26.0	0.0079
	120	0.0857	0.4000	0.5498	0.0007	0.0454	59.0	0.0077
	175	0.1104	0.6166	0.8731	0.0012	0.0470	108	0.0100
	250	0.1107	0.3575	1.0948	0.0017	0.0368	153	0.0100
	500	0.1468	0.5595	1.3956	0.0022	0.0487	219	0.0132
Rollers Composite		0.0851	0.3979	0.5706	0.0008	0.0386	67.1	0.0077
Rough Terrain Forklifts	50	0.0942	0.3551	0.3066	0.0004	0.0243	33.9	0.0085
	120	0.0801	0.4260	0.5164	0.0007	0.0420	62.4	0.0072
	175	0.1171	0.7240	0.8746	0.0014	0.0477	125	0.0106

	250	0.1168	0.3650	1.0385	0.0019	0.0338	171	0.0105
	500	0.1668	0.5337	1.3642	0.0025	0.0477	257	0.0150
Rough Terrain Forklifts Composite		0.0850	0.4577	0.5588	0.0008	0.0423	70.3	0.0077
Rubber Tired Dozers	175	0.1942	0.8333	1.3944	0.0015	0.0790	129	0.0175
	250	0.2209	0.6304	1.8273	0.0021	0.0762	183	0.0199
	500	0.2932	1.2456	2.3951	0.0026	0.0985	265	0.0265
	750	0.4423	1.8685	3.6712	0.0040	0.1494	399	0.0399
	1000	0.6883	3.0139	6.8297	0.0060	0.2311	592	0.0621
Rubber Tired Dozers Composite		0.2721	1.0420	2.2344	0.0025	0.0924	239	0.0246
Rubber Tired Loaders	25	0.0204	0.0697	0.1291	0.0002	0.0049	16.9	0.0018
	50	0.0993	0.3438	0.2888	0.0004	0.0242	31.1	0.0090
	120	0.0835	0.4090	0.5226	0.0007	0.0431	58.9	0.0075
	175	0.1094	0.6251	0.8077	0.0012	0.0445	106	0.0099
	250	0.1118	0.3444	0.9890	0.0017	0.0337	149	0.0101
	500	0.1678	0.5818	1.3980	0.0023	0.0499	237	0.0151
	750	0.3459	1.1905	2.9534	0.0049	0.1040	486	0.0312
	1000	0.4657	1.6412	5.2967	0.0060	0.1552	594	0.0420
Rubber Tired Loaders Composite		0.1050	0.4615	0.7838	0.0012	0.0416	109	0.0095
Scrapers	120	0.1665	0.6826	0.9915	0.0011	0.0846	93.9	0.0150
	175	0.1871	0.9030	1.3657	0.0017	0.0766	148	0.0169
	250	0.2021	0.5906	1.7470	0.0024	0.0665	209	0.0182
	500	0.2883	1.0688	2.4104	0.0032	0.0930	321	0.0260
	750	0.5001	1.8419	4.2634	0.0056	0.1624	555	0.0451
Scrapers Composite		0.2513	0.9443	2.0647	0.0027	0.0854	262	0.0227
Signal Boards	15	0.0072	0.0377	0.0450	0.0001	0.0018	6.2	0.0006
	50	0.0931	0.3227	0.3148	0.0005	0.0243	36.2	0.0084
	120	0.0970	0.5116	0.6762	0.0009	0.0525	80.2	0.0088
	175	0.1290	0.8300	1.1249	0.0017	0.0559	155	0.0116
	250	0.1416	0.5098	1.6229	0.0029	0.0474	255	0.0128
Signal Boards Composite		0.0171	0.0925	0.1250	0.0002	0.0066	16.7	0.0015
Skid Steer Loaders	25	0.0189	0.0601	0.1125	0.0002	0.0056	13.8	0.0017
	50	0.0378	0.2138	0.2052	0.0003	0.0113	25.5	0.0034
	120	0.0334	0.2710	0.2699	0.0005	0.0170	42.8	0.0030
Skid Steer Loaders Composite		0.0352	0.2220	0.2198	0.0004	0.0128	30.3	0.0032
Surfacing Equipment	50	0.0408	0.1333	0.1263	0.0002	0.0101	14.1	0.0037
	120	0.0840	0.4151	0.5756	0.0007	0.0439	63.8	0.0076
	175	0.0787	0.4705	0.6706	0.0010	0.0335	85.8	0.0071
	250	0.0891	0.3116	0.9338	0.0015	0.0309	135	0.0080
	500	0.1342	0.5759	1.3809	0.0022	0.0468	221	0.0121
	750	0.2139	0.9020	2.2264	0.0035	0.0745	347	0.0193
Surfacing Equipment Composite		0.1116	0.4705	1.0675	0.0017	0.0389	166	0.0101
Sweepers/Scrubbers	15	0.0124	0.0729	0.0870	0.0002	0.0034	11.9	0.0011
	25	0.0237	0.0808	0.1495	0.0002	0.0056	19.6	0.0021
	50	0.0782	0.3186	0.2828	0.0004	0.0211	31.6	0.0071
	120	0.0880	0.5056	0.5893	0.0009	0.0466	75.0	0.0079
	175	0.1193	0.7999	0.9051	0.0016	0.0488	139	0.0108
	250	0.1029	0.3286	0.9094	0.0018	0.0289	162	0.0093
Sweepers/Scrubbers Composite		0.0913	0.5034	0.5746	0.0009	0.0387	78.5	0.0082
Tractors/Loaders/Backhoes	25	0.0192	0.0653	0.1221	0.0002	0.0049	15.9	0.0017
	50	0.0702	0.3020	0.2646	0.0004	0.0186	30.3	0.0063
	120	0.0577	0.3480	0.3870	0.0006	0.0293	51.7	0.0052
	175	0.0854	0.5853	0.6331	0.0011	0.0335	101	0.0077
	250	0.1082	0.3566	0.9047	0.0019	0.0294	172	0.0098
	500	0.2085	0.7089	1.6070	0.0039	0.0559	345	0.0188
	750	0.3148	1.0631	2.4922	0.0058	0.0854	517	0.0284
Tractors/Loaders/Backhoes Composite		0.0666	0.3716	0.4501	0.0008	0.0298	66.8	0.0060
Trenchers	15	0.0099	0.0517	0.0617	0.0001	0.0024	8.5	0.0009
	25	0.0397	0.1355	0.2509	0.0004	0.0094	32.9	0.0036
	50	0.1390	0.3900	0.3235	0.0004	0.0313	32.9	0.0125

	120	0.1144	0.4600	0.7060	0.0008	0.0590	64.9	0.0103
	175	0.1770	0.8534	1.3767	0.0016	0.0748	144	0.0160
	250	0.2105	0.6510	1.9456	0.0025	0.0750	223	0.0190
	500	0.2694	1.1349	2.4560	0.0031	0.0947	311	0.0243
	750	0.5107	2.1334	4.7300	0.0059	0.1802	587	0.0461
Trenchers Composite		0.1274	0.4541	0.6043	0.0007	0.0485	58.7	0.0115
Welders	15	0.0093	0.0400	0.0571	0.0001	0.0034	6.2	0.0008
	25	0.0179	0.0532	0.0974	0.0001	0.0054	11.3	0.0016
	50	0.0801	0.2564	0.2346	0.0003	0.0200	26.0	0.0072
	120	0.0547	0.2606	0.3567	0.0005	0.0296	39.5	0.0049
	175	0.0936	0.5424	0.7713	0.0011	0.0405	98.2	0.0084
	250	0.0749	0.2483	0.8249	0.0013	0.0248	119	0.0068
	500	0.0968	0.3491	1.0171	0.0016	0.0325	168	0.0087
Welders Composite		0.0534	0.1994	0.2301	0.0003	0.0187	25.6	0.0048

Helicopter Emissions

Emissions		Fuel	Nox	HC	CO	PM non vol.
LTO	kg/LTO	16.4	0.060	0.446	0.582	0.002
	lb/LTO	7.438924	0.02722	0.2023	0.263991073	0.000907186
Operations	kg/hr	99.000	0.48	0.960	1.20	0.01600
	lb/hr	44.9057	0.21772	0.43545	0.544311491	0.007257487
Total	lb/hr	52.34462	0.24494	0.63775	0.808302565	0.008164672

Unit Conversion
2.20462 lb/kg

	CO2	CH4
g/gal	-	0.27
lb/gal	21.09	0.000122
lb/hr	590.52	0.003429

Fuel Burn Rate
180 lb/hr
28 gal/hr

* Emission factors for NO_x, HC, CO, PM determined from Guidance on the Determination of Helicopter Emissions for Hughes H500

(<http://www.bazl.admin.ch/experten/regulation/03312/03419/03532/index.html?lang=en>)

* HC emissions are ROG emissions

* Assume 1 LTO per hr of operation for NO_x, HC, CO, PM calculations

* Fuel burn rate for CO₂ and CH₄ calculations from http://www.aoc.noaa.gov/aircraft_md500.htm

* CO₂ and CH₄ emission factors obtained from Department of Energy fuel emission factors

(<http://www.eia.doe.gov/oiaf/1605/excel/Fuel%20Emission%20Factors.xls>), tables shown below

7. Methane and Nitrous Oxide Emission Factors for Non-Highway Mobile Combustion

Vehicle Type/Fuel Type	N ₂ O (g/kg fuel)	CH ₄ (g/kg fuel)	N ₂ O (g/gal fuel)	CH ₄ (g/gal fuel)
Ships and Boats				
Residual	0.08	0.23	0.30	0.86
Distillate	0.08	0.23	0.26	0.74
Gasoline	0.08	0.23	0.22	0.65
Locomotives				
Diesel	0.08	0.25	0.26	0.80
Agricultural Equipment				
Gas	0.08	0.45	0.22	1.26
Diesel	0.08	0.45	0.26	1.44
Construction				
Gas	0.08	0.18	0.22	0.51
Diesel	0.08	0.18	0.26	0.58

Other Non-Highway				
All "Other" Categories ¹	0.08	0.18	0.22	0.51
Aircraft				
Jet Fuel	0.10	0.09	0.31	0.27
Aviation Gasoline	0.04	2.64	0.11	7.05

2. Carbon Dioxide Emission Factors for Transportation Fuels¹

Transportation Fuel	Emission Factors	
	Unit of Volume	Million Btu
Aviation Gasoline	18.33 per gallon	69.19
Biodiesel		
-B100	0 per gallon	0
-B20	17.89 per gallon	59.44
-B10	20.13 per gallon	66.35
-B5	21.25 per gallon	69.76
-B2	21.92 per gallon	71.8
Diesel Fuel (No. 1 and No. 2)	22.37 per gallon	73.15
Ethanol/Ethanol Blends		
-E100	0 per gallon	0
-E85	2.93 per gallon	14.71
-E10 (Gasohol)	17.59 per gallon	65.94
Methanol/Methanol Blends		
-M85	10.68 per gallon	64.01
Motor Gasoline	19.54 per gallon	70.88
Jet Fuel, Kerosene	21.09 per gallon	70.88
Natural Gas	cubic feet	53.06
Propane	12.67 per gallon	63.10
Fuel Oil)	26.00 per gallon	78.80