

**Table 4.3-A (1): Worker Trip Emissions Calculations**

Construction Phase	Vehicle Class	No. of Daily Workers Per Construction Phase	Speed (mph)	VMT (mi/vehicle-day)	CO		NO <sub>x</sub>		ROG					SO <sub>x</sub>		CH <sub>4</sub>		N <sub>2</sub> O	
					Running Exhaust (g/mi)	Start-Up (g/vehicle-day)	Running Exhaust (g/mi)	Start-Up (g/vehicle-day)	Running Exhaust (g/mi)	Start-Up (g/vehicle-day)	Hot-Soak (g/vehicle-day)	Resting Loss (g/vehicle-day)	Running Exhaust (g/mi)	Diurnal Evaporative (g/vehicle-day)	Running Exhaust (g/mi)	Start-Up (g/vehicle-day)	Running Exhaust (g/mi)	Start-Up (g/vehicle-day)	
Clear and Grade for Staging Areas, Access Roads, Poles	Light-Duty Truck, catalyst	5	35	80	3.0975	38.14685	0.301284	2.236171	0.094167	3.031413	1.876347	0.796436	0.20051	1.078687	0.004048	0.02407547	0.03	0.01059328	
Construction Crews	Light-Duty Truck, catalyst	100	35	80	3.0975	38.14685	0.301284	2.236171	0.094167	3.031413	1.876347	0.796436	0.20051	1.078687	0.004048	0.02407547	0.03	0.01059328	
SWPPP	Light-Duty Truck, catalyst	10	35	80	3.0975	38.14685	0.301284	2.236171	0.094167	3.031413	1.876347	0.796436	0.20051	1.078687	0.004048	0.02407547	0.03	0.01059328	
Monitors	Light-Duty Truck, catalyst	20	35	80	3.0975	38.14685	0.301284	2.236171	0.094167	3.031413	1.876347	0.796436	0.20051	1.078687	0.004048	0.02407547	0.03	0.01059328	
Testing and Inspection Crews	Light-Duty Truck, catalyst	5	35	80	3.0975	38.14685	0.301284	2.236171	0.094167	3.031413	1.876347	0.796436	0.20051	1.078687	0.004048	0.02407547	0.03	0.01059328	
SDG&E Personnel	Light-Duty Truck, catalyst	5	35	80	3.0975	38.14685	0.301284	2.236171	0.094167	3.031413	1.876347	0.796436	0.20051	1.078687	0.004048	0.02407547	0.03	0.01059328	

EMFAC2011 emission factors for 2013 - 2017  
 Assume startup after 8 hours  
 Assume 45 minutes run time total

Construction Phase	Vehicle Class	No. of Daily Workers Per Construction Phase	Speed (mph)	VMT (mi/vehicle-day)	Emissions, lbs/day												
					CO	NO <sub>x</sub>	VOCs	SO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	Paved Road Fugitive Dust PM <sub>10</sub>	Paved Road Fugitive Dust PM <sub>2.5</sub>	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2e</sub>	
Crux and H&M Crews	Light-Duty Truck, catalyst	100	35	80	63.04	5.81	3.20	0.07	0.87	0.39	0.84	0.35	6668.89	0.32	0.58	6854.51772	
SWPPP	Light-Duty Truck, catalyst	10	35	80	6.30	0.58	0.32	0.01	0.09	0.04	0.08	0.03	666.89	0.03	0.06	685.451772	
Monitors	Light-Duty Truck, catalyst	20	35	80	12.61	1.16	0.64	0.01	0.17	0.08	0.17	0.07	1333.78	0.06	0.12	1370.90354	
Testing and Inspection Crews	Light-Duty Truck, catalyst	5	35	80	3.15	0.29	0.16	0.00	0.04	0.02	0.04	0.02	333.44	0.02	0.03	342.725886	
SDG&E Personnel	Light-Duty Truck, catalyst	5	35	80	3.15	0.29	0.16	0.00	0.04	0.02	0.04	0.02	333.44	0.02	0.03	342.725886	
<b>TOTAL</b>					<b>88.26</b>	<b>8.13</b>	<b>4.48</b>	<b>0.10</b>	<b>1.22</b>	<b>0.55</b>	<b>1.18</b>	<b>0.48</b>	<b>9336.44</b>	<b>0.44</b>	<b>0.81</b>	<b>9596.32</b>	

Table 4.3-A (2): Construction Truck Emission Calculations - Crux

Vehicle	Vehicle Class	Peak No. of Trucks per day	Speed (mph)	VMT (mi/vehicle-day)	CO	NO <sub>x</sub>	ROG	SO <sub>x</sub>	PM10			PM2.5			CO2	CH4	N2O	Emissions, lbs/day																						
					Running Exhaust (g/mi)	Running Exhaust (g/mi)	Running Exhaust (g/mi)	Running Exhaust (g/mi)	Running Exhaust (g/mi)	Tire Wear (g/mi)	Brake Wear (g/mi)	Running Exhaust (g/mi)	Tire Wear (g/mi)	Brake Wear (g/mi)	Running Exhaust (g/mi)	Tire Wear (g/mi)	Brake Wear (g/mi)	Running Exhaust (g/mi)	Running Exhaust (g/mi)	Running Exhaust (g/mi)	CO	NOx	VOCs	SOx	PM10	PM2.5	Paved Road Fugitive Dust PM10	Paved Road Fugitive Dust PM2.5	Unpaved Road Fugitive Dust PM10	Unpaved Road Fugitive Dust PM2.5	CO2	CH4	N2O	CO2e						
<b>Crux</b>																																								
Crew Trucks	Light Duty Truck 1, Diesel	15	35	60	0.379406935	0.64372	0.09263769	0.003186	0.077891	0.00799996	0.03674982	0.071659	0.002	0.0157499	293.2085	0.01675482	0.01	0.75	1.28	0.18	0.01	0.24	0.18	0.09	0.02	0.00	0.00	0.00	581.78	0.03	0.01	587.0938								
Material Transport Units	Heavy Duty Truck, Diesel	4	35	80	2.013841104	8.936723	0.47044926	0.010712	0.243782	0.01199994	0.13033932	0.22428	0.003	0.0558597	1765.771	0.10090144	0.05	1.42	6.30	0.33	0.01	0.27	0.20	0.03	0.01	0.07	0.01	1245.72	0.07	0.03	1257.108									
Tractor Trailer Units	Heavy Duty Truck, Diesel	2	15	0.25	4.358099782	15.34266	1.75152037	0.010712	0.349447	0.01199994	0.13033932	0.321492	0.003	0.0558597	2702.306	0.15441789	0.07	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.05	2.98	0.00	0.00	3.006027									
Fuel Truck	Heavy Duty Truck, Diesel	1	15	0.25	4.358099782	15.34266	1.75152037	0.010712	0.349447	0.01199994	0.13033932	0.321492	0.003	0.0558597	2702.306	0.15441789	0.07	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.02	1.49	0.00	0.00	1.503014									
<b>Subtotal</b>																	<b>2.18</b>	<b>7.61</b>	<b>0.52</b>	<b>0.01</b>	<b>0.52</b>	<b>0.38</b>	<b>0.12</b>	<b>0.03</b>	<b>0.76</b>	<b>0.08</b>	<b>1831.97</b>	<b>0.10</b>	<b>0.05</b>	<b>1848.71</b>										

2014 Emission Factors from EMFAC2011 average temp 60F

Paved Road Fugitive Dust  
 EPA's AP-42, Section 13.2.1, November 2006  
 $E = k(sL/2)^{0.65} \times (W/3)^{1.5} \times C$   
 For LDT assume 2 tons/vehicle, MDT assume 13 tons/vehicle, HDT assume 20 tons/vehicle  
 Assume silt loading for 10,000 ADT roadways = 0.03 g/m<sup>3</sup>  
 Assume k = 0.016 PM10

Emission Factors  
 Assume 6 miles in addition for track-out for PM10

PM10, LDT	9.81231E-05
PM10, MDT	0.008944829
PM10, HDT	0.017495628

Unpaved Road Fugitive Dust  
 EPA's AP-42, Section 13.2.1, November 2006  
 $E = k(s/12)^a \times (W/3)^b$   
 For LDT assume 2 tons/vehicle, MDT assume 13 tons/vehicle, HDT assume 20 tons/vehicle  
 Assume silt = 8.5%

Assume k = 1.5 for PM10, 0.15 for PM2.5  
 a = 0.9, b = 0.45

Emission Factors	PM10	PM2.5
PM10, LDT	0.916355739	0.09163557
PM10, MDT	2.127527168	0.21275272
PM10, HDT	2.582641374	0.25826414

Table 4.3-A (3): Construction Truck Emission Calculations - H&M

Table with columns: Vehicle, Vehicle Class, Peak No. of Trucks per day, Speed (mph), VMT (mi/vehicle-day), CO, NOx, ROG, SOx, PM10, PM2.5, CO2, CH4, N2O, Emissions (lbs/day) for CO, NOx, VOCs, SOx, PM10, PM2.5, Paved Road Fugitive Dust, Unpaved Road Fugitive Dust, and CO2e. Rows include categories like H&M - Digging, H&M - Shoo-Fly, H&M - Mobilization, H&M - Transmission Line Work, H&M - Distribution UG, H&M - Demobilization, and H&M - Cleanup.

2014 Emission Factors from EMFAC2011 average temp 60F

Paved Road Fugitive Dust
EPA's AP-42, Section 13.2.1, November 2006
E = k(s/L)^0.65 x (W/3)^1.5 - C
For LDT assume 2 tons/vehicle, MDT assume 13 tons/vehicle, HDT assume 20 tons/vehicle
Assume silt loading for 10,000 ADT roadways = 0.03 g/m3
Assume k = 0.016 PM10
Assume 6 miles in addition for track-out for PM10
Emission Factors
PM10, LDT 9.81231E-05
PM10, MDT 0.008944829
PM10, HDT 0.017495628

Unpaved Road Fugitive Dust
EPA's AP-42, Section 13.2.1, November 2006
E = k(s/12)^a x (W/3)^b
For LDT assume 2 tons/vehicle, MDT assume 13 tons/vehicle, HDT assume 20 tons/vehicle
Assume silt = 8.5%
Assume k = 1.5 for PM10, 0.15 for PM2.5
a = 0.9, b = 0.45
Emission Factors
PM10 PM2.5
PM10, LDT 0.916355739 0.09163557
PM10, MDT 2.127527168 0.21275272
PM10, HDT 2.582641374 0.25826414

Table 4.3-A (4): Construction Heavy Equipment Emissions - Drilling

## TL-637 Off Road Emissions

### Crux Equipment - Drilling

Equipment Activity							Criteria Emission Factors (g/bhp-hr)					Criteria Emissions (lbs/d)					GHG Emission Factors (g/bhp-hr)		GHG Emissions (lbs/day)				
Type	BHP	Load Factor	Quantity	Length (days)	hrs/ day	total hours	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2e</sub>		
Drilling Rig	66	0.75	8	150	7	8,400	0.301	3.451	3.134	0.150	0.150	1.84	21.09	19.15	0.92	0.92	568.299	0.027	3,473.00	0.17	3,476.46		
Air Compressor	173	0.48	8	150	7	8,400	0.901	3.880	5.608	0.495	0.495	9.24	39.78	57.49	5.07	5.07	568.299	0.081	5,826.22	0.83	5,843.65		
Crane	66	0.43	2	150	5	1,500	0.527	1.493	5.040	0.177	0.177	0.33	0.93	3.15	0.11	0.11	568.299	0.047	355.57	0.03	356.19		
Transport Unit	225	0.57	4	150	4	2,400	0.452	1.283	3.770	0.125	0.125	2.04	5.80	17.06	0.57	0.57	568.299	0.040	2,570.92	0.18	2,574.72		
Tractor Trailer Unit	450	0.57	2	150	3	900	0.452	1.283	3.770	0.125	0.125	1.53	4.35	12.79	0.42	0.42	568.299	0.040	1,928.19	0.14	1,931.04		
Forklift	150	0.60	9	150	6	8,100	0.798	3.905	5.107	0.431	0.431	8.55	41.84	54.72	4.62	4.62	568.299	0.072	6,089.02	0.77	6,105.22		
Flatbed Truck	250	0.57	5	150	2	1,500	0.452	1.283	3.770	0.125	0.125	1.42	4.03	11.84	0.39	0.39	568.299	0.040	1,785.36	0.13	1,788.00		
Water Truck	300	0.57	2	150	3	900	0.452	1.283	3.770	0.125	0.125	1.02	2.90	8.53	0.28	0.28	568.299	0.040	1,285.46	0.09	1,287.36		
Generator Set	10	0.74	12	150	6	10,800	0.792	3.567	5.478	0.424	0.424	0.93	4.19	6.43	0.50	0.50	568.299	0.047	667.54	0.06	668.70		
<b>Totals</b>												<b>26.91</b>	<b>124.92</b>	<b>191.17</b>	<b>12.88</b>	<b>12.88</b>			<b>Totals</b>		<b>23,981.27</b>	<b>2.384</b>	<b>24,031.34</b>

Table 4.3-A (5): Construction Heavy Equipment Emissions - Grouting

## TL-637 Off Road Emissions

### Crux Equipment - Grouting

Equipment Activity							Criteria Emission Factors (g/bhp-hr)					Criteria Emissions (lbs/d)					GHG Emission Factors (g/bhp-hr)		GHG Emissions (lbs/day)		
Type	BHP	Load Factor	Quantity	Length (days)	hrs/ day	total hours	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2e</sub>
Grout Plant	34	0.74	2	150	4	1,200	0.792	3.567	5.478	0.424	0.424	0.35	1.58	2.43	0.19	0.19	568.299	0.047	252.18	0.02	252.62

Table 4.3-A (6): Construction Heavy Equipment Emissions - Cap and Test

## TL-637 Off Road Emissions

### Crux Equipment - Cap and Test

Equipment Activity							Criteria Emission Factors (g/bhp-hr)					Criteria Emissions (lbs/d)					GHG Emission Factors (g/bhp-hr)		GHG Emissions (lbs/day)		
Type	BHP	Load Factor	Quantity	Length (days)	hrs/ day	total hours	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub> e
Air Compressor	173	0.48	8	150	0	0	0.901	3.880	5.608	0.495	0.495	0.00	0.00	0.00	0.00	0.00	568.299	0.081	0.00	0.00	0.00
Crane	66	0.43	2	150	5	1,500	0.527	1.493	5.040	0.177	0.177	0.33	0.93	3.15	0.11	0.11	568.299	0.047	355.57	0.03	356.19
Transport Unit	225	0.57	4	150	6	3,600	0.452	1.283	3.770	0.125	0.125	3.07	8.71	25.58	0.85	0.85	568.299	0.040	3,856.38	0.27	3,862.08
Tractor Trailer Unit	450	0.57	2	150	3	900	0.452	1.283	3.770	0.125	0.125	1.53	4.35	12.79	0.42	0.42	568.299	0.040	1,928.19	0.14	1,931.04
Forklift	150	0.60	9	150	6	8,100	0.798	3.905	5.107	0.431	0.431	8.55	41.84	54.72	4.62	4.62	568.299	0.072	6,089.02	0.77	6,105.22
Flatbed Truck	250	0.57	5	150	5	3,750	0.452	1.283	3.770	0.125	0.125	3.55	10.08	29.61	0.98	0.98	568.299	0.040	4,463.40	0.31	4,470.00
Generator Set	10	0.74	12	150	7	12,600	0.792	3.567	5.478	0.424	0.424	1.09	4.89	7.51	0.58	0.58	568.299	0.047	778.79	0.06	780.15
<b>Totals</b>							<b>18.12</b>	<b>70.80</b>	<b>133.36</b>	<b>7.56</b>	<b>7.56</b>							<b>Totals</b>	<b>17,471.35</b>	<b>1.587</b>	<b>17,504.67</b>

Table 4.3-A (7): Construction Heavy Equipment Emissions - Digging

## TL-637 Off Road Emissions

### H&M Equipment - Digging

Equipment Activity							Criteria Emission Factors (g/bhp-hr)					Criteria Emissions (lbs/d)					GHG Emission Factors (g/bhp-hr)		GHG Emissions (lbs/day)				
Type	BHP	Load Factor	Quantity	Length (days)	hrs/ day	total hours	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub> e		
Pressure Digger	82	0.75	4	150	8	4,800	0.301	3.451	3.134	0.150	0.150	1.31	14.97	13.60	0.65	0.65	568.299	0.027	2,465.68	0.12	2,468.14		
Air Compressor	78	0.48	2	150	8	2,400	0.901	3.880	5.608	0.495	0.495	1.19	5.12	7.41	0.65	0.65	568.299	0.081	750.53	0.11	752.77		
<b>Totals</b>												<b>2.50</b>	<b>20.10</b>	<b>21.00</b>	<b>1.30</b>	<b>1.30</b>			<b>Totals</b>		<b>3,216.21</b>	<b>0.224</b>	<b>3,220.91</b>

Table 4.3-A (8): Construction Heavy Equipment Emissions - Construction of Shoe-Fly

## TL-637 Off Road Emissions

### H&M Equipment - Shoe-Fly Construction

Equipment Activity							Criteria Emission Factors (g/bhp-hr)					Criteria Emissions (lbs/d)					GHG Emission Factors (g/bhp-hr)		GHG Emissions (lbs/day)		
Type	BHP	Load Factor	Quantity	Length (days)	hrs/ day	total hours	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub> e
Bucket Truck	250	0.57	2	150	2	600	0.452	1.283	3.770	0.125	0.125	0.57	1.61	4.74	0.16	0.16	568.299	0.040	714.14	0.05	715.20
<b>Totals</b>							<b>0.57</b>	<b>1.61</b>	<b>4.74</b>	<b>0.16</b>	<b>0.16</b>	<b>0.57</b>	<b>1.61</b>	<b>4.74</b>	<b>0.16</b>	<b>0.16</b>	<b>568.299</b>	<b>0.040</b>	<b>714.14</b>	<b>0.050</b>	<b>715.20</b>



Table 4.3-A (9): Construction Heavy Equipment Emissions - Mobilization

## TL-637 Off Road Emissions

### Mobilization

Equipment Activity							Criteria Emission Factors (g/bhp-hr)					Criteria Emissions (lbs/d)					GHG Emission Factors (g/bhp-hr)		GHG Emissions (lbs/day)		
Type	BHP	Load Factor	Quantity	Length (days)	hrs/ day	total hours	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub> e
Tractor Trailer Unit	250	0.57	2	150	4	1,200	0.452	1.283	3.770	0.125	0.125	1.14	3.22	9.48	0.31	0.31	568.299	0.040	1,428.29	0.10	1,430.40
<b>Totals</b>							<b>1.14</b>	<b>3.22</b>	<b>9.48</b>	<b>0.31</b>	<b>0.31</b>	<b>1.14</b>	<b>3.22</b>	<b>9.48</b>	<b>0.31</b>	<b>0.31</b>	<b>568.299</b>	<b>0.040</b>	<b>1,428.29</b>	<b>0.101</b>	<b>1,430.40</b>

Table 4.3-A (10): Construction Heavy Equipment Emissions - Power Line Installation

## TL-637 Off Road Emissions

### H&M Equipment - Power Line Installation

Equipment Activity							Criteria Emission Factors (g/bhp-hr)					Criteria Emissions (lbs/d)					GHG Emission Factors (g/bhp-hr)		GHG Emissions (lbs/day)				
Type	BHP	Load Factor	Quantity	Length (days)	hrs/ day	total hours	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub> e		
Bucket Truck	250	0.57	8	150	2	2,400	0.452	1.283	3.770	0.125	0.125	2.27	6.45	18.95	0.63	0.63	568.299	0.040	2,856.58	0.20	2,860.80		
Line Truck	250	0.57	8	150	2	2,400	0.452	1.283	3.770	0.125	0.125	2.27	6.45	18.95	0.63	0.63	568.299	0.040	2,856.58	0.20	2,860.80		
Crane	208	0.43	8	150	1	1,200	0.527	1.493	5.040	0.177	0.177	0.83	2.36	7.95	0.28	0.28	568.299	0.047	896.46	0.07	898.02		
<b>Totals</b>												<b>5.38</b>	<b>15.25</b>	<b>45.85</b>	<b>1.54</b>	<b>1.54</b>			<b>Totals</b>		<b>6,609.62</b>	<b>0.476</b>	<b>6,619.62</b>

Table 4.3-A (11): Construction Heavy Equipment Emissions - Transmission Line Cable Pulling

## TL-637 Off Road Emissions

### H&M Equipment - Cable Pulling

Equipment Activity							Criteria Emission Factors (g/bhp-hr)					Criteria Emissions (lbs/d)					GHG Emission Factors (g/bhp-hr)		GHG Emissions (lbs/day)		
Type	BHP	Load Factor	Quantity	Length (days)	hrs/ day	total hours	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub> e
OH Puller	300	0.62	1	150	4	600	0.324	1.170	3.394	0.109	0.109	0.53	1.92	5.57	0.18	0.18	568.299	0.029	932.15	0.05	933.15
OH Tensioner	300	0.62	1	150	4	600	0.324	1.170	3.394	0.109	0.109	0.53	1.92	5.57	0.18	0.18	568.299	0.029	932.15	0.05	933.15
<b>Totals</b>												<b>1.06</b>	<b>3.84</b>	<b>11.13</b>	<b>0.36</b>	<b>0.36</b>			<b>1,864.29</b>	<b>0.095</b>	<b>1,866.29</b>

Table 4.3-A (12): Construction Heavy Equipment Emissions - Sag Work

## TL-637 Off Road Emissions

### H&M Equipment - Sag Work

Equipment Activity							Criteria Emission Factors (g/bhp-hr)					Criteria Emissions (lbs/d)					GHG Emission Factors (g/bhp-hr)		GHG Emissions (lbs/day)		
Type	BHP	Load Factor	Quantity	Length (days)	hrs/ day	total hours	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub> e
Crawler Tractor	82	0.64	1	150	4	600	1.116	4.194	6.637	0.584	0.584	0.52	1.94	3.07	0.27	0.27	568.299	0.100	263.01	0.05	263.98
							<b>Totals</b>					<b>0.52</b>	<b>1.94</b>	<b>3.07</b>	<b>0.27</b>	<b>0.27</b>			<b>263.01</b>	<b>0.046</b>	<b>263.98</b>

Table 4.3-A (13): Construction Heavy Equipment Emissions - Underground Construction

## TL-637 Off Road Emissions

### H&M Equipment - Underground Distribution

Equipment Activity							Criteria Emission Factors (g/bhp-hr)					Criteria Emissions (lbs/d)					GHG Emission Factors (g/bhp-hr)		GHG Emissions (lbs/day)			
Type	BHP	Load Factor	Quantity	Length (days)	hrs/ day	total hours	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub> e	
Line Truck	250	0.57	3	150	2	900	0.452	1.283	3.770	0.125	0.125	0.85	2.42	7.11	0.24	0.24	568.299	0.040	1,071.22	0.08	1,072.80	
Crew Truck	250	0.57	3	150	2	900	0.452	1.283	3.770	0.125	0.125	0.85	2.42	7.11	0.24	0.24	568.299	0.040	1,071.22	0.08	1,072.80	
Splice Van	250	0.57	1	150	4	600	0.452	1.283	3.770	0.125	0.125	0.57	1.61	4.74	0.16	0.16	568.299	0.040	714.14	0.05	715.20	
Underground Puller	300	0.62	2	150	4	1,200	0.324	1.170	3.394	0.109	0.109	1.06	3.84	11.13	0.36	0.36	568.299	0.029	1,864.29	0.10	1,866.29	
<b>Totals</b>												<b>3.33</b>	<b>10.29</b>	<b>30.08</b>	<b>0.99</b>	<b>0.99</b>			<b>Totals</b>	<b>4,720.87</b>	<b>0.296</b>	<b>4,727.09</b>

Table 4.3-A (14): Construction Heavy Equipment Emissions - Demobilization

## TL-637 Off Road Emissions

### Demobilization

Equipment Activity							Criteria Emission Factors (g/bhp-hr)					Criteria Emissions (lbs/d)					GHG Emission Factors (g/bhp-hr)		GHG Emissions (lbs/day)		
Type	BHP	Load Factor	Quantity	Length (days)	hrs/ day	total hours	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub> e
Tractor Trailer Unit	250	0.57	1	150	2	300	0.452	1.283	3.770	0.125	0.125	0.28	0.81	2.37	0.08	0.08	568.299	0.040	357.07	0.03	357.60
Crew Truck	250	0.57	4	150	2	1,200	0.452	1.283	3.770	0.125	0.125	1.14	3.22	9.48	0.31	0.31	568.299	0.040	1,428.29	0.10	1,430.40
<b>Totals</b>							<b>1.42</b>	<b>4.03</b>	<b>11.84</b>	<b>0.39</b>	<b>0.39</b>							<b>Totals</b>	<b>1,785.36</b>	<b>0.126</b>	<b>1,788.00</b>

Table 4.3-A (15): Construction Heavy Equipment Emissions - Cleanup

## TL-637 Off Road Emissions

### Cleanup

Equipment Activity							Criteria Emission Factors (g/bhp-hr)					Criteria Emissions (lbs/d)					GHG Emission Factors (g/bhp-hr)		GHG Emissions (lbs/day)			
Type	BHP	Load Factor	Quantity	Length (days)	hrs/ day	total hours	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub> e	
Skip Loader	37	0.55	1	150	7	1,050	0.986	4.891	4.812	0.299	0.299	0.31	1.54	1.51	0.09	0.09	568.299	0.089	178.47	0.03	179.06	
Crew Truck	250	0.57	5	150	2	1,500	0.452	1.283	3.770	0.125	0.125	1.42	4.03	11.84	0.39	0.39	568.299	0.040	1,785.36	0.13	1,788.00	
Water Truck	250	0.57	2	150	2	600	0.452	1.283	3.770	0.125	0.125	0.57	1.61	4.74	0.16	0.16	568.299	0.040	714.14	0.05	715.20	
<b>Totals</b>												<b>2.30</b>	<b>7.18</b>	<b>18.09</b>	<b>0.64</b>	<b>0.64</b>			<b>Totals</b>	<b>2,677.98</b>	<b>0.204</b>	<b>2,682.26</b>

**Table 4.3-A (16): Helicopter Emissions**

Helicopter Model	Engine	Assumed Engine	Operating Mode	Fuel Flow, kg/s	Time in Mode, min	Emission Incides, g/kg fuel				Emissions, lbs/mode			Cruise Mode Emission factor, lbs/hour		
						CO	VOC	NOx	PM	CO	VOC	NOx	CO	VOC	NOx
Hughes 500E	Allison 250-C208	250B17B	Taxi Out	0.008154	19	2.199837	23.004097	2.199837	N/A	0.045081939	0.471430067	0.045081939			
			Takeoff	0.031642	10.4	6.599994	0.402675	6.599994	N/A	0.287295342	0.017528297	0.287295342			
			Climbout	0.028926	0.09	5.981142	0.408337	5.981142	N/A	0.002059694	0.000140617	0.002059694	1.373129585	0.093744575	1.373129585
			Approach	0.010516	10.05	2.200637	5.988767	2.200637	N/A	0.03076471	0.083722432	0.03076471			
			Taxi In	0.008154	7	2.199837	23.004097	2.199837	N/A	0.016609136	0.173684761	0.016609136			
<b>Total per LTO</b>									<b>0.381810822</b>	<b>0.746506173</b>	<b>0.381810822</b>				

Mode	Factors (lbs/min)			Minutes per LTO	Emissions (lb/LTO)		
	CO	HC	NO <sub>x</sub>		CO	HC	NO <sub>x</sub>
Approach	0.0687	0.0076	0.0032	8.50	0.584	0.064	0.027
Climb	0.0369	0.0016	0.0244	4.33	0.160	0.007	0.105
Take-off	0.0345	0.0013	0.0292	2.17	0.075	0.003	0.063
Idle	0.1014	0.0209	0.0010	7.00	0.710	0.146	0.007
<b>Total per LTO</b>				<b>22.0</b>	<b>1.528</b>	<b>0.221</b>	<b>0.203</b>

\* EF's from Federal Aviation Administration, Emission and Dispersion Modeling System (EDMS)  
 \* Time in mode based on default times in EDMS

Therefore

Assuming 1 LTO and 3 hours operation per day of pole installation & 1 installation per day

Component	Emissions (lb/day)		
	CO	HC	NO <sub>x</sub>
LTO	0.382	0.747	0.382
Installation - assume 3 hours	4.119	0.281	4.119
<b>Total per Day</b>	<b>4.501</b>	<b>1.028</b>	<b>4.501</b>

\* Installation is assumed to be 3 hours (180 minutes) per installation at climb mode factors

### Helicopter GHG Emission Estimates TL673 - Wood-to-Steel Project

**Table of Factors and Constants**

Value	Units	Description
6.84	lb/gallon	Jet Fuel Density (at 15 degrees C) -- equivalent to 820 kg/m <sup>3</sup>
142	lb/hr	Jet Fuel Usage at Idle
20.8	gallon/hr	Calculated Usage at Idle
679	lb/hr	Jet Fuel Usage at Climbout/Approach
99.3	gallon/hr	Calculated Usage at Climbout/Approach
8.32	kg CO <sub>2</sub> /gallon	CO <sub>2</sub> emission factor for Jet fuel
0.31	g N <sub>2</sub> O/gallon	N <sub>2</sub> O emission factor for Jet fuel
0.27	g CH <sub>4</sub> /gallon	CH <sub>4</sub> emission factor for Jet fuel

\* Fuel usage rates from EPA AP-42, Table II-1-8, Modal Emission Rates - Military Aircraft Engines  
 \* Fuel density from Air BP Handbook of Products - © Air BP Ltd. 2000  
 \* Emission factors from California Climate Action Registry's General Reporting Protocol 3.1

**GHG Emissions**

Component	Time in mode (hrs)	Emissions (tonnes/day)				Days of Operation	Emissions (total tonnes)		
		CO <sub>2</sub>	N <sub>2</sub> O	CH <sub>4</sub>	CO <sub>2</sub> e		CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub> e
LTO - Idle	0.117	0.020	0.000004	0.000003	0.021	90	1.814	0.0001	1.916
LTO - Other	0.250	0.043	0.000008	0.000007	0.046		3.886	0.0002	4.105
Installation	3.000	0.518	0.000092	0.000080	0.548		46.636	0.0024	49.262
<b>Total per Installation</b>	<b>3.367</b>	<b>0.582</b>	<b>0.000104</b>	<b>0.000090</b>	<b>0.615520</b>		<b>52.336</b>	<b>0.0027</b>	<b>55.283</b>

\* Jet Fuel usage was based on fuel usage time spent in approach, idle, and takeoff for each LTO and 3 hours for installation



**Table 4.3-A (17): Fugitive Dust Emissions**

**1) Earthmoving/Grading**

Emission Types

- A) Dozing
- B) Grading
- C) Trenching

A) Dozing (AP-42 Section 11.9 for overburden)

$E = k \times (s)^{1.5} / (M)^{1.4}$  For PM10 and  $k \times 5.7 \times (s)^{1.2} / (M)^{1.3}$  for PM2.5  
 E = lb/hr  
 k = Scaling Constant (0.75 for PM10 and 0.105 for PM2.5)  
 s = Silt Content (assumed to be 16% - SCAQMD Handbook for Farm Roads)  
 M = Moisture Content = 10% (assumes watering when necessary for mitigation)

PM10 Emission Factor  
 1.910914419 lb/hr

PM2.5 Emission Factor  
 0.835618668 lb/hr

Maximum Daily Dozer Use

	Hrs/day
	8

Dozer Emissions

Lbs/Day	PM10	PM2.5
	15.29	6.68
Tons/Year	PM10	PM2.5
	0.34	0.15

B) Grading

**Grading**

Disturbance - 6.5 acres staging areas, 69 SW poles x 314 sf, 87 micropile poles x 39 sf = 7.07 acres

Amount total disturbed 7.07 acres  
 Amount per day 0.707 Acres  
 Control - watering 3 x daily 0.61  
 PM10 PM2.5  
 Maximum Emission Factor, lbs/acre-day 20 4.2  
 Emissions, lbs/day 5.5146 1.158066  
 Average Emission Factor, lbs/acre-day 20 4.2  
 Emissions, tons/year 0.027573 0.00579033

Total	<b>PM10</b>	<b>PM2.5</b>
lbs/day	20.80	7.84
tons/year	0.37	0.16

C) Trenching - Dozing (AP-42 Section 11.9 for overburden)

$E = k \times (s)^{1.5} / (M)^{1.4}$  For PM10 and  $k \times 5.7 \times (s)^{1.2} / (M)^{1.3}$  for PM2.5  
 E = lb/hr  
 k = Scaling Constant (0.75 for PM10 and 0.105 for PM2.5)  
 s = Silt Content (assumed to be 16% - SCAQMD Handbook for Farm Roads)  
 M = Moisture Content = 10% (assumes watering when necessary for mitigation)

PM10 Emission Factor  
 1.910914419 lb/hr

PM2.5 Emission Factor  
 0.835618668 lb/hr

Maximum Daily Trencher Use

	Hrs/day
	8

Trencher Emissions

Lbs/Day	PM10	PM2.5
	15.29	6.68
Tons/Year	PM10	PM2.5
	0.34	0.15

**Table 4.3-A (18): Offroad Emission Factors**

**2014 Offroad Emission Factors (g/hp/hr)**

Veh Type	BHP	Load Factor	Emission Factor (g/bhp-hr)						
			ROG	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH <sub>4</sub>
Air Compressor	78	0.48	0.901	3.880	5.608	0.495	0.495	568.299	0.081
Boom Truck/Auger	250	0.57	0.452	1.283	3.770	0.125	0.125	568.299	0.040
Bucket Truck	250	0.57	0.452	1.283	3.770	0.125	0.125	568.299	0.040
Crane	208	0.43	0.527	1.493	5.040	0.177	0.177	568.299	0.047
Crawler Tractor	82	0.64	1.116	4.194	6.637	0.584	0.584	568.299	0.100
Crew Truck	250	0.57	0.452	1.283	3.770	0.125	0.125	568.299	0.040
Dozer	358	0.59	0.658	2.854	5.490	0.227	0.227	568.299	0.059
Drilling Rig	82	0.75	0.301	3.451	3.134	0.150	0.150	568.299	0.027
Flatbed Truck	250	0.57	0.452	1.283	3.770	0.125	0.125	568.299	0.040
Forklift	83	0.60	0.798	3.905	5.107	0.431	0.431	568.299	0.072
Fuel Truck	250	0.57	0.452	1.283	3.770	0.125	0.125	568.299	0.040
Generator Set	84	0.74	0.792	3.567	5.478	0.424	0.424	568.299	0.047
Grout Plant	84	0.74	0.792	3.567	5.478	0.424	0.424	568.299	0.047
Line Truck	250	0.57	0.452	1.283	3.770	0.125	0.125	568.299	0.040
Mower	74	0.43	1.051	4.156	6.287	0.541	0.541	568.299	0.094
OH Puller	300	0.62	0.324	1.170	3.394	0.109	0.109	568.299	0.029
OH Tensioner	300	0.62	0.324	1.170	3.394	0.109	0.109	568.299	0.029
Pressure Digger	82	0.75	0.301	3.451	3.134	0.150	0.150	568.299	0.027
Pulling Rig	82	0.75	0.301	3.451	3.134	0.150	0.150	568.299	0.027
Skip Loader	37	0.55	0.986	4.891	4.812	0.299	0.299	568.299	0.089
Splice Van	250	0.57	0.452	1.283	3.770	0.125	0.125	568.299	0.040
Testing Jack	84	0.74	0.792	3.567	5.478	0.424	0.424	568.299	0.047
Tractor Trailer Unit	250	0.57	0.452	1.283	3.770	0.125	0.125	568.299	0.040
Transport Unit	250	0.57	0.452	1.283	3.770	0.125	0.125	568.299	0.040
Trencher	69	0.75	1.061	4.063	6.558	0.550	0.550	568.299	0.095
Underground Puller	300	0.62	0.324	1.170	3.394	0.109	0.109	568.299	0.029
Water Truck	250	0.57	0.452	1.283	3.770	0.125	0.125	568.299	0.040
Wire Truck	82	0.75	0.452	1.283	3.770	0.125	0.125	568.299	0.040

From: CalEEMod™ Users Guide Appendix D plus OFFROAD 2007

**Table 4.3-A (19): Summary of Criteria Pollutant Emission Estimates**

**TL673 - Wood-to-Steel Project**

**Maximum Daily Emissions - lbs/day**

<b>Year</b>	<b>VOCs</b>	<b>CO</b>	<b>NOx</b>	<b>PM10</b>	<b>PM2.5</b>
2014	36.45	243.56	240.28	40.61	24.13

Maximum Daily Emissions occur during the following simultaneous activities:  
Drilling, Grouting, Digging, and Shoe-Fly Construction  
These activities assume simultaneous use of heavy construction equipment,  
truck trips, worker trips, and helicopter use.