Preliminary Draft Emission Estimates for
NCRA DEIR Technical Analysis

DRAFT

Model Year 2033 Basis with Tier 3 off-road engines

MCAQMD Operations

	lbs/day																Thresholds of Significance	
Pollutant	Train 1	Train 2	Train 3	Train 4	Train Total	T1-Traffic Que	T2-Traffic Que	T3-Traffic Que	T4-Traffic Que	Traffic Que Total	T1-Disp Truck Travel	T2-Disp Truck Travel	T3-Disp Truck Travel	T4-Disp Truck Travel	Total Disp Truck Total	Solid Waste Transfer Operations	Total	lb/day	%of Threshold
Criteria Pollutant Emissions																			
ROG	0.246	0.240	0.914	0.000	1.399	0.003	0.015	0.113	0.000	0.131	0.698	1.916	10.573	0.000	13.186	0.000	-11.656	180	-6%
CO	4.015	3.913	14.930	0.000	22.858	0.019	0.101	0.742	0.000	0.863	4.600	12.631	69.699	0.000	86.930	0.000	-63.209	690	-9%
NOx	11.799	11.500	43.875	0.000	67.174	0.019	0.101	0.743	0.000	0.863	6.556	18.004	99.349	0.000	123.909	0.000	-55.871	42	-133%
SOx	0.631	0.615	2.346	0.000	3.592	0.000	0.000	0.001	0.000	0.001	0.061	0.167	0.919	0.000	1.147	0.000	2.446	NA	NA
PM-10	0.287	0.280	1.066	0.000	1.633	0.000	0.000	0.003	0.000	0.003	0.315	0.864	4.769	0.000	5.948	0.000	-4.312	80	-5%
PM-2.5	0.264	0.257	0.981	0.000	1.502	0.000	0.000	0.002	0.000	0.003	0.288	0.791	4.367	0.000	5.447	0.000	-3.942	NA	NA
Toxics Emissions																			
Diesel PM	0.287	0.280	1.066	0.000	1.633	0.000	0.000	0.003	0.000	0.003	0.315	0.864	4.769	0.000	5.948	0.000	-4.312	NA	NA
Green House Gas Emissions																			
CH4	0.010	0.010	0.039	0.000	0.060	0.000	0.001	0.005	0.000	0.006	0.034	0.094	0.517	0.000	0.645	0.000	-0.580	NA	NA
CO2	1961.834	1912.007	7294.872	0.000	11168.712	1.414	7.417	54.274	0.000	63.105	6401.513	17578.853	97005.255	0.000	120985.621	0.000	-109753.804	NA	NA
CO_2-e	1962.053	1912.221	7295.688	0.000	11169.962	1.416	7.431	54.377	0.000	63.224	6402.230	17580.821	97016.115	0.000	120999.166	0.000	-109765.979	NA	NA

NSCAPCD Operations

	tons/yr																Thresholds of Significance	
Pollutant	Train 1	Train 2	Train 3	Train 4	Train Total	T1-Traffic Que	T2-Traffic Que	T3-Traffic Que	T4-Traffic Que	Traffic Que Total	T1-Disp Truck Travel	T2-Disp Truck Travel	T3-Disp Truck Travel	T4-Disp Truck Travel	Total Disp Truck Travel	Solid Waste Transfer Operations	Total	ton/yr	%of Threshold
Criteria Pollutant Emissions																			
ROG	0.000	0.026	0.049	0.000	0.075	0.000	0.002	0.011	0.000	0.013	0.000	0.207	0.690	0.000	0.896	0.000	-0.808	40	-2%
CO	0.000	0.430	0.802	0.000	1.233	0.000	0.014	0.069	0.000	0.083	0.000	1.364	4.545	0.000	5.909	0.000	-4.593	100	-5%
NOx	0.000	1.264	2.358	0.000	3.622	0.000	0.014	0.069	0.000	0.083	0.000	1.944	6.479	0.000	8.423	0.000	-4.717	40	-12%
SOx	0.000	0.068	0.126	0.000	0.194	0.000	0.000	0.000	0.000	0.000	0.000	0.018	0.060	0.000	0.078	0.000	0.116	40	0.3%
PM-10	0.000	0.031	0.057	0.000	0.088	0.000	0.000	0.000	0.000	0.000	0.000	0.093	0.311	0.000	0.404	0.000	-0.316	15	-2%
PM-2.5	0.000	0.028	0.053	0.000	0.081	0.000	0.000	0.000	0.000	0.000	0.000	0.085	0.285	0.000	0.370	0.000	-0.289	NA	NA
Toxics Emissions																			
Diesel PM	0.000	0.031	0.057	0.000	0.088	0.000	0.000	0.000	0.000	0.000	0.000	0.093	0.311	0.000	0.404	0.000	-0.316	NA	NA
Green House Gas Emissions																			
CH4	0.000	0.001	0.002	0.000	0.003	0.000	0.000	0.000	0.000	0.001	0.000	0.010	0.034	0.000	0.044	0.000	-0.040	NA	NA
CO2	0.000	210.242	392.012	0.000	602.254	0.000	1.016	5.060	0.000	6.076	0.000	1897.873	6326.243	0.000	8224.116	0.000	-7615.786	NA	NA
CO_2-e	0.000	210.266	392.056	0.000	602.321	0.000	1.018	5.070	0.000	6.088	0.000	1898.085	6326.951	0.000	8225.037	0.000	-7616.628	NA	NA

BAAQMD Operations

	lbs/day															Thresholds of Significance	
Pollutant	Train 1	Train 2	Train 3	Train 4	Train Total	T1-Traffic Que	T2-Traffic Que	T3-Traffic Que	T4-Traffic Que	Traffic Que Total	T1-Disp Truck Travel	T2-Disp Truck Travel	T3-Disp Truck Travel	T4-Disp Truck Travel	Total Disp Truck Travel	Solid Waste Transfer Operations	Total	lb/day	%of Threshold
Criteria Pollutant Emissions																			
ROG	0.000	0.700	1.316	0.782	2.798	0.000	0.080	0.378	0.291	0.750	0.000	3.993	13.309	2.671	19.973	0.849	-15.577	80	-19%
CO	0.000	11.430	21.489	12.774	45.693	0.000	0.547	2.592	1.996	5.135	0.000	26.187	87.289	17.516	130.992	4.244	-75.920	NA	NA
NOx	0.000	33.590	63.150	37.541	134.281	0.000	0.558	2.643	2.036	5.236	0.000	39.333	131.110	26.310	196.753	6.224	-51.011	80	-64%
SOx	0.000	1.796	3.377	2.007	7.180	0.000	0.000	0.002	0.002	0.004	0.000	0.340	1.133	0.227	1.700	0.566	6.051	NA	NA
PM-10	0.000	0.816	1.535	0.912	3.264	0.000	0.003	0.014	0.011	0.028	0.000	1.805	6.017	1.208	9.030	0.283	-5.456	80	-7%
PM-2.5	0.000	0.751	1.412	0.839	3.003	0.000	0.003	0.013	0.010	0.025	0.000	1.657	5.522	1.108	8.287	0.260	-4.999	NA	NA
Toxics Emissions																			
Diesel PM	0.000	0.816	1.535	0.912	3.264	0.000	0.003	0.014	0.011	0.028	0.000	1.805	6.017	1.208	9.030	0.283	-5.456	NA	NA
Green House Gas Emissions																			
CH4	0.000	0.030	0.056	0.033	0.119	0.000	0.004	0.017	0.013	0.034	0.000	0.212	0.708	0.142	1.062	0.265	-0.644	NA	NA
CO2	0.000	5584.828	10499.776	6241.842	22326.446	0.000	42.249	200.220	5362.000	5604.469	0.000	35832.065	119440.216	23968.384	179240.665	49800.000	-101509.750	NA	NA
CO_2-e	0.000	5585.454	10500.951	6242.541	22328.945	0.000	42.324	200.577	5362.275	5605.176	0.000	35836.525	119455.083	23971.367	179262.975	49805.575	-101523.278	NA	NA

	tons/yr															Thresholds of Significance	
Pollutant	Train 1	Train 2	Train 3	Train 4	Train Total	T1-Traffic Que	T2-Traffic Que	T3-Traffic Que	T4-Traffic Que	Traffic Que Total	T1-Disp Truck Travel	T2-Disp Truck Travel	T3-Disp Truck Travel	T4-Disp Truck Travel	Total Disp Truck Travel	Support Operations	Total	ton/yr	%of Threshold
Criteria Pollutant Emissions																			
ROG	0.000	0.109	0.205	0.122	0.436	0.000	0.012	0.059	0.045	0.117	0.000	0.623	2.076	0.417	3.116	0.132	-2.430	15	-16%
CO	0.000	1.783	3.352	1.993	7.128	0.000	0.085	0.404	0.311	0.801	0.000	4.085	13.617	2.733	20.435	0.662	-11.843	NA	NA
NOx	0.000	5.240	9.851	5.856	20.948	0.000	0.087	0.412	0.318	0.817	0.000	6.136	20.453	4.104	30.693	0.971	-7.958	15	-53%
SOx	0.000	0.280	0.527	0.313	1.120	0.000	0.000	0.000	0.000	0.001	0.000	0.053	0.177	0.035	0.265	0.088	0.944	NA	NA
PM-10	0.000	0.127	0.239	0.142	0.509	0.000	0.000	0.002	0.002	0.004	0.000	0.282	0.939	0.188	1.409	0.044	-0.851	15	-6%
PM-2.5	0.000	0.117	0.220	0.131	0.468	0.000	0.000	0.002	0.002	0.004	0.000	0.258	0.861	0.173	1.293	0.041	-0.780	NA	NA
Toxics Emissions																			
Diesel PM	0.000	0.127	0.239	0.142	0.509	0.000	0.000	0.002	0.002	0.004	0.000	0.282	0.939	0.188	1.409	0.044	-0.851	NA	NA
Green House Gas Emissions																			
CH4	0.000	0.005	0.009	0.005	0.019	0.000	0.001	0.003	0.002	0.005	0.000	0.033	0.110	0.022	0.166	0.041	-0.100	NA	NA
CO2	0.000	871.233	1637.965	973.727	3482.926	0.000	6.591	31.234	24.058	61.884	0.000	5589.802	18632.674	3739.068	27961.544	7768.800	-16647.935	NA	NA
CO_2-e	0.000	871.331	1638.148	973.836	3483.315	0.000	6.603	31.290	24.101	61.994	0.000	5590.498	18634.993	3739.533	27965.024	7769.670	-16650.045	NA	NA

REDWOOD VALLEY TO WILLITS MERCHANDISE TRAIN

TRAIN OPERATIONS BASIS	Loaded trip	Return trip
Trains per day	1	1
Days per week	6	6
Trains per week	6	6
Weeks per Year	52	52
Trains per year	312	312
Min cars per train	10	10
max cars per train	10	10
Ave Cars per train	10	10
Length per car (feet)	67.583	67.583
Number of Engines	1	1
Length per engine (feet)	62.5	62.5
Train Length (feet)	738	738
Weight per Car (tons)	130	30
Cargo weight per car	100	0
Horse Power per Engine	2100	2100
Engine Load Factor (%)	60%	40%
Trip Distance (mi)	21.50	21.50
MCAQMD Portion (mi)	21.50	21.50
NSCAPCD Portion (mi)	0.00	0.00
BAAQMD Portion (mi)	0.00	0.00
Travel Time MCAQMP Portion (hr/day)	0.87	0.87
Travel Time NSCAPCD Portion (hr/day)	0.00	0.00
Travel Time BAAQMD Portion (hr/day)	0.00	0.00
Travel Time MCAQMP Portion (hr/yr)	271.13	271.13
Travel Time NSCAPCD Portion (hr/yr)	0.00	0.00
Travel Time BAAQMD Portion (hr/yr)	0.00	0.00

TRAIN EMISSIONS

Emission Factors[1]		MCAQMD Operations		NSCAPCD Operations		BAAQMD Operations	
Tier 3 (off-road engines)	g/bhp-hr	lbs/day	tons/yr	lbs/day	tons/yr	lbs/day	tons/yr
ROG[2]	0.06	0.24	0.04	0.00	0.00	0.00	0.00
CO	0.98	3.94	0.62	0.00	0.00	0.00	0.00
NOx	2.88	11.59	1.81	0.00	0.00	0.00	0.00
SOx[3]	0.154	0.62	0.10	0.00	0.00	0.00	0.00
PM-10	0.07	0.28	0.04	0.00	0.00	0.00	0.00
PM-2.5[4]	0.06	0.26	0.04	0.00	0.00	0.00	0.00
CH_4[5]	0.003	0.01	0.00	0.00	0.00	0.00	0.00
CO_2[6]	478.85	1926.47	300.53	0.00	0.00	0.00	0.00

1) Tier 3 emission factors based on published data provided by the locomotive manufacturer for N-ViroMotive with Cummins QSK19 Engine sets.
2) ROG emission rates were not published for locomotive engines. Therefore, the THC emissions were conservatively assumed to be equivalent to ROG.
3) SOx emission factor is based on low sulfur fuel with 500ppm sulfur content allowed for locomotive use prior to 2014. Assuming all the sulfur is emitted as SO2, this equates to an emission factor of 0.154 g/bhp-hr calculated as follows:
500/10^6 x 7.08 lb/gal x 453.6 g/lb x 1gal/20.8 bhp-hr x 64.1 mol-lb SO2/32.1 mol-lbs Sulfur = 0.154 g/bhp-hr
Where 7.08 lb/gal is the density of diesel fuel and 20.8 bhp-hr/gal is the EPA conversion factor (EPA420-F-97-051, December 1997).
4) A PM-2.5 emission factor for locomotives was not found in the available literature sources. However, based on the EMFAC2007 model for heavy duty diesel trucks, the PM2.5 emission rate is aproximatley 92% of the PM-10 emission rate. Therefore, 92% of the PM-10 emission factor was used to estimate the PM-2.5 emissions for diesel combustion in locomotives since the engines operate similarly with compression ignition.
5) An emission factor for CH4 from trains was not found in the available literature from the manufacturer or EPA. Therefore, CH4 from trains is based on factoring the train CO2 emission factor by the ratio of CH4 to CO2 emissions provided by the EMFAC2007 model for Heavy Duty Diesel Trucks. This approach is considered appropriate since it is based on combustion of diesel fuel from compression ignition engines.
6) Emission factor for CO2 is based on the California Climate Action Registry (CCAR) General Reporting Protocol (GRP) v2.2, March 2007, Emission Factors for Mobile Emissions, Table C.3: Carbon Dioxide Emission Factors for Transport Fuels (CA Low Sulfur Diesel) of 9.96 kg CO2/gal. Based on the EPA Conversion value of 20.8 bhp-hr/gal of diesel for locomotives (EPA420-F-97-051), this equates to 478.85 g/bhp-hr.

REDWOOD VALLEY TO WILLITS NORMAL FREIGHT

TRAFFIC QUEUING BASIS	Loaded trip	Return trip	
Trains per day	1	1	
Days per week	6	6	
Trains per week	6	6	
Weeks per Year	52	52	
Trains per year	312	312	
Min cars per train	10	10	
max cars per train	10	10	
Ave Cars per train	10	10	
Length per car (feet)	67.583	67.583	
Number of Engines	1	1	
Length per engine (feet)	62.5	62.5	
Train length (feet)	738	738	
Crossing guard closure time (s/train)	22	22	Based on FRA requirements of 20 second pre-crossing signal control and 2 second post-crossing signal control
MCAQMD Crossings Que Time (hr/train)	0.6019	0.6019	
NSCAPCD Crossings Que Time (hr/train)	0.0000	0.0000	
BAAQMD Crossings Que Time (hr/train)	0.0000	0.0000	

AUTOMOBILE IDLING EMISSIONS AT TRAIN CROSSINGS (NORTH COAST AIR BASIN EMFAC2007 EMISSION FACTORS)

Emission Factors		MCAQMP Section Emissions		NSCAPCD Section Emissions	
Model Year 2033 (future full operations)	gr/idle-hr	lbs/day	tons/yr	lbs/day	tons/yr
ROG	1.11E+00	2.94E-03	4.58E-04	0.00E+00	0.00E+00
CO	7.29E+00	1.93E-02	3.02E-03	0.00E+00	0.00E+00
NOx	7.29E+00	1.93E-02	3.02E-03	0.00E+00	0.00E+00
SOx	5.00E-03	1.33E-05	2.07E-06	0.00E+00	0.00E+00
PM-10	2.60E-02	6.90E-05	1.08E-05	0.00E+00	0.00E+00
PM-2.5	2.40E-02	6.37E-05	9.94E-06	0.00E+00	0.00E+00
CO2	5.33E+02	1.41E+00	2.21E-01	0.00E+00	0.00E+00
CH4	4.80E-02	1.27E-04	1.99E-05	0.00E+00	0.00E+00

AUTOMOBILE IDLING EMISSIONS AT TRAIN CROSSINGS (BAY AREA AIR BASIN EMFAC2007 EMISSION FACTORS

Emission Factors		BAAQMD Section Emissions	
Model Year 2033 (future full operations)	gr/idle-hr	lbs/day	tons/yr
ROG	5.12E-01	0.00E+00	0.00E+00
CO	3.51E+00	0.00E+00	0.00E+00
NOx	3.58E+00	0.00E+00	0.00E+00
SOx	3.00E-03	0.00E+00	0.00E+00
PM-10	1.90E-02	0.00E+00	0.00E+00
PM-2.5	1.70E-02	0.00E+00	0.00E+00
CO2	2.71E+02	0.00E+00	0.00E+00
CH4	2.30E-02	0.00E+00	0.00E+00

Based on idling emissions (0 mph) from EMFAC2007
In accordance with BAAQMD CEQA Guidance recommended temperature basis, the Mean Summer Max for all pollutants except CO, and Mean Winter Minimum for CO, were applied for evaluating emissions with the EMFAC2007 program.

REDWOOD VALLEY TO WILLITS NORMAL FREIGHT

TRAIN OPERATIONS BASIS	Loaded trip	Return tip	
Trains per day	1	1	
Trains per year	312	312	
Ave Cars per train	10	10	
Gross weight per car (tons/car)	130	30	
Cargo weight per car (tons/car)	100	0	
Total daily cargo weight (tons/day)	1000	0	
Total annual cargo weight (tons/yr)	312000	0	
Average Truck Capacity (tons/truck)	25	0	Based on 4 trucks per train car
Equivalent number of trucks (trucks/day)	40	40	assume trucks travel full one way and empty back
Equivalent number of trucks (trucks/yr)	12480	12480	assume trucks travel full one way and empty back
Trip Distance (mi)	21.50	21.50	
MCAQMD Portion (mi)	21.50	21.50	
NSCAPCD Portion (mi)	0.00	0.00	
BAAQMD Portion (mi)	0.00	0.00	

HHDT EMISSIONS (AVERAGE SPEED OF 45 MPH)-(NORTH COAST AIR BASIN EMFAC2007 EMISSION FACTORS

Emission Factors		MCAQMD Section Emissions		NSCAQMD Section Emissions	
Model Year 2033 (future full operation)	gr/mi	lbs/day	tons/yr	lbs/day	tons/yr
ROG	1.84E-01	6.98E-01	1.09E-01	0.00E+00	0.00E+00
CO	1.21E+00	4.60E+00	7.18E-01	0.00E+00	0.00E+00
NOx	1.73E+00	6.56E+00	1.02E+00	0.00E+00	0.00E+00
SOx	1.60E-02	6.07E-02	9.46E-03	0.00E+00	0.00E+00
PM-10	8.30E-02	3.15E-01	4.91E-02	0.00E+00	0.00E+00
PM-2.5	7.60E-02	2.88E-01	4.50E-02	0.00E+00	0.00E+00
CO2	1.69E+03	6.40E+03	9.99E+02	0.00E+00	0.00E+00
CH4	9.00E-03	3.41E-02	5.32E-03	0.00E+00	0.00E+00

HHDT EMISSIONS (AVERAGE SPEED OF 45 MPH)-(BAY AREA AIR BASIN EMFAC2007 EMISSION FACTORS

Emission Factors		BAAQMD Section Emissions	
Model Year 2033 (future full operation)	gr/mi	lbs/day	tons/yr
ROG	1.88E-01	0.00E+00	0.00E+00
CO	1.23E+00	0.00E+00	0.00E+00
NOx	1.85E+00	0.00E+00	0.00E+00
SOx	1.60E-02	0.00E+00	0.00E+00
PM-10	8.50E-02	0.00E+00	0.00E+00
PM-2.5	7.80E-02	0.00E+00	0.00E+00
CO2	1.69E+03	0.00E+00	0.00E+00
CH4	1.00E-02	0.00E+00	0.00E+00

Based on average maximum sumertime temperature for all compounds except CO. Based on average minimum wintertime temperature for CO.

LOMBARD TO REDWOOD VALLEY MERCHANDISE TRAIN

TRAIN OPERATIONS BASIS	Loaded trip	Return trip	
Trains per day	1	1	
Days per week	6	6	
Trains per week	6	6	
Weeks per Year	52	52	
Trains per year	312	312	
Min cars per train	10	10	
max cars per train	25	25	
Ave Cars per train	18	18	
Length per car (feet)	67.583	67.583	
Number of Engines	1	1	
Length per engine (feet)	62.5	62.5	
Train Length (feet)	1279	1279	
Weight per Car (tons)	130	30	
Cargo weight per car	100	0	
Horse Power per Engine	2100	2100	Not provided
Engine Load Factor (%)	60%	40%	
Trip Distance (mi)	122.40	122.40	
MCAQMD Portion (mi)	32.80	32.80	
NSCAPCD Portion (mi)	22.70	22.70	
BAAQMD Portion (mi)	66.90	66.90	
Travel Time MCAQMP Portion (hr/day)	0.85	0.85	
Travel Time NSCAPCD Portion (hr/day)	0.58	0.58	
Travel Time BAAQMD Portion (hr/day)	2.46	2.46	
Travel Time MCAQMP Portion (hr/yr)	266.60	266.60	
Travel Time NSCAPCD Portion (hr/yr)	182.21	182.21	
Travel Time BAAQMD Portion (hr/yr)	768.58	768.58	

TRAIN EMISSIONS

Emission Factors[1]		MCAQMD Operations		NSCAPCD Operations		BAAQMD Operations	
Tier 3 (off-road engines)	g/bhp-hr	lbs/day	tons/yr	lbs/day	tons/yr	lbs/day	tons/yr
ROG[2]	0.06	0.24	0.04	0.16	0.03	0.68	0.11
CO	0.98	3.88	0.60	2.65	0.41	11.18	1.74
NOx	2.88	11.39	1.78	7.79	1.21	32.85	5.12
SOx[3]	0.154	0.61	0.10	0.42	0.06	1.76	0.27
PM-10	0.07	0.28	0.04	0.19	0.03	0.80	0.12
PM-2.5[4]	0.06	0.25	0.04	0.17	0.03	0.73	0.11
CH_4[5]	0.003	0.01	0.00	0.01	0.00	0.03	0.00
CO_2[6]	478.85	1894.32	295.51	1294.66	201.97	5461.05	851.92

1) Tier 3 emission factors based on published data provided by the locomotive manufacturer for N-ViroMotive with Cummins QSK19 Engine sets.
2) ROG emission rates were not published for locomotive engines. Therefore, the THC emissions were conservatively assumed to be equivalent to ROG.
3) SOx emission factor is based on low sulfur fuel with 500ppm sulfur content allowed for locomotive use prior to 2014. Assuming all the sulfur is emitted as SO2, this equates to an emission factor of 0.154 g/bhp-hr calculated as follows:
500/10^6 x 7.08 lb/gal x 453.6 g/lb x 1gal/20.8 bhp-hr x 64.1 mol-lb SO2/32.1 mol-lbs Sulfur = 0.154 g/bhp-hr
Where 7.08 lb/gal is the density of diesel fuel and 20.8 bhp-hr/gal is the EPA conversion factor (EPA420-F-97-051, December 1997).
4) A PM-2.5 emission factor for locomotives was not found in the available literature sources. However, based on the EMFAC2007 model for heavy duty diesel trucks, the PM2.5 emission rate is aproximatley 92% of the PM-10 emission rate. Therefore, 92% of the PM-10 emission factor was used to estimate the PM-2.5 emissions for diesel combustion in locomotives since the engines operate similarly with compression ignition.
5) An emission factor for CH4 from trains was not found in the available literature from the manufacturer or EPA. Therefore, CH4 from trains is based on factoring the train CO2 emission factor by the ratio of CH4 to CO2 emissions provided by the EMFAC2007 model for Heavy Duty Diesel Trucks. This approach is considered appropriate since it is based on combustion of diesel fuel from compression ignition engines.
6) Emission factor for CO2 is based on the California Climate Action Registry (CCAR) General Reporting Protocol (GRP) v2.2, March 2007, Emission Factors for Mobile Emissions, Table C.3: Carbon Dioxide Emission Factors for Transport Fuels (CA Low Sulfur Diesel) of 9.96 kg CO2/gal. Based on the EPA Conversion value of 20.8 bhp-hr/gal of diesel for locomotives (EPA420-F-97-051), this equates to 478.85 g/bhp-hr.

REDWOOD VALLEY TO LOMBARD NORMAL FREIGHT

TRAFFIC QUEUING BASIS	Loaded trip	Return trip	
Trains per day	1	1	
Days per week	6	6	
Trains per week	6	6	
Weeks per Year	52	52	
Trains per year	312	312	
Min cars per train	10	10	
max cars per train	25	25	
Ave Cars per train	18	18	
Length per car (feet)	67.583	67.583	
Number of Engines	1	1	
Length per engine (feet)	62.5	62.5	
Train length (feet)	1,279	1,279	
Crossing guard closure time (s/train)	22	22	Based on FRA requirements of 20 second pre-crossing signal control and 2 second post-crossing signal control
MCAQMD Crossings Que Time (hr/train)	3.1576	3.1576	
NSCAPCD Crossings Que Time (hr/train)	2.7725	2.7725	
BAAQMD Crossings Que Time (hr/train)	35.3695	35.3695	

AUTOMOBILE IDLING EMISSIONS AT TRAIN CROSSINGS (NORTH COAST AIR BASIN EMFAC2007 EMISSION FACTORS)

Emission Factors		MCAQMP Section Emissions		NSCAPCD Section Emissions	
Model Year 2033 (future full operations)	gr/idle-hr	lbs/day	tons/yr	lbs/day	tons/yr
ROG	1.11E+00	1.54E-02	2.40E-03	1.35E-02	2.11E-03
CO	7.29E+00	1.01E-01	1.58E-02	8.91E-02	1.39E-02
NOx	7.29E+00	1.01E-01	1.58E-02	8.91E-02	1.39E-02
SOx	5.00E-03	6.96E-05	1.09E-05	6.11E-05	9.53E-06
PM-10	2.60E-02	3.62E-04	5.65E-05	3.18E-04	4.96E-05
PM-2.5	2.40E-02	3.34E-04	5.21E-05	2.93E-04	4.58E-05
CO2	5.33E+02	7.42E+00	1.16E+00	6.51E+00	1.02E+00
CH4	4.80E-02	6.68E-04	1.04E-04	5.87E-04	9.15E-05

AUTOMOBILE IDLING EMISSIONS AT TRAIN CROSSINGS (BAY AREA AIR BASIN EMFAC2007 EMISSION FACTORS

Emission Factors		BAAQMD Section Emissions	
Model Year 2033 (future full operations)	gr/idle-hr	lbs/day	tons/yr
ROG	5.12E-01	7.98E-02	1.25E-02
CO	3.51E+00	5.47E-01	8.53E-02
NOx	3.58E+00	5.58E-01	8.70E-02
SOx	3.00E-03	4.68E-04	7.30E-05
PM-10	1.90E-02	2.96E-03	4.62E-04
PM-2.5	1.70E-02	2.65E-03	4.14E-04
CO2	2.71E+02	4.22E+01	6.59E+00
CH4	2.30E-02	3.59E-03	5.60E-04

Based on idling emissions (0 mph) from EMFAC2007
In accordance with BAAQMD CEQA Guidance recommended temperature basis, the Mean Summer Max for all pollutants except CO, and Mean Winter Minimum for CO, were applied for evaluating emissions with the EMFAC2007 program.

LOMBARD TO REDWOOD VALLEY NORMAL FREIGHT

TRAIN OPERATIONS BASIS	Loaded trip	Return tip	
Trains per day	1	1	
Trains per year	312	312	
Ave Cars per train	18	18	
Gross weight per car (tons/car)	130	30	
Cargo weight per car (tons/car)	100	0	
Total daily cargo weight (tons/day)	1800	0	
Total annual cargo weight (tons/yr)	561600	0	
Average Truck Capacity (tons/truck)	25	0	Based on 4 trucks per train car
Equivalent number of trucks (trucks/day)	72	72	assume trucks travel full one way and empty back
Equivalent number of trucks (trucks/yr)	22464	22464	assume trucks travel full one way and empty back
Trip Distance (mi)	122.40	122.40	
MCAQMD Portion (mi)	32.80	32.80	
NSCAPCD Portion (mi)	22.70	22.70	
BAAQMD Portion (mi)	66.90	66.90	

HHDT EMISSIONS (AVERAGE SPEED OF 45 MPH)-(NORTH COAST AIR BASIN EMFAC2007 EMISSION FACTORS

Emission Factors		MCAQMD Section Emissions		NSCAQMD Section Emissions	
Model Year 2033 (future full operation)	gr/mi	lbs/day	tons/yr	lbs/day	tons/yr
ROG	1.84E-01	1.92E+00	2.99E-01	1.33E+00	2.07E-01
CO	1.21E+00	1.26E+01	1.97E+00	8.74E+00	1.36E+00
NOx	1.73E+00	1.80E+01	2.81E+00	1.25E+01	1.94E+00
SOx	1.60E-02	1.67E-01	2.60E-02	1.15E-01	1.80E-02
PM-10	8.30E-02	8.64E-01	1.35E-01	5.98E-01	9.33E-02
PM-2.5	7.60E-02	7.91E-01	1.23E-01	5.48E-01	8.54E-02
CO2	1.69E+03	1.76E+04	2.74E+03	1.22E+04	1.90E+03
CH4	9.00E-03	9.37E-02	1.46E-02	6.49E-02	1.01E-02

HHDT EMISSIONS (AVERAGE SPEED OF 45 MPH)-(BAY AREA AIR BASIN EMFAC2007 EMISSION FACTORS

Emission Factors		BAAQMD Section Emissions	
Model Year 2033 (future full operation)	gr/mi	lbs/day	tons/yr
ROG	1.88E-01	3.99E+00	6.23E-01
CO	1.23E+00	2.62E+01	4.09E+00
NOx	1.85E+00	3.93E+01	6.14E+00
SOx	1.60E-02	3.40E-01	5.30E-02
PM-10	8.50E-02	1.81E+00	2.82E-01
PM-2.5	7.80E-02	1.66E+00	2.58E-01
CO2	1.69E+03	3.58E+04	5.59E+03
CH4	1.00E-02	2.12E-01	3.31E-02

Based on average maximum sumertime temperature for all compounds except CO. Based on average minimum wintertime temperature for CO.

LOMBARD TO WILLITS MERCHANDISE TRAIN

TRAIN OPERATIONS BASIS	Loaded trip	Return trip
Trains per day	1	1
Days per week	6	6
Trains per week	6	6
Weeks per Year	52	52
Trains per year	312	312
Min cars per train	60	60
max cars per train	60	60
Ave Cars per train	60	60
Length per car (feet)	67.583	67.583
Number of Engines	2	2
Length per engine (feet)	62.5	62.5
Train Length (feet)	4180	4180
Weight per Car (tons)	130	30
Cargo weight per car	100	0
Horse Power per Engine	2100	2100
Engine Load Factor (%)	70%	25%
Trip Distance (mi)	143.90	143.90
MCAQMD Portion (mi)	54.30	54.30
NSCAPCD Portion (mi)	22.70	22.70
BAAQMD Portion (mi)	66.90	66.90
Travel Time MCAQMP Portion (hr/day)	1.72	1.72
Travel Time NSCAPCD Portion (hr/day)	0.58	0.58
Travel Time BAAQMD Portion (hr/day)	2.46	2.46
Travel Time MCAQMP Portion (hr/yr)	537.73	537.73
Travel Time NSCAPCD Portion (hr/yr)	182.21	182.21
Travel Time BAAQMD Portion (hr/yr)	768.58	768.58

TRAIN EMISSIONS

Emission Factors[1]		MCAQMD Operations		NSCAPCD Operations		BAAQMD Operations	
Tier 3 (off-road engines)	g/bhp-hr	lbs/day	tons/yr	lbs/day	tons/yr	lbs/day	tons/yr
ROG[2]	0.06	0.91	0.14	0.31	0.05	1.30	0.20
CO	0.98	14.86	2.32	5.03	0.79	21.24	3.31
NOx	2.88	43.66	6.81	14.79	2.31	62.41	9.74
SOx[3]	0.154	2.33	0.36	0.79	0.12	3.34	0.52
PM-10	0.07	1.06	0.17	0.36	0.06	1.52	0.24
PM-2.5[4]	0.06	0.98	0.15	0.33	0.05	1.40	0.22
CH_4[5]	0.003	0.04	0.01	0.01	0.00	0.06	0.01
CO_2[6]	478.85	7259.51	1132.48	2459.85	383.74	10376.00	1618.66

1) Tier 3 emission factors based on published data provided by the locomotive manufacturer for N-ViroMotive with Cummins QSK19 Engine sets.
2) ROG emission rates were not published for locomotive engines. Therefore, the THC emissions were conservatively assumed to be equivalent to ROG.
3) SOx emission factor is based on low sulfur fuel with 500ppm sulfur content allowed for locomotive use prior to 2014. Assuming all the sulfur is emitted as SO2, this equates to an emission factor of 0.154 g/bhp-hr calculated as follows:
500/10^6 x 7.08 lb/gal x 453.6 g/lb x 1gal/20.8 bhp-hr x 64.1 mol-lb SO2/32.1 mol-lbs Sulfur = 0.154 g/bhp-hr
Where 7.08 lb/gal is the density of diesel fuel and 20.8 bhp-hr/gal is the EPA conversion factor (EPA420-F-97-051, December 1997).
4) A PM-2.5 emission factor for locomotives was not found in the available literature sources. However, based on the EMFAC2007 model for heavy duty diesel trucks, the PM2.5 emission rate is aproximatley 92% of the PM-10 emission rate. Therefore, 92% of the PM-10 emission factor was used to estimate the PM-2.5 emissions for diesel combustion in locomotives since the engines operate similarly with compression ignition.
5) An emission factor for CH4 from trains was not found in the available literature from the manufacturer or EPA. Therefore, CH4 from trains is based on factoring the train CO2 emission factor by the ratio of CH4 to CO2 emissions provided by the EMFAC2007 model for Heavy Duty Diesel Trucks. This approach is considered appropriate since it is based on combustion of diesel fuel from compression ignition engines.
6) Emission factor for CO2 is based on the California Climate Action Registry (CCAR) General Reporting Protocol (GRP) v2.2, March 2007, Emission Factors for Mobile Emissions, Table C.3: Carbon Dioxide Emission Factors for Transport Fuels (CA Low Sulfur Diesel) of 9.96 kg CO2/gal. Based on the EPA Conversion value of 20.8 bhp-hr/gal of diesel for locomotives (EPA420-F-97-051), this equates to 478.85 g/bhp-hr.

LOMBARD TO WILLITS NORMAL FREIGHT

TRAFFIC QUEUING BASIS	Loaded trip	Return trip	
Trains per day	1	1	
Days per week	6	6	
Trains per week	6	6	
Weeks per Year	52	52	
Trains per year	312	312	
Min cars per train	60	60	
max cars per train	60	60	
Ave Cars per train	60	60	
Length per car (feet)	67.583	67.583	
Number of Engines	2	2	
Length per engine (feet)	62.5	62.5	
Train length (feet)	4,180	4,180	
Crossing guard closure time (s/train)	22	22	Based on FRA requirements of 20 second pre-crossing signal control and 2 second post-crossing signal control
MCAQMD Crossings Que Time (hr/train)	23.1049	23.1049	
NSCAPCD Crossings Que Time (hr/train)	13.8090	13.8090	
BAAQMD Crossings Que Time (hr/train)	167.6187	167.6187	

AUTOMOBILE IDLING EMISSIONS AT TRAIN CROSSINGS (NORTH COAST AIR BASIN EMFAC2007 EMISSION FACTORS)

Emission Factors		MCAQMP Section Emissions		NSCAPCD Section Emissions	
Model Year 2033 (future full operations)	gr/idle-hr	lbs/day	tons/yr	lbs/day	tons/yr
ROG	1.11E+00	1.13E-01	1.76E-02	6.74E-02	1.05E-02
CO	7.29E+00	7.42E-01	1.16E-01	4.44E-01	6.92E-02
NOx	7.29E+00	7.43E-01	1.16E-01	4.44E-01	6.92E-02
SOx	5.00E-03	5.09E-04	7.95E-05	3.04E-04	4.75E-05
PM-10	2.60E-02	2.65E-03	4.13E-04	1.58E-03	2.47E-04
PM-2.5	2.40E-02	2.44E-03	3.81E-04	1.46E-03	2.28E-04
CO2	5.33E+02	5.43E+01	8.47E+00	3.24E+01	5.06E+00
CH4	4.80E-02	4.89E-03	7.63E-04	2.92E-03	4.56E-04

AUTOMOBILE IDLING EMISSIONS AT TRAIN CROSSINGS (BAY AREA AIR BASIN EMFAC2007 EMISSION FACTORS

Emission Factors		BAAQMD Section Emissions	
Model Year 2033 (future full operations)	gr/idle-hr	lbs/day	tons/yr
ROG	5.12E-01	3.78E-01	5.90E-02
CO	3.51E+00	2.59E+00	4.04E-01
NOx	3.58E+00	2.64E+00	4.12E-01
SOx	3.00E-03	2.22E-03	3.46E-04
PM-10	1.90E-02	1.40E-02	2.19E-03
PM-2.5	1.70E-02	1.26E-02	1.96E-03
CO2	2.71E+02	2.00E+02	3.12E+01
CH4	2.30E-02	1.70E-02	2.65E-03

Based on idling emissions (0 mph) from EMFAC2007
In accordance with BAAQMD CEQA Guidance recommended temperature basis, the Mean Summer Max for all pollutants except CO, and Mean Winter Minimum for CO, were applied for evaluating emissions with the EMFAC2007 program.

LOMBARD TO WILLITS NORMAL FREIGHT

TRAIN OPERATIONS BASIS	Loaded trip	Return tip	
Trains per day	1	1	
Trains per year	312	312	
Ave Cars per train	60	60	
Gross weight per car (tons/car)	130	30	
Cargo weight per car (tons/car)	100	0	
Total daily cargo weight (tons/day)	6000	0	
Total annual cargo weight (tons/yr)	1872000	0	
Average Truck Capacity (tons/truck)	25	0	Based on 4 trucks per train car
Equivalent number of trucks (trucks/day)	240	240	assume trucks travel full one way and empty back
Equivalent number of trucks (trucks/yr)	74880	74880	assume trucks travel full one way and empty back
Trip Distance (mi)	143.90	143.90	
MCAQMD Portion (mi)	54.30	54.30	
NSCAPCD Portion (mi)	22.70	22.70	
BAAQMD Portion (mi)	66.90	66.90	

HHDT EMISSIONS (AVERAGE SPEED OF 45 MPH)-(NORTH COAST AIR BASIN EMFAC2007 EMISSION FACTORS

Emission Factors		MCAQMD Section Emissions		NSCAQMD Section Emissions	
Model Year 2033 (future full operation)	gr/mi	lbs/day	tons/yr	lbs/day	tons/yr
ROG	1.84E-01	1.06E+01	1.65E+00	4.42E+00	6.90E-01
CO	1.21E+00	6.97E+01	1.09E+01	2.91E+01	4.55E+00
NOx	1.73E+00	9.93E+01	1.55E+01	4.15E+01	6.48E+00
SOx	1.60E-02	9.19E-01	1.43E-01	3.84E-01	6.00E-02
PM-10	8.30E-02	4.77E+00	7.44E-01	1.99E+00	3.11E-01
PM-2.5	7.60E-02	4.37E+00	6.81E-01	1.83E+00	2.85E-01
CO2	1.69E+03	9.70E+04	1.51E+04	4.06E+04	6.33E+03
CH4	9.00E-03	5.17E-01	8.07E-02	2.16E-01	3.37E-02

HHDT EMISSIONS (AVERAGE SPEED OF 45 MPH)-(BAY AREA AIR BASIN EMFAC2007 EMISSION FACTORS

Emission Factors		BAAQMD Section Emissions	
Model Year 2033 (future full operation)	gr/mi	lbs/day	tons/yr
ROG	1.88E-01	1.33E+01	2.08E+00
CO	1.23E+00	8.73E+01	1.36E+01
NOx	1.85E+00	1.31E+02	2.05E+01
SOx	1.60E-02	1.13E+00	1.77E-01
PM-10	8.50E-02	6.02E+00	9.39E-01
PM-2.5	7.80E-02	5.52E+00	8.61E-01
CO2	1.69E+03	1.19E+05	1.86E+04
CH4	1.00E-02	7.08E-01	1.10E-01

Based on average maximum sumertime temperature for all compounds except CO. Based on average minimum wintertime temperature for CO.

LOMBARD TO SANTA ROSA SOLID WASTE TRAIN

TRAIN OPERATIONS BASIS	Loaded trip	Return trip
Trains per day	1	1
Days per week	6	6
Trains per week	6	6
Weeks per Year	52	52
Trains per year	312	312
Min cars per train	60	60
max cars per train	60	60
Ave Cars per train	60	60
Length per car (feet)	67.583	67.583
Number of Engines	2	2
Length per engine (feet)	62.5	62.5
Train Length (feet)	4180	4180
Weight per Car (tons)	70	30
Cargo weight per car	40	0
Horse Power per Engine	2100	2100
Engine Load Factor (%)	40%	25%
Trip Distance (mi)	53.70	53.70
MCAQMD Portion (mi)	0.00	0.00
NSCAPCD Portion (mi)	0.00	0.00
BAAQMD Portion (mi)	53.70	53.70
Travel Time MCAQMP Portion (hr/day)	0.00	0.00
Travel Time NSCAPCD Portion (hr/day)	0.00	0.00
Travel Time BAAQMD Portion (hr/day)	2.12	2.12
Travel Time MCAQMP Portion (hr/yr)	0.00	0.00
Travel Time NSCAPCD Portion (hr/yr)	0.00	0.00
Travel Time BAAQMD Portion (hr/yr)	662.34	662.34

TRAIN EMISSIONS

Emission Factors[1]		MCAQMD Operations		NSCAPCD Operations		BAAQMD Operations	
Tier 3 (off-road engines)	g/bhp-hr	lbs/day	tons/yr	lbs/day	tons/yr	lbs/day	tons/yr
ROG[2]	0.06	0.00	0.00	0.00	0.00	0.77	0.12
CO	0.98	0.00	0.00	0.00	0.00	12.52	1.95
NOx	2.88	0.00	0.00	0.00	0.00	36.80	5.74
SOx[3]	0.154	0.00	0.00	0.00	0.00	1.97	0.31
PM-10	0.07	0.00	0.00	0.00	0.00	0.89	0.14
PM-2.5[4]	0.06	0.00	0.00	0.00	0.00	0.82	0.13
CH_4[5]	0.003	0.00	0.00	0.00	0.00	0.03	0.01
CO_2[6]	478.85	0.00	0.00	0.00	0.00	6118.07	954.42

1) Tier 3 emission factors based on published data provided by the locomotive manufacturer for N-ViroMotive with Cummins QSK19 Engine sets.
2) ROG emission rates were not published for locomotive engines. Therefore, the THC emissions were conservatively assumed to be equivalent to ROG.
3) SOx emission factor is based on low sulfur fuel with 500ppm sulfur content allowed for locomotive use prior to 2014. Assuming all the sulfur is emitted as SO2, this equates to an emission factor of 0.154 g/bhp-hr calculated as follows:
500/10^6 x 7.08 lb/gal x 453.6 g/lb x 1gal/20.8 bhp-hr x 64.1 mol-lb SO2/32.1 mol-lbs Sulfur = 0.154 g/bhp-hr
Where 7.08 lb/gal is the density of diesel fuel and 20.8 bhp-hr/gal is the EPA conversion factor (EPA420-F-97-051, December 1997).
4) A PM-2.5 emission factor for locomotives was not found in the available literature sources. However, based on the EMFAC2007 model for heavy duty diesel trucks, the PM2.5 emission rate is aproximatley 92% of the PM-10 emission rate. Therefore, 92% of the PM-10 emission factor was used to estimate the PM-2.5 emissions for diesel combustion in locomotives since the engines operate similarly with compression ignition.
5) An emission factor for CH4 from trains was not found in the available literature from the manufacturer or EPA. Therefore, CH4 from trains is based on factoring the train CO2 emission factor by the ratio of CH4 to CO2 emissions provided by the EMFAC2007 model for Heavy Duty Diesel Trucks. This approach is considered appropriate since it is based on combustion of diesel fuel from compression ignition engines.
6) Emission factor for CO2 is based on the California Climate Action Registry (CCAR) General Reporting Protocol (GRP) v2.2, March 2007, Emission Factors for Mobile Emissions, Table C.3: Carbon Dioxide Emission Factors for Transport Fuels (CA Low Sulfur Diesel) of 9.96 kg CO2/gal. Based on the EPA Conversion value of 20.8 bhp-hr/gal of diesel for locomotives (EPA420-F-97-051), this equates to 478.85 g/bhp-hr.

LOMBARD TO SANTA ROSA SOLID WASTE TRAIN

TRAFFIC QUEUING BASIS	Loaded trip	Return trip	
Trains per day	1	1	
Days per week	6	6	
Trains per week	6	6	
Weeks per Year	52	52	
Trains per year	312	312	
Min cars per train	60	60	
max cars per train	60	60	
Ave Cars per train	60	60	
Length per car (feet)	67.583	67.583	
Number of Engines	2	2	
Length per engine (feet)	62.5	62.5	
Train length (feet)	4,180	4,180	
Crossing guard closure time (s/train)	22	22	Based on FRA requirements of 20 second pre-crossing signal control and 2 second post-crossing signal control
MCAQMD Crossings Que Time (hr/train)	0.0000	0.0000	
NSCAPCD Crossings Que Time (hr/train)	0.0000	0.0000	
BAAQMD Crossings Que Time (hr/train)	129.1096	129.1096	

AUTOMOBILE IDLING EMISSIONS AT TRAIN CROSSINGS (NORTH COAST AIR BASIN EMFAC2007 EMISSION FACTORS)

Emission Factors		MCAQMP Section Emissions		NSCAPCD Section Emissions	
Model Year 2033 (future full operations)	gr/idle-hr	lbs/day	tons/yr	lbs/day	tons/yr
ROG	1.11E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO	7.29E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOx	7.29E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SOx	5.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PM-10	2.60E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PM-2.5	2.40E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO2	5.33E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CH4	4.80E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00

AUTOMOBILE IDLING EMISSIONS AT TRAIN CROSSINGS (BAY AREA AIR BASIN EMFAC2007 EMISSION FACTORS

Emission Factors		BAAQMD Section Emissions	
Model Year 2033 (future full operations)	gr/idle-hr	lbs/day	tons/yr
ROG	5.12E-01	2.91E-01	4.55E-02
CO	3.51E+00	2.00E+00	3.11E-01
NOx	3.58E+00	2.04E+00	3.18E-01
SOx	3.00E-03	1.71E-03	2.66E-04
PM-10	1.90E-02	1.08E-02	1.69E-03
PM-2.5	1.70E-02	9.68E-03	1.51E-03
CO2	2.71E+02	1.54E+02	2.41E+01
CH4	2.30E-02	1.31E-02	2.04E-03

Based on idling emissions (0 mph) from EMFAC2007
In accordance with BAAQMD CEQA Guidance recommended temperature basis, the Mean Summer Max for all pollutants except CO, and Mean Winter Minimum for CO, were applied for evaluating emissions with the EMFAC2007 program.

LOMBARD TO SANTA ROSA SOLID WASTE

TRAIN OPERATIONS BASIS	Loaded trip	Return tip	
Trains per day	1	1	
Trains per year	312	312	
Ave Cars per train	60	60	
Gross weight per car (tons/car)	70	30	
Cargo weight per car (tons/car)	40	0	
Total daily cargo weight (tons/day)	2400	0	
Total annual cargo weight (tons/yr)	748800	0	
Average Truck Capacity (tons/truck)	40	0	Based on 1 truck per train car
Equivalent number of trucks (trucks/day)	60	60	assume trucks travel full one way and empty back
Equivalent number of trucks (trucks/yr)	18720	18720	assume trucks travel full one way and empty back
Trip Distance (mi)	53.70	53.70	
MCAQMD Portion (mi)	0.00	0.00	
NSCAPCD Portion (mi)	0.00	0.00	
BAAQMD Portion (mi)	53.70	53.70	

HHDT EMISSIONS (AVERAGE SPEED OF 45 MPH)-(NORTH COAST AIR BASIN EMFAC2007 EMISSION FACTORS

Emission Factors		MCAQMD Section Emissions		NSCAQMD Section Emissions	
Model Year 2033 (future full operation)	gr/mi	lbs/day	tons/yr	lbs/day	tons/yr
ROG	1.84E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO	1.21E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NOx	1.73E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SOx	1.60E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PM-10	8.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PM-2.5	7.60E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO2	1.69E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CH4	9.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00

HHDT EMISSIONS (AVERAGE SPEED OF 45 MPH)-(BAY AREA AIR BASIN EMFAC2007 EMISSION FACTORS

Emission Factors		BAAQMD Section Emissions	
Model Year 2033 (future full operation)	gr/mi	lbs/day	tons/yr
ROG	1.88E-01	2.67E+00	4.17E-01
CO	1.23E+00	1.75E+01	2.73E+00
NOx	1.85E+00	2.63E+01	4.10E+00
SOx	1.60E-02	2.27E-01	3.55E-02
PM-10	8.50E-02	1.21E+00	1.88E-01
PM-2.5	7.80E-02	1.11E+00	1.73E-01
CO2	1.69E+03	2.40E+04	3.74E+03
CH4	1.00E-02	1.42E-01	2.22E-02

Based on average maximum sumertime temperature for all compounds except CO. Based on average minimum wintertime temperature for CO.

				City		Crossing Street Name	Mile Post	Distance Miles	10	15	Speed (MPH) 20	25	35	40	Speed (mph)	Seg Travel Time (hr)	Train 1	Gate Closure Time (s) Train 2	Train 3	Train 4	Approach Traffic Vol. D1 (veh/hr)	Approach Traffic Vol. D2 (veh/hr)	Number of Lanes	Saturation Flow (veh/hr-lane)	T-1 Vehicle Delay (veh-hr)	T-2 Vehicle Delay (veh-hr)	T-3 Vehicle Delay (veh-hr)	T-4 Vehicle Delay (veh-hr)
Bay Area	Lombard to Willits	Lombard to Redwood Valley	Lombard to Santa Rosa	Lombard	1	Green Island Rd.	0.75	0.75			1				20	0.0375		65.60	164.50	164.50	571	571	1/1	1800	0.000	0.278	1.746	1.746
					2	Milton Rd.	3.04	2.29	1						10	0.2290		109.20	307.00	307.00	571	571	1/1	1800	0.000	0.770	6.082	6.082
					3	Skaggs Island Rd.	6.69	3.65					1		35	0.1043		46.92	103.43	103.43	571	571	1/1	1800	0.000	0.142	0.690	0.690
				Shellville	4	**SR 12/121 Cameros Hwy.**	**10.57**	**3.88**		**1**					**15**	**0.2587**		**176.55**	**308.41**	**308.41**	**1336**	**1214**	**1/1**	**1800**	**0.000**	**10.716**	**32.702**	**32.702**
					5	Redding Rd.	13.63	3.06					1		35	0.0874		46.92	103.43	103.43	571	571	1/1	1800	0.000	0.142	0.690	0.690
					6	**SR 37 Sears Point Rd.**	**18.08**	**4.45**						**1**	**35**	**0.1271**		**46.92**	**103.43**	**103.43**	**878**	**1121**	**1/1**	**1800**	**0.000**	**0.398**	**1.934**	**1.934**
					7	Reclamation Rd.	20.14	2.06					1		35	0.0589		46.92	103.43	103.43	571	571	1/1	1800	0.000	0.142	0.690	0.690
					8	(Roughly MP 20)	20.53	0.39					1		35	0.0111		46.92	103.43	103.43	571	571	1/1	1800	0.000	0.142	0.690	0.690
					9	Port Sonoma Rd.	21.81	1.28					1		35	0.0366		46.92	103.43	103.43	571	571	1/1	1800	0.000	0.142	0.690	0.690
					10	Grandview Ave.	22.86	1.05	1						10	0.1050		109.20	307.00	307.00	571	571	1/1	1800	0.000	0.770	6.082	6.082
					11	Parking Lot Access	23.09	0.23	1						10	0.0230		109.20	307.00	307.00	571	571	1/1	1800	0.000	0.770	6.082	6.082
					12	Stone Tree Ln.	23.26	0.17	1						10	0.0170		109.20	307.00	307.00	571	571	1/1	1800	0.000	0.770	6.082	6.082
				Ignacio	13	Hanna Ranch Rd.	25.9	2.64		1					15	0.1760		80.14	212.00	212.00	571	571	1/1	1800	0.000	0.414	2.900	2.900
					14	Grant Ave.	27.9	2						1	40	0.0500		43.80	93.25	93.25	571	571	1/1	1800	0.000	0.124	0.561	0.561
				Novato	15	Olive Ave.	28.1	0.2						1	40	0.0050		43.80	93.25	93.25	571	571	1/1	1800	0.000	0.124	0.561	0.561
					16	Golden Gate Place	28.35	0.25						1	40	0.0063		43.80	93.25	93.25	571	571	1/1	1800	0.000	0.124	0.561	0.561
					17	Rush Creek Place	28.5	0.15						1	40	0.0037		43.80	93.25	93.25	571	571	1/1	1800	0.000	0.124	0.561	0.561
					18	County Dump Rd.	31.98	3.48						1	40	0.0870		43.80	93.25	93.25	571	571	1/1	1800	0.000	0.124	0.561	0.561
					19	Hopper St.	38.3	6.32				1			25	0.2528		56.88	136.00	136.00	571	571	1/1	1800	0.000	0.209	1.194	1.194
				Petaluma	20	**D St.**	**38.5**	**0.2**				**1**			**25**	**0.0080**		**56.88**	**136.00**	**136.00**	**746**	**837**	**1/1**	**1800**	**0.000**	**0.354**	**2.025**	**2.025**
					21	**Washington St.**	**38.6**	**0.1**				**1**			**25**	**0.0040**		**56.88**	**136.00**	**136.00**	**1784**	**3064**	**2/2**	**1800**	**0.000**	**3.010**	**17.208**	**17.208**
					22	Lakeville St.	38.8	0.2				1			25	0.0080		56.88	136.00	136.00	571	571	1/1	1800	0.000	0.209	1.194	1.194
					23	W. Payran St.	39.2	0.4				1			25	0.0160		56.88	136.00	136.00	571	571	1/1	1800	0.000	0.209	1.194	1.194
					24	South Point Blvd.	40.4	1.2						1	40	0.0300		43.80	93.25	93.25	571	571	1/1	1800	0.000	0.124	0.561	0.561
					25	N. McDowell Blvd.	40.7	0.3						1	40	0.0075		43.80	93.25	93.25	571	571	1/1	1800	0.000	0.124	0.561	0.561
					26	Corona Rd.	41.1	0.4						1	40	0.0100		43.80	93.25	93.25	571	571	1/1	1800	0.000	0.124	0.561	0.561
					27	Ely Rd.	42.2	1.1						1	40	0.0275		43.80	93.25	93.25	571	571	1/1	1800	0.000	0.124	0.561	0.561
					28	Main St.	43.3	1.1						1	40	0.0275		43.80	93.25	93.25	571	571	1/1	1800	0.000	0.124	0.561	0.561
					29	Adobe Rd.	43.6	0.3						1	40	0.0075		43.80	93.25	93.25	571	571	1/1	1800	0.000	0.124	0.561	0.561
					30	E. Railroad Ave.	44.8	1.2				1			25	0.0480		56.88	136.00	136.00	571	571	1/1	1800	0.000	0.209	1.194	1.194
				Cotati	31	**E. Cotati Ave.**	**46.1**	**1.3**				**1**			**25**	**0.0520**		**56.88**	**136.00**	**136.00**	**1782**	**1404**	**2/2**	**1800**	**0.000**	**0.728**	**4.160**	**4.160**
					32	**Southwest Blvd.**	**46.8**	**0.7**						**1**	**40**	**0.0175**		**43.80**	**93.25**	**93.25**	**1873**	**1534**	**2/2**	**1800**	**0.000**	**0.487**	**2.207**	**2.207**
					33	**Rohnert Park Expy.**	**47.4**	**0.6**						**1**	**40**	**0.0150**		**43.80**	**93.25**	**93.25**	**1571**	**1728**	**2/2**	**1800**	**0.000**	**0.452**	**2.050**	**2.050**
					34	**Golf Course Dr.**	**48.5**	**1.1**						**1**	**40**	**0.0275**		**43.80**	**93.25**	**93.25**	**2719**	**1083**	**2/2**	**1800**	**0.000**	**0.937**	**4.247**	**4.247**
					35	Scenic Ave.	49.4	0.9						1	40	0.0225		43.80	93.25	93.25	571	571	1/1	1800	0.000	0.124	0.561	0.561
					36	**Todd Rd.**	**50.3**	**0.9**						**1**	**40**	**0.0225**		**43.80**	**93.25**	**93.25**	**612**	**779**	**1/1**	**1800**	**0.000**	**0.170**	**0.772**	**0.772**
					37	W. Robles Ave.	50.8	0.5						1	40	0.0125		43.80	93.25	93.25	571	571	1/1	1800	0.000	0.124	0.561	0.561
					38	Bellvue Ave.	51.3	0.5						1	40	0.0125		43.80	93.25	93.25	571	571	1/1	1800	0.000	0.124	0.561	0.561
					39	**Hearn Ave.**	**52.2**	**0.9**						**1**	**40**	**0.0225**		**43.80**	**93.25**	**93.25**	**1844**	**2974**	**2/2**	**1800**	**0.000**	**1.546**	**7.006**	**7.006**
					40	W Barham Ave.	53	0.8						1	40	0.0200		43.80	93.25	93.25	571	571	1/1	1800	0.000	0.124	0.561	0.561
					41	Sebastopol Rd.	53.4	0.4				1			25	0.0160		56.88	136.00	136.00	571	571	1/1	1800	0.000	0.209	1.194	1.194
				Santa Rosa	42	**3rd St.**	**53.7**	**0.3**				**1**			**25**	**0.0120**		**56.88**	**136.00**	**136.00**	**1216**	**2600**	**2/2**	**1800**	**0.000**	**1.398**	**7.989**	**7.989**
			Sub-Total (Lombard to Santa Rosa)					53.7	4	2	1	9	6	20		2.123	25.29564297								0.0000	27.578	129.110	129.110
		Lombard to Redwood Valley	Santa Rosa to Redwood Valley		43	6th St.	53.8	0.1				1			25	0.0040		56.88	136.00		571	571	1/1	1800	0.000	0.209	1.194	0.000
					44	7th St.	53.9	0.1				1			25	0.0040		56.88	136.00		571	571	1/1	1800	0.000	0.209	1.194	0.000
					45	8th St.	54	0.1				1			25	0.0040		56.88	136.00		571	571	1/1	1800	0.000	0.209	1.194	0.000
					46	**9th St.**	**54.1**	**0.1**				**1**			**25**	**0.0040**		**56.88**	**136.00**		**1442**	**1185**	**1/1**	**1800**	**0.000**	**1.338**	**7.648**	**0.000**
					47	**College Ave.**	**54.4**	**0.3**				**1**			**25**	**0.0120**		**56.88**	**136.00**		**1767**	**1439**	**2/2**	**1800**	**0.000**	**0.732**	**4.187**	**0.000**
					48	**Guerneville Rd.**	**55.3**	**0.9**						**1**	**40**	**0.0225**		**43.80**	**93.25**		**2662**	**2379**	**2/2**	**1800**	**0.000**	**1.275**	**5.781**	**0.000**
					49	**W. Steele Ln.**	**55.6**	**0.3**						**1**	**40**	**0.0075**		**43.80**	**93.25**		**770**	**686**	**1/1**	**1800**	**0.000**	**0.178**	**0.806**	**0.000**
					50	**Piner Rd.**	**56.3**	**0.7**						**1**	**40**	**0.0175**		**43.80**	**93.25**		**2093**	**1614**	**2/2**	**1800**	**0.000**	**0.587**	**2.659**	**0.000**
					51	San Miguel Ave.	56.8	0.5						1	40	0.0125		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
					52	**Fulton Rd.**	**58.5**	**1.7**						**1**	**40**	**0.0425**		**43.80**	**93.25**		**2030**	**1915**	**2/2**	**1800**	**0.000**	**0.647**	**2.934**	**0.000**
					53	**River Rd.**	**58.8**	**0.3**						**1**	**40**	**0.0075**		**43.80**	**93.25**		**1246**	**897**	**2/2**	**1800**	**0.000**	**0.229**	**1.040**	**0.000**
					54	**Airport Blvd.**	**59.9**	**1.1**						**1**	**40**	**0.0275**		**43.80**	**93.25**		**1648**	**1681**	**2/2**	**1800**	**0.000**	**0.458**	**2.078**	**0.000**
					55	**Aviation Blvd.**	**60.2**	**0.3**						**1**	**40**	**0.0075**		**43.80**	**93.25**		**736**	**571**	**1/1**	**1800**	**0.000**	**0.154**	**0.698**	**0.000**
					56	**Shiloh Rd.**	**61.1**	**0.9**						**1**	**40**	**0.0225**		**43.80**	**93.25**		**1318**	**1395**	**1/1**	**1800**	**0.000**	**0.823**	**3.731**	**0.000**
					57	Mitchell Ln.	61.7	0.6						1	40	0.0150		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
				Windsor	58	Windsor River Rd.	62.9	1.2						1	40	0.0300		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
					59	Starr Rd.	63.8	0.9						1	40	0.0225		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
				Grant	60	Limerick Ln.	66.2	2.4						1	40	0.0600		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
					61	Grant Ave.	66.9	0.7						1	40	0.0175		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
			Sub-Total (Bay Area)				**66.9**		**4**	**2**	**1**	**14**	**6**	**34**		**2.463**									**0.0000**	**35.369**	**167.619**	**129.110**
N. Sonoma	Lombard to Willits	Lombard to Redwood Valley	Santa Rosa to Redwood Valley		62	Bailhache Ave.	67.4	0.5						1	40	0.0125		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
				Healdsburg	63	Front St.	67.7	0.3				1			25	0.0120		56.88	136.00		571	571	1/1	1800	0.000	0.209	1.194	0.000
					64	**Healdsburg Ave./Mill St./Vine St.**	**68.2**	**0.5**				**1**			**25**	**0.0200**		**56.88**	**136.00**		**1069**	**628**	**1/2**	**1800**	**0.000**	**0.424**	**2.421**	**0.000**
					65	Matheson St.	68.4	0.2				1			25	0.0080		56.88	136.00		571	571	1/1	1800	0.000	0.209	1.194	0.000
					66	North St.	68.5	0.1				1			25	0.0040		56.88	136.00		571	571	1/1	1800	0.000	0.209	1.194	0.000
					67	Grant St.	68.8	0.3						1	40	0.0075		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
					68	**Dry Creek Rd.**	**69.5**	**0.7**						**1**	**40**	**0.0175**		**43.80**	**93.25**		**1058**	**1174**	**2/1**	**1800**	**0.000**	**0.361**	**1.635**	**0.000**
					69	Grove St.	70.3	0.8						1	40	0.0200		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
					70	Parking Lot Access Near Parkland Farms Blvd.	70.5	0.2						1	40	0.0050		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
					71	Site Access near Passalacqua Rd.	70.85	0.35						1	40	0.0087		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
					72	Lytton Springs Rd.	71.9	1.05						1	40	0.0263		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
				Geyerville	73	State Highway 128	75.8	3.9						1	40	0.0975		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
					74	Washington School Rd.	80.9	5.1						1	40	0.1275		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
					75	Kelly Rd.	83.16	2.26						1	40	0.0565		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
					76	Asti Rd.	84.5	1.34						1	40	0.0335		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
				Cloverdale	77	E. 1st St.	85.4	0.9						1	40	0.0225		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
				County Line		Not a crossing	89.6	4.2						1	40	0.1050		43.80	93.25		571	571						
			Sub-Total (N. Sonoma)					**22.7**	**0**	**0**	**0**	**4**	**0**	**13**		**0.5840**									**0.0000**	**2.7725**	**13.8090**	**0.0000**
Mendocino	Lombard to Willits	Lombard to Redwood Valley	Santa Rosa to Redwood Valley	Hopland	78	State Highway 175	99.9	10.3						1	40	0.2575		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
					79	Henry Station Rd.	105.8	5.9						1	40	0.1475		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
					80	Norgard Ln.	111.7	5.9						1	40	0.1475		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
					81	Airport Park Blvd.	112	0.3						1	40	0.0075		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
					82	Commerce Dr.	112.9	1.2						1	40	0.0300		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
					83	**Talmage Rd.**	**113**	**0.1**				**1**			**25**	**0.0040**		**56.88**	**136.00**		**954**	**973**	**1/1**	**1800**	**0.000**	**0.518**	**2.960**	**0.000**
					84	E. Gobbi St.	113.6	0.6				1			25	0.0240		56.88	136.00		571	571	1/1	1800	0.000	0.209	1.194	0.000
				Ukiah	85	**E. Perkins St.**	**114**	**0.4**				**1**			**25**	**0.0160**		**56.88**	**136.00**		**1123**	**920**	**2/2**	**1800**	**0.000**	**0.358**	**2.047**	**0.000**
					86	Clara Ave.	114.4	0.4				1			25	0.0160		56.88	136.00		571	571	1/1	1800	0.000	0.209	1.194	0.000
					87	Ford St.	114.5	0.1				1			25	0.0040		56.88	136.00		571	571	1/1	1800	0.000	0.209	1.194	0.000
					88	Brush St.	114.6	0.1				1			25	0.0040		56.88	136.00		571	571	1/1	1800	0.000	0.209	1.194	0.000
					89	Ford Rd.	115.2	0.6				1			25	0.0240		56.88	136.00		571	571	1/1	1800	0.000	0.209	1.194	0.000
					90	Masonite Truck Rd.	115.7	0.5						1	40	0.0125		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
					91	Hollow Tree Rd.	115.9	0.2						1	40	0.0050		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
					92	Lake Mendocino Dr.	117	1.1						1	40	0.0275		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
					93	Moore St.	119.8	2.8						1	40	0.0700		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
				Redwood Valley	94	E. School Way	122.1	2.3						1	40	0.0575		43.80	93.25		571	571	1/1	1800	0.000	0.124	0.561	0.000
			Sub-Total (Santa Rosa To Redwood Valley)					68.7	0	0	0	16	0	37		1.779									0.000	13.722	68.903	0.000
			Sub-Total (Lombard To Redwood Valley)					122.4								3.902									0.000	41.300	198.012	129.110
		Redwood valley to Willits			95	Laughlin Way	123	0.9			1				20	0.0450		47.17	164.50		571	571	1/1	1800	0.144	0.000	1.746	0.000
					96	E. Hill Road	123.9	0.9				1			25	0.0360		42.14	136.00		571	571	1/1	1800	0.115	0.000	1.194	0.000
					97	E San Fransisco Av.	125	1.1				1			25	0.0440		42.14	136.00		571	571	1/1	1800	0.115	0.000	1.194	0.000
					98	E. Valley Road	137.8	13.9				1			25	0.5560		42.14	136.00		571	571	1/1	1800	0.115	0.000	1.194	0.000
				Willits	99	E. Commercial St.	139.5	1.7				1			25	0.0680		42.14	136.00		571	571	1/1	1800	0.115	0.000	1.194	0.000
				End of Line		Not a crossing	142.5	3				1			25	0.1200					571	571						
			Sub-Total (Mendocino)					**54.3**	**0**	**0**	**1**	**31**	**0**	**61**		**1.724**									**0.602**	**3.158**	**23.105**	**0.000**
			Sub-Total (Redwood Valley To Willits)					21.5	0	0	1	5	0	0		0.86900												
			Sub-Total (Lombard to Willits)					143.9								4.771												
									4	2	2	49	6	108														

MCAQMD

Pollutant	Emission Factor (g/bhp-hr)	Power[1] (bhp)	Time (hr/stop)	Stops per train[7] T1	T2	T3	T4	Trains (trains per day)	(trains per year)	Cumulative Emissions (lbs/day) T1	T2	T3	T4	Cumulative Emissions (tpy) T1	T2	T3	T4
ROG[2]	0.06	67	0.25	2	1	2	0	1	312	4.43E-03	2.22E-03	4.43E-03	0.00E+00	6.91E-04	3.46E-04	6.91E-04	0.00E+00
CO	0.98	67	0.25	2	1	2	0	1	312	7.24E-02	3.62E-02	7.24E-02	0.00E+00	1.13E-02	5.65E-03	1.13E-02	0.00E+00
NOx	2.88	67	0.25	2	1	2	0	1	312	2.13E-01	1.06E-01	2.13E-01	0.00E+00	3.32E-02	1.66E-02	3.32E-02	0.00E+00
SOx[3]	0.154	67	0.25	2	1	2	0	1	312	1.14E-02	5.69E-03	1.14E-02	0.00E+00	1.77E-03	8.87E-04	1.77E-03	0.00E+00
PM-10 (Diesel Particulate)	0.07	67	0.25	2	1	2	0	1	312	5.17E-03	2.58E-03	5.17E-03	0.00E+00	8.06E-04	4.03E-04	8.06E-04	0.00E+00
PM-2.5[4]	0.06	67	0.25	2	1	2	0	1	312	4.76E-03	2.38E-03	4.76E-03	0.00E+00	7.42E-04	3.71E-04	7.42E-04	0.00E+00
CH_4[5]	0.003	67	0.25	2	1	2	0	1	312	1.89E-04	9.43E-05	1.89E-04	0.00E+00	2.94E-05	1.47E-05	2.94E-05	0.00E+00
CO_2[6]	478.85	67	0.25	2	1	2	0	1	312	3.54E+01	1.77E+01	3.54E+01	0.00E+00	5.52E+00	2.76E+00	5.52E+00	0.00E+00

NSCAPCD

Pollutant	Emission Factor (g/bhp-hr)	Power[1] (bhp)	Time (hr/stop)	Stops per train[7] T1	T2	T3	T4	Trains (trains per day)	(trains per year)	Cumulative Emissions (lbs/day) T1	T2	T3	T4	Cumulative Emissions (tpy) T1	T2	T3	T4
ROG[2]	0.06	67	0.25	0	3	3	0	1	312	0.00E+00	6.65E-03	6.65E-03	0.00E+00	0.00E+00	1.04E-03	1.04E-03	0.00E+00
CO	0.98	67	0.25	0	3	3	0	1	312	0.00E+00	1.09E-01	1.09E-01	0.00E+00	0.00E+00	1.69E-02	1.69E-02	0.00E+00
NOx	2.88	67	0.25	0	3	3	0	1	312	0.00E+00	3.19E-01	3.19E-01	0.00E+00	0.00E+00	4.98E-02	4.98E-02	0.00E+00
SOx[3]	0.154	67	0.25	0	3	3	0	1	312	0.00E+00	1.71E-02	1.71E-02	0.00E+00	0.00E+00	2.66E-03	2.66E-03	0.00E+00
PM-10 (Diesel Particulate)	0.07	67	0.25	0	3	3	0	1	312	0.00E+00	7.75E-03	7.75E-03	0.00E+00	0.00E+00	1.21E-03	1.21E-03	0.00E+00
PM-2.5[4]	0.06	67	0.25	0	3	3	0	1	312	0.00E+00	7.13E-03	7.13E-03	0.00E+00	0.00E+00	1.11E-03	1.11E-03	0.00E+00
CH_4[5]	0.003	67	0.25	0	3	3	0	1	312	0.00E+00	2.83E-04	2.83E-04	0.00E+00	0.00E+00	4.41E-05	4.41E-05	0.00E+00
CO_2[6]	478.85	67	0.25	0	3	3	0	1	312	0.00E+00	5.30E+01	5.30E+01	0.00E+00	0.00E+00	8.28E+00	8.28E+00	0.00E+00

BAAQMD

Pollutant	Emission Factor (g/bhp-hr)	Power[1] (bhp)	Time (hr/stop)	Stops per train[7] T1	T2	T3	T4	Trains (trains per day)	(trains per year)	Cumulative Emissions (lbs/day) T1	T2	T3	T4	Cumulative Emissions (tpy) T1	T2	T3	T4
ROG[2]	0.06	67	0.25	0	7	7	7	1	312	0.00E+00	1.55E-02	1.55E-02	1.55E-02	0.00E+00	2.42E-03	2.42E-03	2.42E-03
CO	0.98	67	0.25	0	7	7	7	1	312	0.00E+00	2.53E-01	2.53E-01	2.53E-01	0.00E+00	3.95E-02	3.95E-02	3.95E-02
NOx	2.88	67	0.25	0	7	7	7	1	312	0.00E+00	7.44E-01	7.44E-01	7.44E-01	0.00E+00	1.16E-01	1.16E-01	1.16E-01
SOx[3]	0.154	67	0.25	0	7	7	7	1	312	0.00E+00	3.98E-02	3.98E-02	3.98E-02	0.00E+00	6.21E-03	6.21E-03	6.21E-03
PM-10 (Diesel Particulate)	0.07	67	0.25	0	7	7	7	1	312	0.00E+00	1.81E-02	1.81E-02	1.81E-02	0.00E+00	2.82E-03	2.82E-03	2.82E-03
PM-2.5[4]	0.06	67	0.25	0	7	7	7	1	312	0.00E+00	1.66E-02	1.66E-02	1.66E-02	0.00E+00	2.60E-03	2.60E-03	2.60E-03
CH_4[5]	0.003	67	0.25	0	7	7	7	1	312	0.00E+00	6.60E-04	6.60E-04	6.60E-04	0.00E+00	1.03E-04	1.03E-04	1.03E-04
CO_2[6]	478.85	67	0.25	0	7	7	7	1	312	0.00E+00	1.24E+02	1.24E+02	1.24E+02	0.00E+00	1.93E+01	1.93E+01	1.93E+01

1) Power rating based on technical data provided by National Railway Equipment Co.

2) ROG emission rates were not published for locomotive engines. Therefore, the THC emissions were conservatively assumed to be equivalent to ROG.

3) SOx emission factor is based on low sulfur fuel with 500ppm sulfur content allowed for locomotive use prior to 2014. Assuming all the sulfur is emitted as SO2, this equates to an emission factor of 0.154 g/bhp-hr calculated as follows:
500/10^6 x 7.08 lb/gal x 453.6 g/lb x 1gal/20.8 bhp-hr x 64.1 mol-lb SO2/32.1 mol-lbs Sulfur = 0.154 g/bhp-hr
Where 7.08 lb/gal is the density of diesel fuel and 20.8 bhp-hr/gal is the EPA conversion factor (EPA420-F-97-051, December 1997).

4) A PM-2.5 emission factor for locomotives was not found in the available literature sources. However, based on the EMFAC2007 model for heavy duty diesel trucks, the PM2.5 emission rate is aproximatley 92% of the PM-10 emission rate. Therefore, 92% of the PM-10 emission factor was used to estimate the PM-2.5 emissions for diesel combustion in locomotives since the engines operate similarly with compression ignition.

5) An emission factor for CH4 from trains was not found in the available literature from the manufacturer or EPA. Therefore, CH4 from trains is based on factoring the train CO2 emission factor by the ratio of CH4 to CO2 emissions provided by the EMFAC2007 model for Heavy Duty Diesel Trucks. This approach is considered appropriate since it is based on combustion of diesel fuel from compression ignition engines.

6) Emission factor for CO2 is based on the California Climate Action Registry (CCAR) General Reporting Protocol (GRP) v2.2, March 2007, Emission Factors for Mobile Emissions, Table C.3: Carbon Dioxide Emission Factors for Transport Fuels (CA Low Sulfur Diesel) of 9.96 kg CO2/gal. Based on the EPA Conversion value of 20.8 bhp-hr/gal of diesel for locomotives (EPA420-F-97-051), this equates to 478.85 g/bhp-hr.

7) Assume each train stops at each siding within its route once per round trip based on following siding locations:

Siding Name	Length (ft)	Train			
Schellville	6300		T2	T3	T4
Burdell	6078		T2	T3	T4
Haystack	3900		T2	T3	T4
Petaluma	4354		T2	T3	T4
Wilford	8350		T2	T3	T4
Todd	4750		T2	T3	T4
Santa Rosa	7000		T2	T3	T4
Bailhache	3638		T2	T3	
Lytton	7025		T2	T3	
Geyerville	6492		T2	T3	
Redwood Valley	6993	T1	T2	T3	
Hopland	4175	T1		T3	

Solid Waste Container Transfer Operations (Yard Tractor)
BAAQMD Operations[1]

Emission Factors[2]		power	load factor	Operational Use[3]		Emissions	
Compound	(lb/hp-hr)	(hp)	(%)	(hrs/day)	(hrs/yr)	(lb/day)	(ton/yr)
ROG	0.003	69	82%	5.00	1560.00	0.85	0.13
CO	0.015					4.24	0.66
NOx	0.022					6.22	0.97
SOx	0.002					0.57	0.09
PM-10	0.001					0.28	0.04
PM-2.5[4]	0.0009					0.26	0.04
CH_4[5]	0.0009					0.27	0.04
CO_2[6]	176.03					49800	7769

1) Solid waste handling operations are only anticipated to occur within the BAAQMD region based on prospective potential operations occuring in the souther portion of the project area.
2) Emission factors, horse power and load factor for a yard tractor are based on the SCAQMD CEQA guidance which provides these data for various equipment for purposes of CEQA evaluation. A general purpose utility tractor was used as the basis.
3) The operational use is based on assuming the yard tractor operates 5 minutes per rail car to transfer solid waste containers.
4) A PM-2.5 emission factor for a yard tractor or equivalent was not found in the available literature source. However, based on the EMFAC2007 model for heavy duty diesel trucks, the PM2.5 emission rate is aproximatley 92% of the PM-10 emission rate. Therefore, 92% of the PM-10 emission factor was used to estimate the PM-2.5 emissions for diesel combustion in the yard tractor since the engines operate similarly with compression ignition.
5) An emission factor for CH4 was not provided in the referenced SQAQMD CEQA guidance. Therefore, CH4 from a tractor is based on factoring the tractor CO2 emission factor by the ratio of CH4 to CO2 emissions provided by the EMFAC2007 model for Heavy Duty Diesel Trucks. This approach is considered appropriate since it is based on combustion of diesel fuel from compression ignition engines.
6) Emission factor for CO2 is based on the California Climate Action Registry (CCAR) General Reporting Protocol (GRP) v2.2, March 2007, Emission Factors for Mobile Emissions, Table C.3: Carbon Dioxide Emission Factors for Transport Fuels (CA Low Sulfur Diesel) of 9.96 kg CO2/gal. Based on the Horsepower rating of 69 hp and load factor or 82%, this equates to 176.03 lb/bhp-hr.

Pollutant	Emission Factor (g/bhp-hr)	Power[1] (bhp)	Time (hr/event)	Stops per train (events/day)	Trains (trains per day)	Trains (trains per year)	Cumulative Emissions (lbs/day)	Cumulative Emissions (ton/yr)
ROG[2]	0.06	67	0.25	2	3	936	1.33E-02	6.22E-03
CO	0.98	67	0.25	2	3	936	2.17E-01	1.02E-01
NOx	2.88	67	0.25	2	3	936	6.38E-01	2.99E-01
SOx[3]	0.154	67	0.25	2	3	936	3.41E-02	1.60E-02
PM-10 (Diesel Particulate)	**0.07**	**67**	**0.25**	**2**	**3**	**936**	**1.55E-02**	**7.26E-03**
PM-2.5[4]	0.06	67	0.25	2	3	936	1.43E-02	6.68E-03
CH_4[5]	0.003	67	0.25	2	3	936	5.66E-04	2.65E-04
CO_2[6]	478.85	67	0.25	2	3	936	1.06E+02	4.97E+01

1) Power rating based on technical data provided by National Railway Equipment Co.

2) ROG emission rates were not published for locomotive engines. Therefore, the THC emissions were conservatively assumed to be equivalent to ROG.

3) SOx emission factor is based on low sulfur fuel with 500ppm sulfur content allowed for locomotive use prior to 2014. Assuming all the sulfur is emitted as SO2, this equates to an emission factor of 0.154 g/bhp-hr calculated as follows:

500/10^6 x 7.08 lb/gal x 453.6 g/lb x 1gal/20.8 bhp-hr x 64.1 mol-lb SO2/32.1 mol-lbs Sulfur = 0.154 g/bhp-hr

Where 7.08 lb/gal is the density of diesel fuel and 20.8 bhp-hr/gal is the EPA conversion factor (EPA420-F-97-051, December 1997).

4) A PM-2.5 emission factor for locomotives was not found in the available literature sources. However, based on the EMFAC2007 model for heavy duty diesel trucks, the PM2.5 emission rate is aproximatley 92% of the PM-10 emission rate. Therefore, 92% of the PM-10 emission factor was used to estimate the PM-2.5 emissions for diesel combustion in locomotives since the engines operate similarly with compression ignition.

5) An emission factor for CH4 from trains was not found in the available literature from the manufacturer or EPA. Therefore, CH4 from trains is based on factoring the train CO2 emission factor by the ratio of CH4 to CO2 emissions provided by the EMFAC2007 model for Heavy Duty Diesel Trucks. This approach is considered appropriate since it is based on combustion of diesel fuel from compression ignition engines.

6) Emission factor for CO2 is based on the California Climate Action Registry (CCAR) General Reporting Protocol (GRP) v2.2, March 2007, Emission Factors for Mobile Emissions, Table C.3: Carbon Dioxide Emission Factors for Transport Fuels (CA Low Sulfur Diesel) of 9.96 kg CO2/gal. Based on the EPA Conversion value of 20.8 bhp-hr/gal of diesel for locomotives (EPA420-F-97-051), this equates to 478.85 g/bhp-hr.

PM-10 treated as diesel particulate and modeled for cancer risk based on cumulative annual emissions at a single siding. The maximum number of trains operating in a single section of track is 3 (between Lombard and Santa Rosa). Therefore, the maximum possible diesel emissions from idling trains at a siding would occur if the 3 trains stopped at the same siding for each direction of travel resulting in 6 stops per day for 6 days a week, 52 weeks a year for a total of 1872 stops a year. Assuming each stop lasts 15 minutes, the total modeled emission rate is:

6.96E-05 annualized emissions in g/s

Temperature and RH data by city

North Coast Air Basin

	Temperature (F)			
City	Ave Max	Ave Min	Ann Ave Max	Ann Ave Min
Willits 1 NE	85.3	32.5	69	38.9
Willits Howard Rd	88.1	30.5	66.5	40.7
Ukiah	93	35.6	73.9	43.7
Cloverdale	93.8	37.5	74.1	45.4
Healdsburg	88.9	38	73.9	46
Averages	**90**	**35**	71.5	42.9

Bay Air Basin

	Temperature (F)			
City	Ave Max	Ave Min	Ann Ave Max	Ann Ave Min
Santa Rosa	83.2	37	71.7	44.5
Petaluma	82.4	38	70.6	45.2
Sonoma	89.4	37	74	44
Averages	**85**	**37**	72.1	44.6

In accordance with BAAQMD CEQA Guidance recommended temperature basis, the Mean Summer Max for all pollutants except CO, and Mean Winter Minimum for CO, will be applied for evaluating emissions through EMFAC2007.

EMFAC2007 Output by Air Basin using above Temperatures

AUTOMOBILE IDLING EMISSIONS AT TRAIN CROSSINGS (gr/idle-hr)

	NORTH COAST AIR BASIN				**BAY AREA AIR BASIN**			
	2009		**2033**		**2009**		**2033**	
Compound	**Summer**	**Winter**	**Summer**	**Winter**	**Summer**	**Winter**	**Summer**	**Winter**
THC	1.284	1.363	1.025	1.061	0.608	0.635	0.474	0.487
ROG	1.443	1.543	1.107	1.153	0.670	0.704	0.512	0.529
CO	6.729	8.426	6.156	7.286	3.522	4.094	3.087	3.507
NOx	8.308	7.822	7.289	6.855	3.687	3.523	3.576	3.415
SOx	0.006	0.006	0.005	0.005	0.003	0.003	0.003	0.002
PM-10	0.121	0.16	0.026	0.028	0.051	0.064	0.019	0.02
PM-2.5	0.112	0.147	0.024	0.026	0.047	0.059	0.017	0.018
CO2	622.567	574.777	532.758	495.161	292.276	276.206	270.912	256.961
CH4	0.064	0.069	0.048	0.05	0.030	0.031	0.023	0.023

HEAVY HEAVY DUTY TRUCK TRAVELING EMISSIONS (45MPH) (gr/mi)

	NORTH COAST AIR BASIN				**BAY AREA AIR BASIN**			
	2009		**2033**		**2009**		**2033**	
Compound	**Summer**	**Winter**	**Summer**	**Winter**	**Summer**	**Winter**	**Summer**	**Winter**
THC	0.582	0.583	0.147	0.147	0.623	0.616	0.150	0.150
ROG	0.719	0.720	0.184	0.184	0.755	0.748	0.188	0.188
CO	4.875	5.081	1.238	1.213	5.176	5.164	1.257	1.233
NOx	12.972	16.459	1.729	2.198	13.647	16.642	1.852	2.247
SOx	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016
PM-10	0.472	0.472	0.083	0.083	0.466	0.466	0.085	0.085
PM-2.5	0.434	0.434	0.076	0.076	0.429	0.429	0.078	0.078
CO2	1674.584	1674.584	1688.213	1688.213	1633.316	1633.316	1687.160	1687.160
CH4	0.035	0.035	0.009	0.009	0.04	0.039	0.010	0.010