

CALCULATION SHEET-COMBUSTIBLE EMISSIONS

Assumptions for Combustible Emissions						
Type of Construction Equipment	Num. of Units	HP Rated	Hrs/day	Days/yr	Total hp-hrs	
Water Truck	1	300	8	240	576000	
Diesel Road Compactors	1	100	8	90	72000	
Diesel Dump Truck	2	300	8	90	432000	
Diesel Excavator	1	300	8	15	36000	
Diesel Hole Trenchers	1	175	8	15	21000	
Diesel Bore/Drill Rigs	1	300	8	15	36000	
Diesel Cement & Mortar Mixers	1	300	8	240	576000	
Diesel Cranes	1	175	8	240	336000	
Diesel Graders	1	300	8	90	216000	
Diesel Tractors/Loaders/Backhoes	2	100	8	90	144000	
Diesel Bull Dozers	1	300	8	90	216000	
Diesel Front End Loaders	1	300	8	90	216000	
Diesel Fork Lifts	2	100	8	90	144000	
Diesel Generator Set	6	40	8	240	460800	

Emission Factors						
Type of Construction Equipment	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	PM-10 g/hp-hr	PM-2.5 g/hp-hr	CO2 g/hp-hr
Water Truck	0.440	2.070	5.490	0.410	0.400	536.000
Diesel Road Compactors	0.370	1.480	4.900	0.340	0.330	536.200
Diesel Dump Truck	0.440	2.070	5.490	0.410	0.400	536.000
Diesel Excavator	0.340	1.300	4.600	0.320	0.310	536.300
Diesel Trenchers	0.510	2.440	5.810	0.460	0.440	535.800
Diesel Bore/Drill Rigs	0.600	2.290	7.150	0.500	0.490	529.700
Diesel Cement & Mortar Mixers	0.610	2.320	7.280	0.480	0.470	529.700
Diesel Cranes	0.440	1.300	5.720	0.340	0.330	530.200
Diesel Graders	0.350	1.360	4.730	0.330	0.320	536.300
Diesel Tractors/Loaders/Backhoes	1.850	8.210	7.220	1.370	1.330	691.100
Diesel Bull Dozers	0.360	1.380	4.760	0.330	0.320	536.300
Diesel Front End Loaders	0.380	1.550	5.000	0.350	0.340	536.200
Diesel Fork Lifts	1.980	7.760	8.560	1.390	1.350	690.800
Diesel Generator Set	1.210	3.760	5.970	0.730	0.710	587.300

CALCULATION SHEET-COMBUSTIBLE EMISSIONS

Emission factors (EF) were generated from the NONROAD2005 model for the 2006 calendar year. The VOC EFs includes exhaust and evaporative emissions. The VOC evaporative components included in the NONROAD2005 model are diurnal, hotsoak, running loss, tank permeation, hose permeation, displacement, and spillage. The construction equipment age distribution in the NONROAD2005 model is based on the population in U.S. for the 2006 calendar year.

Emission Calculations									
Type of Construction Equipment	VOC tons/yr	CO tons/yr	NOx tons/yr	PM-10 tons/yr	PM-2.5 tons/yr	SO2 tons/yr	CO2 tons/yr		
Water Truck	0.279	1.314	3.485	0.260	0.254	0.470	340.227		
Diesel Road Paver	0.029	0.117	0.389	0.027	0.026	0.059	42.544		
Diesel Dump Truck	0.209	0.985	2.614	0.195	0.190	0.352	255.170		
Diesel Excavator	0.013	0.052	0.182	0.013	0.012	0.029	21.276		
Diesel Hole Cleaners/Trenchers	0.012	0.056	0.134	0.011	0.010	0.017	12.399		
Diesel Bore/Drill Rigs	0.024	0.091	0.284	0.020	0.019	0.029	21.014		
Diesel Cement & Mortar Mixers	0.387	1.473	4.621	0.305	0.298	0.463	336.228		
Diesel Cranes	0.163	0.481	2.118	0.126	0.122	0.270	196.318		
Diesel Graders	0.083	0.324	1.126	0.079	0.076	0.176	127.657		
Diesel Tractors/Loaders/Backhoes	0.294	1.303	1.146	0.217	0.211	0.151	109.669		
Diesel Bull Dozers	0.086	0.328	1.133	0.079	0.076	0.176	127.657		
Diesel Front End Loaders	0.090	0.369	1.190	0.083	0.081	0.176	127.633		
Diesel Aerial Lifts	0.314	1.231	1.358	0.221	0.214	0.151	109.622		
Diesel Generator Set	0.614	1.909	3.032	0.371	0.361	0.411	298.232		
Total Emissions	2.599	10.034	22.811	2.005	1.952	2.931	2125.647		

Conversion factors	
Grams to tons	1.102E-06

CALCULATION SHEET-TRANSPORTATION COMBUSTIBLE EMISSIONS

Construction Worker Personal Vehicle Commuting to Construction Site-Passenger and Light Duty Trucks									
Pollutants	Emission Factors			Assumptions				Results by Pollutant	
	Passenger Cars g/mile	Pick-up Trucks, SUVs g/mile		Mile/day	Day/yr	Number of cars	Number of trucks	Total Emissions Cars tns/yr	Total Emissions Trucks tns/yr
VOCs	1.36	1.61		60	240	20	20	0.43	0.51
CO	12.4	15.7		60	240	20	20	3.94	4.98
NOx	0.95	1.22		60	240	20	20	0.30	0.39
PM-10	0.0052	0.0065		60	240	20	20	0.00	0.00
PM 2.5	0.0049	0.006		60	240	20	20	0.00	0.00

Heavy Duty Trucks Delivery Supply Trucks to Construction Site									
Pollutants	Emission Factors			Assumptions				Results by Pollutant	
	10,000-19,500 lb Delivery Truck	33,000-60,000 lb semi trailer rig		Mile/day	Day/yr	Number of trucks	Number of trucks	Total Emissions Cars tns/yr	Total Emissions Trucks tns/yr
VOCs	0.29	0.55		60	240	2	2	0.01	0.02
CO	1.32	3.21		60	240	2	2	0.04	0.10
NOx	4.97	12.6		60	240	2	2	0.16	0.40
PM-10	0.12	0.33		60	240	2	2	0.00	0.01
PM 2.5	0.13	0.36		60	240	2	2	0.00	0.01

Pollutants	Emission Factors			Assumptions				Results by Pollutant	
	Passenger Cars g/mile	Pick-up Trucks, SUVs g/mile		Mile/day	Day/yr	Number of Cars	Number of trucks	Total Emissions cars tns/yr	Total Emissions Trucks tns/yr
VOCs	1.36	1.61		30	240			-	0.00
CO	12.4	15.7		30	240			-	0.00
NOx	0.95	1.22		30	240			-	0.00
PM-10	0.0052	0.0065		30	240			-	0.00
PM 2.5	0.0049	0.006		30	240			-	0.00

Truck Emission Factor Source: USEPA 2005 Emission Facts: Average annual emissions and fuel consumption for gasoline-fueled passenger cars and light trucks. EPA 420-F-05-022 August 2005. Emission rates were generated using MOBILE.6 highway vehicle emission factor model.

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19 ton PM10/acre-month		MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42 ton PM10/acre-month		MRI 1996; EPA 2001; EPA 2006

PM2.5 Emissions

PM2.5 Multiplier 0.10 (10% of PM10 emissions assumed to be PM2.5) EPA 2001; EPA 2006

Control Efficiency

0.50 (assume 50% control efficiency for PM10 and PM2.5 emissions) EPA 2001; EPA 2006

Project Assumptions

	Conversion Factors	
Construction Area (0.19 ton PM10/acre-month)		
Duration of Construction Project	12 months	acres per feet
Length	0 miles	feet per mile
Length (converted)	0 feet	
Width	0 feet	
Area	20.00 acres	

Staging Areas

Duration of Construction Project	
Length	0.00
Length (converted)	
Width	
Area	

	Project Emissions (tons/year)		
	PM10 uncontrolled	PM10 controlled	PM2.5 uncontrolled
Construction Area (0.19 ton PM10/ac)	45.60	22.80	4.56
Staging Areas	0.00	0.00	0.00
Total	45.60	22.80	4.56
			2.28
			0.00
			2.28

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM10/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM10/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM10/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM10/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM10/acre-month) and 75% of the average emission factor (0.11 ton PM10/acre-month).

The 0.19 ton PM10/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM10/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particle (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District and the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM10 and PM2.5 in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM10/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM10/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

PM2.5 Multiplier

PM2.5 emissions are estimated by applying a particle size multiplier of 0.10 to PM10 emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM10 and PM2.5

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM10 and PM2.5 in PM nonattainment areas. Wetting controls will be applied during project construction (EPA 2006).

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999*. EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.
EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants*. Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.
MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1)*. Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

CALCULATION SHEET-SUMMARY OF EMISSIONS

Proposed Action Construction Emissions for Criteria Pollutants (tons per year)							
Emission source	VOC	CO	NOx	PM-10	PM-2.5	SO2	
Combustible Emissions	2.60	10.03	22.81	2.01	1.95	2.93	
Construction Site-fugitive PM-10	NA	NA	NA	22.80	2.28	NA	
Construction Workers Commuter & Trucking	0.97	9.06	1.25	0.02	0.02	NA	
Total emissions	3.57	19.10	24.06	24.82	4.25	2.93	
De minimis threshold	NA	NA	NA	NA	NA	NA	