

APPENDIX 8.1-A

Calculation of Construction Emissions

Calculation of Construction Emissions

Tables presented in this Appendix are as follows:

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Table 8.1A-1b	Construction Emissions by Activity
Table 8.1A-1c	Vehicle Exhaust Emissions
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Chevron Power Plant Replacement Project
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Table 8.1A-1 Construction Calculations

Table 8.1A-1a Maximum Daily Emissions from Construction Activities

Peak Daily Emissions	ROG	CO	NOx	SOx	PM ₁₀	PM _{2.5}
Fugitive Dust from Construction	-	-	-	-	40.00	8.32
Construction Equipment Emissions	13.91	109.23	96.42	0.08	3.83	3.41
Onroad Emissions - Workers	1.76	51.80	5.54	0.05	44.15	4.58
Onroad Emissions - Trucks	0.99	9.65	23.02	0.03	5.61	1.09
Peak Daily Emissions (lb/day)	16.66	170.67	124.98	0.16	93.59	17.40

Table 8.1A-1b Construction Emissions by Activity

Construction Equipment	Number per Day	Hours of Operation per Day per Unit	Total Hours of Operation per Day	Emissions (lb/day)					
				ROG	CO	NOx	SOx	PM ₁₀	PM _{2.5}
Air Compressor	1	4	4	0.860	6.595	6.240	0.003	0.265	0.236
Bulldozer	2	4	8	3.660	28.070	26.570	0.020	1.130	1.006
Crane	2	2	4	0.720	6.120	4.260	0.006	0.135	0.120
Excavator	3	4	12	2.760	23.460	16.005	0.016	0.435	0.387
Loader	1	4	4	0.325	2.480	2.350	0.003	0.100	0.089
Motor Grader	1	4	4	0.880	7.495	5.305	0.006	0.185	0.165
Generator	2	4	8	1.720	13.190	12.480	0.006	0.530	0.472
Forklift	1	4	4	0.395	3.345	2.445	0.003	0.100	0.089
Vibratory Roller	1	4	4	0.430	3.670	2.680	0.003	0.110	0.098
Concrete Vibrator	2	4	8	1.080	7.400	9.040	0.006	0.420	0.374
Concrete Pump	2	4	8	1.080	7.400	9.040	0.006	0.420	0.374
Total (lb/day)				13.91	109.23	96.42	0.08	3.83	3.41

1. Assume all equipment operates 4 hr/day, except for cranes which operate 2 hr/day.

2. The emission factors for construction equipment are presented in Table 8.1A-2a.

Table 8.1A-1c Vehicle Exhaust Emissions

Vehicle	Trips/Day	Miles/trip	Total Miles/Day	Emissions (lb/day)					
				ROG	CO	NOx	SOx	PM ₁₀	PM _{2.5}
Activity: Traffic Control and Management Activities									
Delivery Trucks	86	10	860	0.971	9.322	22.607	0.027	0.696	0.593
Truck - Fuel/Lube	1	5	5	0.001	0.040	0.005	0.000	0.000	0.000
Truck - Water	1	5	5	0.006	0.054	0.131	0.000	0.004	0.003
Trucks - 3 ton	1	5	5	0.001	0.040	0.005	0.000	0.000	0.000
Dump Truck	2	5	10	0.011	0.108	0.263	0.000	0.008	0.007
Trucks - Pickup 3/4 ton	2	5	10	0.003	0.080	0.011	0.000	0.001	0.000
Worker Trips (Passenger Car)	1595	5	7,975	1.758	51.795	5.538	0.053	0.510	0.246
Total Trucks (lb/day)				0.99	9.65	23.02	0.03	0.71	0.60
Total Workers (lb/day)				1.76	51.80	5.54	0.05	0.51	0.25
TOTAL (lb/day)				2.75	61.44	28.56	0.08	1.22	0.85

1. Assume peak 1,595 daily worker commutes (Chevron Renewal Project DEIR, (ESA, May 2007))

2. Assume peak 86 daily truck deliveries (Chevron Renewal Project DEIR, (ESA, May 2007))

3. Assume worker commute = 5 mi/trip

4. Assume truck deliveries = 10 mi/trip

5. The emission factors for vehicles are presented in Table 8.1A-2b.

Chevron Power Plant Replacement Project
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Table 8.1A-1 Construction Calculations

Table 8.1A-1d Fugitive Dust Calculations

Grading			PM _{2.5} =	20.80%	of PM ₁₀
Maximum Daily Acres Graded	Emission Factor (lb PM ₁₀ /acre)	PM ₁₀ Emissions (lb/day)	PM _{2.5} Emissions (lb/day)		
4	10	40	8.32		

1. The H2 plant area size is 8 acres and the Cogen area size is 5 acres. Construction of the two sites will not overlap, therefore, it was assumed the maximum daily graded area would be half of the H2 plant area or 4 acres.
2. The emission factor for grading is from URBEMIS2002, version 8.7.0.
3. PM_{2.5} emission factors were calculated following the SCAQMD Particulate Matter (PM) 2.5 Significance Thresholds and Calculation Methodology, October 2006. For construction sources, 20.8% of the PM₁₀ would be PM_{2.5}.

Table 8.1A-1e Vehicle Paved Road Emissions

Vehicle	Trips/Day	Miles/trip	Total Miles/Day	Emissions (lb/day)	
				PM ₁₀	PM _{2.5}
Activity: Onroad Fugitive Emissions				PM₁₀	PM_{2.5}
Delivery Trucks	86	10	895	4.90	0.49
Worker Trips (Passenger Car)	1595	5	7,975	43.64	4.33
Total (lb/day)				48.54	4.82

1. Emission factors for paved road dust are summarized in Table 8.1A-2c. The emission factors are from AP-42 Ch. 13.2.1

**Chevron Power Plant Replacement Project
Chevron Richmond Refinery
Table 8.1A-2 Construction Emission Factors**

Table 8.1A-2a Construction Equipment Emission Factors

Construction Equipment	URBEMIS2002 Category	2008 Emission Factors (lb/hr)					
		ROG	CO	NOx	SOx	PM ₁₀	PM _{2.5}
Air Compressor	Signal Board	0.22	1.65	1.56	0.0007	0.07	0.06
Bulldozer	Rubber Tired Dozer	0.46	3.51	3.32	0.0025	0.14	0.13
Crane	Crane	0.18	1.53	1.07	0.0014	0.03	0.03
Excavator	Excavator	0.23	1.96	1.33	0.0013	0.04	0.03
Loader	Tractor/Backhoe/Loader	0.08	0.62	0.59	0.0008	0.03	0.02
Motor Grader	Grader	0.22	1.87	1.33	0.0015	0.05	0.04
Generator	Signal Board	0.22	1.65	1.56	0.0007	0.07	0.06
Forklift	Rough Terrain Forklift	0.10	0.84	0.61	0.0008	0.03	0.02
Vibratory Roller	Roller	0.11	0.92	0.67	0.0008	0.03	0.02
Concrete Vibrator	Concrete/Industrial Saws	0.14	0.93	1.13	0.0007	0.05	0.05
Concrete Pump	Concrete/Industrial Saws	0.14	0.93	1.13	0.0007	0.05	0.05

ROG, CO, NOx, PM10, and PM2.5 Emission Factors from URBEMIS2002.

SOx Emission Factors from SCAQMD 2007 Offroad Emission Factors.

Table 8.1A-2b Vehicle Emission Factors

Vehicle Type	Vehicle Emission Factors (lb/mile)					
	ROG	CO	NOx	SOx	PM ₁₀	PM _{2.5}
Passenger car	0.00022	0.00649	0.000694444	0.000007	0.000064	0.000031
Light-Duty Truck (3 ton, pickup, lube)	0.00025	0.00804	0.001075838	0.000007	0.000075	0.000042
Heavy-Duty Truck (dump, water, delivery)	0.00113	0.01084	0.026287478	0.00003	0.000809	0.000690

Emission factors are from the CARB EMFAC2007 v. 2.3 model for Contra Costa County for the year 2008 for vehicles traveling at a speed of 45 mph.

Table 8.1A-2c Paved Road Emission Factors

Paved Roads emission factor from AP-42, Section 13.2.1: *Paved Roads* (dated 11/06)

$$E = [k(sL/2)^{0.65}(W/3)^{1.5} - C] * (1 - P/4N)$$

where:

k = 0.016	lb/VMT [Table 13.2.1-1, for PM ₁₀]
k = 0.0024	lb/VMT [Table 13.2.1-1, for PM _{2.5}]
sL = 0.2	[silt loading (g/m ²), AP-42 Table 13.2.1-3. Assume Ubiquitous Baseline, 500-5,000 average daily traffic]
W = 4.31	tons [Average vehicle weight]
C = 0.00047	lb/VMT [Table 13.2.1-2, for PM ₁₀]
C = 0.00036	lb/VMT [Table 13.2.1-2, for PM _{2.5}]
P = 60	days [Average number of days annually with > 0.01 inches of precipitation in Richmond, CA, Western Regional Climate Center, wrcc@dri.edu]
N = 365	days [Number of days in the averaging period]
E _(PM10) = 0.01	lb/VMT
E _(PM2.5) = 0.001	lb/VMT