

APPENDIX A

CONSTRUCTION EMISSION CALCULATIONS

Construction Equipment Emission Factors

Equipment Type	HP	2007 Emission Factors lb/hr ⁽¹⁾				
		CO	NOx	PM10	SOx	VOC
Backhoe Cat 235 110 HP	110	0.375	0.698	0.063	0.001	0.118
Bobcat Loader 49 HP	49	0.398	0.329	0.039	0.000	0.168
Aircompressor 85 HP	85	0.342	0.676	0.059	0.001	0.116
Compactor 10 HP	10	0.026	0.035	0.002	0.000	0.005
Crane 45 Tons	150	0.497	1.101	0.061	0.001	0.142
Concrete Pump 60 CYPH ⁽²⁾	350	0.769	2.447	0.083	0.002	0.209
Fork Lift 15 Tons	70	0.234	0.436	0.043	0.000	0.079
Welding Machines 300 AMP	45	0.317	0.282	0.032	0.000	0.139
Crane 30 Tons	152	0.497	1.101	0.061	0.001	0.142
Crane 90 Tons	275	0.848	2.105	0.082	0.002	0.212
Crane 240 Tons	275	0.848	2.105	0.082	0.002	0.212
Crane 450 Tons	450	0.848	2.105	0.082	0.002	0.212
Boom Truck 5 Tons ⁽³⁾	210	0.412	1.466	0.057	0.001	0.148

Equipment Type	HP	2008 Emission Factors lb/hr ⁽¹⁾				
		CO	NOx	PM10	SOx	VOC
Backhoe Cat 235 110 HP	110	0.370	0.651	0.059	0.001	0.108
Bobcat Loader 49 HP	49	0.383	0.322	0.036	0.000	0.154
Aircompressor 85 HP	85	0.339	0.651	0.058	0.001	0.111
Compactor 10 HP	10	0.026	0.033	0.002	0.000	0.005
Crane 45 Tons	150	0.494	1.042	0.059	0.001	0.135
Concrete Pump 60 CYPH ⁽²⁾	350	0.707	2.277	0.077	0.002	0.194
Fork Lift 15 Tons	70	0.230	0.405	0.040	0.000	0.072
Welding Machines 300 AMP	45	0.313	0.279	0.031	0.000	0.134
Crane 30 Tons	152	0.494	1.042	0.059	0.001	0.135
Crane 90 Tons	275	0.776	1.988	0.077	0.002	0.201
Crane 240 Tons	275	0.776	1.988	0.077	0.002	0.201
Crane 450 Tons	450	0.776	1.988	0.077	0.002	0.201
Boom Truck 5 Tons ⁽³⁾	210	0.388	1.387	0.053	0.001	0.139

Equipment Type	HP	2009 Emission Factors lb/hr ⁽¹⁾				
		CO	NOx	PM10	SOx	VOC
Backhoe Cat 235 110 HP	110	0.366	0.607	0.055	0.001	0.099
Bobcat Loader 49 HP	49	0.369	0.317	0.034	0.000	0.139
Aircompressor 85 HP	85	0.338	0.625	0.056	0.001	0.107
Compactor 10 HP	10	0.026	0.032	0.002	0.000	0.005
Crane 45 Tons	150	0.491	0.985	0.056	0.001	0.128
Concrete Pump 60 CYPH ⁽²⁾	350	0.653	2.122	0.072	0.002	0.181
Fork Lift 15 Tons	70	0.227	0.376	0.037	0.000	0.066
Welding Machines 300 AMP	45	0.308	0.276	0.030	0.000	0.129
Crane 30 Tons	152	0.491	0.985	0.056	0.001	0.128
Crane 90 Tons	275	0.716	1.877	0.073	0.002	0.191
Crane 240 Tons	275	0.716	1.877	0.073	0.002	0.191
Crane 450 Tons	450	0.716	1.877	0.073	0.002	0.191
Boom Truck 5 Tons ⁽³⁾	210	0.366	1.310	0.050	0.001	0.131

(1) SCAQMD, 2006 : http://www.aqmd.gov/ceqa/handbook/offroad/offroadEF_0620.xls

(2) Modelled as 'Other construction Equipment'.

(3) Modelled as a 'Crane'.

Vehicle Trip Emissions

2007 Data
 Passenger Vehicles (pounds/mile)*
 CO 0.01282
 VOC 0.001383
 NOx 0.001361
 SOx 0.000009
 PM10 0.000080

Delivery Trucks (pounds/mile)*
 CO 0.017465
 VOC 0.002608
 NOx 0.024978
 SOx 0.000033
 PM10 0.000440

Fugitive PM**
 Cars 0.000386
 Trucks 0.022013

* Based on 2007 SCAQMD on-road emission rates. (http://www.aqmd.gov/eqaq/handbook/road/road.html)

** Emission Calculations for travel on paved roads from EPA-AP-42, Section 13.2.1, December, 2003
 $E = k(SL)^{0.85} \times (WV)^{0.75} - C$
 Where: k = 0.016 lb/MT for PM10, sl = road silt loading (gms/m2) from CARB Methodology 7.9 for paved roads
 (0.240 for local roads and 0.037 for major/collector roads), W = weight of vehicles (2.4 tons for cars; 5 for pickup trucks,
 and 20 for heavy trucks), and C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear (0.00047 lbs/MT).

2007		2008												2009							
Passenger Vehicles	Miles	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Number of Commuters	35	200	220	0	0	260	280	360	440	420	400	0	0	0	0	0	0	150	120	50	20
Number of Pickups	50	7	7	0	0	7	7	7	7	7	7	0	0	0	0	0	0	7	7	7	1
Total Passenger Miles	7350	8050	0	0	9450	10150	12950	15750	15050	14350	0	0	0	0	0	0	5600	4550	2100	750	

2007		2008												2009							
Delivery Vehicle	Miles	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Number of Stake Bed Trucks	15	2	2	0	0	2	2	2	2	2	2	0	0	0	0	0	0	2	2	2	2
Number of Dump Trucks	25	1	1	0	0	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1
Number of Buses	7	4	4	0	0	4	4	4	4	4	4	0	0	0	0	0	0	4	4	4	4
Number of Delivery Trucks	25	1	1	0	0	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1
Total Delivery Miles	108	108	0	0	108	108	108	108	108	108	108	0	0	0	0	0	108	108	108	72	

		2008												2009							
Vehicle Type	CO Emissions (lb/day)	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Passenger Vehicles	94.23	103.20	0.00	0.00	0.00	121.15	130.12	166.02	201.92	192.94	183.97	0.00	0.00	0.00	0.00	0.00	0.00	71.79	53.33	26.92	9.62
Delivery Vehicle	1.89	1.89	0.00	0.00	1.89	1.89	1.89	1.89	1.89	1.89	1.89	0.00	0.00	0.00	0.00	0.00	0.00	1.89	1.89	1.89	1.26
Total	96.11	105.09	0.00	0.00	1.89	132.01	132.01	167.90	203.80	194.83	185.85	0.00	0.00	0.00	0.00	0.00	0.00	73.68	55.22	28.81	10.87

		2008												2009							
Vehicle Type	VOC Emissions (lb/day)	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Passenger Vehicles	10.17	11.13	0.00	0.00	0.00	13.07	14.04	17.91	21.78	20.81	19.85	0.00	0.00	0.00	0.00	0.00	0.00	7.74	6.29	2.90	1.04
Delivery Vehicle	0.28	0.28	0.00	0.00	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.28	0.28	0.19
Total	10.45	11.41	0.00	0.00	0.28	13.35	14.32	18.19	22.06	21.10	20.13	0.00	0.00	0.00	0.00	0.00	0.00	8.03	6.57	3.19	1.23

		2008												2009							
Vehicle Type	NOx Emissions (lb/day)	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Passenger Vehicles	10.00	10.96	0.00	0.00	0.00	12.86	13.81	17.62	21.44	20.48	19.53	0.00	0.00	0.00	0.00	0.00	0.00	7.62	6.19	2.86	1.02
Delivery Vehicle	2.70	2.70	0.00	0.00	2.70	2.70	2.70	2.70	2.70	2.70	2.70	0.00	0.00	0.00	0.00	0.00	0.00	2.70	2.70	2.70	1.80
Total	12.70	13.65	0.00	0.00	0.00	15.56	16.51	20.32	24.13	23.18	22.23	0.00	0.00	0.00	0.00	0.00	0.00	10.32	8.89	5.56	2.82

		2008												2009							
Vehicle Type	SOx Emissions (lb/day)	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Passenger Vehicles	0.07	0.07	0.00	0.00	0.00	0.09	0.09	0.12	0.14	0.14	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.04	0.02	0.01
Delivery Vehicle	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.07	0.07	0.00	0.00	0.00	0.09	0.09	0.12	0.14	0.14	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.04	0.02	0.01

		2008												2009							
Vehicle Type	PM10 Emissions (lb/day)	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Passenger Exhaust	0.59	0.64	0.00	0.00	0.00	0.76	0.81	1.04	1.26	1.20	1.15	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.36	0.17	0.06
Delivery Exhaust	0.05	0.05	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.03
Passenger Fugitive	2.84	3.11	0.00	0.00	3.65	3.92	5.00	6.08	5.81	5.54	5.54	0.00	0.00	0.00	0.00	0.00	0.00	2.16	1.76	0.81	0.29
Delivery Fugitive	2.17	2.17	0.00	0.00	2.17	2.17	2.17	2.17	2.17	2.17	2.17	0.00	0.00	0.00	0.00	0.00	0.00	2.17	2.17	2.17	1.45
Total	5.65	5.97	0.00	0.00	6.62	6.95	8.26	9.56	9.23	8.91	8.91	0.00	0.00	0.00	0.00	0.00	0.00	4.83	4.34	3.20	1.83

Summary of Construction Emissions

Emissions from Equipment (lb/day)	2007												2008												2009							
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
CO	32.68	35.09	0.00	0.00	37.93	37.93	32.01	32.01	32.01	32.01	32.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.32	39.50	18.95	5.66
NOx	65.64	62.28	0.00	0.00	78.02	75.02	65.52	65.52	65.52	65.52	65.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	39.69	84.74	33.44	14.99
VOC	10.58	12.18	0.00	0.00	11.96	11.96	10.35	10.35	10.35	10.35	10.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.54	12.13	6.48	1.85	
SOx	0.06	0.06	0.00	0.00	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.08	0.03	
PM10	4.48	4.80	0.00	0.00	4.57	4.57	3.86	3.86	3.86	3.86	3.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.80	4.55	2.24	0.85	

Emission from Trips (lb/day)	2007												2008												2009						
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
CO	96.11	105.09	0.00	0.00	123.03	132.01	167.90	203.80	194.83	185.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	73.68	60.22	28.81	10.87
NOx	12.70	13.65	0.00	0.00	15.56	16.51	20.32	24.13	23.18	22.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.32	8.89	5.56	2.82
VOC	10.45	11.41	0.00	0.00	13.35	14.32	18.19	22.06	21.10	20.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.03	6.57	3.19	1.23
SOx	0.07	0.08	0.00	0.00	0.09	0.09	0.12	0.15	0.14	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.04	0.02	0.01
PM10	5.65	5.97	0.00	0.00	6.82	6.95	8.26	9.56	9.23	8.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.83	4.34	3.20	1.83

Total Emissions (lb/day)	2007												2008												2009						
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
CO	128.79	140.18	0.00	0.00	160.97	169.94	199.91	235.81	226.83	217.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	96.00	99.71	47.75	16.53
NOx	100	78.34	75.91	0.00	93.58	94.53	85.84	89.65	88.70	87.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.01	93.63	38.99	17.81
VOC	75	21.03	23.60	0.00	25.31	28.28	28.54	32.41	31.44	30.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.57	18.71	8.66	3.07
SOx	150	0.13	0.14	0.00	0.16	0.17	0.18	0.21	0.20	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.13	0.06	0.02
PM10	150	10.13	10.77	0.00	11.19	11.52	12.11	13.42	13.09	12.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.64	8.89	5.44	2.68

= Peak Emissions

Rule 1401 Analysis
Chevron FCCU SCR Project
Ammonia Analysis

Ammonia Emission Rate

Concentration (C) = 10 ppm
Exhaust Flow Rate (Q) = 210000 dscfm
MW = 17.03

$$\text{Emissions (E)} = \frac{C \cdot M \cdot Q \cdot 60}{379 \cdot 1E6} \text{ lb/hr}$$

$$E = 5.66 \text{ lb/hr} \cdot 8760 \text{ hr/yr} = 49596.39 \text{ lb/yr}$$

Tier 1 Analysis

Distance from source to property line = >1800 ft (>548 meters)

Screening Emission Level @ 100 meters

Evaluation	Chronic (lb/yr)	Acute (lb/hr)
Emissions	49596	5.66
Screening Level	51700	8.57
Pass/Fail	PASS	PASS